County: Island
Grant No: SEANWS-2017-IsCoPH-00007

PROJECT TITLE: Island County Marine Resources Committee Operations and Projects

DELIVERABLES FOR TASK NO: 2.10 Draft summary report of 2018 pigeon guillemot study

PROGRESS REPORT: [ ] FINAL REPORT [X]

PERIOD COVERED: October 2017-September 2018

DATE SUBMITTED: 9/28/18

This project has been funded wholly or in part by the United States Environmental Protection Agency under assistant agreement CE-01J31901-0 to the Puget Sound Partnership. The contents of this document do not necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

Pigeon Guillemot Study
2018 Breeding Season, Whidbey Island, WA
Madeline Remmen

Abstract:

From June 12th to September 5th, 2018 two Pigeon Guillemot colonies, Rolling Hills and Mutiny Sands, were studied on Whidbey Island. Pigeon Guillemots are one of the only seabirds that remain around the island and in the Puget Sound year-round. Due to this the diet, behavior, and population of these birds can indicate the overall health of the Puget Sound area. The study began in 2004, but this is the tenth year of data collected by an intern and the purpose of this study is to build upon and monitor the baseline established in the past. Data was collected five days a week rotating days between the two colonies. Prey choice, prey deliveries, populations and disturbances to the Guillemots were all documented.

Introduction:

Pigeon Guillemots were studied on Whidbey Island from June 11th, 2018 to September 5th, 2018, during their breeding season. The Pigeon Guillemot, *Cepphus columba*, are small black and white birds found along the coastal areas of the northern Pacific Ocean spanning from California to Alaska to the eastern coast of Siberia. Part of the Alcidae family these birds have white upper wing patches with red legs and feet that match the inside of their mouth known as the vermillion lining (USFWS, 2006). In the summer seasons, Guillemots come onshore to nest and breed in coastal bluffs, finding burrows created by erosion or other species. During the non-breeding seasons, Pigeon Guillemots move further offshore but remain in protected areas that are in the same region of their colonies (Sibley D. A., 2001).

The burrows are typically located in high parts of the bluffs to protect against predators like rats and raccoons (Gaston, J. A. & Jones, L.I. 1998). Once a burrow and mate pair are established they will typically lay two eggs. Chicks typically hatch one to two days apart, parents will then begin bringing prey to the chicks (Gaston, J. A. & Jones, L.I., 1998) this prey was found to be primarily gunnels, sculpins and other small benthic fish. The type of fish selected may influence fledging success as there is a correlation between a diet of fish with a high lipid content and chick health, thus the selection of prey given to chicks is very important. Chicks fed a diet with fish containing higher lipids were found to be healthier. (Golet, G. H. et al, 2000). Gunnels and Sculpins, the main source of prey found on Whidbey Island have a lower lipid content of only 10%, compared to other fish like Pacific Sand Lance whose lipid content is 25% (Kreamer, A. K., 2009).

Pigeon Guillemots are diving birds that primarily forage in the waters near their colonies (Gaston, J. A. & Jones, L.I. 1998). The often fly into the waters directly in front of the colony and sit with prey before delivering. With small stiff wings built to provide propulsion underwater, their flight is very different from land-dwelling birds, they never soar and fly very close to the surface of the water with fast small wing beats (Sibley, D. A. 2001).

Pigeon Guillemots are not an endangered species, but are susceptible to by-catch (Zydelis, R., Small, C., & French, G. 2013), environmental harms (Irons, B. D. 2000) and predation. The estimated total population of Pigeon Guillemots worldwide is 235,000 as of 2006 and roughly 50% of those are found in Alaska (USFW, 2006)

Pigeon Guillemot colonies are found throughout the Puget Sound. Two of these colonies were studied on Whidbey Island, the first colony, Rolling Hills, is located on the northeastern side of the island within Penn Cove, the second colony, Mutiny Sands, is located on the southwestern side of the island (Figure 1).

The purpose of this study is to analyze Guillemot populations and to judge fledging success for the 2018 season and compare it to previous years. Pigeon Guillemot fledgling success and populations act as an indicator of the overall health of the Salish Sea. This is because they are one of the only seabirds that breed on the Island and a few remain here for the whole year. As mentioned above the Guillemots feed on benthic fish like gunnel and sculpins and these fish depend on a healthy ecosystem, therefore the overall health of the marine ecosystem will be reflected in the Guillemot health and population. A baseline for the overall health has been established in previous years of this study and further studies of the Guillemots allow for the continuous monitoring of that baseline.

Figure 1: All Pigeon Guillemot colonies on Whidbey Island. The stars indicate the Rolling Hills colony to the north and Mutiny Sands colony to the south.

Methods:

Data collection began on June 11th, 2018 and ended on September 5th, 2018 Rolling Hills and Mutiny Sands were monitored on alternating days Monday-Friday from June 11th-June 29th. From June 29th onward, the colonies were monitored on a Tuesday- Saturday schedule, with alternating days. Data collection began at 6:00 am and ended at 10:00 am. Colony maps were made for each site cataloging occupied burrows, occupied burrows were monitored for prey delivery and fledging success. A burrow was considered occupied once a Guillemot was observed flying in and disappearing into the burrow.

