

The Changing Seasons: Weatherbirds

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It was another autumn season filled with remarkable records of seabirds in unlikely places. Red-billed Tropicbird went unreported in the Atlantic after July, despite a wandering bird north to New Brunswick in summer, but many dozens were reported off California by birders and researchers alike. This adult was photographed nicely off La Manzanilla, Jalisco, Mexico 24 November 2005. Photograph by Stephen J. Dinsmore.

The fall migration marks a transition between the breeding and non-breeding seasons. While some species, such as Mourning Dove, are still reproductively active well into autumn, most species that breed north of Mexico and the Caribbean have completed their primary breeding period, and those that migrate are making their way to wintering areas. The sojourn to nonbreeding sites includes some epic migrations, some of which are still being discovered—for example, the 11,000-km presumably non-stop flight of *baueri* Bar-tailed Godwits from coastal Alaska to New Zealand (Gill et al. 2005). Most species have much shorter flights, usually broken into segments, and other species reside in the same area year-round or make only facultative movements.

As in spring, migrating birds balance the costs and risks of migration with the benefits of residing in warmer climates during the non-breeding season. Chief among those risks is bad weather. Driven by the forces of evolution, inherent memory, and cues from their surroundings, birds' decisions about migration affect their survival, and, for most species, these decisions appear to function relatively well, at least at the species level. But what happens when the forces of nature intervene and move birds off their migratory paths, that is, when severe weather events displace them on a large scale? We know little about such events, and most of our knowledge is anecdotal—and gathered by the likes

of us: birders.

Here we examine the fall 2005 migration season in light of some of the major weather patterns, particularly the mid-season frontal activity in the East and the record-breaking 2005 tropical cyclone season. In reading the season's regional reports, one cannot fail to notice how many of the sightings digested in them are linked to specific weather patterns. The more noteworthy reports are highlighted in Special Attention (S.A.) boxes. While the news from pelagic Pacific Ocean waters was electrifying, and is covered extensively in this issue's articles, the S.A. boxes were most often used in regions in the eastern half of the continent, where storm fronts and tropical cyclones dominated the news headlines—for humans, birds, and our shared habitats—literally every day of this season and well into December, even overshadowing warnings of a coming “bird flu” pandemic. The devastating effects of the weather events of this season will persist and reverberate for decades, in memory as well as the landscape: especially, but by no means solely, in the Gulf

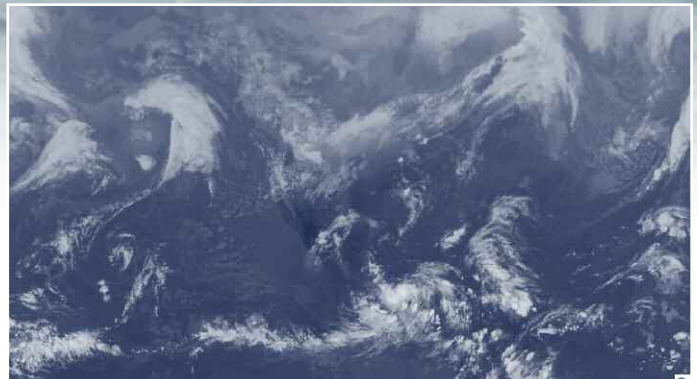


Figure 1. Geostationary Operational Environmental Satellite (GOES) image of North America at 0000 UTC, 4 October 2005. A low-pressure system approaches the Pacific coast of North America, visible as a large cloud mass in the upper left. Such storm systems are sometimes associated with the appearance of Nearctic migrants in western Alaska. Note also a large storm system in the upper right of the image over north-eastern Canada. This type of image shows heat-based radiation from the infrared spectrum, with cooler surfaces brighter and warmer surfaces darker. Because the atmosphere cools with an increase in altitude, clouds appear as bright areas and land surfaces as dark areas. It follows, generally, that low clouds will be grayer and higher clouds will be whiter. Tall thunderstorm clouds appear as bright white areas, and fog is difficult to distinguish from land areas.

Coast region of the United States and Mexico.

Fallouts: October 2005

As many have commented, on these pages and elsewhere, there are elements of bird migration such as its seasonal and daily timing—and to some extent its magnitude and species compositions—that we understand fairly well. Indeed, a marvelous aspect of migration is that it is often somewhat predictable, in the temperate zones at least. Yet, regardless of the year, there is usually a surprising event or two to illuminate the unpredictable quality of the phenomena we call bird migration—a moment when seasonal timing, atmospheric conditions, and geographic features combine to produce an unanticipated spectacle of migration: a fallout. Oc-

tober 2005 produced a series of such events. When viewed in broad spatial-temporal terms, October's fallouts were spectacular not just on one or two nights but over weeks, and not just at isolated locations but across entire regions. Though many migration-related events can be connected or related to one another on some level, the events of October 2005 manifest connections with startling clarity.

Global weather systems spawn, shift, merge, and dissipate constantly and in complex manners, making it difficult to decide where we should begin the narrative about October 2005. A reasonable point to begin could be in late September and early October over the northern North Pacific Ocean, as the first of several large low-pressure systems approached western North America (Figure 1).

This general meteorological pattern is well known to readers of this journal, and meteorologists predict the movements of such storm systems well. However, these particular systems were all rather large and well organized. Storms (and generally unsettled weather) moved across Alaska and through western Canada in late September and early October, and by 8 October, the first of these low-pressure centers had passed through the Great Lakes region. This frontal boundary occluded around 9 October just off the East Coast, generating overcast conditions, a low cloud ceiling, rain, fog, and light or northerly winds across a large portion of the northeastern United States and southeastern Canada (Figure 2).

On its approach to land from the Pacific, the first of these low-pressure centers was al-



Figure 2. GOES image of North America at 0000 UTC, 9 October 2005. Another storm system is approaching the Pacific coast of North America. Extensive cloud cover associated with the now-stalled low-pressure center off New England is apparent over the northeastern United States. The frontal boundary associated with this low pressure is nicely demarcated off the Atlantic coast of North America. Note, also, the area over the central United States that is free of clouds, a pattern characteristic of an area of high pressure.

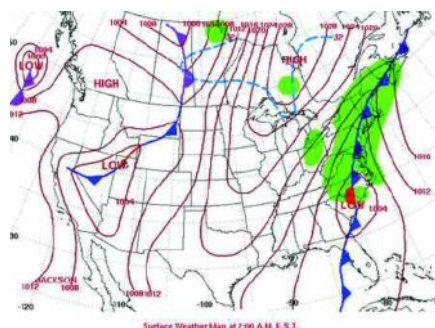


Figure 3. A synoptic weather map for 0700 EST 8 October 2005, showing the positions of high- and low-pressure gradients (in mb) as well as the location and type of frontal boundaries. A cold front, depicted as a line connecting the blue triangles, is approaching the Atlantic coast of the United States. The green patterns associated with the frontal boundary represent areas of precipitation. To the west of the front, note high pressure over Hudson Bay and resultant, light northerly winds across the Great Lakes.

most certainly connected to some of the so-called “reversed migration” of typically continental Nearctic/Neotropical migrants observed in Alaska late in September and early in October, including several notable warblers and even Black-headed and Rose-breasted Grosbeaks (one of the former at Gambell!). While the winds ahead of the passage of these storm systems probably facilitated the arrival of birds such as these, they also probably displace Siberian migrants northward and eastward: Pechora Pipit, late wagtails, Eyebrowed Thrushes, Gray-streaked Flycatchers, *examinandus* Arctic Warblers (one Arctic was recorded 27 September on Southeast Farallon Island, California, the same day the Pechora Pipit arrived on St. Lawrence Island). (As Sullivan [2004] suggests, the Nearctic/Neotropical migrants in Alaska may be best considered misoriented migrants—rather than “displaced” in the sense that they were moved off their intended migratory pathways by weather events, as may be true of the Siberian birds.) However, not until 7-8 October, once the low-pressure center associated with these storms had moved southeastward across Canada and into the Great Lakes and upper Ohio River Valley did the real fireworks begin (Figures 3, 4). (Note that after the passage of this and an associated weather system through the Northwest Territories, observers witnessed large numbers of migrating passerines circling around a gas flare in the during the night of 7-8 October—fireworks in their own right.)

On the evening of 7 October (Figure 4), a large nocturnal migration was underway, and on the next morning, exceptionally large numbers of Hermit Thrushes, Winter Wrens, and White-crowned Sparrows were reported along lakefront migrant traps in Illinois and Indiana. Concurrently, the first wave of an ultimately enormous flight of Black-capped and

Boreal Chickadees along the shores of the Great Lakes was detected. Great numbers of both kinglets and of Yellow-rumped Warblers were tallied at typical migration hotspots such as Point Pelee, Ontario: 14,000 kinglets on 8 October is a mind-boggling count. By the morning of 9 October, the frontal boundary had pushed eastward off the Eastern Seaboard, where it stalled and occluded. During the week that followed, low pressure intensified off southern New England, keeping skies cloudy and ceilings low, as well as producing scattered rain and light northerly winds across the northeastern

United States (Figure 5). Simultaneously, a large ridge of high pressure in the central southern United States prevented any substantial atmospheric energy from changing this pattern—but also created favorable migration conditions across much of the Ohio Valley. A series of major nocturnal movements then occurred, especially apparent in southern New England, with sparrows recorded by the hundreds from Vermont to coastal Connecticut (Figures 6-11). However, the movements were clearly more widespread.

