A BIRDWALK AT BOLIVAR FLATS

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A little history and geology

The crown jewel of shorebird habitats along the upper Texas coast is arguably Houston Audubon Society's Bolivar Flats Sanctuary, located on the Bolivar peninsula and within sight of the ever-growing city of Galveston. Some of the largest concentrations of wintering and migrating shorebirds in North America occur here at Bolivar. For example, over ten thousand American Avocets and thousands of Western Sandpipers have been known to winter here.

Bolivar's avian riches, however, have somewhat of an ironic beginning. In 1856, the United States Corps of Engineers built a 5 mile long jetty at the mouth of Galveston Bay in order to protect the bay's entrance for Texas's maritime industry. Once built, the jetty became obstacle for sediment transport. Westward longshore currents, the same ones that generate the barrier islands along the Gulf Coast, brought sediments from river deltas from the east and deposited them along the base of the jetty. These sediments would normally be carried westward supplying sand for Galveston's beaches. Instead, the gradual accumulation of sediments behind the Bolivar jetty has caused the shoreline of the Bolivar Peninsula to grow incrementally outward. Each new shoreline is gradually stabilized from further erosion by the slow but steady invasion of plants. Where the energy of wave action is low (close to the jetty) and the sediments are dominated by silts, brackish-water grasses like Spartina slowly take hold of newly laid sediments. A little further up the coast, where the wave energies are higher and the sediments are coarser-grained, few plants can take hold along the immediate waterline. Instead, the shoreline is gradually stabilized as grasses, such as Phragmites colonize newly formed dunes.

Through this incremental process of laying down new sediment followed by stabilization with various plants, the shoreline of Bolivar Flats continues to grow outward. In an aerial photo, this pattern of outward growth is manifested as a series of subparallel arcuate ridges, each representing a former dune-shoreline complex (Figure 1). Since the construction of the jetty, it appears that the shoreline has grown outwards by about 1 mile in roughly 100 years, corresponding to roughly 40 feet per year! This seems surprisingly large, but in the course of only four years, I have seen the edge of the Spartina patches creep out a considerable distance. In any case, the topography of the ridge complexes is actually very subtle so one may have a difficult time recognizing them. However, there is enough topography and systematic variation in soil properties with age that the presence of these ridges is in fact revealed by changes in vegetation. Ridges, which represent former dunes, tend to be less waterlogged then the linear lows separating each ridge, and in general, the older the ridge, the less waterlogged they become. Ridges thus become more and more vegetated with woody plants, such as Sea Oxeyes (Borrichia sp.) and Baccharis, both shrubby perennials in the sunflower family. The intervening lows are often waterlogged and therefore underlain by highly alkaline soils. Spartina sp. and Salicornia sp. (pickleweed) dominate these areas. The Spartina tend to grow in areas that are annually waterlogged, whereas the Salicornia grow in the drier parts of the lows.

This cooperation between sediment deposition and plant colonization has generated an extensive estuarine system that supports a wide variety of fauna and flora. In some sense, one can say that although the jetty disturbed the normal deposition of sediments

by longshore currents, the accidental generation of the Bolivar Flats estuary as a byproduct was kind of a silver lining. However, it is important to place Bolivar Flats in context. Over the past hundred years, most of the natural estuarine and wetland habitats along the Gulf Coast have been decimated by dredging, urbanization, and pollution. Only a tiny fraction of the Gulf Coast's original coastal wetlands remain, and of these, almost all have had their ecosystems severely modified by anthropogenic influences. The birds and other wildlife have no other choice but to make use of what is left, no matter how disturbed they may be. It thus behooves us to take appropriate measures to manage Bolivar Flats in such a way that it continues to be a major migratory stopover for birds, especially shorebirds.

