

The Fascinating Butterflies of Northwestern Wisconsin Bogs

by Ann Swengel

The intriguing butterflies of northwestern Wisconsin bogs were expertly described by Jeff Nekola in the fall 1998 issue of *American Butterflies* (“Bog-Trotting for Butterflies in Northern Wisconsin”). Here I’d like to update information on those sites and provide additional tips specific to finding these special butterflies of the north. The maps are reprinted from that article, with kind permission from the North American Butterfly Association (NABA).

Jeff provides an excellent lesson on peatland (bog) types: **muskegs** (black spruce dominated bogs that may also contain tamaracks, in areas slightly lower in elevation than their surrounding uplands), **kettleholes** (depressions and lake margins supporting carnivorous plants such as pitcher plants and sundews), and **coastal peatlands** (along Lake Superior, dominated by sedges and tamaracks, except for muskeg-like “islands” or ridges of peat). Some peatlands verge into riparian shrub thickets and others into marshes with cattails.

I’ve also classified bogs. Waterbed bogs are very easy to walk over, but the peat layer is floating on the lake surface, so you need to be careful not to lose balance or punch through a thin spot. Carpet bogs, such as the Port Wing Boreal Forest bog, don’t quake but are still easy to walk over, because they aren’t mucky or hummocky. Heart-attack bogs are exhausting because the deep peat and jiggly hummocks make every step an athletic phenomenon. Muck and peat can hide horizontal timbers that can trip you or bang your shins. Mudflats are slippery wet spots that are, of course, deeply mucky. Cowabunga (or catapult) bogs have a deep “moat” you must jump, catapult, or pole-vault over, or splash through, to get on the bog. Suction bogs have a lot of standing water in the low spots around hummocks. Besides being messy and slippery, these bogs place quite a grip on your feet. More than once, my footwear has stayed behind the first time I attempted another

step. I’ve always managed to retrieve the boot eventually, but this presents a choice: miss the butterfly to keep yourself shod, or run in your stocking feet after the butterfly!

In any bog it’s possible for a thin spot in the peat layer to give way. Without warning, I’ve punched through to my hip. But that’s getting off easy. Others have sunk to their hat! It’s best to test your footing before putting your full weight down, but this practice slows your chase of butterflies, which have no such impediments in their movement. Except in extreme drought, expect your feet to get muddy and wet, unless you wear rubber boots. In some coastal bogs and in wet periods elsewhere, even knee-high boots may fail to keep your feet reliably dry. In mid-summer you may not mind the cool wetness, but earlier in the season, that water is very chilly, as the winter ice underneath the peat may not fully melt until mid-June.

Looking for butterflies in northern Wisconsin is particularly dicey. It’s a rare season when my co-researcher Scott Swengel and I have a comfortable time getting all our field work in at the right timing at all the sites we want to check for bog butterflies. Many a time a perfect weather forecast from just the night before completely misrepresents the dismal weather that actually happens. It helps to have some backup plans: if the weather is poor in the spot you plan to visit, you may be able to drive a few hours to a different site where the weather may be tenable. On the other hand, perfectly fine butterfly weather sometimes occurs on days with dismal forecasts—all just to keep us gambling about what might happen next! My co-researcher Scott Swengel and I appreciate your understanding that on our field days, we are very busy completing formal butterfly monitoring surveys. If you see us, we greatly appreciate your understanding that we need to continue our surveys uninterrupted, as we never have enough time when the weather and timing are right!

There’s lots of room for more learning. It’s hard to cover thoroughly

the bogs featured here—so many, so big, so hard to walk through, so challenging to get appropriate timing and weather. Plus many other sites have gotten way less attention than these. The flight period information provided in each species account here is necessarily incomplete and sketchy. But it’s all collected by the same method by one research team (us) and accounts for abundance, so I hope it gives some idea of what’s possible for one group to find. During the butterfly survey season, we try to rotate through northwestern (covered in this report), north central, and northeastern Wisconsin—with any luck, one region per weekend, sometimes doubling up when weather is either currently propitious or wasn’t previously.

About the author

An enthusiast of butterflies since childhood, I became serious about them in the mid-1980s, with the encouragement of ornithologist Scott Swengel, whom I met then and subsequently married. Field partners in bird and butterfly surveys ever since, we’ve studied prairie butterflies in seven states, as well as Wisconsin’s barrens and bog butterflies. We’ve published a number of peer-reviewed scientific papers on butterfly detection, habitat associations, phenology and fluctuations, and responses to site management, as well as non-technical articles. A past vice president of the North American Butterfly Association (NABA) and co-editor of the annual 4th of July Butterfly Count report, I am currently honored to serve on the editorial board of the *Journal of Insect Conservation*.

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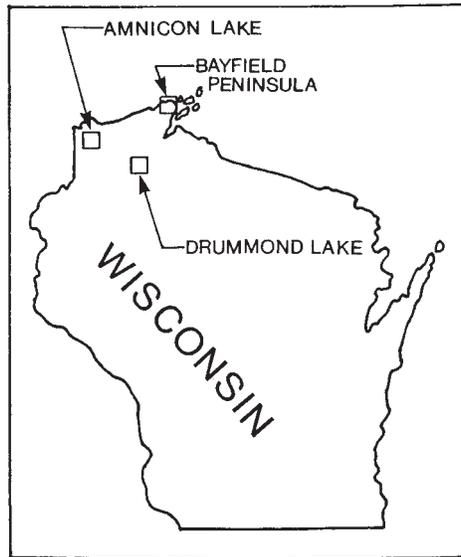
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Why look for bog butterflies here?

As Jeff Nekola pointed out in his *American Butterflies* article, the peatlands of the northern third of North America offer one of the last great wildernesses on earth. Although global influences such as atmospheric pollution and climate change have impacts even here, life progresses in these bogs much as it has since the last Ice Age. Most of these peatlands are isolated from the human world because of lack of roads, but some of the most accessible peatlands on the continent occur in northern Wisconsin. Here they support a set of butterfly species found in no other habitat in the state. While additional bog butterfly species occur farther north, and some of "our" bog butterfly species occur in more kinds of habitats farther north, northern Wisconsin is closer to human population centers and more accessible to human visitors. As a result, this area offers a pleasing variety of bog species at the southern edge of their range in about as accessible a situation as possible for people.

Drummond District (inland Bayfield County): Drummond is about 25 miles north of Hayward on U.S. Highway 63, and offers many kettlehole peatlands. Bog Coppers and Bog Fritillaries abound at all these sites, and Jutta Arctics occur in reliable but low numbers where black spruce groves occur.

