Anisoptera at the University of Notre Dame Environmental Research Center: Summer 1991

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Abstract

A total of 29 species of adult dragonflies in 5 Families was collected this summer. Three new species of adult dragonflies were found; Epiaeshna heros, Erythemis simplicicollis, Gomphaeschna furcillata. This increased the list of known dragonflies of UNDERC to forty-three. Twenty-three species were photographed, adding six new species to the photographic manual. The area for collecting dragonflies increased with the accessibility of Nansen Lake. Different species were also added to already known and well researched areas. New successful methods were tried in the preservation of dragonflies via mounting and photography. The population of dragonflies was estimated in a mark-recapture study for two areas during a specific time in the summer.

Introduction

The purposes of the dragonfly research this summer were:
1) Continue collecting as many different species of adult dragonflies as possible in order to enlarge the list of known dragonflies at UNDERC. Male and female specimens would be collected from every species.
2) Collect dragonflies at Nansen Lake, since this remote lake has not been explored for species.
3) After successfully capturing dragonflies, kill them and quickly take pictures of them so that they may retain most of their natural color. This is to continue the illustrative manual of dragonflies at UNDERC.
4) Photograph the emergence of a dragonfly in captivity.
5) Find out what types of permanent markers least affected dragonflies for a mark-recapture.
6) Conduct a mark-recapture of dragonflies in certain areas at UNDERC in order to make an estimate of the number of individuals in a given population.
7) Watch the behavior of the dragonflies to gain more bionomic knowledge of certain species.

Method

The most effective way to catch dragonflies was with an aerial net. In rare and lucky instances, the bare hand was used. The net takes a bit of practice to get used to. At first one feels like a bull in a china shop swinging wildly, thrashing the net hitting and catching everything but the dragonfly. Eventually one realizes that the quieter, slower and more gracefully one walks and swings, the greater will be the chance of catching an elusive Anisoptera. Soon, most swings will catch the elusive prize. It is important not to move about with jerking motions because dragonflies sense motion extremely well. It is more effective to catch them from behind where their vision is poorer but still very keen. It is also easier to catch them when they land on the ground or on vegetation. After more experience, it is possible to catch

them in flight but this is more difficult and time consuming.

I found that the best times to catch dragonflies were from 10:00a.m.-4:00p.m. on sunny days. Once it became a bit cloudy, dragonfly activity and sightings dropped virtually to zero. Dragonflies were more lethargic in the mornings as cooler temperatures made them easier to catch even though there were fewer of them. In the middle of the day, there were many more dragonflies but they were also quicker. My percentage of misses with my net was greater in the afternoon than in the morning but I caught more in the afternoon due to the abundance of dragonflies.

I tried to collect dragonflies twice at each site. Once in the beginning of the summer and once at the end of the summer. There were some areas which I visited three or more times. This gave me a sense of when dragonfly species emerged and died.

An ethyl acetate jar was used to kill dragonflies in the past, but this year a potassium cyanide jar was used. Potassium cyanide killed the dragonflies more quickly and didn't cause the colors to fade as fast. It is important to be very careful when using the potassium cyanide because it contains dangerous chemicals. Always open the jar outside and downwind. Even after taking these precautions, I would develop a headache after many whiffs of the strong scent. Soon I learned to hold my breath, open the jar, throw the dragonfly in, close the jar and walk a few feet away to breathe again all within five seconds. However, some people didn't mind the smell at all.

After a day of collecting, the dragonflies would first be photographed and then mounted. The photography will be described later in this paper. The mounting was done to straighten the wings and abdomen. Undamaged specimens would be mounted on a mounting board which was labeled to show when and where it was caught. On the first week the mounted dragonflies were put into the freezer and after one night they were taken out to thaw. Julie Stavisky (another

Odontologist) and I found the freezing part to be unnecessary because the dragonflies mounted just as well and with less loss of color when just set out in the air to dry for two days.

