

New York Dragonfly and Damselfly Survey Handbook for Workers

Background

In recent years there has been a slow, but steady growth in the popularity of the study of various insect groups beginning with butterflies and more recently, dragonflies. The recent interest in dragonflies began in the early 1990s, spurred in part by the publication of the first field guides to these fascinating insects.

New York State began receiving funding from a new federal funding source, the State Wildlife Grants Program, in 2003. A required element for this funding is the development of a New York State Comprehensive Wildlife Conservation Strategy (CWCS), complete with conservation needs for species designated as “Species of Greatest Conservation Need.”

Given our very incomplete knowledge of the status of dragonflies and damselflies in New York State, the increasing public interest in these insects, and the need to develop the Comprehensive Wildlife Conservation Strategy, the timing was right for beginning a formal statewide survey of the dragonflies and damselflies of New York State.

The New York Dragonfly and Damselfly Survey (NYDDS) is a three-year project that will span the 2005, 2006, and 2007 field seasons. We are in the process of exploring funding for at least one additional Survey year. We expect the majority of all records for the NYDDS to come from volunteers for whom this handbook has been prepared. The results of the New York Dragonfly and Damselfly Survey will be summarized and presented in a variety of formats, including a high-quality book and electronic-based files for use by conservation biologists and planners. The information gained as a result of this survey will also be important in the development of Comprehensive Wildlife Conservation Strategy with respect to the conservation of these insects.

The New York Dragonfly and Damselfly Survey is a project of the New York State Department of Environmental Conservation (NYSDEC), Division of Fish, Wildlife and Marine Resources, and the New York Natural Heritage Program (NYNHP). The project is being supported with funds from the U. S. Fish and Wildlife Service State Wildlife Grants Program, administered by NYSDEC.

Project Objectives

The main project objective will be to document the distribution of all odonate species occurring in New York, by building upon existing county distribution information previously compiled by Nick Donnelly of the Dragonfly Society of the Americas.

A second, related objective is to direct intensive survey efforts to selected habitats, particularly the habitats that support those species that are listed in the New York Comprehensive Wildlife Conservation Strategy as Species of Greatest Conservation

Need. Information on new locations for Species of Greatest Conservation Need will help to guide conservation activities beneficial to those species that are in greatest need of such efforts.

Two additional project objectives include: evaluating the relative abundance of three state Threatened damselfly species at sites where they occur on Long Island, and directing some survey efforts to areas with the potential to support the federally listed Hine's emerald dragonfly.

While this project has no specific education objective, we expect the New York Dragonfly and Damselfly Survey to foster public interest in the conservation of these insects and the aquatic habitats on which they depend. As all dragonflies and damselflies are aquatic in their immature stages, they can provide important information relative to various water-related issues that are matters of public concern.

How do I participate?

Participants can make major contributions to our knowledge by conducting surveys virtually anywhere in the state. Observers are asked to survey sites of their choosing in order to document the species present. Because dragonflies and damselflies are completely aquatic in the immature life stage (larvae or nymph), most sites surveyed will be at, or near, aquatic habitats such as rivers, lakes, bogs, swamps and ponds. Although participants will not be signing up to cover particular areas as in the *Breeding Bird Atlas*, we can assist participants in choosing places to survey. Because the identification of many species requires careful examination under a microscope, observers are asked to collect single voucher specimens or, for selected species, take close-up photographs.

All project participants should complete a Volunteer Registration Form prior to beginning work on the project. Completion of this form will add your name to the project mailing list ensuring that you receive important updates and other information on the project. Completion of the form also assigns a unique number to each participant that is important for record-keeping purposes.