East Wishbone Lake: From Highway 63 in Drummond, go about 4 miles north on Delta-Drummond Road (223). Just north of Reynard Lake Road is this easily seen depression on the west (left). If you reach East Star Lake Road, turn around because you've gone too far north. It's tempting to go straight west down the steep roadside to the bog, but you are likely to get very



wet in the bit of lake separating you from the bog. A drier approach is to walk into the woods bordering the bog on the north, then drop down to access the openest part of the bog bordering this forest. A second patch of bog is on the west side of this very small lake. Again, the driest approach is from the north through the woods. The wettest section at the western end is where we have found the occasional Freija Fritillary. Amidst some picturesque scenery, this bog offers remarkably dense Bog Copper populations shimmering low over floating sphagnum mats. We've occasionally found Jutta Arctic in both sections too.

East Roger Lake: From Highway 63 in Drummond, turn south (right) on Lake Owen Road (Forest Road 213) for 2.3 miles. This kettlehole peatland is on the east (left) side of the road, but is hard to see when the deciduous trees are leafed out. Watch for the depression in the topography, and marvel at how many Bog Fritillaries and Bog Coppers can fill a tiny kettlehole.

East Crane Lake: Continue south on Lake Owen Road (213) a short distance and turn right on Lake Owen Station Road (216). Continue 1.45 miles. This kettlehole is also on the east (left) side of the road and is also hard to see; watch again for the topographical depression. This site is larger than East Roger Lake and also offers an extensive open spruce grove, with reliable Jutta Arctic.

We've never visited **Sugarbush**

Lake, which Jeff Nekola describes as large and pristine, with a well-developed floating mat and black spruce grove, with Jutta Arctic. It's about 10 miles southeast of Drummond along Lake Owen Drive. From the intersection with Lipke Road, go 0.5 miles north, then east 1.5 miles on a fire lane, park, and then hike about 0.25 miles east along a snowmobile trail.

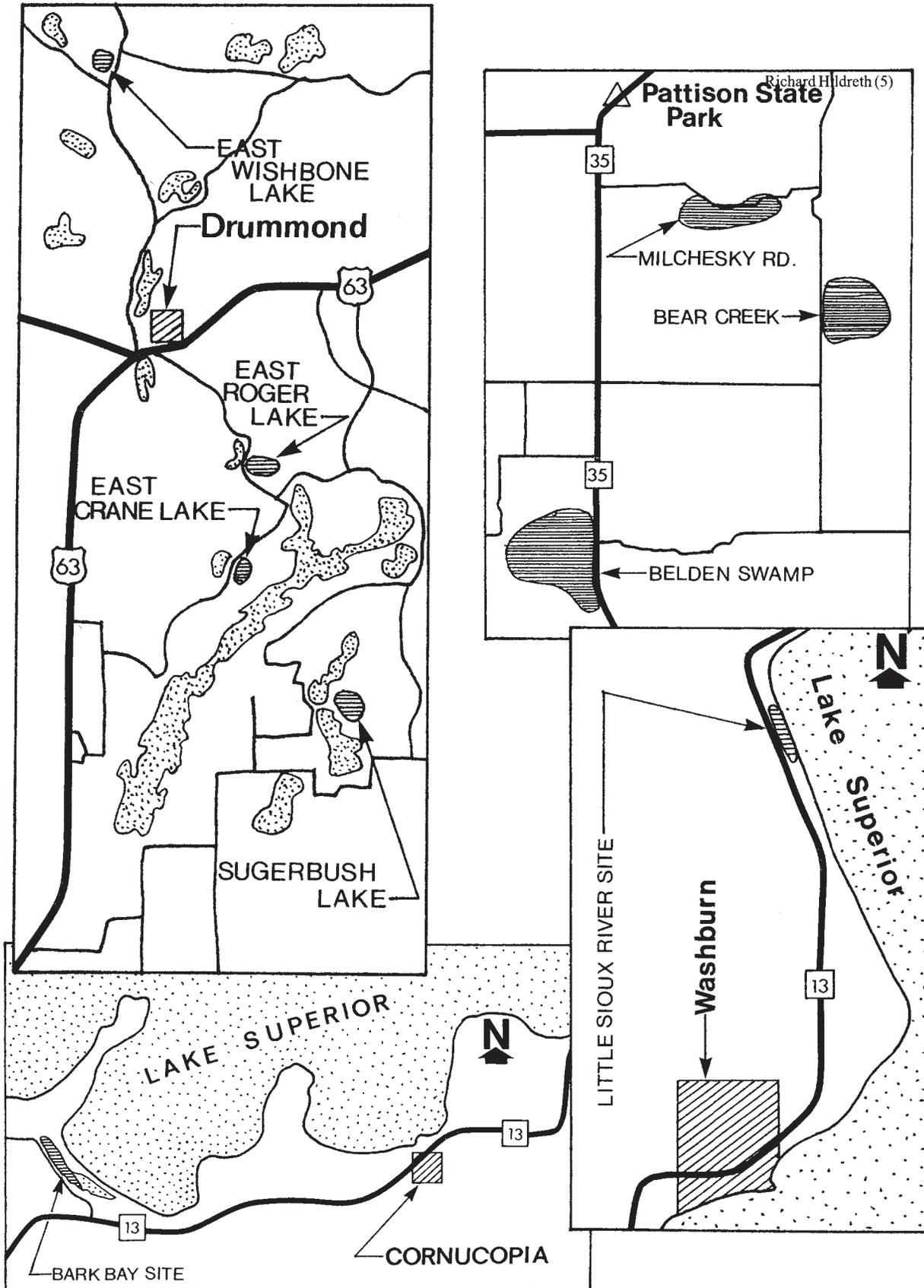
Amnicon Lake District (Pattison State Park area) (Douglas County):

From Highway 35 south of Superior, turn east (left) on County Road B (at Pattison State Park) for 2.5 miles, then turn south (right) on County Road A for another 4 miles to the town of Amnicon Lake. This area offers the most kinds of bog butterflies found in Wisconsin, but everything is relative. Just an hour or two north from here, in northeast Minnesota, you come into Taiga (Disa) Alpine range, but that's another story. The specialty of the Amnicon Lake district is Purplish (formerly Titania) Fritillary, so far known in Wisconsin only from this area. This is also the best bog area we know of to see Freija Fritillaries and Dorcas Coppers.

Milchesky Road: Access is from about 1.15 to 2.0 miles west of County Highway A on Milchesky Road, primarily on the south side of the road. At the 1.15 mile mark, you can see the bog to the south, just behind a line of alders. At the 1.75 mile mark, you can park at a small short service road that goes south up onto a knoll; from there you can see down to the bog panorama to your south. You've got a bit of a walk through brambles and alders to get to it, though. Some bog birch occurs in the wet fringe of moat along the north side of this area.

Bear Creek: This large site starts about 2.5 miles south of Amnicon Lake on County Road A. We have three subsites here: **North Bear Creek** (2.5 miles south of Amnicon Lake, 2.0-2.3 miles north of Pioneer Road, east side), **Bear Creek** (another 0.5 miles south of Amnicon Lake, 1.5-1.8 miles north of Pioneer Road, east side), and **Bear Creek Southwest** (at the south end of the open bog at the Bear Creek site, about 1.4 miles north of Pioneer Road, west side; bog birch and Frigga Fritillary occur here).

