BREEDING BIOLOGY AND ECOLOGY OF THE BROWN-HOODED GULL IN ARGENTINA

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THE Laridae breed in a variety of habitats throughout the world. Of the 44 species of gulls (genus *Larus*), 19 nest exclusively on the ground and 19 others often or sometimes nest on flat ground. Many of the latter species also nest on cliffs and ledges. The adaptations of gulls for nesting on cliffs have been studied in some detail (cf. Cullen 1957; Emlen 1964; Hailman 1965, 1968; Smith 1966). Beer (1966) studied the breeding adaptations of the Black-billed Gull (*Larus bulleri*) for nesting on unstable river beds. I examined the behavioral and ecological adaptations in Franklin's Gull (*L. pipixcan*) for breeding in marshes (Burger 1972a).

The Brown-hooded Gull (*L. maculipennis*) is the ecological counterpart of Franklin's Gull in South America (Weller 1967) where it usually nests in the pampa marshes of Argentina and Uruguay although it infrequently nests on dry ground (Wetmore 1926, Olrog 1959, Meyer de Schauensee 1970). Only very general descriptions of the breeding biology of the Brown-hooded Gull are available (MacDonagh 1944, Plotnick 1951, Moynihan 1962). I studied the behavior and ecology of nesting Brown-hooded Gulls in Argentina, placing emphasis on colony and nest site selection, coloniality, synchrony, and interspecific relationships.

STUDY AREA AND METHODS

I conducted fieldwork in the marshes of the San Jose Estancia, Murphy, Province of Santa Fe, Argentina from 10 October 1972 through 20 January 1973. The pampas here contain shallow alkaline lakes with large tracts of tules (*Scirpus californicus*). The marshes were extensive and had large expanses of open water with a maximum depth of 1.5 m. Water levels dropped during the summer by evaporation. Cattle grazed on the surrounding pampas.

I also worked in a mixed colony of 500 gulls, 500 White-faced Ibis (*Plegadis chihi*), 800 Snowy Egrets (*Egretta thula*), 150 Roseate Spoonbills (*Ajaia ajaja*), and 50 Great Egrets (*Casmerodius albus*) at Laguna de Burgos near Azul, Province of Buenos Aires. This marsh was described by Narosky (1969).

I searched the San Jose marshes on horseback for gull nests twice a week during the study period. Gulls seemed less wary when I was on horseback. The vantage point from the saddle facilitated nest location and reduced searching time.

All nests were marked with plastic tags. Data collected at nests included sequence of egg-laying, size of eggs, width of nest at completion of clutch, distance to nearest neighbor, species of nearest neighbor, visibility from the nest, and other vegetational characteristics. Unless otherwise noted, observations reported below were made at San Jose Estancia.

RESULTS

Prenesting behavior.—The Brown-hooded Gull is relatively sedentary although some local dispersal occurs (Murphy 1936). They feed on insects over the marshes and agricultural lands (Hudson 1920, Aravena 1927, Zotta 1934). They are present in the marshes all year with a general increase in numbers after the breeding season.

When I arrived in early October the 30 to 50 gulls present sat and displayed on sandbars on the edge of the marsh. The number of gulls increased to 300 over the next 2 weeks and I witnessed courtship behavior and copulation. The gulls began to congregate on future nesting sites less than 200 m away by the end of October. They used wet, grassy spots next to the marshes as loafing and display grounds during the entire nesting season. The number of gulls on any such tract usually increased just prior to egg-laying, and decreased when the gulls began to incubate. Courtship and copulation took place only in the grass and sandbars near the colony, and not within the colony.

Colony site selection.—Most gulls generally exhibit colony site tenacity (for review see Bongiorno 1970) and nest in places that remain relatively constant for long periods of time. Notable exceptions are the Black-billed Gull (Beer 1966) that nests on unstable shingle bars in rivers and Franklin's Gull (Burger 1972a) that nests in marshes. A marsh habitat has the potential for rapid physiographic changes with fluctuating water levels (Weller and Spatcher 1965, Orians 1969). The pampa marshes are similar in this respect to the prairie marshes of North America (Weller 1967). Thus, not surprisingly, the gulls shift locations every year (P. Miles, pers. comm.).