After mounting many dragonflies, I noticed that the blue pigment tended to fade the most quickly--almost overnight. Red and yellow followed next in the rate of fading. Pruinose areas didn't seem to fade at all, even after a few months. Once the dragonflies were mounted and dried, they were identified, pinned and put into cardboard or cedar boxes. The cedar boxes were better to use because they are sturdier, looked more professional and were not infected with the museum beetle. Some of my specimens in cardboard boxes were eaten by these museum beetles. This is why it is extremely important to put small boxes filled with naphthalene in each pinning box. Much time and energy can easily be wasted overnight on a hungry beetle. It is also advised not to leave any dragonflies on the tables in the lab because the bat(s) from the rafters come out at night and eat them. I lost a few dragonflies to these creatures too.

A difficult part of the dragonfly research was the identification. I used Merrit and Cummins, An Introduction to the Aquatic Insects of North America to identify the dragonfly down to Family and Genus. The Odonata of Canada and Alaska vol.2 & vol.3 by Walker and Corbet was used to find the species of the dragonfly. If I had difficulty in identifying the insect to Species with Walker and Corbet, I would refer to Dragonflies of North America by Needham and Westfall.

It took me some time to realize that these identification keys are not written in stone and not always correct. The use of another book or manual was always necessary. It also cleared up differences in determining a species.

One species I had difficulty in identifying was the female Ladona exusta. I was never quite sure whether or not it was a Ladona julia. I noticed that it was found in 1988 at UNDERC but there was a question mark next to it. I also question whether or not it exists on the property since the

only Ladona exusta I found were females and it was the females between the Ladona julia and exusta that I had difficulty in identifying. Because no male exustas were found and due to the uncertainty in the female identification I would conclude that Ladona exusta hasn't been found yet. I believe the identification manuals should be more clear on these two species.

Nansen Lake

With the help of two UNDERC students, Richard Huftalen and Mark Lavery, I was able to find the remote Nansen Lake and collect dragonflies. Mr. Huftalen and Mr. Lavery were conducting their own research on the lake but in order to reach it they had to clear a trail to it. With the help of some maintenance keepers, they chopped and chainsawed a path to this lake. On the very sunny day of June 1, some students and I helped Huftalen and Lavery carry a boat and supplies to Nansen. After a mile of hiking, we finally reached this beautiful lake. I recommend anyone who has the chance to visit this lake. To my delight, there were dragonflies everywhere. I collected until most of my jars were full. Nansen was surrounded by a huge bog mat and in one corner there was a small pond. This pond is where most of my dragonflies were caught that day. More dragonflies were collected at Nansen on July 8, but not in such numbers as the first time.
The species found at Nansen were:
Cordulia shurtleffi: male(m.)
Epitheca canis: m. & female (f.).
Gomphus spicatus: m.
Ladona julia: m. & f.
Leucorrhinia frigida: m. & f.
Leucorrhinia hudsonica: m. & f.
Macromia illinoiensis: m.

Mark-recapture

The permanent markers used to mark the dragonflies

were regular store-bought markers found in any supermarket, toy store or art supply store. This researcher happened to buy Pentel Permanent Marker Bullet Point MM450 in black, blue, green, and red. An unknown brand name green marker found in a lab drawer at UNDERC was also used. The test of the markers' effect on dragonflies was needed because it was necessary to know whether or not they affected the mortality rate. If the markings increased the mortality rate, like making the dragonflies more visible to predators or the chemicals were toxic to the insect, this would affect the results of the mark-recapture. The areas marked on the dragonfly were the wings. A small dot was marked near the tip of the upper right wing. The dot could only be seen when the dragonfly was held in the hand. It was important that the marking could not be seen from afar because it might cause the collector to make more of an effort to net it and bias the results. The dragonflies could not be marked on the abdomen because this would obstruct their breathing. I tried marking the thorax but the thorax on most dragonflies were too dark for the markings to appear. In mark-recapture it is assumed that no change has occurred (i.e. reproduction or emigration). This would have decreased the ratio of the total marked. It is assumed no loss of marks occurred.

The mortality rate experiment of the permanent markers was conducted a few days before the mark-recapture experiment. Fifteen dragonflies had a dot marked on the wings and were placed in a cardboard box covered with wire mesh overnight. A control group of unmarked were placed in another cardboard box. Both groups were handled similarly to ensure that manual manipulation caused no effects on their mortality. The next day, the total dead and alive were counted. In this case, 2 marked and 3 control dragonflies died. It was safe to say that the markings had a minimal or no effect on these insects.