Map scale: Drummond and Cornucopia maps (left): 2 miles per inch. Pattison State Park map (top right): 3.2 miles per inch. Washburn map (bottom right): 1.8 miles per inch.



Northwestern Wisconsin Bog Sites. This map is reprinted with the kind permission of the North American Butterfly Association. It first appeared in the fall 1998 issue of *American Butterflies*, in the article: "Bog-Trotting for Butterflies in Northern Wisconsin."

We've never surveyed in the **Belden Swamp State Natural Area**, although we've looked at it from the parking area access and been discouraged by the shrubby access. From the junction of Highways 35 and M in Moose Junction, go north on 35 5.0 miles to a parking area west of the road. If you're willing to find your way in, you will be in a vast peatland.

South of the Belden Swamp access is what we call **Moose Junction**. This is 3.9 miles north of County Highway M and the town of Moose Junction on Highway 35, on both sides of the highway. While this peatland falls outside the mapped bounds of the Belden Swamp State Natural Area, our Moose Junction site no doubt actually connects to the Belden Swamp habitat patch. We've never found Red-disked Alpine in the Moose Junction site and the other sites in this region are better for Purplish Fritillary too, but the east side of the road has bog birch and Frigga Fritillary.

Bayfield Peninsula (Cornucopia) (coastal Bayfield County): Start at the junction of Highway 13 and County Road C in Cornucopia. For these coastal peatlands, obtaining suitable butterfly weather and phenology (seasonal development) presents interesting challenges. Even when it's hot inland with a southerly or westerly wind (from farther inland), right by Lake Superior the wind can be coming off the lake, resulting in 50s even in midsummer. While this is a very refreshing break from summer heat, it means slower phenology and fewer opportunities for butterfly finding weather. On the other hand, it's not that long a drive from this area to the other bog areas, and what's no longer in flight there may be lingering here. Bog Fritillaries and Bog Coppers are the stars here, with the occasional Jutta Arctic and Dorcas Copper.

Bark Bay State Natural Area: About 5.5 miles west of Cornucopia on Highway 13, then north (right) on Bark Bay Road about 0.75 miles to the parking area for the boat landing. West of the landing is the state natural area with its coastal peatland. We've occasionally found Dorcas Copper here in bog vegetation on both sides of Bark Bay Road.

Another site not on Jeff's maps, west of the previous site, is **Port Wing Boreal Forest State Natural Area (west unit)**. It's not difficult to get to, but you do need to walk a bit.

From the junction of Highway 13 and Washington Avenue in Port Wing, go north on Washington Avenue 0.6 miles, then west on Quarry Road 1 mile, then north on Quarry Point Road 0.25 miles to the parking area. As the crow flies from here straight to the bog, deep water and thick brush block your way. More round about but easier is to approach via the beach. Walk about 3/8 mile east (toward the harbor) down the beach, then go straight inland away from the lake where you can find an easy passage (without thick brush and without deep water) across the swale up onto a narrow piney ridge. Keep going straight away from the lake over this ridge to the bog behind it.

We've never surveyed **Little Sioux River**, 3.5 miles north of Washburn (which is east of Cornucopia on Highway C) on State Highway 13. The peatland is in a linear narrow swale between two dunes east of the road.

Also not on the map, **Pine Lake** is an inland kettlehole, but nearer these sites than the other kettleholes in the Drummond District. From Cornucopia, drive south on Highway C about 8.5 miles, then turn right (west) on paved Highway 236, and travel another 8.5 miles to the junction with Forest Road 248 (good gravel road). Turn right (west) for about 0.5 miles and turn south onto a one-lane dirt road. You can either park right away at a pullout area at the top of the hill, or negotiate your way downhill to the boat launch on this high-crowned dirt road. From there you can see your target bog to the right (west). You'll need to wade through some shallow water to reach the bog.

Finding Bog Coppers

Widely distributed and locally abundant in Wisconsin peatlands, the diminutive Bog Copper (about the size of a dime) shimmers low over the vegetation in the haze of summer heat. Due to its very high local abundance in some sites and wide presence in numerous Wisconsin bogs, this species more readily demonstrates some interesting patterns in abundance and

flight period that are very hard to learn from some of the other bog butterflies, which are just so darn hard to find consistently in any numbers.

Location, location, location: Just within the fairly circumscribed geographic scope of this account, you will find remarkable differences in Bog Copper abundance among bogs. In main flight period, the Drummond District kettleholes usually put on a glittering spectacle, so long as you can tolerate some biting flies and successfully dodge summer thunderstorms. Nothing beats dozens of Bog Coppers in view at once as you bounce along on the "waterbed" bogs of East Wishbone and Pine Lakes. The coastal Bayfield sites can put up similar densities, but it's more challenging to get the necessary warmth for butterfly activity given the coolness of lake breezes.

By the standards of other bog butterfly numbers, Bog Copper tallies in the Amnicon Lake District are impressive, but compared to the Bog Copper totals in the Drummond District and coastal Bayfield Peninsula sites, these are sharply lower. While it could be that both the Drummond and Bayfield Peninsula districts do have a lot more cranberry (the caterpillar food plant), it's also true that the Amnicon Lake bogs have a lot of cranberry too. However, the Amnicon Lake bogs compel because of two other specialties that overlap in time with Bog Coppers. This district is the best we know of for Dorcas Coppers and the only known area in Wisconsin for Purplish Fritillary. Dorcas and Bog Coppers have similarly timed flight periods, and Bog Coppers linger well into Purplish Fritillary timing. In muskeg bogs (such as the extensive peatlands at Bear and Milchesky), head for the squishiest, wettest spots for Bog Coppers. Also watch for them nectaring along roadsides in wet ditches by bogs.

Timing, timing, timing: Taking all our records throughout northern Wisconsin for all years, our first and last dates ever for Bog Copper are June 23 and August 17. For 2003-2008, when we did lots of surveys regularly throughout northern Wisconsin, we recorded an average and median flight period of about 40 days, varying from 22 to 49 days among these years.

The peak date on average was July 15 (median July 10), varying from July 7 to 27.

But it's the variation in flight period just among these three bog districts in northwestern Wisconsin that's extraordinary. For the 2003-2008 flight periods we observed:

	Flight Period		Peak Date	Peak Date Range
	Length	Mean/Median		
Drummond	32 days/36 days	July 12/July 10	July 7-25	
Amnicon La.	20 days/18 days	July 19/July 20	July 9-31	
Bayfield Pen.	24 days/23 days	July 31/July 30	July 27-Aug. 8	

Our observations suggest that Drummond sites peak about 7-10 days before the Amnicon Lake sites, which in turn peak about 10-12 days before the coastal Bayfield Peninsula sites. This is rough, because we're certainly not there every day or even week, but it gives you an idea of the differences you might encounter. I'm not surprised that flight period length comes out so much longer in Drummond, because it's typically the case that greater abundance leads to longer flight period detected. I do suspect that the coastal sites should have a longer flight period that we would detect if we just had more time to wait around for the wind to change from lakeward to landward and warm things up.