Five small colonies (5–48 nests) at San Jose and one large colony (500 nests) at Burgos were near the edge of large bodies of open water. The gulls prefer a habitat of low density tule with many small pools. In each of the 18 randomly chosen plots (10 m^2) in the marsh I counted all tule stems in 15 randomly chosen samples (80 mm^2). Figure 1 shows the mean tule density, arranged in sequence of decreasing means, for the 18 random plots; the colony sites, represented by triangles, show the gulls' preference for low density tules.

Colonies of Silver Grebe (*Podiceps occipitalis*) and/or Rolland's Grebe (*Podiceps rolland*) were started earlier than the gull colonies, and the gulls usually nested within grebe colonies. All of the gull colonies at San Jose were in grebe colonies. The few Brown-hooded Gulls that did not nest in colonies built solitary nests in habitats similar to that which colonial birds selected in sparse tules near open water.

Nest site selection.—Several authors have alluded to the effects of vegetation on breeding gulls (cf. Drent 1967, Brown 1967). Bongiorno

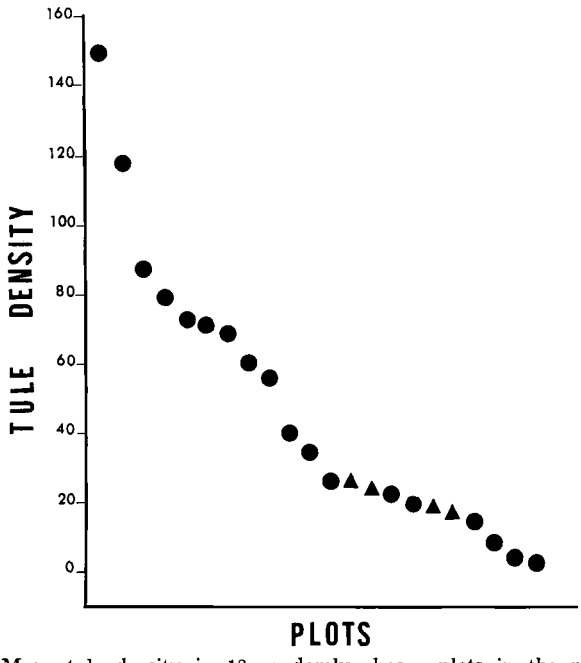

Figure 1. Mean tule density in 18 randomly chosen plots in the marsh at San Jose (circles) compared to that within four Brown-hooded Gull colonies (triangles). See text for explanation.

(1970) experimented with Laughing Gulls (*Larus atricilla*) and changed the nesting pattern by altering the pattern of marsh grasses. In Franklin's Gulls (Burger 1972a, 1972b) nest site selection is dependent upon aggression and visibility. As Franklin's Gull and the Brown-hooded Gull nest in similar habitats, I examined the relationship between inter-nest distance and visibility.

For each of the 80 nests I computed the visibility index (Burger 1972b) for the quadrant in the direction of the closest nest, adjacent to the closest nest, and opposite the closest nest. Only three quadrants

TABLE 1

VISIBILITY INDICES FROM THE NESTS OF THE BROWN-HOODED GULL, WHITE-FACED IBIS, AND SILVER GREBE[1]

Direction	Brown-hooded Gull	Silver Grebe	White-faced Ibis
Closest nest	12.3 ± 5.6 (0-23)	4.7 ± 3.4 (0-12)	9.9 ± 6.2 (0-23)
Opposite	16.5 ± 4.5 (8-26)	3.5 ± 3.6 (0-12)	11.9 ± 5.7 (0-28)
Adjacent	16.0 ± 4.2 (6-27)	5.0 ± 4.3 (0-16)	10.0 ± 6.6 (0-24)

[1] $\bar{X}$ ± SD (range).

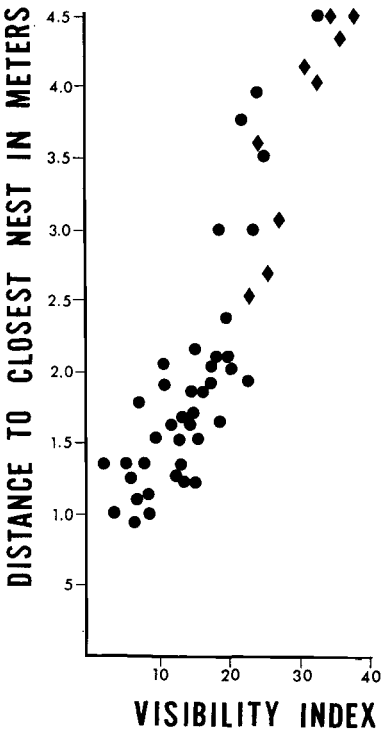

Figure 2. The distance to the closest nest as a function of the visibility index. The circles represent data taken at Azul, and the triangles data taken at San Jose.

