THE BOOK OF MARMOT

A Marmoteering Handbook

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PURPOSE

This guide describes the protocols we have developed to study yellow-bellied marmots at the Rocky Mountain Biological Laboratory. This is one of the world's longest studies of free-living animals (Ken Armitage started the study in 1962) and we're excited to have you on board! All people on the marmot project should expect to be trained to trap, handle, and observe animals. Everyone helps with the trapping and observations because these are the key pieces of information that are necessary to keep this long-term study going. In addition, you may be conducting a more detailed experiment for which we will develop specific protocols.

Some protocols may or may not be used in any given year. As a *new* member of the team, you should familiarize yourself with the sections titled "Marmoteering Essentials". Always ask if you have any questions about anything. It is crucial that we do our best to 'see' and record the same things, thus *communication is key*.

Familiarize yourself with the sections titled "Marmoteering Essentials"

PREFACE

This document, like the entire marmot project, is a collaborative product. Dan initially wrote the first drafts of many sections, but it's been edited over the years to improve clarity. Some sections were entirely written by others (Julien wrote the instructions about the tablet, and modified others) and were put into this document to consolidate a number of different protocols. At the time of this compilation (June 2022), Dan remembers that major contributions were made by: Julien Martin, Lucretia Olson, Tina Wey, Jenn Smith, Adriana Maldonado, Lilah Hubbard, Tiffany Armenta, Dana Williams, Gina Johnson, Conner Philson, and Xochitl Ortiz Ross. Xochitl re-organized it and created the beautiful template. **Thanks everyone!**

(Pagination requires fixing up)

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1. Marmoteering Values and Expectations (Marmoteering Essentials)

Thank you for joining Team Marmot and contributing to the RMBL marmot project. We hope that this experience will be rewarding and that you will learn a lot, and enjoy your time here. You are part of long tradition of trainees from around the world that have worked on the project since 1962.

We are here to collect data that contribute to one of the longest-running studies of a free-living mammal. We are here to maximize high quality data collection but we work at the pleasure of marmots and the weather. We don't choose where the marmots are, when they are active, whether or not they decide to go into a trap—they do. We have no control over the weather, but marmot activity depends on it. These two constraints mean that we must all be maximally flexible and willing and able to change plans so as to ensure data are collected during a rather short marmot active season while ensuring safety for both us and marmots. Indeed, the season changes quickly as do marmot activity patterns. This means that you will be working at different times and doing different things in the field throughout the season. Newly emergent pups must be trapped and marked immediately upon emergence and late June/July are particularly busy times.

To collect these priceless data, we must share some key values and attributes.

1) **Safety.** We highly value the health and wellbeing for both marmoteers and marmots. We have protocols designed to ensure both. Egregious violations may result in termination. If you have safety concerns please contact Dan or Julien. Because you are working at RMBL, the RMBL Fundamental Behavior Code (in the handbook) and the Research Code are reference points for RMBL-specific expectations.
    a. RMBL Title IX issues are discussed at: https://www.rmbl.org/staff-info/title-ix/
    b. If you are a UCLA affiliate: https://sexualharassment.ucla.edu
    Important: if you are an undergraduate student at UCLA, all UCLA graduate students on the marmot team are mandatory reporters for UCLA.
    c. If you are a uOttawa affiliate: https://www2.uottawa.ca/about-us/policies-regulations (policies 66 and 67)
    d. Other students should familiarize themselves with their own university policies as well.

2) **Respect**. Everyone has strengths and weaknesses and we aim to work with people to achieve the best they can do, by valuing their strengths and working on their weaknesses. You are expected to treat others with respect. While Dan or Julien have the final say on all decisions, we are not explicitly hierarchical; everyone is valued, everyone has a voice, and everyone has something meaningful to contribute.

3) **Flexibility**. Plans will change regularly based on successes and failures, weather, or availability of personnel. That's just the way it is.

4) **The ability to take constructive criticism**. Nobody is born knowing how to be a marmoteer. You will be trained, get experienced and become confident in collecting marmot data. However, over time you will be corrected to ensure the consistency and quality of the data collected.

5) **Communication**. The only way to efficiently collect high quality data is by sharing information about marmot individuals and their locations. We expect that people will be in regular communication with each other, about where they've seen marmots, the current status of marks, etc. We expect that there will be a lot of professional radio chatter, conversations, and messaging; without it, lesser quality data are collected. Mis- or lack of communication leads to inefficiencies and can create interpersonal conflicts. We also expect that if you have concerns you will raise them with Dan or Julien so that they can be addressed.

6) **Cooperation**. Cooperation is at the heart of any long-term study. Everyone benefits from the long-term data only because of the efforts and cooperation of generations of previous people. While there are some bespoke experiments, generally, everyone helps collect most of the data. The data you are collecting might not be useful directly for your project but the data you are using was collected by the combined effort of hundreds of people. Thus, we must all cooperate to ensure that the data are being collected. You will be doing different things, and learning a diversity of transferable skills.

7) **Your opinion**. There are always ways to improve what we do. We value suggestions and often modify protocols and instructions to clarify procedures and expectations. We respect your suggestions and have adopted many of them over the years. However, Dan and Julien have more experience working in this system, managing the data, and they often know (from prior failures) what works, what doesn't work, and what is counterproductive. So not all ideas will be adopted, and explanations about the final decision will be provided.

8) **Collegiality and good cheer**. While the work is time consuming, and at times exhausting, it's much more fun in a collegial atmosphere. Many former trainees look back at their time here as transformative and memorable. Communication and respect are a key part of creating a collegial atmosphere. Over a summer, it is not surprising to see grievances or grudges arise between some marmoteers. It is extremely important to be able to discuss them in order to solve the problem and be able to work together efficiently. After all, data collection on this scale is a team effort. We expect that if you have concerns, you will raise them with Dan or Julien so that they can be addressed and we will check in with you periodically.

A team leader (or leaders) will be in charge of setting the schedule which everyone must follow. However, the schedule will be set collaboratively and transparently so as to ensure that key observations and data are collected and so that everyone understands why they are working where they are working and that workload is split fairly among marmoteers. Please share your constraints when establishing the schedule, otherwise we can't try to work around them! Dan has the final say over the schedule (and any other decisions) and will, based on extensive experience working in this system, make changes to ensure that data are collected efficiently and comprehensively while ensuring the safety of personnel and marmots.

2. The Study Site

2.1 The Rocky Mountains Biological Laboratory

For nearly everything you should to know about living in Gothic please read through the **RMBL Summer Handbook**

2.2 Our Study Sites

Located in the valley around the Rocky Mountain Biological Laboratory (RMBL) close to Crested Butte, the study site could be split in two main areas: the down-valley and the up-valley colonies. Bolded areas represent our main sites, which we observe regularly. The other sites are monitored, mainly by Dan, but are not regularly observed.

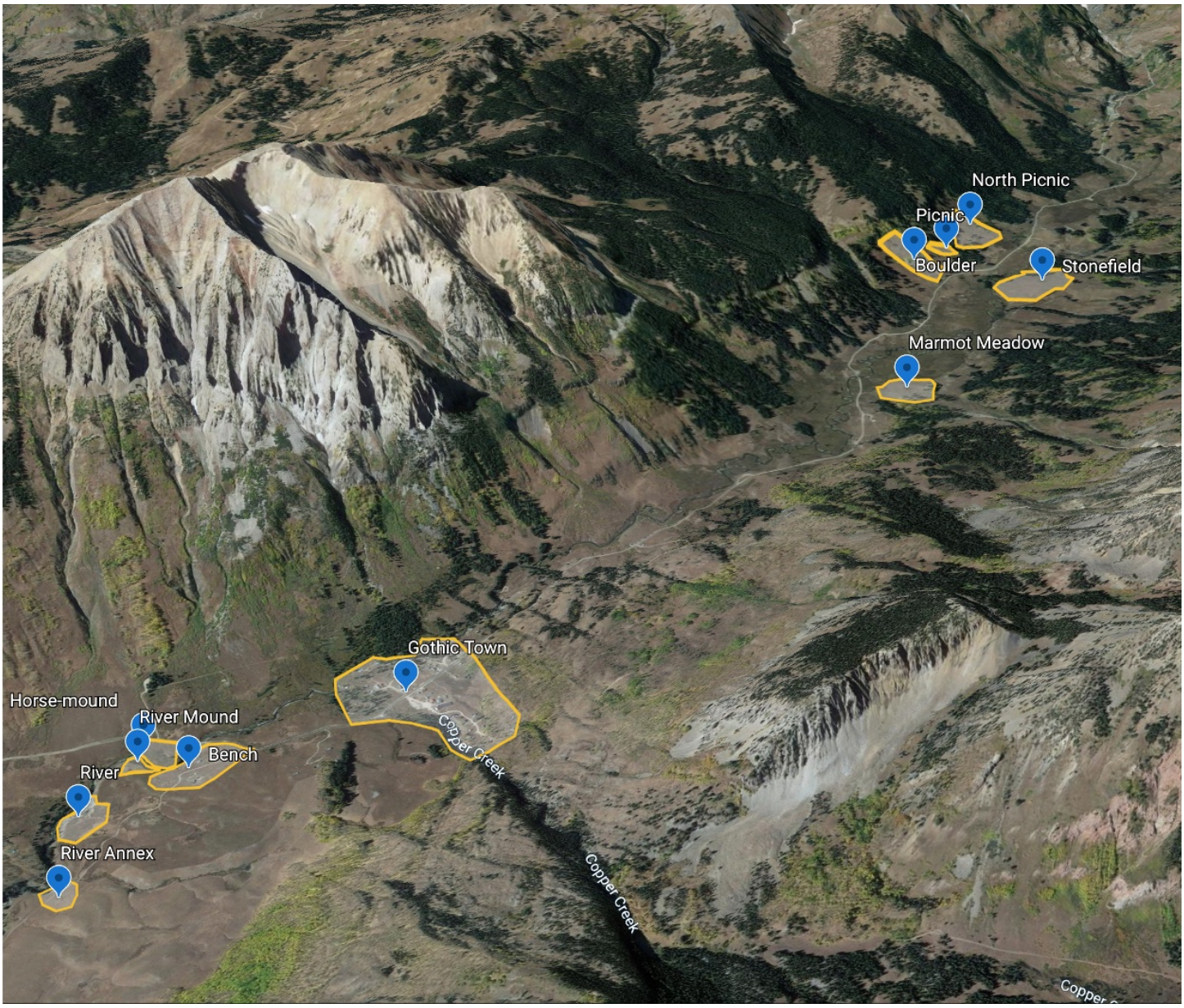
Gothic Mountain, view from river annex. Photo by Xochitl Ortiz Ross

The down-valley colonies from north to south:

- **Town**
- **Avalanche**
- **Bench**
- **Horsemound**
- **River** (split into river mound, sage mound, middle mound, and south mound)
- Corral burrow
- **River annex**
- River bend
- Falls

The up-valley colonies south to north:

- Beaver talus
- Avery campground
- **Marmot meadow** (split into aspen and main talus)
- **Cliff**
- **Picnic** (split into lower, middle, upper, and upper upper)
- **Boulder**
- Stonefield
- **North picnic**
- Bellview



2.3 Packing list

Winter packing list

Clothes:
Long underwear (at least 2 pairs)
Heavy snow pants AND/OR waterproof rain pants (can layer underneath)
Heavy wool socks (many pairs)
Light gloves
Heavy gloves OR mittens
Hat AND/OR beanie
Scarf/neck warmer/something to cover your face (for wind during a snow storm or for sun)
Fleece pants/sweat pants (you can wear these under things in the field or around the house or both)

Outdoor jacket (one of the big puffy ones and that you can fit layers under)
Lighter jacket (preferably one you can still put layers under)
Sweatshirts
Regular clothes: jeans, pants, shirts, shoes, etc. (will be nice for days off)
Rain jacket
Rain pants
Sunglasses (polarized)
Snow boots (waterproof)
Cozy shoes to wear around cabin
SUNSCREEN!!!!!!! SPF 40+

Gear:
Backpacking pack (this is essential as you will use it in the field every day to carry your gear, as well as to pack your stuff in initially) **If you don't have one/do not want to purchase your own please let us know and we can get you a used one from the lab. We suggest at least a 50L pack.*
Digital Watch
Headlamp
Water bottle (at least 1L)
Thermos (for hot liquids if you want them while in the field)
Ski's or snowshoes (talk to Dan about options) **If you chose to purchase ski's, they must be backcountry ski's with metal edges and fish scales. You will also need boots and poles. People sell boots on craigslist/in garage sales a lot, but they're usually an old style that doesn't work with any bindings. You'll want NNN BC for boots/bindings.*

<u>Summer packing list (building off of the winter list)</u>
**Those coming only for summer might not need all things mentioned in the winter list. Ask if you have questions!*

Clothes:
Field pants (2) **Preferably pants that you don't mind getting very dirty/getting dye on them*
Field shirts (many)
Hat for sun
Hiking boots (waterproof)

Other stuff:
Sleeping bag or sheets (most cabins have twin beds; can also sleep in a sleeping bag all season)
Pillow/pillowcase
Slip for sleeping bag (this will make your bag warmer and help it last longer)
Towel
Personal products (soaps, toothbrush, all that stuff, etc.)
SUNSCREEN!!!!!!! SPF 40+
Headphones (optional)
Computer
Computer charger

Hard drive (if you have one, for data backup)
Life stuff (you'll be there for a while, bring things that you like and need, your cabin is your home while you're there, make it nice!)

3. FIELD SAFETY (MARMOTEERING ESSENTIALS)

Our goal is to ensure the safety and well-being of all members of the lab group, regardless of gender, race, or any other identity, while performing fieldwork at the Rocky Mountains Biological Laboratory. We acknowledge that not everyone joining the field team is expected to be familiar with the field environment. Everyone has different levels of experience with fieldwork, and you should feel comfortable asking questions and reaching out for additional support. Our first priority is ensuring your physical, mental, and emotional safety and well-being. We recognize that you cannot be a productive member of the team if your basic needs are not being met.

We would also like to acknowledge that living and working in the field poses unique challenges that will differ among individuals. To help mitigate any challenges that arise communication is key, please feel free to reach out if you have any concerns. In this section we outline what living and working conditions can be expected, what potential safety risks can be encountered, what our protocols for mitigating those risks are and what additional actions you can take if at any stage you don't feel safe.

This is a living document, which means it is a collaborative effort that is continually updated. We encourage feedback and suggestions to improve its effectiveness. This document is intended to merely supplement the information in the RMBL Handbook[1] and the safety protocols[2] already listed on the RMBL website.

For any questions of concerns regarding your safety or that of a colleague, please talk to your team leaders and/or Dan Blumstein. For any emergency, please call 911.
What is an emergency?
Maybe add something here…

3.1 Code of Conduct

Harassment, bullying, and discrimination of any kind will not be tolerated.

We are committed to creating a diverse, inclusive, and respectful environment. Any member accepting a position with the Blumstein lab is expected to have read, understood, and agreed to the code of conduct outlined here. Any objections should be brought up to Dan Blumstein or Julien Martin prior to the start of fieldwork.

All members of the Blumstein Lab field team agree that anyone requested to stop unwanted behavior is expected to stop immediately.

Unacceptable behavior includes but is not limited to:

- Physical or verbal abuse or assault
- Intimidation
- Coercion

[1] https://www.rmbl.org/field-station-info/2021-rmbl-handbook/

[2] https://www.rmbl.org/safety-in-gothic/

- Threats
- Gender, racial, or sexual harassment
- Sexual misconduct
- Behavior that endangers the health and safety of oneself or others

Resolution or reporting depends on the nature of the alleged behavior; some accusations must be formally and immediately reported to RMBL and/or various universities. Our, however, goal is to create a supportive environment where people feel free to communicate to others about behavior they perceive as unacceptable so as to avoid escalation and interpersonal conflict.

RMBL Fundamental Behavior Code
"Everyone who is admitted to the various programs of RMBL is expected to show respect for others, even if they hold widely divergent opinions from yours. We try to provide a friendly and nondiscriminatory forum for the free and rich exchange of ideas. Receptivity to your fellow RMBL residents and consideration for them in every way possible helps assure a peaceful, productive, and non-threatening environment."

3.2 What to Expect: A Day in the Life of a Marmoteer

Early season work is entirely dependent upon the weather; we work when we can, often only in the mornings. As the snow melts, marmots become more active and we must shift our activity patterns to match theirs. When there are just a few people around, it's easy to make a schedule—talk through where marmots must be studied and figure out who goes where. However, once we have more people and are conducting experiments, observing and trapping, things get more complex. So, for much of the season we develop a more formal schedule weekly.

THE SCHEDULE

Aims

- Being transparent about the creation of the weekly schedule
- Explaining the constraints involved in making it
- Clarify the notation used

Important things we consider when making the schedule

- People should indicate any constraints in their availability for the week being scheduled
- Experiments and FID have priorities for colonies (but realize that people can move as personnel leave to trap another location)
- Trapping is on a bi-weekly schedule down then up. Order of colonies depends on where the traps are (to minimize trap movement) and on the number of animals per colonies
- People setting traps and people checking traps should ideally be in the same part of the valley for their observations. When trapping up-valley it is better to have at least one person on the trapping team observing down-valley so that they can bring the trapping bag(s) and coolers.
- People not trapping or doing experiments can be assigned to other colonies
- When scheduling, **we try to split the workload as fairly as possible** among the different persons while respecting people's constraints and availability
- **The process should be transparent and open, discussed with and agreed by everyone**

Making the schedule

1. Define which colonies will be trapped and when

2. Let persons doing FID or other experiment define where they need to go
3. Determine who will be setting traps
4. Determine trapping teams
5. Determine who will bring the trapping bags
6. Determine observation locations

Remember, the schedule is highly flexible and not set in stone. Depending on trapping and experiment success as well as on the weather, the schedule might be updated to optimize research effort.

Pup emergence will change everything. Often the person who sees the pups will trap them because they know exactly where they are, but this too is not set in stone.

Board notation

Notation on the board, each day of the week and colony as a square. The square can be divided into AM and PM by left and right of the square. In each square, put the initial of the person, the color used, the place in the square and * or ** are used to indicate the different roles:

Notations	roles	example
initials in red	Observations in this colonies	**JM**
initials in blue	setting traps in this colonies	**JM**
initials in green	fid or experiment	**JM**
initials in black	trapping only (used mostly for Dan and Julien)	**JM**
initials + black *	trapping in addition to the color-coded roles	**JM***
initials + black **	Trapping and bringing the trapping bag	**JM****

3.3 Field and Chemical Safety Plan

All safety plans and protocols can be found in the RED FOLDER in the lab. You will read and be trained through all safety risks and protocols in person. Once you are comfortable with this information you must sign our training sheet.

Here is a brief summary of potential safety risks you should be familiar with. If you have *any* questions don't hesitate to ask Dan, Julien, or the field leads.

Add a section about early-season considerations.
Add a section on identity-based risks.

A. ENVIRONMENTAL SAFETY

- Let people know where you are going and when you will return. Carry a two-way radio with spare batteries.
- Avalanche, snow, cold weather. Do NOT ski, walk, or snowshoe on steep avalanche prone slopes.

- Storms and lightning: rapidly changing weather in the mountains with heavy rain and cold temperatures in the middle of a sunny day
- Sun: avoid sunburn by using high SPF sunblock and reapplying before each trapping/observation session. Wear clothes that block the sun.
- Dehydration: carry a liter of water with you and drink throughout observation sessions. Avoid eating or drinking anything once you've started to handle marmots until you can properly clean your hands.
- Wildlife encounters: do not run after bears, do not feed coyotes or squirrels. Report all mountain lion sightings to RMBL (they are very rare); if you see a lion, back away slowly. Do not approach. There are no poisonous snakes in or around the RMBL.
- Hiking: avoid cliffs, be very cautious on wet or steep slopes. Be very careful walking across talus and boulders.
- Biking: you must wear a helmet when biking. No exceptions.
- Driving: drive carefully. There are narrow, and sometimes wet windy dirt roads. Drive slowly and be aware of reduced visibility.