During the week that this low-pressure

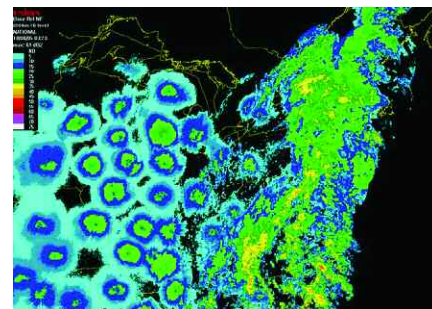


Figure 4. Upper Midwest and Northeast portions of a WSR-88D national mosaic of base reflectivity imagery produced by Unisys Weather and archived at the Clemson University Radar Ornithology Laboratory, night of 7 October 2005. The blocky and irregular patterns of greens and yellows visible on the right side of the image correspond to extensive areas of precipitation (some of it heavy) across the coastal regions, typical of the passage of a cold front (the same front shown in the previous figure). More uniform and circular color patterns visible on the left side of the image represent radars detecting bird migration. The scale in the upper left depicts relative reflectance characteristic of scattering of the radar’s energy pulse. Gauthreaux and Belser (1998, 1999) calibrated this scale in a density of birds per cubic kilometer, and the green colors are densities ranging from approximately 220 birds per cubic kilometer (lightest green) to nearly 1800 birds per cubic kilometer (darkest green). Note that some of the targets in the non-precipitation patterns are also likely to be insects and other aerial plankton, best distinguished by examining wind speeds aloft (for example, collected from weather balloons) and radial velocity radar imagery (not shown).

Table 1. Estimates of birds encountered during an unprecedented fallout on the night of 11-12 October 2005 at Ithaca, New York.

| SPECIES ^a | NUMBERS |
|------------------------------|---|
| American Bittern | 1 |
| Great Blue Heron | >8 heard overhead |
| Green Heron | >10 heard overhead |
| Red-tailed Hawk | 1 perched |
| Killdeer | 4 (at least) heard overhead |
| Semipalmated Plover | 1 (at least) heard overhead |
| Greater Yellowlegs | 1 heard overhead |
| Solitary Sandpiper | 1 heard overhead |
| Pectoral Sandpiper | 1 heard overhead |
| Wilson's Snipe | 1 overhead |
| Mourning Dove | >2 overhead |
| unidentified cuckoo | 1 observed flying away |
| Belted Kingfisher | 1 heard |
| Eastern Phoebe | >1 |
| Gray-cheeked Thrush | many heard overhead |
| Swainson's Thrush | many heard overhead |
| Hermit Thrush | 1 on ground, many heard overhead |
| Wood Thrush | 2 heard on ground, many heard overhead |
| Gray Catbird | >4 on ground, also heard calling overhead |
| American Pipit | >2 heard overhead |
| Tennessee Warbler | 1 |
| Nashville Warbler | 1 |
| Northern Parula | >4 |
| Chestnut-sided Warbler | 1 |
| Magnolia Warbler | >4 |
| Black-throated Blue Warbler | >15 |
| Yellow-rumped Warbler | >400 |
| Black-throated Green Warbler | >8 |
| Blackburnian Warbler | 1 |
| Western Palm Warbler | >20 |
| Yellow Palm Warbler | >2 |
| Bay-breasted Warbler | 2 |
| Blackpoll Warbler | 1 |
| Black-and-white Warbler | 1 |
| American Redstart | 2 |
| Ovenbird | 1; plus 1 specimen |
| Common Yellowthroat | >45 |
| Hooded Warbler | 1 |
| Scarlet Tanager | 1 |
| Chipping Sparrow | 1-2 on the ground, a few heard overhead |
| Savannah Sparrow | >200 on turf, dozens more in trees, >1000 calls |
| Song Sparrow | 2 |
| White-throated Sparrow | >3 |
| White-crowned Sparrow | 1 adult, 3 juveniles |
| Blue Grosbeak | 2-3 heard calling from bushes |
| Indigo Bunting | 1-2 perched, more heard overhead |
| Dickcissel | >4 heard calling overhead |
| Rose-breasted Grosbeak | 2 perched in tree, more heard |
| Bobolink | >6 heard overhead |

^a Other species observed near the stadium during the day of 12 October included a probable Eastern Wood-Pewee, a Blue-headed Vireo, a Red-eyed Vireo, a Mourning Warbler, and a Lincoln's Sparrow.

area remained off the coast of southern New England, the night of 11-12 October held just the right combination of low cloud ceiling, light rain, northerly winds, and seasonal timing to create classic conditions for a large flight of nocturnal migrants. Observers in and around Ithaca, New York, were in the right place at the right time to witness a nocturnal fallout that included not just large numbers of birds but also a great diversity of migrants: at least 48 species were observed over the course of several hours of watching and listening (Figures 12a,b; Table 1). The Cornell University football stadium had its lights on well into the night, and the combination of the stalled cold front and subsequent low ceiling and light drizzle caused thousands of birds to be attracted to the lights (and probably boosted calling rates of these migrants, with several observers reporting call counts of more than 20 calls of multiple species in ten-second periods). The stadium provided the means to estimate numbers of migrants, even to identify some of them as they foraged in trees or on the ground! Although the true numbers were probably uncountable, thousands of birds clearly converged at this location. Ten kilometers south of Ithaca, in Danby, New York, W. R. Evans documented a heavy flight of Savannah Sparrows, Gray-cheeked and Swainson's Thrushes, and Black-throated Blue, Prairie, Palm, and Hooded Warblers by flight calls that night. In addition, Evans observed migration directly in the lights illuminating the low cloud ceiling, revealing the presence of large numbers of Gray Catbirds and Red-eyed Vireos. In lighted areas, birds were apparently moving in all directions at many levels from the ground up to approximately 100 m, and solid illumination seemed to be attracting large numbers of birds; whether some of these behaviors occurred in non-illuminated areas is unknown.

The departure of the stalled low-pressure center to the north and a simultaneous frontal passage on 14-15 October stimulated an even more massive movement of short-distance migrants (Figures 13-14). The morning flights visible in Manhattan just after the passage of this front were tremendous, with two days of thousands of Yellow-rumped Warblers among countless other assorted passerines streaming onto Manhattan Island across the East River from Long Island. The sparrow flight along the Atlantic coast of New England, New York, and New Jersey generated by this frontal passage was gigantic—perhaps the largest on record, involving *hundreds of thousands* of birds!

Birds accumulated at many locations over the following week at many coastal locations, especially in southern New Jersey, where each backyard held dozens to hundreds of sparrows. While sparrows were clearly the dominant group in the flight, there were also exceptional numbers of other species, including Northern Flicker, Eastern Phoebe, Yellow-rumped and Palm Warblers, and Golden-crowned and Ruby-crowned Kinglets. The kinglet flight through the northeastern United States and southeastern Canada must have been monumental this season. Some forested city blocks in Manhattan with any patches of vegetation contained *hundreds* of both kinglets and sparrows, and the counts of Winter Wren and Hermit Thrush far exceeded the highest on record. In some areas, the densities of these species rivaled those seen on the Texas coast during classic spring fallouts there. The extents of these mid-October flights were not limited to the Northeast: the kinglet explosion was felt as far south as Virginia, where Ruby-crowned's numbers were "the best in ages," and even eastern Texas, where Golden-crowns invaded during the second half of October.

The causes for these incredible fallouts and accumulations of avian biomass are in part meteorological, in part geographical. Nights with favorable wind conditions (northerly or light winds) at this time of the year always produce good movements of migrants. Every year in the Northeast, at some point between the beginning of October and the beginning of November, at least one large-scale nocturnal movement of passerines occurs. However, nights with favorable winds also typically have clear skies, not low ceilings and precipitation. It is these conditions of poor visibility that beget the confusion of migrants and ultimately their "fallout," usually a localized affair. The uncommon confluence of weather conditions of October 2005 was also uncommonly ex-

tensive, spanning hundreds of kilometers. The largest fallouts observed were coastal in distribution, as expected: topographic features such as coastlines and ridges are especially good at concentrating nocturnal migrants (W. R. Evans has been studying this from an acoustic perspective; numerous researchers and birders have studied this with radar technology). Given the architecture of migration resulting from poor visibility and the concentrating effects of ridges, lakes (such as Cayuga Lake), and ocean coasts, the addition of artificial illumination in several areas broke the bank, so to speak. Nocturnal migrants are drawn to such light sources, especially under conditions of poor visibility. These birds also vocalize more frequently under these conditions, presumably to improve their understanding of where other individuals are—both to avoid collisions and to maintain orientation. It is clear from the radar imagery that large flights of birds were taking place, and visual and acoustic data from this evening indicate that in many areas these movements were occurring at low altitudes (at least for some of this period). Birds were hedging their bets as far as how far to travel and when and where to land under equivocal conditions: favorable winds but unfavorable sky conditions, coupled with the effects of geography and artificial illumination.

