



# How to take Photos of Fireflies in Flight

Terry Priest 2021

The firefly can be photographed mid-flight in focus because of the slowness of his flight, and the predictable pattern he makes. I have taken photos of fireflies in flight every year since 2006. I started with a modest 4 megapixel point and shoot camera. Even cheap cameras can accomplish this trick, if they can be set to all-manual control, especially a manual focus.

Firefly 2012-06-03 Canon G12





I take the photos like a sport, for the physical challenge. I look at the photos like art. Sometimes at the peak of the season I can get over 200 shots in a night. I practice like I am shooting jump shots or hitting golf balls. There is a lot of repetition and there is a lot of misses, but there is the occasional great shot. The technique is not easy but gets doable with practice. The firefly is a half inch long, it is getting dark, and he is flying. What I am looking for is a technically successful photo - in focus, fully contained in the frame, good exposure – with a lucky coincidence of a healthy animal at the peak of his life in a good pose.

Firefly 2014-06-27 Canon G15



I like to think I am a generalist, but this a highly specific activity, about as niche as you can get. As far as I know, I only photograph one species, the common eastern firefly in the U.S., *Photinus pyralis* (Fo-tinus pire-a-lis), native over half of the country with a range from Florida into Canada, and from the East coast almost to the Rocky Mountains.

Firefly 2021-06-09 Fuji XT2

The 3 dots in his eye are my 3 flashes. I usually do no post-processing other than cropping.





Photinus pyralis has characteristics which permit it to be photographed.

- Huge numbers that come out while it is still daylight.
- A predictable six second flight pattern.
- A pause that comes right after the glow. The glow is the signal he is about to pause.

When ordinary people began to be able to afford digital cameras, about the year 2000, there was an explosion of bug photos, because small cameras with small lenses can take good macros. Not only can they focus very close to the lens, but they have a good depth of field. And there is no cost of film, or delay in processing. You can repeatedly practice a difficult technique with instant feedback.



Firefly 2020-06-29 Fuji XT2

In June 2006 I had been out taking pictures - flowers, trees, plants mostly – when it started getting dark. I sat down and began watching the fireflies. There was still plenty of daylight so I could see them between flashes. I noticed that they were actually flying rather slowly. I wondered if the autofocus on the camera would pick them up in flight. The answer is no. But I was able to get the camera up close to them. I set a manual focus very close to the lens and tried to hold the camera the correct distance away. I got a couple of really bad, exciting pictures of fireflies in flight. Pretty soon I realized I had to stop watching the camera screen and visually memorize the focus distance. I hold the camera out to my side and do not look at the screen, but look at the barrel of the lens and the flying insect, judging the distance between them, and pointing by feel. That is why you need a lot of practice attempts.



Firefly 2006-06-23 Canon A80

First successful photo. I can see this is pretty good focus, I just need to tone down the flash a lot.

My first digital camera was a Canon A80, a point and shoot, fixed lens, 4 megapixel. Point and shoots have automatic controls, but the canon also had a manual mode. They have very small lenses. They can focus on objects very close to the lens. I set the manual focus to 2 inches.

The lighting conditions are always similar. The flash is providing nearly all the light. All camera settings are set to manual so there is no shutter lag. Set White Balance to get a natural look with flash. Do not set it to Auto (current setting is 3800K). My early pictures were often too yellow.

Firefly 2006-07-09  
Canon A80

Firefly 2006-07-25 Canon A80

This 2006 image was in use on the Wikipedia  
Photinus pyralis page as of summer 2021.  
[https://en.wikipedia.org/wiki/Photinus\\_pyralis](https://en.wikipedia.org/wiki/Photinus_pyralis)





The built-in flash on the A80 had 3 settings in manual mode - weak, medium and strong. I set it to weak so the flash did not overwhelm an object 2 inches away. I set the shutter speed fast and the aperture small so the very near object was exposed properly. ISO is set as low as possible. All these settings tend to increase the quality of the photo, since the subject is close and there is plenty of light.

