THE NATURE AND CAUSES OF THE 'COASTAL HIATUS'

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THE object of this paper is to re-examine the nature and causes of the so-called 'coastal hiatus' in the springtime migratory birdlife of our southern states. The hiatus lies along the northern shore of the Gulf of Mexico and extends several hundred miles inland. Within it transient birds are "extremely rare, highly intermittent in their occurrence, or even wholly absent during many consecutive spring migrations" (Lowery, 1945: 119). Cooke (1904: 378; 1915: 33), Chapman (1907: 17), Lincoln (1939: 50–51), and many other ornithologists aside from Lowery and myself have recognized this hiatus, and Lowery (1945: 119) believes it exists because transients arriving from across the Gulf "do not come down immediately on reaching land but fly far inland before descending."

On the other hand, I have maintained in two articles (1945; 1947) that evidence for large-scale trans-Gulf migration is lacking, and that, on the basis of the actual evidence at hand, we must believe that the really significant migrations from south of the United States "take the coastwise routes *around* the Gulf" through Florida and Texas.

One of the just-mentioned articles (1947) suggested, but for want of space and adequate evidence did not develop, certain independent hypotheses concerning the coastal hiatus. The present paper examines those hypotheses in the light of evidence accumulated in the intervening years.

Meanwhile, however, it should be said that Lowery has modified his original views about the hiatus. He now believes (he informs me) that the hiatus is more apparent than real; that trans-Gulf migrants actually do land in numbers within the hiatus, but are dispersed so widely and thinly over a very large area that they are seldom observed. Since the very nature of this particular hypothesis makes either verification or refutation impossible, the present paper must deal with it as only a part of the overall picture. The main difficulty with it is that incontrovertible evidence of large-scale trans-Gulf migrations is still lacking.

Confession of Error

Since writing the two papers mentioned above, I have been able to make telescopic observations of night migrants. These observations have been less extensive and regular than I could have wished. But since 1947 there has hardly been a clear moonlit night in April or May that I have not spent from one to four hours (as the press of other business permitted) from early in the evening till after midnight, and on two occasions all night long, observing migrants at Houston; at a place 10 miles southwest of Houston; on Galveston Island; on Matagorda Island; and at Rockport, Texas. Erratic as these observations have

been, they have amounted, all told, to many hours of work. They have convinced me that my original papers on trans-Gulf migration contained errors.

1. Both Lowery and I were impressed by the fact that spring migrants accumulate in great numbers along the Gulf coast during passage of a cold front, *no matter what hour the front strikes*. Accordingly, we agreed that spring migrations proceeded steadily and continuously (Lowery, 1945: 112; Williams, 1945: 108). Telescopic observations, however, do not confirm these conclusions. In the first place Lowery (whose telescopic work has been more extensive and consistent than mine) informs me that, normally, migration reaches a peak at certain hours of the night, and falls away sharply thereafter. And in the next place, I myself have noted that, on some nights during the spring migration along the Texas coastal plain, only 5 to 15 birds an hour will cross the moon's face; but on other nights they will pour across by the score—on one occasion (May 5, 1947) in such numbers during a two-hour period that, literally, they could not be counted.

This difference in the number of birds passing at different hours and on different nights requires that another explanation be found for the invariable accumulation of birds on the coast whenever a cold front passes.

2. Another seeming error in my original paper was its almost exclusive emphasis on coastline migration. Coastline migrations do occur. I have witnessed them repeatedly both by day and by night. The daylight migrations have involved many species and many individuals of land and water birds. Moreover, the coast undoubtedly forms a kind of sideline, as on a football field, which birds follow when unfavorable meteorological conditions make inland migration difficult.

But though the coastline migration exists, is vastly important, and must always be reckoned with, it is not exclusive. Telescopic observations have shown that, along the Texas coast, night migration may be very pronounced at least 50 miles inland.

