

# USE OF SAN DIEGO BAY ALONG THE PACIFIC FLYWAY - A SPATIAL AND TEMPORAL ANALYSIS OF BIRD USE USING OPPORTUNISTIC AND SYSTEMATIC DATA

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PennState



**PORT** of  
**SAN DIEGO**



**Pangea**  
Biological

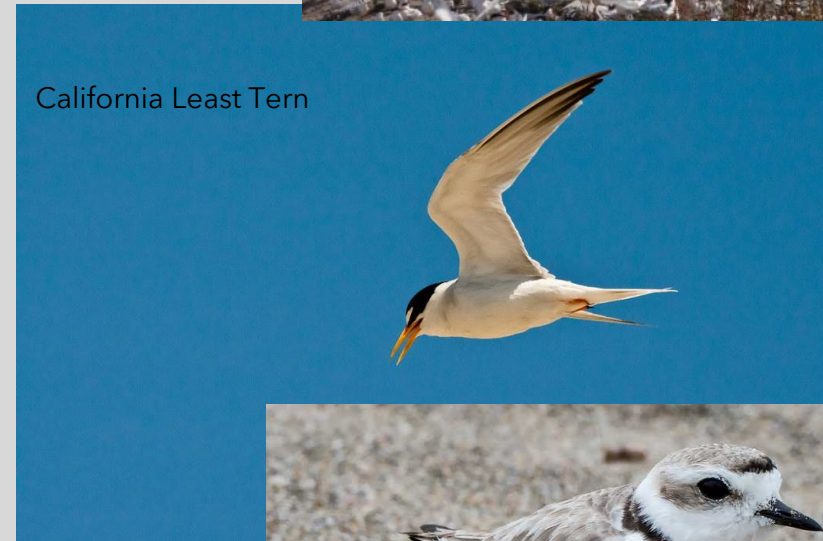
# Background - Avian Use in the Bay

- San Diego Bay provides important refuge habitat
- Supports over 300 bird species\*
- Over a third of bay-dependent birds are threatened\*