People who are new to dragonflies and damselflies are encouraged to attend one of the summer workshops to be held at various locations each year of the project. **Prior experience with dragonflies and damselflies and the ability to identify the various species is *not* essential in order to participate in the project.**

Purpose of the Handbook for Workers

This handbook has been developed to provide interested persons with the majority of the information they will need to participate in the New York Dragonfly and Damselfly Survey. It includes information on selecting places to survey, when to conduct surveys, the information that needs to be collected during a survey and how to record and report the data gathered during surveys. Other materials that project participants will need are listed in the section on "Books and Materials". A copy of this handbook, other project

materials, and other New York Dragonfly and Damselfly Survey information can be found at the project website. We recommend all NYDDS participants purchase of a copy of the excellent *Field Guide to the Dragonflies and Damselflies of Massachusetts* available for \$20 at www.mass.gov/dfwele/dfw/nhosp/nhpubs.htm. This book will provide participants with the basics of dragonfly biology, behavior, and identification, and allow participants to become familiar with most of the species that occur in New York.

Where should I survey?

While the number of species already recorded for many counties suggests that a large amount of surveying has already been done, this is somewhat deceiving (Appendix I). Many of the records are from prior to 1990 (and usually very much earlier!) and even in recent years there has been only a handful of efforts to thoroughly survey specific locations for their full complement of dragonfly and damselfly species. This means that participants can make major contributions to our knowledge by conducting surveys virtually anywhere in the state. We are interested in any records, for any species, in any county of the state.

However, we do want to make a special effort to direct surveys to regions that are under-surveyed, portions of the state that are likely to be the most diverse in species, and habitats that offer the greatest potential for new locations for Species of Greatest Conservation Need (additional information in this regard is provided in Appendix III, Odonata Opportunities in New York State). Habitats that are of special need for surveys include:

- Large rivers and streams
- Small, low gradient forest streams
- Seepages and rivulets that feed into streams and gorges
- Bogs/fens, bog ponds, and small streams within bogs
- Lakes and ponds with abundant water lilies
- Lakes at higher elevations (principally Adirondacks and Catskills)
- Brackish marshes, ponds and lakes (these are principally on Long Island)
- Coastal plain ponds and lakes (these are only on Long Island)

We can assist participants in choosing places to survey and hope to direct participants to sites or regions that may be of special interest, particularly in the final years of the Survey.

Of course, because dragonflies and damselflies are aquatic in their immature life stage (larvae or nymph), most surveys should take place at or near aquatic habitats such as lakes, ponds, bogs and fens, swamps, rivers or creeks, marshes, forest seeps, etc. Many aquatic habitats will have a fair amount of variation within them. For example, a pond may have a shallow section with abundant vegetation and a section of deeper water where

vegetation is lacking. A river may have a fast-flowing section as well as slower-moving sections and areas with vegetated pools. Different species may be found in different portions of a larger habitat, so look at as many different types of areas as you can. In addition, don't spend all of your time right at the water's edge. Some species concentrate their activities over the water, while other species perch in vegetation around the water, and others may be found in open sunny or even shady areas some distance from the water.

We expect that participants may want to follow one or more of the following general strategies:

- Frequent visits to a small number of sites close to home
- Visits to habitats supporting particular species or species groups
- Visits to a wide variety of habitats in counties with few species currently recorded

If you are new to these insects and are just getting to know them, a good approach may be to choose a few convenient sites of different aquatic habitats and visit these sites throughout the course of the year. Different species have different flight seasons, and visits throughout the course of the year will allow you to record the maximum number of species for a site, while at the same time get familiar with the various species and their habitats.

If you already have some familiarity with a number of dragonflies and damselflies, you may be able to make greater contributions by conducting surveys of specific habitats or of counties with relatively few species recorded. Regardless of your experience level, we would be happy to assist participants with selecting places to survey.

If you are interested in seeing a list of species that have already been recorded in any particular county, there is an excellent website that allows you to do that. The site is **www.odonatacentral.com**. This site is the electronic version of the county map project completed by Nick Donnelly, and county distribution information for all species across North America is easily accessible. New York State county distribution information is presented in Appendix I for 2004.

When should I survey?

In general, flight seasons for individual species last just a month or two. Our earliest dragonfly species emerge in late April or early May but have mated, laid their eggs, completed their flight season, and died by July. Our latest flying species may not emerge until August, and will continue flying into October or even November (even after the earliest frosts).