Southern Migration Patterns

The number of individual migrants passing north along the lower Texas coastal area is simply incredible. Thus, Mrs. Conger Hagar and Fred M. Packard, in a study of birds in the Rockport-Corpus Christi area of Texas (the manuscript of which I have seen) speak of 500 Yellow-throats (*Geothlypis trichas*) counted together in a 100-foot row of young salt-cedars (*Tamarix*); 57 Bay-breasted Warblers (*Dendroica castanea*) in one tree and hundreds flocking through the adjacent area; 500 Tennessee Warblers (*Vermivora peregrina*) in a single day; waves of thousands of Baltimore Orioles (*Icterus galbula*) in a day or two; Scarlet Tanagers (*Piranga olivacea*) several dozen at a time; 50,000 Barn Swallows (*Hirundo rustica*) within two hours—and so on.

No such concentrations of birds have ever been reported in Texas outside the immediate coastal area. For example, at Austin and Dallas, regions well worked

by ornithologists, the very best days in the field produce hardly one-twentieth the number of individual birds of most migrant species appearing in the Rockport area. Furthermore, at least half the 65–70 transient species recorded as regular and abundant in the Rockport area in spring are listed as "rare", "uncommon", "scarce", or "irregular" at Austin (Simmons, 1925) and at Dallas (Stillwell, 1939). The same is true of the central Oklahoma region, about 500 miles directly north of Rockport (Nice, 1931). Finally, many species (the warblers in particular) that pass through the Rockport area do not nest, and seldom appear, in the Plains region northward from Rockport to Canada. It seems obvious, therefore, that all those birds which travel along the lower Texas coastal area in such vast numbers do not continue straight northward toward Austin, Dallas, central Oklahoma, and the Great Plains. What, then, does become of them?

The answer to the question is suggested by two facts: First, a large proportion of the land species transient through the Rockport area breed largely to the northeast of Rockport, in the wooded and mountainous regions of eastern North America. Indeed, the following species, all common transients through the Rockport area, breed entirely (or with minor and casual exceptions) east of the Rockport meridian: Wood Thrush (*Hylocichla mustelina*), Worm-eating Warbler (*Helmitheros vermivorus*), Golden-winged Warbler (*Vermivora chrysoptera*), Blue-winged Warbler (*Vermivora pinus*), Parula Warbler (*Parula americana*), Cerulean Warbler (*Dendroica cerulea*), Blackburnian Warbler (*Dendroica fusca*), Hooded Warbler (*Wilsonia citrina*), Canada Warbler (*Wilsonia canadensis*) and Louisiana Water-Thrush (*Seiurus motacilla*).

Second, telescopic observations in the general region about Houston show a huge majority of night migrants flying, not north, but northeast, or north-northeast. Except when cold fronts are imminent, observation at any given hour will show that 60% to 90% of all birds seen are traveling northeast, or north-northeast. This is true of any date in April or May, or any hour of the night. All told, the average of birds traveling in this direction in any one hour is about 80% of the birds actually seen. A good typical night, in the midst of an extensive period of warm, bright weather, was May 3, 1947, when I used the telescope 2 hours and 15 minutes between 7:45 and 10:45 p.m. Birds seen were as follows: 3 going north, 2 going northwest, 5 going southwest, 47 going between east and north-northeast.

These two circumstances seem to allow of no other interpretation than that the birds passing so abundantly through the Rockport area must fan out, as they proceed, in a great triangle like that indicated in Figure 1.

But this triangle is not necessarily rigid, as it appears to be in the figure. An aggregate of hundreds of daylight observations, as well as a few nighttime observations, suggest that the triangle may waver from side to side. The push of a cold front on the northwestern edge of the triangle may compress it against the coast, where it coalesces with the regular coastwise migration. Or the flow

of warm air from the south, with clear weather to the north, may swing the triangle far to the northward. Or various combinations of meteorological factors may affect it in other ways.

That this western triangle of migration exists seems certain. Whether there is a corresponding triangle extending up from Florida has never been investigated. Lowery tells me that its existence is not confirmed by the small amount of telescopic evidence now at hand. But if such a triangle exists, it must involve fewer species and fewer individuals (Williams, 1945: 103) than those of the western triangle.