B. MARMOT HANDLING SAFETY

- Avoid doing anything that will hurt you or the marmot.
- If you are not comfortable with a procedure, seek help.
- Do not put your fingers near marmot mouths (even if they are in the bag).
- Do not carry a trap with a marmot in it near your leg (they can bite through the cage).
- Remember, you can always put the marmot back into the trap if its escaping the bag and always put it back in the bag if it's wiggling out.
- Ask if there are any questions or concerns.

C. BIOSAFETY

- Fleas: no known plague at the RMBL.
- Blood: no known zoonotics in marmot blood.
- Saliva: no rabies reported in marmots in Colorado.
- Feces: marmot feces contains a species of giardia that may or may not be a zoonotic. Wash your hands with soap and water after touching a marmot or handling any marmot equipment (traps, handling bags, etc.).
- Syringes: do not reuse, do not stick yourself, use safe needles only and put them into a 'temporary' sharps container in the field. When back in the lab, dump that into the green sharps container next to the centrifuge.

D. INJURIES

- Report any injury following UCLA protocol. See the "Injuries N Illness Travel info" xls file for details of the UCLA protocol.

4. Early Season Fieldwork

Early season work is both satisfying and frustrating. It's super beautiful! But, moving around on the snow can be a challenge if you've never done this before. We have snowshoes and some skis and you should pick what you're comfortable with using. It's hard to ski! You'll be using new muscles and you'll need to refine your balance. If you've never cross country skied before, it's a really good idea to do it before you get here. Ideally, you'll use skis with fish scales (patterns on the bottom of the skis that permit you to glide forward but enable you to have a 'kick' to move forward). You'll also need warm boots because you will be sitting in the snow for a long time; don't buy or borrow 'skate skis'—which are typically used for racing. It's a 3.5 mile ski in on that first day and with the altitude, your gear, etc. it may take some time. Indeed, you may wish to walk or snowshoe in along the packed trail; just don't walk in ski tracks! Also be prepared to drink a lot of water to acclimate and because you'll be sweating it out. We'll go through this in detail before you ski in. Feel free to ask questions

It is really neat to be the only ones in the valley, but there can be a lot of snow days that prevent us from going out. We sometimes get 100" of snow between mid-April and mid-May! However, the weather is becoming more and more unpredictable, so this will vary depending on the year. We assume that the marmots are not active in snowstorms (this is supported from observations—or lack of them—in town when we don't see marmots on snowy days). Therefore, you must try to go out whenever you can. It's essential to get an early start if headed up valley and to try to stay out for as long as the snowpack allows—it can get very rotten. Marmots emerge later on cold mornings so early season observations might start at 8 AM. A good rule of thumb is to aim to be at a location before marmots are up. As the season progresses and you notice that marmots are already up when you get there, begin observations earlier (7 AM). Bring food, a hot thermos, warm and waterproof layers, and stuff to sit on and stay warm; then try to stay out until 11 or 12 (if the snow holds). If things are going well, and started late, consider staying out a bit longer. **Ultimately, marmot behavior, snow conditions, and weather will influence your work hours.**

If morning weather is crappy but you can wander around down valley sites, by all means do so. Look in 'non-traditional' as well as traditional sites for marmots. Be sure to keep track of any possible or observed predations (coyotes have good success early in the year!). Enjoy the solitude and be careful.

At the start of the early season, be sure to have (1) an emergence log, (2) a hibernation log, and (3) a snowmelt log on clipboards in the lab (or they can be kept in Dan's cabin if everyone is sharing this living space). Below you will find details on how to collect this data.

4.1 Quantifying Marmot Emergence

One of the main goals is to determine where and when marmot groups emerge from hibernation. To do this, you must regularly check areas where marmots were seen in the fall of the previous year by either skiing or snowshoeing up to known burrow areas (e.g., River, Bench, Town, Marmot Meadow) or by looking with binoculars and/or spotting scopes from afar (e.g., Avery, Cliff, Picnic, Boulder, North Picnic, Stonefield). Avoid skiing or snowshoeing on or near steep slopes! Each day you investigate a site, you should try to identify each animal and get a maximum count for each demographic category (Adult Males, Adult Females, Yearling Males, Yearling Females). If you can't ID an animal, describe it in your notebook (and in the comments section of your observations spreadsheet), take note of any distinguishing features, draw it, take pictures through the scope. It is

very important you try to update your notes when you eventually trap subjects and are able to ID them.

What to record? Each day, in the emergence log, add a list of all the new identified individuals seen and mark them in the appropriate age/class cell. For unmarked animals, record the total number seen each day. If you are not certain whether an animal is marked or not, put it in the unmarked and add a comment saying you were uncertain about whether it was marked or not and refer to the relevant page of your notebook and update later if you can confirm who it was. Continue recording new sightings and when you start trapping, record new animals not previously seen until you think everyone has emerged (often between 31 May and 10 June). It's important to try to update this emergence log with marked animals when you have a very good idea of who the unmarked animal is, but you're not 100% certain until it's captured. These data will ultimately be turned into a cumulative emergence plot and help us determine winter survival.

4.2 Identifying hibernacula

Hibernacula are burrows where marmots hibernate. These are the burrows from which they first emerge in the spring. It's really obvious when a marmot is actively using a burrow (there are footprints on the snow and the area around the burrow is often muddy). It also can be obvious when a marmot emerged, and then went back into torpor—what you see there is a hole that has snow piled in the opening…no sign of active footprints, etc. And, if you know where a burrow should be, it's obvious when nobody has emerged (no holes!). Tricky sites are under cabins and on the cliff burrows of River. At River, the marmots may emerge, but it may take them a while to climb up the cliff and get to the top. It's essential to look for sign of activity from the hillside North of the burrows, which we will sometimes refer to as the winter observation spot. This spot is technically still on sage mound and sometimes has active marmot burrows. When marmots are active here, the location is referred to as "sage mound, cliff."

When marmots first emerge, they lounge around a lot, but yearlings can be very playful. When you see a marmot first emerge, sometimes it will have snow on its nose because it tunneled out! *Keep a list of all known hibernacula and all known animals that use each hibernacula for the groups you're watching*. This will ensure we keep an eye on where marmots are likely to emerge and make it easier to identify who is emerging.

4.3 Quantifying Snowmelt

Each day, at each area you will have to estimate the percent snow cover for each area that marmots use. To do so, draw an imaginary oval/circle that includes much of the traditional foraging range for marmots living in a given area (you need to be trained on this). If there is no bare ground, there is 100% snow-cover. If there is 95% bare ground, there is 5% snow cover. **Aim to quantify ground cover in 5% increments**. Remember, if it snows and you're out there the next morning, an area that was previously 40% snow cover, could be 100% snow cover again.

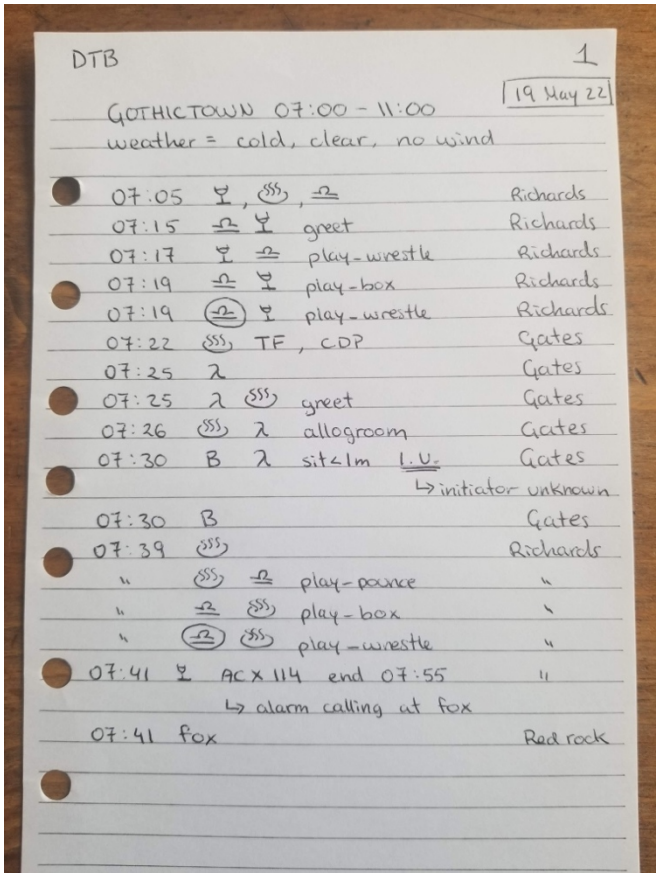
It's best if the same people do this each day for an area. Be sure to calibrate yourself with someone who knows the areas that marmots use. This will ultimately result in a date of 50% snow melt which we use to determine the 'start' of the growing season.

For the River area, we have been quantifying snowmelt separately for each mound. However, from now on (June 2018), please record River Mound as one area, and River South/Middle/Spruce/Sage as another area. Annex is its own area, as is the Bench cabin area (include Bench Ridge with Bench). For town, we quantify snowmelt on each side of the road (East and West). Up valley sites are their

own area except for Marmot Meadow, split into Aspen and Main Talus, and Picnic, split into Lower, Middle, and Upper. The splits should all be reflected in the snowmelt log datasheet.

5. Observing Marmots (Marmoteering Essentials)

5.1 Observations


DTB 1

19 May 22

GOTHICTOWN 07:00 - 11:00
weather = cold, clear, no wind

07:05 ♀, ♀, ♂ Richards
07:15 ♂ ♀ greet Richards
07:17 ♀ ♂ play-wrestle Richards
07:19 ♂ ♀ play-box Richards
07:19 ♂ ♀ play-wrestle Richards
07:22 TF, CDP Gates
07:25 λ Gates
07:25 λ greet Gates
07:36 λ allogroom Gates
07:30 B λ sit<1m I.U. Gates
↳ initiator unknown
07:30 B Gates
07:39 Richards
" play-pounce "
" play-box "
" play-wrestle "
07:41 ♀ AC x 114 end 07:55 "
↳ alarm calling at fox
07:41 fox Red rock

You will be taking notes that should be useful and legible for the next 30 years. Please write on both sides of the page to save paper. Please use it ONLY for marmot notes. Write only in pencil or ball-point pen (roller balls run when wet). Please try to write neatly. Remove and store original pages in the lab as you enter data into the various data sheets (e.g., observation log, alarm calling log, time watching log, etc.). There is no excuse for losing data and it's frustrating when this happens because we work so hard to collect it in the first place.

IMPORTANT: The exact identity of animals is essential. Keep looking at individuals until you have a positive ID. If you see unmarked animals record their behaviors and consider trapping them later in the day or the next day and update your notes promptly.

1. **Always write your name and the date** in the upper left corner of the page, write a cumulative page number on the upper right corner of the page. It's acceptable also to write your initials with the page number.
2. At the beginning of an observation, write the start time and the weather; be sure to comment on the approximate temperature, wind, cloud cover, and precipitation.
3. Whenever you make an entry enter the time on the left margin. Save the right margin for notes to help you locate key events.
4. Start by identifying all the individuals in the group.
5. Be sure to record all instances you see of:
    a. Social interactions—see following section for details
    b. Alarm calling—count alarm calls and note starting and ending times. If you're watching one group and hear alarm calls in another group, be sure to note that. Also, do your best to identify multiple callers.
    c. Location of all identified animals (colony, area and burrow)—if a particular animal is seen in several locations, record all locations (and time) in a given day.
    d. Carrying dry plants (CDP) with location and time
    e. Cheek rubbing (CR) with location and time. Treat a bout of cheek rubbing as lasting a minute and if an individual cheek rubs again after 1 min, record it again. Be sure to record each and every burrow location where cheek rubbing occurs. If you can differentiate cheek from oral angle rubbing, please do so.
    f. Tail flagging (TF) with location and time. Treat a bout of tail flagging as lasting a minute and if an individual tail flags again after 1 min, record it again. Be sure to record each

and every burrow location where tail flagging occurs.

g. Predator visits in the area—coyote, fox, golden eagle, red-tailed hawk, other raptors, ravens. Log those predators that are not positively identified (e.g., raptor—possible *Buteo*). Google these species if you are unsure of what they look like.
h. Pup movement. If you're lucky, you'll see a mother carrying a pup in her mouth from one burrow to another. Note who is doing this and the burrows that are involved in a movement. This can look initially like CDP—or it can look like infanticide—so write detailed observations.
i. Infanticide. If you see this, you'll likely know it. An adult may emerge from a burrow with blood on its mouth.

6. Write down any additional impressions about social dynamics, etc. that you think might be important. Note the loss of any prominent individuals. Your impressions are valuable.
7. Write down the end time when you stop watching marmots.
8. Feel free to draw sketch maps or other aids to help pinpoint the location of marmots.
9. *Be sure to enter notes into the Libre Office data sheets promptly*. Each marmot should be identified by its unique ID (unique left and right tags separated by an underscore (7874_4452). Information about location should be entered in two columns (col_area, location) for all logs (see separate spreadsheet "Database Colony Names" for allowable location names). You may put check marks or other visible marks in the notes as you transfer the data to the data sheets. Do not cross out notes in a way to make them illegible (unless you're removing an observation).

Read more about the colonies you will be observing here, including where you are likely to see marmots and what good spots to watch from are.

Note: All ID numbers recorded when trapping or collecting samples, should refer to the ear-tag numbers you read on the animal (Current ID). All other ID numbers (e.g., those written in your field notes, those referring to playback experiments, and those associated with focal animal samples) should refer to the animal's unique and original set of numbers (UID, and not Current ID). Please draw the marmot's mark on all data sheets and in your notebook.

SOCIAL INTERACTIONS

Check videos of behaviors in the Marmot Training Videos section.

Social interactions are defined when two animals are within 1 m of each other. This includes sitting together, greeting, allogrooming, play, and aggressive encounters. I'm particularly interested in trying to define all sorts of displacements—the observation of one individual moving away while the other stays put. These may be subtle! Displacements can also happen at the end of any other social interaction in which case we talk about a "winner".

When recording social interactions, you should pay attention to 1) who initiated the interaction, and 2) the winner of the interaction. In your notes, you should write the furmark of the initiator first, this indicates that they initiated. If you do not know who initiated the interaction write "initiator unknown" (or I.U.) in your notes and make sure to write "initiator unknown" in the comments in the spreadsheet. **At the end of a social interaction, if one individual leaves, the individuals that stays is considered the "winner" of that interaction**. Circle the furmark of the winner in your notes. While all interactions *could* have a winner, not all interactions will have a winner. If there is no winner or the winner is unknown leave the winner ID column blank when you go to enter your data.

Play and aggression often employ the same motor patterns! Clearly specify whether the activity is play or agression (see ethogram below for more details). For example, chasing, biting, or pushing

may take place in either context, especially for pups. Use the comments column to describe what you saw if you are not sure. Try to keep your comments concise. Finally, social play bouts can be long or short, and they can include various play interactions (e.g., they can start play_boxing and then seamlessly go into a play_wrestle). Thus, animals playing with each other for a while can engage in many play interactions and each one should be entered into the log. Not every play interaction will have a winner. **Only record the winner for the specific play interaction that resulted in one marmot moving away (often the last of the bout, not every interaction in that play bout)**. If there is no winner or you are not sure who the winner is, leave the winner column blank. Each play interaction should have its own initiator. However, it is not always easy to tell who initiates each play interaction, especially when they switch play behaviors quickly. Use your best judgement in specifying the initiator for each interaction, but if you did not see how an interaction started or are not sure who started it simply write "initiator unknown" in the comments. Each of the behaviors are written with a focus on the initiator marmot. Note how the receiver, marmot behaves in the comments section.

If you have multiple marmots interacting:

- Indicate the number of marmots interacting in the "Nb" column.
- If you were able to ID the initiator, use as many lines in the Social Interactions log as there were marmots to link the initiator with each recipient. The goal here is to capture all the various interactions. For example, if you saw 3 marmots play wrestling, this is how you would enter it:

If you had 4 marmots interacting, you would do the same thing, using 6 lines to link each pair, and so on.

Date	Time	Col_area	Location	Initiator UID	Recipient UID	UID Who wins or stays?	Type	Nb indiv interacting	Comments
18-May-09	8:37	picnic_lower	pinnacle	5657_5666	6051_6054		play wrestle	3	
18-May-09	8:37	picnic_lower	pinnacle	5657_5666	5618_5623		play wrestle	3	
18-May-09	8:37	picnic_lower	pinnacle	6051_6054	5618_5623		play wrestle	3	

List of social behaviors (with their database coding):

Each of these behaviors are written with a focus on the initiator marmot.

Type	Description
Aggression - agr	After an aggressive interaction, the marmots will probably quickly separate rather than sit calmly near each other as they would for play. Aggressive interactions tend to be quicker than play interactions and you hear vocalizations (squeaks, yelps, growls, etc.) more often with aggression. *You should be able to specify the type of aggression as follow.*
Bite - agr_bite	initiator marmot bites receiver marmot in an aggressive manner
Box - agr_box	stands on hind legs, using paws to strike opponent in an aggressive manner
Chase - agr_chase	initiator marmot chases receiver marmot in an aggressive manner
Grab/slap/push - agr_grab/slap/push	initiator marmot grabs, boxes, slaps, or pushes receiver marmot in an aggressive manner
mouth spar agr_mouthspar	when both initiator marmot and receiver marmot lunge at each other with open mouths in an aggressive manner; they may lock teeth
Pounce - agr_pounce	initiator marmot pounces on receiver marmot in an aggressive manner

Type	Description
Snap/snarl/ hiss - agr_snap/snarl/ hiss	initiator marmot vocalizes in an aggressive way towards a receiver marmot
Wrestle - agr_wrestle	initiator marmot and receiver marmot wrestle with each other in an aggressive manner
Play - play	the participants don't look as intense as in aggressive interactions. They sometimes get interrupted, look around, pause, or do other things that make them seem less invested. Unlike aggressive interactions, after play bouts, marmots are likely to sit next to each other. Play is generally 'bouncier' than aggression and is often characterized by individuals changing roles repeatedly and shifting from one type of behavior to another regularly. Behaviors appear to be done in a **playful/non-aggressive (P/N-A)** manner. *You should be able to specify the type of play as follow.*
Bite - play_bite	initiator marmot bites receiver marmot in a P/N-A manner
Box- play_box	stands on hind legs, using paws to strike opponent in a P/N-A manner
Chase - play_chase	initiator marmot chases receiver marmot in a P/N-A manner
Grab/slap/push play_grab/slap/push	initiator marmot grabs, slaps, or pushes receiver marmot in a P/N-A manner
mouth spar - play_mouthspar	when both initiator marmot and receiver marmot lunge at each other with open mouths in a P/N-A manner; they may lock teeth
Pounce - play_pounce	initiator marmot pounces on receiver marmot in a P/N-A manner
Mount - play_mount	A mount in the context of play where one marmot places its forepaws on the others back, and/or mounts it.
Wrestle - play_wrestle	initiator marmot and receiver marmot wrestle with each other in a P/N-A manner
Sniff AG -sniff_ag	initiator marmot sniffs butt-end of receiver marmot
Greet - greet	initiator marmot touches nose of receiver marmot with its nose
Allogroom- allogroom	one marmot grooming another or multiple marmots grooming each other. Often concentrated in places a subject cannot reach (back of neck).
Cheek rub - cheek_rub	when a marmot rubs its cheek on an object or sometimes on another marmot
Displacement - disp	when one marmot displaces another. There is two types of displacement
Simple - disp_simple	there is contact between two marmots and one ends up changing locations
Proximity - disp_proximity	by just approaching rather than physical means. Distance for displace proximity is 1 meter. If it is farther than 1 meter and you are sure it was a displacement, score it and make a note in the comments.
Sit - sit	two or more marmots sitting:
< 1m - sit_<1m	within 1 meter of each other but not in body contact
body contact - sit_bc	in physical contact with each other
Follow - follow	when one marmot approaches another and the approached animal moves and this whole interaction occurs three or more successive times

Type	Description
Forage together - fg_tog	marmots are together out feeding in an area with food within 1 meter of each other or obviously moving together (not greater than 5 meters apart)
Mount - mount	One marmot mounts another. This may be part of a complex bout of play, or it may simply be a mount. Score it as a mount unless it's an obvious play mount or sexual mount.
Nurse - nurse	a pup suckling from a mother
Sex - sex	Sex is rarely seen but is characterized by extended periods of foreplay (literally play behavior) punctuated by obvious lordosis displays by the female and mounting with thrusting, ejaculation, and then more play, etc. If you see what appears to be sex (it looks playful), please write detailed descriptions in your notes.
Thrust - sex_thrust	male mounts a female and thrusts pelvis (ask Dan for demo if unclear)
Lordosis - sex_lordosis	female solicitation of male by arching back in lordosis posture
Mount - sex_mount	male mounts female

5.2 Entering Observation Data in LibreOffice

All the observations are logged in a LibreOffice file (download LibreOffice). Go to the lab Dropbox > 3. Obs Data and create a new folder with your initials. Copy the file titled "BLANK_obs_log_YEAR.ods" into your folder and rename it as "INITIALS_obs_log_DATE.ods". Every time you go to enter data you should open the latest version of this file and Save As the date you are entering data (we want multiple versions in case a file gets corrupted, so never overwrite the data and always Save As a new copy). Try to enter your observations as soon as you can, ideally on a daily basis when you are back from the field. Observations are accumulated at a really high rate, and they often take longer than expected to enter. Don't get backed up on data entry; if you do it regularly it's not a problem.
You must enter ALL your data before leaving RMBL.