\*Source: TierraData 2018



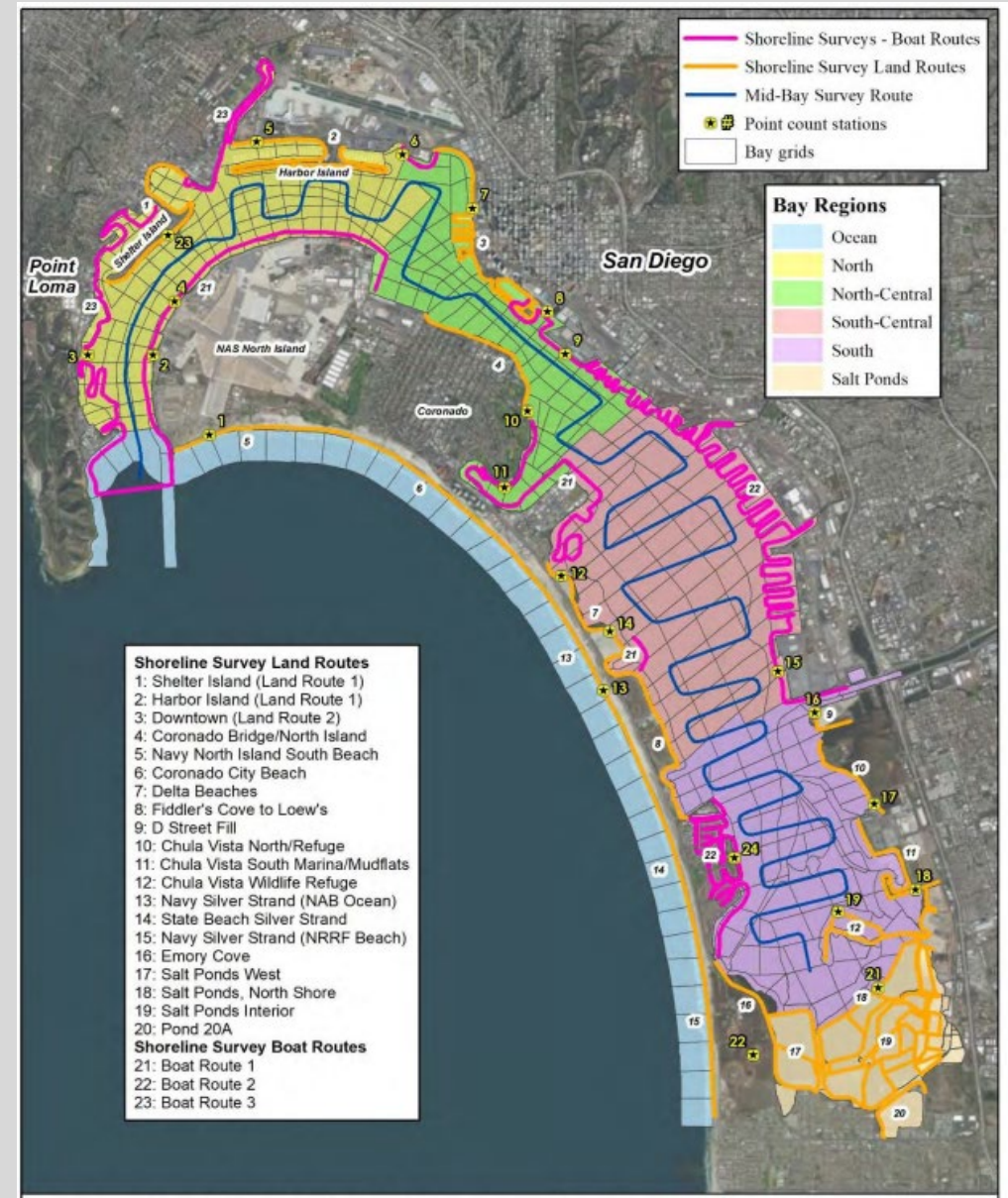
California Least Tern



# Port & Navy Sponsored Systematic Bird Surveys

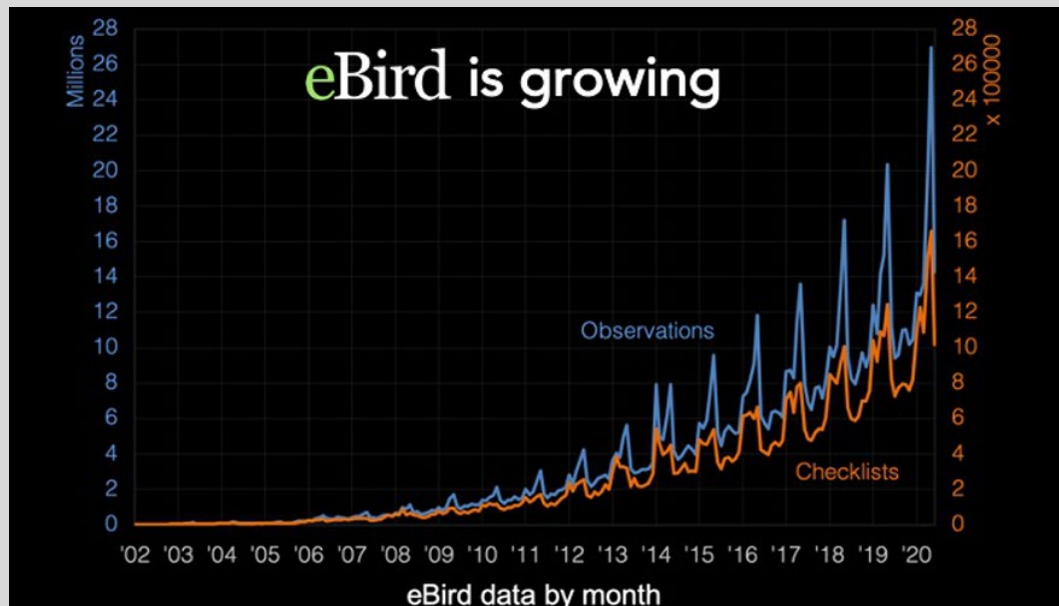
- Baywide Avian Surveys of San Diego Bay
  - 1994-1995 completed by USFWS
  - 2006-2007, 2009-2010, and 2016-2017 surveys completed by Port/Navy consultant (TierraData)
- Surveys included:
  - Monthly point counts at 24 stations
  - Monthly shoreline (walking) transect surveys
  - Monthly mid-water (vessel) transect surveys

Survey Design Map from 2016-2017 Avian Surveys Report (TierraData 2018)

