

Objective: to catalogue and observe behavioral foraging patterns in bears using a key-logging program (BORIS). This project and ethogram are based on a [2009 article](#) found in The Journal of Mammalogy.

Materials:

- BORIS software
- Computer with capabilities to run BORIS
- BORIS project file (Bear Salmon Forage.boris)
- Videos to analyze (Table 1)

Table 1. Videos to choose to analyze		
Subject	Youtube Title	Youtube Link
Bear #1	brooks falls grizzly bear catching and eating a salmon	<a href="https://www.youtube.com/watch?v=4iHVC98d2w4">https://www.youtube.com/watch?v=4iHVC98d2w4</a>
Bear #2	Male Brown Bear eating salmon at Brooks Falls	<a href="https://www.youtube.com/watch?v=2HB0Em2PqrM">https://www.youtube.com/watch?v=2HB0Em2PqrM</a>
Bear #3	Grizzly Bear feeding on Salmon.	<a href="https://www.youtube.com/watch?v=jOF2O0NkHms">https://www.youtube.com/watch?v=jOF2O0NkHms</a>
Bear #4	Grizzly Bear salmon fishing	<a href="https://www.youtube.com/watch?v=VnMLw4jeUZU">https://www.youtube.com/watch?v=VnMLw4jeUZU</a>
Bear #5	Brooks Falls Bears, Katmai AK	<a href="https://www.youtube.com/watch?v=EurWaA7qCDw">https://www.youtube.com/watch?v=EurWaA7qCDw</a>
Bear#6 (Expert Mode)	Brown Bear Shows Off Its Fishing Skills	<a href="https://www.youtube.com/watch?v=ZESQW2HQJZc">https://www.youtube.com/watch?v=ZESQW2HQJZc</a>

Setting up your behavioral station:


1. Install [BORIS](#) and download project file.
2. Open BORIS application.
3. In the BORIS application go to **File** ↪ **Open project** and open the project file. Accept any changes they want to do. Most likely they want to update the project to a current version. I have the original \*.boris and updated versions in the team drive.

Understanding your ethogram

1. The project file contains the ethogram we will be using for this lab (Table 2). Get familiar with key associated with the behavior. All the keys are concentrated the left side of the keyboard. You will be analyzing live which can make it difficult to appropriately match up behaviors with timestamps and you will mess up.

Table 2. Ethogram to analyze bear foraging behavior			
Behavior	Key (on keyboard)*	Event type	Description
Standing/ Sitting	s	STATE	Bear is stationary in stream
Walking	w	STATE	Bear moves slowly along while fishing or accessing alternate fishing localities
Running	r	STATE	Bear moves quickly along or within stream typically while fishing
Attempt	a	POINT	Bear attempts to capture salmon using a variety of techniques, such as pouncing or diving
Success	d	POINT	Bear successfully captures salmon
Feeding	f	STATE	Bear feeds upon salmon carcass that it has caught
Bite	e	POINT	Bear takes a bite
*if keylogging is not your style, watch the video (7:56) to learn how to turn your behaviors into buttons			

- BORIS uses an exclusion matrix (Figure 1). Some behaviors are mutually exclusive, and some are not. For example, one cannot run while one is walking, so that intersection is checked off.

 Behaviors exclusion matrix
 ? X

Check if behaviors are mutually exclusive.  
The Point events (displayed on blue background) cannot be excluded)

	Standing	Walking	Running	Feeding
<b>Attempt</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Success	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Bite	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Standing		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Walking	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Running	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
Feeding	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	