If you are able to make several visits to a site, a good spread for the visits would be something like:

- One in early to mid-June
- One in mid to late July
- One in mid-August to mid-September

Most dragonflies are especially active when the sun has warmed them, so most surveys will record the greatest numbers of species if they are conducted on sunny days from mid-morning until late afternoon. There are exceptions of course, with some species most active in the late afternoon and early evening. We even have a few species that are only active for a couple hours at dusk. In addition, surveys early in the day when the dragonflies are just beginning to warm up may prove valuable in recording certain hard-to-catch species. So if you are visiting a site on a repeated basis, visits at different times of the day may reveal species not recorded on earlier visits.

Considerations in the Collection of Specimens

While many of the excellent new field guides provide the means for identifying many common species of dragonflies, the identification of these insects to the species level while they are in flight is not possible or not reliable for a large number of species. The identification of many species is based on subtle differences in various body structures; structures which may be only a few millimeters in size and may need to be examined from several angles. Examining these structures on a dragonfly in hand is possible, but not as easy as it may sound given the size of the structures that need to be examined, the similarity in the structures from one species to another, and the movement of the insect as it is held in hand. For many of our damselflies, as well as a fair number of dragonflies (particularly females), examination under a microscope is the best, and in some cases, the only way to confirm identification to the species level. Therefore, the collection of voucher specimens is the preferred method for most species records for this project. Documentation of many species by photographs is also possible and is discussed in the next section.

While the collection of small numbers of voucher specimens is necessary for distribution studies of many dragonflies and damselflies, we would be remiss if we did not address various ethical considerations involved with the collection of specimens.

First and foremost, the killing of the voucher specimens should be done in the quickest and most humane manner. The information recorded with the specimen should contribute as much as possible to our knowledge of these insects. Please remember to carefully record the information discussed later in this handbook for all voucher specimens collected. Specimens collected under this project will be deposited at the New York State Museum in Albany, thereby serving as a permanent and verifiable record of species occurrence and distribution. Specimens in collections provide source material for an increasing number of genetics studies that are enabling scientists to resolve taxonomic questions with respect to many species and subspecies, including dragonflies. Collecting specimens is also the best way to learn the various species and what characteristics separate one species from another. Specimens in collections such as the New York State

Museum may be accessible in order to help with identification questions, while some people choose to maintain a small “reference collection” to assist them in this regard.

As with many plant and animal species, habitat disturbance and the loss of habitat are undoubtedly the most significant threats to populations of dragonflies and damselflies. Like most other insects, but unlike many vertebrates, dragonflies and damselflies have very high reproductive rates and typically occur as large populations in the places where they are found. The collection of one or two voucher specimens from a given site is highly unlikely to impact populations of even the least common of dragonfly and damselfly species, and there are no recorded instances where even higher levels of collecting have negatively impacted populations.

Nevertheless, participants should generally restrict collecting to one or two voucher specimens per site. The Dragonfly Society of the Americas has developed an excellent Collecting Policy and Guidelines and participants are encouraged to review these guidelines at the International Odonata Research Institute website: www.iodonata.net.

NOTE: If you are visiting the same site multiple times throughout the summer and see species already recorded (by specimen or photograph) on an earlier visit, there is no need to collect or photograph an additional specimen on subsequent visits as long as you are certain that the species you are seeing is the same (even if you just know them as “Bluet 1” or “Clubtail sp.” but not certain of the exact species). But, use caution, the flight season of most species is at most a few months, so if you are visiting the same site a month or two later than an earlier visit, you may well have a very different set of species flying on the subsequent visit. With difficult-to-identify species, such as the Bluets (*Enallagma*), you can easily have several new species replacing ones that were flying on an earlier visit, and these new species could be passed off as having been previously recorded.

NOTE: Although we expect that most participants will want to make, or at least attempt to make, their own identifications, it is not essential that you do so. We will be confirming specimen identifications, and in many cases, specimens will be sent to one of several experts for final species determination. This holds true for “photographic vouchered” specimens as well.

Documentation by Photographs

Many of the high-quality, close-focusing binoculars available today are excellent for observing dragonflies and damselflies at close range when they are perched, and some of our most common species can be identified in this fashion. Other species can be identified in hand with a hand lens and then released. However, in neither of these cases can field identifications be re-confirmed at a later date should questions arise.