The mark-recapture was conducted on Monday June 17 and Tuesday June 18. Two sites were chosen. The first site

was about a 100 meter stretch of dirt road between Plum and Inkpot Lakes. The second site was also along a 100 meter stretch of dirt road but between Peter and Paul Lakes. These sites were chosen because the water on both sides of the road created a natural barrier to collect, the areas were accessible and there were many dragonflies at these sites. The marking was done on Monday and the recapturing on Tuesday. Collectors were told not to deviate past given markers along the road (i.e. into the woods). The area for the mark-recapture was the same on both days. If people were allowed to collect further the second day, this would change the results.

The mark-recapture took quite a bit of planning to organize since students were needed to help collect at Plum/Inkpot from 9:00a.m.-1:00p.m. and at Peter/Paul from 2:00p.m.-6:00p.m.. The experiment was split into two hour shifts of four people (including the researcher). So three students were needed from 9-11 at Plum/Inkpot and three more from 11-1. This was the same for the afternoon shifts at Peter/Paul. Due to the large distances from the lakes to the student housing, drivers and vans were needed to transport the collectors. Fortunately, the fourteen UNDERC students helped me with this experiment. One person was needed to help only one shift each day.

Fortunately, after a week of poor weather, Monday June 17 was very sunny and warm so the dragonflies came out in swarms. 209 dragonflies were marked with red or green markers in the upper right hand wing at Plum/Inkpot. 263 dragonflies were marked with black or blue markers in the same area of the wing at Peter/Paul. The reason for choosing two colors each day was because there weren't enough markers of the same color for each person. The colors were different at each area just in case a dragonfly wandered between the two sites. However, this didn't happen in this experiment.

On Tuesday, the day of the recapturing, the morning was hot and hazy. 16 marked and 218 unmarked dragonflies were caught at Plum/Inkpot. Unfortunately, the weather changed in

the afternoon and it became very cloudy an hour into the collecting at Peter/Paul. Only 4 marked and 34 unmarked dragonflies were caught before it began to rain.

Using the equation N=MC/R where N=total no. of dragonflies, M= marked dragonflies on Monday, C = total number of dragonflies captured on Tuesday, R = marked dragonflies that were recaptured, I was able to come up with roughly how many dragonflies existed in a certain area. For Plum and Inkpot Lakes on June 17 and 18, there were about 3056 dragonflies (N = 3056). Peter and Paul lakes had about 2498 dragonflies (N= 2498).

Photography

Photography was the most difficult part of my dragonfly research. It was not clicking the shutter that was difficult but the rush to photograph these insects before their colors faded, making sure everything was in maximum focus, and to make sure the lighting was perfect.

The ideal picture of a dragonfly would be while it was still alive with its brilliant hues especially in the eyes and abdomen. However, this was not feasible since dragonflies do not stay still for long periods of time and do not allow the photographer to get within inches of them to take the picture. Once a dragonfly dies, it begins to lose its colors within minutes because the pigments begin to break down.

The equipment I used was a Nikon FE2 camera with a micro-NIKKOR 55mm lens. This allowed me to take close up pictures of them filling the entire frame which was important because I didn't have the skills or equipment to process color film to blow up the image if the dragonfly was too small on the negative. Therefore, an outside company, primarily Mystic Color, was used. They were more expensive than other mail order film developers but had an outstanding record in processing and brought out the brilliant pigments of the dragonfly. York Photo Lab was another company used to process the film. It was less expensive and the difference in

quality showed in the prints. As the saying goes, "You get what you pay for."

The only feasible way I knew of photographing dragonflies alive was Sidney W. Dunkle's method in his book Dragonflies of the Florida Peninsula, Bermuda and the Bahamas. He would catch the dragonflies and put them into a cooler filled with ice for a few minutes. This chilled them enough to allow him to place them on a branch or other natural objects and photograph them before they warmed up and flew away. This eliminated the problem of the breakdown of color pigments because the dragonflies never died. Unfortunately, I did not have the time nor the manpower to lug an ice chest over miles and miles of wilderness from bog to bog and lake to lake.