## Start collecting behavioral data

1. Next go to **Observations** → **New Observation**. A new window should appear (Figure 2)

New observation

Observation id: Bear#6 Date and time: 2021-03-09 11:39:50

Description

Independent variables

Variable	Type	Value
1 Species	value from set	brown

Time offset: + 0 00 0000 hh:mm:ss seconds

☐ Limit observation to a time interval

Media Live


Scan sampling every 0 seconds

☐ Start from current time

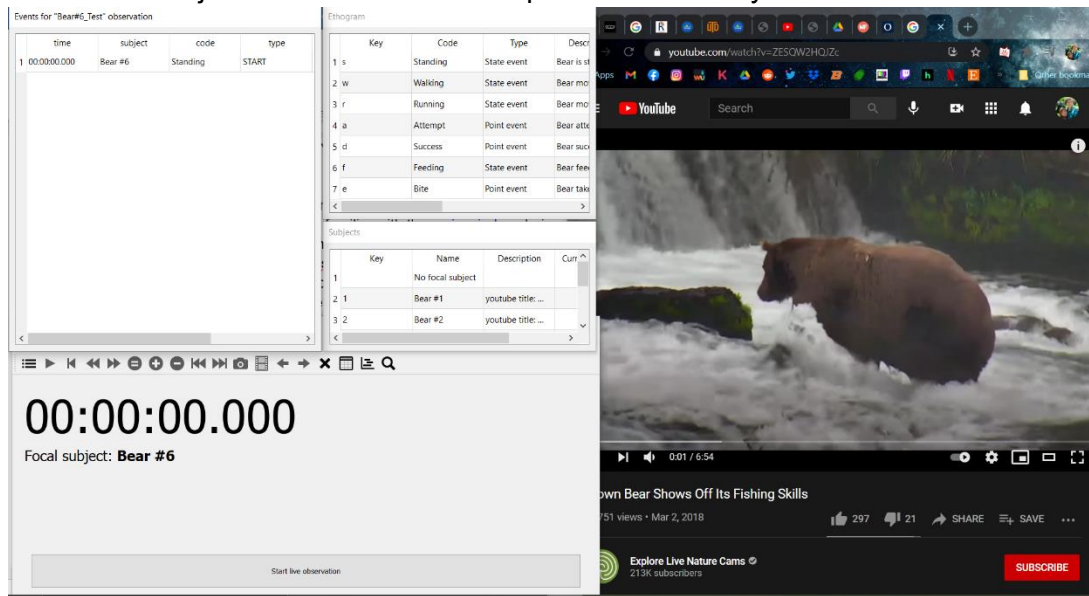
☒ Day time

☐ Epoch time (seconds since 1970-01-01)

Cancel Save Start

2. Add observation id. I would include the subjects name in your id.
3. In the **Independent variables** section in the **Values** column select the species of bear in your video.
4. Go to the **Live** tab
5. Click the **Start** button
6. Before you start, get familiar with the [main window](#) during an observation.
7. Open the youtube link of the video you will be analyzing. Pause the video and if you need it here is cheatsheet for YouTube's [hotkeys](#).
8. Push subject key. Adjust different windowpanes (Figure 3). You want to be able to see keys & code under ethogram. Ride-sided pane (Events for observation) you want to be able to see the time, subject, code, type (see below for reference). Pushing the pane in pane button (  ) pops windows out of the program, which is helpful when analyzing live (Figure 3).