But this table does not portray some of the abrupt discontinuities in abundance we've detected among these three districts and nearby. For example, on July 9-10, 2004, we found zero Bog Coppers in Amnicon Lake and coastal Bayfield Peninsula, as well as none just east of the area covered in this account, in a district I call "North Central" (Ashland, Price, and Iron counties), which awaits its own account. But at the same time (on July 10), we tallied 125 in the Drummond district. On the same date in 2005, we recorded 324 in the Drummond district, but only 17 in Amnicon Lake and 4 in coastal Bayfield Peninsula. Later that year, on July 30, we found 34 in coastal Bayfield Peninsula but on July 30-31, less than half a dozen each in the other three districts (Drummond, Amnicon Lake, as well as North Central). In 2006, we totaled 238 in the Drummond district on July 9, but only 33 in Amnicon

Lake, while on July 28, we found 36 in coastal Bayfield versus 1-2 in Amnicon Lake and Drummond on July 28-29. The following year, we found 107 in coastal Bayfield Peninsula on July 27 versus a dozen or so each on July 26-30 in Drummond and Amnicon Lake.

You can, of course, use this steep gradient in seasonal progression to advantage. For example, if you want to find the first Bog Copper of the season, Drummond is your place. If you are hoping to catch a late Bog Copper, head for coastal Bayfield Peninsula and hope for favorable winds.

Other tips: Despite its small range in the northeastern U.S. and adjoining Canada, this diminutive copper shows considerable variation in underside color among areas. This can be confusing when you consult the field guides. Fortunately, in Wisconsin, Bog Coppers have the distinctive silvery-gray background below—a form that makes it easier to distinguish from other small coppers, all of which have more orange in the background below. Even though Bog Copper is small, you can still distinctly see the silvery underside in flight, and fortunately, its flight is not that frenetic, although given its small size, it can sometimes seem to disappear depending on its angle relative to the sun.

Other coppers: The other copper you're most likely to encounter when searching for Bog Copper is the **Dorcas Copper**, which is on average a bit larger and a dull orange on the underside. Occasionally, in a roadside bisecting a bog, we've encountered an **American Copper** (much orange on the front wing below, but primarily silvery on the hindwing below) nectaring on roadside weeds. Even more rarely, if the roadside includes a deep wet ditch, we've encountered **Purplish Copper** (a brighter orange on both wings below, and a bit larger than Dorcas Copper) sharing the habitat with both Dorcas and Bog Coppers. If you only see the underside, the occasional **Greenish Blue** (not a copper) encountered in a roadside by a bog might also confound.

Good spots: Bog Coppers occur at all of these sites. If you want a Bog Copper show, aim for main flight in the Drummond district or coastal Bayfield Peninsula. If you want to try for a

longer bog butterfly species list, settle for the reliable but lower Bog Copper numbers in the Amnicon Lake district.

Finding Dorcas Coppers

While Dorcas Copper has a relatively large range across Canada and Alaska, the distribution of this unobtrusive butterfly about the size of a penny is quite restricted in the lower 48. In Wisconsin, this is a very localized butterfly that takes some patience to find and enjoy.

Location, location, location: I can give you information on where to go, but I'm not able to explain very well why. A typical starting point is the caterpillar food plant. Shrubby cinquefoil (*Potentilla fruticosa*) is the usual one reported for this butterfly. But in his *American Butterflies* article, Jeff Nekola noted that this plant is not recorded within 100 miles of these bog districts, even though its range entirely encompasses these districts. Certainly, we've never encountered it up here except in ornamental plantings. Another cinquefoil does occur in this area, purple or marsh cinquefoil (*Potentilla palustris*). This plant shows some promise but is also an imperfect associate. While we have sometimes succeeded in using this plant as a guide to finding Dorcas Copper in northern Wisconsin, we have often failed to find the butterfly in sites with good cinquefoil stands, and conversely, we've found the butterfly in places where we fail to find the cinquefoil. On the other hand, the butterflies are better botanists than me. Sometimes I've not noticed the cinquefoil until a Dorcas Copper led me to it. As a result, there's a lot left to learn about what plants and habitat conditions these Dorcas Coppers are keying in on.

In the meantime, I place our Dorcas Copper records in this area into three categories. First, there's the smattering of records we've found in coastal Bayfield Peninsula peatlands. Here it's easy to find marsh cinquefoil but difficult for us to find Dorcas Copper, yet when we do, the butterfly is usually in reasonable proximity to the cinquefoil, or the standing water the cinquefoil likes. Second, in the Amnicon Lake district, where we've found by far the most Dorcas Copper individuals of anywhere in Wisconsin,

the most individuals have been in wet roadsides immediately adjoining bogs, especially at nectar flowers. However, we do regularly find both sexes of Dorcas Copper in low numbers in a third kind of spot, out in the muskegs, either basking or often seeming to be territorial with perches on short black spruces or other short shrubs.

Timing, timing, timing: This is much easier to tabulate and explicate. Since we've found the most Dorcas Coppers in Amnicon Lake, all of our other records elsewhere in northern Wisconsin nest within our results here. Our earliest date is June 23 and latest is August 17, with just past mid-July usually prime time. Our average peak date is July 19 (median July 18), with a range of July 9-31 for peak dates.

Other tips: A rapid flier, Dorcas Copper on the wing out in the muskeg can easily be lost—in part because they're not very numerous out there, so you're lulled into inattentiveness. If you suspect a small butterfly that got away was a Dorcas Copper, instead of chasing after it, it can pay instead to freeze, staying alert for it to return or for another individual in the vicinity to become apparent (they're often clustered in groups). Ironically, Dorcas Copper can also easily be seen yet overlooked when unobtrusively nectaring in roadsides. Examine potential nectar flowers carefully. If it's a good year and you've got good timing, you may be able to find Dorcas Coppers there even in poor weather.

Good spots: In the Amnicon Lake district, the roadsides of Bear Creek, North Bear Creek, and Milchesky Road (1.15 mile mark) are the easiest spots. Once you've found Dorcas Copper in the ditches, you can try your hand at spotting one out in the muskeg. In the Bayfield Peninsula district, Bark Bay doesn't count as a good spot since we've only got a handful of records here. But if you want to give this a try, and I hope you do better than we have, walk between the forest (bordering the bog to the south) and the muskeg-like ridge where the cinquefoil and our smattering of records are located. You can also try in the south bog (south of Bark Bay Road). We've never found Dorcas Copper in the Drummond district.

