UPDATE ON THE STATUS AND BREEDING PHENOLOGY OF THE TIMBERLINE SPARROW (*SPIZELLA BREWERI TAVERNERI*) IN ALASKA

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ABSTRACT: In July 2020 we located 10 singing Timberline Sparrows [*Spizella* (*breweri*) *taverneri*] in the region of Gold Hill, Nutzotin Mountains, east-central Alaska. All birds were on southeast-facing slopes in the ecotone between subalpine scrub and alpine tundra, to which habitat breeding Timberline Sparrows seem narrowly confined. The population's estimated density of 0.77 birds/km^2 was similar to that at the time of its discovery in 1994. We located the first active nest of the Timberline Sparrow reported for Alaska, ~0.3 m above the ground in a shrubby resin birch (*Betula glandulosa*). An observation of young fledged on 11 or 12 July 2020 implies egg laying in the third week of June, later than the beginning of the breeding season of *Spizella* (*breweri*) *breweri*.

Originally described as a species (Swarth and Brooks 1925) and maintained as such by a number of contemporary authorities (see Sibley and Monroe 1990, Klicka and Zink 1997, Klicka et al. 1999, Johnson and Cicero 2004), the Timberline Sparrow remains poorly known, especially at the northern limit of its range, in Alaska. The paucity of information is in part due to its specific habitat associations in remote areas, since it breeds in subalpine and alpine shrublands from extreme east-central Alaska (Doyle 1997) to northwestern Montana (Griffin et al. 2003), while nominate *breweri* breeds in sagebrush and shrub-steppe habitats across the contiguous western United States (Rotenberry et al. 1999).

The Timberline Sparrow was first recorded in Alaska on 22 June 1992 by J. J. Bouton, following which discovery Doyle's (1997) field study from 1993 to 1996 described the species' status, occurrence, habitat associations, and vocalizations around Gold Hill and in the Upper Cheslina drainage in the Mentasta Mountains about 75 km to the northwest. Doyle (1997) reported observations of singing males, and an adult feeding recently fledged young and two adults gathering food provided the first evidence of breeding in Alaska. There have been few observations elsewhere, and little is known about the species' abundance, distribution, or phenology in Alaska.

STUDY AREA AND METHODS

From 25 to 29 July 2020 we searched approximately 13 km^2 in the Gold Hill area of the Nutzotin Mountains (vicinity of 62° 06′ N, 141° 54′ W), about 10 km northeast of Chisana, Alaska. Two other groups also visited the Gold Hill area in 2020 (Table 1). Dominant habitats in the area consist of low shrublands on lower slopes and foothills and dwarf shrub tundra and partially vegetated scree in alpine terrain. Subalpine low shrub habitats reached elevations of ~1500 m

Table 1 Observations and Evidence of Breeding of the Timberline Sparrow in Alaska[a]

Date	Number and breeding status[b]	Location[c]	Observer/reference[d]
22 June 1992	1 (S)	Gold Hill (B)	J. J. Bouton (*in* Doyle 1997)
17 July 1993	2 (FY)	Gold Hill (B)	Doyle 1997
18 June 1994	3 (S, T)	Gold Hill (B)	Doyle 1997
18 June 1994	3 (S)	Gold Hill (Ch)	Doyle 1997
19 June 1994	1 (S)	Gold Hill (B)	Doyle 1997
24 June 1994	1 (S)	Upper Cheslina R., Mentasta Mts.	Doyle 1997
25–26 June 1995	2 (S)	Gold Hill (B)	Doyle 1997, incl. UAM 6669 and UAM 6670
3–5 June 1996	1 (S)	Hyder	Doyle 1997, incl. UAM 6939
2–4 July 1996	4 (S, CF)	Gold Hill	Doyle 1997
7 June 1997	1 (S)	Hyder	UAM 7048, D. D. Gibson and R. W. Dickerman
16 June 2001	3 (S)	Gold Hill (B)	P. Pourchot et al.
25–26 October 2001	1	Ketchikan	Heinl and Piston 2009
18 June 2002	1 (S)	Ptarmigan Lake, Nutzotin Mts.	D. W. Sonneborn
21 June 2003	5 (S)	Gold Hill (B)	D. Chaffin, E. W. Clarke, J. Dearborn, and J. D. Levison
10 June 2007	1 (S)	Juneau	P. M. Suchanek et al.
28 June 2012	2 (S)	Gold Hill (B)	P. Pourchot et al.
23 June 2020	3 (S)	Gold Hill (B)	R. B. Benter, S. Gibson, and N. R. Hajdukovich
25 June 2020	1 (S)	Gold Hill (B)	This study
26 June 2020	4 (S)	Gold Hill (Ch)	This study
27 June 2020	4 (S, T, ON, NE)	Gold Hill (P)	This study
27 June 2020	2 (S)	Trail Creek, Mentasta Mtns.	T. DiMarzio
29 June 2020	1 (S)	Gold Hill (B)	This study
10 July 2020	1 (S)	Gold Hill (Ch)	Z. Pohlen and C. Gesmundo
10 July 2020	1 (CF)	Gold Hill (Ch)	Z. Pohlen and C. Gesmundo
10 July 2020	3 (FL, FY)	Gold Hill (Ch)	Z. Pohlen and C. Gesmundo
10 July 2020	1	Gold Hill (Ch)	Z. Pohlen and C. Gesmundo
12 July 2020 AM	4 (FY)	Gold Hill (Ch)	Z. Pohlen and C. Gesmundo
12 July 2020 PM	6 (UN, FY)	Gold Hill (Ch)	Z. Pohlen and C. Gesmundo
17 October 2020	1	Ketchikan	B. Limle and S. C. Heinl