Another thing that works in your favor - there is only one flash strength. It is either on or off. The strength of the flash is determined entirely by the duration. In weak mode the flash is very fast, much faster than the fastest shutter speed. A serendipitous byproduct of a very fast flash speed is that it freezes the insect in flight and it makes holding the camera steady much less of a problem.



Firefly 2006-07-03 Canon A80

This photo taken in 2006 is still in use today on websites such as Wikipedia Bioluminescence.



The summer firefly show is a mating dance. The firefly is at the end of its life cycle. As an adult, it lives only a few weeks. It has spent most of its life, from 1 to 3 years, as a larva in the ground eating earthworms and other soft insects. Only the males fly. The females are too heavy. Males outnumber females perhaps as much as 100 to 1 or as little as 20 to 1. The males fly and glow. The females, inconspicuous and rare near the ground, see a male glow and answer back with a glow. The females can afford to be picky. They are selecting based on the length and strength of the male glow. The successful male not only produces sperm, but a protein package biologists call a nuptial gift. This gift nourishes the eggs making a larger, healthier brood. The firefly glow is an elaborate evolutionary invention to strengthen the species.



Firefly 2020-07-15 Fuji XT2



Firefly 2014-07-08\_178 Canon G15 (above)

Firefly 2014-07-08\_175 Canon G15 (left)

The female (left) points her lantern toward the male that has caught her eye (not the one pictured who seems to be flying away).



The firefly has a six second flight pattern, a predictable pause right after it glows. It flies in an inverted hoop. Sinking, it suddenly glows while simultaneously shooting up at maximum speed. Then it stabilizes and pauses for a brief second. It is looking for an answering glow from a female below. Not usually getting an answer, it continues the cycle, flying horizontally about 3-6 feet before sinking, shooting up, glowing and pausing again. The effect looking over a field of fireflies is rising sparks. The glow is a signal it is about to pause and hover. The pause is the photographic moment.

Firefly 2021-06-26 Fuji XT2



Even the basic early-model digital camera with built-in flash is capable of taking photos of fireflies in flight if it has an all manual mode, especially if the focus distance can be manually set. The firefly is helpfully pausing and the camera is capable of taking the pictures.

Technically there is only one problem. Deciding where to set the fixed focus – how far in front of the lens the subject will be in focus – and holding the camera that far away from the flying insect with the insect entirely within the frame, while pushing the shutter button. All the issues of exposure and lighting are pretty simple. You can figure them out by taking pictures of a penny or any small object from 2-3 inches away in a semi-darkened room using a flash.



Firefly 2007-06-27 Canon G7

This is full-frame just as it came out of the camera. All the other pictures are cropped and some of them are rotated.



The key to the process is to visually memorize the focus distance. Set a manual focus about 2.5" in front of the lens. Visually memorize how far 2.5" is, and hold the camera that far away from the insect during his pause/hover. That is the challenge of the sport. Practice on non-flying objects like a clover. The depth of field is very thin, perhaps only 1/16" or at most 1/8", depending on the lens and aperture setting. There is almost no margin of error. Small lens cameras have better depth of field than big glass.

There are a lot of reasons to set the focus out farther rather than nearer. It scares the insect less. There is a greater depth of field. It's easier to cover the whole insect with flash. But the reason to set it closer is that it's easier to visually memorize a smaller distance. So you have to experiment with distances and find the right compromise.

At the peak of the season, the fireflies come out by the hundreds, in daylight, the cycle is 6 seconds, there is no film cost, there is instant feedback. Practice and experiment.



Spider and Clover 2013-06-13 Canon G15

To consistently take photos you want the firefly to be in his regular pattern. Stay behind him. Don't move during his pause. Make up ground during his horizontal flight. Don't shift your feet during his pause. When you are in position to take the photo, move the camera up smoothly, anticipate the pause, and be decisive.

Get out early. The best photos are taken with ambient light and background vegetation. You have to see them to photograph them. Fireflies are also a little slower and predictable when they first start flying. Its impossible if there is much wind. They cannot hold their position.

Best photos are near the season peak. Fireflies are healthiest and conditions are best. Season peak this year at my house (Midwest USA) was about June 27. The season depends on ground temperature. The solstice is usually near the peak. The beginning of the season is better than the end. Get out early in the evening during daylight and get out early in the season to get ready for the peak.