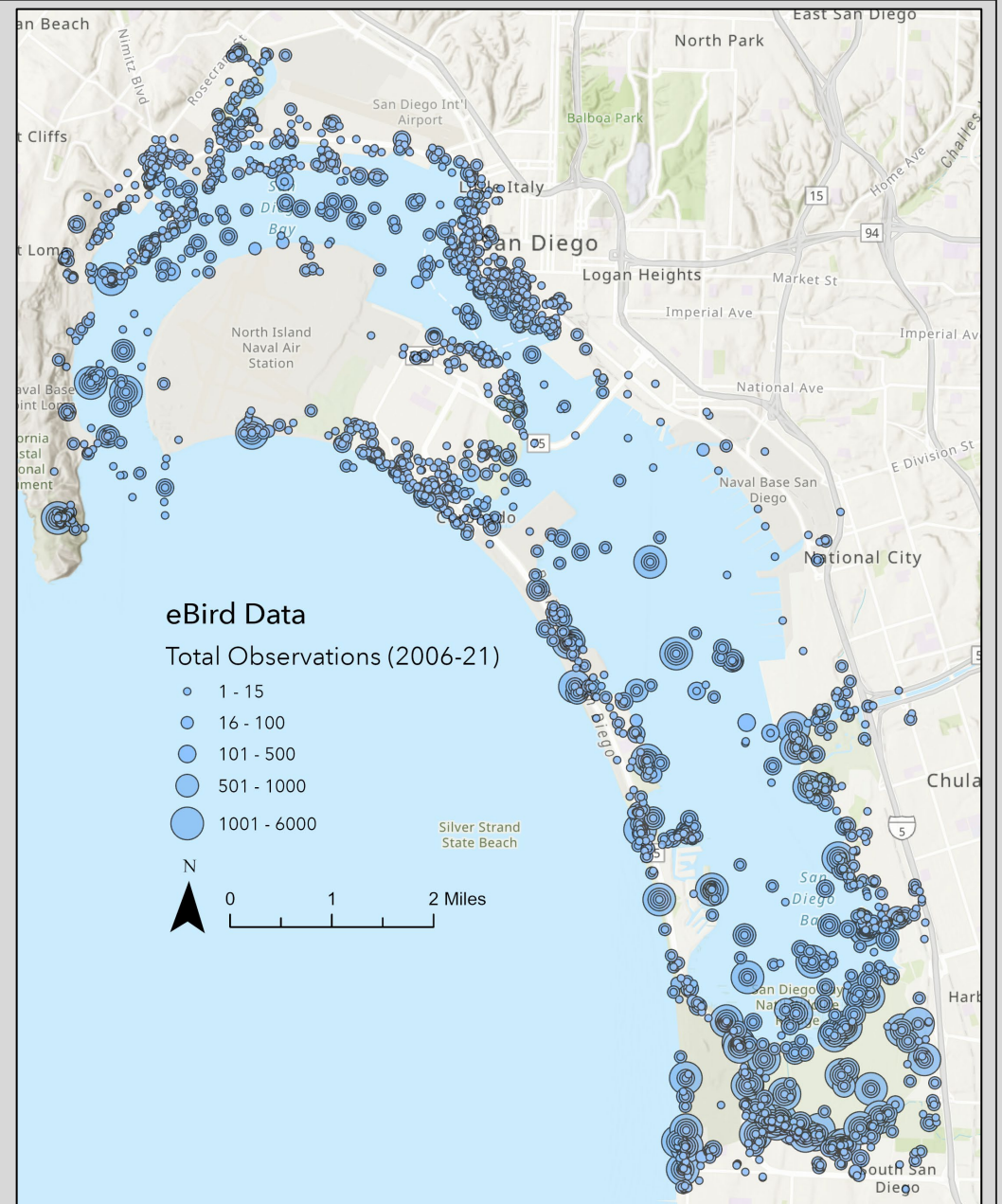


# Opportunistic Bird Data

- eBird Data
  - Online database of bird observations
  - Opportunistically collected data
  - ~5M observations in San Diego region
  - Data ranges from 1947-September 2021\*



\* Data from  $\geq 2006$  were used for analysis.



# Study Questions

1. Are the population trends of birds changing?
2. Does habitat affect bird populations in San Diego Bay?
3. What species and observation numbers should we expect to see upon the establishment of the Pond 20 Wetland Mitigation Bank?
4. Is using opportunistic data a valid substitute for systematic data collection?



