“Cave Swallow Data Mining”

New Mexico

Super Computing Challenge

Final Report

School of Dreams Academy

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Abstract:

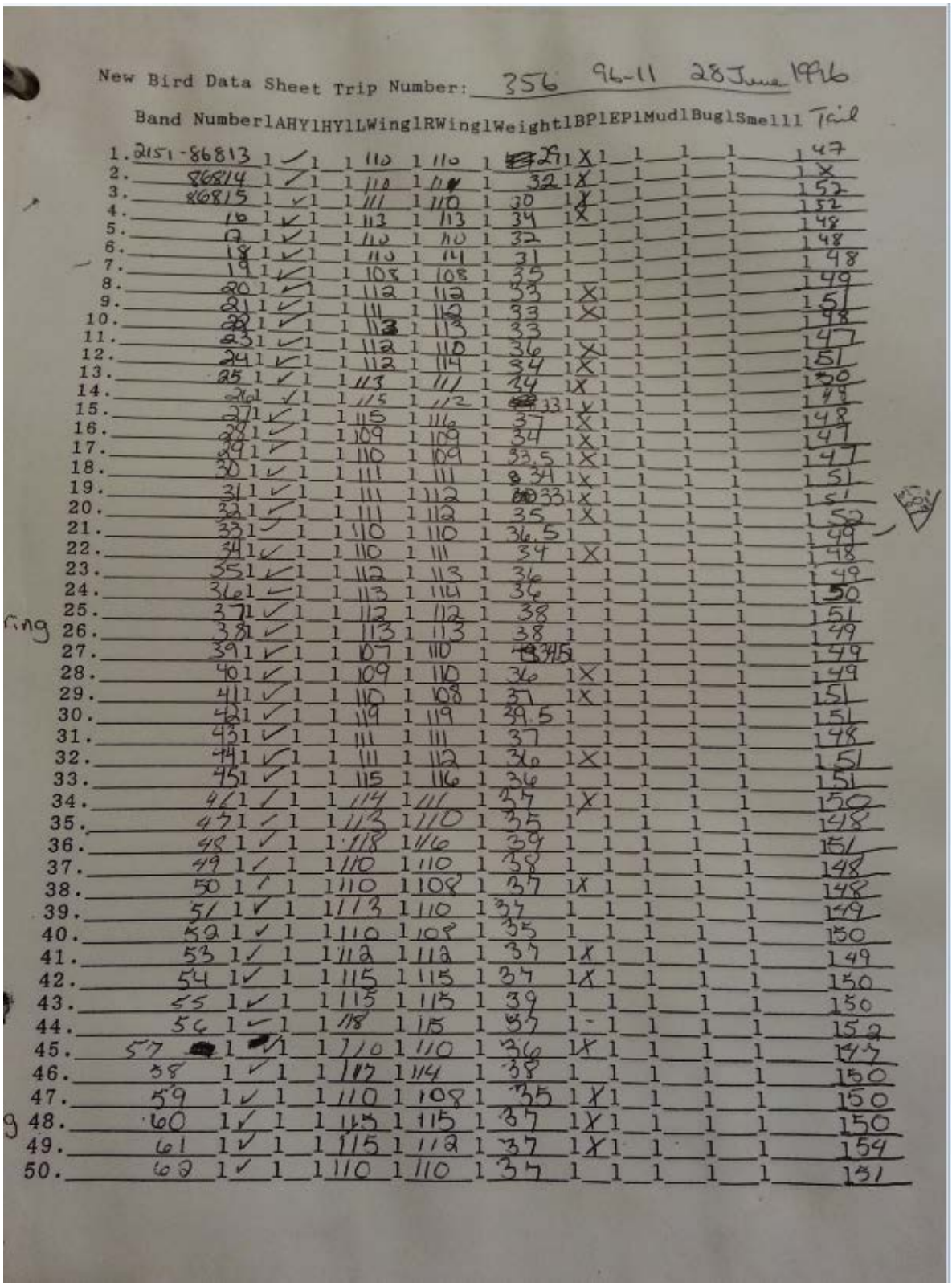
For the past 30 years Steve West, a scientist at Carlsbad Caverns, has been banding cave swallows and documenting data such as their weight, wind span, tail length, ect. The banding takes place on average a couple times a month, excluding winter due to their migration toward Mexico.

