Optimizing Island Nesting Habitat for Waterbirds Breeding in Wetlands of San Francisco Bay

Alex Hartman, Josh Ackerman, and Mark Herzog
U.S. Geological Survey, Western Ecological Research Center, Dixon Field Station, Dixon, California

John Takekawa
U.S. Geological Survey, Western Ecological Research Center, San Francisco Estuary Field Station, Vallejo, California

U.S. Department of the Interior
U.S. Geological Survey

Breeding Waterbirds of San Francisco Bay

- **4,000 American Avocets**
- **1,000 Black-necked Stilts**
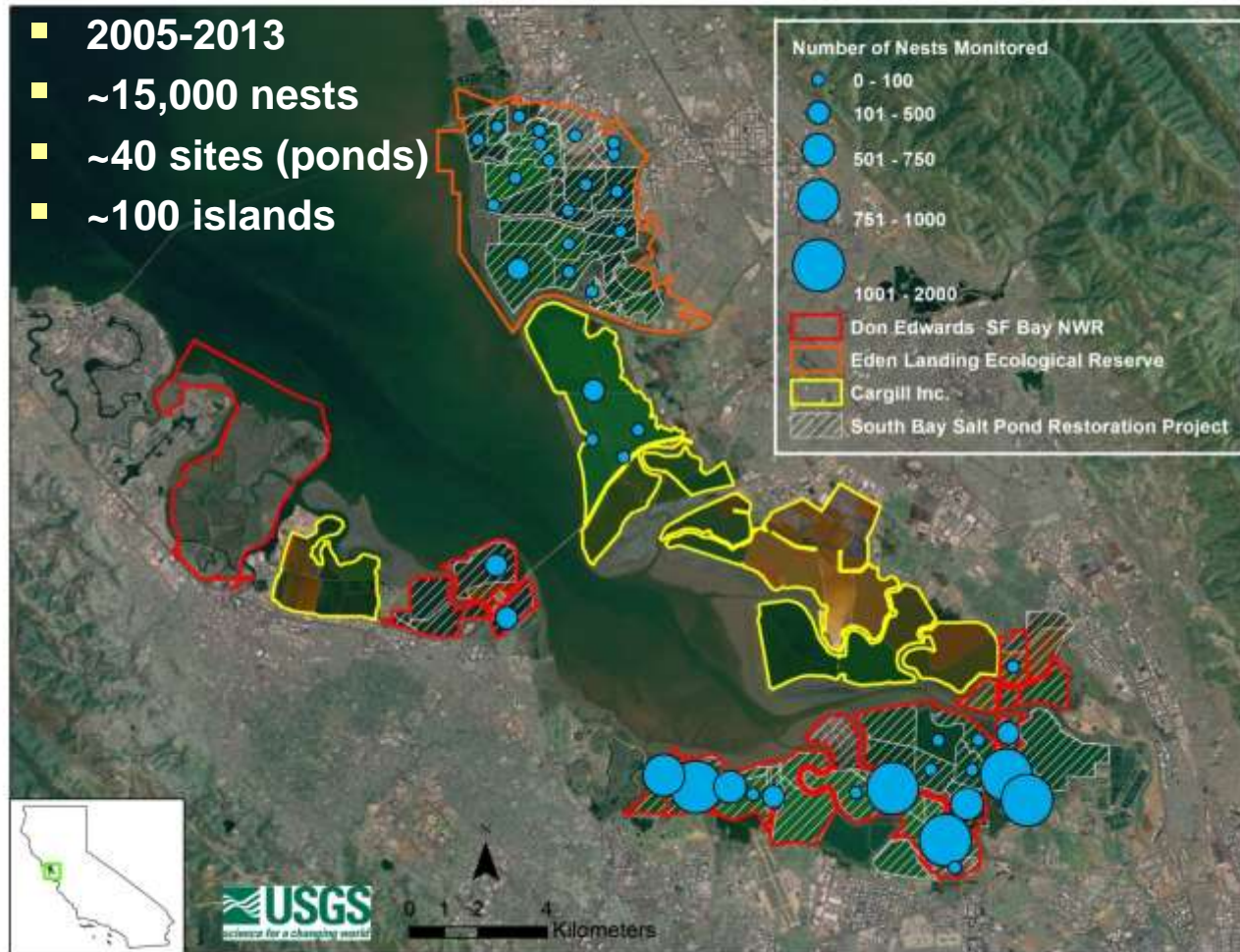- **3,000 Forster's Terns**
- **50,000 California Gulls**