There are a few important rules to log your observations in the LibreOffice file:

- no uppercase, lowercase only
- respect the time and date format
- comments should not include comas (,) and should be shorter than 250 characters.
- Use the standardized names of the locations available on the "do not modify" spreadsheet

The "do not modify" spreadsheet contains the standardized names of colonies, colony_areas, locations and social interactions. Use that spreadsheet when you are not sure how to write a location. Social interactions, colonies, and colony_areas are already constraint to the list on this spreadsheet.

Where to enter your observations in the file should be fairly obvious—the name of each spreadsheet is self-explanatory—but see further explanations below.

Time observing log
Starting and ending time of observations with colony observed and weather. If you observe multiple colonies at the same time add a line per colony observed.

Observation Log
The columns are: date/time/uniqueID/colony_area/location/comments/cheeck rub/tail Flag/CDP. If you see an unmarked marmot moving around in a 'non-traditional' location, note it as well. Observations of marmots should include details of locations and miscellaneous behavior. Whenever you see a marked, or unmarked marmot, fill out an entry in the observation log. For instance, if you record in your notebook that an animal was carrying dried plants (CDP) to a particular burrow, then this goes into the observation log: females CDP to natal burrows. If an animal moves around throughout the day, try to follow it and record the different burrow areas it visits in your notes and abstract these into the log. Don't worry about 'minor' movements (e.g., marmot moved 2 m up slope from a burrow). Your notes will likely be much more detailed than the log and will contain details of the comings and goings of the marmots. Remember, it is this observation log that will help us define social groups, a major purpose of the log.

Social observation log

Alarm Calling

Predator sighting log

Focal observations

5.3 Foraging focal observations

This data is collected by means of 2-minute foraging focals. We conduct 2-minute focal animal samples where the goal is to record the initiation of every behavior during a 2-minute bout of foraging. Speak these focals into a tape recorder and 'score' them promptly in your computer using JWatcher. **Be sure to fill out a focal data sheet and draw the animal's mark on the focal data sheet**. You will then enter everything on the datasheet into the LibreOffice focals sheet.

The goal is to try to have >1 different 2-min focals for every animal every week. We realize this is an unachievable aspiration, but it emphasizes that you must work to get the focals. In some groups this is impossible; other groups it should be relatively straightforward. Ideally, you will have a list of all animals in a group and you will 'cycle' through this list, conducting focals on the next animal in the list. In large groups this may be less effective than simply looking for whomever is foraging and then initiating a focal. You really have to work to try to collect these. Please don't forget to conduct the focals if this is one of your assigned tasks. If you have already collected a focal that day, don't do another one on the same animal. If you collected a focal the day before, consider looking for another animal on which to conduct a focal.

2-min sounds short, until the vegetation begins to grow. Be sure to say "out-of-sight" when the animal moves out of sight and then resume your narration when it comes back in sight. Be sure to fully fill out the data sheet when you do the focal. Please draw the animal's mark on the data sheet.

ETHOGRAM FOR THE FORAGING FOCAL

An ethogram is a catalog of behaviors. Because all behaviors are mutually exclusive, you only have to note the transitions.

Behaviour	Description
Stand forage (f)	marmot is quadrupedally standing and has its head down, nose to ground. Chewing may be seen.

Behaviour	Description
Rear forage (g)	marmot is standing only on its hind feet, nose to food. Chewing may be seen.
Stand look (l)	quadrupedally standing and has its head up, off the ground. Chewing may be seen if the animal is looking and chewing. NOTE: each time the head moves, score another look.
Rear look (r)	marmot is standing only on its hind feet, head up off the substrate. Chewing may be seen if the animal is looking and chewing. NOTE: each time the head moves, score another look.
Walk (w)	marmot is walking. Marmots may walk while they forage, score as a quick "walk, stand forage." Marmots may "moon walk"—their shoulders will move forward even though you did not notice them stepping—this still counts as walking. Score a walk whenever a marmot has moved forward in space.
Run (n)	marmot is running.
Out-of-sight (o)	the marmot is out of sight. It may disappear into a burrow or behind a rock or other vegetation. Be sure that when/if it re-appears, you're watching the same marmot.
Other (t)	other behaviors (which may include social behaviors).

SCORING YOUR FOCALS IN JWATCHER

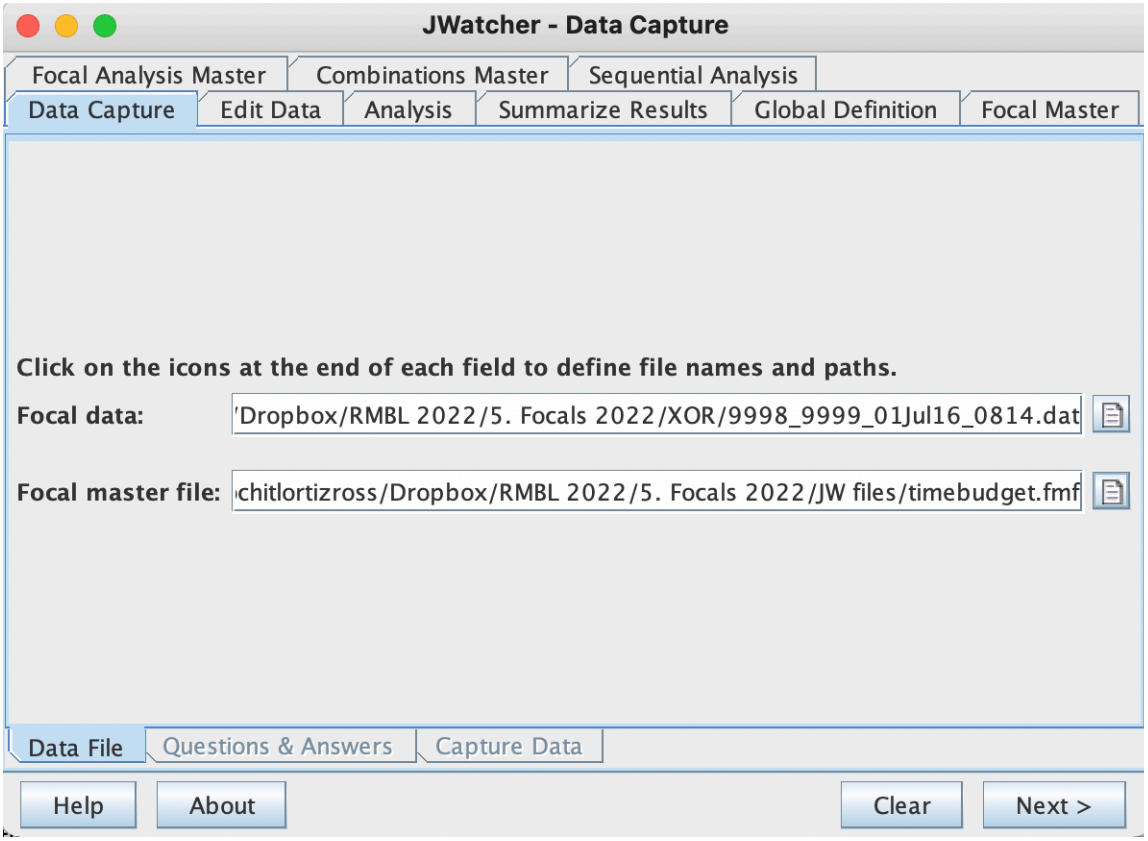
After you learn how to record foraging focals in the field, you must enter your data into JWatcher so we can analyze the time that animals allocate to each behavior. You can download and read about the program at this link: https://www.jwatcher.ucla.edu. Please, read the download instructions carefully—**JWatcher requires Java to be already downloaded on your computer**. You can find a Java download here: If you have issues downloading JWatcher you can check the supplementary materials. You can also find the JWatcher manual in the Focals folder on dropbox.

Follow these instructions to enter your recordings into JWatcher (the .fmf and .faf files are provided in the focals folder in the dropbox—if not, see the JWatcher manual for help with this). Create a folder with your initials in the focals folder on dropbox. You should save all of your focal files here.

Step 1: Data Capture

Data File

- Click on the 'Data Capture' tab in JWatcher
- In the 'Focal data' line, click on the file icon on the right side and find the location where you will save your JWatcher files. Enter the name you are giving your file. For RMBL foraging focals, this will be UID_date_time.dat. UID should be left tag, underscore, right tag, date should be 2 digits for the day, three letters for the month, and 2 digits for the year without any separation between day month and year, time should be 4 digits without any separation in between. Here is an example 9998_9999_01Jul16_0814.dat. Click Open.
- In the 'Focal master file' line, click on the file icon and find the .fmf file (in 5. Focals > JW files). Open it. Click Next.



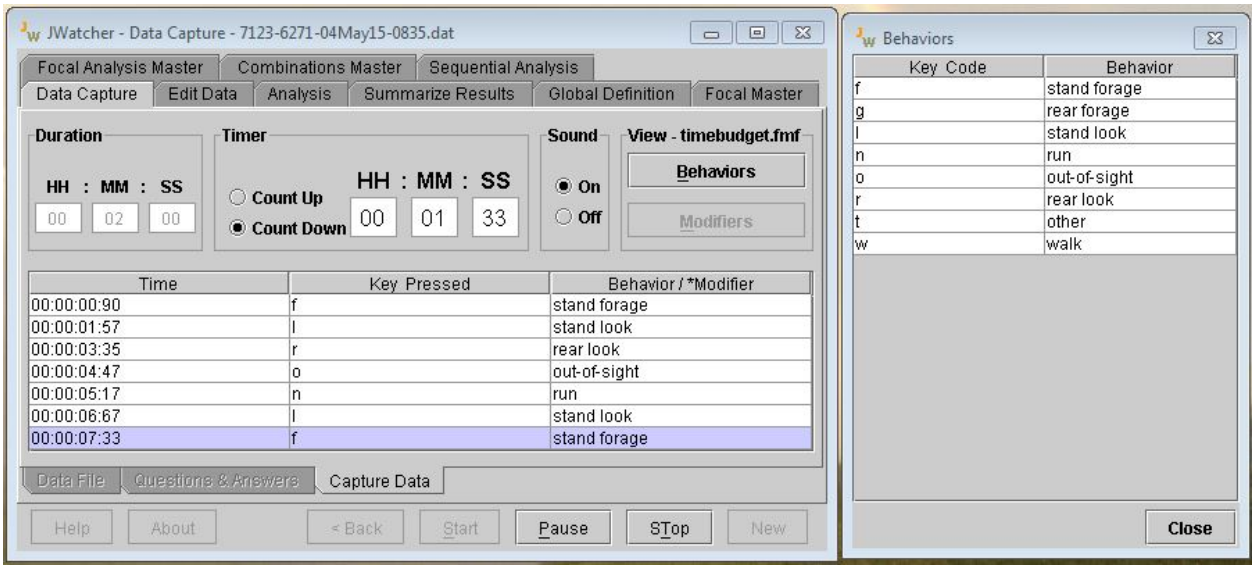
Questions & Answers

- Answer any questions that appear on the screen. Click Next again.

Capture Data

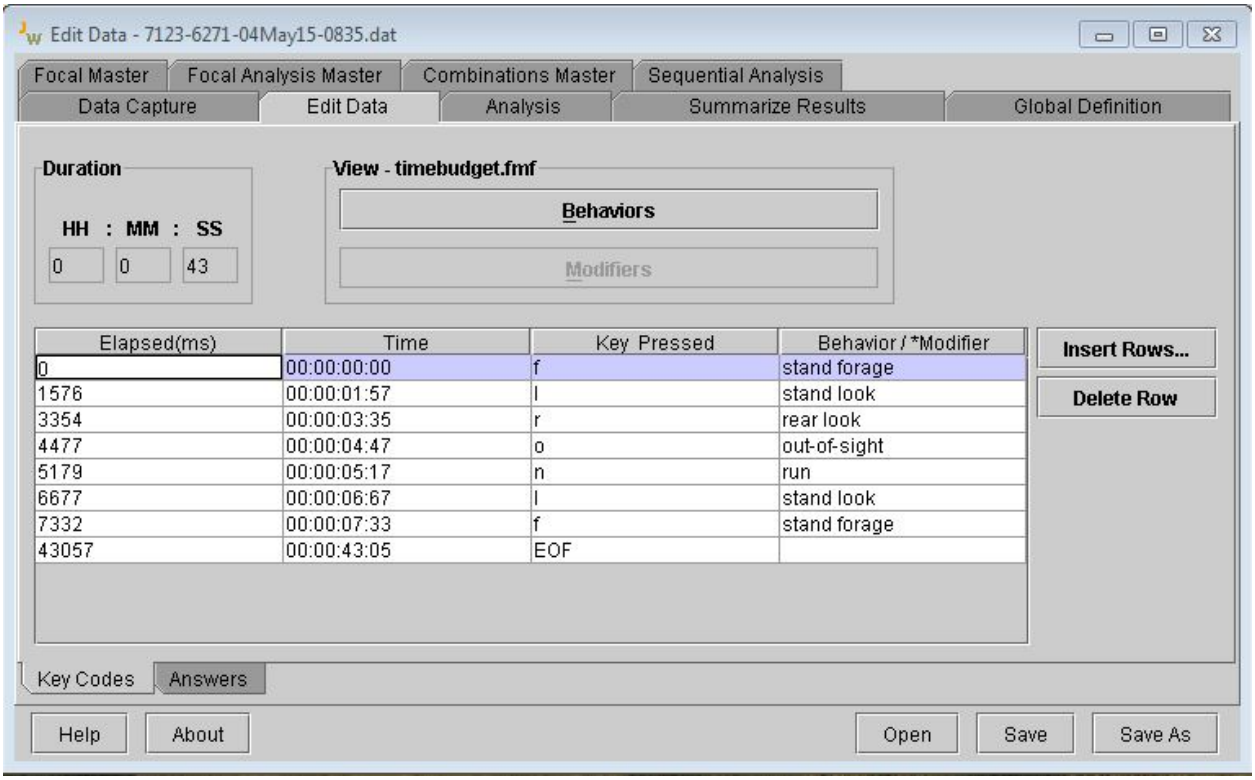
- Click on 'Behaviors' to open up the ethogram. You can put this to the side of your screen so you can see while you enter data.
- The 'duration' section should show you how long the recording will be. JWatcher will automatically cut you off after this length of time.
- When you are ready, start playing your recording and then click start when the focal begins (You should say "start" at the beginning of each recording to make this timing easier). Type the key that corresponds to the behavior said each time it is said in the recording, until you hit 2 minutes. If the recording is less than 2 minutes, press stop when it ends.
- The .dat file that you just created will automatically save when you're done!

Note: if you mess up and need to re-start, click 'New' and when it asks if it can overwrite your previous file, click 'OK'.



Step 2: Edit Data

- Click Open and find the .dat file that you just created. (Note: if you are entering multiple focals in a row, you will see data already open here when you click on this tab – BUT this is NOT the file you just entered – you MUST click open and find it each time.)
- You must 0-out each file to account for the time that it took you to press the first key. To do this, simply double-click the elapsed time ('Elapsed(ms)') in the top row (the first behavior you entered), and change the time to 0. (Alternatively, you can edit the 'time' column – either way, both 'Elapsed(ms)' and 'Time' should change to 0).
- If you made any mistakes, you can edit them here (for example, if you entered a 'stand look' as a 'rear look', you can edit the 'Key Pressed' or if you answered a question incorrectly, you can edit your answer in the 'Answers' tab).
- Click Save!!



To start a new focal, click on the 'Data Capture' tab again and click 'New'.

JWatcher: Observer Consistency Check

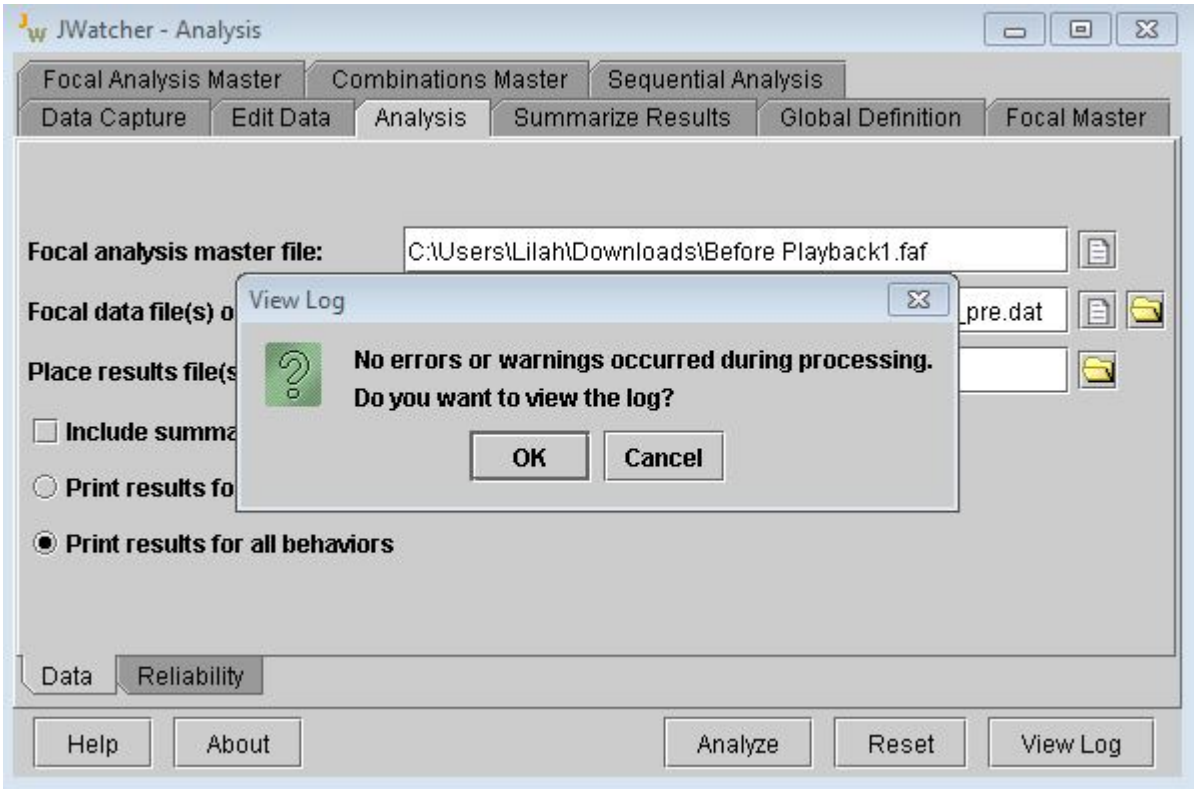
Before you start recording your focals you will need to check that you are entering the data consistently. Begin by recording an example focal (or your first focal) five times and follow the instructions below.