The advent of relatively affordable digital-image cameras provides an alternative to collected specimens for those species where close examination of microscopic body structures is not necessary. The database for the New York Dragonfly and Damselfly

Survey has been designed to accommodate the submission and recording of “photographic vouchered” specimens. We have developed a species list for this project that includes a column called “identification level” (Appendix IV). This information is intended as a *general guide* for participants to assess whether a photograph may be acceptable for a particular species. It should be stressed that while good quality voucher specimens will virtually always constitute valid records (at least for adult specimens), photographic records may not always prove to be acceptable. We expect that the experience level of volunteers for this project will vary greatly, especially at the outset, and thus we have been conservative in setting the identification level indicated for the species. Please remember that the “identification level” should not be interpreted as a “rule.” We are happy to receive specimens for all species, including those where photographic submissions or sight records may be acceptable and are listed as such on the species list.

For species where microscopic examination of small body structures is necessary, the submission of voucher specimens is the preferred method of documentation, though with appropriate close-ups, photographic documentation may be acceptable in many cases. We expect the image quality of the photographs we receive, including close-up photos of definitive body structures, will vary greatly. Remember that individuals can be captured with a net, photographed in hand and then released. Also remember that, while a photograph may be aesthetically pleasing, it may not show the features needed for identification. Please consult the species list to determine if close-ups of various body parts or structures are needed, and remember that the idea is to take photographs that will allow for positive identification of the species, not to take photographs that are highly pleasing from the artistic standpoint (though it is wonderful to see these too, and many photos can serve both purposes).

In addition, please refer to Appendix V with respect to naming the photographic images that you intend to submit as records for the New York Dragonfly and Damselfly Survey.

Collection of Larvae

Larvae of all New York dragonflies and damselflies are aquatic. The aquatic habitats that support the larvae are, therefore, the most critical habitat for the persistence of dragonfly and damselfly populations. However, while the collection of larvae is fairly simple, the identification of larvae to species is markedly more complicated than the identification of adults, and very often it is simply impossible to be certain of species level identifications. This is especially true for larvae that are not nearing the stage of transformation to the adult stage. For this reason, we are not emphasizing the collection of larvae as part of the New York Dragonfly and Damselfly Survey. We recognize that a fair amount of aquatic invertebrate sampling is ongoing as a part of various programs dealing with water quality, and we will seek to examine collections made under those programs, for species level identifications where possible.

Nevertheless, the empty skins left behind when larvae transform to adult (called **exuviae**) can be fairly easy to collect and, in fact, are an excellent way to obtain records for some species. While not all exuviae can be identified to species, most of the river-inhabiting

clubtails and the bog-inhabiting emeralds can be, and these species are especially difficult to catch as adults. Exuviae indicate successful reproduction at the collection site, and because the dragonfly has already emerged leaving its empty skin behind, the collection of exuviae does not involve the collection of a living specimen. For these reasons, **we especially encourage the collection of exuviae along shorelines of rivers and streams, as well as in bog/fen habitats.**

While the rearing of larvae is also a good method of obtaining records, it does require some additional steps and materials. Further discussion of rearing is presented later in the handbook, in the section on “Equipment and Techniques.”

Property Access

The popularity of sport fishing and boating in New York has led the state to purchase a large number of boat and fishing access sites throughout the state which provide access to many sites of interest. Nevertheless, there are many interesting streams, ponds, swamps, bogs, etc. on private lands scattered across all counties of the state, and participants should seek permission from private landowners to access such sites. **Please remember that it is very important to obtain permission before entering private or restricted property.** A landowner introduction letter will be provided to participants after we receive your completed Volunteer Registration Form.

While public lands are typically open to public access, the collection of plant and animal material from these lands is usually restricted. Regional staff of the New York State Department of Environmental Conservation (NYSDEC) having oversight for Wildlife Management Areas and State Forests (including forest preserve lands in the Adirondacks and Catskills) have already been contacted regarding the New York Dragonfly and Damselfly Survey.

