

North Coast Odonata

Survey Manual

2002



**North Coast Odonata
12828 McCracken Road
Garfield Heights, Ohio 44125-3015
216 475-4865**

www.OhioOdonata.com

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North Coast Odonata Survey (NCOS)
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SECTION I

Basic Information

Introduction

In March 2002 the North Coast Odonata Survey (NCOS) was initiated by Lou Gardella with the purpose of accumulating data to obtain a well-balanced perspective on the distribution and abundance of the order Odonata in the following counties: Ashtabula, Cuyahoga, Erie, Geauga, Lake, Lorain, Medina, Portage, Summit and Trumbull. NCOS maybe extended to additional counties in the future.

NCOS will rely on the contributions of volunteer surveyors for whom this manual has been prepared. Volunteers from diverse backgrounds and ages are expected. Consequently, some information that has been included for the instruction of beginners may be basic for more experienced volunteers. All contributions must be submitted on NCOS forms. Before you begin surveying, contact NCOS at the address noted above. At that time you will be asked to indicate whether you will be submitting forms electronically or by mail. (See Section II)

Purpose of the Manual

The main purpose of this manual is to establish standards for documenting dragonflies and damselflies in northern Ohio. In addition, there are sections outlining procedures to follow when collecting and preserving voucher specimens to ensure their validity for use in scientific studies. The collection of voucher specimens **is not** a priority; however, the collection of exuviae is encouraged to determine breeding. Instructions and forms for submitting information are included.

The manual contains little information on the insects themselves. Therefore, for general information on Odonata, we recommend *Dragonflies and Damselflies of Northeast Ohio* (March 2002), *Common Dragonflies of Wisconsin* and *Dragonflies Through Binoculars*. All are easy to understand and reasonably priced and have most of the basic information necessary to appreciate these complex insects. Additional sources of more scientific information and keys are *Dragonflies of North America*, *Damselflies of North America*, *The Odonata of Canada and Alaska*, and the Ohio Odonata Society's *The Dragonflies and Damselflies of Ohio* (June 2002).

The Ohio Odonata Society's website, <http://mcnet.marietta.edu/~odonata>, includes occurrence and distribution maps, details on a particular species and geographical ranges. For Northern Ohio regional information, refer to North Coast Odonata's website, www.OhioOdonata.com.

Useful Knowledge to Start

It is important to have an idea of the basic procedures used in the biological sciences in order to be able to communicate clearly with others.

Taxonomy is the categorization of organisms in an ordered system that indicates natural relationships. The structure of these levels is, (using a dragonfly as the example):

<u>Level (plural)</u>	<u>Nomen</u>	<u>Common Name</u>
Kingdom:	Animalia	Animal
Phylum (Phyla):	Arthropoda	Arthropods
Subphylum:	Uniramia	(no common name)
Class:	Hexapoda	Insects
Subclass:	Pterygota	Winged Insects
Division:	Exopterygota	Externally Winged Insects
Order:	Odonata	Dragonflies and Damselflies
Suborder:	Anisoptera (or Zygoptera)	Dragonflies Damselflies)
Family:	Aeshnidae	Darners
Subfamily:	Aeshninae	(no common name)
Genus (Genera):	<i>Aeshna</i>	Mosaic Darners
Species:	<i>interrupta</i>	Variable Darner
Subspecies:	<i>interrupta</i>	(no common name)

There are usually a number of genera in each family; *Aeshna* is only one genus of the family *Aeshnidae*. Similarly, there are a number of species in this large genus; *Aeshna interrupta interrupta* is only one. The second specific name identifies a subspecies, indicating that there are distinct physical differences between populations of a species, usually in different parts of its range. For example *Aeshna interrupta interrupta* is the subspecies found in the eastern part of the continent, *A. interrupta lineata* is found from the prairie provinces to the Rocky Mountains and *A. interrupta interna* is found in the northwest region of the continent. Specimens with characteristics intermediate between subspecies are not uncommon as they can interbreed.

The eighteenth-century Swedish botanist, Carolus Linnaeus, devised the system of *binomial nomenclature* used for naming species. In this system, each species is given a two-part Latin name (three-part when it is a subspecies) called a "binomial" that is either italicized or underlined, the genus capitalized, the species and subspecies are not. After the first full reference to the name, it can be shortened; i.e.: *Aeshna interrupta interrupta*, *A. interrupta interrupta*, *A. i. interrupta*. Often a binomial will

include the describer and described date, i.e.: *Aeshna interrupta interrupta* Walker 1908. This attribution is not italicized or underlined and indicates that Edmund Walker first described the species in a paper or book published in 1908. An attribution enclosed in brackets indicates that the original description was under a different name, i.e.: *Ladona exusta* (Say 1839), was originally described by Say as *Libellula exusta* Say 1839. The attribution could be referred to initially in a letter or published work, but in most cases is not necessary.

