closely resemble the adults in coloration. They remain in the burrow for twenty-eight days or more, not leaving until they can fly well.

8. Both parents feed the nestlings, bringing them a variety of insects and an occasional lizard. No effort is made to clean the nest, which soon becomes filthy and malodorous. Yet the young emerge with their beautiful plumage unsoiled.

9. The subterminal portion of the central tail feathers of both juvenile and adult birds is denuded of the vanes while these feathers are still no longer than the lateral ones.

10. Observations are given on the process of denudation of the shafts of the central tail feathers of the Lesser Broad-billed Motmot (*Electrón platyrhynchum minor*). In this species, denudation does not begin until the feathers are nearly or quite full-grown.

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LOWERY ON TRANS-GULF MIGRATIONS

BY GEORGE G. WILLIAMS

A COUPLE of years ago I wrote a brief article (1945) saying that all available evidence pointed to the existence of major spring migration routes around the sides of the Gulf of Mexico, and that no good evidence for trans-Gulf migration in spring existed. Mr. George H. Lowery, Jr. (1946) has replied with a long article defending the traditional belief in trans-Gulf migration. His article is important enough to deserve the most careful analysis. The present paper, therefore, making no pretense to originality, devotes itself entirely to an examination of Lowery's contribution.

His article contains a wealth of new and valuable material which will be mentioned in due course. It contains also a wealth of errors. These belong to six principal types: lengthy straw-man arguments about admitted matter, misinterpretation of other observers' data, misinterpretation of original data, misinterpretation of my first article, cardinal omissions, and a tendency to formulate large general laws on the basis of a minute amount of fact. This last type of error pervades the whole article; the other five will be considered here in the order named.

1. ARGUMENT ON ADMITTED MATTER

1. Lowery continually implies that anyone's doubts about trans-Gulf migrations must rise from doubts as to the migrants' ability to

fly across the Gulf of Mexico. Yet I am unable to recall anyone who has ever maintained that a trans-Gulf flight is impossible. Reasons why birds go around the Gulf instead of across it are geological, evolutionary, and distributional; they have little relation to the birds' powers of flight.

2. Whether or not birds migrate across the Gulf in autumn has nothing to do with the problem of spring migration. It so happens that I have long known that some birds (especially young ones) cross the Gulf in autumn. But this has no bearing on the immediate problem of spring migration.

3. The so-called "coastal hiatus" which Lowery enlarges upon in the paper under discussion, as well as elsewhere (1945), has been universally recognized for years. But it proves nothing about trans-Gulf migration. Like the Ptolemaic system of astronomy, Lowery's explanation of the hiatus is one method of accounting for observed phenomena; but it is not necessarily the best method.

4. Lowery would impute to me the belief that *no* birds ever cross the Gulf of Mexico in spring. I never had such a belief; and my article stated the opposite very clearly: "It would be foolish for any man to say that no birds ever fly northward across the Gulf of Mexico in spring, or to deny that some individual birds may fly across the Gulf every spring." When millions of birds are migrating all around the central Gulf area during two months' time, it would be a miracle if no birds at all ever appeared out over the Gulf.

Lowery's extensive discussion of all this admitted matter gives a false impression of the problem. Future writers should stick to the point at issue.

II. Interpretation of Other People's Data

Like myself in my first article, Lowery leans heavily on two old published reports of trans-Gulf migrants—the papers of Frazar (1882) and of Helmuth (1920). He relies also on a series of notes made on a trans-Gulf voyage by his friend, Lieutenant Joseph C. Howell. I shall consider these three in turn.

1. The core of my analysis of Frazar's paper was that the birds he saw during a hard norther 30 miles south of the mouths of the Mississippi contained not only migrants, but also birds that do not occur south of the Gulf, birds known to migrate by land, and common winter residents of Louisiana. It was argued, therefore, that the birds he saw must have been blown southward from Louisiana; they were not migrating across the Gulf. Lowery answers this argument as follows:

By the same line of reasoning, one might argue that the birds could not have come from Florida since the flight contained large numbers of birds extremely rare in that state, and, moreover, they could not have come from Texas since the flight contained large numbers extremely rare there. However, the fallacy of such an argument is obvious. The birds must have come from somewhere. The fact that some birds in a flight originated from one source does not show that other birds in the flight could not have come from other sources. The idea that the bulk of Frazar's birds were trans-Gulf migrants involves at most the assumption that strays from the mainland may mingle in a trans-Gulf flight. Williams's theory, on the other hand, seems to require that birds were carried out to sea from three directions by a wind blowing from only one.

What a distorted picture of my argument is this! My analysis of Frazar's observations was quite simple: Birds were migrating along the Louisiana coast, some from the west, perhaps, and some from the east; other birds wintering in Louisiana were a-wing in the coastal region; a hard wind from the north came down suddenly and blew many birds, both migrants and winter residents, out to sea. One wind blew all the birds in one direction.

2. The argument was much the same with Helmuth's paper, except that I doubted (and still doubt) whether Helmuth was 125 miles from land, as he said he was, when he saw birds at sea in the midst of another norther with "terrific wind and rain." As a matter of fact, however, Howell's subsequent observations of migrants much farther from shore makes the argument here relatively pointless.

Helmuth saw, among other birds, a Henslow's Sparrow, Robins, and Louisiana Herons. Since the first two species do not winter south of Louisiana, I thought they must have been blown southward from the Louisiana coast.

But Lowery dismisses the Henslow's Sparrow as a case of mistaken identification—despite Helmuth's statement that the bird "stayed with us all day, very tame, and ate crumbled hard-tack and drank water from the boat-covers." Under these circumstances, throwing out this piece of evidence seems hardly justifiable. It is not like Lowery, who is a brilliant and careful scientist, and whose mistakes in the paper under discussion can be attributed only to an eagerness to defend a preconceived and long-cherished faith.