The 2005 hurricane season: more broken records

Despite their exceptional status (by virtue of their magnitudes), the fallouts of October 2005 illustrate the effects of weather on bird migration in ways that conform relatively clearly to patterns we understand and can even predict at times. But other weather patterns are less predictable and

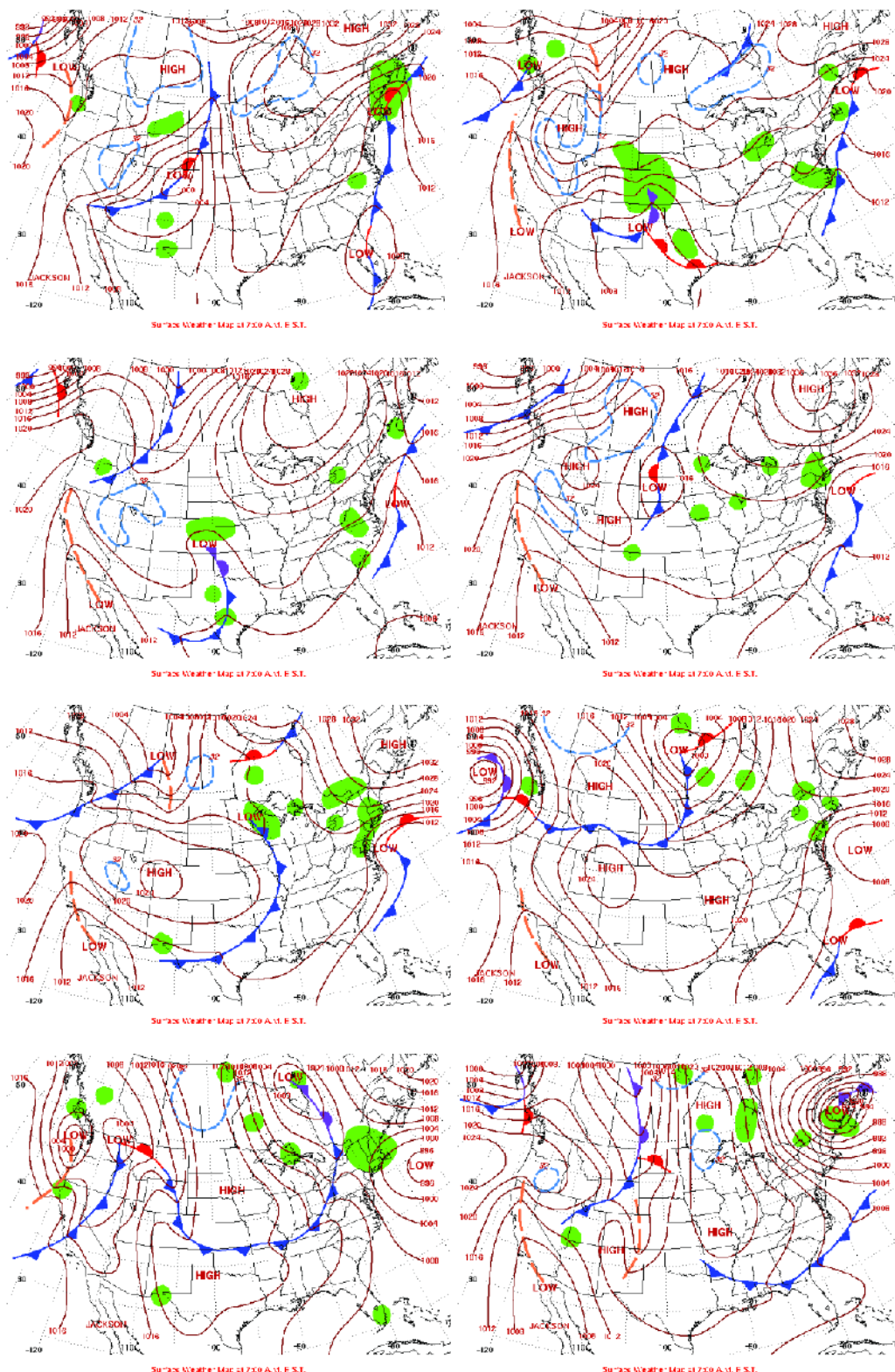


Figure 5 A-H. A mosaic of synoptic maps showing the 0700 Eastern Standard time positions of progression and occlusion of frontal boundaries on dates in 2005: A) 9 October, B) 10 October, C) 11 October, D) 12 October, E) 13 October, F) 14 October, G) 15 October, and H) 16 October. The first six (A-F) maps show a frontal boundary that has stalled off the Atlantic coast. To the west of the front, winds are generally northerly and easterly, with scattered precipitation visible on each day. By 15-16 October (maps G, H), low pressure off the coast of New England has intensified and started to move northward and eastward out of the region. Simultaneously, a stronger cold front approaches from the west, creating conditions favorable for a large-scale movement of birds.

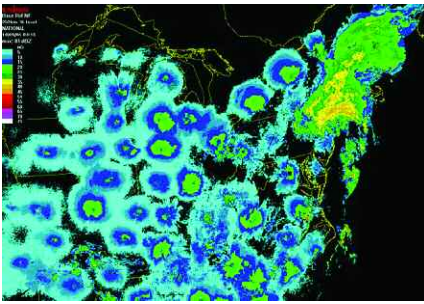


Figure 6. Upper Midwest and Northeast portions of a WSR-88D national mosaic of base reflectivity imagery for the evening of 8 October 2005 produced by Unisys Weather (Unisys) and archived at the Clemson University Radar Ornithology Laboratory (CUROL). Scattered precipitation is visible in the southwestern and central portions of the region, and more intense and extensive storms are producing precipitation over much of New England. Especially heavy bird migration is apparent north of Lake Ontario to the west of the intense precipitation and also south of the Great Lakes.

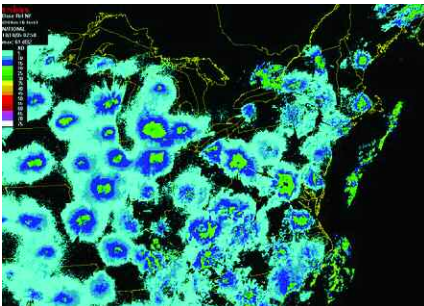


Figure 7. Upper Midwest and Northeast portions of a WSR-88D national mosaic of base reflectivity imagery for the evening of 9 October 2005, produced by Unisys and archived at CUROL. While the most intense and extensive precipitation events have moved northward and eastward out of the region, scattered showers are visible in the eastern Great Lakes, the southern Appalachians, and just offshore. While reflectivity values are not quite as high as those of the previous night, migration is still widespread.

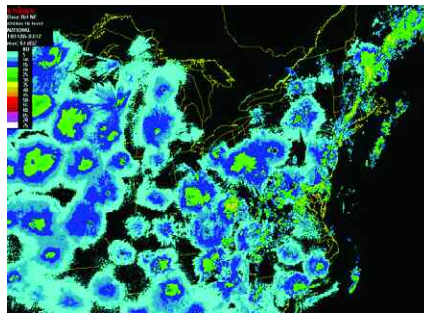


Figure 8. Upper Midwest and Northeast portions of a WSR-88D national mosaic of base reflectivity imagery for the evening of 10 October 2005, produced by Unisys and archived at CUROL. A pattern similar to that of the previous evening is apparent from many of the coastal and Appalachian radars. However, over the upper Midwest, to the west of the Great Lakes, bird migration is underway in force: some of the dark green reflectivity patterns represent nearly 1800 birds per cubic kilometer in western Illinois and Indiana.

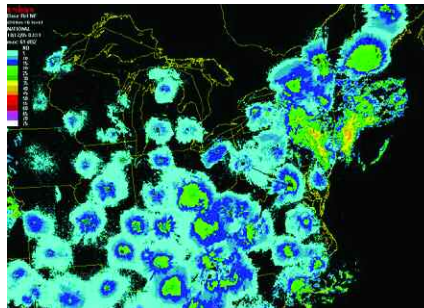


Figure 9. Upper Midwest and Northeast portions of a WSR-88D national mosaic of base reflectivity imagery for the evening of 11 October 2005, produced by Unisys and archived at CUROL. Migration in the Midwest is nothing like the previous night. Scattered storms are still visible across the region, although more intense storms are dumping heavier rains across eastern Pennsylvania, New Jersey, and southern New York. To the north of these storms, heavy migration is underway in northern New York and Maine.

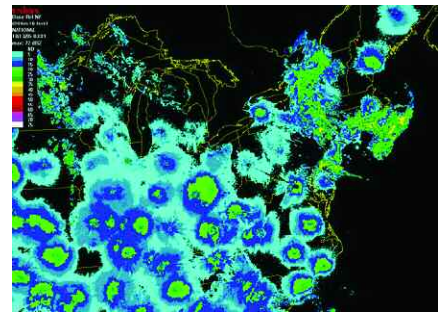


Figure 10. Upper Midwest and Northeast portions of a WSR-88D national mosaic of base reflectivity imagery for the evening of 12 October 2005, produced by Unisys and archived at CUROL. While scattered showers across the upper Midwest and more intense and well-organized precipitation over New York and southern New England are keeping birds grounded, migration amounts are high south of the Great Lakes and in the southern mid-Atlantic states. Widespread greens in the reflectivity patterns indicate densities of 600-1800 birds per cubic kilometer.

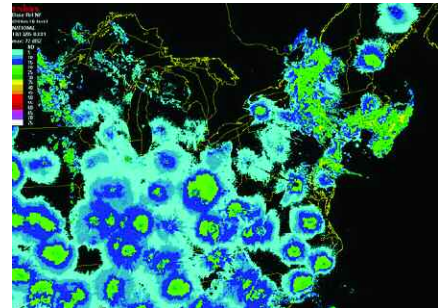


Figure 11. Upper Midwest and Northeast portions of a WSR-88D national mosaic of base reflectivity imagery for the evening of 13 October 2005 produced by Unisys and archived at CUROL. With the exception of extensive shower activity in New England and northern New York, large numbers of birds are migrating across most of the remainder of the region. This is especially true for portions of the upper Midwest and southern mid-Atlantic regions.

often more destructive. The 2005 Atlantic hurricane season was the most active season in recorded history (Table 2). There were 27 named storms (plus one subtropical storm and four numbered tropical depressions), the highest number ever, easily surpassing the 1933 record of 21 named storms; 15 of these storms became hurricanes, which is three more than in the record season of 1969. And of those 15, seven became major hurricanes of Category 3 or higher (tying the record first set in 1950), and an unprecedented four became Category 5 hurricanes, more than the two each in 1960 and 1961. In addition to these all-time seasonal records, many monthly records were tied or shattered.

Over half of these 20 storms made landfall or affected inhabited landmasses (Table 2). Birders whose misfortune it was to live near the landfall sites—even those who lived through and remembered the horrible Hurricane *Camille* of 1969 (central pressure 909

mb at landfall)—were dumbfounded and devastated by these storms. Some lost their homes; some lost their entire communities. And we all, all North American birders, lost some of the loveliest and most productive birding sites in the Gulf coastal areas. And there were perhaps greater losses to mourn. Two hurricanes, *Stan* and *Wilma*, which hit the northeastern part of the Yucatan Peninsula and Cozumel Island, may have struck the death knell for Cozumel Thrasher, of which no sightings have been reported after *Wilma* (as of April 2006).