My method was different. Once I caught the dragonflies, I put them in the potassium cyanide jar. Immediately after they died, I took them out of the killing jar and placed them into a plain air filled jar. I noticed that the longer the dragonflies stayed in the potassium cyanide jar, the quicker the colors faded. So by minimizing the time spent in the jar, the loss of color slowed down and it allowed me to collect more dragonflies before I headed back to the lab.

Another method of photographing the dragonflies with maximum color was to take their picture before mounting them. Since mounting took a day or two and the colors faded within hours, it was best to photograph them before mounting. This created some difficulty because the dragonflies' wings were not as straight as I would have liked them, but with a little bending here and there, I would then place them on the backdrop.

The color and texture of the backdrop was important in the photographic process. A dark backdrop could not be used because the wing venation was black and would not show up in a dark background on film. The wing venation needed to be seen since it was an important identifying clue for Family, Genus and Species. If a white backdrop was used, it would

bounce back too much light making the dragonfly appear darker and with less color than it really had. So a neutral color was needed. A light grey would have been perfect but since no grey paper or cardboard could be found, I used a light sky blue paper. I pasted this on cardboard so the specimens could be pinned. I made sure the paper was smooth because any texture (i.e. bumps and lines) would create unnecessary distractions in the overall picture.

The lighting I used came solely from the ring flash accompanied with the camera and equipment. It was vital to the photograph that I used flash and/or white fluorescent lighting. I didn't want to use incandescent lighting (a regular light bulb) because it appears yellow on color film. This flattens and alters the dragonflies colors making it appear "sickly". Another benefit of the ring flash was that it distributed the light evenly, minimizing any shadows.

Kodakcolor Gold 200 was the film used to photograph the Anisoptera. Since the slower speed film takes clearer pictures, a 64 speed film could have been used. However, the difference between a 64 and 200 speed film is not noticeable when the negative is blown up into a $3\frac{1}{2}$" by 5" print that is used for the illustrative manual. There is a difference in quality if the negatives were blown up to poster size. A difference becomes apparent with a higher speed film like 1600. The 200 speed was used because it was less expensive and did not affect the quality.

All the previous techniques do not create a fine quality photograph unless the dragonfly is properly in focus. This may seem like the easiest step but it is one of the trickiest. I used the lowest f/stop which happened to be 32 on the 55mm lens. The f/stop controls the amount of light coming into the camera by widening or narrowing the iris of the lens. The higher the f/stop, less light comes in, but the focal distance increases, meaning there is a larger distance in focus in front and behind the object focused on. Since the dragonfly is three dimensional, it is necessary to have the abdomen, wings, head

and thorax in focus because they are vital in helping identify the insect. I focused between the pairs of wings on the thorax. The most difficult part of the dragonfly to have in focus was the abdomen. Since it was long, it tended to taper down or curl up and out of the focal distance.

The dragonfly was placed on the light blue backdrop which lay flat on the counter. The camera, mounted on a tripod, looked down upon the insect. The lens was usually just a few inches from the dragonfly because I tried to fill the entire frame, making the dragonfly appear bigger so more detail could be seen. The shutter speed was set to 250 (250th of a second). This was the best speed for flash even though the light meter didn't line up with the shutter pin. The light meter and shutter speed pins can be seen on the left hand side of the camera when looking through the eyepiece. After focusing, the ring flash was placed around the lens. It had to be held by hand because the threader on the lens was missing. Usually two shots were taken of each specimen unless it was a rare find. Then around five shots were taken. This may seem wasteful and redundant but I wanted to make sure at least one picture came out O.K. in case I or the developer made an error. I would not know how the picture would turn out until a week or two later and by then it would be too late to take another picture because the dragonfly would have lost most of its colors.

One of the goals of this researcher was to photograph the emergence of a dragonfly. Naiads collected from different sites were put into a rectangular aquarium with a bubbler. Sticks, macrophytes and other aquatic insects were thrown into the tank because they were collected with the naiads in the delta net and it would create a more natural environment. Only naiads in their last instar stage were used because these were the ones ready to emerge. It turned out to be a waiting game because it was not known when they would become adults. Different species emerge at different times in the year. I checked every day for two weeks but most of the time nothing emerged and when they did emerge, it was in the early

morning when no one was there to see it. Many were seen emerging in the wild but the photographic equipment necessary to document the emergence was not available. Hopefully future odontologists will be able to successfully photograph an emergence.