Step 1: Input data from the same recording 5 times.

- Open JWatcher and input the behaviors from one single recording 3-5 times (note: you may want to name these .dat files as "Practice1", "Practice2", etc.).
- Open the .dat files and look at them. Are the keys pressed in the same order? Are the same keys pressed? Once you are consistently entering data consistently, proceed.

Step 2: Analyze each recording in JWatcher

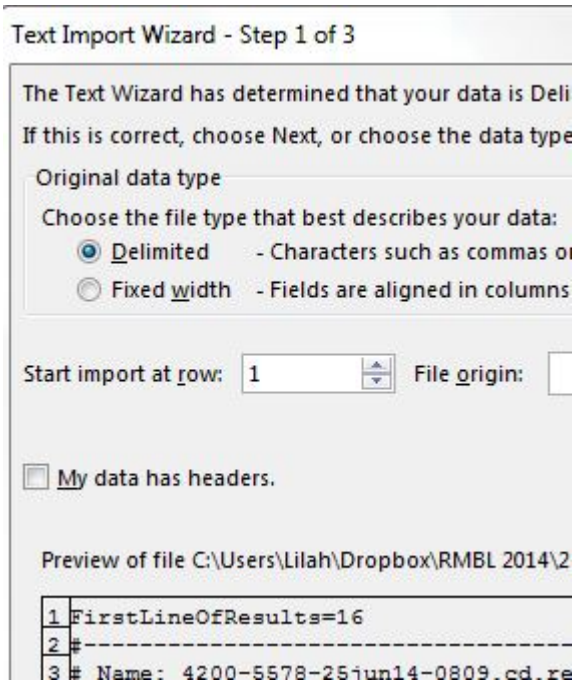
- In the "Analyze" tab, select the .faf file and one of your practice .dat files and click "Analyze". The message that pops up should confirm that there were zero errors or warnings during the analysis. (It is not necessary to view the log here.)

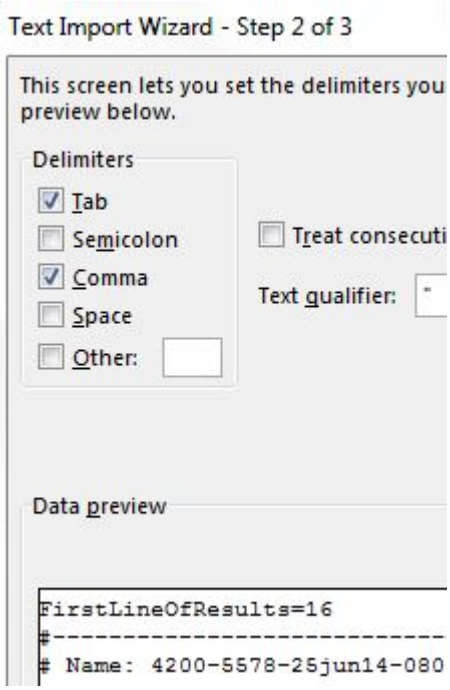


- Repeat this for each of your 3-5 .dat files. Note: JWatcher automatically creates a results folder to put these results files in – be sure to note where this folder is so you can access the files in the next step.

Step 3: Open results in Excel

- Open Microsoft Excel.
- Open your results folder that JWatcher created and look for the 3-5 .cd.res files.
- Open each .cd.res file and select "delimited - comma" for each file (usually "delimited" is already selected and then in the next window, you have to check the "comma" box).





- Expand the columns so you can see the titles of each column.

	A	B	C	D	E	F	G	H	I
1	FirstLineOfResults=16								
2	#----------								
3	# Name: 6127-7339-23jun14-1752.cd.res								
4	# Format: Codes Down Results File 1.0								
5	# Updated: Wed Jan 28 19:13:46 GMT 2015								
6	#----------								
7	FocalDataFile=6127-7339-23jun14-1752.dat								
8	FocalAnalysisMasterFile=timebudget.faf								
9	Answer.1=LMH								
10	Answer.2=picnic								
11	Answer.3=								
12	Answer.4=								
13	Answer.5=								
14	Answer.6=								
15	#BEGIN RESULTS								
16	Time Bin	Behavior	Behavior Name	Modifier	Modifier Name	StateAllDur N	StateAllDur TT	StateAllDur X	StateAllDur PropIS
17	0	f	stand forage			21	96564	4598.29	0.8047
18	0	g	rear forage			0	0	0	0
19	0	l	stand look			5	5589	1117.8	0.0466
20	0	n	run			0	0	0	0
21	0	o	out-of-sight			0	0	0	
22	0	r	rear look			0	0	0	0
23	0	t	other			0	0	0	0
24	0	w	walk			17	17847	1049.82	0.1487
25									

Step 4: Check "N" consistency

Behavior	Behavior Name	Modifier	Modifier Name	StateAllDur N	StateAllDur TT	StateAllDur X	StateAllDur PropIS
f	stand forage			21	96564	4598.29	0.8047
g	rear forage			0	0	0	0
l	stand look			5	5589	1117.8	0.0466
n	run			0	0	0	0
o	out-of-sight			0	0	0	
r	rear look			0	0	0	0
t	other			0	0	0	0
w	walk			17	17847	1049.82	0.1487

- One of the columns is titled "StateAllDur N"; this shows the number of times that each behavior was recorded.
- Check that these numbers are the same between all 3-5 files. They should be because you're typing the same keys in (you checked this before in the .dat files). If they are not,

you must practice listening to your recordings and inputting data until you are consistently recording the correct number of times each behavior was seen.

Step 5: Check PropIS consistency

Behavior	Behavior Name	Modifier	Modifier Name	StateAllDur N	StateAllDur TT	StateAllDur X	StateAllDur PropIS
f	stand forage			21	96564	4598.29	0.8047
g	rear forage			0	0	0	0
l	stand look			5	5589	1117.8	0.0466
n	run			0	0	0	0
o	out-of-sight			0	0	0	
r	rear look			0	0	0	0
t	other			0	0	0	0
w	walk			17	17847	1049.82	0.1487

- One of the columns is titled “StateAllDur PropIS”; this shows the proportion of time that the animal spent conducting a certain behavior while the animal was in sight.
- Create a new excel sheet and copy over the PropIS data from each of your 3-5 files so they are all lined up. Then, use the correlation function in excel (***=CORREL(__,___)***) to compare the data in pairs. This is testing how consistent you are with timing when you input your data. This value should be above 0.95 for each comparison. If it is not, keep practicing inputting data!
- It’s common for common behaviors to have very similar time budget estimates. Pay particular attention to rare behaviors. (Indeed, another way to look at data is to go behavior by behavior and create two columns of pairs of observations and correlate these—this will tell you your consistency for a given behavior).

Remember: Once you’re trained, you should feel comfortable scoring focals. And, you should also be comfortable in a more complex focal stopping and re-doing it because you think you made a mistake.

	A	B	C
1	StateAllDur PropIS	StateAllDur PropIS	StateAllDur PropIS
2	0.8047	0.7998	0.8067
3	0	0	0
4	0.0466	0.0444	0.0501
5	0	0	0
6			
7	0	0	0
8	0	0	0
9	0.1487	0.1497	0.1477
10			
11			
12			=correl(A2:A9,B2:B9)
13			

6. Trapping Marmots (Marmoteering Essentials)

Trapping is essential to 1) monitor marmot population dynamics, 2) mark animals to facilitate behavioral study, 3) bring marmots into the lab for study, and 4) collect samples that range from alarm calls to blood or fecal material for later analysis. *Trapping is one of the single most important on-going activities for the long-term study of the RMBL marmots*. Improper trapping can kill marmots and **there is zero tolerance for trap-induced mortality**. Trap mortality is almost always avoidable if animals are not left to overheat in the sun or left out overnight in an un-checked trap. Sometimes things are stressful (e.g., when you're closing traps during a rainstorm). Marmot safety and well-being are of the utmost importance. If there is *any* doubt in your mind, triple-check to ensure that you've closed all traps. These procedures are designed to allow the safe and effective trapping of RMBL marmots. **Note: each and every time a marmot is trapped, it must be logged on the trap sheet.** This includes multiple captures in a given trapping session (when you may collect no additional data) and multiple captures in a given day (when you may only weigh it).

6.1 Trap Locations

*These are **suggestions**; when pups come out it's often a good idea to saturate an area with traps and trap anything that moves. The bottom line is you want to set traps where animals are and this requires people to watch areas before setting traps. It's always a good idea to set at least one more trap than the number of targeted animals if you're trapping a burrow that is stable.*

River: There are 3 main River locations—River Mound; River Spruce Mound; River South/Middle Mounds and Sage Mound.
Bench: Set traps Bridger house (closest to the river), traps at the water tower, tower mound, and traps at tiny cabin/storage shed--Grey Cabin, and at the stone wall below bench cabin.
Gothic townsite: Set traps where marmots are observed.
Beaver Talus: set traps where marmots are observed.
Marmot Meadow: The Marmot Meadow locations include Main Talus (at the up-valley end of the meadow); Tree Burrow, Rock Talus, Aspen Burrow; Middle Burrow (near Aspen Burrow).
Picnic: There are 4 main Picnic trapping areas—Upper, Middle, Split Rock, Aspen Burrow (immediately below Split Rock), and Lower Picnic (around Big Pinnacle/Little Pinnacle area).
Boulder: Mostly we set traps around the Boulder unless you see them up at Upper or North burrows.
North Picnic: see map for locations. Main talus is traditionally a good place. Only trap when animals have been first seen there.
Stone Field: Set traps around frequented areas in the Main Mound area and traps around South Mound. The big stone mound is the main burrow for one group, South Mound is the main burrow area for the other matriline. Other areas include Diamond Rock.
River Corral/River Annex/River Bend/West River Bend/River Falls: set traps where there is sign of marmots.
Bellview Parking lot area: set traps where you see marmots.

6.2 Setting and checking traps

Check the Marmot Training Videos in the Supplementary Materials.

Place traps as close to burrow entrances as possible or along trails frequented by the marmots.

Ensure that the trap will close with a limited amount of pressure, and that traps are in good repair (i.e., make sure there are no holes or weak spots through which a marmot could escape or hurt itself). Bait traps with Omalene 100 (horse food)—a bait that is preferred to the traditional salted oats. Place a couple handfuls of bait behind the treadle (place a little in the entrance to entice the marmot in) and ensure that the door can close freely. Early in the season consider going down valley to collect dandelions and/or cow parsnip to increase chance of trapping success (the first growth of vegetation is particularly tasty and sometimes it's hard to catch animals on bait alone). Later in the season, when marmots become satiated and hard to trap, we mix peanut butter in the bait. "Judy's special" includes: oats, salt, Omalene, peanut butter, and VANILLA. Bacon grease is another alternative to add.

Make sure the traps are placed in locations where they are secure (i.e., marmots cannot easily roll the trap down a hill or into a river). It is also better if the traps are stable, that is, they don't move when the marmot enters. We have stakes in the lab that can be used to secure traps that are placed near cliff sides (e.g., at River) and are also useful when certain marmots tend to dig or flip the trap to get to the bait without going in. When using stakes, please make sure to collect them at the end of each trapping session to avoid losing them.

Always make sure no object (whether rock or plant) is blocking the door of the trap from closing properly. **It is best practice to always "set-off" a trap after setting it (i.e., by pressing on the treadle) to ensure proper functioning.**

In the lab, the Trap Board should always be properly updated with the current number of traps and their burrow location in the field. If you are moving traps, **update the board**. If you add traps, **update the board**. At Picnic, traps are (currently) labelled A-P. Be sure that you keep track of each trap's exact location.

Before setting traps, always check the Trap Board first to note where and how many traps you are setting (tip: take a picture!). While setting, keep a written list of where each trap is set (this can be on your phone) so that you can cross off each trap off your list as you close them after trapping.

Trapping in the morning: open traps first thing in the morning (no later than 7 AM). Leave traps open until checking. Marmots easily overheat. Traps should typically be checked by 9:30 or 10 AM. The one exception is Marmot Meadow, which is in a shadow for much of the early morning. CLOSE ALL TRAPS AFTER THE MORNING TRAP CHECK. Feel free to provide shade for marmots in traps with rocks, sticks, leaves, branches, or even cow pies.

Trapping in the afternoon: open traps around 3 or 4 PM and leave them open until checking time…6-8 PM. This all depends on weather.

If it is particularly hot (July/August), check traps NO LATER than 9 AM and open traps no earlier than 4 PM. **If it's in the mid-70°'s discuss carefully when to trap. If it's an 80° day, be *very* careful; it's better to NOT trap that to trap and risk mortality**. Consider setting fewer traps and checking them more frequently. Setting traps in the shade, when possible, is a good idea. Pups are particularly unable to thermoregulate. Trap them carefully and check traps frequently.

When any marmot is heat-stressed, you are checking too late. A heat-stressed marmot lies flat on the trap floor and has sweaty feet. Pups become heat-stressed one hour earlier than adults and can die quickly. **Beware of heat-stress…it can kill**.

IMPORTANT! Be absolutely certain that you have checked and closed ALL set traps. Mistakes may be fatal. Make a list of how many traps you set and at what locations. Count all your traps and cross them off the list as you close them to guarantee all are closed. When you are done, count them again. And again! If there is *any* doubt in your mind and you must walk back to double-check, please do so. A marmot's life depends on it. Leaving traps open often results in dead or dying marmots, and this is unacceptable. When the season gets busy it can be easy to forget, since closing traps becomes second nature. Please, always take the time to look back and count them.

When it is time to check the traps, you will need to grab:

A trap bag

A cooler

A tablet

6.3 The Trap Bag

The trap bag should contain:

- A trap book, which includes:
  - 2 trap sheets (one blank for when you run out),
  - 2 blood sheets (one blank for when you run out),
  - the most recent marmot ID sheet,
  - a permit,
  - 2 pens, and
  - 2 sharpies
  - Later in the season you will also need: pup fur marks and running sheets
- 2 marmot bags, 1 large and 1 medium (more if marmots are going to be transferred to the lab). Later in the season you will also add a pup-sized bag.
- 1 digital scale with a spare battery and a backup 10kg spring scale.
- 1 pair of digital calipers (with a back-up battery taped on).
- 1 container of mixed Nyanzol dye (see below).
- 1 container of hydrogen peroxide.
- 1 empty container to mix the dye and the peroxide.
- 1-2 toothbrushes for applying the dye (smaller sized toothbrushes for the pups)
- eartags, eartag pliers, and regular pliers
- alcohol pads for cleaning skin before bleeding and ears and eartags before tagging
- envelopes for collecting hair samples for DNA analysis
- small zip lock bags for collecting fecal samples
- 2 'marmot-be-cool' sticks
- Alarm call recording setup: recorder, microphone, spare batteries, notebook, pen
- Blood kit: syringes, alcohol swabs, vacutainers, rubber band tourniquets, corn starch, and cotton balls to stop bleeding. Don't forget to bring a cooler with ice in the bottom. If you are using micro-capillary tubes, bring those along with putty.

Additional equipment may include:

- Buccal swabs
- Running speed equipment (for later in the season): tape measure, inclinometer, flags, stop-watch, and data sheet
- Cotton swabs for taking vaginal swabs
- Flea collection kit: square white cloth, red comb
- Ectoparasite treatment kit: water spray, pyrethrum spray

MIXING NYANZOL FUR DYE

Nyanzol dye is a 'binary' hair dye. It's mixed by dissolving 1 or 2 tablespoons (more if there is no super saturated solution to begin with) of dye crystals into rubbing alcohol in a dark, sealed jar. A good dark mix should be a super-saturated solution (i.e., there should be un-dissolved crystals in it). The dye is **activated** just before use by mixing 1 capful of hydrogen peroxide per half 'vial' of dye mix in a mixing container. Don't mix more than you need and only use the dye during the trapping session (i.e., morning or evening) that you mixed it.

NOTE: The dye will temporarily stain fingers and permanently stain clothes. Keep the dye off the trap sheets.

6.4 Handling A Trapped Marmot

Check the Marmot Training Videos section in the Supplementary Materials

SHORT VERSION

1. Don't get bitten!
2. Record the time when you first approached the trap (trap time)
3. Identify the marmot (ear tags, furmark)
4. Record alarm call if the marmot is alarm calling
5. Transfer the marmot to the trapping bag and score docility behaviors
6. Take blood if needed
7. Measure AG distance and left hind-foot length
8. Check the sex and reproductive status
9. Weigh the marmot
10. Re-check/replace ear tag if needed
11. Take hair samples if needed
12. Take other samples if needed (e.g., fecal, buccal swab, fleas, anal gland, …)
13. Do personality test if needed.
14. Redo the fur mark if needed
15. Release the marmot and run it if needed (later in the season when we stop bleeding)

DETAILED VERSION

1. Record the time when you first approach the trap. This is the trap time. If there are multiple animals in one trap, record the same trap time for all (this *usually* only happens with pups). If you moved multiple traps at once (e.g., it is getting hot and you want to move them in the shade), record the second time you approach, just before processing the animal.
2. Identify the marmot. Look at the fur mark and try to read the ear tags before doing anything else while the marmot is in the trap in case it escapes while you are getting it into the bag. Record these immediately. Note: if the marmot lost both ear tags and is no longer marked (not a new animal, but unidentifiable), please follow the molting and lost ear tags protocol.

3. If the marmot is alarm-calling, record the calls as fast as you can. Sometimes marmots stop calling before you are ready to record, so be fast. The goal is to record 5, clear, noise-free alarm calls (see section on alarm call recording).
4. Check the tablet to see if you need to collect hair or draw blood from this marmot. **If you find you need blood, this will be collected first** (see section on blood collection protocol).
5. Ensure the handling bag is Velcroed shut and does not have any large holes in it. Put the handling bag over the front of the trap, stretched out ahead with the Velcro side up. Do not leave any openings when you open the door. The easiest way to do this is to straddle the trap, facing the door, **hold the trap bag tight against the bottom corners of the trap with the balls of your feet**, and open the door. Sometimes the marmot will immediately walk into the bag, but it may have to be encouraged. Several methods of encouragement include: banging on the cage, blowing at the marmot, The Marmot Two-step (duck walk from the back of the trap), and The Stick (gently prod a marmot into the bag). In desperate conditions, you may have to try to shake the marmot into the bag (not to be attempted unless very sure of marmot handling skills—this is a good way to lose the marmot!). **Do not forget to score marmot behaviors for docility.**
6. Once in the bag, tie a knot in the back of the bag. Ensure the marmot's head is at the front of the bag and that its ears (not teeth) face the Velcro (e.g., check where the hind legs are or peak in through the hole at the front). If the marmot is not head first, or the head is not on the Velcro side of the bag, give the marmot a bit of room to move around inside the bag by untying the knot and allowing the marmot to reposition itself (keep a twist or two in the wide end of the bag to prevent the marmot from bolting). Retie the knot when the marmot is properly oriented. *Check out this video for a tutorial on re-orienting a marmot in the bag.*
7. Untie the back of the bag and grasp the marmot by its hind legs. Unwrap the bag so that it turns inside out and you can see the marmot's back/belly.
8. Flip the marmot on its back. Collect blood if blood is needed, following the blood collection protocol.
9. Check the sex of the animal and measure the distance between the anterior end of the anus and the posterior end of the 'ball' that either is the penis or the vagina. This is the A-G distance (ano-genital distance). Males have a large A-G distance (>20 mm), females have a relatively short A-G distance (< 10 mm). Young are sometimes difficult to accurately score by eye. If wet, the digital calipers may not work: dry them and/or use the dial calipers in the bag. **Always be sure to re-zero the digital calipers between measurements and if not certain, to re-take the measurement**.
10. Measure the length of the left hind foot (LHF). The appropriate way to measure this is to hold the foot and measure the distance (with the calipers) between the heel and the center front of the foot pad. Don't measure the toes. Ensure you're measuring the maximum length.
11. Check its reproductive status. For males, descended testes are marble to almond sized while non-descended testes might be pea sized. Males are scored as testes scrotal (1) or not detectable (2). For females, nipples are either barely present/visible (3) (in young animals), prominent (4), swollen (5), or lactating (6) where the nipples are both swollen and there is hair missing around the base.
12. Weigh the marmot and the bag. Weigh the empty bag later and enter into appropriate columns on the trapping sheet. **Be very careful to ensure the scale is zeroed before any weight it put on it.**
13. Check the ear tags by carefully opening up the marmot bag near the head; restrain the head if required by pushing down to meet the marmot's resistance. It may be required to open the full front of the bag. If so, be very careful to either have the marmot pinned or to carefully move the flap of the bag around so as to cover the exposed eye. Never let go of the neck/head.
14. If required, ear tag the marmot and record the numbers on the trap sheet. ENSURE THAT THE NUMBERS ARE ON THE OUTSIDE OF THE EAR so that the ear tags can be read in the

trap and to reduce the likelihood of tissue growing around the numbered part of the ear tag.