For most of our analysis we kept the adults and babies separated to obtain more accurate results. The newborn as well as matured birds are so similar in size and weight it is difficult to specify. The presence of freckles on their face and beak confirm they are a hatch year these freckles fade within their first year. To identify the bird's gender we look for a bru patch (a fatherless spot located on the birds chest which becomes visible when blown on). A bru patch signalizes that the bird has recently had eggs, which indicate it is a female. This is another category in which we sorted the birds during the analysis.

The data was first document by hand but was recently transferred into an excel spread sheet to be better analyzed. We took the data and categorized it by the tail length and right and left wing span. With this we found the maximum, minimum and average lengths. This analysis is the foundation for next year's project and will lead us to the answers of bigger questions.

Problem Definition:

Not much is known about the cave swallows at Carlsbad Caverns. Even though scientists have been banding them for so long they still have no hard evidence explaining what there average length, weight, wingspan is; how the weather affects them or the average life span, is still unknown. Furthermore, we already have the answers it’s just a matter of finding them. Being in an excel document makes the data harder to analyze; a problem that we plan on solving in next year’s project. However, based on the results we wanted to obtain we decided it would be more efficient to just leave the data in excel.



New Bird Data Sheet Trip Number: 356 96-11 28 June 1996

	Band Number	A	HY	HY	L Wing	R Wing	Weight	BP	EP	Mud	Bug	Smell	Tail
1.	2151-86813	1	✓	1	110	110	[illegible]	1	X	1	1	1	147
2.	86814	1	✓	1	110	110	32	1	X	1	1	1	152
3.	86815	1	✓	1	111	110	30	1	X	1	1	1	152
4.	16	1	✓	1	113	113	34	1	X	1	1	1	148
5.	17	1	✓	1	110	110	32	1	1	1	1	1	148
6.	18	1	✓	1	110	111	31	1	1	1	1	1	148
7.	19	1	✓	1	108	108	35	1	1	1	1	1	149
8.	20	1	✓	1	112	112	33	1	X	1	1	1	151
9.	21	1	✓	1	111	112	33	1	X	1	1	1	148
10.	22	1	✓	1	113	113	33	1	1	1	1	1	147
11.	23	1	✓	1	112	110	36	1	X	1	1	1	151
12.	24	1	✓	1	112	114	34	1	X	1	1	1	150
13.	25	1	✓	1	113	111	34	1	X	1	1	1	149
14.	26	1	✓	1	115	112	[illegible]33	1	X	1	1	1	148
15.	27	1	✓	1	115	116	37	1	X	1	1	1	147
16.	28	1	✓	1	109	109	34	1	X	1	1	1	147
17.	29	1	✓	1	110	109	33.5	1	X	1	1	1	151
18.	30	1	✓	1	111	111	[illegible]34	1	X	1	1	1	150
19.	31	1	✓	1	111	112	[illegible]33	1	X	1	1	1	151
20.	32	1	✓	1	111	112	35	1	X	1	1	1	152
21.	33	1	✓	1	110	110	36.5	1	1	1	1	1	149
22.	34	1	✓	1	110	111	34	1	X	1	1	1	148
23.	35	1	✓	1	112	113	36	1	1	1	1	1	149
24.	36	1	✓	1	113	114	36	1	1	1	1	1	150
25.	37	1	✓	1	112	112	38	1	1	1	1	1	151
26.	38	1	✓	1	113	113	38	1	1	1	1	1	149
27.	39	1	✓	1	107	110	[illegible]	1	1	1	1	1	149
28.	40	1	✓	1	109	110	36	1	X	1	1	1	149
29.	41	1	✓	1	110	108	37	1	X	1	1	1	151
30.	42	1	✓	1	119	119	39.5	1	1	1	1	1	151
31.	43	1	✓	1	111	111	37	1	1	1	1	1	148
32.	44	1	✓	1	111	112	36	1	X	1	1	1	151
33.	45	1	✓	1	115	116	36	1	1	1	1	1	151
34.	47	1	✓	1	114	111	37	1	X	1	1	1	150
35.	47	1	✓	1	113	110	35	1	1	1	1	1	148
36.	48	1	✓	1	118	116	39	1	1	1	1	1	151
37.	49	1	✓	1	110	110	38	1	1	1	1	1	148
38.	50	1	✓	1	110	108	37	1	X	1	1	1	148
39.	51	1	✓	1	113	110	34	1	1	1	1	1	149
40.	52	1	✓	1	110	108	35	1	1	1	1	1	150
41.	53	1	✓	1	112	112	37	1	X	1	1	1	149
42.	54	1	✓	1	115	115	34	1	X	1	1	1	150
43.	55	1	✓	1	115	115	39	1	1	1	1	1	150
44.	56	1	✓	1	118	115	37	1	1	1	1	1	152
45.	57	1	✓	1	110	110	36	1	X	1	1	1	149
46.	58	1	✓	1	117	114	38	1	1	1	1	1	150
47.	59	1	✓	1	110	108	35	1	X	1	1	1	150
48.	60	1	✓	1	115	115	37	1	X	1	1	1	150
49.	61	1	✓	1	115	112	37	1	X	1	1	1	154
50.	62	1	✓	1	110	110	37	1	1	1	1	1	151