# Project Question 1

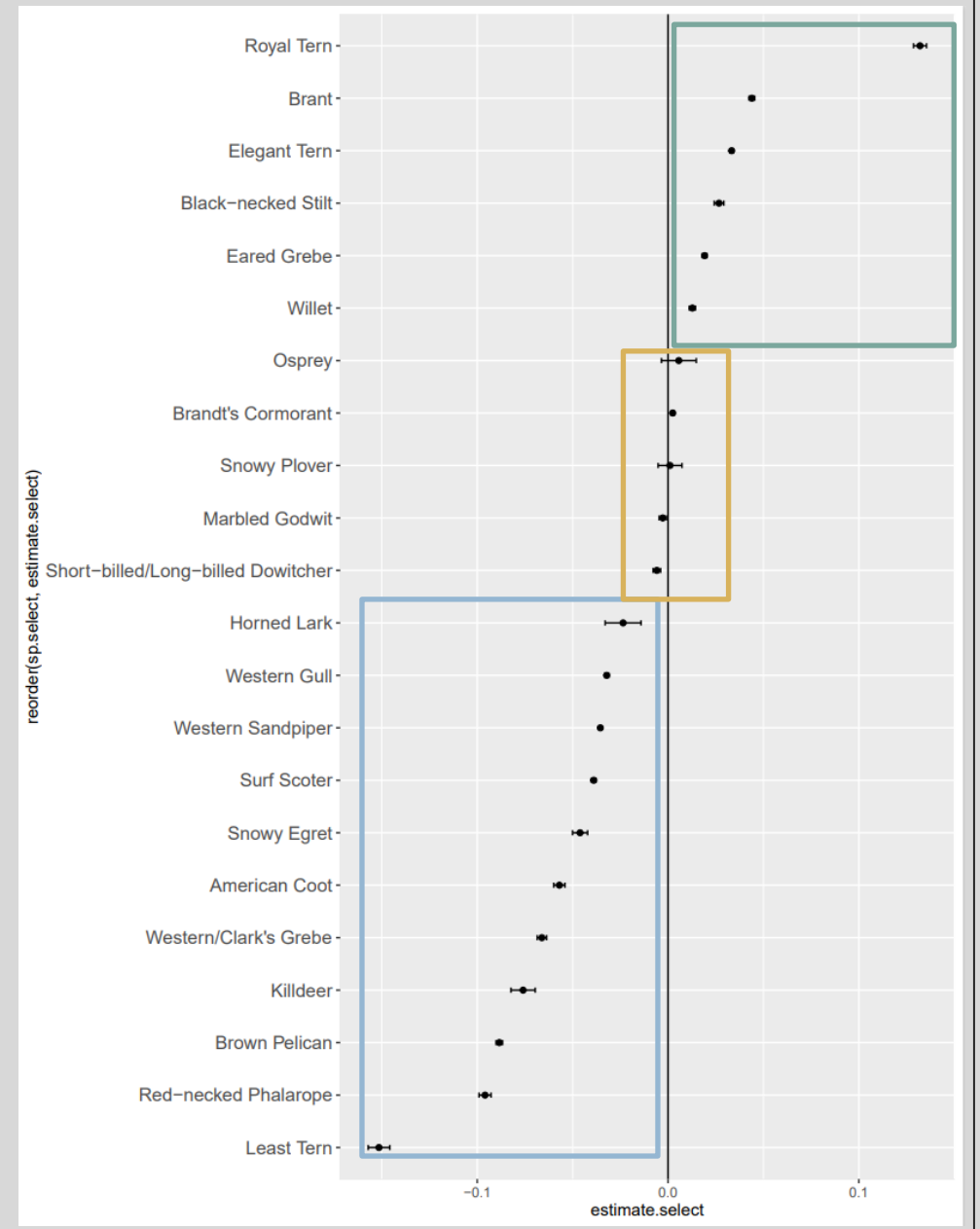
*Are the population trends of birds changing?*

## Methods

- Poisson GLM used to estimate abundance for all species in eBird data

## Results

- 400 individual species captured since 2006
- 20% of species show positive significant trend
- 43% of species show negative significant trend
- 37% of species showed no trend