15. Re-seal the Velcro fasteners and ensure the marmot will not break out of the front of the bag.
16. Comb the marmot for fleas. Grab the marmot's feet from the bag and scoot the bag to the top of its bag. Place the marmot on the white flea cloth. Comb the marmot with the wide tooth side of the red comb. Comb each side and the back five times, each time wiping the comb on the cloth to count fleas. Then, remove the marmot from the cloth and count any fleas under the marmot. Record the flea count in the comments. If you collect the fleas, list under samples collected and note the number of the vial. If not, make sure to shake the cloth and get all the fleas off of it.
17. Collect hair samples by swiftly ripping large pinches of hair from just above the tail. Careful not to damage the mark. It is essential that you collect the root follicles of the hairs (white tips), since we are trying to collect DNA.
18. Mark the marmot. The dye is activated just before use by mixing 1 capful of hydrogen peroxide per half 'vial' of dye mix. If working alone, use one hand to grasp the marmot through the bag around its shoulders or neck while peeling back the bag to expose back. If two people are working together, one person can hold the feet/base of tail and the shoulders/neck while the other marks the marmot. Do your best to get the mark as high up as possible on the marmot. Sometimes this can be done by keeping the marmot in the bag and opening a few Velcro fasteners. **Remember, you're the boss. Pushing down on the back of the skull is a particularly effective way to immobilize an 'active' marmot. Using both hands to push on the back and shoulders is even safter and often helps immobilize the marmot. Depending if you're worried about it backing out or pushing out, you want to be on different sides of the shoulders. You can always put the marmot back into the bag and/or the trap if it's getting away from you and then try again.**
    a. Marks may include: numbers, letters, blots, stripes, posts, or a mix of the previous. A stripe refers to a horizontal line (across marmot, from left to right side), and a post refers to a vertical line (along length of marmot, head to foot). When marking a marmot with a stripe, try to extend the stripe as far to the right and left sides of the marmot's body as possible. Ensure that you record the location of the blots and stripes. For instance, a marmot can be a blot head, a blot shoulder, a blot middle, a blot rump. A marmot could also be a stripe shoulder, stripe middle, stripe rump, or two stripes middle, two stripes rump, etc. Draw the mark on the trap sheet assuming the head is up.
    b. Abbreviations for body locations include: H = head, N = neck, S = shoulder, M = middle, R = rump. **Anterior marks should be used first** as they are easier to see in the field when marmots are in tall vegetation. Here marks may be applied by opening the Velcro (anterior) end of the bag. One hand can hold the marmot by the neck or top of the head and the other can apply the mark. Marmots tend to pull back when the anterior end of the bag is opened and you may use your knees as a barrier to backward movement. You can also push down on the head to keep it in the bag. Pushing down on the back of the skull is a particularly effective way to immobilize an 'active' marmot.
    c. In general, when choosing a new mark, simple marks are always better than more elaborate ones (less is more). Numbers and letters are often harder to tell apart than simple blots, stripes and posts, particularly if the number and letters involve curved lines. **Symmetrical marks** are generally easier to identify than asymmetrical ones because you don't necessarily need to see both sides of the animal to identify the mark. When choosing a new mark, it is particularly important that you **consider the other pre-existing marks within the colony and that part of the valley**. Choose marks that are as different as possible from one another, while keeping in mind constraints imposed by the particular terrain of a colony. For example, in an area with tall vegetation, it would be best to avoid using a mark low on the rump as the distinguishing feature between two marmots (e.g., H• and H•R- would be poor choices). Some marks are particularly

difficult to distinguish and should not be used in the same colony. For example, an “X” and a “+” can often end up slightly off-center, and therefore indistinguishable. An ‘8’ and a ‘3’ will look exactly the same from the right side. An “O” and a “Q” will look identical from the left. An “A” and a “delta” may look very similar depending upon how they are applied. Initials are generally not good marks. Please don’t have too many marks in an area that rely on circles, or identical lines.

19. Release the marmot where you caught it by gently removing it from the posterior end of the bag and letting it run away into its burrow.
20. Check the trap and collect any fecal sample left by the marmot using a ziplock bag. Try to collect as clean a fecal sample as possible, free of any leaf litter, dirt, or other debris – these items may contaminate the samples. Often, marmots will defecate while they are in the bag. Collect these samples as well, they are often cleaner. Label the ziplock bag with at least the furmark of the animal in the upper right corner (you can finish labelling the bag in the lab) and immediately store the sample in the cooler.

WHAT TO DO IF YOU ARE BITTEN BY A MARMOT

Avoid getting bitten by a marmot by handling them with care. In the unfortunate case that you are bitten, immediately make the wound bleed and wash it out with water in the field and a diluted solution of 10% provodone iodine in the trap kit. When you get back to the lab, wash it carefully and completely with soap and water. Dress the wound.

You must report all injuries to Dan and to UCLA within 24 hours. Let Dan know immediately, and he will take care of that. If Dan is not around, contact the current UCLA EEB Department Chair with a full description of the incident. Check in the lab for the current accident reporting sheet.

You must also go to the doctor in Crested Butte. The lab has a relationship with the Crested Butte Medical Center just north of the main 4-way stop on Elk Avenue. Call to see if/when you can come in: 970-349-0321. They’ve handled marmot bites before. If you’ve not had a tetanus shot recently, you may get one. They may also prescribe antibiotics. If you’re covered by UCLA workman’s comp, then provide them with Our TPA: Sedgwick-CMS, 10880 Wilshire Blvd. Suite 850, Los Angeles, CA 90095 phone # (310) 794-8247.

6.5 The Trap Data Sheet

The trap sheet has TWO sides. Familiarize yourself with what data is on which side to make recording the data easier in the field.

FRONT

	Furmark	Colony	Location	Date (DD Mon YY)	Time	Left tag	Right tag	Mass with bag (g)	Bag mass	Sex (M/F)	AG dist (mm)	Repro status*
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												

(*) 1 = testes scrotal, 2 = testes unknown, 3 = nipples visible, 4 = nipples prominent, 5 = nipples swollen, 6 = lactating

BACK

	Left tag	Defecated[1]	Tooth chattered[2]	Called[2]	Struggled in trap[2]	Tried bite thr. Cage[2]	Walked into bag[2]	Samples[3]	LHF	New tags?	Comments
1								□B □F □H □Run □Rec			
2								□B □F □H □Run □Rec			
3								□B □F □H □Run □Rec			
4								□B □F □H □Run □Rec			
5								□B □F □H □Run □Rec			
6								□B □F □H □Run □Rec			
7								□B □F □H □Run □Rec			
8								□B □F □H □Run □Rec			
9								□B □F □H □Run □Rec			
10								□B □F □H □Run □Rec			
11								□B □F □H □Run □Rec			
12								□B □F □H □Run □Rec			
13								□B □F □H □Run □Rec			
14								□B □F □H □Run □Rec			

(1) 0= no/1= in trap/2= in bag/3= both. (2) 0= No/1 = Yes. (3) B=blood/F=feces/H=hairs/V=vaginal cells/Rec=recorded/RNA/Run/S=saliva/...

FRONT

	Furmark	Colony	Location	Date (DD Mon YY)	Time	Left tag	Right tag	Mass with bag (g)	Bag mass	Sex (M/F)	AG dist (mm)	Repro status*
1	⫫	Town	North Pole	13 Jun 22	18:03	9998	9999	31460	280	F	18.7	4

draw the furmark on the trap sheet assuming the head is up

List the the burrow location where the trap was set

Should be 24-hour

Ear tag numbers. **Any time you give an animal NEW ear tags, circle the new tag numbers**, then make note of it on the BACK side of the trap sheet. These will have to be entered in the New Ear Tag Log back at the lab.

Mass of marmot in the bag, in grams. We will subtract bag mass later

Scores listed at the bottom of sheet.
1 = testes scrotal, almond sized
2 = testes unknown, pea sized or smaller
3 = nipples visible but mostly flat
4 = nipples prominent, raised off the surface but not swollen
5 = nipples swollen both in the nipple and at the base of the nipple
6 = lactating, nipples may leak milk and have hair loss around the base, they are longer and very full

BACK

	Left tag	Defecated[1]	Tooth chattered[2]	Called[2]	Struggled in trap[2]	Tried bite thr. Cage[2]	Walked into bag[2]	Samples[3]	LHF	New tags?	Comments
1	9998	1	0	0	1	0	0	☒B ☒F ☒H □Run □Rec	48.2	No	

Options listed at the bottom of the sheet.
0 = did not defecate
1 = defecated in the trap
2 = defecated in the bag
3 = defecated in the trap AND in the bag.

All binary. 0 = no, 1 = yes.
Tooth chattered—see video for an example
Called—if the marmot alarm calls at all
Struggled in trap—if the marmot was struggling or pushing against the trap, obviously trying to get out
Tried to bite through cage—self-explanatory
Walked into bag—if the marmot walked into the handling bag more-or-less immediately without coaxing

Cross the appropriate boxes for each sample taken:
B = blood, F = fecal, H = hair,
Run = run, Rec = recorded alarm calls

Left hind foot measurement, mm

Whether or not you gave an animal new ear tags (including new animals). These will have to be entered in the New Ear Tag Log back at the lab. Remember to circle the new ear tags in the FRONT side.

Additional information that may help with identification (e.g., missing ear, new ear tags, short tail, etc.), number of fleas, whether it rolled the trap, and whether it is a NEW ANIMAL.

NOTE: Do not keep completed data sheets in the trap bag and avoid spilling dye on the trap sheets. Ensure that the data are entered into the trap log on the computer when a trap sheet becomes full.

Some additional comments on scoring nipple size. Nipple development is dynamic and you can see the difference in seasonality already up and down valley. However, to be consistent I think it's important we are scoring animals the same way.

3 is what yearlings are. You can, if you dig around in the fur, find small, flat spots…their nipples. 2-year olds may also be.

4 is a partially developed nipple. It could be the state that a mother the year before is in, but it also could mean that the female is cycling.

5 is bigger. If you squeeze them you MIGHT (or may not) get some milk. But it's larger and it's correlated with young in the burrow.

6 is huge…I like to say that they look like pig sows. Fur is chewed off around them, the base will be swollen. Milk is easily expressed in many cases.

The main point is that 5's and 6's mean that there are pups. We need to know this. We also need to know 6's because by that time the pups will be pouring out the burrow any day.

IMPORTANT: New animal/New ear tag log
It is essential to keep track of individuals and ear tags. Any time you put an ear tag into an animal, please write NEW LEFT or NEW RIGHT tag in the comments line of the trap sheet and fill out the new tag log which should be posted on the wall in the lab and in the trap log on the computer.

6.6 Recording A Marmot's Alarm Calls

We are studying the alarm calls of marmots. You will be using an expensive digital recorder. Please treat these recorders with extreme care. Avoid dropping it, putting it in the dirt, leaving it in direct sun, or under the rain, bouncing it around (e.g., while cycling back to Gothic). For instructions on how to use older recorders, please see the Supplementary Materials.

No matter which recorder you are using you will want to follow these steps:

1. Turn the machine on (it takes a few minutes so do this quickly)
2. Hit record and place the microphone 20-30 cm from the marmot's mouth
3. Adjust the recording levels if necessary. How will vary on the recording machine.
4. Try to be quiet while recording and try to record 5-10 different alarm calls; we really need at least 5 clear calls but recording more is good because we can then select the best calls. If you are at the River area, try to put your back to the river and block out the water noise. Point the microphone at the marmot, but away from the water. If calls are coming rapidly, be sure to record for at least 1 minute.
5. It's important to talk on the tape and identify the date, time, location and animal ID.
6. Record this information in the little notebook that accompanies the recorder. At this point there is no formal data sheet for recording; calls get transferred to computers periodically.

Marantz PMD660 Solid State Recorder

Solid state recorders record directly to a compact flashcard. While they are less sensitive to bouncing around than DATs and video cameras (no moving parts), they nevertheless should be treated carefully. Moreover, like all electronic equipment, they are very sensitive to dust and water. Please keep them in a Ziploc bag and in the carrying case whenever possible and keep them dry and out of the dust.

Recording alarm calls

- Be sure to plug the microphone into the L microphone input (it says MONO below it) before recording and unplug it after recording. The leverage from the XLR jack could break the equipment.
- Turn on the recorder using the Power Switch on the right side.
- Turn down the speaker volume by rotating the knob away from you as far as it will go. Otherwise, you may hear a loud whining sound (interference).
- The screen has 3 digits for the track numbers, and then the time remaining on the compact flash card. Additionally, you should see 44.1K MIC. If you see anything else, ensure that the settings are correct. To do this, touch the MENU/STORE button and make sure it says Preset-1. If so, then touch the MENU/STORE button one more time until you see the screen with the track numbers and the time remaining. If not, select the >> Track Jump button until you toggle through to the Preset-1, then select the MENU/STORE button.
- To record, push on the red REC button and then adjust the recording levels using the round knob on the right front of the recorder. The recording level should peak around orange led 6, the orange OVER led should NEVER be lit. Adjust the recording knob so that the alarm calls peak at around 6.
- To stop recording, push on the STOP button.
- You can turn off the device between marmots. When you turn it back on, you will see the remaining time and the track that you are on.

Transferring sound files onto a computer

- You must plug in the external power supply.
- Push down on the USB/Copy button while turning the Marantz on. You should see USB on the monitor. Then you will see the Compact Flash card mount on the computer. Drag the files over onto the computer.

- Re-name the files using the LTAG-DDMMMYY-TIME format.

Changing batteries
Keep an eye on the battery indicator level. Change them when it starts to drop. Be sure to put them in the correct way and with the piece of fabric below the batteries to aid getting them out.

NOTES: Preset 1 should be set at:
Input: MIC
Output: SP/HP+LINE
Date/Time
Rec Format: PCM-44.1K
RecChannel: MONO
PreRecord: On
Manual Trk: On
Auto Trk: 5 min
Auto Mark: Off
SilentSkip: Off
LevelCont. Manual
Meter Mode: Normal
Mic Atten.: 0dB
AutoPowOff: On
Battery: Alkaline
Beep: Off
Machine ID: MZ000
Default: DO NOT SELECT DEFAULT…it will remove all settings!

Use the EDIT button to enter the setup mode and use the ENTER and << >> buttons to toggle around and make selections.

ZOOM instructions

Turn on the zoom with the on button (on the left side) and wait (it takes almost a minute!). While waiting, carefully insert the XLR connector into the left microphone input. Once the Zoom is on, place the microphone 20 cm from the marmot and hit the red record button. It will flash. Press it a second time and it should start recording. Adjust the recording amplitude (button on the right side) to ensure that the alarm calls peak about half way through the range…if the line peaks (the black bar is fully filled…rather it should not be at the far right), the recordings will be distorted and useless. When finished hit the stop button and fill out the notebook in the bag, carefully remove the microphone and place the Zoom back in the protective case.

6.7 Blood collection

The objective is to quickly obtain the sample and ice it until processed. Thus, we've got two coolers in the lab freezer with ice in the bottom. Keep them frozen upright so as to keep the ice in the bottom.

Blood Kit Assembly

- Cooler
- Vacutainers
- Needles/syringes
- We have in the past used microcapillary tubes (and putty to close them off) for very small pups—now we collect blood from 1kg pups with a syringe. If we are bleeding smaller animals bring microcapillary tubes.
- Rubber bands (used as torniquets)
- Styptic stick or cornstarch to stop excess bleeding (wet styptic stick with alcohol swab before use).
- Cotton balls to staunch bleeding
- Alcohol swabs
- Gloves
- A sharpie for writing animal ID on vacutainer and the syringe

- Trash bag

Blood Collection Method
Check this video on how to collect blood in the Marmot Training Videos section.

1. Record the time you reach the trap (SAME TIME AS THE TRAPSHEET, this is really important) and, if known, the time the marmot was initially in the trap, on the data sheet. If multiple marmots are caught in the same trap use the same trap arrival time.
2. Immobilize marmot in handling bag and record this time on the data sheet in the 'time in bag' column.
3. Extract a leg, and tie a rubber band around a hind leg, as far up as you can.
4. Wipe area with alcohol swab. This should expose the femoral vein on the leg. If not, rip hair off the leg over the vein and re-wipe area with alcohol.
5. Have the needle and syringe ready to go (PUMP THE SYRINGE ONCE TO BREAK THE SEAL! This will make collecting blood much easier). Be very careful with an un-capped needle: only decap the needle once you are ready to collect the blood. When the needle is decapped, be aware of your and your partner's movements to prevent accidents. Do not wave needles around.
6. Once the vein is exposed, gently and in a direction parallel to the vein and with the bevel up, insert the needle into the vein at a shallow angle. Do your best to not go *through* the vein. Try to hold both the marmot's leg and the syringe in one hand, so that when it struggles, the needle doesn't come out or injure the marmot.
7. When the needle is in the vein, loosen the rubber band and gently pull back on the syringe. **If you pull too quickly, you may collapse the vein**. To encourage blood flow, you can also try rotating the needle in the vein, massaging the foot, lifting the leg vertically or bending it slowly. If you are using a syringe be sure that you do not inject anything into the marmot, and draw the appropriate amount of blood (typically 2-3 ml). For very small pups, we use micro-hematocrit tubes that can be used to collect blood via capillary action. These must be sealed off with putty and put into a vacutainer for storage. For pups that are 1kg or larger, use a syringe but be careful because with too much suction you collapse the vein and can't get blood. If the marmot is struggling too much, you can always reposition and get a better hold of the marmot. It is better to take some time than it is to hurt the marmot! Don't worry if there is a hematoma; marmots heal very quickly.
8. Collect about 2-3 ml of blood (the vacutainers hold 5 ml). When sufficient blood is collected (detatch the syringe or vacutainer) and record the time the blood first starts flowing. Hold a cotton swab over the vein for a few moments to stop the blood flow. If you need to use two legs to get blood, **please make a note of that in the comments.**
9. When you pull the needle out of the vein, put pressure on the injection site with a cotton ball until the bleeding has stopped (this should be fairly instantaneous if done correctly). If the marmot keeps bleeding, use the cotton balls, styptic stick and/or cornstarch to stop the bleeding.
10. Inject blood collected from the syringe into the vacutainer and **shake gently** to mix the EDTA. It is very important to mix the blood with the EDTA to **stop coagulation**. Please do not invert as that gets blood in the cap. If you do, spin the tube in the lab to get the blood back.
11. We should be using safety syringes; close the purple syringe guard carefully. If using a non-safety syringe, recap the syringe using the OSHA-approved one-handed re-capping procedure.
12. LABEL the vacutainer with the fur mark.
13. Immediately ice the blood in the vacutainer and put the syringe in the ice box for transport. Do not put the vacutainer in a pocket or leave it in the sun. Do not carry used syringes that are not stored in a hard container.

6.8 Buccal swab collection

The objective is to obtain repeated buccal (cheek) swabs from the same individuals multiple times, ideally once in the early season and again as late as possible in the season. Therefore, you should keep track of which individuals already have or don't have a buccal sample (see ID log on iPad). These swabs are expensive(!) so double check that you are not taking an unnecessary sample.
Note: do not leave buccal swabs out in the sun, minimize their sun exposure.