We will be providing these regional NYSDEC staff with a list of project participants. A list of regional NYSDEC contacts for state Wildlife Management Areas, Unique Areas, Multiple Use Areas, State Forests, State Forest Preserve, or other state lands under the jurisdiction of the Department of Environmental Conservation is included as Appendix VI. If you anticipate either collecting voucher specimens or netting and releasing specimens at any of the above state land types, you may wish to contact the appropriate NYSDEC staff person prior to your visit. We will also provide registered participants with an introductory letter to show to NYSDEC staff (including Environmental Conservation Officers) that may ask about your activities.

Please note that in New York, State Parks are administered by the New York State Office of Parks, Recreation, and Historic Preservation, and **not** the Department of Environmental Conservation. Collection of specimens in New York State Parks is not allowed. However, individual parks can provide short-term permits for certain activities, so it is possible that in some cases, participants will be able to obtain permission by inquiring at an individual state park that they may visit.

present at each site closely resembles the layout of the data entry screen in the actual database for ease of later data entry.

Participants can submit all of their records by mailing in their Survey Site Visit Forms (you may wish to keep a copy for yourself) **OR** by entering their survey information into a copy of the project database and sending us a copy of the files by e-mail or on a disk.

Detailed descriptions of the fields on the Survey Site Visit Form are included in the last section of the handbook, following the section on “Equipment and Techniques.” **Please familiarize yourself with these forms before beginning surveys for the NY Dragonfly and Damselfly Survey.**

A copy of the database is available for downloading to your computer by going to:

<ftp://ftp.dec.state.ny.us/dfwmr/nydds>

An instruction file for downloading the database and for submitting your electronic files is available when you download a copy of the database. If you prefer, we can mail you a copy of the database on disk.

Tracking of Volunteer Expenses

The funds supporting the New York Dragonfly and Damselfly Survey are part of a federal-to-state government-funding stream that requires state governments to demonstrate a “match component” for the project. The expenses that volunteers incur as participants in this project including; mileage, time spent, purchase of equipment/books, and other expenses, provide the easiest and most valuable means of demonstrating the match component for this project.

It is very important that we receive this information in order for us to continue to receive funding for the project. The Summary of Effort Card is designed for recording mileage and time spent during the course of surveys for the project. The card may be carried in your pocket or kept in the glove compartment of your car for easy recording of time and mileage. **Please fill in your time and mileage information for all field surveys you complete for the New York Dragonfly and Damselfly Survey. Time and mileage while attending a workshop or project meetings, as well as time spent at home preparing and identifying specimens should also be recorded.** We will need you to return the card at the end of the field season so that we may total all volunteer time and mileage and calculate our project match. And please remember to initial the entries **and** sign the card before submitting it. You may wish to keep a copy for your records as expenses that you incur while participating in the project may be claimed on your income tax as a contribution to a non-profit organization.

Equipment and Techniques

Catching adults

The single most important piece of equipment for pursuing surveys of adult dragonflies and damselflies is a lightweight insect net commonly called an “**aerial net**” for capturing flying insects.

Because dragonflies are such fast and agile flyers, a long net handle, generally five feet but probably not longer than your individual height, is best. Various diameter net bags are available (15 -inch diameter and 18-inch diameter are the sizes most commonly used). Commercially available nets come in green or white cloth. Many people feel that a green net is less visible to dragonflies, but success in capture almost certainly has more to do with individuals techniques rather than net color. Collapsible nets with net handles that come in one-foot sections are ideal for many surveys as they can be taken apart and put in a backpack while walking to or from a site without getting tangled in vegetation. Some people use homemade nets or handles and to some extent, the type of net and handle are a matter of personal preference.

Probably the greatest variety of nets is available from BioQuip Products (www.bioquip.com).