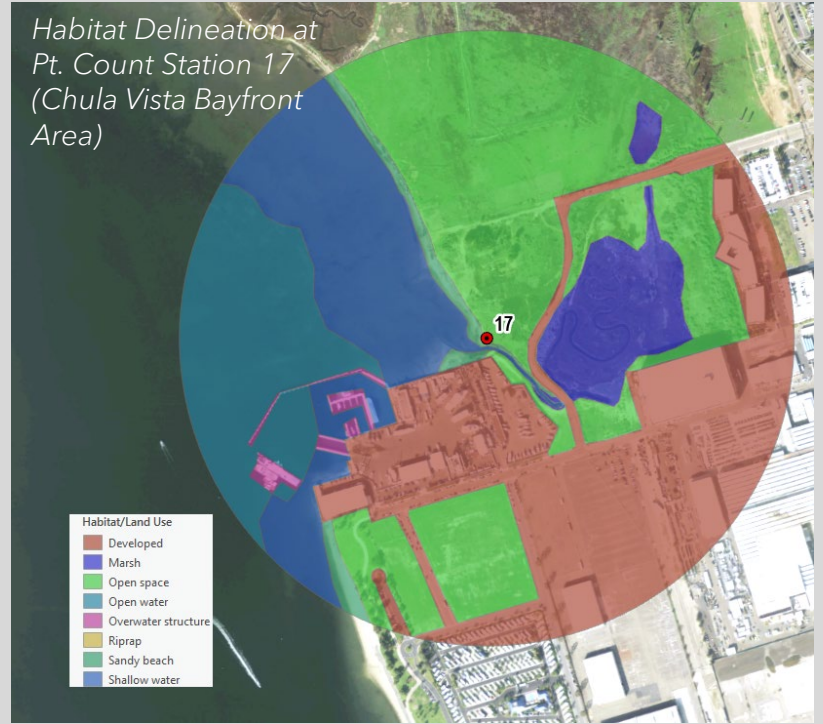
# Project Question 2

Does habitat affect bird populations in San Diego Bay?

## Methods

- Habitat PCs calculated and used in Poisson GLMM to predict bird observations

## Results:



Coefficient		Trend	Species
PC1		+	<ul style="list-style-type: none"> <li>• Seabirds: California least tern, elegant tern, osprey, red-necked phalarope, royal tern</li> <li>• Shorebirds: dowitcher, marbled godwit, western sandpiper, willet</li> <li>• Waterfowl: eared grebe</li> </ul>
		-	<ul style="list-style-type: none"> <li>• Terrestrial: horned lark</li> </ul>
PC2		+	<ul style="list-style-type: none"> <li>• Seabirds: brown pelican, California least tern</li> </ul>
		-	<ul style="list-style-type: none"> <li>• Shorebirds: killdeer, marbled godwit, willet</li> <li>• Marshbirds: snowy egret</li> <li>• Waterfowl: American coot</li> </ul>

