THE USE OF A FISH-EYE LENS TO STUDY NEST PLACEMENT IN FRANKLIN'S GULLS[1]

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Abstract. A Franklin's Gull colony in northwestern Minnesota was sampled to determine if there is a correlation between closeness of adjacent nests and visibility. A method of vegetation analysis using a fish-eye lens is presented. Franklin's Gulls select nest sites which are least visible to neighboring gulls.

Franklin's Gulls (*Larus pipixcan* Wagler) nest in cattail (*Typha* spp.) marshes in the northern prairie regions of North America. The gulls build partially floating nests that are attached to the previous year's dead cattails. Nest density is inversely related to cattail density (Burger, unpublished data). My observations indicate that the gulls establish territories by standing on a station in the cattails and defending it and the surrounding area against other gulls. This paper describes a method of analyzing the distribution of vegetation from the gull's perspective by evaluating photographs taken with a fish-eye lens camera. This present study is part of a 3-year study on adaptations for breeding in the Franklin's Gull being conducted at Agassiz National Wildlife Refuge, Minnesota.

The location of a station (and later the nest) is determined by the individual gull's ability to see other gulls; the greater the visibility between two stations the farther apart nests are likely to be. The ability of one gull to see other gulls from a station cannot be determined from cattail density indices since similar densities can result in different visibilities (Fig. 1). These differences in visibility theoretically could result in different nest placements and slightly different nest densities. Although Fig. 2*A*, 2*B*, and 2*C* depict areas of equal cattail density, nest densities in each could vary with different cattail configurations. If visibility is a key factor in nest site selection, the closest nest would be located in the direction of the least visibility.

Photographs taken with a camera equipped with a fish-eye lens were used to test the hypothesis that the nest closest to a given nest is located in the direction of the least visibility. The fish-eye lens photographs a 360° panorama: close objects appear in the center of the resulting photographs.

For each of 60 nests, the direction of the closest nest was marked so that it would appear in the photograph. Photographs were taken with the camera placed flat on each nest. A grid divided into four quadrants was placed over the photographs so that a

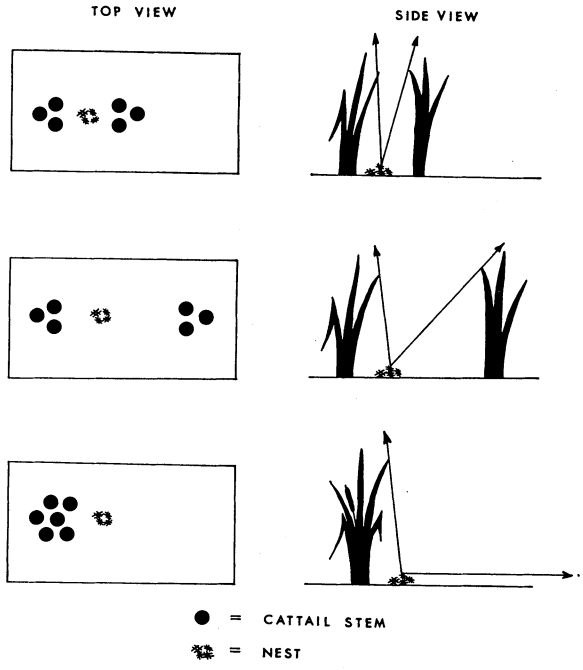

FIG. 1. Different visibilities result from different cattail dispersion patterns.

radius through the center of the arc of one quadrant pointed in the direction of the closest nest (Fig. 3*A*). Only three quadrants were analyzed since I was in the fourth quadrant of each photograph. To avoid bias, in half of the sample photographs I stood in the right adjacent quadrant, and in the other half in the left adjacent quadrant. Each quadrant was subdivided into 40 sections by a series of radii and concentric arcs. The grid was then placed on the photograph (Fig. 3*B*) so that the arrow pointed in the direction of the closest nest (Fig. 3*C*). For each photograph the number of sections that did not contain at least one cattail was summed for each quadrant and this number is termed the "visibility index." A high visibility index indicates high visibility.