Dragonflies have amazing eyesight and flying abilities and capturing some species is very challenging. Some good tips for catching dragonflies include:

- Observe dragonflies to determine whether they are patrolling a small area or returning to a favorite perch before attempting to capture them
- Approach them slowly, which is usually more effective than running quickly after these agile insects (there are exceptions of course!)
- Where possible, swing your net toward flying dragonflies from **behind** and below, as this is their blind spot, (although at times they literally appear to have “eyes in the back of their heads”!)
- It is best to hold the net flat against the net handle as you begin your swing, releasing the net as your swing gets closer to the dragonfly. As you complete your swing and determine that the insect is in the net, quickly twist your wrist. This motion closes the net bag against the net frame, trapping the insect in the back portion of the net.
- Dragonflies perched on the ground, or sometimes in vegetation, are more easily captured by swinging down on them
- Skim dragonflies or damselflies off the surface of the water, which can be especially difficult

Another important piece of equipment is a good **hand lens** with magnification of at least 8x. The hand lens may enable you to identify some species in hand while in the field, or

at least to identify individuals as different from one another, regardless of whether you can put a name to them. Remember, it is not necessary for participants to identify all specimens or photographs as we will be confirming identifications over the winter months.

A net and hand lens will be valuable for those participants that are submitting photographs, as well as for those that are collecting voucher specimens. Remember that close-up photographs of specific body structures will be needed for some species, and these are best obtained by having the specimen in hand.

Two other important field items for those participants that will be collecting voucher specimens include clear “glassine” envelopes and a container to put the envelopes in while in the field. Glassine envelopes are available from BioQuip Products (www.bioquip.com), or at post offices as stamp collectors use them. **We will be providing a limited number of glassine envelopes of two sizes to participants attending one of the training workshops.** Information on ordering additional envelopes, nets, hand lenses and various other books and materials is given in Appendix IX.

Various types of non-crushable, plastic sandwich boxes work well for field storage of the envelopes, while some people use small fishing tackle boxes. If the boxes are covered with black tape or kept in a dark backpack, the dragonflies remain calm in the envelope while one continues surveying.

When a specimen is captured, reach into your net and grasp the dragonfly by folding both wings together over its back or thorax. Place it alive in a glassine envelope; larger envelopes for dragonflies, smaller envelopes for most damselflies. The wings should be **together** above the thorax or back rather than out to the sides. When male/female pairs are caught while attached to one another (referred to as being in tandem), they should be kept together in the same envelope. If they are too large to go together in a single envelope, make certain that the fact they were a tandem pair is indicated on both envelopes.

Collection data should be written on the glassine envelope in pencil, India ink or some other insoluble ink. Minimally, this information should include:

- Date
- Location
- Location coordinates if determined in the field

Alternatively, record this information, along with habitat and other information, on a 3 x 5 specimen label and place the label inside the glassine envelope with the specimen.

NOTE: The color pattern of the large, late summer, blue darner species (*Aeshna*) fades somewhat soon after capture. The color of the stripes and spots on the thorax are important in the identification of these species, so it is useful to record some notes on the color pattern after capture for these species.

Preservation of Specimens

Unless one uses a standard insect killing jar in the field, the most practical routine is to kill the specimens at home in the quickest and most humane manner. The two most common killing methods include putting them in a freezer or placing them in acetone. The acetone method is faster (usually about 10 seconds) and also preserves specimen colors the best as well as the specimens themselves. Specimens may be placed directly into acetone or placed in the acetone while in the glassine field envelope.

Nearly all museum collections now store dragonfly and damselfly specimens in clear, 3 x 5 envelopes rather than as pinned specimens as in the past. This method of storage results in tremendous space saving, but equally important, it ensures that as specimen breakage occurs, the parts that have broken off remain associated with the rest of the specimen.

For maximum color retention and prevention of other decomposition problems, dragonfly and damselfly specimens are best preserved by dehydration with acetone.

Therefore, regardless of which killing method is used, specimens should be placed in glassine envelopes and soaked in acetone after they have been killed. Dragonflies are normally soaked for 24 hours while damselflies need only a half-day or overnight treatment. Specimens should be positioned with their wings above the thorax (back), their abdomen straight, and legs extended downward so they do not cover the thorax or head.

Acetone can be purchased at any hardware store in the paint supplies section. Note that it is highly flammable and somewhat toxic, so it should always be used outdoors or with adequate ventilation. For specimen treatment, acetone is best kept in a wide-mouthed jar (wide enough to easily insert the 3 x 5 envelopes) or other container that is inert to the acetone and is airtight. Some plastic storage containers may be damaged by the acetone while others are not. Always label any container that you are using (or have previously used) for acetone.