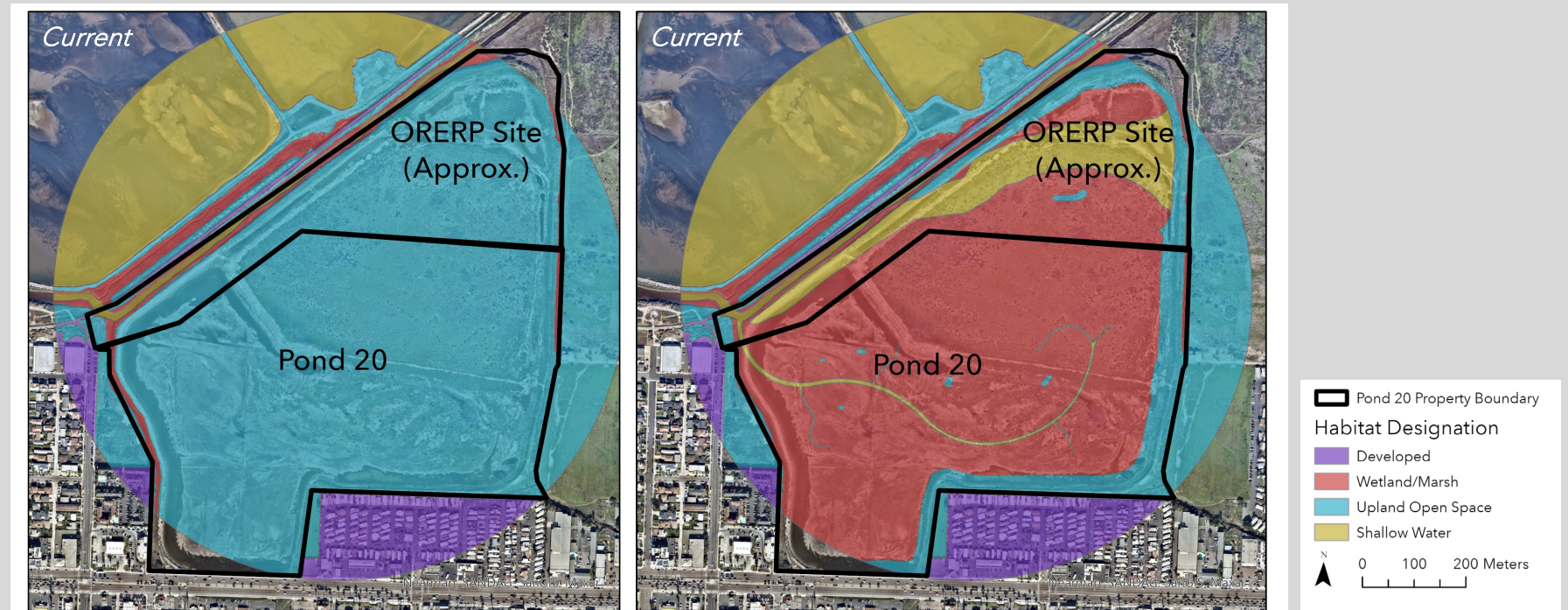
# Project Question 3

*What species and observations should we expect to see upon the establishment of Pond 20?*

## *Methods*

- Used Poisson GLMM to estimate pre- and post-wetland establishment bird abundances based on current and future Pond 20 habitats

