Landscape use by herons and egrets in the San Francisco Estuary

Integrated Regional Wetlands Monitoring (IRWM) Project

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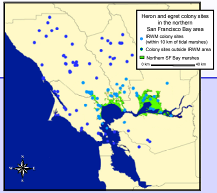
CALIFORNIA BAY-DELTA AUTHORITY



INTRODUCTION

We measured colony size, productivity of successful nests, and nest survivorship at 45 known heronries within 10 km of historic tidal marsh of San Pablo Bay and Suisun Bay. The data were used to evaluate landscape associations of heronries and the potential use of six IRWM study marshes by herons and egrets. This work is part of a larger, ongoing project that began in 1990 to monitor all known heronries in the northern San Francisco Bay region.

BACKGROUND AND METHODS

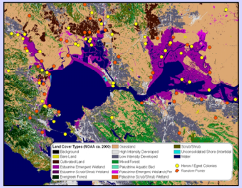
We visited most heronries at least 4 times times each nesting season, 1991-2004. Counts of active nests and measurements of reproductive success were made from the ground or from boats, often by trained volunteer field observers.

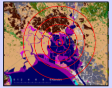
Nest survivorship

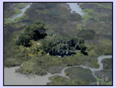
The survivorship of heron and egret nests primarily reflects the risks of predation, severe weather, and colony site disturbance. We estimated nest survivorship at each heronry by monitoring the number of focal nests that successfully raised at least one nestling to fledging age.

Prefledging brood size

Herons and egrets typically reduce the sizes of their broods in each nesting attempt. They achieve this through asynchronous incubation and hatching, which leads to a hierarchy of competitiveness and survivorship among nestlings in each brood. One likely benefit of brood reduction is an ability to match reproductive effort to unpredicted changes in prey availability, or wetland productivity. Most brood reduction in Great Egrets and Great Blue Herons occurs when nestlings are less than four weeks old. Therefore, to monitor relationships between landscape foraging conditions and heron and egret productivity, we recorded the sizes of broods late in each season, when nestlings were 5-8 weeks old.

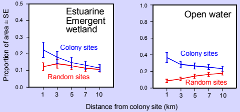






COLONY-SITE LOCATIONS

We analyzed landscape associations based on the areal extents of land cover types (NOAA Landsat images, 2000-2002) and several wetland-patch (Fragstats) metrics within 1, 3, 5, 7, and 10 km of heronries.

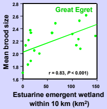


To examine colony site selection, we compared land cover and wetland-patch metrics at all distance scales with those of randomly selected, unoccupied sites. Logistic regression revealed significant selection of nesting areas with more estuarine emergent wetland and more open water within 1 km of heronries than expected. However, herons or egrets did not nest within 1 km of the IRWM sites.

REPRODUCTIVE SUCCESS

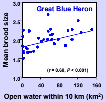
Nest Survivorship

We found no significant relationship between nest survivorship and landscape characteristics at any scale. Patterns of nest failure reflect localized effects of nest predation, disturbance, or severe weather that vary spatially among years.



Productivity in successful nests

In contrast to localized effects of wetland habitat on colony-site selection, the productivity of successful nests was significantly related to landscape conditions at relatively large spatial scales. The results indicate the importance of suitable foraging areas within 10 km of heronries and suggest the value of wetland edges and isolated wetland patches. The patterns are significant among annual and long-term colony-site means over 14 years but are not evident every year.

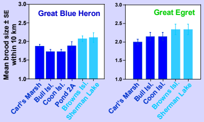


Predictors of nestling productivity (multiple regression models)

Dependent variable = mean prefledging brood size in successful nests, 1991-2004

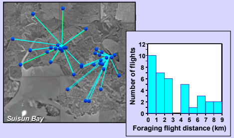
Predictor	Standard Coefficient	*P*
Great Egret		
Land cover types (n = 19 colonies, R^2 = 0.90)		
Estuarine emergent wetland (km^2) within 10 km	0.89	<0.001
Open water (km^2) within 10 km	-0.56	<0.001
Low-intensity develop. (km^2) within 3 km	0.39	<0.001
Land cover and wetland patch metrics (n = 18 colonies, R^2 = 0.87)		
Open water (km^2) within 10 km	-0.70	<0.001
Total edge of tidal wetland patches within 10 km	0.38	0.003
Proximity (aggregation of patches) within 10 km	-0.28	0.012
Great Blue Heron		
Land cover types (n = 36 colonies, R^2 = 0.56)		
Open water (km^2) within 10 km	0.45	0.002
Cultivated (km^2) within 3 km	-0.49	0.001
Palustrine emergent (km^2) within 10 km	0.21	0.098
Land cover types and wetland patch metrics (n = 31 colonies, R^2 = 0.55)		
Cultivated (km^2) within 3 km	-0.59	0.001
Shape complexity within 5 km	0.38	0.016
Proximity (aggregation of patches) within 10 km	-0.34	0.050

Differences in the number of young produced in successful nests within 10 km of individual IRWM marshes were difficult to distinguish. However, nest productivity was significantly greater among sites near Suisun Bay marshes than among sites near San Pablo Bay marshes.



FORAGING DISPERSION

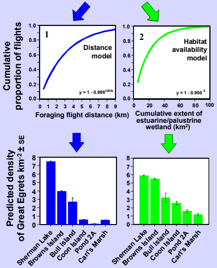
We used aircraft to track foraging flights of Great Egrets departing from heronries in Suisun Marsh. Using these data, we modeled foraging dispersion according to (1) distance from heronries and (2) cumulative extent of estuarine/palustrine habitat.



Most Great Egrets foraged within 3 km of heronries or within an area with less than 20 km^2 of estuarine or palustrine emergent wetland.

Foraging dispersion models predicted greater densities at Sherman Lake and Brown's Island than at IRWM sites in San Pablo Bay marshes.

Because herons and egrets are highly selective in their use of marshes within their foraging range, we are developing additional information on foraging behavior and habitat preferences that will improve our ability to predict heron and egret use of feeding areas across the wetland landscape.



IMPLICATIONS FOR CONSERVATION

Our results demonstrate the importance of large-scale processes in understanding the use of marshes by an important group of predators. This work contributes to the development of techniques to measure the effects of landscape conditions on local ecological processes associated with wetland protection and restoration projects. Future investigation will focus on incorporating measurements of foraging habitat quality and validating models with surveys of heron and egret use of particular foraging sites.