Sandy beaches

My favorite way to visit Bolivar is to first walk down the sandy part of the beach. Here, the beach is made up of tiny broken up pieces of shells and barnacles mixed in with fine-grained sand and silt. At most times of the season, there are usually flocks of Sanderlings, running up and down the beach in unison with the waves. Although many Sanderlings make Bolivar their wintering spot, many of the Sanderlings in spring are migrating northwards from as far south as Tierra del Fuego! If you look carefully at these Sanderling flocks, you will probably see Black-bellied Plovers and Willets and if you're lucky a Red Knot. These three shorebirds are much larger than Sanderlings and walk more slowly along the shore as they probe the sand for various invertebrates.
Further up on the shore, perhaps just above the waterline, you might notice some small shorebirds with short stubby bills. These are plovers, and depending on the season, you could potentially see a number of species, such as Piping, Wilson's, Snowy, and Semipalmated Plovers. What these small plovers have in common is that they use their stubby bills to pick off invertebrates from the surface of the sand. They are constantly running as they frantically search for food. The Wilson's Plover is the largest of this group and nests regularly here. They move south during winter, but apparently they do not go too far south because they return to Bolivar Flats by the end of January. The Wilson's Plovers start nesting by March. They will tend to build their nests by wallowing out a little hollow just above the flotsam line, so be careful where you step! The Semipalmated Plover is a common winterer and migrant, sometimes even abundant.
The Piping and Snowy Plovers are species of special concern. There are only a few thousand Piping Plovers left in the world. They nest primarily in the Great Plains and a few hundred winter in the Bolivar-Galveston area. The Snowy Plover occurs worldwide, but along the Gulf Coast, its status is somewhat threatened. Snowy Plovers nest along very sandy beaches, but most of these have either been paved over, eroded away or are constantly being disturbed by beachgoers and all-terrain vehicles. We now they nest on some of the relatively inaccessible barrier islands because every summer we see juveniles at Bolivar. At any given time, however, the number of Snowies typically does not exceed a few dozen, making it our most uncommon regularly occurring plover.

Birds in the estuary

After watching plover antics, it is usually time to walk down to the estuary itself. This is where the salty seawater transitions into freshwater. This is also where the effects of tides are greatest because it is here where the tidal waters are focused into narrow inlets. The estuary has an interesting structure. The mouth of the estuary is wide open and is underlain by extensive mudflats, which are inundated by a few feet of seawater during high tide and exposed to the air during low tide. As we work our way up the

estuary, the mudflats give way to patches of Spartina grasses. Working even further "upstream", the estuary begins to narrow into brackish-water channels, which turn into intricate meandering streams if you were to follow them up further. Continuing up the estuary, the salinity of the water progressively decreases. At Bolivar, the uppermost reaches of the estuaries give way to bulrushes and cattails. These plants cannot tolerate very high salinities.

One of the best ways to appreciate the intricate structure of the estuarine ecosystem is to look at how the birdlife partitions itself throughout the estuary. For example, Western Sandpipers, Short-billed Dowitchers, Marbled Godwits, Red Knots, and most of the plovers prefer to feed in the more saline parts of the estuary. In contrast, Least Sandpipers, Long-billed Dowitchers, and Greater and Lesser Yellowlegs, all of which who generally prefer fresh water over seawater are often found foraging in the brackish sections of the estuary. While there is of course some overlap in habitat use, the degree of segregation of these shorebirds by salinity is sometimes striking. Some shorebirds can often be found feeding in both habitats. Long-billed Curlews and Whimbrels do not seem to mind. Others, like the American Oystercatcher are so finicky that they are almost always found where there are oysters and these occur primarily in the edge of the brackish water section.

Shorebirds are not the only birds that we should pay attention to. Some birds like Clapper Rails are found primarily in the Spartina grasses. Although they are also found occasionally in freshwater, where cattails (Typhus) dominate, the more brightly colored King Rail is found (though at Bolivar, King Rails are rather uncommon). Seaside sparrows are Spartina-obligate although some may venture into the Salicornia wetlands. The very similar Sharp-tailed Sparrow, which occurs only in the winter, will venture further into the brackish water parts of the estuary than Seaside Sparrows.

The structures of shorebird feeding

I am often asked why I am so fascinated with shorebirds, those little brown birds that are so hard to identify. One of the secrets to shorebirds is that their feeding habitats are so loyal to their feeding structures (and vice versa), as manifested by the shape and size of their bills and legs. Through millions of years of natural selection, shorebirds believed to have evolved from gull-like birds, have diversified into almost a circus of different-looking species. Long-billed Curlews, with their long decurved bills are able to probe deep into the mud looking for clams and soft-bodied invertebrates. Dowitchers, with their intermediate length bills, can probe a few inches into the mud using a sewing-like action to search for worms. Along with curlews and whimbrels, they also have relatively tactile mandibles, allowing them to grasp or feel their way in the mud when they otherwise cannot see. Sandpipers, with their shorter bills, probe only the upper inch or so of the mud, and finally, plovers, with their short stubby bills hardly probe at all, but glean invertebrates off the surface of the sand.