Other species:

- **Caspian Terns**
- **Double-crested Cormorants**
- **Black Skimmers**
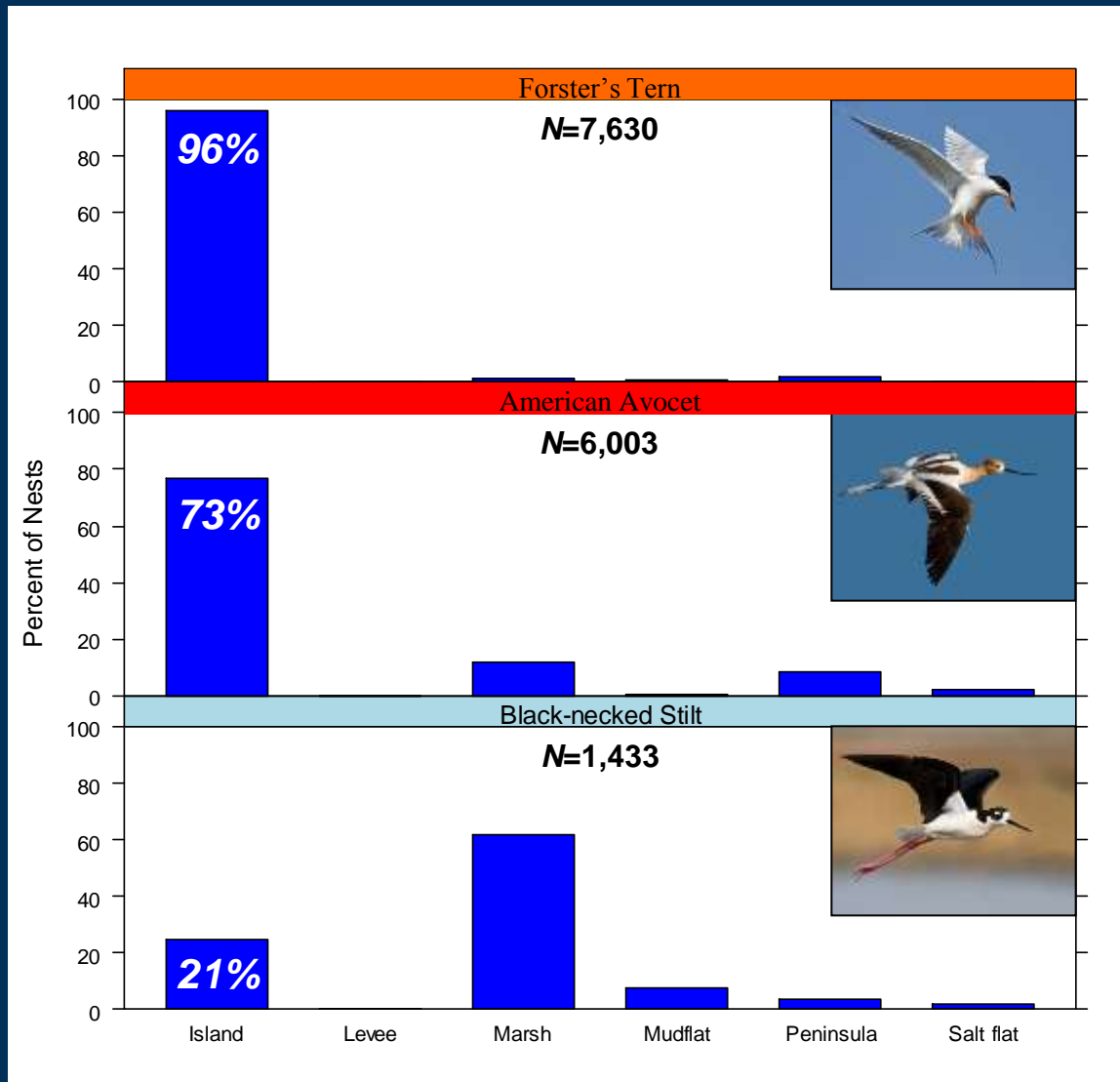- **Snowy Plovers**
- **California Least Terns**
- **Waterfowl**
- **Songbirds**
- **Rails**

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Former salt ponds as breeding habitat

Most Nests Are On Islands

South Bay Salt Pond Restoration Project

Pond SF2
-30 islands in 2011
-0.1 – 0.2 ha

Pond A16
-20 islands in 2013
-0.1 – 0.2 ha

Ponds A2W, AB1
-4 islands
-0.01 – 0.05 ha

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Recipe for Island Nesting Habitat

- Where should nesting islands be built?