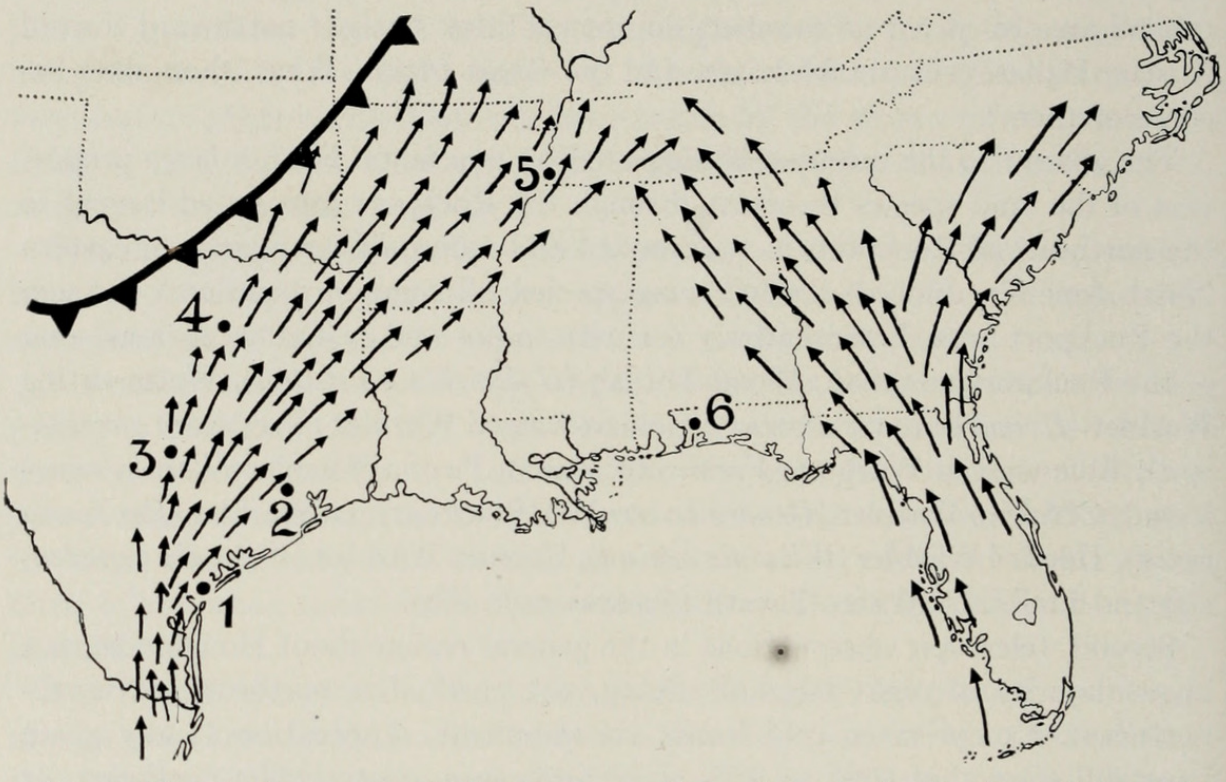

FIG. 1. Map to show spring bird migration patterns through the Southern States. The 'coastal hiatus' is obvious. The heavy barbed line across the northwest represents a typical cold front advancing toward the southeast. Places mentioned in the text: 1. Rockport; 2. Houston; 3. Austin; 4. Dallas; 5. Memphis; 6. Pensacola.

Nevertheless, when one recalls that certain species generally recognized as entering North America almost exclusively through Florida in spring breed in areas extending far to the northwest, north, or northeast of Florida, it seems probable that the eastern migration triangle exists for a few species at any rate, and perhaps for some individuals of many species. Birds in this category are the Cape May Warbler (*Dendroica tigrina*), Black-throated Blue Warbler (*Dendroica caerulescens*), and Bachman's Warbler (*Vermivora bachmanii*), and probably the Swainson's Warbler (*Limnothlypis swainsonii*), Kirtland's Warbler (*Dendroica kirtlandii*), Prairie Warbler (*Dendroica discolor*), Black-poll Warbler (*Dendroica striata*) and Bobolink (*Dolichonyx oryzivorus*). It is interesting that, according to Weston (1938: 222), the area 50–60 miles from the

Gulf inland from Pensacola has a more nearly "normal" migration than Pensacola itself. This is what we should expect if the eastern migration triangle exists. Furthermore, Weston has repeatedly remarked, in his reports from Pensacola appearing in *Audubon Field Notes*, that Swainson's, Cape May, Black-throated Blue and Black-poll Warblers, as well as the Bobolink, are rare "this far west"; yet all these birds are recorded as common spring migrants through Georgia (Greene et al., 1945). Again, this is what we should expect if the eastern migration triangle does exist.