I highly recommend future dragonfly photographers to take at least one photo course or to at least read a book on the mechanics of the camera in order to understand the f/stop, shutter speed, lens and flash.

Bionomic Knowledge

Over time, one notices the many different types of insects dragonflies prey on. Many dragonflies were seen with moths, damselflies and even other dragonflies in their labium. Even when caught and held in the hand, they would continue eating. To the enjoyment of many of the researchers at UNDERC another favorite prey was the deer fly. Sometimes the Anisoptera would snatch the deer flies flying around your head. Although the dragonflies ate throughout the day, they were more likely to be seen feeding in the late afternoon. Many would be seen dodging in and out of swarms of mosquitoes and gnats and no-see-ums. This is interesting to watch by actually standing in one of these swarms which does not seem to disrupt the dragonflies' feeding behavior. They would zoom around your head snapping the prey with incredible speed and agility. For such large insects, I was continually amazed by their split second ability to change direction.

A few dragonflies were dissected for their stomach contents. This proved to be trial and error at first because no book was available on the anatomy of the Anisoptera. A freshly killed dragonfly was used so that the organs would not be dried out. It was placed under a dissecting microscope and cut with a razor blade aided by probes. I began cutting the dragonfly in the first logical place I thought the stomach would be, the thorax. I quickly realized how dragonflies could fly so fast by the large amounts of muscle I had to cut through.

Just beyond the muscle of the first dissected dragonfly was a thin, clear, long, damp membranous tube. I first thought it was the lung because when I poked it with a probe, it deflated. But as I followed this tube down to the abdomen I noticed brown mucous material containing particles in it. Then I realized it must be the stomach. A second dragonfly was dissected at the thorax and this brown particular mucous material was immediately noticed. Unfortunately, the dissecting microscope was not powerful enough to identify what was in the stomach. It was recommended to me afterwards, and now to future researchers, to mount the stomach contents on a slide and identify them through a compound light microscope. Hopefully, more about the dragonflies' feeding habits can obtained through future stomach analysis.

The Aeschnids were the largest fastest dragonflies found this summer. Five different species were caught but usually only one or two were captured for each species. Due to these low numbers, not much was learned about their behavior. Usually it was a surprise and luck to find one in the aerial net like the time I caught an Anax junius on 6/2. This species is easy to spot due to its light green thorax and blue abdomen. An Anax junius was seen but not caught at Forest Service Bog. This individual was seen circumscribing the entire bog which took a few minutes because I waited to no avail to capture this dragonfly. The territory of the A. junius and most of the larger dragonflies was much larger than that of the smaller dragonflies. This was one of the reasons it made the smaller ones easier to catch; less time was spent on waiting for an individual to come back from its rounds around its territory. This territorial behavior was almost like clockwork because the dragonflies could almost be timed on when they would return to a certain spot of a guarded plot. Many A. junius were seen mating inches above the water on Tenderfoot Lake on 6/16. This was the only time they were observed mating and the only time a female was seen. Unfortunately, this sex was never caught. There seems to be no general area at UNDERC in

which Aeschnids will be found because they have been caught at bogs, lakes and over dry areas.

Corduliids, on the other hand, were much more prevalent and easier to catch. Six species were collected and in larger numbers. They were prevalent the first two weeks of the research. Epitheca princeps was an exception being found in the middle of June. A Dorocordulia libera was also found on 7/8.

Three species of Gomphids were found. Gomphus spicatus was by far the most abundant of the three. They were found in nearly all corners of UNDERC. Most of the G. spicatus were found on the roads near bodies of water. They were rarely seen on the periphery of or above a lake or bog. A single female Hagenius brevistylus was found at Plum/Inkpot on 6/18. One of an unknown sex was seen at the South bridge crossing Tenderfoot Creek. It was probably a male because it showed territorial behavior by fighting off other species. Sometimes it was seen chasing a feisty individual for long distances, far beyond its staked-out territory.