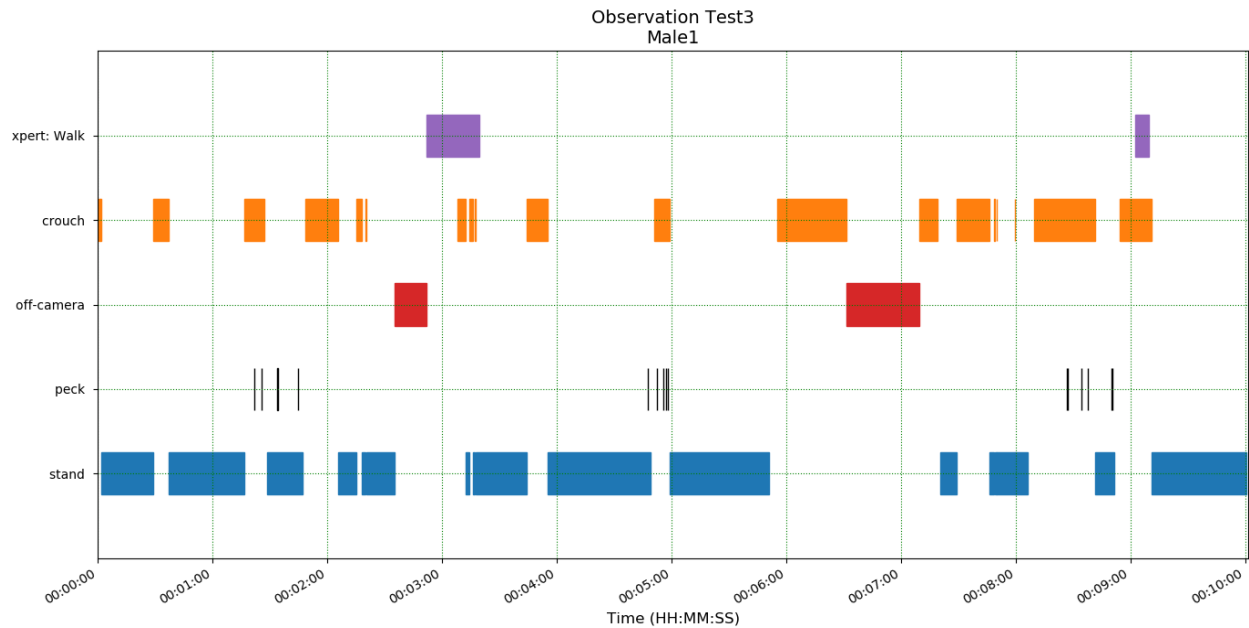
- Determine subject's initial behavior and push behavior key.



- Restart video and then click **Start live observation**. You will be prompted when you click **Start live observation**. Do you want to delete the current events, click **No**.
- Focus on capturing the start of behaviors, don't worry about making any mistakes for the practice video. Always be verifying in the center information panel that you have a focal subject and behavior selected for the entire video, there should be no gaps in your time budgets.
- After video is finished, right click inside Events for observation pane and click check state events, which will give you a new pop-up where you made all your mistakes. If you want, save the text so it is easier for you to refer to while fixing unmatched pairs.
- Move on to proofing your data.

### Proofing your data

- Double-clicking a row in this pane will also bring you to that point in the video, and you can verify in the center information panel what subject and behavior is selected for that time.
- If you need to delete events just select the event(s) to be deleted and right-click and click **delete selected events**. Additionally, you can fix unmatched pairs by either selecting **fix unpaired events**.
- Double check that everything is hunky dory by going to **Analysis** → **Plot** → **Plot events**
- Select your observation its id and click Ok. In the next window (**select subjects and behaviors**) just verify that your subject(s) are selected. Check the **Exclude behaviors without event** box and **Full observation(s)** is bubbled and click Ok. You should get a graph like below:



5. Make verify that events don't overlap or gape in an inaccurate manner. Point event should be occurring inside state events. Do you notice any trends immediately?

## Analysis

1. Go to **Analysis** → **Time Budget**
2. Select your observation its id and click Ok. In the next window (**select subjects and behaviors**) just verify that your subject(s) are selected. Check the **Exclude behaviors without event** box and **Full observation(s)** is bubbled and click Ok. The next window, **Select behaviors to exclude**, check the off-camera box and click Ok. You should receive a window that looks like this:

Time budget

Selected observations

Test3

Analysis from 0.000 to 600.780 s

Behaviors excluded from total time: off-camera

	Subject	Behavior	Modifiers	Total number of occurrences	Total duration (s)	Duration mean (s)	Duration std dev	inter-event intervals mean (s)	inter-event intervals std dev	% of total length
1	Male1	stand		18	334.536	18.585	18.531	15.567	22.354	61.3
2	Male1	crouch		19	178.353	9.387	10.584	20.694	19.266	32.7
3	Male1	peck		15	0	0	0	32.054	69.683	NA
4	Male1	off-camera		2	54.749	27.375	14.67	219.745	NA	9.1
5	Male1	Expert: Walk		2	34.247	17.124	14.665	343.251	NA	6.3

Save results

Close

3. Click the save results box and save the document in a format you want (\*.tsv, \*.csv, \*.xlsx, \*.txt)