The results are presented in Table 1. An analysis of variance indicates that the visibility index for the closest quadrant is different than the other two quad-

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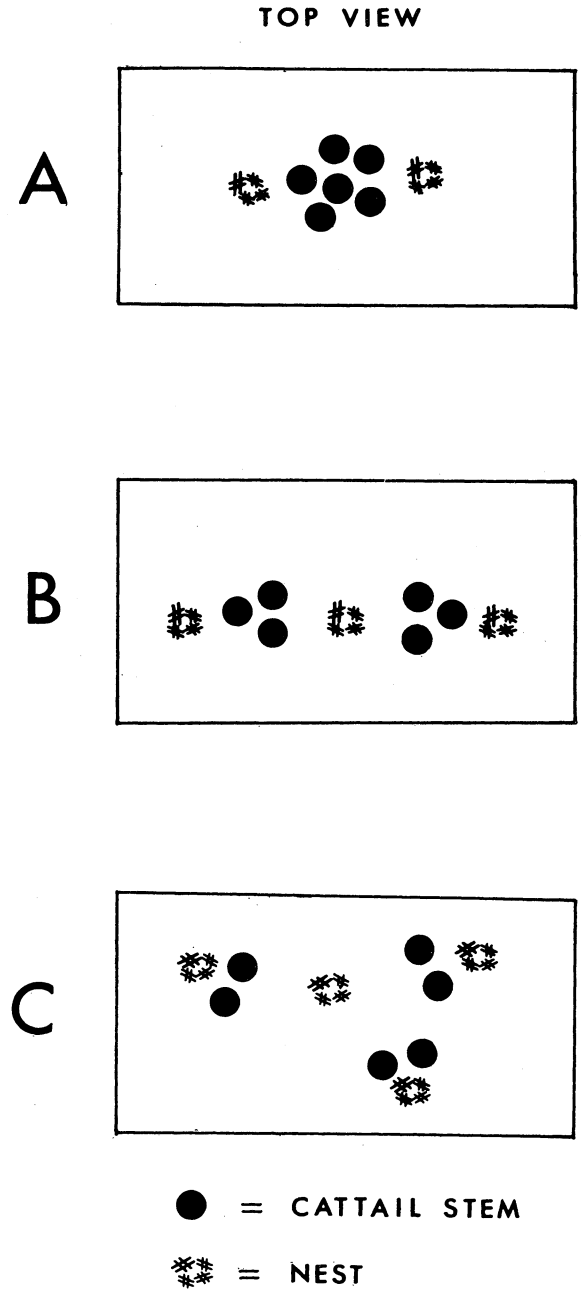

FIG. 2. Although the cattail density is the same, the nest density differs as a function of different cattail placement.

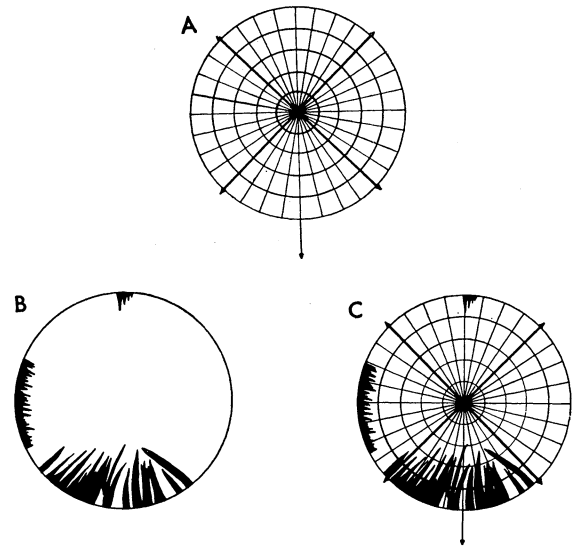

FIG. 3. A grid (*A*) is placed on the photograph (*B*) so that the arrow points in the direction of the closest nest (*C*).

TABLE 1. Index of visibility looking toward the closest nest, versus toward the opposite quadrant, versus the adjacent one

	N	Mean	Range	SD
Closest	60	22.8	34–10	5.4
Opposite	60	31.3	38–14	5.0
Adjacent	60	31.0	40–17	5.5

rants at the 0.01 probability level. There was no difference between the opposite and adjacent quadrants at the 0.01 probability level. Thus, the results indicate that the gulls select nest sites where neighboring gulls are least visible.

