Sofia, Jess, & Miranda

Final Report – Nest Data

Objective:

The Piping Plover population at the JWNP preserve has been declining over the span of 35 years. The purpose of this report is an attempt to discover a reason for this decline and how it is declining, along with ways to prevent the loss of a species. We set upon looking at different data in order to find out what was affecting the Plovers. We first found all the available data for the number of total nests, fledged Plovers, and hatched Plovers over the years 1984 through 2019. We made a master table in order to compare different processes (i.e.: precipitation & temperature) and to see whether these natural processes and their correlating fluctuations were negatively affecting the Plover population. The following is that research.

Data Tables:

Table 1 – Nest Data

ND Nest Data

Years	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Total Nests:	94	145	159	34	53	38	40	74	96	140	133	118	14	31	47	59	54	35	25	50	48	29	140	79	74	90	79	33	N/A	36	34	25	41	N/A	44
Fledged	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	131	N/A	N/A	22	19	N/A	36	48	68	49	42	N/A	N/A	N/A	38	60	100	65	N/A	N/A	N/A	N/A	19	N/A	N/A	N/A

Table 2 – Individual Nest Totals

	# Nests		
Year	Pelican	Peterson	Williams
1994	38	44	23
1997	5	4	4
1998	8		
2000	21	9	4
2001	21	11	1
2002	22	11	
2003	19	7	
2004	17	10	
2008	20	15	15
2009	24	7	19
2010	28	15	13
2011	41	19	4
2016	30	8	

Table 3 – Fledged and Hatched

	Total Fledged			Total Hatched		
Year	Pelican	Peterson	Williams	Pelican	Peterson	Williams
1994	55	45	30			14
1997	7	7	8			4
1998	19					
2000	19	13	4			2
2001	41	7	0			0
2002	40	28				
2003	39	13				
2004	33	9				
2008	24	2	9	20	10	7
2009	33	7	8	20	3	7
2010	27	19	35	15	8	12
2011	7	11	0	22	13	0
2016	53	3		24	6	

Table 4 – Nest Totals, Average Yearly Rainfall, and Average Yearly Temperature

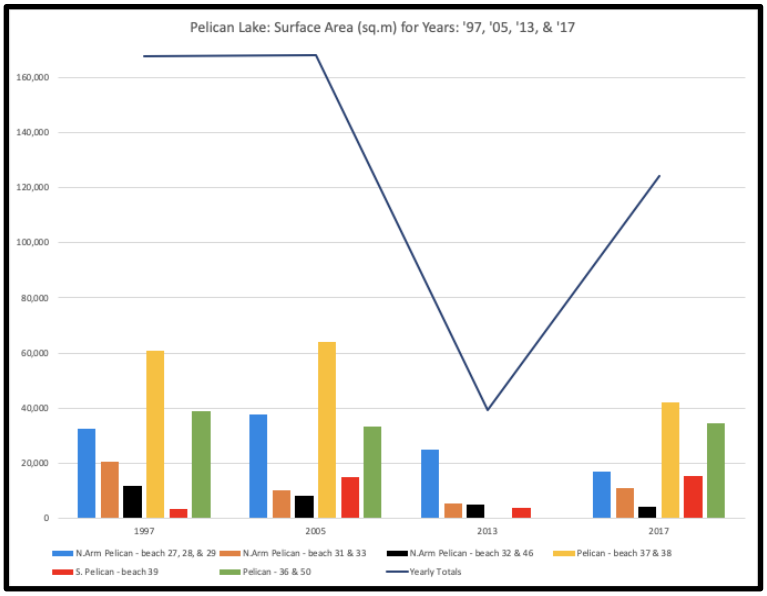
Year	NestTotal	Average Rainfall	Average Temp
1985	94	1.59	
1986	145	1.76	
1987	159	2.19	
1988	34	1.52	
1989	53	1.03	
1990	38	1.2	
1991	40	1.4	
1992	74		
1993	96		
1994	140		51.67
1995	133		50.5
1996	118	1.65	47.75
1997	14	1.24	53.17
1998	31	1.84	54.33
1999	47	2.2	53.92
2000	59	2	51.83
2001	54	1.85	53.58
2002	35	1.02	54.92
2003	25	1.17	54.08
2004	50	1	56.08
2005	48	1.67	56.17
2006	29	1.06	57.83
2007	140	1.61	55.16
2008	79	1.64	53.92
2009	74	1.61	51.17
2010	90	2.37	51.59
2011	79	1.58	52.2
2012	33	0.96	57.67
2013		1.64	52
2014	36	1.77	52.75
2015	34	1.31	57.33
2016	25	1.47	58.92
2017	41	0.94	56.58
2018		1.64	53.25
2019	44	1.7	