[a]Unsubstantiated reports from elsewhere in Alaska include one bird on 26 July 1995 at Brushkana Creek, Denali Hwy., Alaska Range (R. B. Benter and C. Dooley); one bird on 3 May 2002 at Juneau (R. J. Gordon); and one bird on 27 June 2014 at Skagway (R. Taylor).

[b]Abbreviations: S, singing bird; T, territorial defense; UN, used nest; ON, occupied nest; FL, recently fledged young; CF, carrying food; FY, feeding young; NE, nest with eggs.

[c]Abbreviations: B, southeast-facing hillsides above intersection of Bonanza and Canyon Creeks; Ch, southeast-facing hillside above Chathenda Creek; P, southeast-facing hillside above Paulsen Creek.

[d]UAM, University of Alaska Museum.

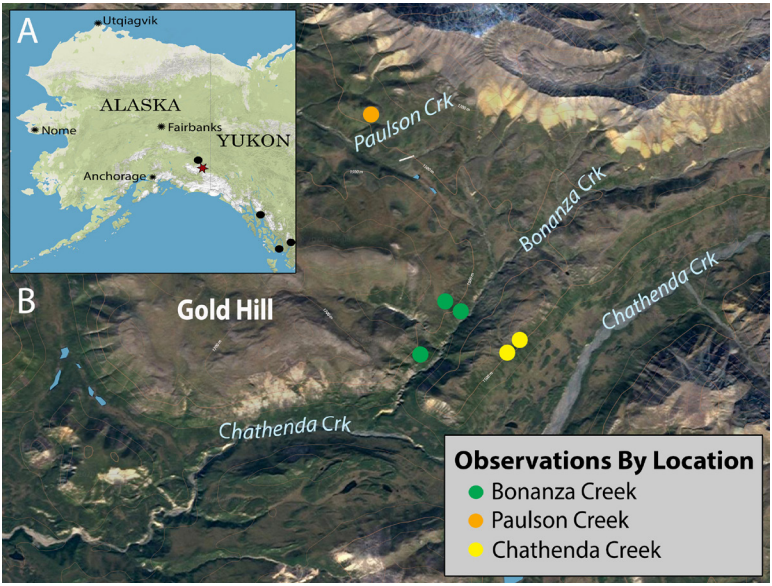

FIGURE 1. (A) Sites of documented reports of the Timberline Sparrow in Alaska. (B) Sites of observations near Gold Hill. Green dots, southeast-facing hillsides above the confluence of Bonanza and Canyon creeks; yellow dots, southeast-facing hillside above Chathenda Creek; orange dot, southeast-facing hillside above Paulsen Creek.