*Pond 20 Habitat Delineations*

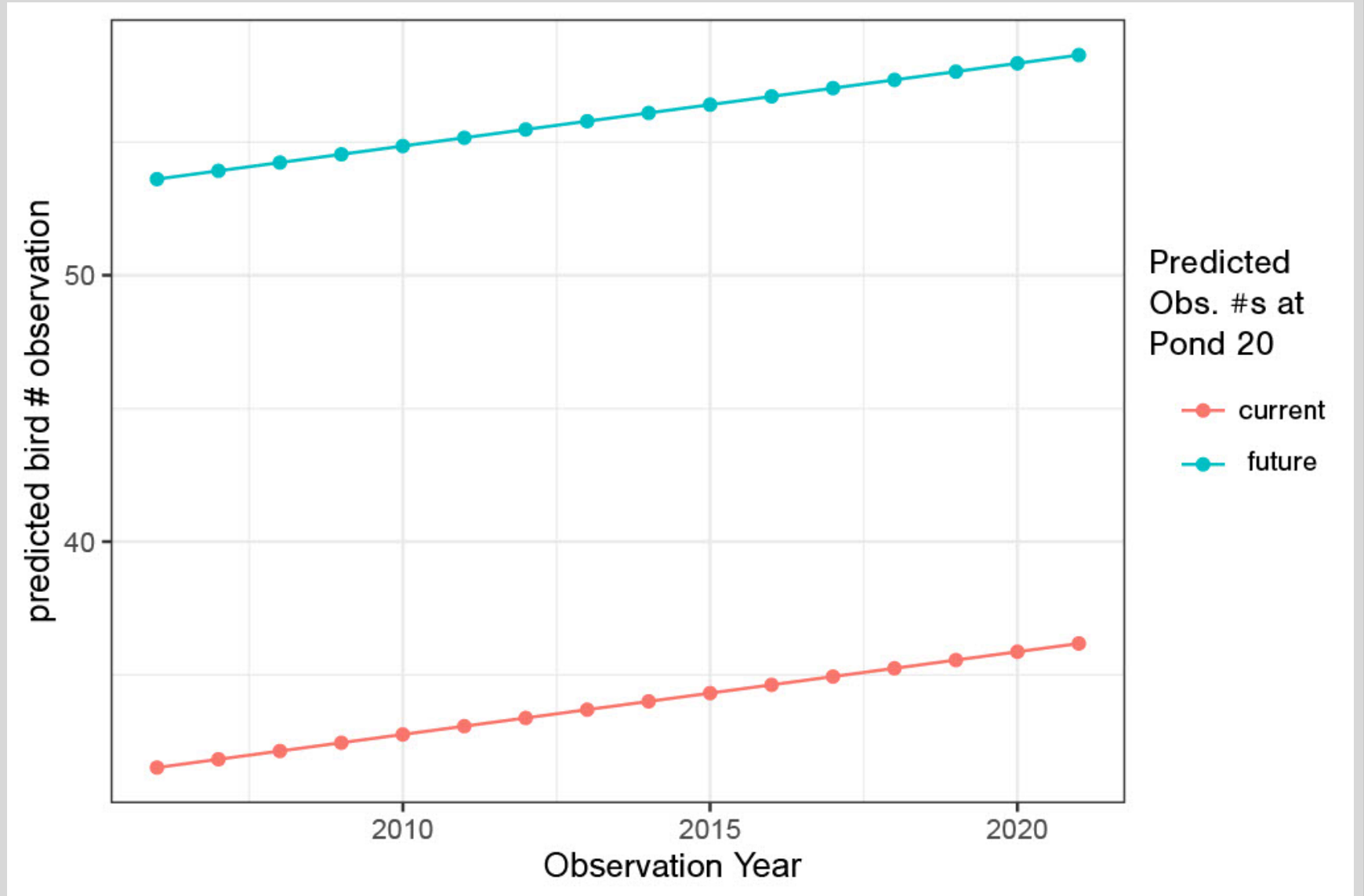




## Project Question 3 (cont'd)

### Results

- Likely to attract species that favor PC1
- 60% increase in estimated observations post-establishment



# Project Question 4

*Is using opportunistic data a valid substitute for systematic data collection?*

## *Methods*

- Compared GLM effect sizes for both opportunistic and systematic data

## *Results*

- Similar effect sizes for species such as:
  - Royal tern, surf scoter, elegant tern, osprey, brant, dowitcher

Royal Terns



Surf Scoter



Long-Billed Dowitcher



# Conclusions & Recommendations

- Abundance trends are varied by species
- Overall trends showed similarities between eBird data and systematic Baywide surveys
- Opportunistic data could stand in for systematic surveys for some, but not all bird species
- Habitat does have an impact on bird observations
- We should expect a substantial increase in bird observations as the result of establishing a wetland at Pond 20
- Can use these methods to evaluate trends of birds in a larger context

# Thank you!

*Special Thanks to:*

Dr. Jason Keagy, Penn State  
Pangea Biological  
Port of San Diego

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Questions?

# References

- Bartonek, J.C. (1994). Unpublished data from the U.S. Fish and Wildlife Service Office of Migratory Bird Management. Portland, OR.
- Desrochers, David W., Jason C. Keagy, and Daniel A. Cristol. "Created versus Natural Wetlands: Avian Communities in Virginia Salt Marshes." *Ecoscience* 15, no. 1 (March 2008): 36-43. [https://doi.org/10.2980/1195-6860\(2008\)15\[36:CVNWAC\]2.0.CO;2](https://doi.org/10.2980/1195-6860(2008)15[36:CVNWAC]2.0.CO;2).
- Boersch-Supan, Philipp H. "Robustness of Simple Avian Population Trend Models for Semi-Structured Citizen Science Data Is Species-Dependent." *Biological Conservation*, 2019, 8.
- Hickey, C., W.D. Shuford, G.W. Page, and S. Warnock (2003). Version 1.1. The Southern Pacific Shorebird Conservation Plan: A strategy for supporting California's Central Valley and coastal shorebird populations. PRBO Conservation Science, Stinson Beach, CA.
- Horns, Joshua J., Frederick R. Adler, and Çağan H. Şekercioğlu. "Using Opportunistic Citizen Science Data to Estimate Avian Population Trends." *Biological Conservation* 221 (May 1, 2018): 151-59. <https://doi.org/10.1016/j.biocon.2018.02.027>.
- Kamp, Johannes, Steffen Oppel, Henning Heldbjerg, Timme Nyegaard, and Paul F. Donald. "Unstructured Citizen Science Data Fail to Detect Long-Term Population Declines of Common Birds in Denmark." *Diversity and Distributions* 22, no. 10 (2016): 1024-35. <https://doi.org/10.1111/ddi.12463>.
- McGarigal, K., SA Cushman, and E Ene. 2012. FRAGSTATS v4: Spatial Pattern Analysis Program for Categorical and Continuous Maps. Computer software program produced by the authors at the University of Massachusetts, Amherst. Available at the following web site: <http://www.umass.edu/landeco/research/fragstats/fragstats.html>
- Port of San Diego and US Navy (2013). Integrated Natural Resources Management Plan of San Diego Bay. Retrieved on September 10, 2021 from [https://pantheonstorage.blob.core.windows.net/environment/San-Diego-Bay-Integrated-Natural-Resources-Management-Plan\\_Sep2013.pdf](https://pantheonstorage.blob.core.windows.net/environment/San-Diego-Bay-Integrated-Natural-Resources-Management-Plan_Sep2013.pdf)
- TierraData Inc. (2018). 2016-2017 San Diego Bay Avian Species Surveys. Retrieved on October 18, 2021 from <https://pantheonstorage.blob.core.windows.net/environment/2016-17-San-Diego-Bay-Avian-Species-Surveys-April-2018.pdf>
- USFWS (2021). *Flyways*. Retrieved on October 15, 2021 from <https://www.fws.gov/birds/management/flyways.php>