(Above you see an example photo of the hard copy bird data.)

Procedure:

Step 1

When beginning this project the first thing we did was verify all the data. When the data was being transferred into the excel document there were errors made and numbers copied incorrectly. We decided that for this year two years would be sufficient to obtain the results we were looking for. We chose the years at random: 1988 and 1995. This procedure took only a couple of days; with two students, one reading the numbers out of the book and the other checking it on the computer. When we would find a mistake the general rule was to go by what the book said but we were also able to ask Steve West to verify our conclusions.

Step 2

We went about the project by first organizing the data. Using the tools in excel we separated the babies from adults; the hatch year from after hatch year. Next we organized the date they were captured in order from earlier to later in the year.

Step 3

We went on to analyzing the data finding the average weight, left, right wing span and tail length from each day data was collected. This would help us understand the difference in weight and size between the adult birds and baby birds. To further identify the data we then went through all the information relating to the recaptured birds. Where we analyze the overall change from one month to the other, this made it easier to see the patters and cycles the cave swallows undergo annually.

Step 4

We charted all the results so they could be easily understood.

Average left wingspan

Average right wingspan

Average tail

	date	average mass	alw	arw	aTail
HY	09/17/88	24	109	109	32
	09/18/88	24.2	109	109	33.2
	09/25/88	23.9	110	110	33.9
	10/02/88	25	109	110	33.6
	10/09/88	24.3	110	110	32.3
	10/14/88	24.7	111	111	34.7
	10/26/88	24.4	112	112	32.4
	10/27/88	24	112	112	32
	10/30/88	23.8	113	114	32
AHY	03/19/88	25.9	99	100	34.6
	03/24/88	27	103	104	35
	03/31/88	25.8	104	105	34
	04/14/88	26.6	107	107	37.6
	04/18/88	24.7	108	108	33.7
	04/22/88	23.1	109	109	31.1
	04/24/88	22.3	109	110	30.5
	04/29/88	24.8	110	110	32.7
	05/03/88	24.8	110	110	32.6
	05/10/88	24.3	110	110	32.3
	05/18/88	24.3	110	111	32.3
	05/30/88	23.2	111	111	32.2
	06/03/88	24	111	111	33.1
	06/15/88	23.8	111	111	32.8
	06/22/88	23.5	111	111	32.5
	07/05/88	22.2	111	112	31.7
	07/08/88	23	112	112	31
	08/25/88	23.9	112	112	31.7
	08/30/88	23.5	112	113	33.1
	08/31/88	24.1	113	113	32.6
	09/03/88	25	113	114	33
	09/06/88	24.2	115	115	33.2
	09/12/88	24.2	116	116	34.2
	09/17/88	24.2	118	118	32.3