One challenging aspect of *nomenclature* is that names change according to the current understanding of the position the organism holds in its relationship to other similar organisms. The genus (see above) is particularly subject to change; for example you will find contemporary treatments of the White Corporal under the names *Libellula exusta* (usually Canadian authors) and *Ladona exusta* (American). In this case, certain authors feel that a number of the species of *Libellula* are sufficiently different to warrant a separate genus, which they named *Ladona*. Others consider *Ladona* a subgenus at most.

When the genus of a specimen is known but the species is not, the binomial is given as, for example, *Aeshna* sp. (*spp.* if more than one species in the same genus). The International Commission controls nomenclature for Zoological Nomenclature. The rules governing, assigning, and changing nomen are rigorous; and care should be taken not to alter nomen.

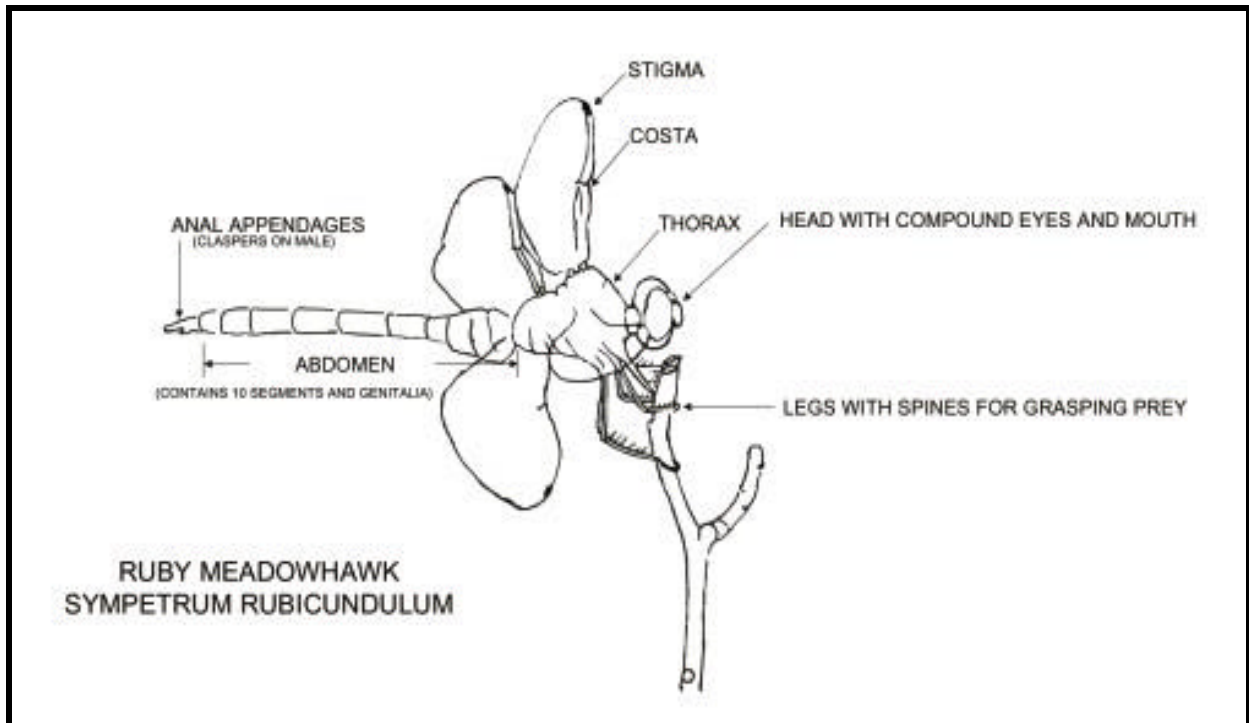
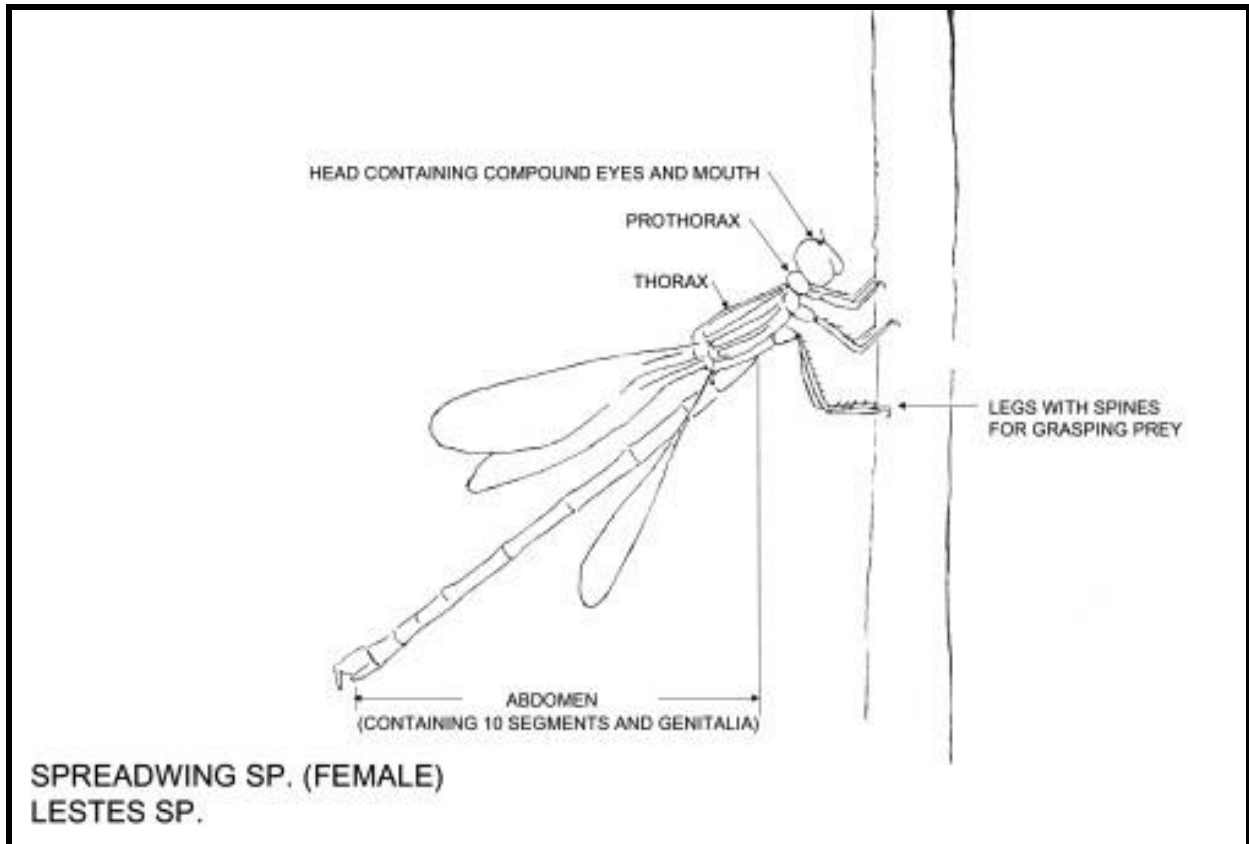
It can be quite interesting to seek out the roots of nomen (see Borror 1960) and, once you have gotten over the novelty of the names, they become quite easy to remember. A good guide to pronunciation of scientific names is in Borror (1960) and Needham and Westfall (1955).