All deliveries were cataloged using 12x50mm Bushnell Binoculars. Prey was identified and categorized as gunnel, sculpin or other/ unknown fish. Fish were identified when the Guillemot was sitting in front of the colony or while in flight to the burrow. Fledgling was considered successful if there were three weeks of deliveries to a burrow.

In addition to monitoring prey deliveries, a population count was taken every 30 minutes for the duration of the survey. All disturbances to the Guillemots were recorded and rated as small, medium or large based upon the Guillemots recovery time. A small disturbance was 2-10 minutes, a medium was 10-30 and 30+ minutes was considered large. To be considered a disturbance a minimum of 60% of the birds had to be disrupted.

Results/ Discussion:

In past years Rolling Hills has been the first colony to have recorded deliveries and the first colony to fledge. This trend continued this year, the first delivery was on June 12th and the last recorded delivery was on July 21st. Rolling Hills had a total of six occupied burrows. Five of these burrows had deliveries for at least three weeks, therefore they are classified as having probable fledging success. Burrow #26 was the only occupied burrow that had suspected fledging failure as there were only deliveries there for two weeks (Table 1). The Rolling Hills colony is much more spread out compared to Mutiny Sands making it hard at times to determine what burrow a Guillemot was entering. Due to this the data in Table 1 only represents confirmed deliveries to specific burrows, there were other deliveries that could not be confirmed due to the size of the bluff. The unconfirmed deliveries are not represented in Table 1 but are shown in all other figures. Burrow #3 has an asterisk next to it because from the intern's vantage point the burrow could not be seen, but the Guillemots repeatedly flew to the same are in the bluff where Burrow #3 was located. There was also guano located at the entrance of Burrow #3 suggesting that this burrow was the one in use.

Compared to past years data estimated fledging success is the second highest ever recorded with 83% of the burrows estimated to have successful fledging. Having higher fledging success than every year previously except 2014, which had an estimated fledging success of 89% Rolling Hills was not monitored during from 2015 to 2016 so there is no data for those years (Table 3) (Connolly, 2017 & Zupich, 2013). The last three times Rolling Hills has been monitored it has had an estimated fledging success rate of at least 80% suggesting that the Pigeon Guillemots are able to continue to successfully breed at this colony.

Total Deliveries per Week Rolling Hills 2018

Burrow #

Date (weeks):	**3***	**5**	**8**	**26**	**32**	**33**
6/11/18	0	2	8	2	-	0
6/18/18	7	6	22	2	6	9
6/25/18	4	3	7	0	6	0
7/3/18	17	10	16	0	10	11
7/10/18	9	4	0	0	7	2
7/17/18	13	0	0	0	0	0
7/24/18	0	0	0	0	0	0

Table 1: Deliveries per burrow per week at Rolling Hills, green represents probable successful fledging and red indicates probable fledging failure. All burrows had at least three weeks of deliveries except for #26.

The first delivery at Mutiny Sands occurred on June 19th and the last recorded delivery was on September 5th when the study ended. Burrow # 7 still had deliveries the last day of the study, due to this there was no way to determine when the chick fledged. However, it is still considered a fledging success because there were six weeks of deliveries. Mutiny Sands had a total of eight active burrows, seven of which had at least three weeks of deliveries indicating probable fledging success. The total estimated fledging success rate was 87%. (Tables 2 and 3). The burrow with suspected fledging failure is Burrow #18, only having one week with deliveries.

At the Mutiny Sands colony, a dead fledgling was found just below Burrow #24, this may suggest that Burrow #24 or one surrounding it may have experienced fledging failure. However, this was not considered when calculating the estimated fledging success because it did not relate to the number of weeks these burrows had deliveries. It may indicate that the actual fledging success rate may be lower than 87%.

The deliveries to Burrow #7 began much later than any other burrow, beginning the week of July 30th. On June 21st, an egg was observed in the burrow. This egg either fell out of the burrow or was predated, but fragments of it were observed under the burrow a few days later. This burrow began receiving deliveries so late in the season suggests that the Guillemots may have relayed, and this was the second clutch in this burrow.

Like Rolling Hills, this is the second highest estimated fledging success rate at Mutiny Sands. The only year higher than 2018 was 2010, which had a fledging success rate of 92% (Table 3) (Connolly, 2017 & Zupich, 2013).

Total Deliveries per Week Mutiny Sands 2018

Burrow #

Date (weeks):	**2**	**7**	**10**	**17**	**18**	**23**	**24**	**25**
6/11/18	0	0	0	0	0	0	0	0
6/18/18	0	0	0	0	0	5	0	0
6/25/18	0	0	5	0	0	8	7	0
7/3/18	0	0	10	0	0	10	10	0
7/10/18	4	0	3	0	0	20	8	8
7/17/18	6	0	0	0	0	11	14	9
7/24/18	9	0	0	6	6	0	11	15
7/30/18	16	4	0	7	0	0	0	8
8/7/18	2	2	0	6	0	0	0	1
8/14/18	8	5	0	9	0	0	0	0
8/21/18	0	1	0	0	0	0	0	0
8/28/18	0	15	0	0	0	0	0	0
9/4/18	0	2	0	0	0	0	0	0

Table 2: Deliveries per burrow per week at Mutiny Sands, green represents probable successful fledging and red indicates probable fledging failure. All burrows had at least three weeks of deliveries except for #18.