Other coppers: A bit smaller than

Dorcas Copper, **Bog Coppers** are a silvery gray, while Dorcas is a muted orange on the underside. Occasionally, in a road corridor bisecting a bog, we've encountered an **American Copper** (much orange on the front wing below, but primarily silver on the hindwing below) among roadside weeds. Even more rarely, if the roadside includes a deep wet ditch, we've encountered **Purplish Copper** (a brighter orange on both wings below than Dorcas Copper, but not as bright as American Copper) sharing the habitat with both Dorcas and Bog Coppers. Purplish and Dorcas Coppers are easier to separate based on females, so long as you see the above side. Female Purplish Coppers have way more orange patterning above. For males, you also want an above side view. The orange band on the hindwing is much longer and larger on Purplish Copper. Both Purplish and Dorcas Coppers share a propensity for rapid flight, which can be very frustrating because you see enough of the muted orange underside to know that you really want to get a good look. As a result, I suggest you first practice identifying Dorcas Coppers nectaring in roadside ditches. Much larger, the brightly colored **Bronze Copper** has also turned up occasionally in these wet roadside ditches.

Finding peatland fritillaries

Larger than a Pearl Crescent but smaller than a Great Spangled Fritillary, the peatland species of "lesser" fritillaries (*Boloria*) rotate through a season-long cycle of butterflies to enjoy.

The first of the bog-restricted butterflies to fly in the spring, **Freija Fritillary** is easily neglected because little else is flying then and there. Even if you do decide to go looking for bog butterflies despite few species to look for in peatlands at that time, you may be amazed at how active and elusive a fritillary can be in cool conditions.

After a few weeks of chasing Freijas, you'll notice two things once the **Frigga Fritillary** joins the scene: it's larger and much more localized within bogs.

By the time it's **Bog Fritillary** time, you may be thoroughly frustrated with peatland fritillaries, because they are relatively small, hard to identify

without a close look at a perched individual, and flighty upon your approach. Bog Fritillary has the largest Wisconsin range of these peatland fritillaries, but with large variation in abundance among sites.

Purplish Fritillary is incredibly refreshing after months of slogging through the seasonal cycle of peatland fritillaries. By far the most restricted in its Wisconsin range of the peatland fritillaries, Purplish Fritillary can also be locally abundant and readily observed at length on nectar flowers. In fact, of all the peatland fritillaries, we've recorded by far the most Purplish Fritillaries on our surveys, even counting all Wisconsin bogs, with most being outside the known range of the Purplish Fritillary.

These four fritillary species also display gradients across spatial dimensions in their wide distributions in North America (primarily north of Wisconsin). The first three species not only have multiple subspecies on our continent, but are considered circumpolar in distribution, while Purplish Fritillary is part of a species complex with Arctic Fritillary (in far northern North America) and Titania Fritillary (in Eurasia). Given the few butterfly experts in the western hemisphere available to cover vast areas of relatively inaccessible peatlands, specific information on caterpillar food plants and other vegetative restrictions can be sketchy for a particular region, but what's known from one region may not apply to others. Changing concepts of the boundaries for these species and subspecies, and the varying plant and habitat requirements of those entities complicate the application of information in field guides and reference books to understanding our Wisconsin butterflies.

Location, location, location: Favoring more open spots in muskegs with fewer trees and tall shrubs, **Freija Fritillary** is actually widely occurring in northern Wisconsin muskegs. But its very early and relatively short flight period when weather is particularly fickle can make Freija hard to find. Several authors have reported this butterfly laying eggs on cranberry in the Great Lakes states, and Freija Fritillary has been reared on cranberry

in Michigan (per Mogens Nielsen in *The Butterflies of Michigan*). In neighboring areas of Canada, caterpillar food plants have included other heaths (bilberry, blueberry, bearberry).

For **Frigga Fritillary**, you'll have more shrubs in the way. Jeff Nekola reported both bog birch (*Betula pumila*) and bog willow (*Salix pedicellaris*) in the Frigga sites he studied, but with adults more strongly associating with bog willow. Meanwhile, in Michigan, Mogens Nielsen described in *The Butterflies of Michigan* that Frigga has been reared on bog birch. Bog birch has been a very good steer for us to find Frigga, but then we find bog birch a more distinctive shrub than bog willows. It's also very limited in occurrence in these peatlands, in places that can be real leg-breakers due to the very wet conditions, shrubs, and deadwood. Although bog birch also occurs in shrubby marshes and streamside thickets, we've not found Frigga there, at least not yet. So far all our Frigga sites in this article's region are in the Amnicon Lake district.

While **Bog Fritillary** occurs in all bog types, it is more abundant in kettleholes and coastal peatlands than muskogs. This corresponds well to where Bog Coppers occur here too, presumably because they share the same caterpillar food plant (cranberry), on which Bog Fritillary females have laid eggs.

By far the most **Purplish Fritillary** individuals can be found nectaring on roadside flowers in wet ditches by muskeg peatlands in the Amnicon Lake district. It can also be seen in low numbers out in the muskeg, often flying at about chest height or perching on spruces. I've not found reports of caterpillar food plants for Wisconsin or Minnesota, and it's unclear whether and how reports from farther afield apply to our populations.

Timing, timing, timing: During the first part of **Freija Fritillary** flight period, no other fritillary is in flight in this range and habitat. Since we've found the most Freija Fritillaries in the Amnicon Lake district, all of our other records elsewhere in northern Wisconsin nest within our results here. Our earliest date in any year is May 7 and the latest is June 15; later in May

is when we usually find the most. Our average peak date is May 23 (median May 25), with a range of May 12-29. I suspect these peak dates are biased late for two reasons: first, it's just so hard to get a good enough forecast to warrant the trip up north in early May, so we have fewer visits then. Plus, we've happened not to survey in this area in the week ending on May 22 very often, so that's a hole in our dataset. When we pool all our data from northern Wisconsin, we come up with an average flight period of 20 days (median 22) with a range of 8 to 30 days. In the Amnicon Lake district, our average is 17 days (median 16), with a range of 7 to 30 days. I suspect that if spring weather weren't so capricious, Freija would come out in our surveys at least as abundant as Bog Fritillary.

At the very end of Freijas' flight, when they are usually worn, the **Frigga Fritillary**, as well as Silver-bordered Fritillaries, emerge. Taking all our records from throughout northern Wisconsin for all years, our first and last dates ever for Frigga Fritillary are May 19 and June 20. In the Amnicon Lake district, we recorded an average and median flight period length of about 15 days, varying only from 14 to 16 days so far. I think this is testimony to just how hard it is to get decent weather at this time of year and also how localized this butterfly is. Frigga numbers lag far behind those of the other peatland fritillaries in our Wisconsin surveys. Our peak date in the Amnicon Lake district was May 31 on average (median May 29), varying from May 26 to June 7. Pooling all our data across northern Wisconsin, our average and median peak date is June 1 (range May 23 to June 13).

We've never overlapped **Bog Fritillary** flight period with Freija in the same year, but we have with both Frigga and Silver-bordered Fritillaries, sometimes with all three species in the very same section of the same bog. Coastal Bayfield Peninsula is where we've surveyed for Bog Fritillary in the most years. So it's no surprise that, with the great variation in seasonal development among years, this area has the record for earliest and latest dates out of all our northern Wisconsin data: June 4 to July 14. Unlike Bog Copper, we've not been able to

demonstrate variation in flight period timing for Bog Fritillary among the bog districts in this region, but we assume it is occurring nonetheless. Peak dates average right around June 15 or a few days later but can vary by a week either way. Flight period length, when we succeeded in effectively covering very much of the flight period, was typically about 2-3 weeks.