Firefly 2020-06-26 Fuji XT2



So we can upgrade to better cameras and more sophisticated flash arrangements, but the system is in place even with a 4 megapixel fixed lens camera with built-in flash first released in 2003.



After the first year, I wanted a camera with an external flash. I bought a Canon G7, a nice compact fixed lens 10 megapixel. I made a reflector similar to others I had seen to push the light down and packed it with bubble wrap and white cloth. I used an old manual flash from film days and set it to its weakest i.e. fastest speed. The picture quality improved dramatically.

I had 3 Canon G series compact cameras. They made beautiful pictures. I liked everything except all 3 had shutter lag when an external flash was used, and 2 of them broke. I used them heavily. I still like the pictures they made. I used several of them at the beginning of this document.





Firefly 2007-06-11 Canon G7

Uhaul used this 2007 photo, loaded it into Illustrator, and made an Indiana branded graphic that was on the side of 1900 trailers.





I bought a Sony DSC-RX100 II (fixed lens compact) and it had 20 mp and no shutter lag. It was the first camera that I was able to reliably take pictures of the firefly glow. To get the glow, set the shutter to a slow 1/30 second. The flash freezes the insect, but the slow shutter captures the glow trail – two sources of light. The sony did not have a setting to time the flash. The fast flash went off at the beginning of the very long shutter opening, freezing the insect, then capturing the glow.



Firefly 2015-06-29 Sony RX100

Firefly 2015-06-13 Sony RX100

The glow occurs during the firefly's maximum upward acceleration. There is no signal the glow is about to start. It lasts less than a second. If taking pictures of the pause is 100 times harder than taking a stationery shot, the glow is 100 times harder than the pause. Use a slow shutter speed 1/30 second. The fast flash freezes the insect, the slow shutter captures a glow trail. Practice the pause pictures a lot before you try to take the glow. Whenever I am trying too hard to get a glow picture and I am getting nothing, I go back to the pause pictures. You need to establish the muscle memory of where the camera needs to be with the pause pictures. Look for a setting called rear curtain flash sync which makes the glow trail behind the insect.

Firefly 2020-07-08 Fuji XT2



After you get the basic idea, the quality of the photo is all about the lighting. I made a camera bracket to move the flash off the hotshoe and add a second flash. One flash fires from an adapter on the hotshoe (or a port on the camera) and the other is a slave that flashes when it sees the other go off.

The bracket is made from aluminum flat bar, 1 inch by 1/8 inch, cut with a jigsaw, bent with a hammer in a vise, drilled for 1/4 inch bolts.

I currently use 3 flashes, the two main with reflectors are at 180 degrees to each other, the third is mid way between them, farther away, and aimed at the background, over the head of the subject, but does give some light to it. The reflectors are made with construction paper (white and black) and a lamination machine. The window part is made with tracing paper and lamination. They are cut out, folded, taped and placed over the end of the flash units.





This is the same bracket before I moved the flashes back about 3 inches and added the laminated paper reflectors. It has two handles. I have a clear path for my hand to rest on the shutter button and for me to see the barrel and the insect. I am taking the photo vertically to capture the long glow.

I modified the bracket every year - how can I make the pictures prettier and more natural looking? With cameras with larger lenses, its hard to get the flash around the lens. Fireflies are skittish and don't like big white reflectors coming towards them, so its not possible to completely optimize the light. Reflectors made a better light and were less intrusive.



Ethics -

Does it hurt fireflies to flash them from a few inches away? It doesn't do them any good. Does it hurt them permanently? Specifically, am I permanently damaging the structure of his eye? I don't know. I welcome any research. I suspect some entomologists will eventually say yes. I am not sure. Especially about the permanent part. It does affect some of them. They seem dazzled, shaky, and head for the ground. A lot of them don't seem to mind it. I can sometimes get many photos from one individual without him leaving his pattern, if I flash from the side. He finally tires of me and flies off at right angles, or farther than normal, or into the bushes or up high, but he seems in control and not hurt by it.