Experienced personnel work with nomen, and many have not yet memorized Common Names (Paulson and Dunkle, 1996). This is scarcely surprising considering that most of these people are familiar with hundreds of species. It is both sensible and courteous to use nomen when communicating with them.

Terminology

Like nomenclature, terminology is usually based on Latin terms and describes body parts or processes for which there is no obvious human equivalent. As a result, these terms are challenging to learn. Also, various authors use different terms for the same things, thus further complicating the matter. Remember as you become more familiar with Odonata, you will become more proficient.

The most basic body components of adult dragonflies and damselflies are shown below. Consult Carpenter, (1997), Dunkle, (1989, 1990), and Westfall and May, (1996), for more detailed information.



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Common Names

Common names are those given to animals or a plant by the general public; "dragonfly" is one such name. A common name is untrustworthy for scientific communication because it tends to vary from location to location. For example, *Libellula exusta* and *L. lydia* both have striking white abdomens. It is quite probable that they are both called the 'White-tailed Dragonfly' in different places.

Sometimes nomenclature to the genus level is "commonized". For example, Odonata becomes Odonates (or "Odes"), or Aeshnidae becomes Aeshnids.

English names have been determined for Odonata, (Paulson and Dunkle 1996), and accepted by the Dragonfly Society of the Americas (DSA) in an effort to bring some control to common names, thus addressing the demand for common names that has grown with interest in the order. Common names should be capitalized when referring to a species, but lower case when speaking in general. For example, we refer to dragonflies in general but to a King Skimmer (genus *Libellula*) or the Common Green Darner, (*Anax junius*). Capitalizing species names is desirable because many of them begin with adjectives or adverbs. It is difficult to determine the name of the common green darner (where 'common' might be editorial comment) as opposed to the Common Green Darner.