The Coastal Hiatus

If the two migration triangles just mentioned really exist (and the western one certainly does), the coastal hiatus postulated by Cooke (1904) long ago, and described by Lowery (1945) more recently, is that land area which lies south of and between the two migration triangles.

Lowery's description (1945) outlined three characteristics of the hiatus: (a) Along the Mississippi Valley "the northern edge of the hiatus must lie to the south of Tennessee"; the southern edge lies along the coast (p. 106). (b) Many transients "are recorded consistently much earlier in Tennessee, for example, than on the coast itself" (p. 103). (c) The number of individuals and of species recorded within the hiatus "do not seem to approach those recorded slightly farther north" (p. 106); the region about Memphis, Tennessee, in particular, "throngs day after day with migrants" (p. 106).

The hypothesis of the two migration triangles fits this three-fold characterization like a glove. Specifically, (a) birds traveling along the two triangles would not enter the region of the hiatus except under the push of unfavorable weather northward from the triangles. (b) In good weather (warm and clear) they would reach Arkansas, Tennessee, Missouri, Kentucky, and northern Mississippi, northern Alabama, and northern Georgia before appearing within the hiatus. (c) The numbers of individuals and of species traveling along the triangles would be greater than the number that normally entered the hiatus.

Transients in the Hiatus

1. *Arrival Dates.*—Weston (1948) points out that during 30 years of observation at Pensacola, Florida, he has consistently "recorded 'first arrivals' here in spring on dates that afterward proved to be later than the bulk arrival date of the same species at some point much farther north." Likewise Lowery (1945) has shown that a large percentage of transient species have been recorded earlier at Memphis, Tennessee, than at Baton Rouge, Louisiana, or anywhere on the Gulf from Pensacola to western Louisiana. The traditional explanation has long been that trans-Gulf migrants during good weather "pass over the Gulf coast in the spring and proceed far inland before descending" (Lowery, 1945: 103).

This explanation might accont for the phenomenon. But it requires our

believing that tiny land birds would fly at least 950 miles (the south-north distance from Yucatán to Memphis) without stopping, and 400 miles after their first landfall. Lowery suggests (1946: 205) that some of the migrants begin their flights from southern Yucatán, or "points even farther south." The non-stop flight to Memphis might thus cover about 1200–1300 miles.

Though the 500–600 mile flight across the Gulf itself is not impossible, the longer distances involved seem fabulously great for the regular migrations of small birds. The two migration triangles here described offer a much more logical and credible explanation of those good-weather discrepancies that have long been noted in arrival dates.

2. *Bird Waves.*—All along our Gulf coast the arrival of a cold front in spring is almost invariably accompanied by the appearance of hosts of migrants in the immediate coastal area. Weston in Florida, Burleigh (1944) in Mississippi, Lowery (1945) in Louisiana, and all observers on the Texas coast are familiar with this spectacular phenomenon. The traditional explanation of these bird waves is that migrants coming in from off the Gulf meet the cold front and, unable to make headway against it, accumulate on the coast and wait for it to pass.

At this point the reader's attention should be called to the fact that birds migrating in spring may retreat long distances with, or ahead of, a cold front. This phenomenon has been analyzed in some detail in a recent paper (Williams, 1950).

What seems to happen, during the passage of a cold front, to the birds migrating along the western triangle is this: they are struck on their port beam by the cold front coming, usually, out of the northwest or north-northwest. They veer off-course, and fly with the front, or ahead of it, toward the east or southeast. That is, they invade the coastal hiatus. But they do not usually stop within the hiatus itself; they press on till they see the waters of the Gulf ahead of them. Fearing to be swept out to sea, they plunge to earth and "pile up" there. Some of them may even be swept out to sea in the darkness, and return to land the next morning. Or perhaps, being crowded between the cold on the left and the sea on the right, they struggle eastward in a narrow column, hugging the coast, till the cold abates; then they turn and resume their flight directly toward their original destination. In any event, the number of individuals that appear on the coast is tremendous because the whole width of the migration triangle, with its vast numbers of migrants, has been swept clean, and the birds compressed into the narrow coastal area.

