CHAPTER 5

South by Southwest

PAT AND I HAD BEEN VISITING POINT PELEE National Park, a veritable Mecca for birdwatchers in southwestern Ontario, for only a few years when we went there to do some fall birding in September of 1985. By then, we had quickly lost the "thrill" of just assembling a list of species that we had seen—to our way of thinking this was the next best thing to a useless pursuit—and had quickly become amateur behaviorists. We enjoyed trying to figure out what the creatures that we saw were doing far more than simply identifying them, so it became something of a conundrum for us to consider what we saw the Monarch butterflies doing that day.

After scanning out off the eastern tip for pelagics we began looking for peeps along the shore (for non-birders, pelagics are ducks and other waterfowl that rarely come close to shore and peeps are, strictly speaking, sandpipers but is also the slang used for just about any shorebird). That's when I first noticed a Monarch gliding along the beach just above the packed sand. As we scanned the beach we then noticed quite a number of Monarchs standing in the sand, one every five or ten meters or so. Every once in a while one would spread its wings and fly a bit, more often than not along the beach, but also out a bit over the water, then return to the beach and set down. Others disappeared around the tip and out of sight.

Now here was a mystery! What were they doing there in the sand? Of course, we were peripherally aware of the migration of the Monarch (but hadn't really thought much about it), but I did know something about other butterfly behaviors so thought that maybe they were puddling for mineral salts. Like all animals, butterflies need salt and because plants contain so little of it, herbivores particularly must seek out salt "licks"— and damp, sandy areas along streams, puddles and other bodies of water are favorite "puddling" areas. We quickly determined that the standing butterflies were not probing the sand with their proboscises but did notice,

Preparations for the long migration southward include converting flower nectar into lipids that can be stored for long periods to sustain life during the journey and long winter ahead. Backyard butterfly gardens often provide needed resourced before they depart and all along the migration routes.

surprisingly I thought, that they were all facing into the onshore southerly breeze. I had no idea why this might be so we instead asked ourselves where some of them were flying to as they disappeared from view around the tip.

As we followed a few of them around to the west side of the tip we discovered quite a number of sweet clovers, some asters and other wildflowers along with a bevy of nectaring Monarchs. But there were also a fair number of butterflies standing in the sand on this side of the tip, too. A half hour later or so we had determined that there were at least six or seven dozen Monarchs standing or flying along the beach or nectaring on the wildflowers on the two sides of the tip. It was an interesting phenomenon but, at the time, not something that we could fathom.

Later that afternoon, after crossing back to the paved road, we once again made our way back to the tip before heading back to the visitor center. We immediately noticed that there seemed to be fewer butterflies standing on the beach but those that were still there were still facing south, not puddling, and those few that flew out over the water quickly flew back and then around the west side of the tip again. We followed but most of the nectar sources that had attracted the Monarchs earlier in the day were empty of butterflies. Another mystery! Where were the Monarchs going? Then we noticed someone on one of the cross paths gazing through their binoculars up into one of the trees. We went over to see what he was looking at.

To our surprise and delight he wasn't looking at birds at all but a collection of a couple of dozen Monarch butterflies coming to roost for the night. What a strange sight it was to see the tip of a tree branch covered in big orange butterflies. That's when we found out what was going on as he regaled us with the tale of how Monarchs often roost in the trees near the tip of Point Pelee and other peninsulas for a few days while they wait for favorable winds to make the dangerous trip across the open water to continue on their southward journey. Of course, the solution to the mystery and our observations and thoughts about what we had seen that day only raised more questions, but it was those questions and that experience that have led directly to the book you hold in your hand.

The Return Journey

Monarchs in the northern part of the breeding range begin to migrate south as early as late August but reach their peak numbers in mid- to late September, continuing through early October. Their flight style changes remarkably and

Does the Monarch have a "general-purpose genotype?" The alternation of inbreeding in the north—where there is a small, local gene pool—with random mating in the south when the entire population is present gives Monarchs the intriguing ability to adapt to widely varying conditions. Perhaps they will be more resilient to global change and human intrusion than we think.

their movements begin to have a distinct southwestern orientation. Throughout the summer breeding season, Monarchs keep relatively close to the ground while they seek flowers or host plants, and seem to spend about as much time in powered, flapping flight as they do gliding. Yet at the start of migration they begin to spend far more time gliding and fly higher and further between landings. What triggers this change?