- How many islands should be built in a wetland?

- How big, and what shape should islands be?

- Island topography
  - Elevation
  - Distance to water
  - Slope
  - Aspect

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Historic nesting data 2005 - 2013

Linear mixed models analyses: nest abundance, nest success

Wetland scale (22 ponds)	Island scale (100 islands)
1) Species	1) Species
2) Year	2) Year
3) Wetland area	3) Island area
4) Number of nesting islands	4) Island shape
5) Distance to SF Bay	5) Distance to SF Bay
6) Total island area	6) Distance to levee
7) Island area:Wetland area	

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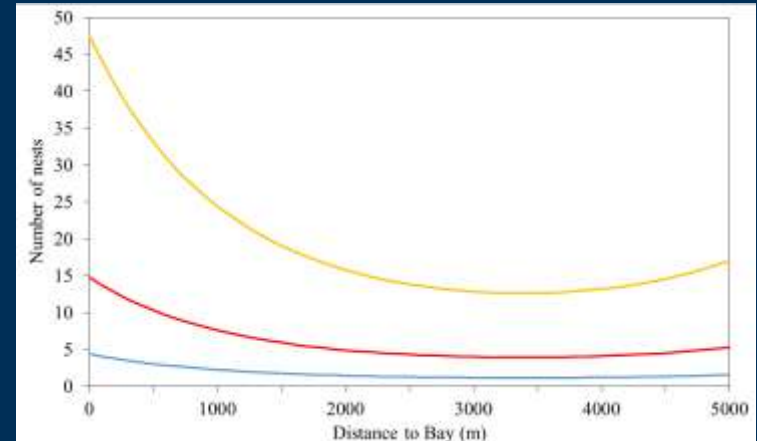# Nest abundance greatest in wetlands close to and far from SF Bay
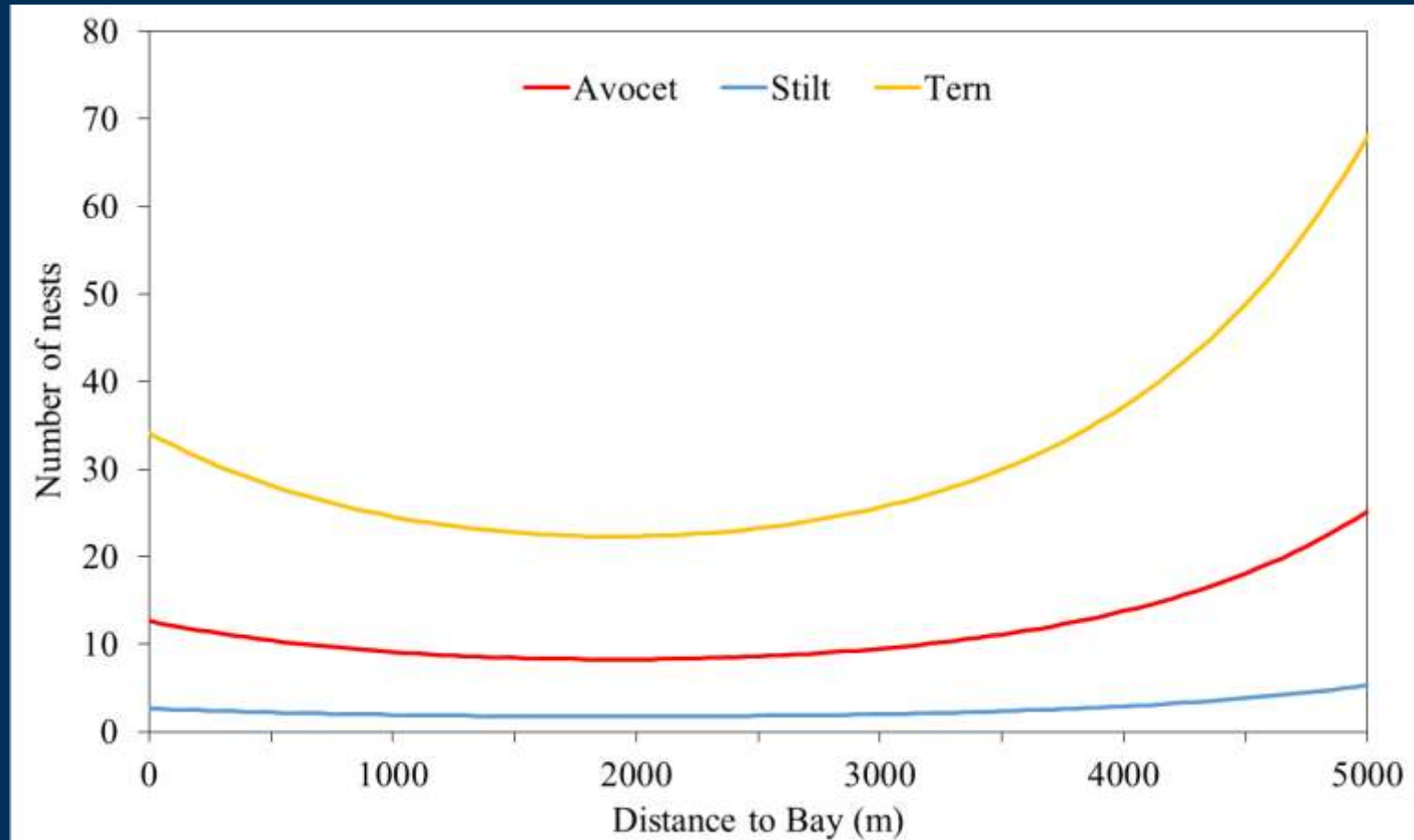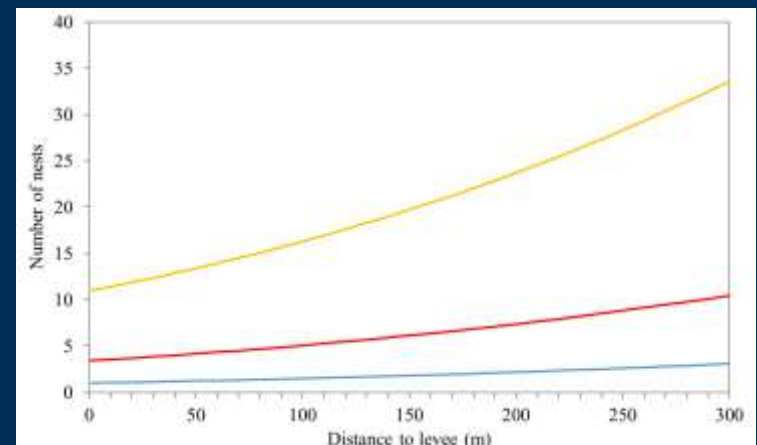
Nest abundance on islands greatest…
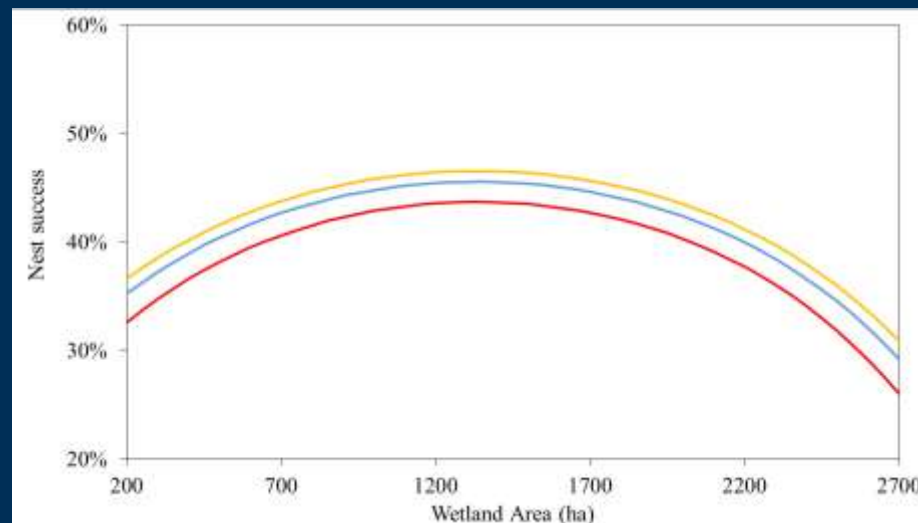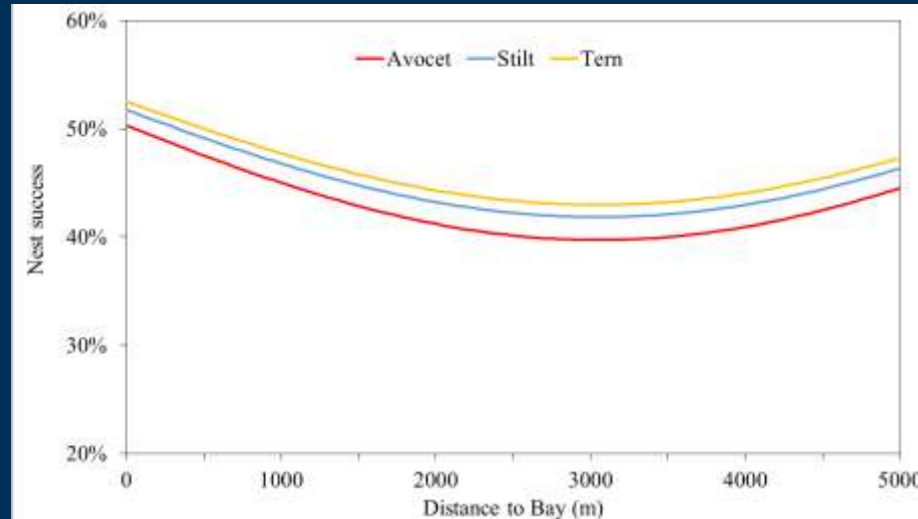

