DATA ANALYSIS

Camera trap data sets lend themselves to a wide variety of analyses, ranging from simple tabulating that grade school students can handle to determining the probability of detection, which requires skills typically acquired at the college level or beyond. The nature of the research question and the mathematical abilities of your students will drive the choice of analyses. Examples of common analyses are presented below. The eMammal Academy site has several helpful resources including how-to videos and fully-developed lesson plans for both middle and high school levels.

Abundance

Figure 1 presents a hypothetical data set showing the number of detections for each species at each of four camera locations during each of three, one-week deployments. This simple tabulation – which can be done as a whole-class exercise at the front of the room – facilitates comparisons of species abundance from location to location. The same data could be reorganized to make comparisons of abundance across the three deployments somewhat easier (Figure 2). In either case the totals allow students to determine with ease the relative number of detection for each species, and at each camera location, and during each deployment. In discussing their results, students should be prompted to consider the extent to which the data allows them to reach definitive conclusions about the composition of the community. The section below concerning Relative Abundance points up one important caveat.

- Figure 1 -

Detections by Location by Week

	Camera 1			**Camera 2**			**Camera 3**			**Camera 4**			**Totals**
	Week 1	**Week 2**	**Week 3**	**Week 1**	**Week 2**	**Week 3**	**Week 1**	**Week 2**	**Week 3**	**Week 1**	**Week 2**	**Week 3**	
Bobcat							1						1
Coyote								1					1
Dom. Dog			3	2									5
Squirrel	24					1	1			1	16	13	56
G. Fox									2				2
Raccoon	12	2									2	4	20
Rabbit	3						1						4
Opossum	9												9
Deer		4		4	16	1	19	8	24	20	2	2	100
Wild Boar					1								1
Unknown	5	5	2			1	1			4		5	23
Totals	53	11	5	6	17	3	23	9	26	25	20	24	222

- Figure 2 -

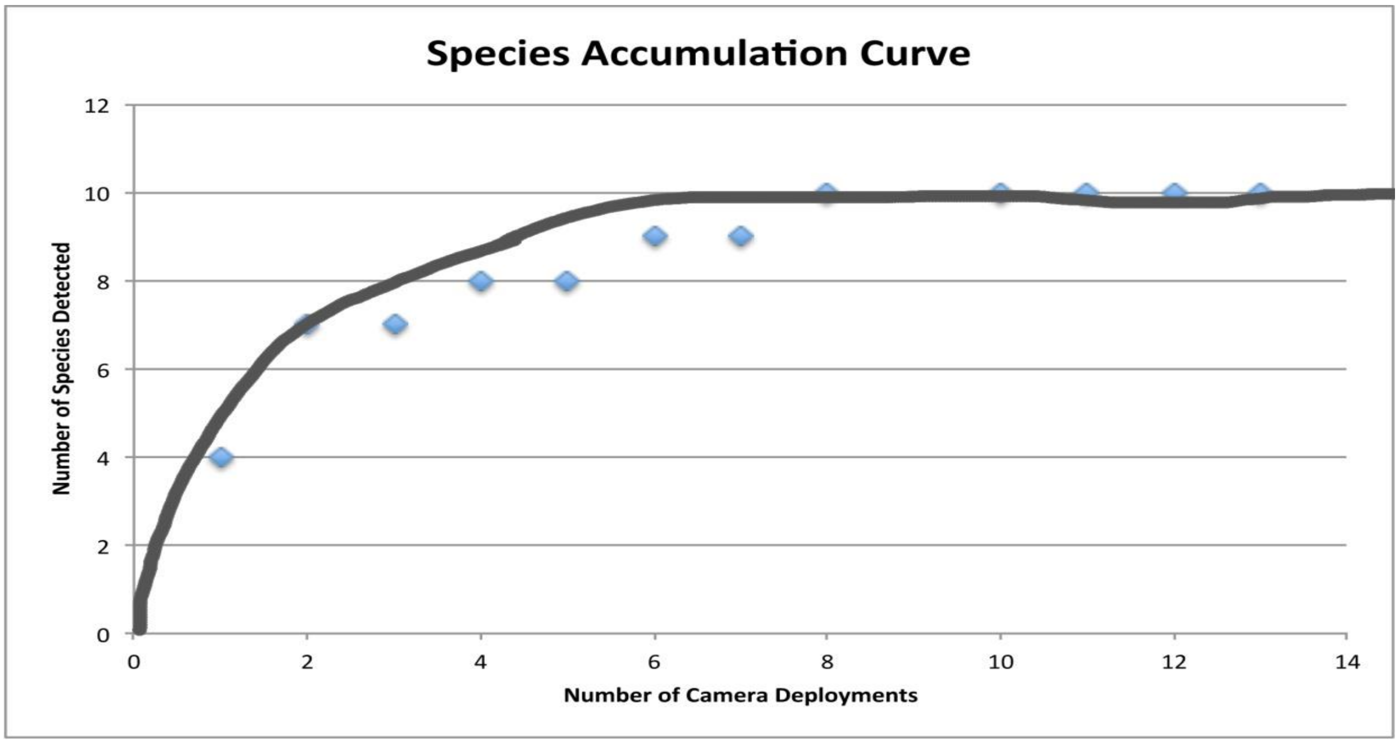
Detections by Week by Camera

	Week 1				**Week 2**				**Week 3**				
	Cam 1	**Cam 2**	**Cam 3**	**Cam 4**	**Cam 1**	**Cam 2**	**Cam 3**	**Cam 4**	**Cam 1**	**Cam 2**	**Cam 3**	**Cam 4**	**Totals**
Bobcat									1				1
Coyote							1						1
Dom. Dog		2							3				5
Squirrel	24		1	1				16		1		13	56
G. Fox										2			2
Raccoon	12				2			2				4	20
Rabbit	3		1										4
Opossum	9												9
Deer		4	19	20	4	16	8	2		1	24	2	100
Wild Boar						1							1
Unknown	5		1	4	5				2	1		5	23
Totals	53	6	22	25	11	17	9	20	6	5	24	24	222