The Libellulids easily outnumbered the other Families in the number of species, a total of thirteen. They were also the most abundantly caught. In sheer amount collected, Ladona julia won hands down. They were collected nearly every week and in nearly every location throughout the summer. It would be surprising not to find one at a location. If L. julia won the award for quantity, Celithemis elisa won for beauty. Its bright red and yellow colors, depending on its sex, and interesting wing pattern makes it easy to spot and identify. C. elisa preferred tall grassy areas. When found at a bog or lake, it was usually caught further away from the water where there was more grass. Many were seen on the field near the basketball courts. Half the field was well kept and mowed while the other half was allowed to grow. All the C. elisas seen on this field were on the half of the uncut tall grass. The Leucorrhinias were the smallest of all the dragonflies. They were easier to catch because they were not as quick and likely

to travel long distances. In general, most were found at bogs. The Genus Sympetrum emerged late in the summer. They were collected from 6/13 to 7/8. Their red and yellow coloration made them a joy to photograph.

Not much can be said about the Macromiids unless it is said they are a rare find. Only two species, one individual each, were caught.

Future Research Recommendations

This individual neglected to collect naiads, an important part of dragonfly research. This area can be greatly improved upon for it is still relatively untouched. Some naiads have been collected in the past but not to the extent the way the adults have. Understandably this is more difficult because it is easier to catch something that one can see sitting on a branch or flying through the air than by randomly dipping a net into the water at something not seen always uncertain anything will be collected.

Another area that can be improved upon is the photographic manual. There are still quite a few dragonflies that have been caught but not photographed. The manual is also incomplete in representing both sexes. Finally, the color, detail and quality of the pictures can always be enhanced.

Acknowledgements

I would like to thank The Bernard J. Hank Family Endowment for their generosity in making this program possible and allowing me to have the opportunity to experience and learn the uniqueness of UNDERC. I am forever grateful to my advisor Dr. Craig. His guidance, patience, encouragement and wisdom helped me not only finish the dragonfly research but changed my derogatory perception of 'bugs' to a new found worldly appreciation and respect for insects. I realized, especially with the photography part of the research, how beautiful dragonflies are. If I ever came back to life as an insect, I would choose without hesitation the Anisoptera. I would like to thank Dr. Berg for answering the numerous questions I had concerning the many obstacle and errors I encountered nearly everyday. I will never forget the many times I went collecting with Julie Stavisky for dragonflies and damselflies. Without her help my dragonfly collection would be incomplete. To all the professors who opened the world of aquatic biology to me, thank you. Finally, a big hug to all the UNDERC students this summer. Not only did I appreciate your help in the mark-recapture and the times I would find dragonflies you caught for my collection on my desk, but without you, this summer wouldn't have been nearly as memorable and successful.

Anisoptera of UNDERC: 1991

Family	Genus/Species	Sex/Site	Date
Aeschnidae	Anax juncea	m. Forest Service	7/5
	Anax junius	m. Peter/Paul	6/2
		m. Stdnt. Housing	7/4
	Basiaeschna janata	m. & f. Plum/Inkpot	5/26
		m. Bergner	5/26
		m. Brown Crk.	6/8
	Epiaeschna heros	m. North and West Gravel Pits (NWGP)	7/17
	Gomphaeschna furcillata	m. Plum/Inkpot	5/26
Corduliidae	Cordulia shurtleffi	m. & f. Plum/Inkpot	5/26
		m. & f. Forest Service	5/27
		m. & f. Bolger	5/30
		m. Cranberry	5/31
		m. Nansen	6/1
	Dorocordulia libera	f. Bolger	5/30
		f. Cranberry	7/8
	Epitheca canis	m. Bolger	5/26
		m. Tuesday	5/26
		m. Plum	5/27
		f. Road from Stdnt. Housing-Morris	5/28
		m. NWGP	5/29
		m. & f. Nansen	6/1
	Epitheca cynosura	f. Plum/Inkpot	5/26
		f. Boathouse	6/1
		m. Raspberry	6/2
		m. Tendrft. Lake	6/16