The only other lesser fritillary possible in bogs at **Purplish Fritillary** time is Silver-bordered. When we've tried to cover a fair amount of the Purplish flight period, we've gotten spans of 14-27 days. Our earliest date is July 25 and latest is August 23 but both of those are ripe for beating, as we recorded 291 individuals on July 25, 2001 and 39 on August 23, 2002. The most reliable time is the first week of August, within main flight period both in seasonally early years (such as 2001) and late years, such as 2008 when we found 0 on July 25 but 86 on August 8. Likewise in 2004, another cool summer, we found 6 on July 31 but 171 on August 13. By the way, in 2001, we still found 8 on August 20.

Other tips: Freija Fritillary has a remarkable ability to draw warmth not just from the sun but from the microclimate of hummocks, whose tan-brownness in spring and shelter from wind provide warm microclimates. Our record is a Freija flying, and it wasn't flushed, at 44 degrees on a sunny mid-morning in a boggy depression creating sheltered warmth. In fact, a sunny day with light wind in the mid-50s is ideal; much warmer and the Freijas may be so wound up that you'll have difficulty getting a good look at them. All this frenzy can also be difficult to spot between the hummocks or when blocked by shrubs and trees. It also helps to look out ahead in front of you and in the pathways between hummocks. In pictures, Freijas are bright orange, but in flight the darker area near the body can be rather prominent, and if the orange has faded, you may not at first think this is a fritillary.

Frigga Fritillary has a rapid flight, and with its somewhat later spring timing, Friggas have somewhat warmer temperatures with which to rev themselves up. They may also be flying anywhere from low over the peat to

eye level among and around the tops of their shrubs.

On average it's warmer yet in main **Bog Fritillary** season, and by then you'll be thoroughly familiar with what heat means to a fritillary's activity level. But at least there's more chance you'll get decent butterfly weather during this species' flight period, and Bog Fritillary usually flies close to the peatland surface. This helps concentrate your searching low in front of you. Bog Fritillary is also more inclined than the earlier species to nectar; especially watch Labrador tea. In unfavorable weather but at sites with large populations, we've sometimes found individuals perched on short shrubs and hummocks.

Your reward for a season of fritillary forays is the **Purplish Fritillary**, which can abound on roadside flowers and allows you to approach nectaring individuals closely.

Other fritillaries: Not peatland-restricted at the species level, **Silver-bordered Fritillary** occurs regularly in bogs in all three districts covered here, usually in low but consistent numbers. Mogens Nielsen, in *The Butterflies of Michigan*, treats the bog-occurring version as a separate subspecies. I've noticed violets, this butterfly's caterpillar food plant, in muckier and marshier parts of peatlands, but I can't claim I've noticed violets very often here. On the other hand, when I have, they've been very tiny plants easy to overlook. This fritillary has several generations per year, with our earliest date ever in this region on May 21 and latest on August 23, but we've only made a few butterfly forays here later than that. In the last seven years, with increased surveying here, our first date of the year varied from May 24 to June 20 and last from July 25 to August 23. Early in the peatland fritillary season, Silver-bordered Fritillary overlaps most in flight with Bog Fritillary, but also some with Frigga and occasionally with the very end of Freija season (for example, on May 24, 2002, and May 29, 2005). Later in the summer, Silver-bordered also overlaps with Purplish Fritillary.

Silver-bordered Fritillary confounds identification most for Bog Fritillary, as the former has black dots while the latter has black-rimmed white dots in

the arc paralleling the margin of the hindwing underside. Identification of all fritillaries is clenched by a view of the hindwing below. But some clues from the above side can help you prioritize which individuals to try to observe the underside on first. Silver-bordered Fritillary on the above side seems more orange and less black overall even in flight than the Bog Fritillary, which also seems to have more pronounced dark loops in the black lines of the hindwing above. Silver-bordered also seems smaller, with a "neater" but not more prominent black margin above, than Bog Fritillary.

The only other lesser fritillary recorded in Wisconsin is the **Meadow Fritillary**. In our prairie and barrens surveys, we've found this species in lowland grassy patches, although more abundantly in drier ones. But we've never found Meadow Fritillary in a bog, and only rarely in roadsides by bogs, and then only in more upland roadsides, not in wet ditches. Nonetheless, Meadow Fritillaries are in range in this region, so you should be prepared for them, if only for when you're traversing uplands between bogs. In our northwestern Wisconsin barrens surveys, our earliest date ever for this species is May 13 and latest is August 20. Beware how very similar the Meadow Fritillary hindwing below is to Frigga's.

A "greater" fritillary (*Speyeria*), the **Atlantis Fritillary** is much larger than the peatland fritillaries. It occurs regularly but in low numbers out in bogs. Like Silver-bordered Fritillary, the Atlantis's caterpillars feed on violets, so I suspect that Atlantis may also breed in bogs, even though its prime breeding habitat is more upland. We've found Atlantis out in bogs in all three districts here. Counting individuals both out in bogs and in adjacent roadsides, our first date ever for Atlantis here is June 18 and latest is August 20.

Good spots: The Amnicon Lake muskegs have particularly good numbers of **Freija Fritillary** compared to muskegs we've visited elsewhere in the state. We've found Freijas only very rarely in these kettleholes (but if you try, perhaps you should aim for drier, peatier, hummocky spots), and never in these

coastal peatland sites (but Freija might be possible in the muskeg-like ridges of such bogs).

In this region, we've only found **Frigga Fritillary** at Bear Creek (southwest), Moose Junction (east), and Milchesky Road (formerly on the north side of the road at the 1.15 mile mark but bog birch seems to have declined there, and currently only in small numbers at the 1.75 mile mark site as the bog birch is not extensive there). We've certainly not checked all spots in this region with bog birch though.

Bog Fritillary is abundant in the Drummond and Bayfield Peninsula districts, and occurs in lower but consistent numbers in the Amnicon Lake district.

Limited in known range in Wisconsin to the Amnicon Lake district, **Purplish Fritillary** abounds in the wet ditches of roadsides through muskegs. For some reason, we've only found very low numbers in the roadside at Moose Junction, but Purplish is prolific at Bear Creek, North Bear Creek, and Milchesky (only at the mile mark 1.15 site; for most of Milchesky Road, the roadside is more upland and removed from the muskeg).

Finding Jutta Arctic

Widespread and easily identified on the wing, Jutta Arctics are about the size of a Mourning Cloak.

Location, location, location: Juttas are associated with spruce savannas and open forests within bogs, and seem to be territorial in their floppy flights between perches primarily on spruce trunks but also on shrubs and grass.