If you refer to a common name in correspondence, be sure that you first have a good idea of the scientific name, noting it at the beginning of your letter or e-mail. If unsure of the identification, enclose the name in quotation marks with a question mark to indicate this uncertainty.

Ethical Considerations

Collecting entails responsibility. As there is no practical way to pursue a serious interest in insects without collecting individuals, this issue should be addressed in a way that will contribute to the knowledge of the order Odonata.

For example, if a person collects for 10 years and kills 2000 insects, yet influences someone against filling in one pond - the person will likely have saved the life of thousands, perhaps tens of thousands of individual insects. Also, this person will have killed fewer insects than the average suburban bug-zapper during the same period. This seems a reasonable exchange.

A minimum practical number of individuals per species should be collected: 2 adult males and 2 adult females from each site, (females being generally harder to catch). There is no need to restrict your collection of exuviae, the abandoned skins after adults have emerged, as they are not alive.

Dragonflies and damselflies are robust organisms and generally well distributed. Certainly collecting is not a significant threat to them at this point. However, if there were hundreds of irresponsible collectors, that could change. Care should be taken not to over-harvest rare species in known locales. Note that *Somatachlorda hineana*, (Hines's Emerald), is a Federally protected species, and a Federal Permit is required to collect it. If you inadvertently take one, as soon as you are aware of the situation, contact Bob Glotzhober at OOS or Lou Gardella at NCO.

Habitat disturbance is by far the most significant threat to Odonata, usually in their aquatic life stages. Filled-in wetlands or ponds and increased silt in moving waters can eradicate populations within certain areas, changing the species composition and biodiversity of water bodies. Some species disappear, and are usually replaced by a fewer number of species that are more tolerant. For example, nymphs of the genus *Ophiogomphus* inhabit clear, rapid rivers and streams and will be decimated by excessive siltation caused by construction, agriculture, or forestry.

There are disjunct populations, which are small populations separated from their main ranges. Habitat disturbance over a relatively small area could eliminate these isolated populations that may have survived for thousands of years and may harbor unique local adaptations. Disjunct populations, being separated from the main genetic pool of the species, may be evolving into other species or subspecies and are potentially valuable, as well as adding greatly to the diversity and interest of our fauna.

Collecting and/or Surveying

As previously mentioned, collecting **is not** a priority of NCOS. Although the northern Ohio area has been surveyed – collected - for more than 10 years, new county records do appear from time to time. Specimens are crucial to correctly determine a species and represent the means by which future workers will confirm your work. It is inescapable, therefore, that you will have to preserve and eventually deposit specimens with NCOS. This is not to say that you cannot simply enjoy Odonata by watching or catching and releasing, only that you cannot expect future workers to credit records that cannot be confirmed.

Another reason that specimens are critical is that the taxonomy of the order will undoubtedly evolve with further study. It is to be anticipated that a number of subspecies, or even species, will be described in the future. Without specimens it will be impossible to determine which subspecies was present at the time the record was collected.

Collecting in the Cleveland Metroparks, local and county park systems, state

wildlife areas, or the Cuyahoga Valley National Park requires contacting the appropriate authority to obtain a permit. Needless to say, volunteers must obtain permission to collect or survey on all private property.

Legalities, Courtesies and Safety

Volunteers collect in a fashion similar to that of freshwater fishermen or hunters, following the safety rules and courtesy toward on-lookers and property owners. As a NCOS volunteer, you are not exempt from any legal responsibilities, including respecting private property. Controlled areas for which you should seek permission or avoid entering to survey or collect are: town water supplies, national, state and local parks and state nature preserves.

Remember that the general public will be drawn to your activities. A friendly, open attitude not only reduces anxiety but also may lead to suggestions of other good sites. It's also an opportunity to engage others in the subject of Odonata.

If you plan to leave the road for any significant period of time, or for any considerable distance, it is important to let someone know where you are going and when you expect to return. It is also advisable to take basic survival supplies with you (see General Equipment).

Depositing Specimens and Records

Voucher specimens for records tendered should be deposited with NCOS on an annual basis. In turn NCOS will deposit these specimens at The Cleveland Museum of Natural History. See the accompanying forms for detailed advice regarding the tendering of data.

If you choose to maintain a personal collection, forward your specimens to NCOS for confirmation and data entry and request their return. Before you are finished with your collection, make arrangements to have it deposited in a public collection of your choice.

Using NCOS forms to maintain your records will facilitate the process of entering the information into NCOS database. (See the Appendix). All forms can be downloaded and filed electronically. Always retain a copy for your records.

Equipment and Techniques

Collecting equipment should be simple and lightweight considering that it will have to be carried in a variety of habitats.