	Epitheca princeps	m. Plum/Inkpot	6/12
		m. Tuesday	6/16
		m. Plum/Inkpot	6/18
	Epitheca spinigera	m. & f. Plum/Inkpot	5/26
		f. Plum	5/27
		m. & f. Moccasin	5/28
		m. & f. Plum/Inkpot	5/28
		m. & f. NWGP	5/29
		m. & f. Boathouse	6/1
		m. Tendrft. Lake	6/16
Gomphidae	Gomphus exilis	m. Ed's Bog	5/30
		m. Brown	6/2
		m. Raspberry	6/17
	Gomphus spicatus	m. & f. Bolger	5/26
		m. Plum/Inkpot	5/26
		m. Forest Service	5/27
		m. Moccasin	5/28
		m. Plum/Inkpot	5/28
		m. Road Stdnt. Housing -Morris	5/29
		m. NWGP	5/29
		f. Bolger	5/30
		m. Nansen	6/1
		m. & f. Brown	6/2
		f. Stdnt. Housing	6/13
	Hagenius brevistylus	f. Plum/Inkpot	6/18
Libellulidae	Celithemis elisa	m. Plum/Inkpot	6/17
		f. Tuesday	6/17
		f. Tuesday	7/4
		m. & f. Bolger	7/8

	f. Cranberry	7/8
	m. & f. Ed's Bog	7/8
Erythemis simplicicollis	m. Tend. Crk.	6/13
Ladona julia	m. Tuesday	5/26
	m. Bolger	5/26
	m. Brown	5/27
	m. Forest Service	5/27
	f. Plum	5/27
	f. Moccasin	5/28
	m. & f. Road Stdnt.Housing-Morris	5/29
	m. & f. NWGP	5/29
	m. & f. Bolger	5/30
	m. Ed's Bog	5/30
	f. Cranberry	5/31
	m. & f. Stdnt. Housing	5/31
	m. Boathouse	6/1
	m. Donut Bog	6/1
	m. & f. Nansen	6/1
	m. Brown	6/2
	m. Peter/Paul	6/2
	m. Raspberry	6/2
	f. Firestone	6/13
	m. Tuesday	6/16
	f. Raspberry	6/17
	m. Bolger	7/8
	m. Cranberry	7/8
	m. & f. Nansen	7/8
Leucorrhinia frigida	f. NWGP	5/29
	f. Cranberry	5/31
	m. & f. Nansen	6/1
	m. Tendrft. Lake	6/16
	m. Raspberry	6/17

	m. & f. Bolger	7/8
	m. & f. Cranberry	7/8
	m. & f. Nansen	7/8
Leucorrhinia glacialis	f. Bolger	7/8
	m. & f. Ed's Bog	7/8
Leucorrhinia hudsonica	f. Plum/Inkpot	5/26
	m. NWGP	5/29
	f. Bolger	5/30
	m. & f. Ed's Bog	5/30
	m. Donut Bog	6/1
	m. & f. Nansen	6/1
	f. Firestone	6/13
Leucorrhinia intacta	m. Bolger	5/30
	m. Tendrft. Lake	6/16
	f. Stdnt. Housing	7/5
Leucorrhinia proxima	m. Bolger	5/30
	m. Donut Bog	6/1
	m. & f. Firestone	6/13
	f. Tuesday	7/4
	m. Bolger	7/8
	f. Cranberry	7/8
	f. Ed's Bog	7/8
Libellula pulchella	f. NWGP	5/29
	m. Plum/Inkpot	6/18
Libellula quadrimaculata	m. Plum	5/26
	m. Moccasin	5/28
	m. & f. Brown	6/2
	m. Firestone	6/13
	m. Tuesday	7/4

	Sympetrum internum	f. Firestone	6/13
		m. South Gate	7/2
		f. Cranberry	7/8
	Sympetrum obtrusum	f. Stdnt. Housing	6/30
		m. Tuesday	7/4
		f. Stdnt. Housing	7/5
		m. Bolger	7/8
	Sympetrum rubicundulum	f. Cranberry	7/8
Macromiidae	Didymops transversa	f. Plum/Inkpot	6/18
	Macromia illinoiensis	m. Nansen	6/1