His treatment of Helmuth's Robins is almost equally unscientific. In the last 80 years, four birds identified as Eastern Robins have been reported from south of the Gulf. On the strength of these reports, Lowery says that the Robins Helmuth saw must have been migrating from south of the Gulf. Here is an example of a broad generalization made on the basis of a very small amount of concrete evidence. Virtually all biological principles are based on major proba-

bilities, not rare exceptions, and, so far as we know today, Eastern Robins directly south of the Gulf of Mexico are rare exceptions to the general rule.

Anyhow, Helmuth's Robins came aboard ship in the evening, after the "terrific wind and rain" that rolled the ship over to a 42 degree angle had been blowing all day. Is it reasonable to suppose that the Robins would have been able to push their way northward all day in the face of this storm? The same question is applicable to the Henslow's Sparrow and to the Louisiana Herons, which came aboard the ship the next day, *after the stormy weather had prevailed for at least 24 hours.*

Of the Louisiana Herons, I said originally: "The species is not known to migrate from regions south of us to Louisiana." Lowery, however, points out, very properly, records of two Louisiana Herons banded as nestlings in Galveston and recovered in autumn in southern México. Galveston is not Louisiana, and autumn is not spring. Nevertheless, Lowery makes a point there.

Otherwise, however, the relation of Helmuth's and of Frazar's papers to the problem of trans-Gulf migration remains exactly what it was when my paper appeared. They prove only that a hard offshore wind can drive birds far out to sea.

3. According to notes quoted in Lowery's article, Lieutenant Joseph C. Howell crossed the Gulf of Mexico from Galveston to the Yucatán Channel on May 3–6, 1945. On May 4–5 he counted 21 species of birds and at least 65 individuals aboard his ship when it was 121 to 361 miles south of the northern Gulf Coast. All but one of the birds seen on those days came aboard the ship; all were in a state of extreme exhaustion; and most of them stayed on board for at least 12 hours, some for more than 24 hours.

Lowery thinks that the birds had been migrating northward across the Gulf, and that "a moderate northerly wind blowing in the central Gulf area on May 3–5" was sufficient to halt their progress, and drive them exhausted to Howell's ship. As a matter of fact, however, the wind in the central Gulf area did not freshen past 12 m. p. h. till between 12:30 A. M. and 6:30 A. M. on May 4, and never passed beyond the 13–18 m. p. h. stage at any time. Furthermore, the skies remained clear.

Howell does not say exactly when the first birds came aboard, but he does say that most of them "came aboard during the daylight hours of May 4. No time of day was favored over any other." But since birds in mid-Gulf could not have met the fresh head-winds

until the early hours of May 4, they could not have been struggling against the wind (when they came aboard the ship exhausted) any longer than if they had been making an uneventful flight to the Louisiana or Texas coast. To call it a "struggle," indeed, is not quite accurate; the birds merely move forward at a certain air-speed, and are borne backward or forward or sidewise, as the case may be, by the air-mass in which they are suspended. What matters is the *time factor,* in so far as exhaustion is concerned. Why, then, should these birds, which (according to the trans-Gulf theory) had been on the wing no longer than would have been required for an ordinary Gulf crossing, be exhausted almost to the point of death? Lowery's explanation of their presence on the ship, and of their exhaustion, seems far-fetched. He is trying to defend an old theory, not to explain new facts.

But is there any reasonable explanation of the birds on Howell's ship, and of their exhausted condition? Yes, there is—though Lowery deliberately refrains from discussing it. The crucial period is May 3–5, 1945. Consultation of the weather data for the period reveals the following:

May 2: A cold front that extends in a southwest-northeast direction lies across central Texas, and is moving from the northwest toward the Texas coast.

May 3: General rains occur all along the Texas coast; the forward edge of the cold front moves out into the Gulf on a line roughly parallel with the Texas coast; a drop in temperature occurs all along the coast.

May 4: The temperature drops still further; steady northwest winds are blowing from the coast.

May 5: Winds on the coast shift to the east and southeast; the temperature begins to rise.

This was a major cold wave. Mr. E. A. Farrell, Meteorologist in Charge, U. S. Weather Bureau, Houston, Texas, writes to me: "The temperature along the Gulf Coast averaged 15°–20° below normal during the cold spell of May 4–5, 1945." Only two or three times previously in more than 20 years had the temperature in spring after April 25 fallen so low at key points along the Texas coast.

Knowing these extraordinary weather conditions, we can understand Howell's extraordinary visitation of birds. Presumably the birds were migrating along the western coast of the Gulf on the night of May 2–3. The cold front descending from the northwest struck them on their port beam sometime that night or early in the day-

light hours of May 3. To avoid the rains and the intense and unusual cold pressing from the interior of the country, the birds veered to starboard, out over the Gulf. As the cold kept increasing in intensity; as the cold air-mass kept coming down from the northwest like a great moving wall, pushing the birds before it; as the offshore winds began to catch the birds; and as the birds became more and more exhausted as they remained longer and longer on the wing, some of the birds eventually found themselves flying along more or less parallel with the cold front without venturing, or without having the strength, to resist its cold temperature or its steady offshore winds. This course ended in the birds being well out over the Gulf, where Howell saw them. Moreover, since they had probably been on the wing since the night of May 2–3, they were utterly exhausted when they came aboard Howell's ship in the daylight hours of May 4.

This interpretation seems much more consistent with fact and with reason than does Lowery's interpretation.

It may be worth noting, too, that every species that Howell saw was one that was said, in my first article, to be a migrant along the Texas coast. Moreover, the Red-backed Sandpiper (of which Howell saw one individual) does not normally winter south of the southern tip of Texas and the northern extreme of México. Unless it was one of those rare exceptions upon which Lowery tends to build broad hypotheses, it was not migrating northward across the Gulf.

III. Interpretation of Original Data

On a trip which he took southward across the Gulf of Mexico from New Orleans to Yucatán on April 30–May 2, 1945, Lowery saw about 56 land birds. Of these, all but 11 were Barn Swallows. These latter will be discussed presently; but just now I wish to examine more carefully the other 11 birds.

1. It may be recalled that my original thesis was this: The spring migrations occur along the coasts of the Gulf, sometimes right over the shoreline, sometimes well back from it or well out over the water, sometimes cutting chords across indentations in the coast, but, in general, following the actual broad outlines of the coast, and more or less within sight of it.