Table 5 – Nest Totals Compared to Monthly Average Temperature over the years 1995, 2000, 2005, 2010, & 2015 for the Months of May, June, and April.

May		
Year	Nest Totals	May Average Temperature
1995	133	68
2000	59	68
2005	48	65
2010	90	63
2015	34	65
June		
Year	Nest Totals	June Average Temperature
1995	133	78
2000	59	71
2005	48	78
2010	90	75
2015	34	78
April		
Year	Nest Totals	April Average Temperature
1995	133	48
2000	59	54
2005	48	61
2010	90	62
2015	34	59

Nest Totals Compared to Open Gravel:

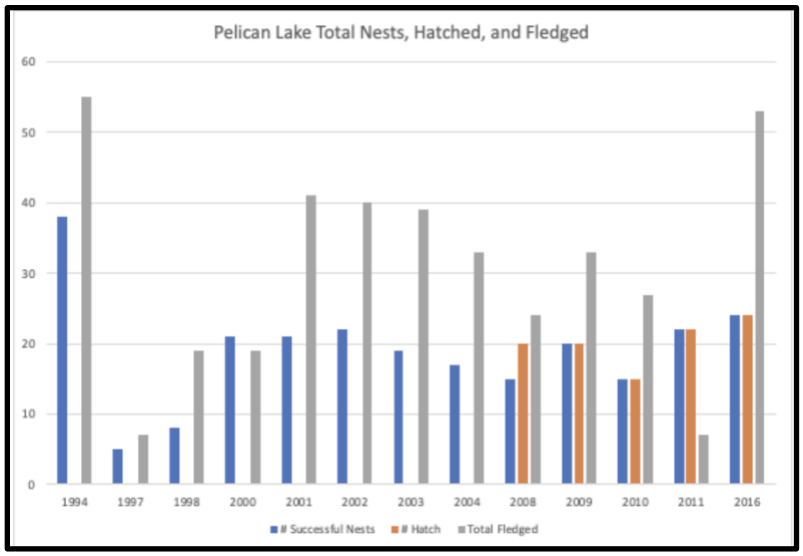
Nest Totals vs. Open Gravel Areas (per m/sq) in the years 1997, 2005, ‘13, & ‘17



When looking at open gravel surface area, it’s apparent the surface area data set (represented by the various-colored columns) can be directly correlated with the Plover nesting totals (represented by the solid, navy-blue line). Specifically, in 2013, it can be seen that gravel surface area available (for Plover nesting) & nest totals, both significantly decrease but this is due to the lack of total Plover nesting data for 2013. However, since gravel surface area was found in student’s individual reports for their assigned beaches, I think the assumption (regardless of missing Plover nest totals for 2013) that open surface area and nest totals remain directly correlated, is valid. This argument is validated by the fact that even without 2013 total nesting data, the trend of open gravel surface area being a decline (on all observed beaches) is enough for one to safely assume that with less habitable surroundings, there would be less total Plover nests to document. However, in 1997 & 2005 on Pelican’s beaches 37 & 38 it can be seen that open gravel surface area is consistent and so are the nesting totals. This seems to be a trend that follows in the fact that, again in 2007, Pelican’s beaches 37 & 38 retain the most open gravel nesting areas. However, it’s interesting that overall, in 2017, that open gravel areas decrease while nest totals take the opposite effect in progressing upward. This upward progression, however, could possibly seem more drastic due to the gap of missing nest total data in 2013.