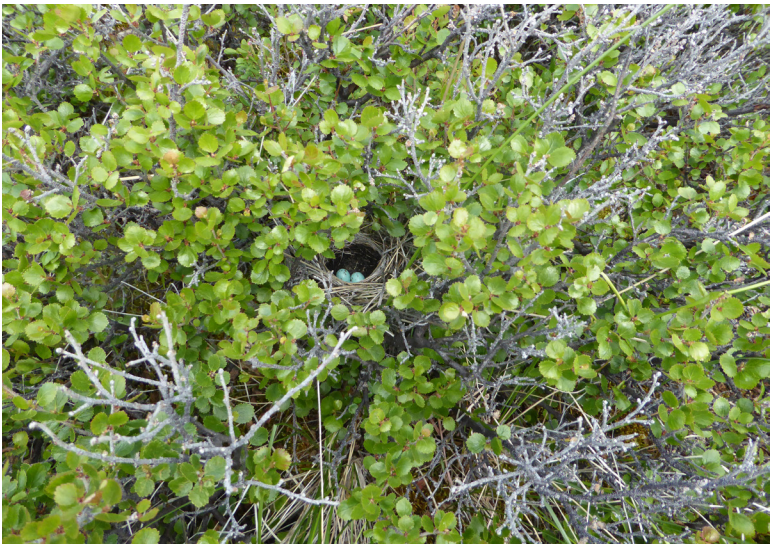

FIGURE 2. Timberline Sparrow nest found near Chisana, Alaska, on 27 June 2020.

Photo by Michelle L. S. Lake

on south-facing slopes, but the subalpine/alpine ecotone was much lower on north-facing slopes. Subalpine habitats on south-facing slopes consisted of a mosaic of low and medium willows (e.g., *Salix glauca*, *S. richardsonii*, and *S. pulchra*), with resin birch (*Betula glandulosa*) common in the understory. Gaps in the canopy were dominated by Altai fescue (*Festuca altaica*), arctic lupine (*Lupinus arcticus*), and other herbaceous plants. Temperatures ranged from daytime highs above 15° C to lows around 5° C. Rain showers were sporadic and local, with various types of frozen precipitation falling at higher elevations.

In addition to searching the two sites previously known for the Timberline Sparrow near Gold Hill on the southeast-facing slopes above Bonanza and Chathenda creeks (Figure 1B), we searched other similar habitat in the general area. We did not broadcast recordings of the species' song. The sparrows sang most frequently during calm, sunny conditions; we often failed to detect them when we passed through known occupied habitat during windy, overcast, and cool periods that were still adequate for standard avian survey and census protocols. Similarly, Walker (2000) excluded data from days of song recording when the weather was windy, cool, or rainy, as song levels then decreased dramatically. Detecting Timberline Sparrows by sight alone is difficult because they appear to spend much of their time below the shrub canopy.

FIGURE 3. A closer look at the Timberline Sparrow nest and eggs found in the Paulsen Creek drainage of the Gold Hill area on 27 June 2020.

Photo by Gerald V. Frost

RESULTS

We detected 10 singing birds (Table 1) and inferred that they were males, as female Brewer's Sparrows are not known to sing (Rotenberry et al. 1999). The birds were gregarious, commonly seen associating with other passerellids including the American Tree Sparrow (*Spizelloides arborea*), Dark-eyed Junco (*Junco hyemalis*), White-crowned Sparrow (*Zonotrichia leucophrys*), and Savannah Sparrow (*Passerculus sandwichensis*). We observed an antagonistic interaction with another Timberline Sparrow after an intruding bird sang at the Paulsen Creek drainage, behavior perhaps consistent with reports that the species tolerates territorial transgressions for feeding (Rotenberry et al. 1999). Documentation of Timberline Sparrows in the Paulsen Creek drainage, 3.5 km from the Bonanza Creek site (Figure 1B), represents a new site for the species. There we detected three singing birds, observed territorial defense, and discovered an active nest.

At ~10:00 on 27 June 2020, Stuyck observed a Timberline Sparrow alternate between singing and foraging just below the crowns of medium-sized willows on a southeast-facing slope above Paulsen Creek. A second individual joined, probably pushed into the area by persons in our group, and the two foraged in close proximity until the second individual rose to the crown of a willow and sang. That action prompted the first bird to defend its territory by quickly chasing away the intruder. Shortly thereafter, this second bird was heard singing again, ~25 m to the east. The first bird's pattern of behavior—foraging, self-maintenance, and singing—suggested a core area of use and attention. Noting that the bird made soft contact calls from middle heights and lower in the vegetation, Stuyck searched the area more thoroughly and flushed a bird from a nest that was well hidden in the branches of a birch shrub ~0.3 m above the ground (Figure 2)—the first Timberline Sparrow nest with eggs found in Alaska.