Results

		year	date	timecat	prefix	band#	age	agecat	lw	rw	tail	Thanks for	weight
03/19/88	25.9	1988	03/19/88	12	2011	45094	AHY	2	93	96	.	33.0	24.0
	99	1988	03/19/88	12	2011	45095	AHY	2	99	98	.	35.5	26.5
	100	1988	03/19/88	12	2011	45096	AHY	2	100	101	.	33.0	24.0
	34.6	1988	03/19/88	12	2011	45098	AHY	2	100	101	.	35.0	26.0
		1988	03/19/88	12	2011	45099	AHY	2	100	101	.	34.0	25.0
		1988	03/19/88	12	2011	45100	AHY	2	102	102	.	35.5	26.5
		1988	03/19/88	12	2011	45102	AHY	2	102	102	.	36.5	27.5
03/24/88	27.0	1988	03/24/88	13	2011	45101	AHY	2	103	102	.	35.5	27.5
	103	1988	03/24/88	13	2011	45103	AHY	2	103	104	.	34.0	26.0
	104	1988	03/24/88	13	2011	45104	AHY	2	103	104	.	35.0	27.0
	35.0	1988	03/24/88	13	2011	45105	AHY	2	103	104	.	34.0	26.0
		1988	03/24/88	13	2011	45106	AHY	2	104	104	.	36.5	28.5
03/31/88	25.8	1988	03/31/88	14	2011	45107	AHY	2	104	104	.	35.0	27.0
	104	1988	03/31/88	14	2011	45108	AHY	2	104	105	.	33.0	25.0
	34	1988	03/31/88	14	2011	45109	AHY	2	104	105	.	33.5	25.5
04/14/88	26.6	1988	04/14/88	16	2011	45110	AHY	2	105	105	.	38.0	27.0
	107	1988	04/14/88	16	2011	45111	AHY	2	105	105	.	34.0	23.0
	107	1988	04/14/88	16	2011	45112	AHY	2	105	105	.	36.5	25.5
	37.6	1988	04/14/88	16	2011	45113	AHY	2	105	106	.	36.0	25.0
		1988	04/14/88	16	2011	45114	AHY	2	106	106	.	40.0	29.0
		1988	04/14/88	16	2011	45115	AHY	2	106	106	.	36.5	25.5
		1988	04/14/88	16	2011	45116	AHY	2	106	106	.	39.5	28.5
		1988	04/14/88	16	2011	45117	AHY	2	106	106	.	38.0	27.0
		1988	04/14/88	16	2011	45118	AHY	2	106	106	.	41.0	30.0
		1988	04/14/88	16	2011	45119	AHY	2	106	106	.	38.0	27.0
		1988	04/14/88	16	2011	45120	AHY	2	106	106	.	37.0	26.0
		1988	04/14/88	16	2011	45121	AHY	2	106	106	.	37.0	26.0
		1988	04/14/88	16	2011	45122	AHY	2	106	107	.	38.5	27.5

(Example of excel spreadsheet)

From this development we learned the average dimensions of a matured cave swallow. The average right wing span was 110.5 and the average left wing span was 110.2. The tail length was 32.9 and the weight 24.2. We also determine the average dimensions of a new born cave swallow. Average right wing span was 110.7 the left wing span was 110.5, the average tail length 32.9 and the average weight 24.03.

Conclusion

We have concluded that throughout the year cave swallows undergo an annual cycle of weight loss and molting. The main factor of these cycles is the climate changes from month to month and their migrating patterns. This project is laying down the foundation for a more extensive research and the development of a database. Our plans for this project is to create a database using the program MUMPS that will sort and analyze the data much more effectively and efficiently. We started with a small scale analysis in a excel workbook to obtain the basis of understanding what we would like next year’s project to accomplish.

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Significant Achievement

Our biggest achievement in this project was laying down the foundation for a continuation next year. We now have a much better understanding of what we need to do to accomplish our goals. We are more familiar with the data and can easily understand it and have learned how to make useful connections.

Acknowledgements

We would like to give thanks to our teacher Creighton Edington who is always there and supporting us along the way. We would also like to thank our mentors Steve West who answered all our many questions and Dave Culp for giving us advice.