Now, of the 11 land birds (not counting Barn Swallows) that Lowery saw on his two-day trip southward, he saw four within three miles of land, and one within eight to nine miles of land, and all five within the space of about an hour near sunrise one morning. That leaves only six land birds (still not counting Barn Swallows) for his remaining two days at sea. Even of these six, however, one

is an intermediate case: it was observed at 6:45 in the morning, only 21 miles from land, and was making toward the land, which it could undoubtedly see from a couple of hundred feet in the air. We have as much right to believe that the bird had been migrating along the coast in the early dawn, and had wandered slightly off-course as to believe that it was a trans-Gulf migrant.

In contrast to this concentration of birds near the shore, the other five birds were scattered out over 500 miles of sea. Of these five birds, three came aboard the ship; and of these three birds, two stayed on the ship long enough to be carried 189 miles in the wrong direction, and the other, "very tame," apparently remained on the ship for some time. That leaves only two birds, a Least Sandpiper and a Mourning Dove, which did not act like casual strays. But even these two birds circled the ship several times (as if they were lost?) before continuing away from it.

2. The Barn Swallows Lowery saw on his trip southward deserve special comment. My own article pointed out that Barn Swallows in considerable numbers had been observed migrating northward 20–30 miles off the Texas coast, parallel with the lower coast. But (I admit frankly) I did not think that even this flight, as its edges expanded eastward late in the season, would produce 45 swallows in two days. This is certainly an important count in Lowery's favor.

On the other hand, these 45 were an infinitesimal fraction of the Barn Swallows that would have been seen at the same time of year at almost any spot along the Texas coast. For example, I am just in receipt of a note from Lieutenant Commander Fred M. Packard in which he informs me that about 50,000 Barn Swallows passed over the Naval Air Station at Corpus Christi on the evening of April 30, 1946—a year to the day after Lowery saw his 45 Barn Swallows in two days. On May 5, 1946, I stood on the beach at Rockport for eight minutes and counted the Barn Swallows flying past parallel with the beach; I counted 118 in the eight minutes, or about two and one-half times the number Lowery saw in two days. Moreover, my count included only those in sight from the beach, not those which were migrating at the same rate all day long not only on the beach but also several miles back of it. Finally, it should be mentioned that Rockport is separated by a wide bay and an island from the Gulf beach itself, where the really major migrations occur.

3. On his trip from Yucatán back to Louisiana on May 10–11, 1945, Lowery saw no Barn Swallows (though the species is regularly observed on the Texas coast until late May or early June). But he

saw 11 other land-birds at distances from Louisiana of 342 to 16 miles. Three of these birds—Cape May Warbler, Bobolink, and Gray Kingbird—are known to have their regular migration routes through Florida almost exclusively. Indeed, up until the time Oberholser's book on 'The Bird Life of Louisiana' (1938) appeared, there were only three records of Cape May Warblers from the entire state of Louisiana, there was no record of a Gray Kingbird, and Bobolinks were extremely rare along the coast except in the east. The Gray Kingbird (seen by Lowery 32 miles from the coast of Louisiana) is an almost incredible anomaly. Without Lowery's notation: "I have no doubt whatever regarding the correctness of this identification," one would certainly doubt the record.

The very presence of a Floridian species like the Gray Kingbird hundreds of miles west and north of its usual range, and of the Cape May Warbler (which winters in the West Indies) out in the middle of the Gulf far to the west of its normal migration route, should have suggested to Lowery that something abnormal was occurring; and he should have looked for an explanation that would fit the case.

The explanation is there. Upon reading in Lowery's paper about the Cape May Warbler and the Gray Kingbird, I wrote to the U. S. Weather Bureau at Key West to ask whether any unusual weather phenomena of the May 8–11 period in 1945 might account for the birds on the Gulf; the usual weather charts had revealed no credible explanation. Mr. S. M. Goldsmith, Junior Meteorologist in Charge, became interested in the problem, and went to considerable trouble to give me data on the period. In his letter he wrote: "Apparently there was no unusual weather phenomenon in this immediate vicinity." But he added the following:

> Evidently the Everglades region (a vast muckland covering most of the southern peninsula of Florida) had some fires burning. The winter months are the dry season in south Florida. The water table in the Everglades region fed by Lake Okechobee, a large fresh-water lake in the interior of the southern section of the State, reaches the minimum during April & May. Campers, hunters, automobilists and fishermen are prone to leave campfires burning with resultant fires throughout the sawgrass section. Even farmers in burning off dead vegetation allow the fires to become uncontrolled. Lightning sets some fires but thunderstorms attended by severe lightning are rather rare in April. But once fires begin, the muck, which is a species of peat, burns slowly and to a great depth. Of course, smoke pours from the earth and at times reduces visibility to nil and blots the sun or moon from the sky. From a perusal of the record it seems certain that such fires attended the Everglades region during the period mentioned, and is it not possible that birds flying northward would become confused in such a smoke pall and veer off course? Then is it not possible that flying at various altitudes above the earth, the terrain would be blotted from their sight by such smoke and again be a cause of maldirection of movement?

Mr. Goldsmith appends the following table:

May 7, 1945: Smoke from Everglades fire restricting visibility at Key West to 2 miles in the morning and 4 miles in the p. m.
Light smoke which began day before 2000
Visibility as follows: 7 a. m. 2 miles; 1 p. m. 4 miles; 7 p. m. 6 miles
May 8, 1945: Visibility as follows: 1 a. m. 8 miles
Haze began 1400 ended 1730
May 10, 1945: Haze began 1025 ended 1930

Meanwhile, according to Mr. Goldsmith's notation, a steady southeast wind of 6–12 m. p. h. was blowing at Key West.

If conditions of visibility were such as Goldsmith describes at Key West and near-by Boca Chica, more than 50 miles from the nearest point on the mainland, they must have been far worse on the mainland itself. It is certainly reasonable to believe that birds coming north toward Florida would see ahead of them nothing but a cloud of smoke, with no land in sight, and that, under the gentle push of the southeast wind, they would gradually veer off into the clear air of the Gulf where Lowery saw them. To believe this, indeed, is much more reasonable than to believe that the three birds mentioned were engaged in a trans-Gulf flight.

