# **1. Introduction**

### <u>Objective</u>

Our objective is to graphically represent the US Fish and Wildlife data collected on birds after the BP Gulf Oil Spill 2010.

### The Data Set

The original data set contained 7,229 records representing 119 unique classifications of bird species. The data set included 8 variables.

For our logistic regression, we added an additional variable to the data set, Biological Order. This variable was used to decrease the number of possible classifications from 119 species to 17 biological orders.

Data Set Time Frame

May 2010 – October 2010

Variables

- Biological Order
- •Condition: Dead and Live
- Date of recording
- •Latitude
- •Longitude
- •Oil Conditions of birds
- Live / Not Visibly Oiled
- Live / Visibly Oiled
- Dead / Not Visibly Oiled
- Dead / Visibly Oiled
- Dead / Unknown
- Live / Unknown
- •Oiling: Visibly oiled, Not visibly oiled, and Unknown.
- Species
- •Week Number



### 2a. Where Were The Birds Located?

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### Heat Map of Dead Birds, Heat Map of Live Birds

Software: Google Maps, Tableau



### <u>Result</u>

It is evident from our heat maps that the areas of greatest concentration of birds were nearest to the coasts off New Orleans and the Deepwater rig.

Dead birds were found in greatest concentrations in Baratoria Bay, just below New Orleans, and the Chandeleur Sound, which is the primary mouth of water leading to the Gulf.

Live birds were found in greatest concentrations in Mobile Bay, outside Alabama, and Baratoria Bay.

# Effects of Oil Spill on Birds: A Graphical Assay of the Deepwater Horizon Oil Spill's Impact on Birds

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# **2b. A Closer Look**

### **The Chandeleaur Sound Location by Oil Condition**



# **3. Which Birds Were Most Affected?**

Software: Tableau, R, SAS

### **Frequency Counts of All Birds**





These Birds are Significant From Our Logistic **Regression for Species for Dead Birds:** 

Black Skimmer (p-value = 0.09061) Least Tern (0.05717) Unidentified Gull (0.00178) Unidentified Pelican (0.04991) Unidentified Tern (0.00429) Unknown (6.28e-05)

And the Logistic Regression for Biological Orders is not significant.





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### 4. Predicted Probabilities by Bird Species and Oil Condition

These predicted probabilities represent the likelihood of a bird being found dead.

Probabilities by Bird Species and Oil Condition									
Species	Live / Not Visibly Oiled	Live / Visibly Oiled	Oil_ Dead / Not Visibly Oiled	Cond Dead / Visibly Oiled	Dead / Unknown	Live / Unknown			
American Coot									
American Oystercatcher American Redstart									
American White Pelican									
Barn Owl									
Barn Swallow Belted King Fisher									
Black Crowned Night Heron									
Black Oystercatcher Black Skimmer									
Black Tern									
Black-necked Stilt Blue-winged Teal									
Boat-tailed Grackle									
Canada Goose									
Caspian Tern Cattle Egret									
Clapper Rail									
Common Loon Common Moorhen									
Common Nighthawk									
Common Tern Common Yellowthroat									
Double-crested Cormorant									
Eastern Meadowlark									
Eurasian Collared-Dove Forster's Tern									
Glossy Ibis									
Great Blue Heron Great Egret									
Great Horned Owl									
Greater Shearwater Green Heron									
Gull-billed Tern									
Herring Guil Horned Grebe									
House Sparrow Killdeer									
Laughing Gull									
Least Bittern Least Tern									
Lesser Black-backed Gull									
Lesser Scaup Little Blue Heron									
Long-Billed Dowitcher									
Magnificent Prigatebild									
Manx Shearwater Masked Booby									
Mottled Duck									
Mourning Dove Neotropic Cormorant									
Northern Cardinal									
Northern Gannet Northern Mockingbird									
Osprey									
Pied-bill Grebe									
Piping Plover Purple Gallipule									
Purple Martin									
Red-Breasted Merganser Red-tailed Hawk									
Red-winged Blackbird									
Ring-billed Gull									
Rock Pigeon Roseate Spoonbill									
Royal Tern									
Ruddy Turnstone Rudy Duck									
Sanderling									
Sandwich Tern Seaside Sparrow									
Semipalmated Sandpiper									
Snowy Egret									
Sooty Tern Sora									
Spotted Sandpiper									
Surf Scoter Tricolored Heron									
Unidentified Blackbird									
Unidentified Dowitcher									
Unidentified Duck Unidentified Egret									
Unidentified Flycatcher									
Unidentified Grabe									
Unidentified Gull Unidentified Hawk									
Unidentified Heron									
Unidentified Loon Unidentified Mockingbird									
Unidentified Ow									
Unidentified Pigeon									
Unidentified Rail Unidentified Raptor									
Unidentified Sandpiper									
Unidentified Shearwater Unidentified Shorebird									
Unidentified Skimmer									
Unidentified Swallow									
Unidentified Tem									
Virginia Rail									
White Ibis White-winged Dove									
Willet									
wilson's Plover Wilson's Storm-petrel									
Yellow-billed Cuckoo Yellow-crowned Night Heree									
	0.0 0.5 1.0	0.0 0.5 1.0	0.0 0.5 1.0	0.0 0.5 1.0	0.0 0.5 1.0	0.0 0.5			
	Probabilities	Probabilities	Probabilities	Probabilities	Probabilities	Probabilities			

# **5. Predicted Probabilities by Biological Order**



# 6a. Time Series of Bird Count by Condition

### Software: Tableau

From the beginning of the time series, the numbers of Dead birds relative to Live birds is increases. Rates steadily increase to form sharp peaks in early July, early August, and again in late August to produce the maximum. The trend in this chart is toward larger instances of Dead birds during early July to mid-September compared to Live birds, with the most interesting feature the lagging influence of the oil released on the birds starting April 20, 2010.



### **6b. Time Series of Bird Counts by Oiling**

After the initial spike in Not Visibly Oiled (NVO) and Unknown (U) counts early in the series, where NVO counts overtake Visibly Oiled (VO) counts, the NVO counts are below VO counts in early June. The U counts remain relatively stable throughout the series, this continues until mid-summer, when volatility is exhibited. Also in mid-summer, the NVO count experiences dramatic spikes above the other categories. NVO counts stay relatively larger than others until the end of our data set.



# 7. Preparing for Disaster

### Conclusions

These visualizations lead us to valuable information for the planning of future ecological emergencies of this sort.

- •Most birds were found in coastal perimeters closest to the oil rig. The farther away from the oil rig, the fewer birds recorded.
- •Although several birds species possessed noticeably higher counts, none of these species were found to be significantly related to death.
- •The oil has a lagging influence on counts by Condition and Oiling of the birds.
- •In an ecological disaster similar to this oil spill, action should be taken as quickly as possible to prepare local coastlines.
- •Authorities should also expect a lag before reaching maximum height in death and live counts.

# 8. Future Work

Continue to work with R and SAS software to generate custom KML files for Google Earth.

Master the details in Google Fusion Tables and Tableau for generating custom visual displays.

Explore other mapping software and R packages for visualizing data, such as Ggobi.

Investigate Bayesian methodology and geostatistical processes used in R packages such as GeoR and RAMPS.

# 9. Acknowledgment

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