On islands close to SF Bay
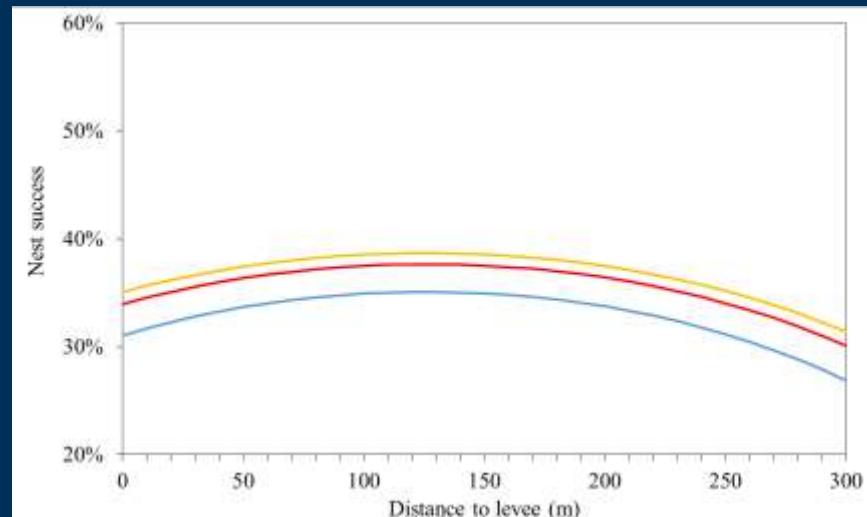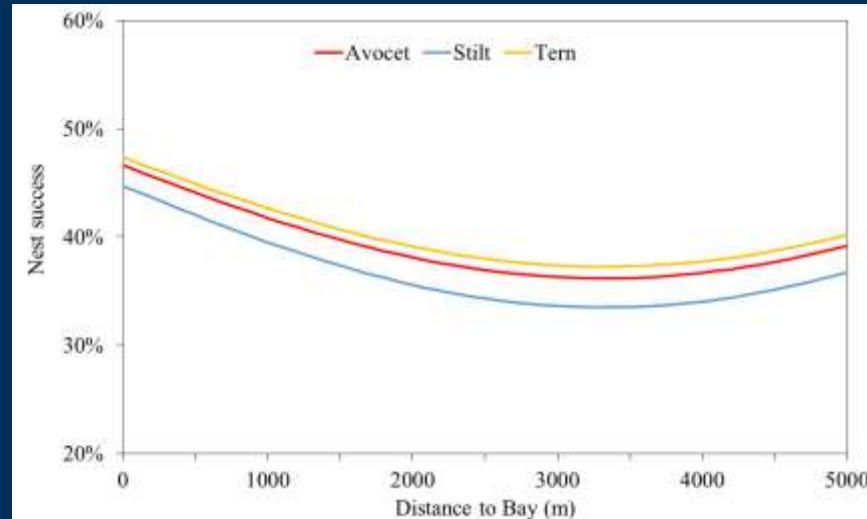
On linear vs. rounded islands
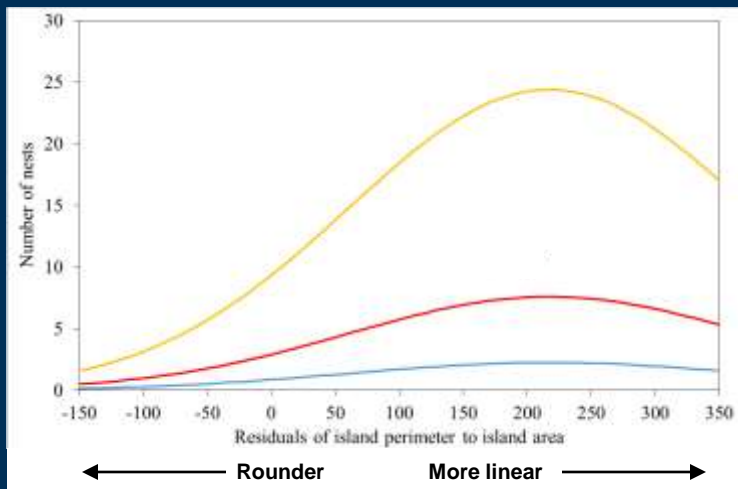
On islands further from pond levees