A good way to see these feeding strategies is to wait for low tide and watch the shorebirds along the water's edge. Long-billed Curlews, Whimbrels and Willets will typically be farthest out in the water as will American Avocets. Instead of probing in the mud, avocets skim the surface of the water looking for zoo- and phytoplankton with their upturned bills. Working our way toward the shore, we will then encounter the dowitchers, followed by the Dunlins and finally the Western Sandpipers. The Western Sandpipers will work the shallow parts of the water, usually at depths shallower than 1-2 inches. During spring and fall, Semipalmated Sandpipers, which look very much like Westerns, will also be found at Bolivar. Although Semipalmateds will tend to forage in the brackish water sections and Westerns out in the more saline mudflats, when they do occur

together, it becomes a challenge to identify them. However, Semipalmated Sandpipers have just slightly shorter bills and legs than Western Sandpipers and, as a consequence they will tend to work the very edge of the water, segregating themselves from Westerns, which often feed in knee-deep water. Least Sandpipers with the shortest bills and legs of the Calidris sandpipers will be found working the shoreline or the open mudflat. They are rarely seen wading in waters with Westerns (in addition, Leasts prefer brackish or freshwater habitats). Thus, the make-up of shorebirds along the shore is often stratified by subtle nuances in habitat, and if you recognize these subtle differences, you will appreciate much more the joys of shorebird watching!

Birding with the tides

Tides are the cyclic rising and falling of the ocean surface caused by changes in the positions of the Earth with respect to the moon and the sun. There are two sets of tides each day (two high and two low tides) and their effects on estuaries are profound. At high tide, the tidal mudflats are inundated and the invertebrates living in the mud come out to feed. High tide is the opportune time for these invertebrates to feed because at low tide, they would dessicate in the sun. In addition, at high tide, the waters are typically too deep for most shorebirds to feed. Only wading birds, such as egrets, may be able to prey on these invertebrates during high tide.

So when is the best time to watch shorebirds? Shorebirds are of course most active during low tide. Although most of the invertebrates burrow deep into the mud during low tide stands in order to stay moist and stay in a buffered chemical environment, shorebirds take advantage of the low tides because the mudflats are exposed. The shorebirds have special adaptations to their bills, which allow them to seek out invertebrates even though they have burrowed into the ground. Thus, if you want to see shorebirds in action and in greatest numbers, low tide is the best time. The only problem with low tide is that shorebirds are typically spread out over large expanses of mudflats, making it a daunting task to survey these birds unless you have a telescope and are willing to walk a bit. However, it is really only at these times when one can really assess how many shorebirds are making use of the estuary as they are all out actively feeding. Bird surveyors are not the only ones who realize this. Birds of prey, such as Peregrine Falcons, cannot wait until low tide as this is when the shorebirds are out in the open and easy to pick out.

Now, if you want to get a little closer to shorebirds, high tides are probably best. During these times, shorebirds have really no place to feed, so they move up on to dry land to sleep, often congregating in the safety of large flocks. The trick is to find where they roost. Some will roost just above the high water line, often blending in with the flotsam and scattered vegetation. If you are not observant, you might even pass up a huge flock of sleeping sandpipers, hunkered down in the dunes. Other shorebirds may roost up in the more heavily vegetated parts of the Bolivar Peninsula. These roosting flocks are incredibly difficult to observe because they camouflage with their environment. Some of the larger sandpipers, such as curlews and dowitchers, will occasionally roost in grassy fields, particularly when very high tides coincide with heavy rains. In any case, although you may be able to get closer to roosting flocks, we should never forget that these shorebirds are sleeping and recuperating so that at the next low tide they have enough energy to go out and forage. This may be their only time to sleep so if you disturb them, you may be the one who causes them to take a little yawn while feeding, setting them up for getting snatched by a Peregrine Falcon.

A note on shorebird migrations

We end with a note on shorebird migration. Shorebirds have been migrating for tens of thousands of years. Most of the world's shorebirds breed in the arctic during the northern summer months and winter at low latitudes or in the southern hemisphere. The upper Texas coast is one of the main stopovers for migrating shorebirds. Shorebird migration is often not as well appreciated or understood as passerine migration. In large part, this is because the many species of shorebirds migrate at slightly different times of the year and the migration periods of any given species can be very protracted. To complicate matters further, shorebirds at Bolivar Flats at any given time often represent a mixture of wintering and migrating shorebirds.