Catching Adults

Adults are caught with aerial nets made of commercially available fine mesh netting 18" or more in diameter. The cloth should be a dark color and make a long enough "purse" to hold the specimen when the net is turned. Alternately, insect nets can be purchased from Bioquip or another biology supply house. Children's fine "toy" nets are excellent for collecting Damselflies.

Mounting the net head on an extendible metal handle - such as for painting rollers - considerably increases one's reach, although it will be heavy and ponderous at full extension. The length of the net and handle should not be greater than your height. For collecting from a small boat the length should not be greater than three or four feet - the distance usable with one hand - as a longer one can cause the loss of balance.

After the adult is caught, ensure that it is well trapped in the purse of the net. There's nothing worse than catching an interesting specimen, only to fumble the net and watch it fly away! To help prevent this situation, brace the net against your body so that both hands are free.

Adults should be placed on their sides with wings folded above their backs in field envelopes available at cost from NCOS or from Bioquip. Before inserting the insects, all relevant information should be written in pencil on the envelopes.

If collecting a breeding pair, place them in separate envelopes. Stuff foliage, dead grass or evergreen stems, if available, (since they will not stain the acetone), loosely into the envelope to reduce its tendency to crush the specimen, but only to the approximate thickness of the insect.

Odonata apparently go to 'sleep' in the dark and stop struggling. After being enveloped, they should be placed in a dark box, which is both humane and causes less damage to specimens. Black videotape boxes with their sprocket fittings removed make effective and inexpensive dark boxes, as well as a desk on which to fill out field envelopes. Limit the number of envelopes in a dark box; if too tightly packed the specimens will be crushed.

Dragonflies have very acute eyesight and can detect movement from some distance. Rushing at a specimen is generally futile. A slow 'stalk' without

abrupt movements usually yields the best results. However, stalking is generally less effective than bushwhacking. You will often notice a distinct patrol that insects follow or a favorite perch. During their absence, move to the appropriate place and, when they return to that place, you have a good chance of capturing them. For example, the *Macromia illinoensis*, (Illinois River Cruiser), flies at prodigious speeds, but can be caught if you time its patrol along the shore and are ready when it appears. Many species, which perch, fly up and then return to the same perch, (such as Libellulids), can be taken when they return.

Swing on flying dragonflies from behind, if possible; on perching specimens trap them against the ground by swinging down from behind, bearing in mind that they take off at an angle up and forward. Specimens perching or flying close to the ground or water surface can be trapped by lowering a net on top of them and then raising the netting up with your hand until they fly high enough to be trapped in the net's purse. This is much more effective than trying to skim the water's surface with a sideways sweep.

It is amazing how little damage adult dragonflies when caught in a net sustain; teneral or recently emerged adults are the exception. Wings are rarely damaged regardless of the strength of the swing and only on rare occasions is a neck damaged. One common problem is that the insects bite the net and hang on when removed - occasionally resulting in the loss of the head. To avoid this situation, take time when removing insects from nets.

Dragonflies are late risers, stirring when the sun warms them; collecting at first light near water can often yield specimens that you simply pick off the marginal vegetation or superb photographic opportunities. Collecting during the middle of the day generally generates the greatest number of specimens. However, there are some oddities. *Macromia illinoensis* apparently takes a mid-day siesta and is hard to find for an hour or two; scientists theorize that its high activity and dark coloration may cause it to over-heat. A number are crepuscular species, those that fly after sundown, and some may be virtually nocturnal. Therefore, collecting should be continued until after the light is gone to obtain a well-rounded perspective of each site's list.

Night collecting with lights often yields perching specimens, as do morning trips. In addition, you will encounter emerging - changing from nymph to adult - specimens, particularly around ponds. (Inform your local wildlife authorities of this intended activity or to avoid any questions.) For dusk and night collecting a hiker's or spelunker's lamp strapped to your head is convenient.

'Road-killed' dragonflies are common, and can be spotted while driving. An

advantage is that you often find females that have been struck while flying

away from water. Of course, you must be careful not to drive too slowly or stop too quickly. Remember to use your emergency lights to warn other drivers of your intentions!

Collecting nets placed on the front of vehicles – ‘bumper nets’ - will catch specimens while you’re drive. It may be worthwhile to do this but, if you do this, stop frequently to get an accurate idea of where the specimens are taken. These nets are most effective on back roads where you can travel safely at approximately 15-25 mph.

Safety Note: When collecting near water, it is always safer to deliberately get your feet wet than to fall trying to stay dry by tip-toeing from place to place. (Tripping near water can lead to serious injury – even drowning.) The exception to this rule is in still waters, such as marshes, fens or ponds where the bottoms can be like quicksand. Do not enter into these locations when alone and always wear a personal floatation devise - PFD.