Buccal Swab Collection Method

1) Immobilize marmot in handling bag and record this time on the data sheet in the 'time in bag' column.
2) After finishing hair collection, remove buccal swab and accompanying falcon tube from packaging and label with the furmark of the animal.
3) While most of the time you can insert the swab through the opening at the front of the bag, there may be times when you might want to open the front of the bag. Only attempt this if the handler is sure they have the marmot secure and be extra careful around the mouth.
4) Making sure you do not touch the bag with the swab, insert the swab in the marmot's mouth behind its front teeth (there is a gap in their teeth there) and swab the inner cheek with concentric motion ~10 times. Repeat on the other cheek. Do no position swab in the middle of the mouth and avoid giving the marmot an opportunity to bite and break the swab (remember the gap in their teeth).

6.9 Running a marmot

The goal is to get a good estimate of how fast marmots run over a relatively homogeneous interval. We only run marmots around August, after we stop bleeding them.

What you need:

- stopwatch
- meter tape
- flags on sticks to throw down

What you do:

- Bring the marmot in the handling bag to a point where you're going to release it.
- Be sure you know where all the nearby escape and main burrows are. Select an interval between 5 and 20 m over which to run the marmot. The substrate should be relatively homogeneous. The incline should be constant. These two constraints often make those intervals short but try to find a longer interval. Marmots will often run back to their nearest burrow.
- Gently shake the marmot from the bag onto the ground and begin shouting "GO GO GO GO" while chasing the marmot. Be very careful running around on stones, talus, and slippery substrates.
- When the marmot is up to speed, start your stopwatch and drop a flag at the point where you start timing the marmot.
- Continue timing it over your pre-determined interval. However, if you think the marmot is about to turn, stop timing before the turn. Ideally, runs should be straight, but a gentle curve is OK. Sharp turns are not because they lose speed when turning. Ideally, runs should be over

homogeneous substrate and a good reason to stop timing is because the substrate changes dramatically.

- When you stop the watch, place another flag at the point where you stopped timing the marmot.
- Fill out the data sheet. Be sure to measure distances correctly and in meters. If the run was gently curved, measure that distance.
- If the marmot ran to a burrow over a cliff, stop your measurement of total distance run/distance to burrow at the cliff edge.

7. Post-Trapping Lab Protocols

When you are done trapping, please make sure you:

1) Process and label any samples you may have.
    a. Blood
    b. Fecal
    c. Hair (labelling and storage)
2) Update the Master Blood Log.
3) Update the New Ear Tag Log with any new tags.
4) Update the Pup Emergence Log if you trapped new pups.
5) Enter the trap, blood, and new ear tag data into the trap log on the computer
6) Update both the digital ID log and the paper the Master Individual ID list with any new animals
7) Restock your trap bag with any depleted supplies. It should be ready to go for the next person to grab the bag and run.

7.1 Blood processing in the lab

Blood must be processed immediately after collection.
Remove the tops from the vacutainers

To make a blood smear

1. Label the slide by writing date, time, and current ID (see example in lab).
2. Dip a capillary tube into the vacutainer and get about 1 cm of blood. About ¾ of way up the slide (below the writing on the slide) tap a line of blood out of the capillary tube onto the clean slide.
3. Hold a push slide at a 45° angle and slowly back it onto the line of blood. Allow capillary action to spread the blood along the edge of the slide you're holding at 45°.
4. When the blood is spread out, press firmly (but don't break the pushing slide) and push, in one smooth motion, the line of blood across the length of the slide. A successful smear creates a 'monolayer' of blood. It should be a pale red/yellow color and it should be smooth. It's essential that the slides be perfectly clean before you do this otherwise dust or grease will interfere with the process. Be sure to not touch the slide with your fingers before making the slide.

To spin down the blood and isolate plasma, buffy, and cells

Carefully insert the vacutainers without their tops into the centrifuge. Do your best to balance out the load, using blanks filled with water if needed.

1. Centrifuge at **3/4 speed** (to avoid splicing cells) for 10 min (to ensure proper separation of buffy coat).
2. Label 3 cryogenic tubes per sample with: the current UID, date, time, furmark, and sample type (P = plasma, B = buffy, C = cells). See also example in lab.
3. After spinning the blood, remove the plasma layer on top with a pipette and put it into the cryotube labelled "P". To make sure you do not disturb the buffy coat, leave a bit of plasma above the buffy coat.
4. Use a pipette to remove the buffy coat and put it into the cryotube labelled "B". You may be able to see the buffy coat as a thin, milky white line laying on top of the red blood cells. Depending on the sample this layer may be too thin to see. To ensure you got the buffy coat,

collect the bit of plasma above the buffy coat and the red blood cells immediately below it.
5. You can tap the remaining red blood cells into the cryotube labelled “C”, but you will have less waste if you use a pipette instead.
6. Read the amount of plasma and red blood cell sample in each tube and record it in the Master Blood Log. Fill out the rest of the log with the information in the blood trapping sheet.
7. Store the tubes in proper cryoboxes, record the location of the samples in the Master Blood Log, and store the cyoboxes in the freezer. Careful to only remove these boxes from the freezer for the time it takes to add the new samples. Do not let the samples unthaw.
8. Dispose of needles and glass in the sharps box (the plastic syringe goes in the trash), and wipe down the counter with 10% bleach solution.

7.2 Fecal processing in the lab

Feces are collected for future hormonal analyses and microbial/viral studies. Historically we also conducted fecal floats and collected fecal for parasite studies. You can read these protocols in the “Other Protocols” section.

Fecal samples should be iced on collection and processed quickly so that they can be frozen within an hour or so of collection. **Label** each Ziplock bag with the animal’s fur mark, L and R ear tags, date, time, and colony. When collecting samples, ensure they are not covered with leaf litter, dirt, or other debris – these items may contaminate the samples.

<u>Preserving samples for microbial/viral analyses:</u>
Using a clean stick, carefully remove clean feces and stuff into TWO labelled cryotubes (one for microbiome and one for viral). Be careful to not touch other objects with the stick. Close the labelled cryotubes and store the stick in the stick bag in the freezer to keep the smell under control. Store the cryotubes in their respective labelled bags in the freezer. The remaining fecal in the Ziploc bag will be used for hormonal analysis.

<u>Preserving the samples for hormonal analysis:</u>
Re-seal the Ziploc bag, place in its respective colony bag, and freeze. **NOTE**: be sure there is something left for hormonal analysis. When in doubt, do not remove for other analyses.

7.3 Entering and saving trap related data

This section describes the workflow to:

- enter the trapping data,
- generate the master trap and blood log,
- synchronize the trap & blood log on all tablets
- use a tablet in the field.

When coming back from trapping marmots, the trapping data should be entered immediately into the trap and id log file. Then the *“id log”* should be exported as a pdf and synchronized on the tablets.

All trapping data should be entered in the trap log. The file is located in **Dropbox > RMBL YEAR > 6. Trap_data**. This file is named **trap_id_log_DDMMMYYYY_HHMM.ods** where *DDMMMYYYY* stands for the date in the following format for example “08Jun2018” and *HHMM* is the time when saving the file in 24h military time, “0943” for example.

Once you have located the folder containing all the trapping files, select the latest version of the file, and open it with LibreOffice to enter new data.

When opening the file, a pop-up security window might appear and ask if you want to enable macros (Figure 1), please accept by clicking on Enable macros. If you don't, you will still be able to open the file but you won't be able to update the "id log". Normally, on the lab computer the security window should not appear because the macros are activated automatically.

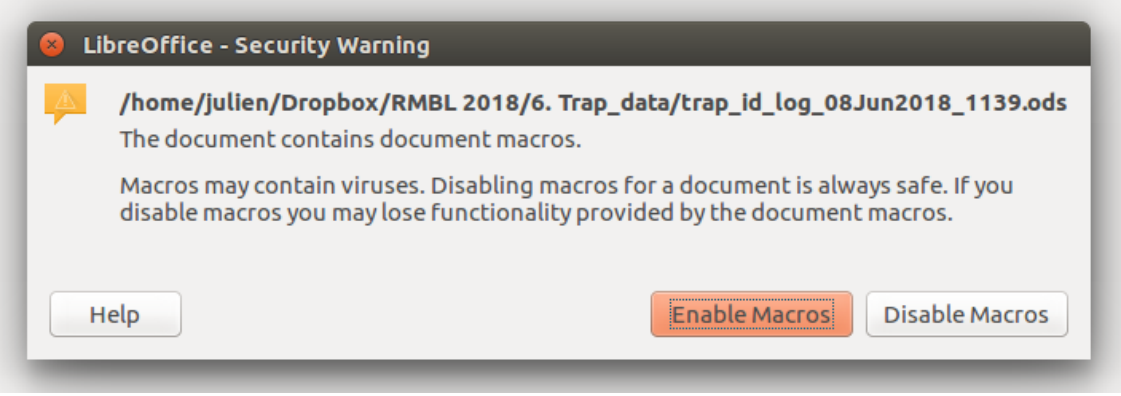


Figure 1. Security warning about macros

The file is composed of multiple spreadsheets as follow:

Spreadsheet	Description
trap log	use to enter the trapping, blood and running data after each trapping session
id log	trap and blood log to be updated for the tablets
new eartag log	use to enter all new tags either for new individuals or for replaced tags in known individuals
death log	report any dead individual
pup emergence log	to log emergence date, litter size and potential parents of pups. Usually filled in at the end of the season.
do not modify	contains keys information for all the error proofing functions in the spreadsheet. As the name indicates, please do not modify. However, additional colony locations and furmarks could be added at the bottom of the respective columns.
start_trapping	contains info to setup the trapping periods for blood collection

The first thing to do when entering trapping data is to update the "new ear tag log" if you have any new ear tags (see updating new ear tag log). Then you enter the trapping data. Once you are done entering the data, save the file under a new name following the standard name "trap_id_log_DDMMMYYYY_HHMM.ods". You can then update the id log for the tablet.

UPDATING NEW EAR TAG LOG

Enter all the information needed in that spreadsheet about any new tags used when trapping. The spreadsheet is structured as:

column name	description
date	enter it as "DD MMM YY"
Time (trap)	time on the trapping sheet
col_area	please use the dropdown menu or type an exact name. if you receive a warning message edit the content accordingly to standardize colony names

location	similarly use the dropdown menu or type the exact standardized names.
new curID	new combination of eartag used to identify the animal
old curUID	if known
UID	UID of the individual. If it is a new individual it should be the same as the curID
newtags	indicate the side of the new tag (L, R or LR)
new animal	indicate yes if it is a new individual
fur mark	fur mark of the animal (could use the dropdown menu).
comments	comments

ENTERING TRAPPING DATA

To enter the trapping data, go to the *"trap log"* spreadsheet. **Please enter the data really carefully**, and make sure not to forget anything. Once you have entered all the data from the trapping sheet do not forget to also enter the data from the blood sheet and from the lab blood log (*i.e.* volume of cell and plasma as well as box location) into the electronic file.

IMPORTANT: if you notice any mistakes on the paper trap sheets while entering the data (e.g., unchecked sample box even though a sample was collected), please correct the mistake on the paper sheet as well as in the digital log. When proofing data at the end of the season we will be going by whatever is written on the paper sheets.

The structure of the spreadsheet is as follows:

column name	description
Bag	initial of color of the trapping bag and the number of the data sheet. For example, B6 stands for Blue bag sheet number 6
Line	line number on the spreadsheet
col_area	please use the dropdown menu or type an exact name. if you receive a warning message edit the content accordingly to standardize colony names
location	similarly use the dropdown menu or type the exact standardized names.
date	enter it as "DD MMM YY"
Time (trap)	time on the trapping sheet
Current_id	left and right eartags separated by _ (e.g. 4444_5555) when entering the current_id check the colmn uid it should go from "#N/A" to a unique id. If it stays as "#N/A" either you typed a wrong current_id or you forgot to update the new ear tag log.
fur mark	fur mark of the animal (could use the dropdown menu). New furmarks could be added on the *do_not_modify* spreadsheet at the end of the furmark column
UID	automatically matched based on known tags and the "new ear tag log". If it stays as "#N/A" after entering the current id either you made a mistake or your forgot to update the "newe ear tag log"
Columns in grey	similar as the trapping sheet. please enter the data carefully without missing anything.
Columns in red	correspond to the blood sheet data. The column "Time got to trap" is automatically filled with the trapping time if you indicated that we collected blood. In this section do not forget to add the data from the *lab blood log* data on plasma and cell volume as well as box location.

Columns in yellow	correspond to running speed data. The column “Time run” is automatically updated if you indicates that we collected a Run sample.

UPDATING THE *“ID LOG”*

If you trapped new individuals then do not forget to add their *uid, colony and sex* to the `id log` spreadsheet.

Once you entered the trapping data and you saved the file with the proper name (i.e. “trap_id_log_DDMMMYYYY_HHMM.ods”), you need to **click on the UpdateTrapLog button** on the top right of the toolbar. Nothing apparent will happen. To be sure that everything works, go to the id_log and check that the data about blood and hair has been updated for the individuals you trapped.

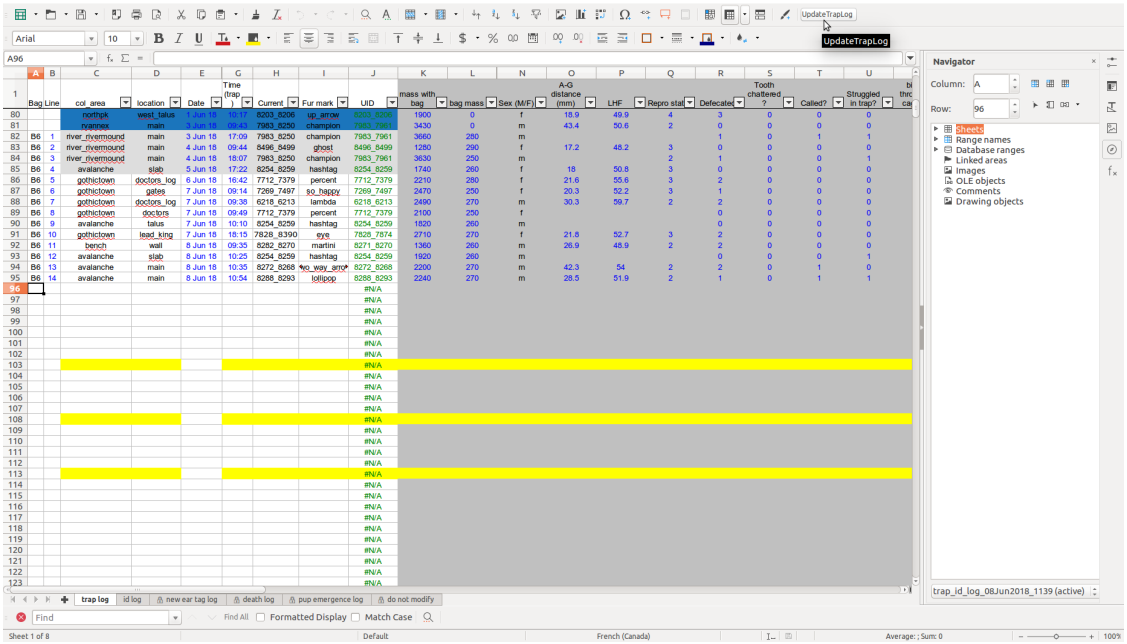


Figure 2. Button to update the blood log on the toolbar

EXPORT THE ID LOG TO THE TABLET

Now that you updated the id_log by clicking on the UpdateTrapLog button, you have to export it as a pdf. To do so, go to File > Export as PDF … It should open a new window, with multiple tabs and options. Usually the settings do not need to be modified, but check them and modify if needed. Under the tab General, and the option Range, you need to select the “Selection/Select sheet(s)” option. This is the only modification to do here. Once you have done it, you can click you can click on Export.

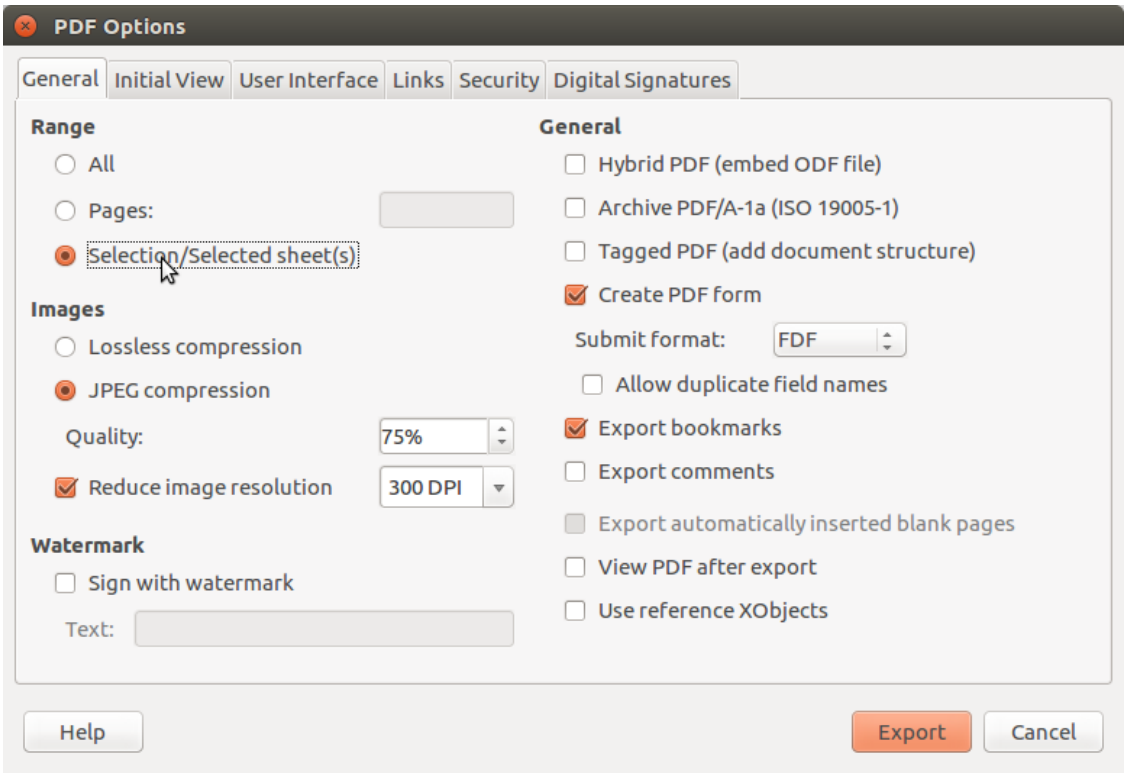


Figure 3. Popup window to export as PDF

Double check that the name for saving the file is the same as previously but with .pdf at the end instead. If not, it is because you have not saved the file with the proper name yet. So please do so. The file needs to be saved in the folder Marmot_RMBL_tablet.

Finally save the .ods file by using cmd + S or with File > Save.

SYNCING THE TABLET

Using Wifi

1. Turn-on the tablet by pressing on the button on the upper right corner of the tablet (marked with a red tape)
2. Swipe the screen to get access
3. Go to **Dropbox**
4. Check that the pdf you have just created is in Dropbox. If not drag the screen downward to sync the dropbox folder.
5. Once you see the new `id log`, make sure it is available for offline use, a small green icon with a downward arrow should be next to the file name (see Figure 4). If you need to make it available for offline use, it is better to make the entire folder availlable for offline given it should automatically download all future files added to the folder. To do so, press on the three vertical dots next to the folder name on the rightside of the screen, and choose the option *available offline*. This should download all files within the folder and set it as a default for all new files within the folder.