were analyzed as I was in the fourth quadrant. The results are presented in Table 1. I used a single classification analysis of variance (F test) to test for significant differences between or among the means. The visibility index in the direction of the closest nest was significantly lower than that for the other two quadrants ($F = 17.47$, $df = 238$, $P < 0.001$). The means for the other two directions showed no significant differences.

A similar series of photographs was taken and analyzed to test the hypothesis that the distance to the closest nest was directly related to the visibility index. The results (Figure 2) indicate that internest distance is positively correlated with the visibility index ($r = 0.6$, $df = 38$, $P < 0.01$).

Normal summer growth of the tules did not begin until after nest site selection. As gulls used the nests of the Silver Grebe, and were suspected of using the nests of the White-faced Ibis, I analyzed nest photographs in a similar manner for each of these two species. I found

TABLE 2
NEAREST NEIGHBOR AND NEST CHARACTERISTICS OF SPECIES AT LAGUNA DE BURGOS

	Distance to nearest neighbor[1]	Width of nest[1,2]	Height above water[1]	Percent of conspecific nearest neighbors
Brown-hooded Gull	160.5 ± 40	56.0 ± 13	11.2 ± 6	100
White-faced Ibis	111.7 ± 50	45.6 ± 11	13.4 ± 8	95
Roseate Spoonbill	142.0 ± 36	46.0 ± 7	38.2 ± 8	65
Great Egret	133.2 ± 12	59.3 ± 7	50.3 ± 7	100
Snowy Egret	105.5 ± 48	43.2 ± 7	37.6 ± 9	89

[1] Measurements are in cm $\bar{X}$ ± SD.
[2] At widest point.

no significant differences in the visibility index for the three quadrants analyzed (F = 0.7, 0.9 respectively, df = 58, see Table 1). The Brown-hooded Gull chooses nest sites having a greater visibility index (less vegetation) than those of the grebe and ibis.

Use of nests of other species.—Brown-hooded Gulls not only nested in grebe colonies, but took over active nests of the Silver Grebe. Brown-hooded Gulls did not usurp the nests of Rolland's Grebe even though they nested nearby. Silver Grebe nests were similar in form, construction, material, location, and size to those of the Brown-hooded Gull. The mean diameter of a Brown-hooded Gull's nest was 56.2 cm (SD = 13, range = 23–71), the mean for Silver Grebe was 45.2 cm (SD = 8.8, range = 36–61), and the mean for Rolland's Grebe was 29.2 cm (SD = 5.2, range = 17–41). Silver Grebe nests were usually dry whereas Rolland's Grebe nests were wet.

I detected the gull piracy of Silver Grebe nests by marking all grebe nests in the marsh. Had the grebe nests not been marked, I would have assumed that the gulls were merely nesting in the same places. Removing some of the new nest material added by the gulls revealed the trampled structure of the grebe nest. Grebe eggs were either covered by the new nest material, found nearby in the water, or were missing completely. Gulls usually added nest material and laid an egg in one day. Of 220 marked, active Silver Grebe nests, gulls usurped 19. In five of these nests the gull eggs were subsequently pecked, presumably by the grebes, and the nest abandoned by the gulls. In two of the 19 nests a complete clutch of grebe eggs was replaced by a gull egg, and the gull eggs were then replaced by grebe eggs. As grebes nested earlier, their eggs often hatched before the gulls nested, and the gulls sometimes used these deserted nests. Individual gull eggs were sometimes laid in active grebe nests; the grebes incubated these eggs until their own eggs hatched, whereupon they left the nest with their brood, leaving the gull egg unhatched. Brown-hooded Gulls also dump eggs in the