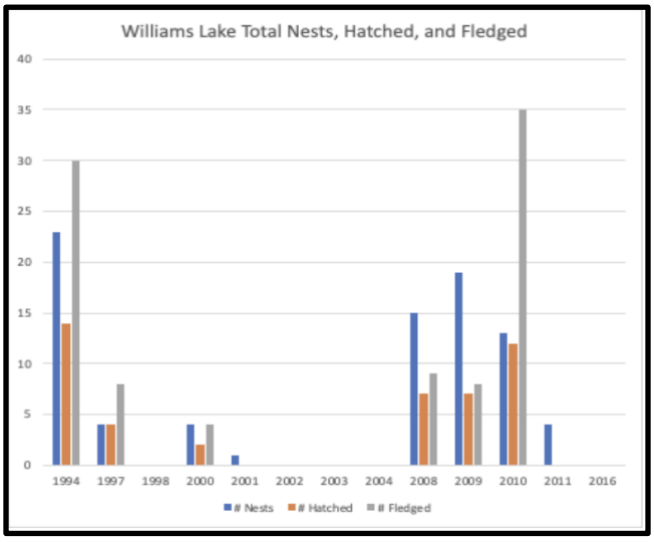
Individual Lake Comparison Data:

Graph 1 – Peterson Lake



This graph shows the difference in number for plover nests, hatched plovers, and fledged plovers over the years 1984 to 2016. The purpose of this graph was to see how the changes in habitat over the years affected the plover population. A fledged plover is one that is able to fly, meaning they made it through their weakest phase. There is more fledged that total nests for most years because more than one bird can come from a nest. There is a huge drop in successful nests starting in 1987. From then on the number of successful nests increases till about 2002 and drops until 2008. It increases in 2009, drops about 5 nests in 2010 and then increases going into 2016. We then used this graph to compare it to 2 other beaches to see if the plover population was being negatively affected at certain lakes or across the entire preserve.

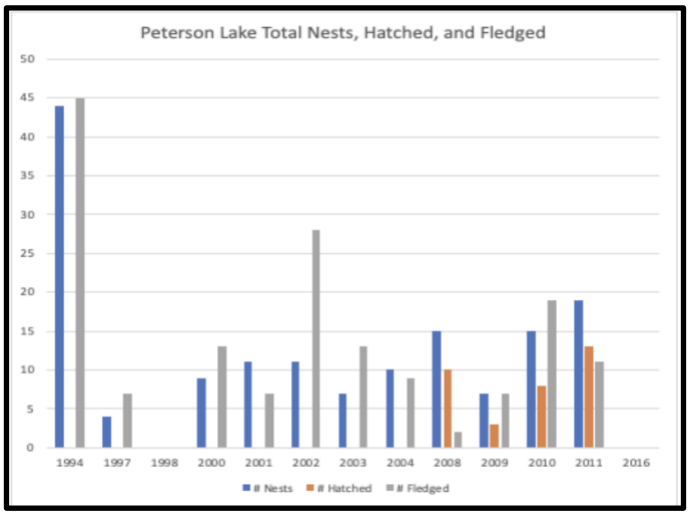
Graph 2 – Williams Lake



There is less data available for Williams Lake. However, the data we do have still shows the rising and falling of the plover population over the years. There again is a huge drop of around 20 nests from 1994 to 1997. In 2001 there were less than 5 total plover nests on Williams Beach. Then from 2008 till 2009, there is an increase in plover nests and a sharp decline from 2010.

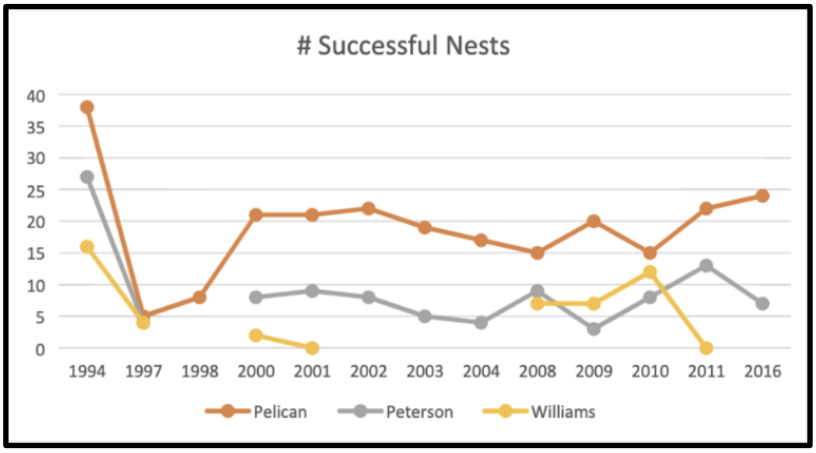
From this data, we can see that whatever is negatively affecting the plover population is happening on more than one beach.