As near as can be determined, the onset of migration is "wired" during the caterpillar stage. A combination of the duration and quality of light, falling temperatures and even the quality of their milkweed host plants changes the Monarchs' growth and development so that more energy is channeled to flight

muscles and lipid mass and less to the maturation of their sex organs. They emerge from the pupa in a state of reproductive stasis, or diapause, that is, without fully matured sex organs or the procreative drive that accompanies them. In other words, they simply have no interest in mating.

At the same time, the nutrients and energy that would normally have been earmarked for reproduction are shunted to heavier flight muscles and the development of a unique migrational asset: energy storage in the form of fats in a "lipid body" together with the metabolic means of using this stored resource. The lipid mass, held in the abdomen, is balanced by the increased muscle mass of the thorax to maintain their flight "trim" or balance. So the Monarchs emerge as prepared as it's possible to be for their long flight.

It's important to bear in mind that this change is also generational. The three or four preceding generations had typical adult life spans of up to four or five weeks but the migratory generation is different. A side effect of reproductive diapause and the establishment of the metabolic chemistry attending lipid storage is that the normal lifespan is greatly increased, on the order of five to seven times longer than the previous generation's lifespan. So not only are the Monarchs prepared for the long migratory flight but they are also set for an extended stay once they arrive at the overwintering roost.

David Gibo from the University of Toronto at Erindale has been studying flight behavior and the migration of Monarchs in innovative ways, including following them in gliders and ultralight aircraft, using radar, and taking vanishing bearings and body orientation to determine how they maintain their flight direction and compensate for winds. Like hawks, vultures and human gliders, Monarchs spend much of their migration gliding from thermal to thermal, and are known to achieve some pretty respectable altitudes (up to 1,200 m [4,000 ft] above the ground). Also one of the first to study the use and consequences of their lipid mass during migratory flight, Dr. Gibo was astounded to learn that individual butterflies actually compensate for loss of their lipid mass by drinking and storing water. His experience with gliding flight and this research have led him to suggest that Monarchs are not only consummate gliders but are uniquely adapted to migration.

Monarchs appear to use an internal time-compensated compass to determine their current position and ultimate flight direction. What this means is that they basically always seem to know when and where they are and where they're going—even on cloudy days, thanks to the ultraviolet sensitivity of but-

terfly eyes. Of course, we still have no idea of how or why they migrate to a specific spot over such a long distance, especially given that they are multiple generations away from the last of their species to make the journey. Think about this for a moment—could you find the emigration point of your great-great-grandparents without being able to ask your parents, grandparents and their parents' parents for the necessary directions? A strange and wondrous phenomenon indeed.

Rest Stops

During the extended time period of Monarch migration they must stop and rest, feed or drink daily. Keep in mind that the migrants are being "chased" by winter and the slow but steady decline in the availability of their nectar resources but that they are also no longer constrained by reproductive prerogatives that would consume more of their time than they could otherwise devote to the flight.

Monarchs migrate as individual butterflies, not in small to large flocks, as many birds travel. They also fly much slower—only about 18 km/h (12 mph)—than birds so their migration proceeds at a much less frenetic pace. Of course, birds, as the "hares" in this "tortoise and the hare" race, probably fly quickly between points that are relatively far apart but then spend more time feeding and resting at favorable points along the way. The slower Monarchs also rest and feed along the way, and do not, as a general rule, fly at night as many birds do, but the distances between their rest stops is usually shorter. As a result, like the race between the tortoise and the hare, Monarchs probably arrive at their destinations just as quickly.

Drinking is critical on the southward migration. In addition to finding overnight roost sites, butterflies must seek out water wherever they can. Here a Queen drinks from a drop of overnight dew trapped in the leaves of a seedling partridge pea, Cassia fasciculata *(Leguminosae), in Texas.*

Even though Monarchs migrate as individuals, they're all going in the same direction at the same time so it's inevitable that aggregations form—eventually there *are* "flocks" of migrant Monarchs. As they get closer to their destination and are funneled through a finite area, the size

and number of these aggregations grow and expand. What began as individual butterflies resting overnight or through a storm or other adverse conditions becomes a roost. How these overnight or storm roosts form is something of a mystery. Is there some sort of attraction between individuals, perhaps color, perhaps a scent or pheromone, perhaps some "need" to aggregate that presages the overwhelming numbers that will gather together in the mountains of Mexico? Or is it simply a consequence of many individuals all making the same choices about the best place to rest?