Meteorologically, the fall season's storms were very much a continuation of the summer's seven storms (a record number for June-July); Tropical Storm *Harvey* inaugurated the fall hurricane season inauspiciously, as *Arlene* had ushered in the summer season seven weeks earlier. The mix of bird species displaced by the summer and fall storms was fairly similar, at least for seabirds. In July

2005, Hurricane *Dennis* and other storms displaced large numbers of terns, notably Sooty (144+) and Bridled (127+), along with nine Brown Noddies, a few storm-petrels, and an astonishing Audubon's Shearwater in Tennessee. Fall-season storms displaced mostly the same pelagic species, but the fall storms also entrain large numbers of Nearctic and Neotropical migrants, especially shorebirds, passerines, swifts, swallows, and cuckoos. While seabirds have presumably some adaptive advantage in coping with tropical cyclones, having evolved in the environment in which such storms are produced, landbird migrants appear to be extraordinarily vulnerable to the storms: during and just after several October storms, millions of warblers and hundreds of tanagers, vireos, cuckoos, and swifts were observed in situations of extreme stress, starvation, or displacement this year, in settings that ranged from San Andrés Island off Nicaragua to the Azorean Archipelago off

Table 2. Atlantic tropical cyclones and depressions, summer–winter 2005–2006.

| NAME | MAX. STRENGTH | AFFECTED AREA(S) | DATES |
|------------------|-------------------------------------|--|--------------|
| <i>Arlene</i> | Tropical Storm | Florida, Alabama | 8–13 Jun |
| <i>Bret</i> | Tropical Storm | Mexico | 28–30 Jun |
| <i>Cindy</i> | Hurricane (Category 1) ^a | Louisiana, Mississippi | 3–7 Jul |
| <i>Dennis</i> | Hurricane (Category 4) ^b | Jamaica; Cuba; Florida, Alabama | 5–13 Jul |
| <i>Emily</i> | Hurricane (Category 5) | Grenada; Mexico | 11–21 Jul |
| <i>Franklin</i> | Tropical Storm | none | 21–29 Jul |
| <i>Gert</i> | Tropical Storm | Mexico | 23–25 Jul |
| <i>Harvey</i> | Tropical Storm | none | 2–8 Aug |
| <i>Irene</i> | Hurricane (Category 2) | none | 4–18 Aug |
| T.D. #10 | Tropical Depression | none | 13–14 Aug |
| <i>Jose</i> | Tropical Storm | Mexico | 22–23 Aug |
| <i>Katrina</i> | Hurricane (Category 5) | Florida; Louisiana, Mississippi ^c | 23–31 Aug |
| <i>Lee</i> | Tropical Storm | none | 28 Aug–2 Sep |
| <i>Maria</i> | Hurricane (Category 3) | none | 1–10 Sep |
| <i>Nate</i> | Hurricane (Category 1) | none | 5–10 Sep |
| <i>Ophelia</i> | Hurricane (Category 1) | North Carolina | 6–18 Sep |
| <i>Phillippe</i> | Hurricane (Category 1) | none | 17–24 Sep |
| <i>Rita</i> | Hurricane (Category 5) | Louisiana; Texas | 18–26 Sep |
| T.D. #19 | Tropical Depression | none | 30 Sep–2 Oct |
| <i>Stan</i> | Hurricane (Category 1) | Mexico | 1–5 Oct |
| <i>Tammy</i> | Tropical Storm | Florida, Georgia | 5–6 Oct |
| T.D. #22 | Tropical Depression | none | 8–9 Oct |
| <i>Vince</i> | Hurricane (Category 1) | Portugal [first ever] | 9–11 Oct |
| <i>Wilma</i> | Hurricane (Category 5) | Mexico; Belize; Cuba; Florida ^d | 15–25 Oct |
| <i>Alpha</i> | Tropical Storm | Haiti; s. Bahamas | 22–24 Oct |
| <i>Beta</i> | Hurricane (Category 3) | San Andrés; Nicaragua | 27–31 Oct |
| T.D. #27 | Tropical Depression | none | 14–16 Nov |
| <i>Gamma</i> | Tropical Storm | none | 18–21 Nov |
| <i>Delta</i> | Tropical Storm | none | 23–28 Nov |
| <i>Epsilon</i> | Hurricane (Category 1) | none | 29 Nov–8 Dec |
| <i>Zeta</i> | Tropical Storm | none | 30 Dec–8 Jan |

^a Hurricane *Cindy* was first listed as a tropical storm; its status was upgraded to hurricane after a more careful study of wind data.
^b Hurricane *Dennis* damaged the Gulf of Mexico coastline extensively; most notable among the birds displaced by the storm was an Audubon's Shearwater in Tennessee (see the summer Changing Seasons essay).
^c Hurricane *Katrina* destroyed or damaged a great diversity of habitats important to birdlife in these states; see the S.A. in the Central Southern regional report.
^d Hurricane *Wilma* made landfall in Mexico and in Florida, but the birds it displaced or grounded were noted from as far away as Bermuda, New England, Atlantic Canada, western Europe, and the Azores.
 N.B.: In addition to the above-listed storms, an unnamed subtropical storm was active 4–5 Oct in the Azores, bringing the season total to 28 storms.

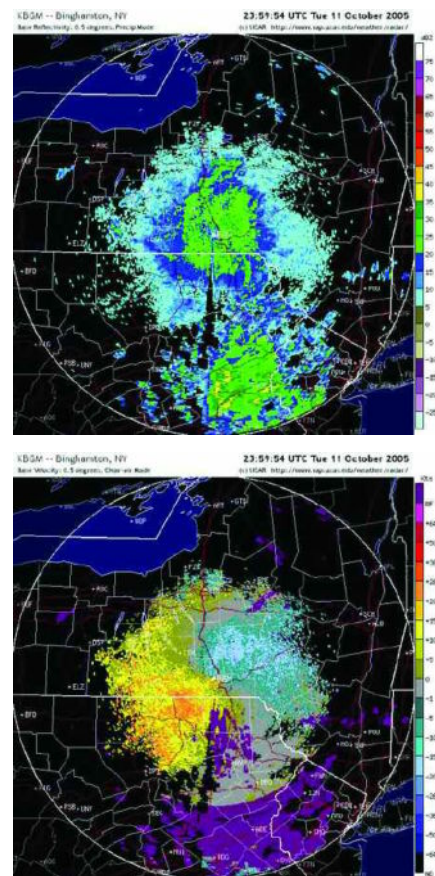
Africa. We tend to think of hurricane damage at the level of ecosystem—or in extreme cases (Grenada Dove, Cozumel Thrasher), potential extinction—but the loss of many millions of Neotropical migrants to hurricanes, even in a single season, could affect some of our widespread, “common” birds at the population level. For uncommon species such as Bay-breasted Warbler (see the Central American regional report), we could well see the negative effects of these storms in the 2006 migration and breeding seasons.

Hurricane Katrina

Certainly one of the major events of the au-

tumn 2005 season—indeed of United States history as a whole—was the destruction brought by Hurricane *Katrina*, which made landfall first near Hollywood, Florida on 25 August, then again on the Louisiana-Mississippi state line on 29 August (Figure 15). *Katrina* was a moderate (Category 1) hurricane when it struck Florida, and no bird sightings are mentioned in the Florida regional column (which, as of the current issue, includes the entire state of Florida) as connected to that landfall. The storm then entered the unusually warm waters of the Gulf of Mexico and rapidly intensified to a Category 5 Hurricane (central pressure 902 mb) by 27 August, dropping to a Category 4 storm (920 mb) just prior to landfall in Louisiana and Mississippi. In addition to its strength, *Katrina* was notable because of its size. When it made landfall in Louisiana/Mississippi, the storm's outer bands were simultaneously affecting southeastern

Texas, the Florida Panhandle, and western Tennessee; the diameter of the storm at this point exceeded 1000 km. East of the storm's eye, a powerful storm surge in excess of 8 m inundated coastal areas for several kilometers inland and led to levee failures along Lake Pontchartrain and widespread flooding that inundated more than eighty percent of New Orleans with up to 5 m of water. For a period of 24 hours, essentially all of the marsh habitats in this part of the world were completely underwater. After the storm passed inland in a north-northeasterly direction, it was clear that the coastline from eastern Louisiana east through Mississippi and Alabama had been heavily modified: islands had either disap-



Figures 12 A-B. Binghamton WSR-88D display for 2359 UTC on 11 October 2005, produced by the University Corporation for Atmospheric Research and archived by W. R. Evans. 12A) The base reflectivity image shows blocky patterns characteristic of precipitation in the bottom (more southerly) portions of the image. More uniform patterns represent primarily birds, although scattered precipitation is visible interspersed within this more uniform pattern. Migration amounts correspond to widespread densities of approximately 110 birds per cubic kilometer (the darkest blue color) with isolated areas of 220–600 birds per cubic kilometer (two shades of green). 12B) The velocity image for the same radar scan shows precipitation and range folding (i.e., the radar cannot accurately determine target velocities) in purple. Bird targets (the primary but not sole constituent of non-precipitation targets; insects are also aloft) are moving to the south-southwest at 15–20 knots close to the radar and to the southwest at 15–20 knots farther from the radar; closer targets are at lower altitudes because the radar antenna is elevated at a 0.5° angle and the microwave pulse from the radar increases in altitude above the ground with increasing distance from the radar.