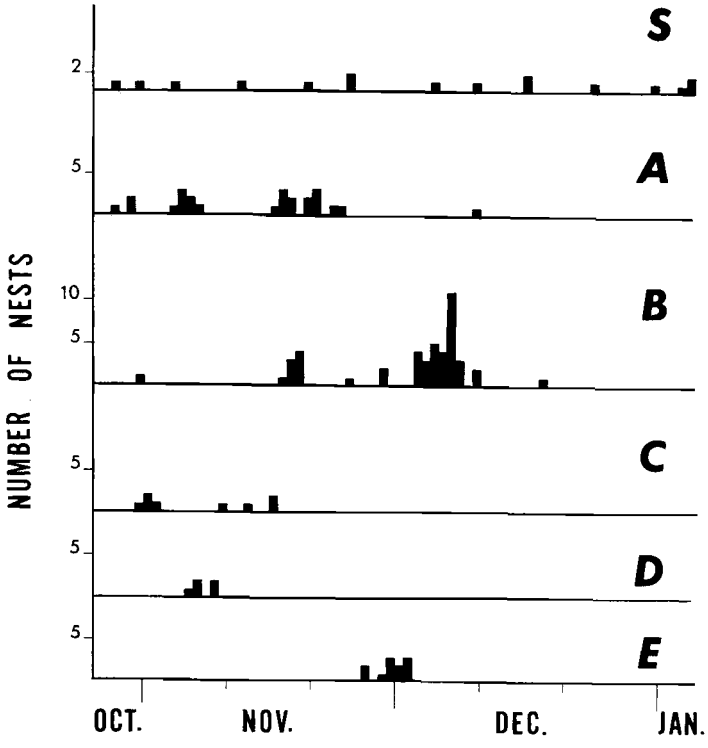

Figure 3. Egg-laying period at San Jose for the Brown-hooded Gull. A through E are from individual colonies, and S is the combined data from solitary nesting gulls.

nests of conspecifics. I found two nests in which six eggs were laid over a 3-day period.

Egg-laying period.—The egg-laying period for all colonies at San Jose spanned a 67-day period from 29 October through 3 January. There was more synchrony within a colony than between colonies (Figure 3). When nests were destroyed in one site, gulls did not desert but laid eggs in the same place approximately 2 weeks later (presumably the same birds). Causes of nest destruction included inclement weather and predation by grebes and caracaras.

When I first visited the colony at Burgos in December it contained fledged young, chicks of all ages, and eggs. A sample of 100 nests showed that 10% had fledged, 50% were chicks, and 40% had eggs.

Measurements of 60 eggs taken at San Jose and Burgos were not significantly different. Egg length: $\bar{x} = 51.3$ mm, SD = 1.8 mm, range = 48.1–54.9 mm. Egg breadth: $\bar{x} = 36.3$ mm, SD = 1.0 mm, range = 34.2–39.0 mm. Clutch size: $\bar{x} = 2.6$, SD = 0.8, range = 1–4.

Parental care behavior.—I watched incubation behavior from a blind in colony B. Both members of a pair incubated with a mean incubation bout of 110 minutes (SD = 63, range = 30–247, N = 31). Early in the incubation period exchanges often involved vocalizations and displays, but as the season progressed exchanges were often executed without audible or observable interactions at the nest. Sometimes the incubating bird flew before the incoming bird landed. Both sexes usually brought nest material, often stolen from a nearby nest, back to the nest after nest relief during the entire incubation period.

Chicks of all ages remained on the nest platform and were always fed there. They did not normally leave the nest unless I disturbed them, when they usually swam a short ways and froze. I did not note the "*simulando hallarse muertos*" or death feigning Plotnick (1951) reported, nor did I see any cases of cannibalism. I also failed to find any peck marks or scars on the heads or bodies of over 100 chicks examined at the Burgos colony.

Interspecific relationships.—I made direct behavioral studies on grebes, ibises, and egrets from a blind at San Jose. Most aggressions occurred between gulls and grebes, as gulls sometimes took over and used grebe nests. In these cases a gull usually approached a grebe nest giving an aggressive "kek kek" call, and tried to climb onto the grebe nest. A fight usually ensued in which the grebe and gull both wingflapped, pecked, and vocalized. At this stage the gull often flew and began to dive at the grebe. Grebes being dived at either remained on the nest, or went off the nest and under water. This diving at a grebe by a gull often lasted for as long as 11 minutes. Sometimes the takeover attempts by the gull were successful, and often they were not.