When collecting in the cooler weather that occurs in the spring and fall months, it is advisable to wear waders. Chest-high ‘stocking-foot’ waders are recommended, both for comfort and to prevent hypothermia, low body temperature. Waders can be dangerous if they fill with water, particularly in a current. Wear tennis or deck-shoes that can be slipped off in an emergency, and use a PFD.

When collecting in the water, it is useful to have a boat to serve as home base. Other choices include a canoe, an inflatable rafts or an inner tube with an attached platform, anything that will reliably support your weight. The simplest rig is an inner tube from a large truck tire with a sheet of plywood or box on it. Whatever you use, be sure you can easily towed it into a current by a rope tied around your waist. If the water can be waded, you should not collect from a boat because it is dangerous to swing a net from an unstable platform.

Collecting Exuviae

Exuviae, the skins left behind when the adult Odonata emerges from the nymph, can be determined to species as readily as can the nymphs themselves. Look for exuviae on emergent plants and rocks, the shoreline, foliage and tree-trunks on the shore and inland perhaps 33'. Note on field cards distance from the water and elevation from the ground or water surface.

Small, clear tackle boxes are excellent for carrying exuviae, especially ones

that will fit in a shirt pocket. Always have a number of them on hand. For final storage exuviae can be stored in plastic pill bottles or larger sectioned boxes that are used for hardware or tackle; they do not have to be airtight. Record site and date information on labels that go into the compartments with the exuviae.

Teneral, recently emerged adults with soft bodies and wings, can be detected by their faltering flight and the appearance of the wings - slightly wrinkled like cellophane rather than smooth like glass as an adult's. The collection of teneral **is not** recommended because they are very difficult to key out to species, especially females, and can be damaged by the slightest touch.

General Equipment

Use No. 2 lead pencils for writing on the data cards and envelopes. Pen ink sometimes disappears in acetone; pencil is stable and doesn't fade.

A good thermometer is necessary. Binoculars are an excellent tool for insect watching; they should be small, powerful and have a close focus of 6' or less. When reversed, binoculars are a passable field microscope; otherwise, you'll want a hand lens of at least 15x. Other useful items are insect repellent, sunscreen lotion, headache medicine, a small flashlight, and a waterproof watch. Another item is a water-resistant camera, with spare film. The camera should be as small as possible and capable of recording the date on the photo. Sunglasses will prevent headaches on bright days but should be a neutral tint so that color observations are as accurate as possible. Cords to keep the glasses on your head are handy.

If you plan to survey in wilderness areas, add the following items to your basic equipment: A waterproof means of making a fire, compass, map, orange vest or hat, survival blanket, flashlight, first aid kit and knife. A cell phone is a good idea, too.

Clothing

Clothing for surveying is largely a matter of taste, but we suggest the following items based on past experience. From a functional perspective, wear a broad-brimmed hat to reduce glare, a fisherman or photographer's vest with many pockets, a long-sleeved shirt, light pants, tall cotton socks and light sneakers with a good tread. (Short-sleeved shirts and shorts give you no recourse if the biting insects are bad.) Include a windbreaker or heavy coat for windy or cool weather conditions. All clothing should be loose-fitting.

When in wilderness areas, it is advisable to wear an article of clothing in hunter orange. This increases your visibility and also would assist authorities attempting to locate you from the air in an emergency situation.

Choosing Your Sites

Volunteers often use a number of strategies:

- surveying a single site frequently
- surveying a specific group of species
- surveying a number of different habitats
- surveying a specific habitat (bog, fen, lake, marsh, pond, stream)

As a volunteer surveyor you, too, can use these strategies. OOS has identified certain Odonata species as rare and certain types of habitat and areas around the State of Ohio as little collected. To make the most valuable contributions you might consider applying your interest to the habitats and areas least studied to date.

We recommend that you start with a few convenient sites near your home. Collect exuviae and adults over a season, deferring more extensive collecting to the following year when the procedures are more familiar to you. Although simpler than a broad-based study, this type of effort can yield very valuable information, particularly regarding seasonal flight periods.

Pick a site that you can easily access. Odonata are largely indifferent to the presence of humans so the site can be close to a dwelling or a public road. Document it extensively. Identify all flora and fauna. Spend some time there observing everything about it.

Remember, when making repeat visits to a site, document on the Site Visit Form the absence of a species known to be there previously. (Note: Adults are absent during inclement weather.) These observations assist in determining flight periods.

Give each site a code number that begins with your three initials and a number in the sequence you first surveyed them. This will help you fill in the appropriate NCOS forms and save considerable writing in the future.