peared (e.g., the Chandeleur Islands off Louisiana) or were remade (East Ship Island off Mississippi was split into several smaller islands), some coastal beaches and marshes had vanished, and protective dunes, cheniers, hammocks, and maritime forests were leveled, including cherished sanctuaries and migrant “fallout” locations visited by birders for decades. The storm caused more than 1200 human deaths (new bodies are still being found as of April 2006), caused an estimated

Table 3. Notable reports of seabirds associated with Hurricane *Katrina*, August–September 2005.^a

| SPECIES | STATE OR PROVINCE; NUMBER |
|--------------------------|---|
| Sooty Shearwater | Florida (3 onshore) |
| Greater Shearwater | Near Murfreesboro, TN (1, 31 Aug; later died) |
| Wilson's Storm-Petrel | Florida (1 onshore) |
| Band-rumped Storm-Petrel | Pickwick Dam, TN (2, 30-31 Aug), Falls of the Ohio, KY (1, 31 Aug), and Franklin County, KY (2, 31 Aug; 1 later retrieved as a specimen) |
| White-tailed Tropicbird | Florida (2 onshore) |
| Magnificent Frigatebird | Florida (many), Georgia (2 inland), Alabama (2 inland), Tennessee (1), Arkansas (1), Ohio (1 imm., 5 Sep), Iowa (adult female, 4-5 Sep) |
| Frigatebird sp. | Indiana (1 imm., 1 Sep), Iowa (1, 18 Sep) |
| Long-billed Curlew | Presque Isle State Park, PA (1 on 31 Aug) |
| South Polar Skua | Pickwick Dam, TN (1, 30-31 Aug) |
| Long-tailed Jaeger | Pickwick Dam, TN (1 juv., 30 Aug) |
| Laughing Gull | Ohio (9+) |
| Sabine's Gull | Pennsylvania (1) |
| Gull-billed Tern | Mississippi (1 inland), Alabama (1 inland) |
| Royal Tern | Georgia (1 inland), Tennessee (2) |
| Sandwich Tern | Georgia (1 inland), Alabama (1 inland) |
| Least Tern | Georgia (1 inland), |
| Bridled Tern | Lake Seminole, GA (1), Hamilton County, TN (2, 30 Aug) |
| Sooty Tern | Florida (peak coastal count 100+), Georgia (8 inland), Alabama (25 at six sites, all 30 Aug), Mississippi (2), Louisiana (1 inland), Tennessee (10+), Ontario (1) |
| Black Tern | Lake Seminole, GA (150) |
| Brown Noddy | Gulf Breeze, FL (1) |
| Black Skimmer | Tennessee (2), Arkansas (1) |

^aOther reports certainly or possibly related to *Katrina* include many Laughing Gulls, Forster's, Common, and Black Terns inland, plus small numbers of Red Phalarope, Long-tailed Jaeger, Black-necked Stilt, and American Avocet; a Lesser Frigatebird 18 September at the Lake Erie Metropark, Wayne County, MI; an unidentified frigatebird 19-21 September at Big Lake, St. Louis County, MN; a Clapper Rail 23 September at Chattanooga, Hamilton County, TN; a Gull-billed Tern 17-20 September at Pt. Mouillee, Wayne/Monroe Counties, MI; and a Black Skimmer 17 September in Shelby County, TN/Crittenden County, AR.

in the Atlantic, figured relatively prominently after *Katrina*. Three Sooty Shearwaters and a Wilson's Storm-Petrel (plus 2 White-tailed Tropicbirds) made an appearance along the Florida coast just prior to and during landfall; a Greater Shearwater was moved to Tennessee; and five Band-rumped Storm-Petrels were noted between Kentucky and Tennessee. Frigatebirds were blown well inland in small numbers, north to Iowa, Indiana, Ohio, and apparently Minnesota. Hurricane *Gilbert* of 1988 apparently displaced far more frigatebirds than *Katrina*, but the geographic span of *Katrina*'s refugees was remarkable nonetheless. One wonders if the Lesser Frigatebird photographed in Michigan in mid-September was also related to this storm. Other pelagic birds found well away from coastal areas after the hurricane included a South Polar Skua (Figure 16) and a Long-tailed Jaeger at Pickwick Lake, Tennessee; there are perhaps three other inland reports of the skua in North America. The extratropical remnants of *Katrina* also apparently

as Swallow-tailed Kite (one recorded at Sugar Bay, Pennsylvania 31 August; two at Wakarusa Wastewater Treatment Facility, Indiana the next day)—we will probably never know to what degree hurricanes influence extralimital appearances, as kites have begun wandering widely in late summer and early autumn in recent years. (The same is true of Roseate Spoonbills, 128 of which were tallied on 25 September in Desha County, Arkansas, after Hurricane *Rita* had passed.) But the remnants of passing hurricanes do seem to stir the migrational pot, and even if seabird strays are not discovered on one's local patch, interesting birds often seem to appear after these storms. And it often pays to walk beaches, if the local authorities permit it; a weakened Brown Booby was found at Port Aransas, Texas, 29 September.

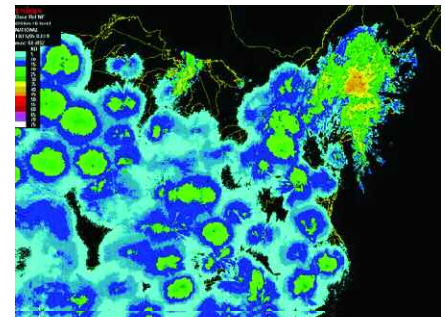


Figure 13. Upper Midwest and Northeast portions of a WSR-888 national mosaic of base reflectivity imagery for the evening of 14 October 2005, produced by Unisys and archived at CUROL. With the exception of extensive shower activity in New England, large numbers of birds are migrating across most of the remainder of the region. This is especially true for the upper Midwest and southern mid-Atlantic areas as well as the Appalachians and western New York.

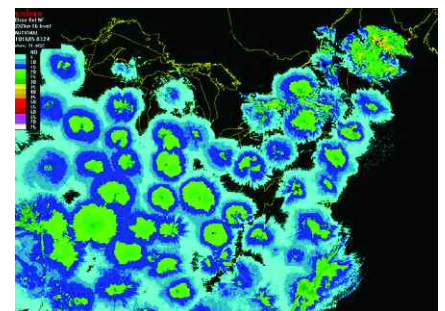


Figure 14. Upper Midwest and Northeast portions of a WSR-888 national mosaic of base reflectivity imagery for the evening of 15 October 2005, produced by Unisys and archived at CUROL. With only scattered showers remaining across Lake Ontario and northern New England, large numbers of birds are migrating along the Atlantic coast. Additionally, areas south of the Great Lakes show heavy migration, as do many sites across the remainder of the region. Note that some of the irregular patterns visible in the bottom-right portion of the image over coastal Virginia and North Carolina represent anomalous reflectivities indicative of atmospheric effects rather than actual atmospheric targets.

\$100 billion in property losses, and will surely affect birds and their habitats along the central Gulf Coast for decades to come.

Despite the impossibility of any form of birding in the worst-affected areas of the Gulf Coast, observers farther inland, mostly along the storm's track (Figure 15), found an assortment of grounded seabirds and coastal birds (Table 3), the likes of which had never been observed after a Gulf hurricane—no doubt the result of *Katrina*'s size, strength, and track across the Gulf of Mexico, as well as to the greater understanding of hurricanes' displacement of birds than existed in 1969, when *Camille* hit. Tubenoses, far less prominent in hurricane displacement events in the Gulf than

grounded shorebirds in the Carolinas and Georgia, in the Champlain Valley of Vermont (765 shorebirds of 16 species, including 140 American Golden-Plovers), and in the Eastern Highlands and Upper Ohio Valley region, where Pennsylvania's first Long-billed Curlew was the pearl among 21 shorebird species 31 August. Laughing Gull numbers were greatest nearer the Gulf Coast, where counts reached double digits in interior Mississippi and Alabama, but dozens appeared at inland sites throughout the East and as far north as the Great Lakes; while this pattern is not always linked to tropical cyclones, it was a good bet it was this year: 54 autumn Laughing Gulls in Indiana is not the norm. For some species—such

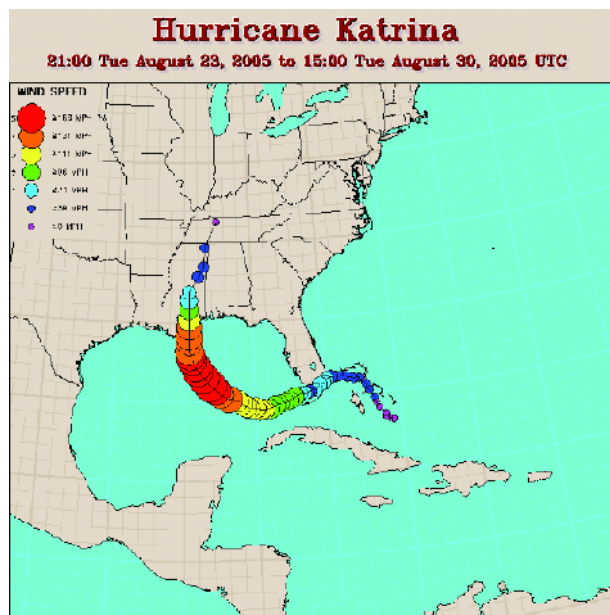


Figure 15. Track and windspeed of Hurricane Katrina, 23-30 August 2005. Graphic courtesy of Johns Hopkins Applied Physics Laboratory.