Of the remaining eight birds Lowery saw on this trip, one was a Great Blue Heron flying from east to west 19 miles from the Louisiana coast, and two others were seen within 16 miles of the coast. Lowery himself mentions the fact that he saw, proportionately, many more birds near the Louisiana coast than he saw out on the Gulf. The reason for the disparity, he believes, is that the birds are tired by the time they near the coast and so descend to a lower level of flight. Curiously enough, however, the only birds that were tired enough to come aboard the ship were (with one exception) birds far out in the Gulf, not those near shore.

In summary, though the observations Lowery made on his trip across the Gulf are new and valuable, they do not prove what he wants them to prove. They prove merely that a relatively few birds appear on the Gulf of Mexico in spring.

4. Here is the crux of the whole problem. Lowery feels that the scattering of birds which he saw on the Gulf in two days indicates "trans-Gulf flights of tremendous magnitude." The evidence is minute, and the generalization is large. Lowery's trip across the Gulf and back shows merely that birds appear on the Gulf casually and fitfully, and that their presence there may often be related to abnormal meteorological phenomena. Compared with the floods of birds that go around the Gulf, those that appear on it in spring are

a mere few droplets. Their flights over the Gulf seem to be commonplace and even frequent, but not normal or abundant.

But do birds actually migrate "in floods" around the coast?

I have mentioned the multitudes of Barn Swallows on the Texas coast (in comparison to Lowery's 45 in four days on the Gulf). Here are three more instances of the same sort of thing that have come to my attention within ten days after the appearance of Lowery's article: Mr. Packard tells me that during an hour or two on a day late in April, 1946, he saw about 500 Yellow-throats in a 3–4 acre patch near Corpus Christi; on April 25, 1946, in a single thin line of low bushes about 200 yards long and about 300 yards from the surf on Galveston Island, I saw, in the space of 30 minutes, about half the species of warblers that migrate through the region, together with migrant thrushes, orioles, flycatchers, and buntings in numbers from two or three to over a hundred; on May 5, 1946, within a hundred yards of Mrs. Hagar's door in Rockport, I saw, in a little over an hour, 30 to 40 species of migrating warblers, vireos, thrushes, buntings, tanagers, orioles, and flycatchers, and (with a few exceptions) five to 20 individuals of each species.

In the following passage Griscom (1945) describes conditions as he saw them on Green Island, on the lower Texas coast, in the spring of 1943:

> I landed on the 22nd of April, and the first five minutes that I was on this island I realized that there was one land-bird migrant per cubic yard. They had presumably been flying north for several hundred miles over similar country in eastern Mexico, in the state of Tamaulipas, and this was the first green island that they had seen in some time, and they put down there in prodigious numbers. We saw warblers, vireos, thrushes, orioles, and flycatchers. There were two different kinds of hummingbirds. Most of the swallows of North America were passing overhead in a steady stream. Later in the day my friends and I went to the extreme south tip of the island, and as a matter of experiment we raised our field glasses and just looked south over the salt waters of the lagoon. We were immediately rewarded for doing so, because every thirty seconds one little flock of land-bird migrants or another would fly into the field of our glasses, and we could follow them north until they reached Green Island and pitched down into the bushes fifteen yards or so back of us. Hummingbirds, cuckoos, thrushes, warblers, orioles, finches, and grosbeaks of various kinds came in every thirty seconds to a minute during the time that we spent on the south end of the island.

Griscom believes that Green Island offers very exceptional migration phenomena; and to a certain extent he is right, for, as explained in my earlier article, birds are continually being funneled off from the coastwise route so that both numbers and species thin out along the northern sections of the coast. But it is true, I believe, that Griscom has spent only two days on islands on the Texas coast, one

day on Green Island and one on Galveston Island. If he were better acquainted with the islands, he would know that the phenomena he observed on Green Island are repeated, in a gradually diminishing scale, along every island on the coast.

I have not come across any accounts of similar concentrations along the Florida beaches—perhaps because the swampy terrain of southern Florida has prevented adequate observation, or because the generally fine weather conditions of southern Florida in spring encourage the migrants to pass without stopping. Yet a multitude of records of birds striking lighthouses on the Florida Keys proves the reality of heavy migrations across the Keys; and many years ago (1909) Commander F. M. Bennett, U. S. N., published a fascinating account that reveals something of the vastness of the migrations across the Keys. According to Bennett, on the night of April 14, 1909, a violent thunderstorm of several hours' duration blew across the Keys *from the southwest.* On that night there was an inundation of birds on all the Keys, and at the Tortugas Lighthouse they came, according to the light-keeper, "in such masses that he could not see out through the glass panes." The next day there were "millions" of birds on the island; "they were so numerous that it was difficult to walk anywhere without stepping on them."

The record is especially interesting because it shows not only the vast numbers of birds involved, but also the direction from which they probably came. A full analysis of Bennett's observations would be out of place here; but it would necessarily conclude exactly as Bennett concluded his article: "that on the night of April 14, 1909, there was an enormous flight of birds . . . making passage from Cuba or Yucatán toward the coast of Florida."

I have tried to show in this section that countless hordes of birds are known to migrate around the Gulf of Mexico. Nobody has yet shown that countless hordes migrate across it.

4. On two nights while he was in Yucatán, Lowery made telescopic observations of birds flying between him and the moon. The "path of the moon was such that the portion of the sky under observation was largely over land." He counted the birds he saw, and from their number estimated their "flight density" — that is, "the theoretical number of birds per hour passing over a one-mile line on the earth's surface at right angles to the average direction of flight." In one and one-fourth hours of one night he saw 12 birds, and in one hour the next night he saw eight birds. From the 12, he estimated a flight density of 3,710, and from the eight a flight

density of 1,960. Since Lowery makes a special point of saying (pp. 205–206) that the place where he made these observations is just like any other spot on the northern coast of Yucatán, and also that birds migrate at all times of the day, we may follow his reasoning to its logical conclusions. Since Yucatán is about 235 miles wide, Lowery would figure that 21,000,000 birds passed northward from the peninsula on the first day of his observations—on the basis of 12 birds seen! The next day 11,000,000 passed northward—on the basis of eight birds seen! Even if we ignore the many other questions involved in the observations, Lowery's method of estimating millions of birds on the basis of the minute amount of birds he actually saw is so fabulously hypothetical that I cannot see that it has any value at all.