Estimated Fledging Success 2009-2018:

	Estimated Fledging Success Rolling Hills			Estimated Fledging Success Mutiny Sands
2018	83%		**2018**	87%
2017	82%		**2017**	Not monitored
2016	Not monitored		**2016**	64%
2015	Not monitored		**2015**	58%
2014	89%		**2014**	Not monitored
2013	46%		**2013**	60%
2012	75%		**2012**	66%
2011	73%		**2011**	78%
2010	58%		**2010**	92%
2009	No Data		**2009**	71%

Table 3: Probable fledging success over the past ten years for the Rolling Hills and Mutiny Sands colonies.

There was a total of 220 deliveries at Rolling Hills. Prey choice was found to be primarily gunnels. A total of 73% of deliveries were identified as gunnels, while 17% were identified as sculpins and 10% were identified as being either another type of fish like perch or unidentified (Figure 2).

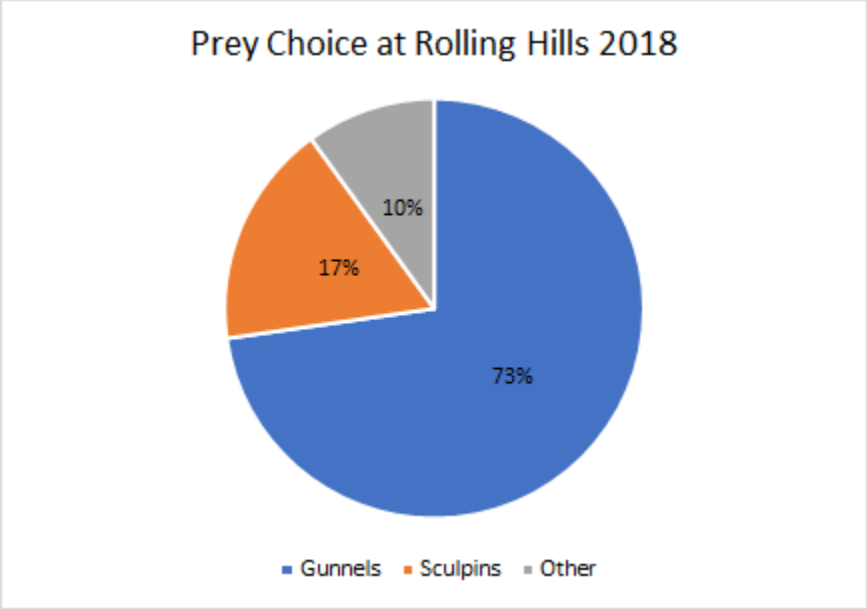

Figure 2: Pie chart of prey choices at Rolling Hills.

Mutiny Sands had a total of 264 deliveries. Of those prey, the choice was found to be primarily sculpins. Sculpins were delivered 68% of the time, while gunnels were delivered 17% of the time and 7% of the time the prey was unknown or another family of fish (Figure 3).

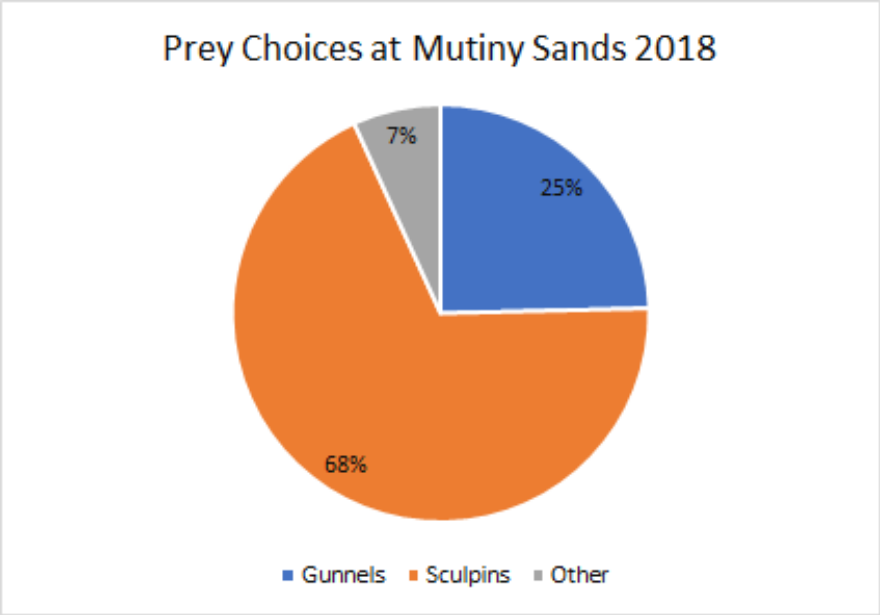

Figure 3: Pie chart of prey choices at Mutiny Sands.