In a culture where "broad spectrum insect spray" is a selling point, it is statistically insignificant to the health of the population to affect them singly. I think it could be assumed that if I take out the alpha male, there are many others to take his place. Mowing the lawn in season kills how many females? Driving to the store when they are flying? But I want to know. Every individual deserves a chance to live. If it hurts fireflies, does macro flash photography hurt all insects? It's the flash that freezes the wings and makes it possible, so it's hard to imagine an alternative method.

Questions -

According to Sara Lewis in her book “Silent Sparks” entomologists can only tell the difference between the 30+ species of Photinus by secondarily analyzing the flash pattern and primarily by microscope dissection of the genitalia. That means I have no way to tell if even one of my 1000 photos is Photinus pyralis or something else.

I have always noticed baby fireflies, and I always called them hatchlings. They barely blink. They fly like babies walk, just barely. I always assumed they would grow up over the next week or so. But fireflies, I read, do not eat. So are these different species than pyralis? Do fireflies grow?

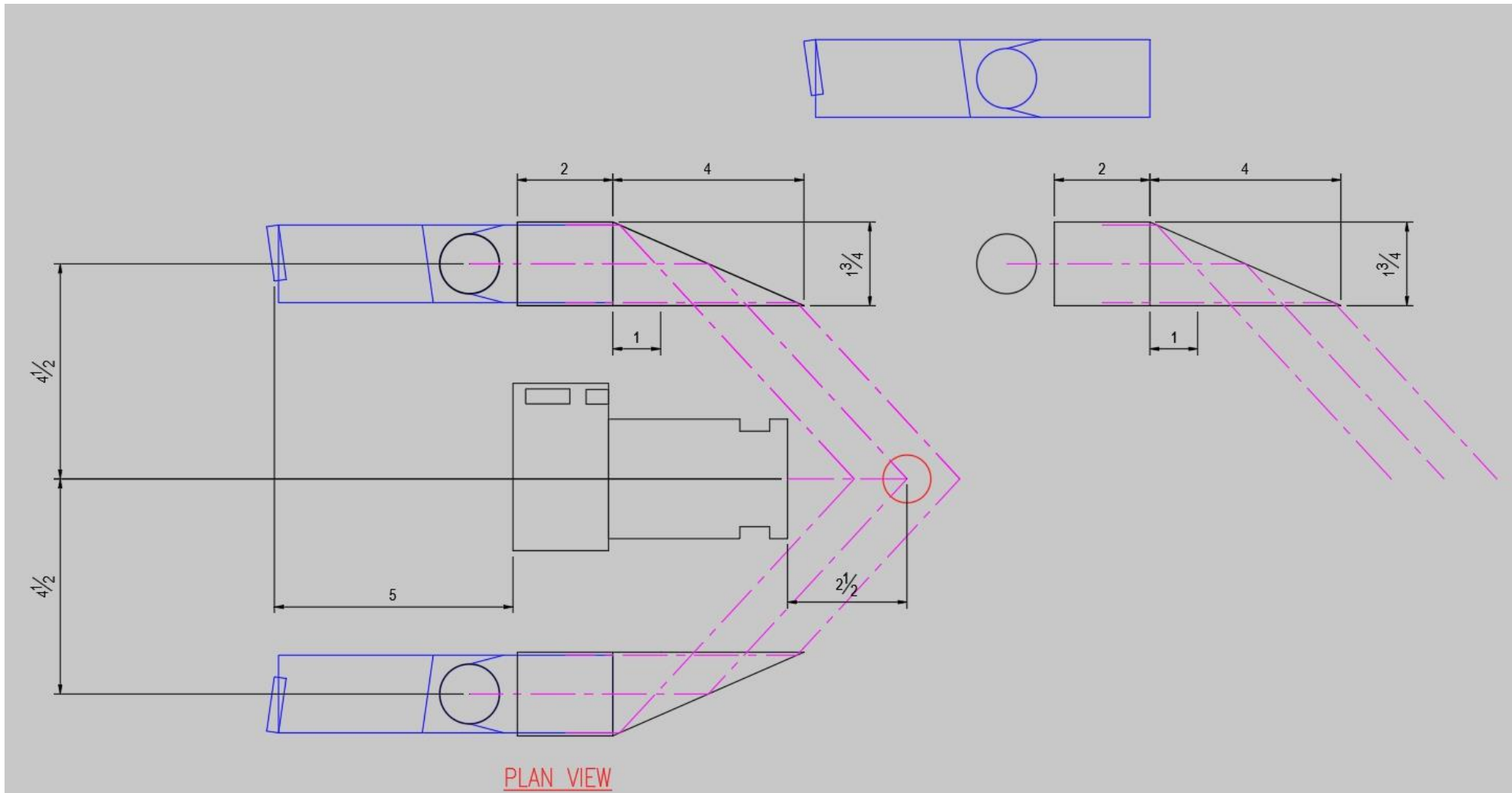
I have always noticed a paler version than the typical brightly colored one. Is that a different species? The normal version is a black body firefly, but some of them are much darker than others.