This may be a good place for a remark about the birds Van Tyne and Trautman (1945) saw leaving the coast of Yucatán in spring. In autumn on the Texas coast I have often seen Black Terns, flying rather high, reach the Gulf from the interior of the country, dip down nearly to the water, and then fly straight south over the Gulf. Evidently, one would say, they were beginning a trans-Gulf flight. But if one watched carefully, one could see them turn to the right far out over the water, and proceed westward parallel with the coast. The two sets of observations differ in many ways, of course; but the point is that what looks like a trans-Gulf migration at its beginning may end as a coastwise migration as soon as the birds begin to lose sight of land.

I concluded my first article by saying: "There is no direct evidence to show that birds migrating from regions south of us in spring actually cross the Gulf of Mexico in any appreciable numbers; but there is abundant evidence to show that vast numbers of these birds, both individuals and species, take the coastwise routes *around* the eastern and western edges of the Gulf." Nothing in Lowery's article would make me want to change this conclusion.

Lowery, by the way, significantly misquotes (p. 180) the passage just cited. He omits the phrase "in any appreciable numbers," and thus gives a distorted version of my argument. I do not believe that he purposely misquotes; I think that, as in the rest of his paper, he is so eager to defend a preconceived theory that he unconsciously ignores what the other side has to say. It is a common human weakness; even Darwin confesses to it.

IV. CARDINAL OMISSIONS

Lowery's article omitted to mention the extremely abnormal cold wave that accompanied the appearance of birds on Howell's boat in

mid-Gulf; it omitted discussion of the Red-backed Sandpiper Howell saw; it omitted discussion of the Gray Kingbird and the Cape May Warbler seen on the Gulf, though these were obviously highly abnormal occurrences; it omitted mention of the smoke-pall that hung over Florida in early May, 1945; it omitted all but the vaguest criticism of the table around which so much of my first article was written; it omitted comparison of Burleigh's 'The Bird Life of the Gulf Coast Region of Mississippi' (December 30, 1944) with my article. (Burleigh's work will be examined in more detail a little later.)

More important, Lowery's article does not exclude the possibility, or even the probability, of his mid-Gulf birds being casuals or strays. "It is no unusual thing," says Henshaw (1901), "as every ornithologist knows, for land birds to board ships, when a greater or less distance off land, or to be seen from the decks as they wing an aimless course over the ocean."

The very number of the 'Auk' in which Lowery's article appears contains a record of a Knot 500 miles west of the tip of Ireland (in this note "south" is obviously a misprint for "west"), a Golden-Crowned Sparrow 400 miles southeast of Nova Scotia, and a Jaçana 42 miles from land (pp. 250, 255). I have not made any special study of waifs and strays at sea; but it so happens that I have a few notes on the subject taken from some early volumes of the 'Auk.' On May 8, 1885, W. J. Jeffries (1886) was on a ship about 600 miles east of New York when he made the following observations:

> I noticed a flock of Peeps on the port side, flying toward the steamer from the northwest. When within about 80 yards of us they turned to the east till they could pass our bows, then turned sharply, passing within a few yards, or even feet of us, and then off to the S. E. by E. I at once went to the upper deck to watch for more, and was surprised to find that, in every direction, as far as I could see in the then light fog, were large flocks of Peeps all flying in the same direction, S. E. by E. The birds were flying in large scattered flocks of from fifty to apparently several hundred birds. The flight lasted for nearly three hours, during which a very large number of birds must have passed us.
>
> Why were they flying S. E. by E.? They should at that season have been bound for their northern breeding grounds and not for Africa.
>
> There was not any evidence to show that the birds were lost, as all flew exactly the same way . . . Not one flock or even a single bird did I see turn to the westward to pass astern of us.
>
> They were flying strong, easily passing our steamer. Not one tried to alight, nor did any fall into the water, nor were any seen floating, though I watched carefully.
>
> Whether the Peeps were *Tringa minutilla* or *Ereunetes pusillus* I can not say.

These sandpipers at sea remind one of Lowery's Barn Swallows. Birds at sea a little closer to the coast (as was the case with so many of Lowery's birds) are recorded in an article by Leverett M. Loomis

(1901) on 'Birds Observed During a Steamer Voyage from San Francisco to Victoria, B. C.' On September 9, when he was seven miles offshore opposite the Rogue River, Oregon, Loomis saw several Mourning Doves, one of which came aboard his ship, and an Olive-sided Flycatcher which also came aboard. On the same day, when the ship was 20 miles offshore, an American Pipit and a Red-breasted Nuthatch came aboard. For September 10, Loomis reports that the ship is near Cape Flattery, and that the air is

> smoky from forest fires; the ocean without a ripple. A Sandwich Sparrow and a Yellow Warbler boarded the ship . . . Between 10 and 11 A. M., a Townsend's Warbler, a Wilson's Warbler, several Yellow Warblers, and an American Pipit sought refuge on the deck.
>
> Strait of Juan de Fuca; 2 P. M.; land hidden by smoke. A Red-shafted Flicker appeared and alighted on the stays supporting the smokestack.

This last notation is especially interesting because it suggests the smoke-pall over Florida mentioned earlier in this paper; and the entire article is interesting because it shows that either strays or coastwise migrants are fairly common at sea up to 20 miles offshore, at least.

Other random notes follow:

Young (1884) reports, for September 23, a Kestrel 500 miles west of the Irish coast; for September 24, three hawks (one of them an American Sparrow Hawk), a Pied Wagtail, and two Wheatears 1,000 miles west of Ireland; for September 25, another Wheatear, a Land Rail, and a Turnstone 800 miles east of Labrador.