Hurricane Ophelia

Hurricane *Ophelia*, a Category 1 storm, technically never made landfall (its eye remained just offshore), but the storm was very close to shore and caused extensive flooding and other damage along the North Carolina coastal plain. In Florida, some 5407 terns of five species were moved inshore to Huguenot Park and Nassau Sound 7 September, including 7 Sooty Terns. The slow-moving storm then strafed the Outer Banks of North Carolina over 14-16 September. Reports from 15-16 September included 4+ Bridled Terns, a Sabine's Gull, 3 Black-capped Petrels, over 200 Cory's, one Greater, one Manx, and 5 Audubon's Shearwaters, and 6 Wilson's Storm-Petrels. As in Hurricane *Bonnie* of 1998 (Brinkley 1999), the larger tubenoses "trapped" in the sounds, within sight of the ocean, did not cross beneath the bridges to return to pelagic waters but spent days milling around in these inshore waters, west of the bridges. Well north of the Outer Banks, a Long-billed Curlew at the French island of Miquelon 18 September was presumed to have been transported by *Ophelia*; there are several such records of the species in the literature, including the Hurricane *Katrina* bird noted above and another in Belize after *Wilma*, but this was the first record in modern times for Atlantic Canada.

Hurricane Rita

Following *Katrina*, a second powerful hurricane impacted the central Gulf Coast on 24

September. Hurricane *Rita* made landfall that day along the Texas-Louisiana border as a strong Category 3 storm, having diminished in strength from a Category 5 storm just two days earlier. This compact storm, like *Katrina*, weakened considerably just prior to landfall, although it still produced widespread damage and coastal flooding in western Louisiana and surrounding areas. *Rita* may have displaced just as many seabirds inland as *Katrina*, but only a few were reported, most in northern Louisiana and Arkansas, where terns, Laughing Gulls, and ardeids were the fare. Because of the remoteness of this section of the Gulf Coast (and the genuine fear that *Rita* would be as damaging as *Katrina*, or worse), there were essentially no reports from the coast during or just after the

passage of *Rita*, with the exception of 26 Cory's and two Audubon's Shearwaters and a Brown Noddy well to the east of the landfall point at Boynton Beach Inlet, Florida 20 September. Small numbers of Magnificent Frigatebirds were found well inland, most in Louisiana but also up to four in Arkansas. Other reports included a Long-tailed Jaeger at Wheeler Dam in Alabama 26 September, good numbers of Laughing Gulls inland (double-digit counts in Arkansas, Mississippi, and Alabama; could some of Colorado's seven have been *Rita* birds?), a Sabine's Gull found dead at Wheeler National Wildlife Refuge in Alabama 29 September, Gull-billed and Royal Terns in Louisiana, and a few more Royal Terns in Arkansas and interior Texas. See the Central Southern regional report's S.A. box for more details on its hurricanes and their aftermath.

Hurricane Wilma

After all of this perturbation, it seemed that the tropical cyclone season might finally wind down in October. Alas, this was not to be. Hurricane *Wilma* (Figures 17, 18) made headlines around the world, and storm-weary Gulf coast residents—even those evacuated and dis-

persed across the continent—watched its progress with dread and disbelief: *Wilma* had the lowest central pressure ever recorded for an Atlantic hurricane (882 mb), surpassing the record set by *Gilbert* in 1988 (888 mb); it was the third Category 5 hurricane (and twelfth hurricane overall) of the 2005 season; and it produced as much as 120 cm of rain on the Yucatan Peninsula and destroyed 850,000 hectares of precious tropical hardwood forest there. In the state of Yucatan, the storm was credited with mainland rarities as diverse as White-crowned Pigeon, Greater White-fronted Goose, Smooth-billed Ani, and Masked Booby, some of these representing first state records.

After hammering the western Caribbean and Yucatan Peninsula 21-23 October, *Wilma* sped across Florida on 24 October, badly damaging the Everglades National Park and other important bird habitats, then traveling very rapidly to within 200 km of Sable Island, Nova Scotia on 25 October, and moving eastward across the Atlantic toward Scotland by 27 October. Reminiscent of the now-famous "Perfect Storm" of October 1991, *Wilma* merged with the remnants of Tropical Storm *Alpha* and with another low-pressure system



Figure 16. One of Hurricane *Katrina*'s more astonishing waifs was this South Polar Skua at Pickwick Lake, Hardin County, Tennessee on 30 August 2005, a first record for the state and one of few inland reports of the species in North America. Figure 15 shows clearly how this individual arrived in Tennessee. Photographs by Joe Guinn.

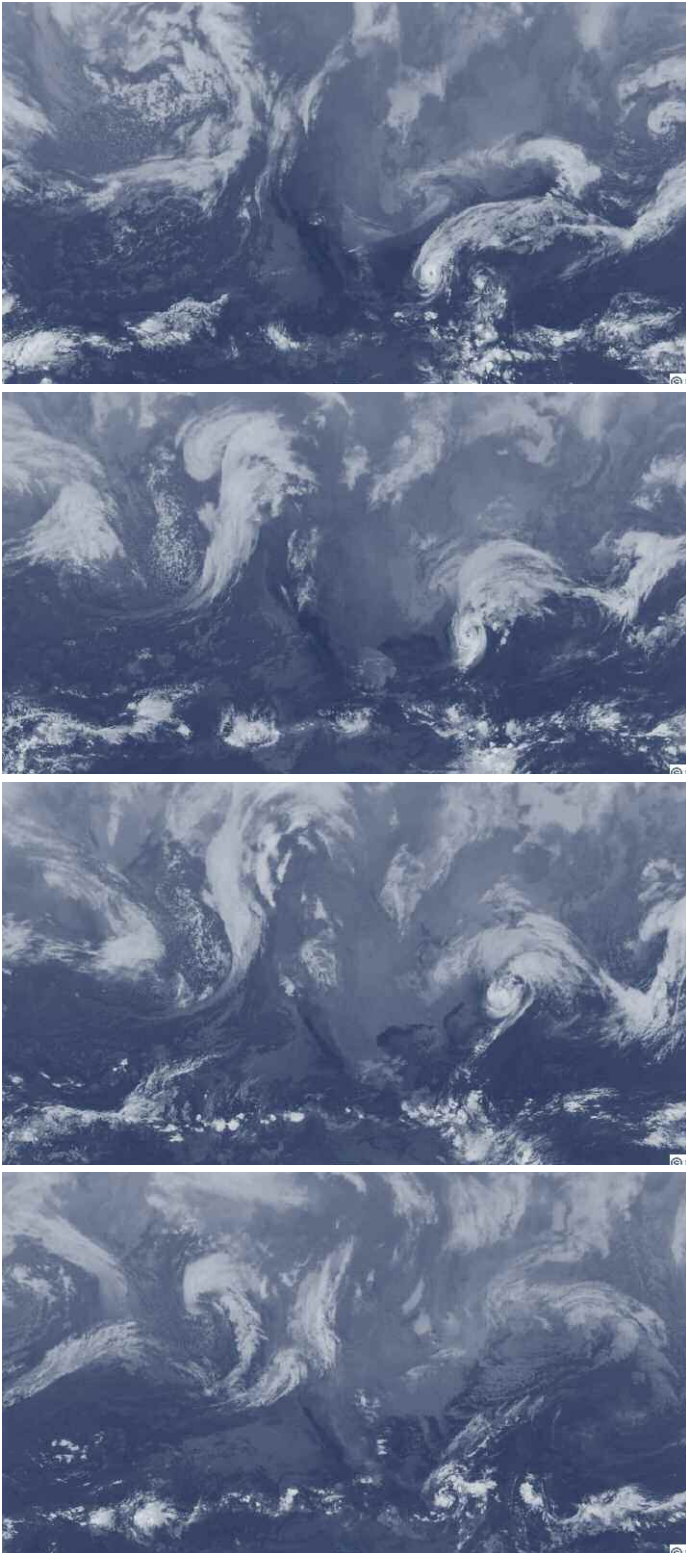


Figure 17. Operational Significant Event Imagery (OSEI) tropical cyclone imagery produced by Unisys for NOAA from polar and geostationary satellites showing the progression of Hurricane *Wilma* from the Gulf of Mexico to the northern Atlantic Ocean in October 2005. A) 0000 UTC 24 October, B) 0000 UTC 25 October, C) 1200 UTC 25 October, and D) 1200 Z 27 October. *Wilma* moves from a position (A) in the central Gulf of Mexico, (B) across Florida, (C) toward Nova Scotia, and (D) into the northern North Atlantic Ocean over the course of just three days.

as it moved northeastward away from the North American landmass.

With at least some of the many thousands of bird associated with the October fallouts moving south along or just off the Atlantic coast and the countless migrants still crossing the Gulf of Mexico and the northern Caribbean, it seems clear that the hurricane entrained and carried some of these migrants northward to Bermuda, the northeastern Canadian provinces, even to mainland Europe and islands off Africa. The storm moved with exceptional speed (90 km/hr), carrying with it thousands of migrants, the first of which appeared during and just after the storm's passage. Birds typically associated with hurricane displacement, notably frigatebirds, ardeids, and larids, were conspicuous constituents of *Wilma's* cargo. Frigatebirds were abundant (70+ birds) as never before on Bermuda—David Wingate observed 41 in a single kettle one evening over Wreck Hill—and seven were tallied between Nova Scotia and the French island of St. Pierre. After the storm's passage, up to five were noted in coastal New Jersey and Delaware, two or three were in Virginia, 11+ were in coastal North Carolina, and singles were in Georgia and South Carolina. All of these birds were reported after 2 November, suggesting they were returning southward after being displaced by *Wilma*. (The problem of associating records of frigatebirds with tropical cyclone activity has been mentioned often in Changing Seasons essays; this season, single wanderers 1-2 August along Lake Huron, Ontario, and 7 August on Long Island, New York, made the point nicely: no storms could be connected to their appearances. The same is true for boobies; a Brown at Cape May 16 September and an unidentified booby at Nantucket Shoals 27 August were almost certainly not storm-driven.)