Timing, timing, timing: This species is distinctive for appearing to have a two-year life cycle, but fortunately, these are staggered, so that Jutta adults occur every year. Odd years are higher than even years, but the species is readily found in Wisconsin in both. Looking at our results for 2003-2008, when we sampled widely in the flight period each year, we found about 60% as many individuals in even as odd years. This ratio also holds when we look at the single best day in even versus odd years. However, as with all butterflies, Juttas do fluctuate in abundance among years (after

controlling for even versus odd). So even years varied from 40-95% of the previous (higher) odd year.

Counting all of northern Wisconsin, we've recorded an average flight period length of 34 days (median 35), ranging from 21-44 days. The average and median peak date was June 9 (range May 26 to June 20). Our earliest and latest dates ever both occurred in the Amnicon Lake district, from May 12 (2007) to July 10 (2004). Restricted to that district, our average peak date is June 13 (median June 16).

Other tips: It's all about the spruce groves and open forests. Be in a bog, but aim for spruces, and you're in the right spot. The Juttas may perch on the ground but may also be at eye level (or higher). If you fail to track an individual, wait a bit in that area because it may be territorial and come back.

Other satyrs: Jutta flight period broadly overlaps with **Red-disked Alpine** timing. See "Other satyrs" in that species account. Smaller and much lighter in color and much more abundant in upland habitats, **Common Ringlet** also breeds in peatlands but its flight period is somewhat later (June 10-August 13). Only barely overlapping with Jutta's flight period, **Northern Pearly-eye** occasionally turns up in more canopied sections of bogs, from June 15 to July 28 in our experience. More abundant than Northern Pearly-eye in bogs but even less overlapping with Jutta's flight period, **Eyed Brown** has occurred from June 24 to August 15 in our surveys here. Occasional in bogs, **Appalachian Brown** has shown up on our bog surveys here from July 4 to August 8.

Good spots: Jutta Arctic is most abundant in the Amnicon Lake muskegs, with low but consistent numbers in the Drummond District (except not at tiny East Roger Lake). We have no Jutta records in these coastal Bayfield Peninsula sites. However, we have found this species at Pine Lake (technically a kettlehole but closer to the Bayfield Peninsula district than to Drummond).

Finding Red-disked Alpine

This butterfly seems contradictory. Red-disked Alpine has a spring flight

period in a northern range, yet is decidedly a "fair weather friend" regarding conditions for spontaneous flight. In fact, the adult flight period occurs at a time when such fair weather seemingly never occurs in its Wisconsin range. Furthermore, the butterfly field guides and reference books seem contradictory or at least confusing about when, where, and how to find this elusive treasure. Let me try to make sense of this.

First of all, northern Wisconsin is at the very warmest edge of this species' range. In its core range in Canada, this butterfly occurs in a much wider range of habitat types, from moist prairies and grassy bog edges up to sandy ridges in open jack pine forest. But in Michigan, Minnesota, and Wisconsin, this alpine is restricted to large peatlands, usually ones that look grassy.

The flight period is also often reported as only two weeks long. This is a slight understatement, but not by much. By logic, then, you must intensively concentrate your searches on the best (i.e., seemingly endless) bogs and settle for whatever weather is remotely tenable for butterfly searching in this narrow window of time. After all this slogging, you finally find a Red-disked Alpine but this encounter may be very disappointing. All of a sudden it flushes out from underneath you, from a perch hard to spot within a grassy hummock, rapidly rises up to about eye level and rockets far, far away, rapidly out of sight. You may attempt to chase it. Good luck—it's gone, and you may be a goner if you trip over a peat-covered log, fall through muck, run into swaying trees in a "drunken forest" loose in their shallow and jiggly peat moorings, or mire on a hummock. Perhaps because of this, some recommend searching either early or late in the day, or in mid-day on overcast or partly cloudy days, the logic apparently being to slow down those alpiners as much as possible, so as to get a decent look at them.

But I advise a counterintuitive approach. Take advantage of the very warmest, sunniest, windless weather available, especially in mid-day. That's when we've seen the alpine's "happy flight," a spontaneous (that is, non-evasive) fluttery flight above the short shrubby bog vegetation but below my

eye level. While the butterfly may fly a fair distance, it's not hard to see or track, and often, these happy flights are relatively brief, before the alpine alights again within a grassy hummock.

If you are uncomfortable with this emotional term applied to a butterfly, bear in mind how disconsolate you will be if you only encounter a flushed alpine in the evasive "unhappy flight." If you only know this species from unhappy flight, you may question that happy flight is within its repertoire of behavior. Then imagine your joy when at last you behold the happy flight. So, the "happy" and "unhappy" in these flights can apply to you. At a minimum, we've found these terms to be great field shorthand for what we're seeing.

You'll be ecstatic if you encounter a "swarm," when multiple individuals are in happy flight at once in your vicinity. "Swarm" may not quite be the right word, as it implies frenetic disorderliness, while this looks remarkably calm and orderly to me. I suspect that this extreme "fair weather friend" tendency has great logic behind it. Precisely because of how capricious the weather is, and how vast their habitat is, a strong tendency to fly in fair weather coordinates the timing when boy alpine can reliably expect to meet girl alpine, and brings about these essential encounters most safely and efficiently. In sum, I think of Red-disked Alpine as actually a very sedentary butterfly, but with an extreme flight response to fright.

Location, location, location: The advice to look in bog margins also seems to contradict the species' restriction to large peatlands. Why would it prefer margins yet require the adjoining presence of that vast interior occurring only in large bogs? Why wouldn't margins without that vast interior suffice? From our observations, I can assure you that this is very much a bog-restricted species; only once have we seen this species outside a bog—one flew out of the bog adjoining Milchesky Road into the wet roadside ditch, but then went right back over the alders into the bog. Rather, I think that bog margins are topographically shielded locations. To be boggy, a peatland is relatively low in elevation, even if this is a subtle difference from the surrounding

landscape. But the vegetational shift is far from subtle. Often dense and relatively taller forest surrounds the spindly and sparsely treed bogs. This creates a windbreak and shelter to collect heat in grassy/sedgy bog margins. It's not necessarily that this is better habitat for alpiners, but if any alpiners are there, the conditions may be more climatically favorable for more activity. Reared on cottongrass (per Mogens Nielsen in *The Butterflies of Michigan*), Red-disked Alpine is much harder to find here than this abundant and prominent plant of Wisconsin bogs—yet another paradox presented by this butterfly.

Overall, Scott finds more alpiners than I do. Granted, he walks the outside (longer) edge of our circuits, due to his greater strength, and so, not only samples more area than I do but also all those thermally advantageous sheltered bog margins. But I think it's more than that. He uses his track-and-field athletic talents to spend more time looking out for butterflies instead of down at his footing. But I'm not so reckless in my steps, and watch more where I'm putting my feet, and that's what I recommend to you too.

Nonetheless, on our swarmiest day ever, I found more than him. Evenly distributed in wide open bog without wind shelter on Milchesky Road (the 1.75 mile area), Red-disked Alpines so abounded that they “bogged” him down as he tried to write everything we observed about them for his clipboard data-collecting duties. I was even happy to switch to the outer, longer route. Now that's the way to get mired.