Robbins (1900) reports a Maryland Yellow-throat on his ship when it was 305 miles E.S.E. of Boston, "well to eastward of a line drawn from Nova Scotia to any land on this side of the Atlantic, even Bermuda."

Henshaw (1901 and 1902) reports a Hawaiian hawk (*Buteo solitarius*) on a ship 200 miles east of Hawaii in June, another on a ship 400 miles south of Hawaii, and a Short-eared Owl 500 miles northwest of the Hawaiian Islands in October.

Helmuth (1920) reports, in the very paper that Lowery and I have haggled over so much, a Great Blue Heron 20 miles off the coast of Georgia on February 25. On the same day, when the ship was "approaching Savannah, Georgia, a Savannah Sparrow, appropriately enough, spent a few hours on the boat deck." Two days later, while the ship was about six miles offshore near Palm Beach, Florida, "a Ruby-throated Hummingbird flew over us, and a Yellow-throat was with us all day; it was joined later by a Yellow-Palm Warbler." This early in the year, none of the birds was, very likely, on a migration flight when observed.

Buckley (1945) tells of the afternoon of October 11, 1945, when his ship was "nearly five hundred miles due west of the southern California coast," and when over fifty land birds (including Flickers, White-throated Sparrows, and a small owl) came aboard, and other small birds fell into the water near the ship.

No doubt a diligent study of the literature would reveal records of numerous other birds observed at sea where they could not possibly be normal migrants, or where, if they were migrants, they were unmistakably coastwise migrants many miles from shore. It would be strange, indeed, if, during spring in a region like the Gulf of Mexico, a large number of strays and casuals did not appear far out over the water. But these strays and casuals should not be confused with normally migrating birds following the regular lanes of travel.

V. INTERPRETATION OF THE WILLIAMS ARTICLE

The present section consists of small potatoes pared rather thin. I include them only because Lowery's imputation of a dozen small errors is perhaps more subtly damaging to the thesis of my first article than the imputation of error in essential matters.

In the following paragraphs, sentences from Lowery's article are quoted, and then briefly discussed:

1. "Williams apparently failed to recognize that trans-Gulf migration and coastwise migration are not exclusive operations. To prove the one is not to disprove the other." — But the point is this: Vast spring migrations around the Gulf have been thoroughly proved; major migrations across the Gulf have not been proved.

2. "To show that some birds migrate up the coasts of Texas and México is not to show that they all do. If so, it would disprove not only trans-Gulf migration but migration up the coast of Florida as well." — My article stated very plainly, and contained a map to illustrate, that species which do not come up the México-Texas route, come up the Florida route.

3. "Because Texas, itself, is to all intents and purposes a part of the northern Gulf Coast, conclusive observations . . . can never be sought there." — Conclusive observations can never be sought in any one place, either on the Texas coast or on the Louisiana coast. And a glance at the map will show that at least one-third of the Texas coast is not a part of the northern Gulf Coast. Again and again we find blind spots like this in Lowery's logic. They are almost incredible to one who is acquainted with Lowery's careful work elsewhere.

4. "When we observe birds on the coast, there is no certain way of knowing from which direction they have arrived." — But Griscom saw them arriving from *along the coast;* I have seen them arriving from *along the coast;* I have never seen them arriving from over the Gulf. (It is quite possible, of course, that birds following the coastwise route a few miles out to sea, or birds blown out to sea from the coastwise route, might be observed coming into the coast from over the Gulf. But such an observation would not prove a trans-Gulf flight.)

5. "Williams presented a table of 56 species which purported to show that birds migrate around the sides of the Gulf. Aside from omitting a number of critical species . . ." — Species were selected for the table on what I considered the bases most fair to the opposition. The bases of selection were as follows: Oceanic species were omitted; western birds were omitted; species wintering normally anywhere in the United States were omitted so that there could be no question as to which individuals were migrants and which were winter residents; species appearing in spring in approximately equal numbers at all points along the Gulf Coast were omitted because, in the present state of our knowledge, these species prove nothing, either way, about trans-Gulf migration. This last category included rare species like the White-tailed Kite, Swallow-tailed Kite, Black Rail, Hudsonian Godwit, and Kirtland's Warbler; species and subspecies difficult for the tyro to distinguish from related forms in life, such as Baird's Sandpiper, the Crested Flycatchers, the Yellow-throated Warblers, and the Water-Thrushes; and about 20 other species, nearly half of which breed in the coastal region, and which, therefore, would appear in that region in any event.

If I had included in the table those species that winter north barely to the tips of Texas or of Florida, the tables would have been lengthened by the following: Reddish Egret, White Ibis, Roseate Spoonbill, Mississippi Kite, Black-necked Stilt, Cabot's Tern, Roseate Tern, Prairie Warbler, Palm Warbler, and Lark Sparrow. It seems probable, also, that the Mourning Warbler should be added to the list.

6. "In regard to the central Gulf Coast region especially, there is a wealth of unpublished data which renders practically every one of Williams's designations of status hopelessly misleading." — I have no way of knowing, of course, about the unpublished data Lowery has. My table was made out, for the most part, from the extremely thorough and scholarly works by Oberholser (1938) and by Howell

(1932) on the bird life of Louisiana and of Florida, from Francis Weston's long series of "Season" reports in 'Bird-Lore' and 'Audubon Magazine' concerning the northwestern arm of Florida, and from the many papers and monographs published in the early years of this century by Cooke, Chapman, and Oberholser on the distribution and migration of many groups of birds. These last, to be sure, are not to be relied upon where *negative* evidence is concerned, but their *positive* evidence is still reliable.

Burleigh's monograph on 'The Bird Life of the Gulf Coast of Mississippi (1944) fills a wide gap in our knowledge about birds in the central Gulf Coast area. It was published after my article was in print, and before Burleigh knew about my article. It may be regarded, therefore, as a kind of check on my article.