Nest success greater in wetlands close to SF Bay, and on intermediate-sized wetlands

Nest success greater on islands close to SF Bay and on islands 100-200m from the surrounding wetland levee

Historic nesting data 2005 - 2013

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7) Island area:Wetland area	

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Recipe for Island Nesting Habitat

- Where should nesting islands be built?
  - **Locate islands near (<1km) SF Bay**
  - **Locate islands 100-200m from pond levees**

- How many islands should be built in a wetland?
  - **Construct 3-5 islands within multiple wetlands**

- How big, and what shape should islands be?
  - **Construct relatively small (0.05-0.10 ha) and linear islands**
  - **Eg. 50m by 10m or 100m by 10m**
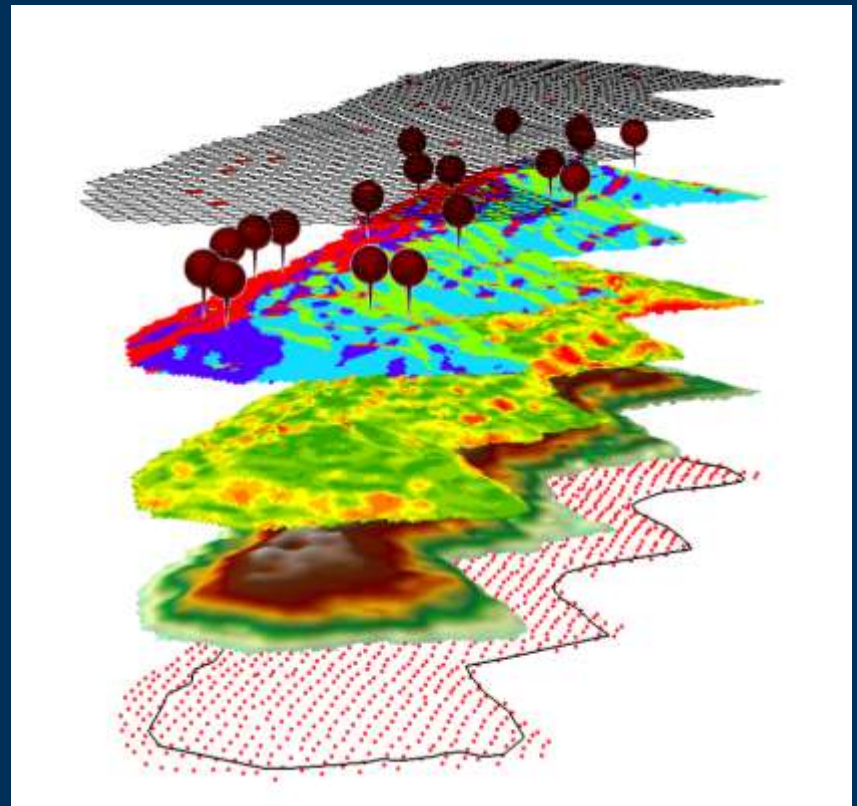
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- **Island topography**
  - **Elevation**
  - **Distance to water**
  - **Slope**
  - **Aspect**