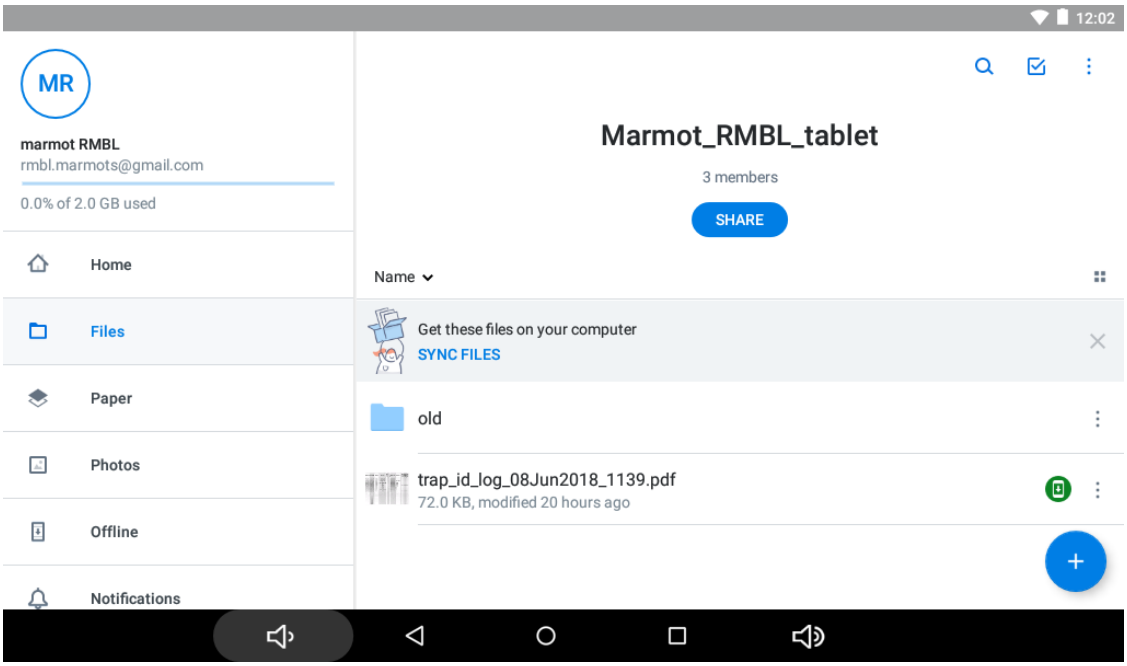


Figure 4. Screenshot showing dropbox on the tablet with an id log available for use offline

Without wifi

1. Plug the tablet to the computer using the micro usb cable
2. transfer the file to the tablet in the *Download* folder.
3. Eject the tablet
4. Open the file using *Adobe Acrobat Reader*

USING THE TABLET IN THE FIELD

1. Press the button on the top right corner of the tablet (identified by a red tape) to turn on the tablet.
2. Swipe the screen to get access
3. Go to *Dropbox*
4. Select the latest version of the file and open it. You can either open it in *Dropbox* by directly pressing clicking on it, or you can open it using *Adobe Acrobat* by pressing on the three vertical dots then by selecting *Open with….* There is not much differences between the 2 pdf readers. When updating the file withou wifi, you can only open the pdf using *Adobe Acrobat.*

8. Emergency Procedures (Marmoteering Essentials)

8.1 Power Failure

Don't panic (save that for later…when the power really doesn't come back on). Keep the freezer closed (it'll save the 'cold'). If the power does not come back on after half an hour, try to find out why the power is out. After 3 hours of power failure, consider driving to CB to get dry ice at Clarks' or block ice at a liquor store. Block ice will be colder than snow or other form of ice. Note: putting a large warm object in the freezer will warm everything up. If you put block ice in the freezer, make sure that it is in something (a bucket or a plastic box) to prevent the ice from melting and filling up the bottom of the freezer. When the freezer comes back on, any standing water will freeze samples to the bottom of the freezer!

8.2 Freezer failure

If the freezer is not working, make sure it is plugged in. Double-check that it is set at the coldest setting. This knob should be taped in place at the bottom left side of the freezer. If in fact it is not working, begin moving the samples to other freezers. Make a note where samples are stored.

Dry ice is available in Gunnison at City Market and in Crested Butte at Clarks. It now costs over $1/lb. 20 lbs is the minimum required to keep samples in a cooler frozen while moving samples.

8.3 What to do if you find a hypothermic marmot

Bring the marmot back to the lab. If feasible, attempt to warm the marmot by holding it against your body, taking care to avoid being bitten. If this fails and you're sure the animal has no chance of surviving without additional aid, consider immersing the marmot in warm water ensuring that head is above water at all times. Once warm, thoroughly dry marmot with hair dryer. Leave in heated room inside trap until marmot has completely recovered. Make sure to keep the marmot hydrated. To check for dehydration, pull the skin on the scruff and let it go. If it returns to normal slowly, the animal may be dehydrated. In the lab, grab a syringe (either monoject 3cc syringe or blood drawing syringe) and take up 2.5% of the body mass from the bag of 0.9% sodium chloride (ONLY use physiological saline). Pull up on scruff skin and insert needle. Pull back to make sure you didn't hit a vein, then inject slowly. There will be a lump where you rehydrated that should wear off soon.
If medical treatment is required, tell Dan (or another designated person) ASAP

8.4 What to do if you find an overheated marmot

If you're near a stream, immediately immerse the marmot in the cold water, or wet a shirt and cover the marmot with the cold, wet shirt. Be sure to NOT drown it. Bring the marmot back to the lab. The marmot will more than likely be dehydrated, so you will probably have to re-hydrate. In the lab, grab a syringe (either monoject 3cc syringe or blood drawing syringe) and take up 5% of the body mass from the bag of 0.9% sodium chloride (ONLY use physiological saline). Pull up on scruff skin and insert the

needle. Pull back to make sure you didn't hit a vein, then inject the saline slowly. There will be a lump where you re-hydrated that should wear off soon as the saline is absorbed.
If medical treatment is required, tell Dan (or another designated person) ASAP

8.5 What to do if you find a dead marmot or see a marmot killed

If you know that a marmot is dead (i.e., it's a road kill, trap death, predator kill, found dead), enter it in a trap log with the date, time, location, and cause of death. If you have the body (road kill or trap death), check ear tags, collect blood (you can do a cardiac puncture to get a blood sample), make all trapping-related measurements and put the carcass in the freezer with a piece of paper noting the date, time, location and cause of death. **Record the death in the death log.**

NOTE: If the dead marmot does not have ear tags yet, give it new ear tags, add it to the new ear tag log, and then follow as above.

To do a cardiac puncture:
Put the marmot on its back. Locate the breastbone with your fingers and insert a syringe into the chest. If you hit the heart, you'll easily be able to collect a large blood sample. Keep trying if you miss.

If it's a predator kill and you have the carcass, process as above but consider leaving it for the predator. If the foxes are killing and caching pups, you can often follow them around and as soon as they step away from the cache, you can go up and dig out the pup. After processing, put the carcass back for the fox.

Take caution early season – marmots can appear dead when they are actually in torpor. In this condition, they can have depressed respiration and heart rate that is very difficult to detect. **Be sure a marmot is actually dead before doing anything drastic!**

9. Data Proofing Protocol

All of the data collected from the summer needs to be checked for errors and consistency. This protocol should serve as a guide to help you compile and proofread the data. Once it is all proofread, it should be sent to Julien Martin (or the person in charge) to be added to the database.

Proofreading the data is a meticulous process in which the person in charge of the marmot team goes through each file from the summer and reads through it to check for errors and consistency. Every file that will be included in the database must be proofread. This includes going through each sheet of each file and checking for missing data, checking UIDs correspond correctly with the individual, locations are correctly entered, etc. *If certain data is removed or changed, it is important to take note of the change in the comments sections*. For example, if a substrate is changed from “talus” to “short vegetation” because the location recorded does not have talus areas, make note of the change. Most of the proofreading can be done using the data logs and ID list, but if necessary, refer to the original field data sheets.

**Note: ALWAYS make new versions of the files instead of simply over-writing existing ones. For example, when working with the trap log, add “proofread_date_initials” or something similar to the end of the file, instead of fixing errors directly on the original file. Additionally, it is a good habit to save a new file with the date as part of the name on days when you have done a lot of work. That way, if you make a big mistake and/or your computer crashes or some other tragedy occurs, you will not lose all of your progress. These can be deleted once you are confident that you have a final proofread file.

For ALL data files:

- CHECK UIDs: make sure UIDs correspond correctly with individuals
    - Sometimes the same fur mark may be used in multiple colonies, so we need to make sure that the UIDs correspond to the individual in the appropriate colony. This is a very common entry error, so pay special attention to UIDs! To do this, filter the data by colony and then furmark when checking UIDs.
    - Check that the correct CurIDs were used
- For all “unknown”, “unidentified”, “unmarked” or similar entries, leave the cell completely blank. The database views blank cells as No Data.

Files to be proofread:

- Trap & ID log
- Observation logs- to be compiled into ONE file with everyone’s observations
- FID log

Trap & ID log

The first file you will work with is the trap & id log because it contains the UID, current id and furmark of all the individuals seen or trapped during the season. *It is important that this information is perfect because many database connections rely on these data.*

Tab 1. New ear tag log: using field notes, check data and make sure all new tags are entered.

- New animals: only UID and New CurID should be filled out
- Animals with tag(s) replaced: all 3 columns (UID, Old CurID, New CurID), should be filled out (even if Old CurID is same as UID, fill both out)

Tab 2. ID log: this needs to be a clean version of who was seen or trapped during THIS summer; you should take notes at the end of the summer about who has been seen and who is probably dispersed or dead

- Make sure all UIDs (especially for new pups!) are correct and match new ear tag log (new ear tag log should be proofread first!)
- Make sure all current IDs are correct (use updated, proofread new ear tag log)
- Make sure sex is correct, especially for animals whose sex changed during the summer
- Make sure age is correct (P=pup, Y=yearling, A=adult)
- Enter notes for end of summer so you have information at the beginning of the following season
- Be sure to save previous version(s) of ID log!

Tab 3. Death log: check that all known dead individuals are entered and that they have the correct ID. Make sure that the most accurate information is included. Note: this log needs to be proofread in the field as the season is going.

Tab 4. Pup emergence log: check that each litter has only one emergence date. The mother/father info probably will not be certain or complete until after genotyping but all the litters need to have a potential mother and a potential father.

Tab 5. Trap log:

- Trapping info (white): Check that current IDs are correct. Do this for each individual one at a time: filter by colony and also by fur mark to make sure current IDs are consistent. If current ID changes through the season, double check with new tag log that the change occurred and is not a data entry error. While you are checking this tab, it helps to sort by date so that you can also see if mass data make sense.
- Measurements and samples (grey): check samples collected (blood, fecal, hair, RNA, recording, run) – if it says we collected any samples, verify that we have them. If we have samples that are not recorded, enter them!
- Blood info (red): check the blood log to verify that we have all the samples that are marked as collected and that all the collected samples are recorded in the log. Do the “volume blood collected”, “plasma”, and “cells” numbers make sense?
- Running info (yellow): check that all of the running data entries have “time run” automatically entered (column AL). If a row that has running data does not have a time entered, then “1” probably was not entered for “run” as a sample collected (column W). If a time IS entered and there is no corresponding running data, check the running sheets and figure out if a run was recorded. Keep distances formats consistent (just numbers, no “m” for meters)

Tab 6. Do not modify: This tab controls drop down options and connections for the entire database. If there is anything that you think you want to modify, talk to Julien first!!

Observation log

First compile observation logs from all observers into one file. To do this, open a new blank **master** observation log and copy and paste each person’s data into that single file. Name it something like “obs log_year_compiled”. When proofreading this log, watch out for areas where current IDs may have been entered instead of UIDs! Proofread the file:

Tab 1. Time observing: Make sure times make sense (time observing should usually be under 200 minutes and should not be earlier than 6 am or later than 8 pm) and information is entered correctly.

Tab 2. Observation log: First, sort by date to ensure dates are in the proper format. Second, filter by fur mark and then by colony_area and check that UID is consistent for each individual one at a time. Finally, make sure "0"s are filled in for "cheek rub", "tail flag", and "carrying dry plants" when none of these behaviors were observed

Tab 3. Alarm calling: Check that dates and times are filled out, UIDs correspond correctly with fur marks, and that the stimulus cell is blank when the stimulus is unknown.

Tab 4. Social observations: This tab will take the most time to proofread because there are so many UID columns. Again, first sort by date to ensure dates are in correct format. Second, filter by colony and then by **initiator** fur mark and check that UIDs are correct. Do this for each individual one by one and then repeat the process for **recipient** fur mark and **winner** fur mark. While you are doing this, pay attention to where these animals are observed. Use your knowledge from the field to judge whether the observations seem reasonable (i.e. if a fur mark that you know is from 58icnicc was observed interacting with an animal from river at river, double check that this is a correct observation using the observer's field notes and your own common sense). Finally, make the UID cell blank for all "unknown", "unidentified" and "unmarked" individuals.

Tab 5. Predator sightings: Use common names for predators. It is ok for species column to be specific to observation (2 coyotes, 3 bears, etc.) but try to group predators as much as possible. For example, if one observer entered "bear" and another entered "black bear" (and we know there are no brown bears at RMBL), make them all "black bear".

Tab 6. Scent marking: As always, check that UIDs are correct. Keep distance formats consistent (just numbers, no "m" for meters).

Tab 7. Focals:

- Make sure that dates/times make sense (you can do this easily by glancing at drop down options for each column).
- Check substrates to see that they make sense for corresponding location and time of year.
- Keep distances formats consistent (just numbers, no "m" for meters).

Tab 8. Emergence: Double check that animals were seen in the appropriate colony. Use field notes for reference if necessary.

Tab 9. Snow melt: Ensure that the data makes sense, especially as the season goes on. So, sort by date and check that percentages are constantly getting smaller (unless there is a new layer of snow of course, in which case the percent snow in all colonies should increase).

Tab 10. Do not modify: This tab controls drop down options and connections for the entire database. If there is anything that you think you want to modify, talk to Julien first!!

FID log

Make sure that times are entered in correct format, UIDs are correct, number format is consistent (number only; no "m" to signify meters), substrates make sense for colony location, and cells are blank where information is unknown.

Do not modify: This tab controls drop down options and connections for the entire database. If there is anything that you think you want to modify, talk to Julien first!!

While you are doing this… **save, save, save** new files with dates along the way!

Send all 3 final proofread files to Julien and let him know if there were any additional problems you encountered (missing colony locations, burrows, etc.)

10. Responsibilities of field team leader(s)

Tasks to be completed by the field team lead/s before the season begins:

- Provide the incoming field team with this Book of Marmot and related documents/information (e.g., training videos, marmoteer packing list, LibreOffice/JWatcher download, etc.)
- Create the Dropbox entitled “RMBL YEAR” (e.g., RMBL 2022)
    - Transfer materials from previous year’s Dropbox and remove unneeded documents (e.g., observation logs from previous year and previous year’s not active permits)
- Help the incoming field team coordinate their arrival and departure dates. Provide them with travel options and information about getting here.
    - Keep track of these dates in an annual schedule document
    - This takes a lot of time and effort
- Provide the incoming field team with RMBL housing and application information (e.g., the nuance of the housing assignment process, what cabins are desirable in the affordable categories, etc.)
- Create and print the ID sheet for the early season (based on the proofed ID sheet tab from the trap log and knowledge from the previous year)
- Create/print the emergence log, snowmelt log, death log, new ear tag log, and permits.
- Communicate with RMBL Admin about the team’s arrival and identify where the overnight parking is (this parking often changes year to year)
- Answer questions and help the incoming field team be as prepared as possible for the upcoming field season!
- Do or delegate other tasks as needed

Tasks to be completed by the field team lead/s during the season:

- Train, and delegate training, of new team members (e.g., trapping, observations, focals, data entry, lab work, etc.)
- Ensure data is being entered correctly and regularly
    - Delegate the double checking of trap data to the paper trap data sheets during the season as needed
- Organize the weekly collaborative scheduling making process (see description of the scheduling making process elsewhere in this Book of Marmot)
- Do or delegate other tasks as needed

Tasks to be completed by the field team lead/s at the end/after the season:

- Organize the team to put the traps away in the predetermined, safe trap storage areas and keep a detailed record of how many traps are where.
- Organize the cleaning of the lab and proper storage of equipment (e.g., deconstruct trap bags, wash marmot handling bags, store bikes, etc.)
- Organize a subset of the team to undergo the data proofing protocol of all data (see description of data proofing elsewhere in this Book of Marmot)
- Do or delegate other tasks as needed

11. Other Protocols

11.1 Flight initiation distance (FID) experiments with marmots (ACTIVE)

Identify an animal. If you have just arrived at a site, wait at least 10 minutes. This will control for the flushing that sometimes occurred when the experimenter arrives at the site. After 10 minutes of observation, and a focal animal has relaxed (it's standing looking or foraging or lying down and looking; it's not rearing up and nervously looking around), begin the experimental approach. Do not begin an experimental approach if you think that another person is walking towards your subject. Do not begin an experimental approach if a predator or alarm calls have been recently seen or heard; the goal is a relaxed animal that you're going to scare.

The approach. Stand and walk directly toward the focal marmot at a speed of a 0.5-meter step per second (a funereal pace). Minimize up-and-down movement and extraneous motions. If the focal marmot is more than 100 meters away, it's OK to periodically check its location with binoculars, but it's best to not stop; keep walking at a consistent pace. Note, please start a stopwatch when you start the approach and stop it when the marmot first initiates flight. This time will be used to calculate your velocity.

There are two ways to make these measurements. First drop flags at relevant locations, and then either count your paces (and convert to meters) or use a rangefinder (or both).

What to record. First, record, the observer (i.e., your name), the date, and the time. Write the marmot's mark on the data sheet. Write the colony you're at on the data sheet along with the starting behavior (again, the goal is a relaxed marmot—sit, forage, look, or stand look).

While maintaining the same speed drop flags when the marmot first looks, initiates flight (FID), moves again (if it does), and disappears out of sight into its burrow.

Now, fill out the data sheet**. Unless otherwise instructed, please ONLY fill out the information on the first escape, initial position, etc.**

Straight-line d from start to initial location: The distance between where you started walking towards the marmot and where the marmot initially was; the 'starting distance'.

Method of first escape: run, walk, out of sight.

Unless otherwise instructed, do not do this. Method of second escape: run, walk, out of sight.

N w/in 10 m: number of other marmots within 10 meters.

Initial substrate where the marmot was when you began the experimental approach: low veg, high veg, dirt, stones, talus

Substrate encountered during escape: low veg, high veg, dirt, stones, talus

Slope of marmot's initial position: What was the incline where the marmot was initially?

Marmot escape incline (only if moved, if not, no entry): If the marmot ran away, what was the incline that it ran over?

Start to marmot incline: The incline from where you started your experimental approach to where the marmot was when you started your experimental approach (note, this should be from the marmot's perspective. Thus, if you were below the marmot, it should be negative).

Alert distance: the distance from the marmot to the person when the marmot oriented its head to the person. It's not always possible to record this.

Flight initiation distance (FID): The distance from the marmot to the person when it moved.

Unless otherwise instructed, do not do this. Time (Stop watch time): the time it took you to walk from the starting point to the point where the marmot initially fled (i.e., FID).

Unless otherwise instructed, do not do this. 2nd movement: The distance from the person to the marmot at the 2nd movement. Note: this may be an oblique angle. Also note, there may be no second movement.

Distance to burrow at FID: The distance between the marmot and the burrow when it initially moved.

Unless otherwise instructed, do not do this. Distance to burrow at 2nd movement: The distance between the marmot and the burrow when it moved the second time. This may not happen.

IF YOU ARE NOT SURE OF AN EVENT, DO NOT ESTIMATE IT, RATHER LEAVE IT BLANK.

11.2 Fur length and thermoregulation project (ACTIVE)

Hair samples are collected from all individuals early in the season and after they molted. One sample in May- early June and one sample in August. For each sample, hairs will be taken from the lower back. These need to be complete hairs, at least 10 and ideally both inner hairs as well as guard or outer hairs. Grab hairs at their base, as close to the skin as possible, thus insuring that you grab both types and that we have full hairs. To decrease the pull on the skin and make sampling easier, you also need to use your other hand to hold the fur next to the pulling area thus ensuring that you are pulling hairs and not skin. Check that you are as close to the skin as possible when you grab hairs.

Hairs should be stored in an envelope with the date, UID of the animal and an 'A' on them and store separately from hair collected for DNA.