The *DeLorme Atlas & Gazetteer* for Ohio, the basic NCOS geographical reference tool, is readily available at retail bookstores. Most water bodies in Ohio have names, but you may wish to want to identify specific sub-sites, such as a cove in a lake. Running water sites can be named for the nearest road intersection, or by some other feature that provides a precise location. If your site does not include a water feature, locate it as precisely as

possible in the Atlas. Determine latitude and longitude to a reasonable degree of accuracy, and include this information on the NCOS Site Description Form.

Site Visits

Site visits should be planned for all times of the day and types of weather except rain and heavy overcast or fog; even then exuviae can be collected, although adults will be absent. The month of May usually marks the earliest emergence of Odonata in Northeast Ohio. From May to November adults can be observed, and exuviae collected.

How often you get to a site is dependent upon your other commitments. You'll likely find it hard to stay away once you have started surveying an area. If you pursue your interest over a number of years, you can look at the annual differences in emergence dates and species diversity at each site.

Traveling with Specimens

Unless you are on an extended trip, you will usually do the determining and preserving at home. However, photography is best done in the field as the colors of some dragonflies fade after capture, particularly *Aeshna* spp., even if they remain alive.

Adults can be transported alive in dark boxes. Most will last for the better part of a day with little loss of appearance, if protected from extreme heat conditions. Never leave dark boxes in direct sunlight or in a sealed vehicle on a hot day, as the heat will kill the specimens and speed their decomposition.

Killing

Killing specimens should be done quickly. One method is to chill adults in a dark box placed in a freezer. An alternative method is to put a specimen in an envelope and dip it in acetone; this takes about ten seconds and is the most practical method to use in the field.

Cleaning

Adults rarely require cleaning, but some exuviae need it before their markings are visible. Some are so encrusted with silt and algae that they

must be cleaned to observe the finer physical structures. Cleaning can be done by agitating them in a small bottle with water and a bit of dishwasher detergent, followed by brushing with a stiff fine-art paintbrush. An alternate method is ultrasonic bathing, using a machine that can be purchased at graphic arts supply stores for cleaning technical pens. These machines are expensive, but the method is effective.

Preserving

Adult dragonflies that are air-dried, even in a heated environment, rapidly lose their colors. To maintain color to the best extent possible adults should be dried in acetone, a liquid that dehydrates their tissues. Acetone can be purchased in hardware stores. Note: Acetone is highly flammable and somewhat toxic; use it outside or with adequate ventilation and away from all potential sources of fire.

It is important to only use plastic storage containers that acetone doesn't melt. Also, mark all used containers and tops boldly with skull and crossbones and the word "**Poison**". Once you have used acetone it persists in the plastic; they should never again be used to store food. When traveling with acetone, return it to the containers in which it was bought, if possible. On extended trips, where you will be drying specimens in the containers as you travel, take care that the covers are securely fastened. Traveling with acetone in glass containers is dangerous as they might break. After it has yellowed slightly, discard the remaining acetone. (This can be difficult to detect if you have dried fresh foliage in it that absorbs some of the green pigment from the plants.) Check the specimens to ensure that they are completely dry. If in doubt, discard the acetone and re-dry the specimens in fresh acetone. Some collectors inject acetone into the thorax of larger specimens with a hypodermic needle and later remove it in the same way, apparently improving the color retention.

Used acetone should be discarded on pavement, although it will stain asphalt a bit, or gravel roads, but only where there is no chance of it accidentally being set on fire. A good method of disposal is to mix the acetone at least 50/50 with water before discarding it. The acetone/water mix could be control-burned in a firepot, if you are very careful. Full strength acetone is virtually explosive when burned so make sure you dilute it before burning.

Those species that show pruinessence, a white, gray or light blue pigment exuded on the body, should not be acetone-dried, as the pruinessence will usually disappear. Such specimens should be freezer-killed and then dried with the heat from a light bulb or dried in an oven set at 125°F and frequently checked because excessive heat can also damage the pruinessence.

Adult specimens should be taken from the field envelope after killing, positioned, then returned in their envelopes to the acetone for 24 hours and, finally, thoroughly dried - preferably outside in the direct sunlight. Use metal tongs to handle envelopes in acetone.

There are two ways of mounting the insects - pinned or enveloped, either flat or on the side. Pinned and flat is the way most people visualize an insect collection, but enveloped allows you to keep more specimens in the same storage area. The preferred method for NCOS is for the Odonata to be flat on its side, wings over the abdomen and in a storage envelope.

Exuviae require no preservation. To make them pliable for positioning in the best stance, soak them for a brief period in water. Before putting them in an envelope or bottle, be sure that they are completely dry. Keep them under a light bulb or in sunlight for a couple of hours. If you have collected vegetation with the exuviae, dry it in acetone or air before sealing to prevent the growth of fungi and the any decomposition. Check the exuviae for small spiders that often make their homes inside these convenient shelters. If spiders are present, put them in acetone or air-dry and return to the exuviae.