Especially late in the season, fireflies do not fly in the same regular pattern, but are irregular and hard to photograph. Are these a different Photinus?

How many eggs does a female lay and how far do the larva travel over their life in the dirt? It seems like we should be digging up clusters of larva somewhere by accident directly where we observe females.



Reflector sketch – the body is made of black construction paper laminated (school type hot laminator). There is a white insert to reflect the light. The window is made from tracing paper laminated. The blue thing is the flash.



The Loves and Lies of Fireflies – Ted talk by Sara Lewis

[sara lewis the loves and lies of fireflies](#)

my flickr archive with photos back to 2006

[My Flickr Site](#)

Uhaul firefly graphic website

[The-Science-Behind-The-Glow](#)



Firefly 2021-06-27 Fuji XT2





Firefly art - I used to load pretty but slightly out of focus shots into photoshop and use the watercolor filter.



Backgrounds look good and the back reflected light makes them look less flat.



Firefly 2013-07-11 Canon G15



Firefly 2021-06-27 Fuji XT2





Firefly 2015-07-05 Sony RX100

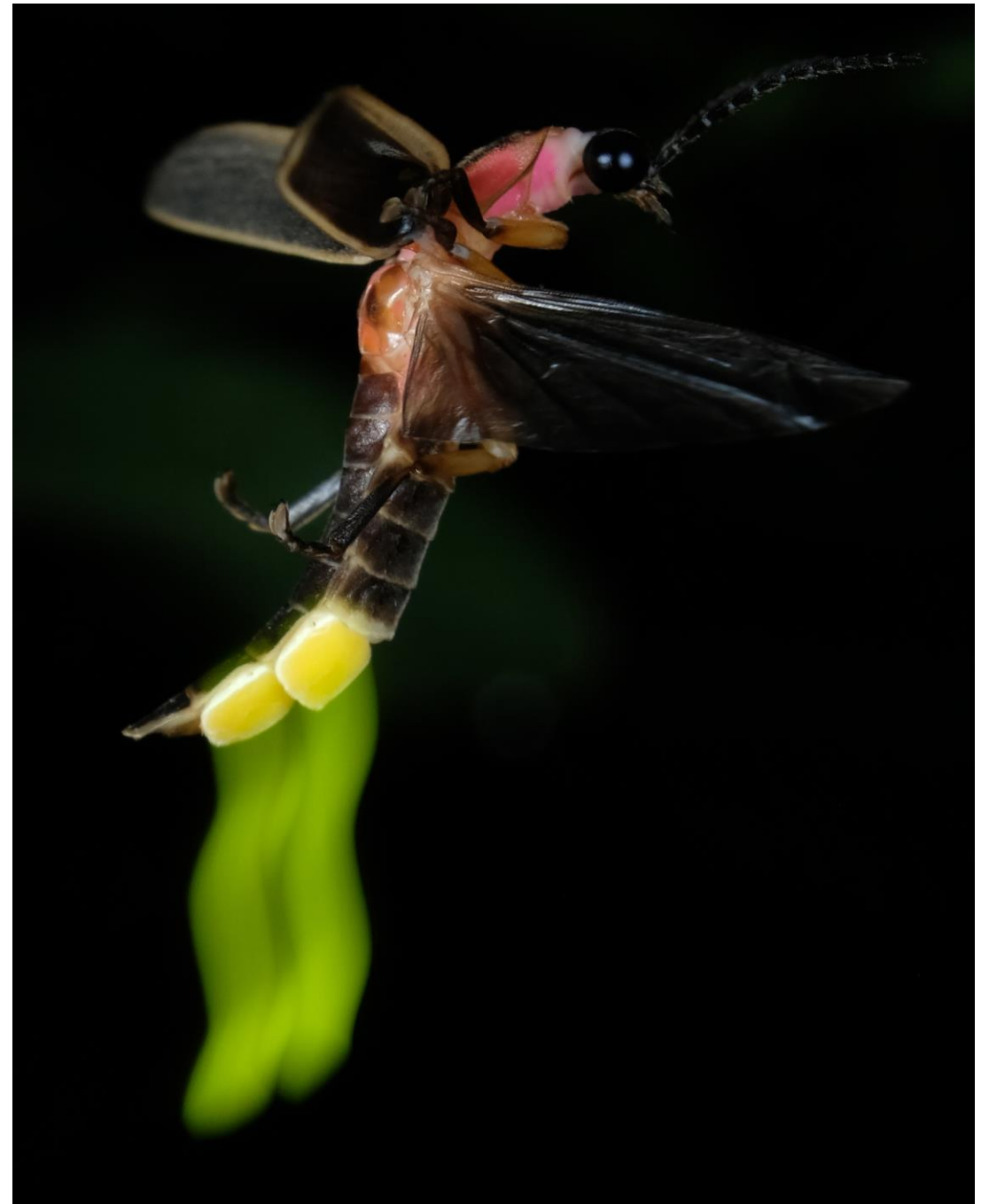


The glow is hard to get because it is so quick. Sara Lewis in her book *Silent Sparks* quotes research done many years ago that the glow lasts .75 second. I question that. This is taken with a shutter speed of 1/30 second. .75 divided by a thirtieth is 22.5. This glow is not very long, but I have photos where the glow is close to an inch. The math says they can glow for 22 inches and I do not believe that, maybe 6 inches max. The only time I get a full glow like this I feel like the shutter click and glow are simultaneous. If it lasted .75 seconds I think it would be a lot easier to get a glow. Also there are baby fireflies who clearly are just blinking. So it's a range of times, not a single value.