11.3 Habitat assessment

Goals:

- to determine environmental factors that differentiate colony from satellite sites and/or explain differences in turnover rates (Brandon)
- to develop a logistic regression model that will differentiate sites from non-sites (Veronica)
- to begin collecting data that will allow us to validate a simple GIS model (future project)

Sampling colony and satellite sites

50 m x 2 m transects/plots
5 per colony site 'early season'
+5 more later season?
Standardized size patch to be sampled

Sampling no occupancy sites

Focus on areas where marmots could be (i.e., exclude willows and dense forests).
Within these larger habitat patches, sample smaller sites randomly using sampling protocol.
Standardized size patch to be sampled.

At each site (after first round of sampling):

- walk the perimeter of the habitat opening in 'track' mode to calculate area

At each starting point:

- record a compass bearing of the slope
- note the GPS location
- note the fall line

While walking the plot:

- count all burrows (or potential burrows) within the plots
  - defined as a hole that a marmot can hide in
- count all boulders that you cross
  - we need to have a more detailed way of describing boulders and rocks
  - flush with ground? Overhanging ground? By size?

At 0, 10, 20, 30, 40, and 50 m

- note percent ground cover of trees, shrubs, herbaceous plants, grasses, bare ground, and rock (one person can do this by telling the other what the cover is). 1m x 1m plots?
- Estimate vegetation height (0-10 cm, 10-100 cm, > 100 cm)
- on the 'graph' cross out areas without visibility

11.4 Novel Object Experiment

11.5 The Box

11.6 Oxytocin Experiment

11.7 Preserving Fecal samples for parasite analysis

We'll only need 1 gram of feces (not including pebbles or vegetation!) for parasite analysis so if you collect an 'egg-sized' sample, it should be fine. However, if there is more, collect it.

- First, write the marmot ID info from the Ziploc bag onto the specimen container.
- For preserving the feces, we want to preserve 1 part feces to 4 parts 10% buffered neutral formalin (see below). This is equivalent to 1g feces to 4ml formalin solution.
- To avoid contamination from debris, take specimen from the center of the feces.
- TIGHTLY screw the cap on the container and store. The feces should be stored in a cool, dry place away from sunlight.
- Keep the remaining fecal sample for hormonal analysis.

Preparing the 10% buffered neutral formalin

- Mix 10ml of 100% Formalin (40% Formaldehyde gas dissolved in water) in 90 ml of physiologic saline.
- Prepare physiologic saline by dissolving 8.5g of NaCl in 1000ml distilled water (this prepares a

0.85% working solution).

11.8 Fecal floats

Using lab tape, label ALL beakers, containers, etc. to keep track of samples during processing. Do not write on beakers—it's difficult to remove.

Be careful not to cross-contaminate samples. Wash stirring rod, beakers, flasks, etc. between samples.

- Using a wood applicator, and weighing paper, separate and weigh out 1 gm of freshly collected feces. NOTE: If there are many samples, immediately pre-weigh 1 gm from each sample and store on labeled weighing paper so that the remainder can be frozen as soon as possible.
- Using a stirring rod, homogenize 1 gm of feces in 30 ml of luke-warm tap water.
- Pour the entire solution through a 4 x 4" square of mesh that has been formed into a filter on a plastic specimen jar. Using the same stirring rod that was used to homogenize the sample, swill the sample through mesh to get the remainder of the solution. Discard the feces in the filter immediately and rinse the mesh before the feces hardens.
- Pour 15 ml of fecal solution into a 15 ml conical centrifuge tube. Spin at 3/4 speed for 3 min. Ensure the centrifuge is properly balanced.
- Pour out the supernatant and pour in 15 ml of filtered fecal solution. Spin again at 3/4 speed for 3 min and pour out the supernatant.
- Wash the pellet with tap water by spinning at 3/4 speed for 3 min until the supernatant is clear. (this often takes up to 3 washings)
- Fill centrifuge tube with 15 ml of saturated salt solution (36 gm / 100 ml of luke warm tap water—ensure it is fully dissolved).
- Using the pointy end of the inoculation loop, swirl the fecal pellet with the liquid. Then, centrifuge for 4 min at 3/4 speed. (The parasites should float up to the meniscus).
- Bend the inoculation loop 90° and gently touch the edge of the meniscus with the loop. (Do not dip beyond the meniscus or the parasites will sink in).
- Spread the liquid in the loop on a labeled microscope slide. Repeat steps 9 and 10 a second time.
- Carefully cover the spread with a cover slip. Leave undisturbed on a flat horizontal space until the slide dries (about 30 min). Once dry, store in the 'fecal slide storage box'.

12. DATA ARCHIVING AND DATA SHARING PROTOCOLS FOR REPRODUCABLE SCIENCE

Data sharing philosophy

The yellow-bellied marmot long-term study data is managed using a R package `ybamaRmot` hosted on a private github directory. Data are freely available for collaborations upon request and would only be denied if we are actively engaged in a similar project (there are many student projects in the pipeline). Any person collaborating/using the marmot data should agree to the commitment of transparent and replicable open science by the marmot team. The procedure below is mandatory for all studies using the marmot data.

Open science and replication commitment

Each manuscript using marmot data should have a public OSF repository in which the data and code used for the analysis should be deposited, and the DOI associated with the OSF repository should be clearly provided in the manuscript. In addition to the different co-authors, the account "YB marmots" should be added as a contributor to the OSF repository. It should have administrator rights and the box bibliographic contribution should be unchecked.

Files to be archived

Dan Blumstein and Julien Martin are archiving all code and data file associated with each marmot manuscript. Before submission, please provide them with the following files:

1. The manuscript to be submitted.
2. Code to extract data from the `ybamaRmot` R Package (please include the package version used).
3. Data file(s) in `.csv` format extracted from the ybamarmot R package and obtained via the previous script. Code and data files will be archived. In addition, the data file to be posted on the OSF repository should be anonymized by creating a new name for each individual (e.g., 1, 2, 3…).
4. A key file listing all files included with a brief explanation as well as a section defining the content of the data files and explaining the columns.
5. Code for the all analysis and plots.

Publishing data with a manuscript

The OSF repository should include:

1. Data file(s) in `.csv` format extracted from the `ybamarmot` R package. The posted data file should be anonymized (random name for each individual).
2. A key file listing all files included with a brief explanation as well as a section defining the content of the data files and explaining the columns.
3. Code for the analysis and plots which will permit replication of the analyses in the paper.

SUPPLEMENTARY MATERIALS

S1. Colony Areas Explained

Down Valley

Gothic Townsite: Gothic is a large, complex site. Female social groups are usually centered around one or two cabins. Solitary females may live under other cabins scattered around the townsite. Multiple males may be present, but in some years one male controls the entire site.

Avalanche: There is one main group using the burrow at the main boulder in the large meadow of the avalanche corridor on Gothic. Observe from the mound at the intersection of the main road and the kettle pond road. If conducting FIDs or playbacks, you can sit on the road up above the cabin and get an excellent view of marmots at talus, main, and north.

Bench: Bench marmots (never a large group) can be trapped at the Bench cabin or around the water tower. However, when the Bridger's arrive, they bring dogs and trapping the Bridger cabin isn't advisable or possible at that time.

Horsemound: One group (never large) using mainly the area around the rocks. Observe from bench or from the same side of the river in the meadow in front of river mound.

River Mound: River Mound marmots (never a large group) are typically isolated from the main River area but may come from either the River area or from Bench. Marmots at River Mound are also seen at the Bridger Cabin. Observe River Mound marmots from either across the river, or while walking to the main River area.

River Area: The River Group typically consists of marmots living at either Spruce Mound or South Mound. When populations are high (usually), these are two separate social groups that a dominant male is likely to control. The River area is best observed from the hillside after crossing the fence on the Kettle Pond trail.

Down valley from River: Corral Burrow (across from the Corral along the river), River Annex (after the bend in the river), Fence Burrow (below two spruce trees where a fence hits the river, West River Bend (across the river), and River Bend (the next bend on the main river side of the river), Upper Falls, and Lower Falls (both on the River side of the river). These areas should be trapped several times a year to mark likely immigrants to the main River Group.

Up-Valley

Beaver Talus: a 5-10 min walk above the beaver ponds between RMBL and the Avery Picnic Area.

Marmot Meadow: If the group is small, Main Talus is likely to be the center of activity, but as the group grows, it's likely to fission into a Main Talus group and an Aspen Burrow group. Marmots from Aspen Burrow also use 'Middle'—located in the meadow itself, and Spruce—located left of the main Aspen area. Observe them from across the road so as not to impact their behavior.

Cliff: Faces down on the East River Bridge near Marmot Meadow. It can be observed from the bridge area and should be trapped several times a year to mark likely immigrants to other areas.

Picnic Area: Picnic is comprised of as few as 2 and as many as 4 separate groups.

Lower Picnic: is the group comprising Aspen Burrow, Split Rock, and the Pinnacle rocks. This is almost always present as a group. Other burrows may be used as hibernacula or as main burrows if there are a lot of animals.

Middle Picnic: is a group above the band of Aspen based next to a grove of Spruce adjacent to the 403 trail. Historically, this is a group that seems to be founded by animals from either Upper or Lower/Main Picnic.

Upper Picnic: is a group in the talus above the aspen band. They forage up to Upper Upper Picnic and in the meadow to the right of the main burrow area.

Upper Upper Picnic: is a group founded by surplus animals from Upper Picnic in the talus high above Upper Picnic. It is typically occupied only when all other sites are occupied. All Picnic area burrows can be observed from 'Ken's Pullout' just down valley from the 2nd Gothic Campground, or from the road directly below Big Pinnacle Rock.

Boulder: A narrow meadow between Picnic and North Picnic. Easily accessible from the Gothic Campground, but not easily observed without scaring the marmots. The big boulder is the main burrow area. In years with many marmots, animals may be found higher up the clearing. Trapping is the only real way to monitor Boulder.

Stonefield: There may be as many as 2 matrilines at Stonefield. One has been centered on the 'Main Mound' and the burrows around it. This group uses burrows in front of it, behind it as well as the Diamond Burrow. The other matriline more-or-less uses only the 'South Mound' burrow—a well-vegetated burrow south of main area. There is no single place to watch marmots from. The road allows you to see parts of the main mound area. To see South Mound, you've got to watch from the Stonefield side of the river.

North Picnic: The main burrow area is on the lower third of the slope in a clearing. Slope and Main talus are the areas where marmots are likely to be seen if there are marmots around. Above those burrows are 'Steep Slope', Talus (just below the cliff band, Cliff (in the upper right hand corner of the meadow), and a few other burrows left of the main burrow area (Gooseberry, Big Flat Rock). This is an area best trapped as observations are more difficult when the vegetation grows up. It's not prime marmot area and can be used as an 'index' of marmot saturation in the valley.

S2. JWatcher Installation Help for Mac

So you want to download JWatcher and record cute marmot videos? (With minimal pain and keyboard bashing?)

THE TLDR: **JWatcher is written in the Java computer language** (http://www.sun.com/java) and thus should work on any operating system. **It will run on virtually any microcomputer capable of running a Java Virtual Machine**, and it has been tested on both Windows (Linux) and Macintosh operating systems.

The following describes the detailed steps for installing Java + JWatcher on Mac computers. If you have a Windows computer, your install should (hopefully) be much more straightforward! But just in case, the detailed instructions for installing JWatcher on Windows 10 are here: https://www.jwatcher.ucla.edu/wp-content/uploads/sites/128/2020/07/jWatcher_windows10.pdf

STEP 1:
Are you using a Mac computer running at least **Lion IOS or newer**?

STEP 2:
Figure out if you have a M1 or Intel Chip in your Mac (see About This Mac).
(Tip: late 2020+ machines are most likely running M1)

STEP 3:
Do you have ~1 GB or so of hard drive storage and at least 68mb RAM free on your machine?

STEP 4:
Check if you have Java installed on your machine:
Open the Terminal:
Type: "which java" or "java -version'.

- If you see “/usr/bin/java” or something along these lines:
- “java version "18.0.1.1" 2022-04-22
  Java(TM) SE Runtime Environment (build 18.0.1.1+2-6)
  Java HotSpot(TM) 64-Bit Server VM (build 18.0.1.1+2-6, mixed mode, sharing)”

you are in the clear! If you see anything besides this, follow the steps below:

Install Java using JDK. Read through the detailed instructions in this guide:
https://docs.oracle.com/en/java/javase/15/install/installation-jdk-macos.html#GUID-2FE451B0-9572-4E38-A1A5-568B77B146DE

The possible files you will need for the installation are here:
https://www.oracle.com/java/technologies/downloads/#jdk18-mac
- For Macs running Intel chip, you want the **x64 .DMG** file listed as: **macOS x64 DMG Installer**.
- For Macs running M1, you want the **Arm 64 .DMG** file listed as: **Arm 64 DMG Installer**.

Follow the instructions that you are prompted with from the DMG installer after that.

You can install Java from the command line by downloading the Compressed Archive .tar.gz file. Click on it or download it using “wget <url>” and unzip it with “gunzip /Downloads/<filename>”

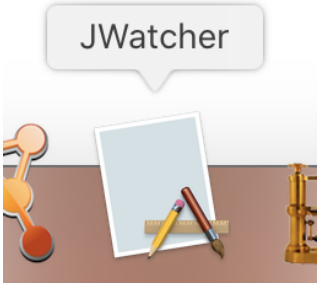
STEP 5:
Check that Java actually got installed. Go back to the Terminal and rerun the commands from Step #3 to make sure *some* version of Java is now on your machine.

STEP 6:
Proceed to installing JWatcher! Go here: https://www.jwatcher.ucla.edu/download-jwatcher/
Read here for any special tips that apply to your machine and then click on JWatcher Version 1.0 for Mac to download the **”jwatcher-mac.jar”** file. You can also install in the fewest steps from the command line like this:

Open the Terminal. Make the installation file executable by typing:
“chmod 555 ~/Downloads/jwatcher-mac.jar”

Then install JWatcher by typing:
“java -jar ~/Downloads/jwatcher-mac.jar”

STEP 7:
Check that Jwatcher actually got installed. Go to your Applications folder on your Mac and look for “JWatcher” (the icon is just a blank page). The first time you click on this, the icon should be added to your home bar. It should then look like this:



Congratulations! You can now use JWatcher to record the secret life of marmots from your very own machine.

TROUBLESHOOTING 101

1) Java did not install. :(

Make sure that you are using the right x64 or Arm 64 file version for your Java JDK installation. Try installing Java from the command line instead (not using the .DMG installer).
Follow the commands listed above for installing with the correct .tar.gz file.

2) JWatcher did not install. :(

You may need to fill out **a short e-form** on the JWatcher installation site describing your role on the marmot project, why you are using JWatcher, etc. in order to access the correct version of the .jar file. Try opening the JWatcher site in an Incognito window or another browser (Safari) until you are prompted to fill out this form, which requires you to input your email address.

3) JWatcher looks like it/said it installed, but I can't find the JWatcher icon in my Applications folder (or anywhere else on my computer).

Delete everything and try again. Remove the .jar file from your Downloads (use rm ~/Downloads/jwatcher-linux.jar" on the command line) or drag and drop all the JWatcher files that are visible on your machine into your trash, then ***empty your trash***. If you try again and receive a pop-up message saying that JWatcher and/or "dependencies" are already installed, click the option to "Overwrite these files" and continue as before with the installation.

S3. Marmot Training Videos

How to trap and process a marmot
How to set a marmot trap:
https://www.youtube.com/watch?v=mXXUKg58Mx8
https://youtu.be/mXXUKg58Mx8

Getting a marmot into the bag:
https://www.youtube.com/watch?v=OxIIC55y44Q
https://youtu.be/OxIIC55y44Q

How to adjust a marmot in the bag:
https://www.youtube.com/watch?v=vqqhKUkcoqE
https://youtu.be/vqqhKUkcoqE

Collecting a blood sample:
https://www.youtube.com/watch?v=XQ-bQvG93zU
https://youtu.be/XQ-bQvG93zU

Measuring a trapped marmot:
https://www.youtube.com/watch?v=_JydrEPnNFE
https://youtu.be/_JydrEPnNFE

How to process samples back in the lab
Processing blood samples in the lab:
https://www.youtube.com/watch?v=DQavhXLmqWE

https://youtu.be/DQavhXLmqWE

Processing fecal samples in the lab:
https://www.youtube.com/watch?v=0Mph4GyMySQ
https://youtu.be/0Mph4GyMySQ

Observing marmot behavior--Video ethograms
Video ethogram:
https://www.youtube.com/watch?v=btIYbzwyOB8
https://youtu.be/btIYbzwyOB8

A fight between two (completely focused marmots):
https://www.youtube.com/watch?v=NnZxf1_PWLk
https://youtu.be/NnZxf1_PWLk

Example of aggressive behavior (fighting):
https://www.youtube.com/watch?v=w5fzXIvPw8w

S4. Over-Winter Trap Storage

Most traps are stored in the field in safe locations. The goal is to prevent the traps from getting flattened from the heavy snow and to make them inconspicuous to prevent theft or vandalism. However, so as not to put all eggs in one basket it's important to not leave ALL the traps in the field and to bring traps back to Gothic for indoor storage. Specific storage locations are (and these are not used in all years since we've been storing traps in the lab):

River: in the gully between South Mound and Spruce Mound. Note: use Gothic Town traps to trap Bench.

Gothic townsite: In the Murray lab (by the work crew area)

Marmot Meadow: in the grove of spruce behind main talus—NOTE: store traps out of sight when not actively trapping Marmot Meadow to prevent people from seeing and disturbing them..

Picnic: to the left of the main Picnic area, in a grove of three spruce trees (triple spruce). Ensure traps are NOT stacked on top of each other or the snow will flatten them. Store no more than 14 adult traps (pup traps can be stored inside some).

Boulder: No more than 7 adult traps can be stored in the spruce trees above and to the right of the main big rock. Go up the slope to the first smallish spruce tree standing on its own, turn right, go into the trees, traps are at the base of the spruce. You may need to go further up the slope and further into the trees than you think, but if you go up and to the right (north) of the main rock, they should be in that general area. I always just end up circling around in the trees for a while before I stumble on them. When everything's melted out and dry, there's a little bit of a "path", but not really.

Cliff: 4 adult and 2 pup traps are stored NW of upper cliff. Follow the fallen log which acts as a pointer to where the traps are stored out of the path of avalanches.

Stone Field: 5 adult traps are stored near The Diamond Rock.

NOTE: Before leaving for the winter, write down a more detailed location and details on the number of traps stored at each site so they won't be lost. Hang this in the lab in an obvious location.

S5. Molting and Lost Ear Tags Protocols

We have a formal way of finding who it is with a genotype matching analysis ("identity analysis").
The analysis is super easy and quick to run in Cervus once you have everything setup for parentage assignment.

The protocol for that is:
1. to flag it in the newtag log during the summer to make sure that the individual will be genotyped and that I can pick up the potential problem (we need to have a better system to keep track of issues or potential issues)
2. genotype the individual based on new sample
3. when sending me the genotype for the year flag which individuals are "retagged"
4. run an identity analysis with either Cervus or MasterBayes on retagged individual.
5. if we got a match, update uid in genotype file and change accordingly the taglook_up data and all other data tables for the last field season. if not match then sadly add it as a new individual in database
6. run parentage assignment analysis for the year

In Cervus to do an "identity analysis" you need to 1. estimate the allele frequency distribution, 2. simulate assignment based on population structure and finally 3. do the identity analysis (1. and 2. are the same step required for parentage assignments.

S6. How to use older recorders

How to use the Sony PCM-M1 DAT
Be very careful if you have to change a tape: ensure that the area is dust-free before opening it up in the field.
Checklist before recording:
Power cord in?
Tape in?
Spare batteries with you (4 C cells)?
Microphone mini in MIC/LINE IN
Headphones for monitoring required!
SP 44.1kHz
MANUAL
MIC/LINE IN: MIC
MIC ATT: 0dB
Setting the record level: hit RECORD button once and use the dial on the right; ensure that the digital level is not peaking
Recording: Hit RECORD and PAUSE. Then, hit PAUSE, wait a moment and you should see the counter moving
UNPLUG THE POWER CORD WHEN NOT USING THE RECORDER, otherwise it will drain the battery.