Graph 3 – Peterson Lake



Just like graphs 1 and 2, the purpose of this graph was to see if the negative effects of the plover population. We wanted to see if any patterns of decline emerged with plover nests, hatched plovers, and fledged plovers. All three beaches have a steep decline from 1994 to 1997. Both Pelican and Williams beach both have a plover nest increase in 2009 while Peterson declines from 15 nests to 7. This further shows that the beaches are not consistently losing plover nests as a group, but rather individual beaches are being affected differently.

Graph 4 – Comparison of Successful Nests across Pelican, Peterson, and Williams Lake

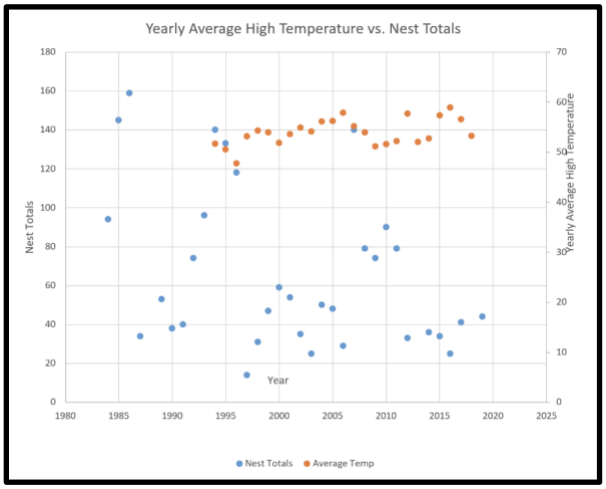


After completing the above 3 graphs, our team decided to turn away from the hatched and fledged data on individual lakes as it was not showing a pattern to help us understand what was happening to the plover population. We instead compared the available nest total data across the Lakes of Pelican, Peterson, and Williams to see if there were any patterns there. Compiling the total nest data required looking back at past recordings and using ArcMap to locate nests. The breaks in the line graph simply mean there was missing data there. In Graph 4, it is possible to

see the steep decline in nests from 1994 to 1997. From 2000 to 2004, Peterson and Pelican nest totals are following a similar pattern. Williams is missing too much data to say the same. However, from 2008 and on Pelican and Peterson differ as well. In 2016, Pelican nest totals were increasing while Peterson nest totals were decreasing. This data shows us that while the lakes all may be experiencing fewer plover nests than 1994, they are declining at different rates and at different times.

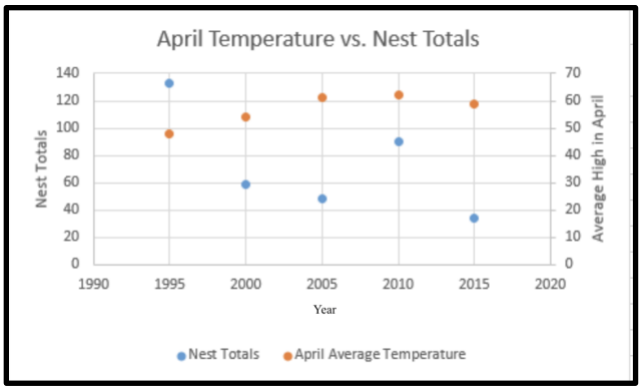
Temperature Data:

Graph 1 – Yearly Average High Temperature vs. Nest Totals



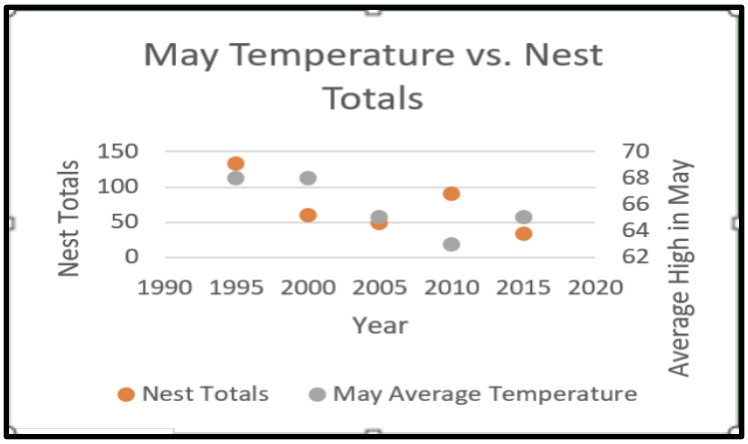
After our research on total nests on all Lakes Williams, Pelican and Peterson, we decided to look at the nest totals of the entire reserve. We wanted to see if the rising temperature due to climate change was visibly affecting the plover population. This data didn't produce any visible patterns. Although, it is worth noting that in 2016 when the temperature was 58.9 degrees Fahrenheit, the highest average temperature in our data, the nest total was 25. The only time plover nests dipped lower than that was in 1997. When the temperature is higher than around 56 degrees, the plover nest totals dip down as well.

Graph 2 – April Temperature vs. Nest Totals (1995, 2000, 2005, 2010, 2015)



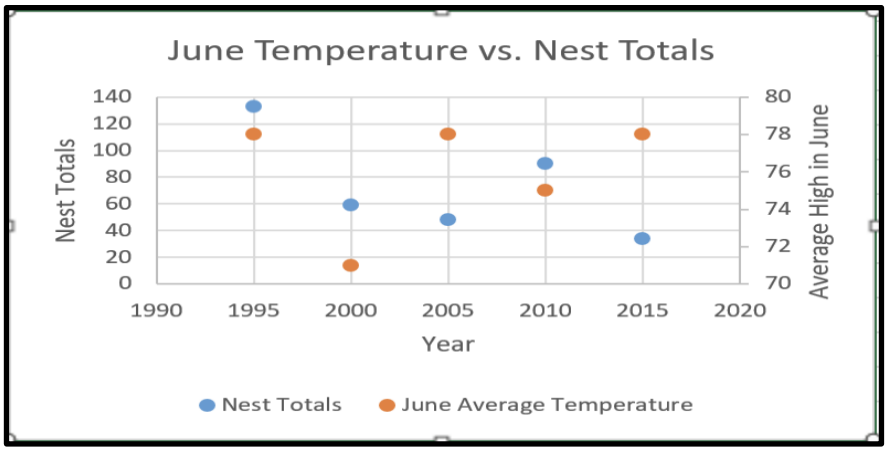
The purpose of this graph was to see if plover populations are being affected by season or are changing at certain times of the year. The research and data yielded no visible patterns. Our hypothesis was that as the temperature increases the plover population will go down. However, nest totals vary widely by year. In 1995 there were 133 nests but in 2000 there were only 60 with the temperature rising 6 degrees which goes along with our hypothesis. However, in 2010 the average temperature was 62º F, the highest in temperature out of the 5 years. The plover population in the year 2010 actually increased from 2005. This graph showed that there is no consistent pattern between temperature and plover nests.

Graph 3 – May Temperature vs. Nest Totals (1995, 2000, 2005, 2010, 2015)



This graph has no patterns. The plover nest totals vary every 5 years as does the temperature. When the temperature is high, the plover nests can vary from over 100 to barely over 50. When the temperature is lower the nests can vary from 40 to 90.