Dried specimens can be quite brittle; if one breaks, it can generally be mended with white or carpenter's glue. Inserting flattened balls of soft paper can relieve pressure on specimens in envelopes. Never use cotton batten with exuviae or adult specimens because you'll never untangled them from it. It is sometimes desirable to relax dried specimens so that they can be re-positioned. Placing them in a small container with water-soaked tissue can do this or paper toweling and a small amount of alcohol. Quickly re-dry relaxed specimens to prevent decomposition.

Storage

Odonata envelopes for voucher specimens are available at cost from NCOS. Data cards are 3x5 index cards. Exuviae should either be placed in a specimen bottle or box and clearly labeled. Address or slide labels work well for recording data.

For your own collection we suggest maintaining the enveloped specimens in *Rubbermaid* containers. These containers provide some protection from Dermestes, museum beetles that might otherwise devour your specimens. The *Rubbermaid* containers can be divided into compartments with foam core or cardboard plates secured in silicone rubber.

Determination or Identification

Determination or identification, is based upon general appearance or by particular physical characteristics following a scientific key, such as those in Needham, Westfall and May, (2000). The latter can be difficult and even trying in some cases but, with practice, most adult species can be identified. Exuviae tend to require more experience to identify with certainty. Determination of some specimens may have to be made by more experienced Odonata workers. In this case the specimen(s) will be forwarded to them.

The use of a hand lens or reversed binoculars, at a minimum, is necessary to identify some species groups as adults and virtually all nymphs. Binoculars should be a minimum 15x. Hand lenses of this sort can be bought as jeweler's loops, loops or fabric testers from graphic arts supply stores.

For the committed volunteer a dissecting microscope is desirable. This type of microscope has a relatively low power and a wide field of view. Such microscopes are available from Bioquip and other supply houses. Used ones can sometimes be purchased at a reduced price.

Shipping

Generally, shipping should not be necessary for this survey. However, if it is, place enveloped adults in a small box with paper toweling or tissue packed firmly but not tightly around them. Always remember when handling and moving specimens care should be taken.

Exuviae should be shipped with tissue firmly inside the container to restrict the movement of the exuviae within it. Do not use cotton, wool, or any other fibrous material, as it will become inextricably tangled in the legs of the specimen. The inside box should be packed in a larger box with at least 4" of padding all around it.

Data Collection

The importance of accurate data of your specimens cannot be overstressed; incomplete records damage one's credibility and may cause your work to be discounted. NCOS forms provide spaces for all the information that should be recorded. When in doubt, write down everything that seems even remotely significant to you, and do it as soon as you get it. Quality data collection is more desirable than quantity data collection. It's much better to stay up to date with data than become bogged down with a backlog of inadequately noted material. American Standard Measurements should be used.

Rearing Specimens in Captivity

It is often easier to identify a nymph by raising it to emergence in captivity and identifying the adult. In addition, it is interesting to observe emergence at home whether you preserve or release the resulting adult.

Teachers or parents who wish to demonstrate the life cycle of insects with partial metamorphosis should note that the nymph of American Emerald *Cordulia shurtleffi* would emerge in captivity during the fall term if collected in September/October in ponds. The adult and exuviae could be preserved for display.

Aquaria for raising nymphs can be kept at room temperature, be any size, and should contain some plants and bottom material from outdoors. Cover the aquaria with a screen box so that the emergent adult can leave the exuviae and perch while drying; cover the water surface except where the stick is left, breaking it for the insect to emerge on. If you are rearing Gomphids, leave a shelving surface upon which they can crawl out; most are almost incapable of climbing.

Backyard lily-ponds are excellent places to observe Odonata in virtually natural conditions. Nymphs can be introduced in the spring, and the resulting adults may establish a breeding population persisting into following years. In all probability some species will colonize your pond by themselves, even if it is an urban setting.

Ponds should be deep enough (20"-30") to ensure that they do not freeze to the bottom in winter. Local water plants in pots can be an integral part of such ponds.

Field isolation is a handy way of raising nymphs under completely natural conditions. Place a wire mesh box containing emergent plants and the nymphs of interest in the water at a site. Position the box out of sight, if possible, since curious passers-by may interfere with it. Regularly check the box to collect adults and determine with reasonable accuracy when they emerged.

To do population studies of a site, remove a section of emergent plants, leaving an isolated stand of a certain size. Frequent visits to count and remove exuviae will give you a good idea of the emergent population of the site and approximate dates of emergence. Field isolation and population studies of a site make excellent summer science projects for students. Once again, remember that volunteers must obtain a permit to conduct these studies on all private property and in local and state parks and wildlife areas.