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Island Topography 2011-2012

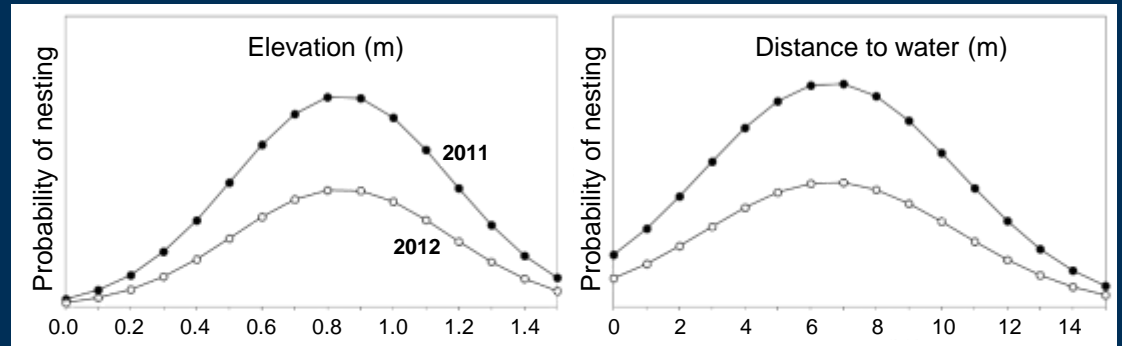- Real-time kinematic (RTK) GPS (~3cm accuracy)
- Resource Selection Probability Functions: Logistic Regression
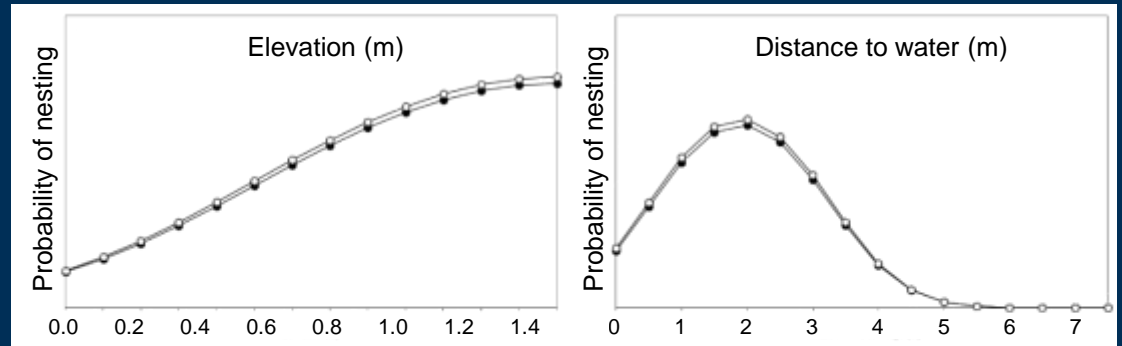
Island-patch scale (24 islands)

1) Species

2) Year

3) Elevation

4) Slope

5) Aspect (direction of the slope)

6) Distance to water

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American avocet nesting probability

Forster's tern nesting probability

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- How big, and what shape should islands be?
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  - Eg. 50m by 10m or 100m by 10m

- Island topography
  - Elevation: **0.5 – 1.5m above the water surface**
  - Distance to water: **Within 10m of the water's edge**
  - Slope: **Mosaic of steep (avocets) and flat (terns)**
  - Aspect: **South-facing, East-West linear islands**

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  - Aspect: **South-facing, East-West linear islands**

- Vegetation: **Patches of 1) dense, short vegetation, and 2) bare ground**

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Acknowledgments

Funding

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Field technicians

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