The most stable time in terms of shorebird numbers and diversity is in December and January. This is the time when nearly all the shorebirds present are wintering residents and when there are few migrants passing through. If you happen to hit the appropriate tide, the flats could be teaming with ten thousand American Avocets, thousands of Dunlins and Western Sandpipers, hundreds of Short-billed Dowitchers, and many other shorebirds. These will all be in their pale gray or brown winter plumages. These winter residents will linger on the flats until about April after which they depart for their northerly breeding grounds. They will begin molting their worn-out winter plumage feathers in early March and replacing them with fresh, crisp clean breeding plumage feathers. The American Avocets will gradually get their orange heads, the Dunlins will become red on their back and black on their bellies, and the Western Sandpipers and Short-billed Dowitchers will become redder and redder. When they are almost fully in breeding plumage, they will finally depart.

However, before these winterers depart, we would have already started to see some northbound migrants. These shorebirds will be coming from more southerly regions and will simply be passing through Bolivar. Some of the early migrants, often arriving in March, will include Upland Sandpipers and American Golden-Plovers. Although neither of these are likely to be seen on the mudflats as they prefer grassy fields, their migrations are often overlooked because they migrate so early compared to most of the other shorebirds and passerines. Most of the other shorebirds pass through in April and during the first two weeks of May. The first migrants to pass through are typically males on their way to establish territories on the breeding grounds. Almost all northward bound migrants are in full breeding plumage (it takes too much energy to molt while in transit). Thus, if you came to Bolivar in April, you would see breeding plumaged Western and Semipalmated Sandpipers, Sanderlings, Dunlins and dowitchers in the thousands. Mixed in with these shorebirds might be a few White-rumped and Pectoral Sandpipers. Because the shorebirds are constantly on the move, every day can be different. We do not know exactly how many shorebirds pass through Bolivar each spring, but the numbers are probably in the several tens of thousands.

Spring migration is largely over by Memorial Day weekend although a few stragglers are still passing through. Unlike the myriads of shorebirds in winter and spring, the first three weeks of June can often be almost devoid of shorebirds. Only a few shorebirds remain at Bolivar to breed; these include the eastern subspecies of the Willet, Wilson's Plovers, and a few Black-necked Stilts. However, if you look carefully, you will notice that these are not the only shorebirds around. You might chance upon some small flocks of Short-billed Dowitchers, a Sanderling or two, a few Black-bellied Plovers, and lots of the western subspecies of the Willet. Most of these shorebirds should be up in their northerly breeding grounds, so why are they still here? What these birds have in common is that they will all still be in their winter plumage even though it is in the middle of summer. These birds are one year old birds and what typifies these particular species is that it takes at least one year for them to reach their full adult breeding

plumage. In their first year, these shorebirds do not molt into breeding plumage and they decide not to travel all the way to their breeding grounds. Instead, they decide to hang out in more southerly locations, such as Bolivar flats. Nobody really knows why, but maybe they're just not ready! The extent to which first year birds linger on their "wintering grounds" is still poorly understood. This phenomenon is better documented in the southern hemisphere, but in the northern hemisphere, it is less common yet for some reason, Bolivar receives more than its share of summering first year birds.

In any case, these first year birds will not be lonely for long. By the first week of July, after they have had their first birthday, fall migration has commenced as southbound dowitchers, Western and Semipalmated Sandpipers, Piping Plovers, and Black-bellied Plovers start to arrive. All of these will be adults in full breeding plumage. However, their breeding plumages will be duller and more worn-out than when we last saw them in April. This is because their plumage has had to weather two long-distance trips. Now some of these fall arrivals will actually stay to winter and some will continue on to more southerly locations. The former will molt into their winter plumages and the latter will just keep on going. In August, the major influx of juvenile birds will finally arrive. These will be characterized by beautiful, crisp clean plumages. The passage of juvenile birds will continue through September with some bleeding into October. By November, most of the southbound shorebird migration has stopped and the composition of shorebirds at Bolivar stabilizes. It is now time to wait for the new shorebird year.

Google Earth view of Bolivar
Flats - click to enlarge
Click on map to enlarge

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