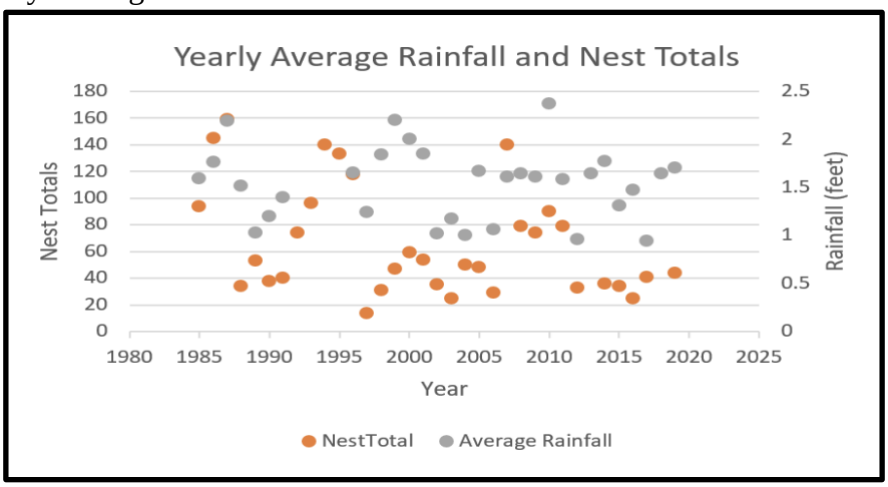
Graph 4 – June Temperature vs. Nest Totals (1995, 2000, 2005, 2010, 2015)



This graph also has no patterns. It seems like every other 5 years, the plover population varies as well. In 1995, the temperature is almost 80 and the plover nest totals are almost 140. In 2000, the average temperature is extremely low and there are 60 plover nests. In 2005 the temperature is high and there are almost 50 nests.

Rainfall Data:

Graph 1 – Yearly Average Rainfall and Nest Totals



The purpose of this graph was to see if rainfall would affect plover populations. Our hypothesis was that with the more rainfall, the fewer plovers. Plovers like open gravel and we believe that rainfall affects the vegetation which affects open gravel. The graph includes the yearly average rainfall and nest totals from 1985 to 2018. The nest totals vary widely over the years spiking up to 160 and dropping as low as less than 20 total nests. When the nests are 140 or above the average yearly rainfall is around 1.75 feet. From 2000 to 2005 the average rainfall was 1 foot and there were fewer plover nests. There are no clear patterns in the graph but collecting this data and manipulating it helped us to see any sudden drops in plover nests and what might cause them.

Conclusion:

In looking at all the research provided above, it's clear that no distinct pattern or inferences can be made from the given data sets. There seems to be no overlapping correlations or patterns between total Plover nests and other environmental data such as temperature, rainfall, and open gravel area. However, in looking specifically at the Plover nest totals across all the beaches, there's a significant decrease in totals in 1997. This decrease affected all the beaches and could possibly point to a widespread natural disaster/occurrence in 1997 that directly affected the Plover population. There is no way of knowing unless a more in-depth search is taken. It might be helpful for future research to look at vegetation at surrounding lakes and see if the vegetation was as dramatically affected as Williams, Pelican, and Peterson in 1997. However in noting the decrease of Plover nest totals, this seems to be the only apparent pattern found. Although a concrete reason for the Plover population decline was not found, these data sets could be helpful in making further conclusions when even more data or past data is uncovered. Apart from the findings of this lab report, other skill sets were used and implemented into making this data collection possible. This lab required the use of multiple softwares including: ArcGIS, Excel, and GoogleEarth tools. This lab also enabled us to become more versatile in looking at a larger scale of data to draw conclusions, look for patterns, and ultimately write up a research report.

Next Steps:

Questions:

1. Did the drop in nest data/available gravel in 2013 **only** occur at pelican? Why? Why not? What factors lead to the drop?
2. All three beaches, Pelican, Peterson, and Williams, show a sudden steep decline in the plover nest totals from 1994 to 1997. Was there a natural phenomenon that caused this sudden decline? What do we think it could be?

Suggestions to answer Questions:

1. In order to address the first question, the access to data not yet collected would be the first order of business. Specifically, a deeper, more thorough search into 2013 nest totals– perhaps, from a different source like the JWNP or another reliable source that had access to Plover nesting data. It also would be interesting to map open gravel area at other locations nearby with Plover a populations to see if there was a drop in open nesting space in 1997 as well as other years to see if an even broader pattern of fluctuation could be noticed.
2. It might be helpful for future research to focus on vegetation at surrounding lakes and see if the vegetation was as dramatically affected as Williams, Pelican, and Peterson in 1997. Perhaps reviewing natural disaster records in or around the surrounding area might also give a clue as to why the Plover population decreased as well.