Regardless of how they form, overnight roosts are a characteristic of the southward migration. Roosts generally form on trees that are near to some natural barrier such as a body of water, a canyon or valley, or a southerly point of land. Fred Urquhart, the "grandfather" of Monarch migration studies, suggested that there are three principal factors necessary for a roost: elevation, the size of the trees and the wind direction. How Monarchs know that a body of water is too large to cross against the wind before nightfall is a mystery, however, elevation and tree size seem to make some sense if you consider that the tallest trees, those facing south on the edges of a canyon or water barrier (where they're less likely to be shaded), are where morning sunshine might be the most predictable.

Urquhart presented some evidence suggesting that roosts were most likely to form on the leeward side of a tree where they are protected from drying or chilling winds (although I think that this would also allow them to determine if the wind direction had changed during the night) but this dependence on wind direction somewhat obviates the morning sunshine argument since the leeward side might not be the side that receives the strongest morning sun. Whether there might be some trade-off among the three roost criteria is an interesting—but still unanswered—question.

There have been suggestions and there is much anecdotal evidence that butterflies roost in the same trees over successive years. Urquhart himself tested a variety of ideas—odors left on the trees from previous use, visual attractiveness of Monarchs that had already arrived at the tree, or pheromones used to advertise the locations of roosts—but concluded that the butterflies visually assessed the location and size of the tree, or group of trees, then choose a tree and eventually settle on its leeward side. In his opinion it was not the tree that was attractive but the location, and in instances where individual trees known to have been roost sites in previous years were removed, the migrants simply chose another tree or group of trees nearby.

(OPPOSITE) Roost formation at the overwintering sites begins in early November when Monarchs gather in loose clusters near the tops of the ridges where the Oyamel firs are found. Later in the season the clusters are far denser and are found further down the mountains within the fir forest.

*During the extended time period of southward migration Monarchs must stop, rest, feed and drink daily. Here a migrant fall Monarch nectars at floss flower (*Eupatorium greggii, *Compositae) along the Gulf Coast of Louisiana to replenish needed energy resources.*

The number of migrants in individual overnight roosts appears to be strongly correlated with temperature and the passage of cold fronts. Temperatures below 13°C (55°F) with strong, cold winds or low atmospheric pressure seem to produce the largest roosts. Whether larger or more numerous roosts provide some sort of temperature buffering is little known, however, butterfly density—that is how closely packed individual butterflies are within the roost—is also related to temperature. Roost duration is also determined by temperature since at temperatures below 10°C (50°F) the butterflies enter a "state of

semiparalysis." Thus, morning sunshine *is* an important consideration in roost formation and dissolution.

Full Circle

As the migrants approach the southern United States and northern Mexico, when much of the journey is behind them, the level of their lipid reserves becomes a critical consideration to their ability to survive over the winter. Once again the gauntlet of Texas—that area between the Gulf of Mexico and the western mountains—assumes considerable importance. A certain amount of overlap between breeding range success and the availability of wildflowers in Texas is important. If it has been a good reproductive year and an "easy" migration then a large number of migrants need a large number of wildflowers to refuel on, however, if conditions in Texas have been unfavorable, generally too hot or too dry, then those resources may not be sufficient and more of the migrants will succumb to starvation over the winter.

Dia de los Muertos, the Mexican holiday known as the "Day of the Dead" on November 1 and 2, corresponds quite well with the arrival of the bulk of the migrants to the main roost sites in Michoacan. This is not inconsequential since the locals consider *la mariposa Monarca* to be the souls or spirits of departed relatives that have returned for an annual visit. Robert Pyle has noted that *las palomas*, another name used for the migrant butterflies by people from near the overwintering sites, translates as "the doves, or the souls of the lost children." This interesting juxtaposition of belief, holiday and arrival nicely illustrates that, while the bulk of the world didn't know until 1976 where the eastern North American Monarchs disappeared to in the winter, the native Mexicans did.

Stragglers continue to arrive after the start of November to cluster in loose groups along the ridge tops but by the end of the month the roosts are pretty much set. Given a mid-August departure from their northernmost breeding grounds, and a early to mid-November arrival in Mexico (for those that have survived the trip), we can see that our approximately 90 day estimate for the maximum duration of migration (*See "As the Monarch Flies?" on page 86*) was pretty accurate. Of course, surviving the journey south is only half of the story—they still need to survive through the winter, mate, and then begin a successful return north to bring the migration phenomenon full circle.

AS THE MONARCH FLIES?