Standard preservation steps upon return from the field are as follows:

- Make sure that glassine envelopes are labeled as described on the previous page (with date and location information written in pencil, India ink or other insoluble ink).
- Place envelopes in freezer or place specimens in acetone (for 10-15 seconds).

- Remove specimens from acetone or freezer. If you are using acetone, remove envelopes with tongs or wear latex gloves.
- Position specimen so that wings are above the back, the abdomen is straight, and the legs are extended down away from thorax and head as in the scanned photo below.
- Cut small sections of the corner off of the glassine envelopes or punch a small hole in them with a hole punch (to drain acetone).
- Place labeled glassine envelopes with specimens into jar or other container with acetone (the specimens should be completely covered) and let soak for 24 hours (dragonflies) or half-day or overnight (damselflies). If you wrote the collection information on a specimen label in the field, transfer it to the glassine envelope (in pencil, India ink or other insoluble ink) before putting the envelope in acetone. Specimen labels reproduced on copy machines have a tendency to run when placed in acetone overnight.
- Remove envelopes from acetone (again, outdoors and using tongs or gloves) allowing acetone to drain from holes.
- Allow specimens to dry. They may be dried in the glassine envelopes, but they dry more quickly outside of the envelopes or under a strong light source. If you remove them from the envelope for drying, be sure to keep them with the envelope if you have specimens from different locations for the same day or from different days. If the heat source is comfortable for your hand to be in, then it will not damage the specimens. A pelleted desiccant may also be used for drying and preservation. **Dry them in a well ventilated location.**
- If you have not already done so, complete a specimen label, including site name, county, town, managed area if appropriate, additional directions or coordinates, collector, date, habitat information, and identification of the specimen to whatever level (family, genus, species) you choose, and place the specimen label in a clear museum envelope. As with glassine envelopes, a limited number of clear museum envelopes will be provided to participants attending one of the training workshops. If the labels are printed on paper as opposed to heavier stock, it is best to place a 3 x 5 index card in the envelope behind the specimen label. This keeps the envelope stiff and helps to reduce specimen breakage.
- Carefully remove the dried specimen from the glassine envelope (forceps or tweezers are useful for this), place it inside the clear envelope in front of the specimen label and fold the remainder of the envelope over. It is not necessary to tape the envelope closed or put a paper clip on it. Because they break more easily, we have found that placing **damselflies** in one of the small clear envelopes and then placing the small envelope inside the larger envelope is desirable.

- If you prefer, or if you do not have any of the clear museum envelopes, you can retain the specimen in the glassine envelope together with the completed specimen label and submit them to us that way. We will transfer them to the museum envelopes when we receive them.
- Store the envelopes in an **upright position** in an airtight container until they are ready to be mailed off for specimen verification.
- Once the specimens have been transferred to the clear museum envelopes, the glassine envelopes are available to be used again. Just remember to cross out or erase previous date/location information that you have written on them before using them again. This will eliminate possible confusion regarding collection dates/locations with subsequent specimens.

Collecting and Storing Exuviae

Exuviae can be found by walking along the edge of a shoreline (moving or still water) and looking on the shore, vertical banks extending up from the water, and on vegetation near the waters edge. They are most easily found when the adults have recently emerged, because over time exuviae will be washed into the water with heavy rains or changes in water level. Therefore, timing surveys to coincide with adult emergence can be critical to the success of efforts to collect exuviae. Many river clubtails emerge in early June, so this is an excellent time to conduct surveys on rivers and streams.

No specialized equipment is required to collect exuviae. They can be stored in empty plastic containers of any sort when they are encountered in the field. They will often have mud or sand on them making identification more difficult. They can be soaked overnight in water with a few drops of dish detergent and brushed off the next day with a water color or other fine brush, then air dried on a piece of cardboard (drying on paper towels often results in the legs sticking to the pores in the paper).