From Barbados to Newfoundland to Wales, larids displaced by *Wilma* were widely observed—in great diversity, as we expect with strong hurricanes, but also in great numbers. Canadian birders, especially in Nova Scotia, found storm birds in nearly every sheltered harbor, especially in the east. Consider the final tally in the Atlantic Provinces region: 340 Laughing and 18 Franklin's Gulls, 4 Gull-billed, 87+ Caspian, 27 Royal, 33 Sandwich (plus one Cayenne), 1635+ Common, 56 Forster's, one Least, and five Black Terns, and 18 Black Skimmers. A Caspian and a Forster's Tern in the Gaspé Peninsula of Québec 30 October were thought to be *Wilma* birds, likewise a Sandwich Tern at North Truro, Massachusetts that day. A similar mix of terns (but also including Roseate, Bridled, and Sooty) was detected in Bermuda, along with 30 Laughing and five Franklin's Gulls; two Franklin's Gulls were on Barbados 9 November (a first record there), seven in New England, and four in New Jersey just after *Wilma*; and both gull species reached Britain: 60+ Laughing and 6+ Franklin's. Quite belatedly, Iceland at last got a bird from *Wilma*—a Laughing Gull that turned up 8 April 2006 was reckoned to be a bird making its way back to the New World from the Old; the species had actually been anticipated there this spring! Because *Wilma* had passed well to the south of Iceland, producing cold northerly and northeasterly winds there, no storm-associated birds were found in October. Among the shorebirds thought to be *Wilma*-transported to Canada were Black-necked Stilt, American Avocet, Stilt Sandpiper, Long-billed Dowitcher, Marbled Godwit, and Wilson's Phalarope; 24 Blue-winged Teal in Atlantic Canada were also attributed to *Wilma*.

But it was the landbird bounty that made *Wilma* such an extraordinary storm in the annals of hurricane history: in addition to minor numbers of many other species, hundreds of Yellow-billed Cuckoos and thousands of Chimney Swifts were recorded along the storm's track, along with noteworthy counts of swallows (six species). These birds presumably became entrained in the hurricane either in the

western Caribbean or Yucatan regions, or more likely while the storm was moving eastward in the Gulf of Mexico. It is interesting to note the dearth of cuckoo reports in Florida following *Wilma*, especially in light of the reports of “thousands” of Chimney Swifts within the storm’s eye as it passed over Jupiter Inlet Colony, Martin County, Florida 24 October. It is fair to say that Hurricane *Wilma* displaced not only a diverse array of migrants but also staggering numbers of individuals, the likes of which Atlantic Canada had not seen in decades, possibly ever: minimally 3000 Chimney Swifts (most of which died) and minimally 350 Yellow-billed Cuckoos. On Bermuda, at least 100 cuckoos (up to 70 at one site, the Arboretum) and over 100 Chimney Swifts were detected, with one Chimney Swift on Barbados being locally rare.

The conventional wisdom in the Southeast has often been that hurricanes that do not cross land do not reveal the birds they entrain. Hurricane *Ophelia* gave that old chestnut a tap; *Wilma* cracked it for good. At Andrew’s Point, Rockport, Massachusetts, a veteran seawatcher’s wait paid off: *Wilma* brought a Black-capped Petrel into spotting scope range. Indeed, all the larids, frigatebirds, and landbirds observed in eastern Canada had come off the ocean, presumably escaping the dissipating eye off the northern/western side of the storm. And so we are reminded again that our understanding of hurricane displacement of birds is still very much in its infancy!

The displacement events associated with *Wilma* were widespread, so much so that one has to wonder to what extent they may have been intertwined with the large-scale fallouts of the weeks preceding them. Some birds, such as the three Winter Wrens in Bermuda or the Bicknell’s Thrush in the Bahamas, were possibly related *both* to the fallouts in the middle of the month *and* to the subsequent hurricane. It is certainly clear that late-season vagrants noted in the East (and the Bahamas and Bermuda) had the mark of *Wilma*: Chimney Swifts lingered in many areas of eastern United States well into November, and Yellow-billed Cuckoos appeared at numerous locations late in the season, although presumably many more went undetected. Swallow numbers were high well into the late fall at many coastal sites, including some rarities, such as the November Cliff Swallows in the Bahamas. Migrants usually rare in Bermuda and the northern Caribbean appeared at a number of locales in both areas, sometimes on very late dates.

We must mention here the unprecedented

diversity and numbers of Nearctic and Neotropical migrants that appeared in the western Palearctic after *Wilma*: Magnificent Frigatebirds in Spain, Portugal, France, and England, Great Blue Heron, American Bittern, Pied-billed Grebe, Sora, Yellow-billed Cuckoo, Chimney Swift (over 80 between Ireland, England, Spain, France, and the Azores), Gray-cheeked Thrush, Tree Swallow, Red-eyed Vireo, Black-throated Blue, Yellow-rumped, Blackpoll, and Hooded Warblers, Ovenbird, Indigo Bunting, and Rose-breasted Grosbeak. The timing and composition of these records suggests a likely association with the migration events of October in the northeastern United States, and some were likely “overmigrants” caught offshore after the major low-pressure system had moved out over the Atlantic—and were then in some cases further entrained by *Wilma*.

Hurricane *Beta*

On San Andrés Island, east of Nicaragua, 70 observers were in attendance at a banding course sponsored by Fundación ProAves during the time that Hurricanes *Wilma* and *Beta* passed through the western Caribbean. They arrived around 19 October, just after Hurricane *Wilma*, and were on the ground during the direct hit of Hurricane *Beta* 26 October. Please read the S.A. on these storms in the

Central America regional report, which details a fallout of more than five million Neotropical migrants on 19 October, largely tanagers, thrushes, catbirds and warblers: Bay-breasted, Chestnut-sided, and Tennessee Warblers, and Ovenbirds. Between the storms, waves of Indigo Buntings, Yellow-billed Cuckoos, and other warblers (including Golden-winged) arrived, mostly in weakened states.

Hurricane *Otis*

The Pacific coast of Mexico was also struck by a significant hurricane this season: *Otis*. This compact storm formed 29 September off the western coast of Mexico and drifted slowly north-northwestward, passing just to the west of Baja California 3-4 October and then dissipating. A Juan Fernandez Petrel 4 October flying along the coast at La Ribera, Baja California was a first for that region and was the storm’s lone highlight.

Noted in brief

Autumn is often a productive season for vagrants, but autumn 2005 produced an unusually large number of “firsts,” including potentially two new species for North America: Parkinson’s Petrels off California and Oregon and a Solander’s Petrel off California. On the level of state, province, or territory, potential

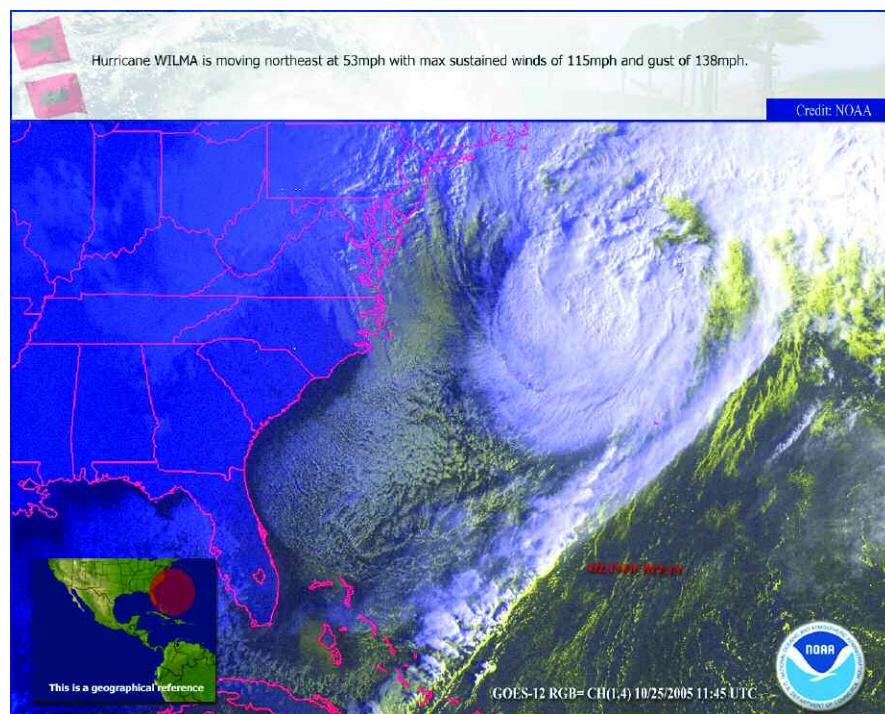


Figure 18. Satellite image of Hurricane *Wilma* taken at 11:45 a.m. EST on 25 October 2005. The storm is here rapidly passing to the east of Bermuda at 53 mph, moving toward a position southeast of Nova Scotia. Observers in both locations recorded hundreds of Yellow-billed Cuckoos and Chimney Swifts, record-high counts of Magnificent Frigatebird, and high diversity and numbers of larids of 18 species. Image courtesy of the National Oceanographic and Atmospheric Administration.

firsts included a Cook's Petrel in Oregon, a Reddish Egret in Nevada, a Little Egret in North Carolina, a White Ibis in Utah, a Wood Stork in Manitoba, a Gray Hawk in Kansas, a Long-billed Curlew in Pennsylvania, a Royal Tern and an Acorn Woodpecker in Iowa, a Vaux's Swift in Texas, single Green Violet-ears in Iowa, New Jersey, and Ohio, an Anna's Hummingbird in Ohio, a Costa's Hummingbird in South Dakota, several Cave Swallows in Indiana and Missouri, a Sedge Wren in British Columbia, a Northern Mockingbird in the Yukon Territory, a Sprague's Pipit in Oregon, a Connecticut Warbler and a Lawrence's Warbler in Idaho, a Scarlet Tanager in Washington, and

a Black-throated Sparrow in Tennessee. An impressive roster, to be sure, but take a look at the species added in Michigan this season: Lesser Frigatebird, Anhinga, Short-tailed Hawk, Eurasian Tree Sparrow, Gull-billed Tern, and White-eared Hummingbird!