When ibises and egrets came to within 3 m of a gull nest, the incubating gull usually gave a series of "kek kek" calls. These calls were often repeated rhythmically and resembled the "gakkering" that Franklin's Gulls give intruders (Burger 1972a). When an intruder did not leave, the resident gull dived on and pecked at the intruder. Great Egrets elicited repeated dive attacks although the smaller Snowy Egrets were often ignored. Ibises were almost always attacked. Gulls were more aggressive towards ibises and egrets than they were toward conspecifics that landed the same distance away.

I recorded the species of the nearest neighbor and the distance to the nearest neighbor at each of 117 nests in the central area of the Burgos colony. Although at first glance the placement of nests appeared to be random, individuals nested closer to conspecifics (Table 2). Gulls maintained the greatest internest distance and their closest neighbor was always a gull. The gulls used the most open tule habitat, ibises used intermediate territory, and egrets and spoonbills used the denser sites.

This reflects the fact that gulls and ibises build semifloating nests on the water surface, and egrets and spoonbills build their nests well above the water in the tules (Table 2). The massive nests of the latter species require thick tules for support.

The main avian predators of Brown-hooded Gulls were the Chimango Caracara (*Milvago chimango*) and the Crested Caracara (*Polyborus plancus*). Although Crested Caracaras ate eggs and adult gulls, their damage was minimal as only one pair of Crested Caracaras was seen in the marshes. Chimango Caracaras were very common and nested in the marshes. I often counted 15 to 25 of them flying over my blind at sunset on their way to roost in the marsh. Chimangos completely destroyed one colony of 36 nests over a 2-week period. Only when the Chimango approached a nest closer than about 2 m did the gull attack. When a Chimango entered the colony early in the season, a few gulls mobbed the bird, and while they mobbed one Chimango, another frequently ate the uncovered eggs. As the colony decreased fewer gulls were available to mob the Chimangos. When this colony was reduced to three nests, Chimangos flew over it less often. Only a single pair of gulls fledged a young from this colony.

Brown-hooded Gulls also mobbed Common Stilt (*Himantopus himantopus*), Southern Lapwing (*Vanellus chilensis*), and Snail Kite (*Rostrhamus sociabilis*). Only gulls nesting in colonies mobbed predators; solitary nesters did not usually leave their nests when a predator flew over.

Reproductive success.—The 107 pairs of gulls that nested in colonies at San Jose fledged only two young. Solitary nesting gulls were more successful, fledging one young in each of 13 nests. Of the three solitary nests that were not successful, one was destroyed by a Chimango Caracara, and the other two disappeared during a heavy rainstorm. The colony at Burgos, which was considerably larger than any colony at San Jose, was more successful in that many birds had already fledged when I was there.

DISCUSSION

Colony site selection.—Most gulls nest in habitats that remain unchanged for long periods of time and exhibit a high degree of colony site tenacity (for review see Bongiorno 1970). Brown-hooded and Franklin's Gulls change colony sites from year to year, selecting a colony site each year on the basis of vegetation density. Both species prefer to nest in open sites far from dry land with its associated mammalian predators. Later in the season when the vegetation has reached full height, gulls have difficulty flying from nests placed in dense tules. The

TABLE 3

COMPARISON OF ECOLOGY AND BEHAVIOR OF BROWN-HOODED, FRANKLIN'S, AND TYPICAL GROUND-NESTING GULL

	Brown-hooded Gull	Franklin's Gull	Typical ground-nesting gull
Marsh habitat	Yes	Yes	No
Colony site selection:			
Site tenacity	No	No	Yes
Preferred areas:			
Sparse vegetation	Yes	Yes	NA[1]
Adjacent to open water	Yes	Yes	NA
Display areas:			
On vegetation	No	Yes	NA
On edge of marsh	Yes	Yes	NA
Nest site selection:			
Closest nest in direction of lowest visibility	Yes	Yes	?[2]
Internest distance direction related to visibility index	Yes	Yes	?
Use nests of conspecifics	Yes	Yes	No
Use nests of other species	Yes	No	No
Nest construction:			
Prior to egg-laying	No	No	Usually
Steal nest material	Yes	Yes	Variable
Semifloating nests	Yes	Yes	No
Synchronous	No	Yes	Variable
Large colonies	No	Yes	Usually
Solitary nesters	Some	No	No
Antipredatory behavior:			
Alarm calls	Yes	Yes	Yes
Mobbing	Sometimes	Usually	Yes
Distraction display	Infrequent	Infrequent	No
Cannibalistic	No	No	Yes
Reduced brood mobility	Yes	Yes	No
Sedentary	Yes	No	Variable

[1] NA = not applicable.
[2] ? = information not available.

shorter the distance to open water, the quicker an adult can reach it and fly from predators.