Deliveries at Rolling Hills peaked on July 5th with a total 54 of deliveries averaging 8.5 per hour. June 26th has been categorized as an outlier. There was a colony-wide disturbance from an Eagle that began at 6:27 and lasted the duration of the survey that day. There was only one delivery before the disturbance occurred. It is likely that if this disturbance did not occur there would have been more deliveries on this day bringing the days total deliveries and average deliveries per hour up (Figures 4 and 5). The last delivery at Rolling Hills was July 21st.

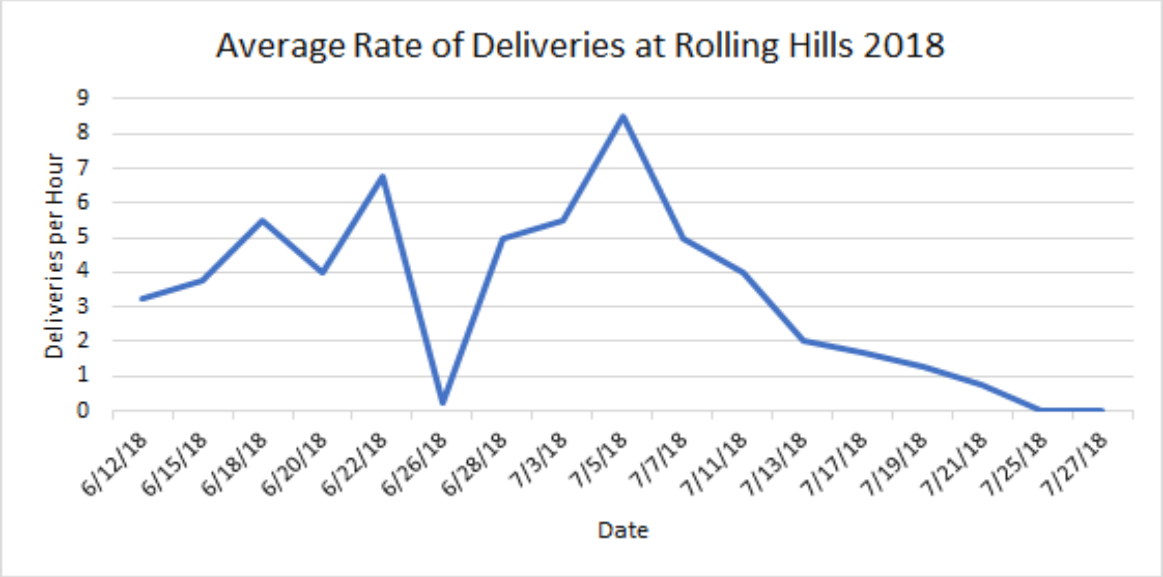

Figure 5: Daily rate of deliveries per hour at Rolling Hills.

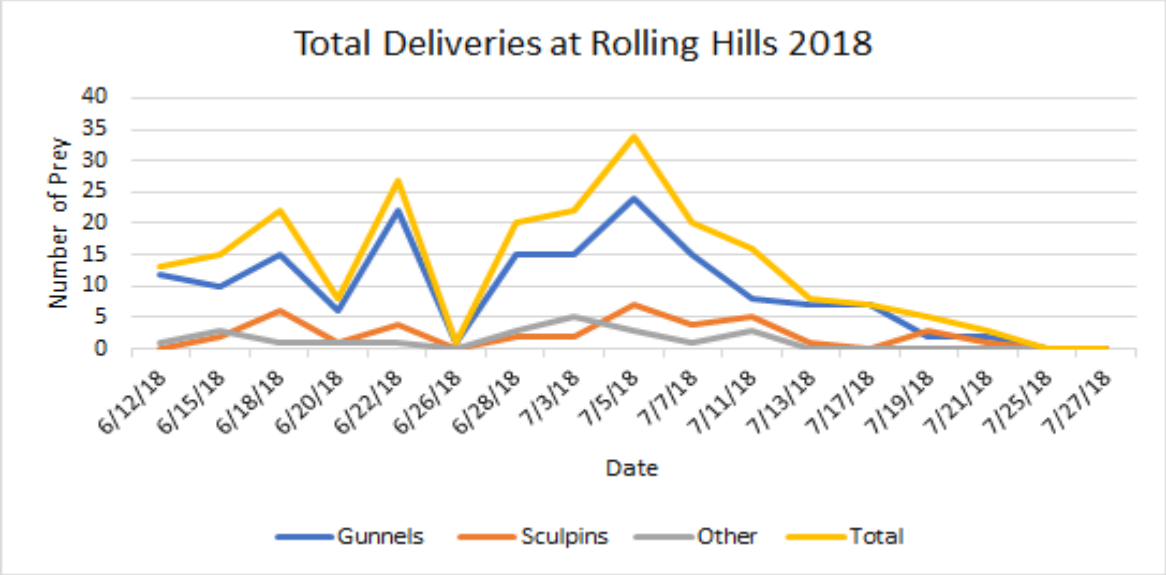

Figure 6: The total number of fish, gunnels, sculpins, and others/ unknown fish delivered daily at Rolling Hills.