The regional reports contained few hints of major irruptions of winter species. South of their expected ranges, there was a paucity of reports of winter owls, Bohemian Waxwings, and most winter fringillids. There were hints of a good Snowy Owl flight, with one as far south as Arkansas. Red-breasted Nuthatch and Purple Finch, which sometimes show a two-year pattern of irruption, made a modest

showing, neither boom nor bust. There was, however, a huge chickadee flight in Ontario and Québec in autumn, peaking in October; Margaret Bain writes that it may have been the largest flight ever recorded in Ontario. Most chickadees were noted flying westward along the eastern Great Lakes, e.g., 2000 per hour on 7 October at Cobourg, Ontario, and these waves were apparently mostly comprised of juveniles (less than 1% of the 943 banded at Tadoussac were adults). To the east, a movement of 1000 Black-capped through a backyard in Shediac, New Brunswick 3 October must have been a sight! A total of 1072 migrating Boreal Chickadees 14 September–12 October through Saint-Fulgence, Québec was impressive; this movement apparently did not translate into extensive southward irruptions in the winter season.

Northward movements by southerly species were again abundant this season, continuing the spring and summer pattern—and arguably a longer-term trend. The provinces of central Canada experienced a strong influx of herons in August–September that included 1000+ Cattle Egrets, a smattering of Snowy Egrets and Little Blue Herons, 2 Glossy Ibis, and Manitoba's first Wood Stork. The Southwest recorded high numbers of Ruddy Ground-Doves (75 or more in Arizona alone!), an Eared Quetzal and 4 Aztec Thrushes in Arizona, and a Painted Redstart in Colorado. More than a dozen of the latter species, plus four Grace's Warblers and a Hepatic Tanager, reached southern California. In what has now become an expected phenomenon, there was also a flush of eastern birds in the Southwest in late August and early September: New Mexico had Red-bellied Woodpecker, Eastern Wood-pewee, 4 Scarlet Tanagers, and a Carolina Wren (another was in Arizona), and both states saw a moderate flight of eastern warblers at this time. The flight of eastern birds to the Pacific coast was mostly average, with a few species above and a few below long-term averages.

Since the 1990s, Cave Swallows have been to the autumn what doves are to the spring migration, at least in the Great Lakes and along the Atlantic Coast. A sprinkling of early fall reports included three Cave Swallows in Kansas over 2–4



Figure 19. On the morning after the passage of Hurricane *Wilma*, 27 October 2005, the Fennells of Red Islands, in Lake Bras d'Or, Richmond County, Nova Scotia saw this mass of exhausted Chimney Swifts clinging to a tree next to their house. Groups such as this were found all over Nova Scotia, and dozens of Chimney Swifts were displaced as far as Europe and Africa. Photograph by Janice Fennell.

September and one in Missouri on 7 September, probably post-breeding dispersers from Texas, as well as one in Georgia on 20 August. But, as now expected, the real movement began in late October and early November, partly a product of the southwesterly winds ahead of the October and November low-pressure systems (see Sullivan 2004), especially a low-pressure system that passed through the Midwest on 12 November 2005. The numbers, like the price of coastal real estate, were again shockingly higher this season than last: 165+ were estimated in New England after 8 November (most seen 11 November); 1000+ were counted in the Hudson-Delaware region after 3 November, including 579 on 6 November at Hamlin Beach, New York; 19+ were along the Southern Atlantic region's coasts after 29 October (the same count came from Pennsylvania after 30 October and Wisconsin 12-20 November); 180+ were in Ontario after 29 October (most seen in November); 60+ was the count in Ohio after 5 November; 11+ visited Indiana on 12 November; and one was photographed in Michigan on 14 November. That's nearly 1500 Cave Swallows far out of range; and that count is surely the tip of the iceberg. Other swallow species were also noted in the mix, also part of a continuing, recent trend, but in almost all cases they were outnumbered by Caves.

In this active tropical storm season, we should not discount the possibility that some of the extralimital Cave Swallows were entrained and displaced by hurricanes (as happened, for instance, with Hurricane *Ivan* in 2004). Hurricane *Wilma* passed through several productive areas for Cave Swallows in its track from the western Caribbean to Europe, and five were reported in Nova Scotia 26-27 October (others there and in New Brunswick 10-12 November were almost certainly a product of the low-pressure system considered above). It is likely that—as for other species of birds (e.g., Chimney Swifts, Magnificent Frigatebirds) displaced by *Wilma*—some of the Cave Swallows seen on the East Coast on November dates were *Wilma* birds moving southward. In most reports of Cave Swallows, *pelodoma* was the subspecies mentioned (14 birds seen 28 October in Florida; one specimen in Virginia, one in Ohio); but one at Bayswater Beach Provincial Park, Nova Scotia 27 October was identified as a Caribbean bird. We should be attentive to this possibility in future flights.

Some of the season's patterns were more widespread. Sabine's Gull, for instance, is a more-or-less routine rarity throughout interior North America, generally decreasing in

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abundance from west to east, and this fall saw a better-than-average flight. What was unusual about this flight was the numbers: most reports are typically one or a few birds, but this fall saw impressive *flocks* at multiple inland sites. The 60+ at Park Point in Duluth on 16 September was a record count for Minnesota and coincided with a flock of 28 that flew past Miller Beach, Indiana that same day and a peak of 22 the next day flying past Van Wagner's Beach, Ontario. These are, needless to say, the most ever reported in the Great Lakes region.

Inland alcid reports are rare, and there are typically one to three reported annually east of the Rocky Mountains. This year was a little better, with a Black Guillemot 26-29 November at Regina Beach, Saskatchewan (second provincial record), a Long-billed Murrelet 8 August at Jasper National Park, Alberta (also a second), a probable Long-billed 12 November at Carlyle Lake, Illinois, and single Ancient Murrelets on 14 October at Whitefish Point Bird Observatory, Michigan and 13 November in Fort Collins, Colorado (the latter found alive on a city street). The fall also saw a mini-invasion of Northern Gannets into the interior, including three in Pennsylvania and one in Michigan.

Other low-density vagrants included single Burrowing Owls in Arkansas (10-14 October), Illinois (after mid-October), and North Carolina (25 October); mid-autumn is a typical time for vagrant Burrowing Owls—but has this species ever been hurricane-displaced?

Sharp eyes

With every reading of this journal's regional reports, we are impressed and encouraged by the increasing discernment of this continent's birders. Subtleties that might have escaped our notice just a few years ago are now recorded in field notebooks and by digital camera—and this journal is reaping, and showcasing, the rewards. Juvenile Curlew Sandpipers, many of which have probably been overlooked in North America, were discerned in Colorado and Montana; a Temminck's Stint failed to slip by the sharp eyes of a Washington birder, and a Florida birder found the state's first Lesser Sand-Plover. Our collective eyes found Gray Flycatcher in Ohio; Hammond's Flycatcher in Maryland; and three or four Yellow-bellied Flycatchers between Colorado and California. Among the more obscure hybrids reported were an apparent Pectoral Sandpiper x Baird's Sandpiper at the famous Hillman Marsh, Ontario, and a Bay-breasted Warbler x Yellow-rumped Warbler at that premier hotspot in

Florida, Lake Apopka. And in West Virginia, banders at Dolly Sods captured and documented a Black-throated Blue Warbler that appears to be a bilateral gynandromorph. Kudos to the keen observers who discovered these birds!

We are also attending carefully to marked birds; banding and color-marking efforts by scientists are bearing fruit, thanks in part to diligent reporting of marked birds by birders, and thanks to the ease of soliciting and reporting sightings of marked birds via the Internet. When a banded juvenile Greater Flamingo appeared in coastal Texas in mid-October, the observers did not assume the bird came from a nearby zoo but instead read the bird's color-band combination and determined that it had been banded in August 2005 at a colony at the Ría Lagartos Biosphere Reserve in Mexico (another flamingo in Florida in 2004 had come from this colony). The bird remained well into spring 2006, observed by hundreds from the Whooping Crane cruises from Rockport. Similarly, a juvenile Black Skimmer found dead on 18 October in New Mexico had been banded two months earlier at the Salton Sea; another skimmer banded there on the same August day was seen alive in Maricopa County, Arizona, in mid-September. Against the odds, even endangered species are being detected across the continent: a *Wilma*-blown Piping Plover showed up at El Palmar Reserve near Celestún, Yucatan, Mexico 30 October; the marked bird had been banded in Big Quill Lake, Saskatchewan, Canada on 13 July. What a small world we occupy with these hardy travelers.

The intricacies of weather and its influence on bird migration and dispersal can now be studied in great detail by virtually anyone in the world who has access to a good computer connected to the Internet. Most of the meteorological products featured in this essay can be found on-line and can help guide us in our birding, whether for choosing our field days carefully or for studying more formally the effects of regional weather patterns on our local birding environments. Even with all this technology at our disposal for understanding our environment, we marvel at the birds we monitor, particularly in desperate times such as these. Nevertheless, despite their sometimes frail appearances, many birds do have remarkable adaptations to protect them from all but the worst weather conditions. Can we really visualize, with Walt Whitman, the course of a frigatebird—moving with a powerful hurricane for days at a time, making landfall in Nova Scotia, then still having the energy to re-

turn homeward? The weather events of 2005 that permitted us to witness so many remarkable bird movements compel us to marvel that, among the thousands that perished, so many birds somehow survived the season's storms. In reading carefully through all the regional reports, we were delighted to find bits of good news to balance or offset the bad: Rusty Blackbird numbers seemed well up this year in many places, after decades of apparent decline (watch for birds color-banded in the Yukon); and the avalanche of kinglets, sparrows, chickadees, creepers, and warblers noted above surely betokens a fine breeding season in the boreal woods.

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