The straight line distance that Monarchs travel during migration can be as much as 3,500 km (2,200 mi) as the crow flies. Of course, not all Monarchs have to fly this far—butterflies that begin migration from the southern side of the breeding range have less distance to cover. However, given the need to conserve energy by gliding, the butterflies seek out thermals, circling up in these columns of rising air to a height that lets them glide to the next thermal flowing in the desired direction. They also must spend time (and distance) finding overnight roost sites, taking on water to balance lipid loss (or seeking flowers in order to avoid using stored fats), and avoiding predators. Given all of these factors, and the generally slow flight speed of Monarchs, I wouldn't be at all surprised that some individuals travel twice this distance or more to get to the winter roost sites.

So how long might it take to arrive at the roost sites? Let's try another exercise. During the fall migration, Monarchs appear to average about 75 km (46 mi) per day *in directional flight towards their Mexican destination,* although some tagged butterflies are known to have covered around 130 km (80 mi) in a single day. A simple calculation then, dividing the 3,500 km distance by 75 km per day, suggests that it only takes about 47 days to arrive at the overwintering roosts. However, it is extremely unlikely that any Monarch flies this straight line distance. If my estimate of 7,000 km (4,350 mi) is closer to the actual flight distance traveled then it might take twice as long.

Let's try a different angle: how good is this "guesstimate" of the real flight distance? If we divide the average daily distance by flight speed, about 18 km (12 mi) per hour, it suggests that only one-half of each day, or about 4 hours, of flight is needed to cover the distance. Even if we assume—erring on the side of caution—that individual butterflies actually fly for twice that time during migration—that is they spend 8 hours per day in flight—then they could fly as much as 150 km (about 95 mi) to cover the 75 km average daily distance. This would suggest that individual butterflies might actually fly at least twice the straight line distance, at least 7,000 km (4,350 mi), and the journey will actually take more than 90 days.

The Big Picture

My final point, if you have read this far and aren't yet one of the converted, is to consider the big picture of Monarch conservation and not just the hysteria surrounding one aspect of it. Make no mistake, I believe that strong conservation efforts at the overwintering roost sites in both Mexico and California will go a long way to helping to protect the extraordinary migration of the Monarch butterfly in North America. But given the amount of traffic that Monarchs must

cross paths with on their journey, or the loss of suitable overnight roost sites from year to year as we build strip malls, homes and factories, or even the fall cutting of roadside wildflowers in the interests of some misguided sense of "beauty," and it's easy to see that ignoring the migratory flyways and the breeding grounds is a recipe for disaster. A basket that is empty of eggs will remain empty if we don't protect the source of the eggs.

What can you do to help? Don't sit back in your easy chair and depend on others to protect the Monarchs in your backyard. Get involved with local butterfly clubs, assist in tagging, counting and monitoring projects, consult and assist with the growing number of citizen science projects on the Internet (visit **www.monarchwatch.org**, **www.monarchlab.org** or **www.learner.org/jnorth** for ideas, links and information), or lobby and encourage your local, regional, state and national legislators and officials to "do the right thing" wherever and whenever humanly possible. It seems somehow fitting to extend the same level of protection offered to migratory birds and waterfowl to the Monarch butterfly.

Consider working to protect known roost sites, possibly setting up Monarch butterfly reserves to protect significant staging areas, or working to improve the quality and quantity of breeding habitats. On a smaller scale, consider adding some milkweed species and favorite Monarch nectar wildflowers to your garden and using organic methods of pest and weed control. If you get a chance, make the excursion to the Mexican roost sites—I guarantee that it will be one of the most profound experiences in your life. If, standing in that living cathedral, you can turn your back on the Monarch then I will be very surprised (and disappointed).

The tri-national migration of the Monarch underscores the connection that our three peoples have: we share one of the natural wonders of the world. As I wrote in my 1996 Canadian status report, *Distribution, Status and Conservation of the Monarch Butterfly In Canada*, "unilateral conservation efforts will be ineffective in conserving this endangered phenomenon—a concerted international effort is required." Only with dichotomous conservation, that is efforts to allay the many threats and sources of endangerment at *both* the overwintering roosts *and* the breeding grounds, can we be successful at saving the king of North America, this Monarch of the New World.

Monarchs gather at a water source after arriving at their overwintering sites at about the same time as the Mexican Dia de los Muertos, *or Day of the Dead. The locals call the returning migrants* las palomas, *which translates as "the doves" or the "souls of the lost children."*