Deliveries to Mutiny Sands peaked on July 20th with a total of 24 deliveries averaging 6 per hour. On August 22nd there were no deliveries, this is likely because smoke from wildfires created very poor visibility (Figure 6 and 7).

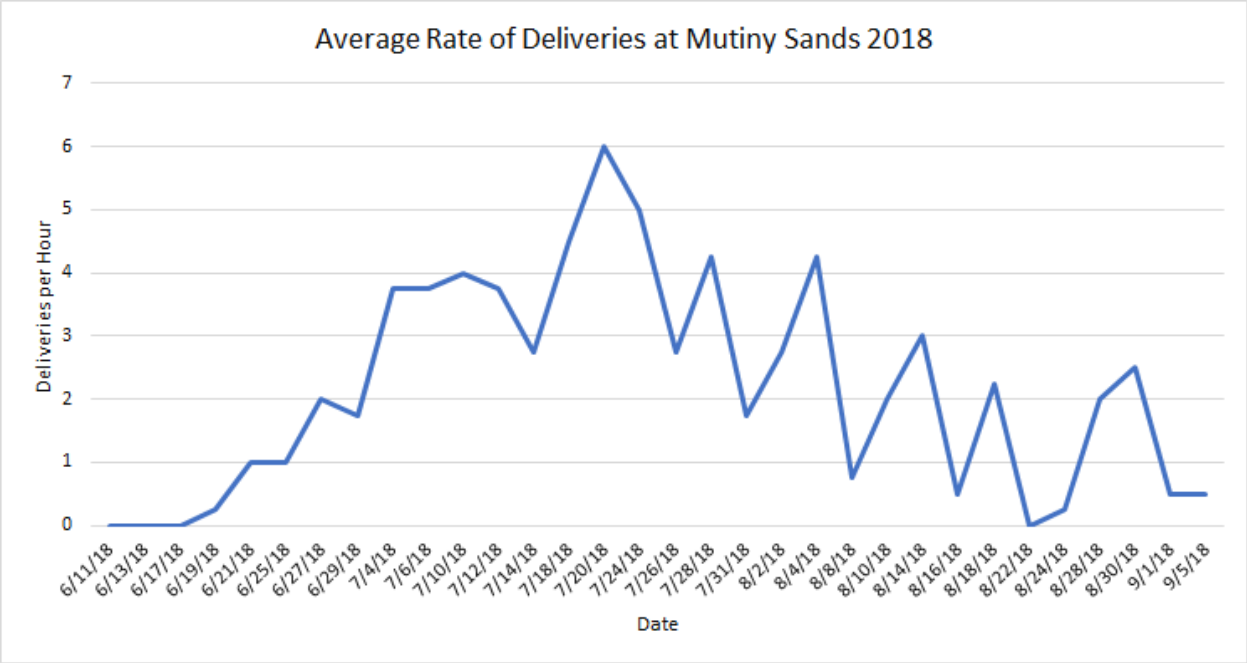

Figure 6: Hourly rate of deliveries to Mutiny Sands per day.

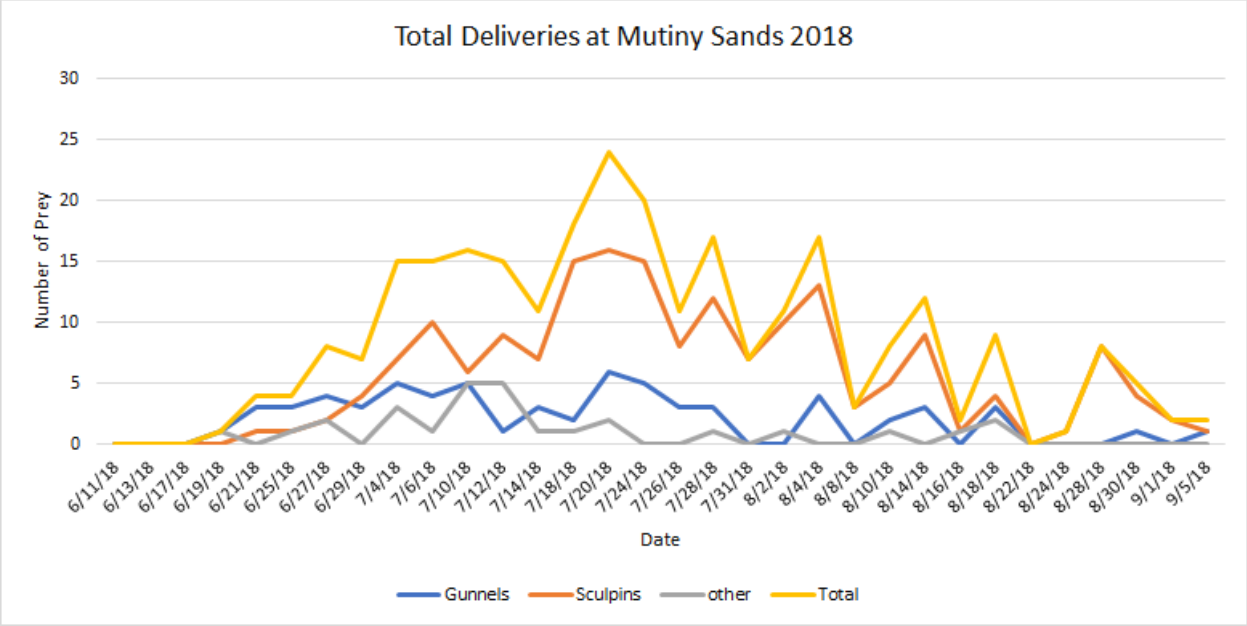

Figure 7: The total deliveries per day, gunnels, sculpins, and other/ unknown fish to Mutiny Sands.