<u>Species Richness - Species Accumulation Curve</u>

From simple tabulations such as those in Figures 1 and 2, students may create a Species Accumulation Curve. This involves plotting the number of species detected, beginning with one deployment or one camera location and plotting the cumulative number of species detected (the dependent variable) as you continue moving through the remaining cameras and deployments (the independent variable) along the horizontal axis. Figure 3 depicts a sample Species Accumulation Curve excerpted from a Florida Middle School Science Lesson (available at https://emammal.si.edu/content/emammal-academy-middle-school). The resulting curve will allow students to infer species richness, i.e., the number of species present, in the target community. The nature of the curve will also help them determine whether their sample size is large enough to support a firm conclusion. A curve that eventually levels off strongly suggests that most, if not all, of the species present have been detected by the cameras. A curve that is still rising at the extreme right would tend to negate that inference. Teachers should ensure that discussion of the results touches on this as an example of how scientists evaluate not just what the data is telling them, but whether the data are sufficiently reliable to allow them to draw inferences with confidence.

- Figure 3 -



Relative Abundance

Relative abundance is expressed as the ratio of the number of detections to the number of days each camera was deployed. In any experiment where there is variation, whether by design or by circumstance, in the time periods for the deployment of the cameras, relative abundance rates must be calculated before valid comparisons can be made across species, locations or deployments. For example, the headings employed in Figures 1 and 2 create the impression that each camera was deployed for exactly the same amount of time: three, one-week intervals. However, any variation in the time a camera was actually deployed during an interval would undermine the validity of any comparisons to be drawn using the data contained in the tables.

Figure 4 below depicts relative abundance calculations for one species, the Northern Raccoon. The data underlying these calculations was drawn from an actual investigation conducted by Valley Springs Middle School in North Carolina. The reader may wish to view that database by accessing the North Carolina Math Lesson: Ratios and Proportions at https://emammal.si.edu/content/emammal-academy-middle-school.

The tables in Figure 4 show differences in camera days among the various cameras and deployments and the resulting relative abundance rates (expressed as the quotient: raccoon detections/camera-days) obtained at each location during each deployment. The uppermost table shows the totals for all locations obtained during each deployment, as well as the totals for all deployments. These tables were prepared by hand data contained in a sizeable Excel spreadsheet. Proficient Excel users could achieve the same result more readily using Excel's Pivot Table feature, which is demonstrated in an eMammal video available at https://emammal.si.edu/content/emammal-academy-videos.

- Figure 4 -

Relative Abundance - Northern Raccoon

COMBINED DATA

DATE RANGE	7/9 – 8/10	8/10 – 9/6	9/6 – 10/2	10/2 – 10/26	10/26 – 11/24	11/24 – 12/16	Totals
Camera days	69	107	108	100	120	92	596
Detections	5	19	32	35	26	12	129
Rel. Abundance	.07	.18	.30	.35	.22	.13	.22

NCR185

DATE RANGE	7/9 – 8/10	8/16 – 9/6	9/6 – 10/2	10/2 – 10/26	10/26 – 11/24	11/24 – 12/16	Totals
Camera days	0	22	27	25	30	23	127
Detections	-	1	2	0	0	0	3
Rel. Abundance	-	.05	.07	0	0	0	.02

NRC187

DATE RANGE	7/9 – 8/10	8/10 – 9/6	9/6 – 10/2	10/2 – 10/26	10/26 – 11/24	11/24 – 12/16	Totals
Camera days	23	28	27	25	30	23	156
Detections	2	8	10	9	4	1	34
Rel. Abundance	.09	.29	.37	.36	.13	.04	.22

NRC211

DATE RANGE	7/9 – 8/10	8/10 – 9/6	9/6 – 10/2	10/2 – 10/26	10/26 – 11/24	11/24 – 12/16	Totals
Camera days	23	29	27	25	30	23	157
Detections	0	9	16	24	22	10	81
Rel. Abundance	0	.31	.59	.96	.73	.43	.52

NRC29

DATE RANGE	7/9 – 8/10	8/10 – 9/6	9/6 – 10/2	10/2 – 10/26	10/26 – 11/24	11/24 – 12/16	Totals
Camera days	23	28	27	25	30	23	156
Detections	3	1	4	2	0	1	11
Rel. Abundance	.13	.04	.15	.08	0	.04	.07

Activity Pattern

Game cameras typically stamp each image with the date and time of day. This enables students to investigate an animal's daily activity pattern. Figure 5 depicts an Excel Charts for two species' activity patterns. These charts were derived from the Valley Springs data. The raw time-stamp data must first be converted to simple whole numbers ranging from 0 to 23, representing the hour of the day. This procedure is demonstrated in an eMammal video also available at the same site referenced above. Then using a Pivot Table or simple column sorting, the data needed to create these charts can be tabulated from the original data set.

- Figure 5 -

ACTIVITY PATTERNS