Burleigh lived on the coast of Mississippi for eight years. "During those eight years," he writes, "a detailed study was made of the bird life of the three coastal counties . . . at least eight months of each year were spent on the Mississippi Gulf Coast. This enabled me to acquire a reasonably complete knowledge of its bird life." Anyone who cares to go through Burleigh's work can see for himself how precisely his findings agree with the estimates of my own table for the central Gulf Coast area. Indeed, without looking at Burleigh, one can predict from my table almost exactly what status Burleigh will record for any bird in his work. This statement applies (with three exceptions) to the 56 birds listed in the table, and also to the 11 additional ones that winter north to the tips of Texas or Florida and come north by way of those two states. (The three exceptions mentioned are the Wood Thrush, the Gray-cheeked Thrush, and the Veery, all of which I recorded as "regularly but not frequently seen each spring" on the upper Texas coast, but which Burleigh regards as "common transients" in spring on the Mississippi coast. I do not know how to resolve the inconsistency; but it should be repeated that, though the Veery is not frequently seen on the upper Texas coast, Ludlow Griscom and I heard thousands passing over Houston early one morning, before daylight, in May, 1943.)

7. "There are notable inconsistencies in his table with respect to the lower Texas coast which L. Irby Davis has kindly supplied me (*in litt.*) regarding the status of migrant species in that region." — All the data about the lower Texas coast which appeared in my first article were culled from Mr. Davis's three spring reports published in the 'Audubon Magazine' several years ago, from Griscom and Crosby's 'Birds of the Brownsville Region, Southern Texas'

(1925–26), from the studies listed in the bibliography of the work just mentioned, from my own knowledge of the lower Texas coast near Rockport, and from the notes of various correspondents in the region.

As was pointed out in my article, one can have no adequate idea of the coastal migrations unless one is actually on the beaches or very near them. Now, I happen to know that, because of difficulties of transportation and terrain, Mr. Davis has practically no opportunity to do any birding on the outer islands of the Texas coast, and very little opportunity to do any birding on the coast itself. I recall that Mr. Griscom told me that, in his one day on Green Island, he saw either three or four species whose occurrence on the lower Gulf Coast Mr. Davis had denied.

Actually, however, Davis and Lowery question specifically the validity of only two of the 280 "designations of status" contained in my table. The two birds concerned here are the Golden-winged and the Blue-winged Warblers. Yet, in three days on the lower Gulf Coast, Griscom saw two of the former and four of the latter; nor was either species more uncommon, on those days, than the mean for 26 other species of warblers that he saw. Furthermore, Davis himself, in his three "Season" reports in the 'Audubon Magazine,' records the Golden-winged Warbler for two springs, and the Blue-winged for one.

To be sure, I do not think my table is sacrosanct, or that future investigation may not alter it in many details. But it is based on a careful study of the available literature, on reports sent to me five times a year by numerous observers on the coast during a period of over ten years, and on 14 years of regular field work by myself in the region. The exactness with which the table checks with Burleigh's monograph on the Mississippi birds is a fair demonstration of its validity.

8. "To draw up such a table on the basis of all the facts would be a gigantic undertaking that would dwarf many current works in ornithology of even broad scope." — Yet Lowery has just taken me to task because my table does not correspond to the table that he and Davis would draw up! Moreover, he himself draws up a table (Table I of his paper) in which he does exactly what he says should not be done. The same thing is true of his paper on western birds appearing in the East (1944). If he means to say that nobody knows everything about birds on the Gulf Coast, he is obviously right. Quite possibly, future observations may prove all my theories about

Gulf migration to be entirely wrong. But what I have been trying to say in this article and in the preceding one is that, *in the present state of our knowledge,* we have no right to believe that the major migration routes in spring lie across the Gulf of Mexico, and we have a good right to say that they lie around it.

9. "Williams emphasized that on the Texas coast migrants are often abundant close to shore, but that a short distance inland they are notoriously rare or absent. . . . The logical explanation lies in the principle [that] birds approaching land from across the Gulf in the face of strong adverse winds come down on the first available land and hence pile up in tremendous concentrations on coastal islands, ridges, and cheniers." — Here is the essential difference between Lowery's ideas and mine. He thinks the birds *pile up;* I think they merely *drop down.* If they piled up from a trans-Gulf flight, they would be found only along the outermost beaches fronting the Gulf. But such is not the case. They are found along the edges of the bays, too, at least in Texas. Mr. Heiser, on the west side of Galveston Bay at Kemah, 25 miles from the Gulf, and Mr. McKay near the head of Galveston Bay at Cove, 40 miles from the Gulf, find the same concentrations after bad weather that observers on the outer beaches find. The logical explanation for these facts is that the birds are following the water-line, and drop to earth when the bad weather strikes them.

10. "Our credulity now suffers a greater shock than before. Instead of struggling with one 500-mile flight, the birds must fly continuously over twice that distance if they follow the general coastline." — This is a perfectly obvious truth. But, as explained earlier, the ability of birds to fly across the Gulf has never been questioned. Lowery himself believes that they normally fly not only across the Gulf, but also, in the case of many species, continue on inland 300–400 miles. If they can fly all this distance, they can just as easily fly around the Gulf.

11. "On reaching the northern Gulf Coast [Williams] has many of them turn abruptly eastward or westward, as the case may be, and fly something like 400 miles from either direction toward the Mississippi Delta, whence again they make another abrupt right-angle turn and proceed up one of the rivers flowing into the Gulf." — I tried to explain in both the map and the table of the previous paper that birds are normally funneled off all along the coastwise routes, and that only a small percentage (many of them birds that will breed in the region) reach the Mississippi Delta. Indeed, this very matter invites further question and speculation.

I have been struck by the frequency with which all writers about birds on the Louisiana coast in spring continually repeat that *northwest* winds drive the migrants to earth. In his paper on the "coastal hiatus" (1945) Lowery says: "The weather along the coast may be highly inclement with overcast skies and fresh winds, but when the winds do not shift to the north or northwest, there is but slight precipitation of migrants" on the Louisiana coast. Speaking of his experiences on the coast in the week following April 21, 1942, he adds: "The weather conditions during the period were for the most part unsettled with occasional rains, but at no time did a 'norther' develop. There were practically no migrants." Moreover, Lowery points out (1945) that even when northerly winds have resulted in record numbers of birds on the coast, an area extending several hundred miles back of the coast has no birds. This area is the "hiatus" he mentions so often.