The highest population recorded at Rolling Hills was 45 on July 12th. After fledging ended it doesn't appear that the Guillemots at Rolling Hills moved offshore right away as the intern continued to visit this colony for several visits after deliveries had ended and continued to have high population counts (Figure 8).

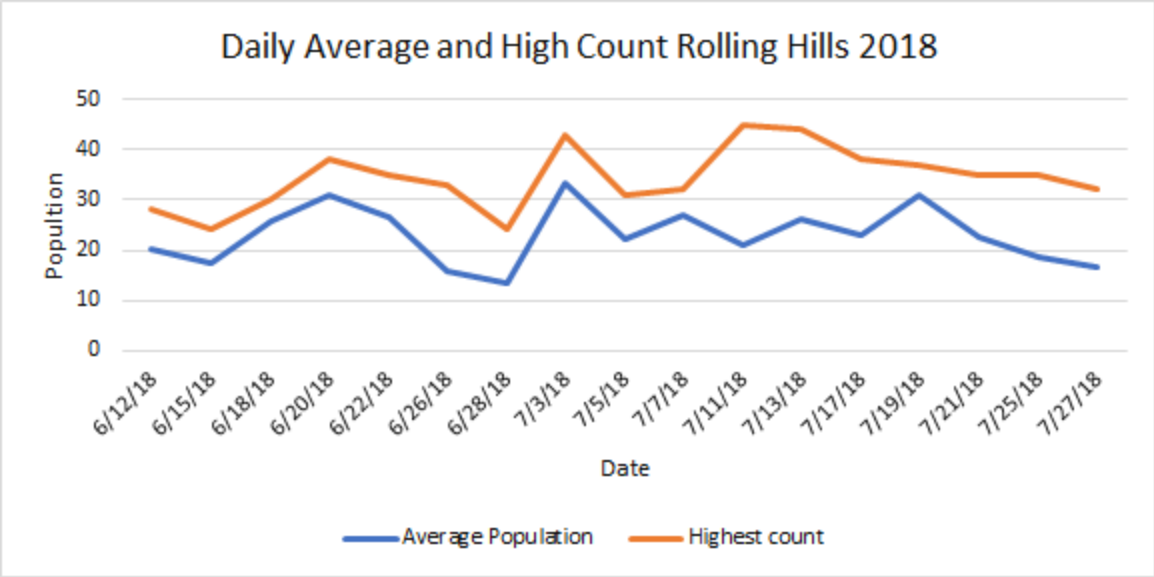

Figure 7: Daily average population and daily high count at Rolling Hills.

The highest population recorded at Mutiny Sands was 63 on June 29th. Unlike at Rolling Hills, most of Guillemots moved offshore before fledging had ended. After August 18th there was no population count higher than ten, but there was still one active burrow (Figure 8). This may be because the active burrow was #7 which likely had a relay of eggs. It is likely Burrow #7 would have fledged around the same time as the other burrows if the first clutch had not fallen or been predated.