The nest was located on the upper third of a steep south-facing slope with habitats similar to those found at other areas of Gold Hill with Timberline Sparrows. An open cup ~7 cm in diameter composed of finely woven dried grasses (mostly Altai fescue), it contained four blue-green eggs. The smooth, subelliptical eggs were adorned with moderate burnt umber speckles (Figure 3). Our observation is broadly consistent with other observations of nest size and composition, clutch size, and egg characteristics of Brewer's Sparrow, in the context of the Timberline Sparrow's habitat (see Baicich and Harrison 1997, Doyle 1997, Rotenberry et al. 1999).

Brewer's Sparrows are typically monogamous though some are polyterritorially polygynous (Walker 2000). Both males and females are known to incubate and raise multiple broods (Mahony et al. 2001, Halley et al. 2015). Therefore, the sex of the incubating bird we observed cannot be immediately inferred. Incubating males rarely sing or respond to broadcast of their songs (Walker 2000), and females may chase away males that are not their mates if they venture too close to the nest (Rotenberry et al. 1999). However, the first bird that cued us did sing, and it engaged in territorial defense behavior in response to another singing bird. Males likely stay near their incubating mate to provision and maintain territory, which assessment is consistent with the location of the antagonistic behavior near the nest.

By their long trilling songs, we easily detected Timberline Sparrows under favorable listening conditions from as far as 100–200 m; one bird detected was heard across the Bonanza Creek canyon from about 500 m away. Singing was sporadic but heard throughout the day, often consisting of several bouts of song followed by periods of silence. Brewer's Sparrows sing two types of song, a long and short song, that reflect pairing status, nest stage, and social context (Walker 2000). Both the intruder and nest-associated male we encountered sang long songs, which are more commonly used in aggressive encounters between paired males (Walker 2000). Perhaps a second nest was active at the Paulsen Creek site. Brewer's Sparrows have small breeding territories, and they have been suggested to be loosely colonial, with densities driven in part by conspecific cueing (Walker 2000, Harrison et al. 2009) and by local weather variables (Best and Petersen 1985, Cody 2008).

DISCUSSION

To date, the Timberline Sparrow has been reported in Alaska primarily in the 6-week period from June to mid-July. However, there are several reports of migrants at sea level in southeast Alaska in early June and in late October (Figure 1A). The only fall reports in Alaska, at Ketchikan (Heinl and Piston 2009; B. Limle pers. comm.) are notably late, as Brewer's Sparrows have not been seen in nearby British Columbia after 1 October (https://ebird.org).

Though undetermined at the landscape scale, suitable breeding habitat is likely distributed broadly if patchily across east-central Alaska. Aerial surveys of 4600 km^2 in the 1990s identified 61 km^2 of habitat (Doyle 1997). In the absence of repeated surveys, most of our current knowledge of the species in Alaska is based on repeated visits to the Nuzotin Mountains and Gold Hill area. However, these observations are beginning to clarify this population's breeding phenology. Previous observations of breeding behavior, our discovery of a nest with eggs on 27 June 2020, and observations of fledged young from 10 to 12 July, likely from a used nest found above Chathenda Creek (Z. Pohlen pers. comm.), allow the inference of breeding chronology. Brewer's Sparrows incubate for 10–12 days (Reynolds 1981), followed by a nestling period of 6–9 days before the young fledge, though many days before they achieve flight (Rotenberry et al. 1999). Back-dating from a known fledging date of 11 or 12 July 2020 suggests the eggs in the Chathenda Creek nest hatched between 2 and 6 July, with incubation and egg laying beginning as early as 20 June and 16 June, respectively. Doyle (1997) did not detect singing after 4 July, and Pohlen (pers. comm.) heard one distant bout of singing, and then primarily contact and agitated alarm calls, from 10 to 12 July 2020. In other parts of their range Brewer's Sparrows are known to double-brood or renest after a failure. But in the north the breeding season appears to be compressed, and double-brooding might not occur, as for other widely distributed songbirds nesting at high latitudes (Böhning-Gaese et al. 2000).