One caveat, if I am swinging the camera, I am affecting the apparent glow trail length. The look and direction are consistent though, and I don't think that's it.

On a different note, I believe the waviness of his glow trail is the effect of the beating of the wings.

Firefly 2019-07-07 Fuji XT2



Sometimes the females get a lot of attention.



Firefly 2019-06-25 Fuji XT2



I don't go after them or publish them a lot, but towards the end of the season the fireflies get loaded down with red mites. This is a fairly mild case. In the worst cases with 10 or more mites, they clearly cannot fly well. You can see them with the naked eye. They look like red back fireflies.

Firefly 2015-07-16 Sony RX100



A large body female



Firefly 2019-06-13 Fuji XT2

If you look carefully on the side of his lanterns, you can see breathing holes. It takes oxygen to make light, but fireflies don't have lungs. There is another larger hole under his wing (more than one actually) I suspect is an oxygen hole for the energy intensive task of flying.

This is a picture taken during his pause. The pause pictures are usually in better focus than the glow pictures. During the pause he and I are relatively stationary, but during the glow we are both on the move.

Firefly 2021-06-15 Fuji XT2





If you work on tempering and optimally placing your flashes, you can take pictures of any insect not just fireflies.

My current and favorite camera is a Fuji XT2 using the “kit” lens 18-55 mm zoom. That won’t focus close enough to the lens, so I use a small extension tube, the MCEX-11 between the lens and the body. The camera is the same physical size as my old film Nikkormat that I use to say I just wish it was digital. The canon G15 pictures though still look good. If I want to breathe some new life I may look for another high quality compact eventually.







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