General behavior.—The behavior and ecology of the Brown-hooded Gull are similar to those of Franklin's Gull (see Table 3). Both species build semifloating nests of material gathered from the marsh or from unattended nests. Ground-nesting gulls steal material from conspecifics, but this is less prevalent (for review see Burger 1972a).

The chicks of Brown-hooded and Franklin's Gulls are always fed on the nest platform, and remain in the nest until they fledge. Brood mobility is reduced, and cannibalism is absent in both species.

TABLE 4

EGG-LAYING PERIODS OF GULLS

Species	Study	Egg-laying period in days	Size of colony
Larus argentatus	Brown pers. comm.	56	9,000
L. atricilla	Bongiorno pers. comm.	33	6,000
L. californicus	Vermeer 1970	30	7,200
L. delawarensis	Vermeer 1970	38	275
L. fuscus	Brown pers. comm.	51	9,000
L. glaucescens	Vermeer 1963	67	478
L. maculipennis	This study	67	106
L. occidentalis	Schreiber 1970	52	600
L. pipixcan	Burger 1972a	21	15,000
L. ridibundus	Patterson 1965	54	800
L. ridibundus	Ytreberg 1956	55	300
Xema sabini	Hussell pers. comm.	25+	38

Synchrony and coloniality.—The breeding season in the Brown-hooded Gull extended from mid-October to the end of January, with an egg-laying period of 67 days. This is longer than in most other gulls (Table 4). As the marsh-nesting Franklin's Gull had a very compressed breeding season with an egg-laying period of 21 days, the length of the laying period is not an adaptation for marsh nesting. The extended egg-laying period of the Brown-hooded Gull may have been due to loss of eggs and subsequent relaying. It may also reflect a lack of selection against late breeders. Franklin's Gull chicks that fledge later in the season have a much lower survival rate than chicks that fledge early (Burger 1972c). In contrast, late-nesting Brown-hooded Gulls at San Jose fledged young.

The low success of colony nesters at San Jose is interesting when compared to findings for the Black-headed Gull (*Larus ridibundus*) nesting on sand dunes. Patterson (1965) found that success was lower on the fringe of the colony, and that outlying nests had zero success. I found that birds nesting solitarily at San Jose fledged young in 81% of the nests. In fact, the 16 solitary pairs fledged seven times more young than the 107 pairs that nested colonially. The relatively higher fledging success at Burgos suggests that the results at San Jose reflect a decrease in effectiveness of antipredator behaviors in small colonies.

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Summary

The behavior and ecology of the Brown-hooded Gull were studied in Argentina from 10 October through 20 January. Studies were conducted in a colony of 500 gulls, and in another site containing 5 small colonies and solitary nesters.

Brown-hooded Gulls do not exhibit colony site tenacity, but frequently nest in the same general area. Birds displayed on dry land near future colony sites, but did not settle on the nesting ground until a week before egg-laying. Colonies were located in low density tule habitats near open water. Solitary nesters comprised 1.3% of the pairs breeding at San Jose.

Nests were placed so that the closest neighbor was in the direction of least visibility. Internest distance was directly related to visibility. At least 20% of the colonial birds used active grebe nests and only added more material. The semifloating nests were attached to tule stems. Nest material was added to the nest throughout the parental care period.

The total egg-laying period for San Jose was 67 days, with more synchrony within colonies than between colonies. Both members of the pair incubated and fed the young. Brood mobility was reduced, and chicks were fed only on nest platforms. Cannibalism was absent.

Generally the behavior and ecology of the Brown-hooded Gull was similar to that of Franklin's Gull (see Table 4). But there were three striking differences: (1) Franklin's Gull is highly synchronous and the Brown-hooded Gull is not; (2) Franklin's Gulls nest in very large colonies with no solitary nesters, Brown-hooded Gulls nest in smaller colonies with some solitary nesters; and (3) Franklin's Gull is migratory and the Brown-hooded Gull is not.

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