The timing of breeding in the Gold Hill area appears to be much later than to the south. Below 50° N the breeding season of Brewer's Sparrow begins in mid-May (Rotenberry et al. 1999) and at the southwest margin of its range in mid-April (Willett 1933). The earliest report of a Timberline Sparrow in the Gold Hill area is 16 June 2001 (P. Pourchot pers. comm.), and Doyle

(1997) detected none from 3 to 5 June 1995. Though these observations are few, reports of the species at Hyder and Juneau (Table 1) suggest that some Timberline Sparrows are still on migration during this period.

If Timberline Sparrows are responding to local weather conditions during migration and nest-site selection, their population density and timing likely vary from year to year. Moreover, the timing of snowmelt might be a primary driver of the birds' preference for south-facing slopes at high elevations in northern latitudes; in Alaska, the snow in the Timberline Sparrow's habitat typically melts before the end of April, at least one month earlier than on north-facing slopes and in alpine areas, according to Landsat satellite data, resolution 30 m (Macander et al. 2015). These conditions likely maintain preferred breeding habitat by controlling the vegetation's structure and phenology, leading to leaf-out around the time of first arrival in June. Cody (2008) reported both the density and timing of Brewer's Sparrow in shrub-steppe habitats at Jackson Hole, Wyoming, to be influenced by snow melt. Though unable to control for bias and inconsistency in effort (in terms of area covered, number of observers, and seasonal timing of observations), we note the similarity of the density of Timberline Sparrows in 1994 (0.75 birds/km^2) and in 2020 (0.77 birds/km^2). Taken together, with the continued availability of preferred habitats over this interval, it appears that the Gold Hill population is currently stable.

In the 1990s the Timberline Sparrow was considered uncommon and local in Alaska, while from 1979 to 2004 the nominate subspecies experienced a rangewide population decline of 50% (Holmes and Johnson 2005). The Timberline Sparrow's strong association with a narrow elevational band at the subalpine–alpine transition might place it at particular risk of decline because of habitat loss from climate change (Griffin et al. 2003) and spread of shrubs, as has been observed in the nearby Kluane region of southwestern Yukon (Myers-Smith and Hik 2018). As global temperatures rise, as much as 69% of current breeding habitat is projected to be lost and only 12% gained at higher latitudes and elevations across North America (Bateman et al. 2020). However, these models are not based on data sufficient to project changes in Alaska and the remote areas that Timberline Sparrows likely inhabit. Further study to separate the role of habitat plasticity from climate-driven adaptive response might identify fine-scale habitat preferences and add clarity to existing models.

Observations in 2020 suggest that habitat in the Gold Hill area remains suitable for breeding, but also highlight the fidelity of this species to this area and to its narrow habitat requirements. Using these traits in predictive modeling might help pinpoint current and potential future breeding localities (Griffin et al. 2003). Further investigation of the Timberline Sparrow's nesting ecology at the northern end of its range might reveal life-history traits that are vulnerable to disruption. Understanding the roles of philopatry and migratory connectivity would improve our understanding of this population's relationship with other northern populations, as well as with the nominate subspecies. These advancements in our foundational knowledge, in the perspective of the whole life cycle, would allow targeted conservation management during critical life stages.

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LITERATURE CITED

Baicich, P. J., and Harrison, C. J. O. 1997. A Guide to the Nests, Eggs, and Nestlings of North American Birds (2nd ed.). Academic Press, San Diego.

Bateman, B. L., Wilsey, C., Taylor, L., Wu, J., LeBaron, G., and Langham, G. 2020. North American birds require mitigation and adaptation to reduce vulnerability to climate change. Conservation Science and Practice 2(8):e242; doi org/10.1111/csp2.242.

Best, L. B., and Petersen, K. L. 1985. Seasonal changes in detectability of Sage and Brewer' s sparrows. Condor 87:556–558; doi.org/10.2307/1367964.

Böhning-Gaese, K., Halbe, B., Lemoine, N., and Oberrath, R. 2000. Factors influencing the clutch size, number of broods and annual fecundity of North American and European land birds. Evolutionary Ecology Research 2:823–839.