In contrast to what happens on the Louisiana coast, any rainy weather from any direction during the spring migratory season causes a precipitation of birds on the Texas coast. Furthermore, as was pointed out in my first article, the advancing season brings a widening of the coastal river of migration so that rainy weather then precipitates great numbers of migrants considerable distances from the coast. Thus, rainy weather on April 30 and May 1, 1945, made as many migrants show up all over the city of Houston as I have ever seen along the coast itself. Houston is 50 miles from the Gulf on the south, and more than 20 miles from Galveston Bay on the east. How much farther inland such precipitations occur, I do not know.

All these bits of evidence, together with other bits contributed by other writers, may justify us in asking the following questions:

(a.) Is it possible that the normal spring migration routes lead upward in two widening triangles from Texas and from Florida?

(b.) Is it possible that southern Louisiana, the southern half of Mississippi, and the southwestern half of Alabama lie in a triangle (with its base along the coast) in which appearances of non-breeding birds are only sporadic?

(c.) Is it possible that the "coastal hiatus" is actually nothing but this triangle lying south of the two great migration triangles leading up from Texas and from Florida?

(d.) Is it possible that (as in the case of Howell's birds in mid-Gulf) the northwest winds push the migrants of the Texas triangle eastward and southeastward to the Louisiana coast?

(e.) Is it possible that there is actually a piling up of migrants on that coast, after all—but a piling up from the west and north instead of the south, and a piling up against the sea instead of against the land?

All these questions are offered as questions, not as answers. Much work on the whole problem remains to be done; and it would be strange if either Lowery or I had already solved the problem. Yet if our little controversy inspires both of us to work more carefully, and if it encourages others to try to solve the problem, the controversy will have been worth while.

In the meantime, I see no reason why I should alter materially the conclusion arrived at in the earlier paper: The evidence shows that vast numbers of birds regularly migrate around the sides of the Gulf of Mexico in spring; there is no valid evidence to show that any large number of birds regularly migrate across the Gulf in spring.

LITERATURE CITED

BENNETT, F. M.
1909. A tragedy of bird migration. Bird-Lore, 11 (3): 110–113.

BUCKLEY, JOHN L.
1945. Land birds at sea. Auk, 63 (3): 440.

BURLEIGH, THOMAS D.
1944. The bird life of the Gulf coast region of Mississippi. Occ. Papers Mus. Zool. La. State Univ., 20: 329–490.

FRAZAR, MARTIN ABBOTT
1881. Destruction of birds by a storm while migrating. Bull. Nuttall Ornith. Club, 6 (4): 250–252.

GRISCOM, LUDLOW
1945. Modern bird study. (Harvard Univ. Press, Cambridge, Mass.)

GRISCOM, LUDLOW, AND CROSBY, MAUNSELL S.
1925–26. Birds of the Brownsville Region, southern Texas. Auk, 42 (3): 432–440; 42 (4): 519–537; 43 (1): 18–36.

HELMUTH, W. T.
1920. Extracts made from notes while in naval service. Auk, 37 (2): 255–261.

HENSHAW, H. W.
1901. Birds of prey as ocean waifs. Auk, 18 (2): 162–165.

HOWELL, ARTHUR H.
1932. Florida bird life. (Florida Department Game and Fresh Water Fish, Tallahassee.)

JEFFRIES, W. A.
1886. Sandpipers at sea. Auk, 3 (1): 131–132.

LOOMIS, LEVERETT M.
1901. Birds observed during a steamer voyage from San Francisco to Victoria, B. C. Auk, 18 (2): 201–202.

LOWERY, GEORGE H., JR.
1945. Trans-Gulf spring migration of birds and the coastal hiatus. Wilson Bull., 57 (2): 92–121.
1946. Evidence of trans-Gulf migration. Auk, 63 (2): 175–211.

McATEE, W. L., BURLEIGH, THOMAS D., LOWERY, GEORGE H., JR., AND STODDARD, HERBERT L.
1944. Eastward migration through the Gulf States. Wilson Bull., 56 (3): 152–160.
OBERHOLSER, HARRY C.
1938. The bird life of Louisiana. (Louisiana Department of Conservation, New Orleans, La.)
ROBBINS, REGINALD C.
1901. Maryland Yellow-throat at sea. Auk, 18 (1): 110–111.
VAN TYNE, JOSSELYN, AND TRAUTMAN, MILTON
1945. Migration records from Yucatan. Wilson Bull., 57 (3): 203–204.
WILLIAMS, GEORGE G.
1945. Do birds cross the Gulf of Mexico in spring? Auk, 62 (1): 98–111.
YOUNG, C. J.
1884. Notes on certain birds observed on a voyage from Liverpool to Quebec in September, 1883. Auk, 1 (4): 398–399.

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THE ROBIN NESTS

BY MINNA ANTHONY COMMON

APRIL 17.—A male and female robin were seen examining possible nesting sites. Each turned about many times in several places in two adjacent apple trees. Neither looked at the other's choices. They were not seen to go near the maples near by.

APRIL 19, 8:00 A. M.—Two female robins were seen fighting in the driveway. Soon we discovered the reason: two nests started. One foundation was laid in Fox's maple in a crotch up 25 feet. The other foundation—the first grasses—was laid in my maple by the drive, 30 feet from the 'Fox' tree. It was on a slight shelf on the bare trunk where two large branches had been recently removed.

APRIL 20, early A. M.—Nest larger in Fox's tree; still just a few dangling grasses on my tree stub-shelf.

APRIL 21, early A. M.—The 'Fox' nest almost full-sized; no robins seen about during this day.

APRIL 22–23.—No activity noticed. The 'Fox' nest looked finished. The stub nest had more grasses laid, but a strong wind was blowing and some grass was drifting away now and then.

APRIL 24, 6:00 A. M.—Much work had been done on the stub nest. Grass and string hung down a foot or more and blew about. The nest was slightly cupped and the female was very busy. She would bring a rather long piece of string or grass and lay it in a coil by placing the end on the nest lining and poking it in securely, then