# Image Links

- [https://www.westerndredging.org/phocadownload/PacificChapter/2018Conference/6\\_K\\_gobbi\\_WEDA2018\\_Final.pdf](https://www.westerndredging.org/phocadownload/PacificChapter/2018Conference/6_K_gobbi_WEDA2018_Final.pdf)
- <https://pantheonstorage.blob.core.windows.net/environment/2016-17-San-Diego-Bay-Avian-Species-Surveys-April-2018.pdf>
- <https://www.google.com/url?sa=i&url=https%3A%2F%2Fsouthcountyedc.com%2Fpond-20%2F&psig=AOvVaw0lgrvQAcAcFu8ae97YlcPx&ust=1635342941010000&source=images&cd=vfe&ved=0CAsQjRxqFwoTCNC0y6qd6PMCFQAAAAAdAAAAABAE>
- [https://www.fws.gov/uploadedImages/Region\\_8/NWRS/Zone\\_1/San\\_Diego\\_Complex/San\\_Diego\\_Bay/Images/512/LCW%20bird%20walk%20512%20pix.jpg?n=8581](https://www.fws.gov/uploadedImages/Region_8/NWRS/Zone_1/San_Diego_Complex/San_Diego_Bay/Images/512/LCW%20bird%20walk%20512%20pix.jpg?n=8581)
- [https://scc.ca.gov/webmaster/ftp/pdf/sccb/2021/2101/20210121Board05D\\_Restoration%20Success.pdf](https://scc.ca.gov/webmaster/ftp/pdf/sccb/2021/2101/20210121Board05D_Restoration%20Success.pdf)
- [https://www.fws.gov/refuge/San\\_Diego\\_Bay/wildlife\\_and\\_habitat/South\\_San\\_Diego\\_Bay\\_Unit.html](https://www.fws.gov/refuge/San_Diego_Bay/wildlife_and_habitat/South_San_Diego_Bay_Unit.html)
- [https://nas-national-prod.s3.amazonaws.com/styles/api\\_hero\\_bird\\_with\\_crop\\_1920\\_1200/public/birds/hero\\_image/a1\\_3701\\_3\\_royal-terns\\_melissa\\_james\\_kk\\_breeding-adults.jpg?tok=1648708358](https://nas-national-prod.s3.amazonaws.com/styles/api_hero_bird_with_crop_1920_1200/public/birds/hero_image/a1_3701_3_royal-terns_melissa_james_kk_breeding-adults.jpg?tok=1648708358)
- [https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.inaturalist.org%2Ftaxa%2F7036-Melanitta-perspicillata&psig=AOvVaw0bsxFZgPf-ekJJ0cSOsVZy&ust=1670073721951000&source=images&cd=vfe&ved=0CA8QjRxqFwoTCMi8xsmD2\\_sCFQAAAAAdAAAAABAE](https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.inaturalist.org%2Ftaxa%2F7036-Melanitta-perspicillata&psig=AOvVaw0bsxFZgPf-ekJJ0cSOsVZy&ust=1670073721951000&source=images&cd=vfe&ved=0CA8QjRxqFwoTCMi8xsmD2_sCFQAAAAAdAAAAABAE)
- <http://www.pbase.com/gregbirder/image/153797401/large.jpg>