This intrepretation of the coastal concentrations is consistent with the following facts:

(*a*) The concentrations appear on the coast, no matter what hour the cold front strikes.

(*b*) The concentrations appear not merely, or even largely, in our coastal area opposite Yucatán (as would probably be the case if the birds had arrived from across the Gulf), but in the entire coastal area from Brownsville, Texas, to

Pensacola. This wide dispersal along the coast is what we should expect if the interpretation here offered is sound.

(*c*) Even when a cold front advances from almost due west, as sometimes happens, a concentration of birds will occur on the southern Texas coast. Moreover, some of the species involved—for example, the Hepatic Tanager (*Piranga flava*), Violet-green Swallow (*Tachycineta thalassina*), White-throated Swift (*Aëronautes saxatilis*), and Black-chinned Hummingbird (*Archilochus alexandri*)—have never been regarded as trans-Gulf migrants.

(*d*) Only occasionally (about once every spring) does a cold front strike the Gulf coast from the northeast. Accordingly, the characteristic birds of the eastern triangle (Cape May, Black-poll, Black-throated Blue, and Prairie Warblers, and even the Bobolink) are much more rare along the coasts of Texas, Louisiana, Mississippi, and the northwestern arm of Florida than are birds of the western triangle; and when these eastern birds do appear, they nearly always accompany one of the rare northeastern fronts. Furthermore, these birds of the eastern triangle become progressively rarer as we move westward along the coast; and conversely, characteristic birds of the western triangle become progressively more scarce as we move eastward along the coast (Williams, 1945: 103). These peculiar, but regular, diversities would not occur if the birds were coming from across the Gulf.

3. *Birds on the Gulf of Mexico.*—Vagrant land birds are seen rather commonly on all the world's seas (Williams, 1947: 229–231). I have records of Blue Jays (*Cyanocitta cristata*), Starlings (*Sturnus vulgaris*), Towhees (*Pipilo erythrophthalmus*), Brown Thrashers (*Toxostoma rufum*), and other species *not* migratory to regions south of the United States, coming aboard ships 30–150 miles out in the Gulf of Mexico, as well as a banded homing pigeon (from San Antonio, Texas) released in New Orleans on June 4, 1949, and coming aboard a ship, 50 miles south of Cameron, Louisiana, on the morning of June 6.

But I have investigated every report known to me concerning *numerous* birds on the Gulf of Mexico in spring. Invariably (and I wish to emphasize the *invariably*) a cold front had passed out over the Gulf within, at the very most, 36 hours before the time when the birds were reported.

It had long seemed to me that these birds had been swept out to sea by the cold front, and were struggling back to land when seen; that they were *not* trans-Gulf migrants. Having had no experience with birds on the Atlantic coast, I was surprised to find that Peterson (1948: 161) described the very same phenomenon on the Atlantic coast, where trans-oceanic migration is out of the question. Telling of autumn migrants at Cape May, New Jersey, Peterson described the effect of "a northwest wind blowing across the traditional lanes of travel of birds moving southward." He continued: "The birds drift southeastward in the moving mass of polar air, and if the wind is strong enough, the night migrants are carried out to sea in the darkness. At daybreak, near the Cape May Light, I have watched small birds, weak and tired, beating their way in over the surf, tacking into the stiff northwesterly breeze that had car-

ried them offshore." Similar refugees on our Gulf coast have long been called trans-Gulf migrants. Much more probably, they are birds that cold fronts have pushed across the coastal hiatus and out to sea.

Summary

The 'coastal hiatus' of our Gulf States appears to be a lacuna south of and between two great spring migration triangles, one extending north and northeast from southern Texas, the other extending northwest, north, and northeast from Florida. In this lacuna few transient species occur during fair, warm weather.

Periodic cold fronts, with northerly winds, striking the northern sides of these migration triangles, push migrants down against the coast, where they are often seen in great numbers immediately after the passage of a cold front. Sometimes the cold fronts push birds out over the Gulf itself, where they have been mistaken for trans-Gulf migrants.

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