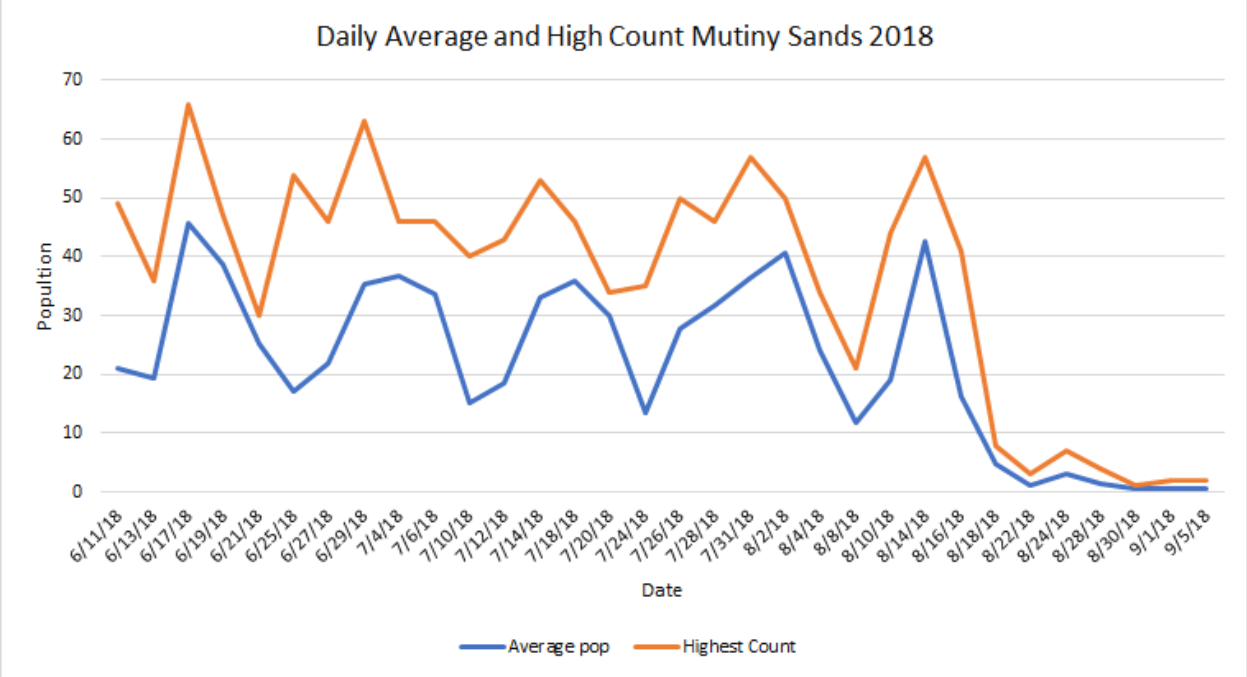

Figure 8: Daily average population and daily high count at Mutiny Sands.

The daily disturbances varied between Rolling Hills and Mutiny Sands. There were multiple days at both colonies where there were several small disturbances and days where there were one or two large disturbances (Figures 9 and 10).

The Mutiny Sands colony experienced more disturbances than the Rolling Hills colony, this is likely due to the location of the colonies. Mutiny Sands has more suburban developments around it, leading to more disturbances caused by anthropogenic influence. It is not yet possible to make any strong correlations between disturbances, populations and delivery rates, as no real trend could be established. As mentioned above, June 26th at Rolling Hills is the only day that appears to have been severely affected by a disturbance. There was one large disturbance and the Guillemots did not recover after it.

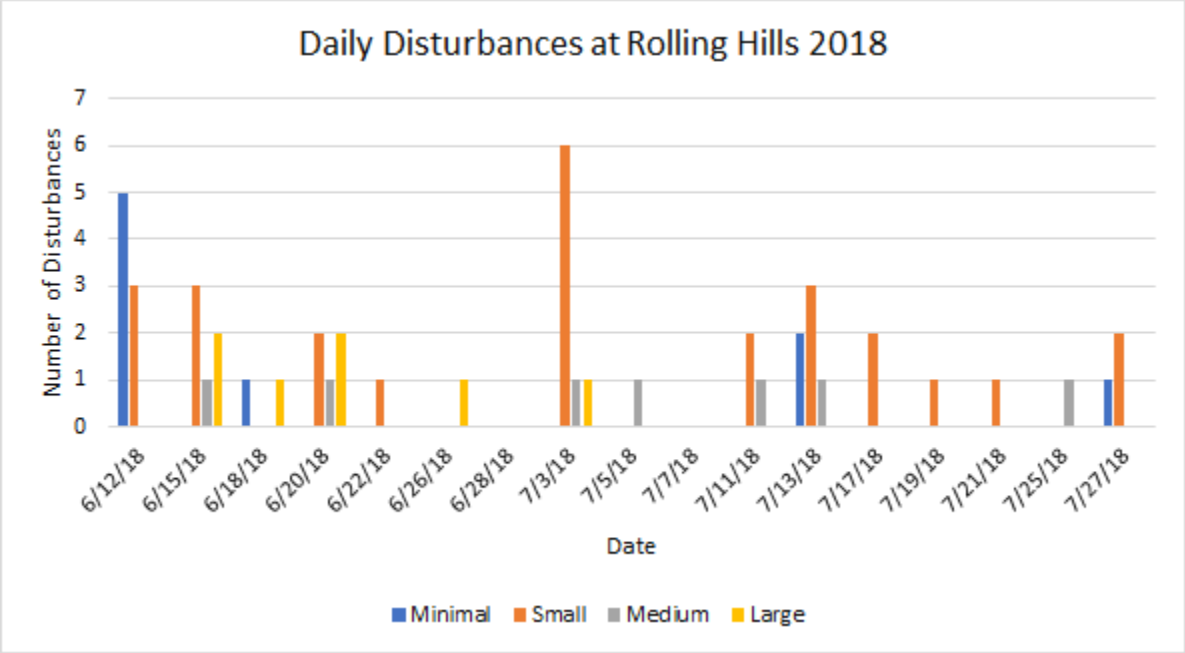

Figure 9: The frequency and size of disturbances at Rolling Hills per day.