Cody, M. L. 2008. Snow meltout dates and breeding density in Brewer's Sparrows (*Spizella breweri*). Univ. Wyo. Natl. Park Service Res. Center Annu. Rep. 31(4):19–21; doi.org/10.13001/uwnpsrc.2008.3691.

Doyle, T. J. 1997. The Timberline Sparrow, *Spizella* (*breweri*) *taverneri*, in Alaska, with notes on breeding habitat and vocalizations. W. Birds 28:1–12.

Griffin, S. C., Walker, B. L., and Hart, M. M. 2003. Using GIS to guide field surveys for Timberline Sparrows in nothwestern Montana. Northwest Sci. 77:54–63.

Halley, M. R., Holmes, A. L., and Robinson, W. D. 2015. Biparental incubation and allofeeding at nests of Sagebrush Brewer's Sparrows. J. Field Ornithol. 86:153–162; doi org/10.1111/jofo.12098.

Harrison, M. L., Green, D. J., and Krannitz, P. G. 2009. Conspecifics influence the settlement decisions of male Brewer's Sparrows at the northern edge of their range. Condor 111:722–729; doi org/10.1525/cond.2009.090126.

Heinl, S.C., and Piston, A.W. 2009. Birds of the Ketchikan area, southeast Alaska. W. Birds 40: 51–144.

Holmes, J. A., and Johnson, M. J. 2005. Brewer's Sparrow (*Spizella breweri*): A technical conservation assessment. U.S. Forest Service Rocky Mountain Region, Lakewood, CO; http://www.fs.fed.us/r2/projects/scp/assessments/brewerssparrow.pdf.

Johnson, N. K., and Cicero, C. 2004. New mitochondrial DNA data affirm the importance of Pleistocene speciation in North American birds. Evolution 58:1122–1130; doi.org/10.1111/j.0014-3820.2004.tb00445.x.

Klicka, J., and Zink, R. M. 1997. The importance of recent ice ages in speciation: A failed paradigm. Science 277:1666–1669; doi.org/10.1126/science.277.5332.1666.

Klicka, J., Zink, R. M., Barlow, J. C., McGillivray, W. B., and Doyle, T. J. 1999. Evidence supporting the recent origin and species status of the Timberline Sparrow. Condor 101:577–588; doi org/10.2307/1370187.

Macander, M. J., Swingley, C. S., Joly, K., and Raynolds, M. K. 2015. Landsat-based snow persistence map for northwest Alaska. Remote Sensing Env. 163:23–31; doi.org/10.1016/j.rse.2015.02.028.

Mahony, N. A., Vander Haegan, W. M., Walker, B. L., and Krannitz, P. G. 2001. Male incubation and multiple brooding in Sagebrush Brewer's Sparrows. Wilson J.

Ornithol. 113:441–444; doi org/10.1676/0043-5643(2001)113[0441:MIAMBI]2.0.CO;2.
Myers-Smith, I. H., and Hik, D. S. 2018. Climate warming as a driver of tundra shrubline advance. J. Ecol. 106:547–560; doi.org/10.1111/1365-2745.12817.
Reynolds, T. D. 1981. Nesting of the Sage Thrasher, Sage Sparrow, and Brewer's Sparrow in southeastern Idaho. Condor 83:61–64; doi.org/10.2307/1367605.
Rotenberry, J. T., Patten, M. A., and Preston, K. L. 1999. Brewer's Sparrow (*Spizella breweri*), *in* The Birds of North America (A. F. Poole and F. B. Gill, eds.), no. 390. Birds N. Am., Inc., Philadelphia; doi org/10.2173/bow.brespa.01.
Sibley, C. G., and Monroe, B. L. 1990. Distribution and Taxonomy of Birds of the World. Yale Univ. Press, New Haven, CT.
Swarth, H. S., and Brooks, A. 1925. The Timberline Sparrow: A new species from northwestern Canada. Condor 27:67–69; doi.org/10.2307/1363056.
Walker, B. L. 2000. The structure use and function of song categories in Brewer's Sparrows (*Spizella breweri*). M.S. thesis, Univ. Mont., Missoula. Graduate Student Theses, Dissertations, & Professional Papers 6554; https://scholarworks.umt.edu/etd/6554.
Willett, G. 1933. A revised list of the birds of southwestern California. Pac. Coast Avifauna 21.

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