Timing, timing, timing: Over the last ten years, when we've found any alpiners anywhere in northern Wisconsin (in nine years), we've recorded a mean and median 16-day flight period (range of 1-29 days per year). The mean and median peak date (if one day stood out) was May 24, ranging from May 12 (2007, also our earliest date ever, so this first date is “soft” and ripe to get beaten), to June 1 (2002); our latest date ever was on June 14 (2003). In this region in northwestern Wisconsin, we've recorded an average flight period of 6 days, ranging from 1-16 days (even with our method of rotating around northern Wisconsin by weekend), and

the average peak date was May 24, ranging from May 12 (2007) to May 29 (2005), with our latest date on June 7 (2008).

Conditions on our five swarmiest surveys (five or more alpiners seen in less than half an hour) were mostly sunny with mostly clear skies and light wind (a maximum of 5 to 15 miles per hour). Temperature was between 61 and 75 degrees (F), in mid-morning on the warmest day and otherwise in mid-day (11:00 a.m. to 1:45 p.m. Central Daylight Time). Phenological cues in the vegetation included bog laurel just starting to flower, bog rosemary still in bud, and cottongrass varying from mostly not displaying its distinctive seed heads at all to being just before those seed heads are fully developed. But be forewarned that even seemingly perfect conditions and timing can still result in only 0-1 alpiners found. This is not a frequently found butterfly and is much appreciated when found! Our best alpine sites in this region are Bear, North Bear, and Milchesky.

Other tips: Should you encounter a potential alpine and have your wits about you, and time to use them, look for a butterfly with about the size and rounded shape of a Common Ringlet (which does not overlap in timing with Red-disked Alpine), and direct (not jerky) in flight.

Other satyrs: The most similar species in bogs here is the **Jutta Arctic**, which is more the size of a Mourning Cloak, more pointed in the front wing apex, and much more jerky and bouncy up and down in flight. Juttas can be dark but are primarily brown, except for some orange on the front wing, while Red-disked Alpines are very dark, almost black, except for the diffuse reddish flush on the front wing. This orange or red color can be detected in flight, with practice. If you luck into a perched individual, Juttas are mottled in a way that suggests fuzzy bands, with eyespots in the orange (which may not be visible if the front wings are pulled well within the hindwings), while this alpine has more of a frosted appearance toward the outer edges and lacks eyespots, but that area, including the reddish disk, may also not be visible. While Juttas are strongly associated with black spruce groves and woods and their edges, and

the alpiners more with opener areas, both species overlap a lot in habitat.

Good spots: The Bear, North Bear, and Milchesky peatlands are reliable. We've never found the species at Moose Junction, the Drummond district, or the Bayfield Peninsula district.

Other notable butterflies in these peatlands

These species aren't particular specialties of this area or this habitat, but can be enjoyed here, and may be of particular interest to out-of-staters. Usually there's a sharp change in the butterfly species from uplands (which require accounts of their own) down into peatlands, and one visits peatlands not for their long list of species, or even necessarily their abundance of individuals, but for their unique species. However, occasionally butterflies from farther upland “leak” down into peatlands, and if you visit peatlands enough, your list of these “local strays” will accumulate. Usually this is a slow process. But from mid-May to mid-June, bogs are actually nectar-rich in floriferous beauty, and occasionally bogs sport a large number of butterfly visitors from outside the bog.

Associated with heaths, **Pink-edged Sulphur** uses caterpillar food plants in the blueberry family. This sulphur is more abundant in upland heaths, but also occurs regularly in bogs. Although reported as single-brooded, Pink-edged Sulphur has a remarkably long flight period—May 21 to August 24 in our experience here. This length is consistent with the span of May 2 to August 21 reported by Mogens Nielsen in *The Butterflies of Michigan*. In the last six years, our first date in the bogs in this region has varied from May 26 to June 20, and our last date from July 10 to August 19. Similar species: Abundant in the surrounding landscape, but only occasional in bogs, both **Clouded Sulphur** and **Orange Sulphur** have very long flight periods, which we've recorded as May 21-September 10. These sulphurs, but not Pink-edged Sulphur, have a leucistic (whitish) female form, which looks a lot like a white. More widespread in western and northern North America, **Mustard White** is a good find in much of the eastern United

States. It has turned up sporadically in our bog surveys from May 24 to July 29. Two other whites with long flight periods are also possible in this region, but only occasionally in or near peatlands. **Cabbage White** is a very common and widespread resident in Wisconsin; we've found them here from May 21 to August 17, but I expect the flight period is longer at both ends than that. Abundant overall in North America, **Checkered White** is a rarely encountered immigrant (or sporadic resident) in Wisconsin, with a much longer flight period than we've recorded in and near these bogs (June 9-19).

Not restricted to bogs but most abundant in this habitat, **Brown Elfin** is typically the first peatland butterfly to emerge in the spring. Our earliest date ever in this article's region is April 23 and latest is June 23 (July 3 in northeastern Wisconsin bogs). While consistently occurring every year, this elfin still varies dramatically in abundance among years. For example, we recorded only 36 in these districts in 2005 but 444 in 2007. During 2003-2008, our surveys also reveal great variation in first date of the year—from April 23 (2006) to May 27 (2005)—and the last date—May 28 (2004, another low abundance year) to June 22 (2007). Very rarely, we've found **Eastern Pine Elfin** in a bog. Based on timing of observations in its prime habitat in the same region (more upland piney areas), I recommend being on the alert for this species any time you see an elfin in a bog. Even more rarely yet, we've found a **Henry's Elfin** in a bog. Our records are so few that I can't define a flight period. But even though 99% of the elfins in a bog are Brown, we never assume and always positively identify elfins.

All the species of comma in range have also turned up occasionally in northern Wisconsin bogs. Since these individuals occur only sporadically, it's easy to assume they're only coming in from the surrounding landscape. That makes sense for **Eastern Comma** (caterpillar food plants: nettles, hops, elms), **Question Mark** (elms, nettles, hackberries, hops), and **Satyr Comma** (nettles). But caterpillars of **Green Comma** use alders, birches, blueberries, and willows (as well as

gooseberries), and we observed a female in egg-laying behavior on bog birch. This suggests the possibility that Green Comma may include shrubby bogs in their breeding habitat. Since all these butterflies overwinter as adults, they can be seen broadly throughout the butterfly season.

Jeff Nekola also mentioned the occurrence of **Common Branded-Skipper** in the roadsides adjoining peatlands. He has had more luck at this than we have. But from our observations, mainly in more upland sites in northeastern Wisconsin, the time to be on the alert for this species is after about July 20 until mid- to late August. In your quest for this specialty, you will have to wade through many other species of skippers, too numerous to cover here.

Editor's Note: Photographs will be added to this article in the future. You can find images of the butterflies described in this article in *Butterflies through Binoculars: the East* by Jeffrey Glassberg and other field guides.

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