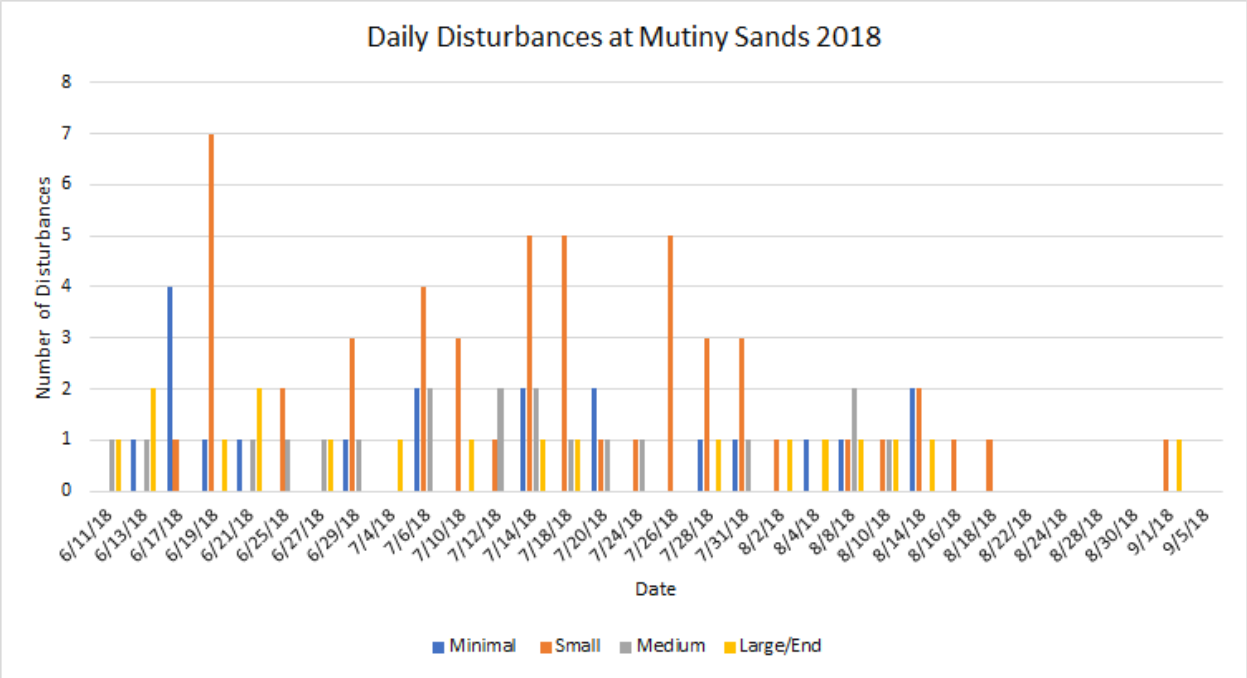

Figure 10: The frequency and size of disturbances at Mutiny Sands per day.

Conclusion:

Mutiny Sands and Rolling Hills both had estimated fledging rates above 80% for the 2018 season. This suggests that the Guillemots continue to bread successfully at these colonies on Whidbey Island.

Limitations to this study included not being able to see the whole survey area, particularly at Rolling Hills. At times this made it difficult for the intern to accurately determine which burrow prey was delivered too.

Further or future studies should include the continued collection of disturbance data. More disturbance data over time would allow for it to be determined if there is a correlation between disturbances and population or deliveries. In addition to the continued collection of disturbances, future studies should examine the lipid content of the fish delivered to chicks. This would allow for the study to determine if the lipid content of fish has any impact on fledging success on Whidbey Island. Since the type of prey fed to chicks is very important for chick health, further studies may also include why Guillemots select they prey they bring to their chicks.

Acknowledgments:

This project has been funded wholly or in part by the United States Environmental Protection Agency under assistant agreement CE-01J31901-0 to the Puget Sound Partnership. The contents of this document do not necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use. Additional thanks to the Island County Marine Resources Committee, Whidbey Audubon Society, and Northwest Straits Initiative for funding this project.

Works Cited:

Connolly, C. (2017). Pigeon Guillemot Study 2017. Unpublished

Golet, G. H., Kuletz, K. J., Roby, D. D., & Irons, D. B. (2000). Adult prey choice affects chick growth and reproductive success in pigeon guillemots. *The Auk, 117*(1), 82-91. Retrieved from https://search-proquest-com.ezproxy.library.wwu.edu/docview/196471627?accountid=15006

Irons, D. B., Kendall J. S., Erickson, P. W., McDonald, L. L., & Lance, K. B. (2000). Nine years after the Exxon Valdez oil spill: Effects on marine bird populations in Prince William Sound, Alaska. The Condor 102:732-737.

Kreamer, K. A. (2009). Prey Selection by Pigeon Guillemots, Cepphus columba, on Whidbey Island for the 2009 Breeding Season, Unpublished. The Evergreen State College

U.S Fish and Wildlife Service (2006). Alaska Seabird Information Series, Pigeon Guillemot. Retrieved from https://www.fws.gov/alaska/mbsp/mbm/seabirds/species.htm

Sibley, D. A. (2001). *National Audubon Society Sibley Guide to Bird Life & Behavior*. Knopf: 2001.

Zupich, K. (2013). Pigeon Guillemot Study 2013. Unpublished.

Zydelis, R., Small, C., & French, G. (2013). The incidental catch of seabirds in gillnet fisheries: A global review. *Biological Conservation,162*, 76-88. Doi: 10.1016/j.biocon.2013.04.002