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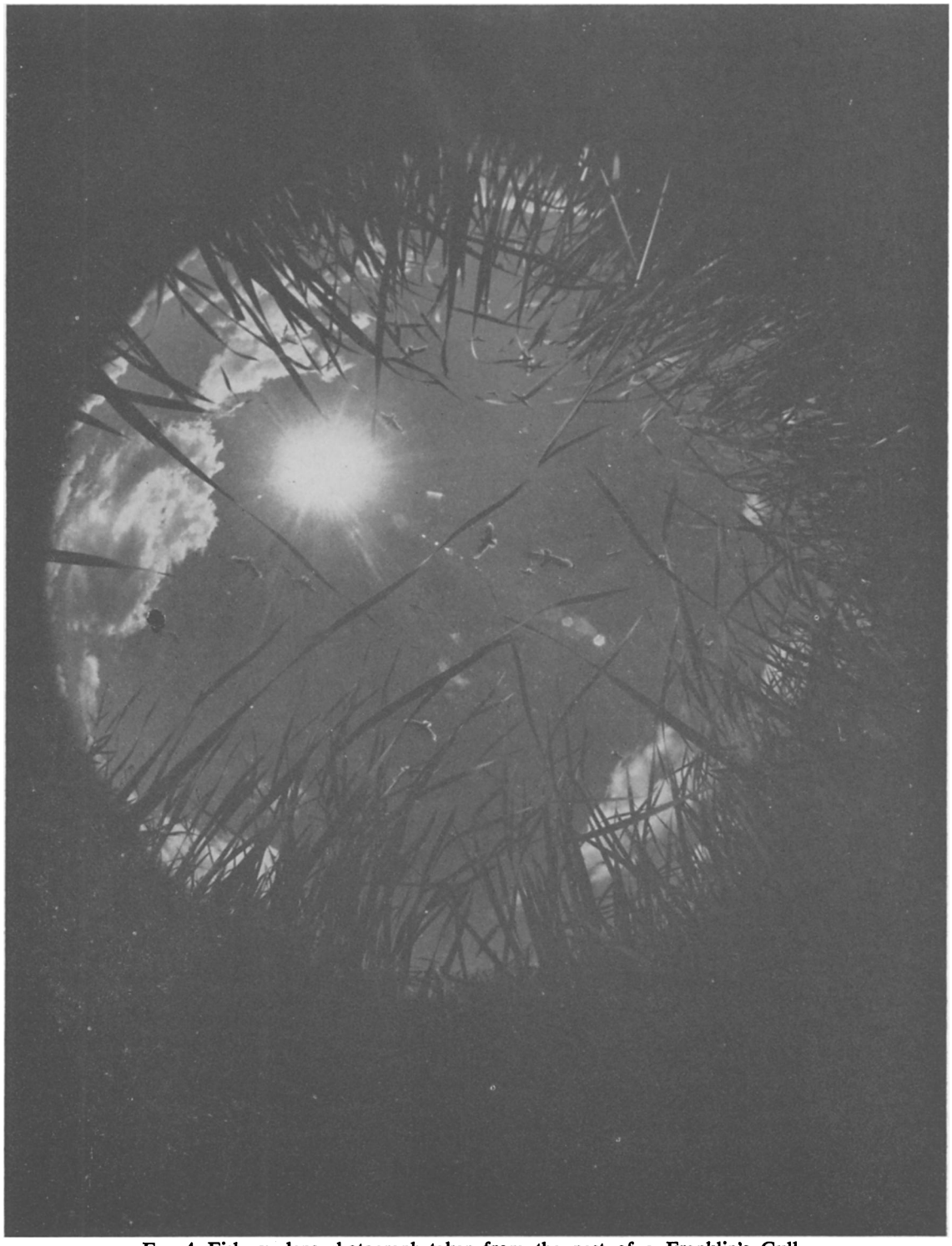

FIG. 4. Fish-eye lens photograph taken from the nest of a Franklin's Gull.