Exuviae may be sorted into those that look alike. Place a couple of each type in the clear museum envelopes with a specimen label, as one would do with adult specimens. They can also be kept with a specimen label in zip lock bags, although some breakage may occur when mailed in this fashion due to individuals rubbing and knocking against one another.

Collecting Larvae

Nets for collecting aquatic insects, including dragonfly larvae, are much sturdier than aerial nets because they must be dragged through underwater vegetation or mud/sand/gravel substrates at the bottom of wetlands, rivers or streams. The mesh needs to be large enough to allow water to easily flow through and out of the net, but not so large as to allow the insects to slip through the mesh. BioQuip carries a variety of aquatic insect nets often called “dip nets” or “d-frame nets.” The net contents can be placed in

some sort of pan, preferably one that is light in color, and sorted through to look for larvae. Some workers have used old colanders to collect larval dragonflies.

As with other aquatic insects, larval dragonflies and damselflies are typically stored in a solution of 70-95% isopropyl alcohol and label information is recorded on a label made of rag paper and placed in the alcohol along with the specimens. Small vials or other airtight, leak-proof containers are normally used.

Rearing larvae

It is sometimes easier or more definitive to identify a larval dragonfly by raising it in an aquarium until it emerges and then identifying the adult. Again, this is especially true with river-inhabiting clubtail species and bog-inhabiting emerald species. Aquaria for raising larvae can be of almost any size and can be kept at room temperature. A pump is usually needed in order to provide aeration. Living plants need not be supplied, but sticks, rocks, or some other material that protrudes above the water surface is needed to allow the larvae to crawl out of the water when it is ready to emerge. The aquarium needs to be covered with some sort of screen so that the emerging adult can shed its larval skin and perch while it dries out, and so that you do not come in to find it flying about the room!

While larvae can be maintained in aquaria for months they do have voracious appetites so long term rearing can be very time consuming. The best method is to obtain larvae very close to the time they would emerge in the wild (called the last larval “instar”). At this stage they eat little and may emerge within a few days of collection. The larval wing pads are very dark and extend far down the length of the abdomen on larvae that are in the last instar. Many clubtails will reach their last instar by May although this varies by species, and species in the *Stylurus* genus may not reach this stage until June. Collection of river clubtails for rearing is probably best done in May. Most bog loving emerald species (genus *Somatochlora*) emerge in July so collection of their larvae can be done throughout the month of June. However, larvae of *Somatochlora* species are not always easy to distinguish from some of the much more common Skimmers, so experience with larvae or exuviae may be desirable when collecting larvae in bogs for rearing.

Shipping of specimens

Dried, adult, specimens can be shipped by regular mail. Simply pack the upright specimens in a small box with paper toweling, tissue, bubble wrap, or some other packing material around the envelopes so that they do not move around a lot in the box. It is not necessary to put packing material around each individual envelope, but be careful not to pack envelopes so tightly that they are pressing hard against one another. Nesting the box within a larger box, protected on all sides by additional packing material, will provide a greater level of protection of the specimens. Exuviae can be shipped in the same manner.

While larvae can also be shipped through the mail, they must be in leak proof vials or other containers and additional care in packing is necessary. If you have collected larvae you may wish to check with us before mailing them.

Recording Information on the Survey Site Visit Form/ Entering Records into the New York Dragonfly and Damselfly Survey Database

The Survey Site Visit Form (Appendix II) was designed as a form that participants can complete in the field ensuring that the most important information is recorded while the survey is taking place. The database itself, consists of a series of fields that can be populated by the observer, as well as instructions to walk you through the database. The database also allows for the transfer of information to a specimen label that can be printed to go with voucher specimens to be submitted.

All of the information fields in the database are also present as lines or check-off boxes on the Survey Site Visit Form and they are arranged in a similar fashion for ease of data entry at a later date.

As with most survey efforts of this nature, there are a number of pieces of information that are essential to record if the information gathered is to be useful. This information, or these **required fields**, include:

- Date
- Collector/observer
- County
- Survey site name (i.e. the location of the place of survey)
- Additional site location directions or geographic coordinates

These are the standard pieces of information that most naturalists would record for observations that they wish to record for animal or plants of interest. Various types of other information will also be very valuable for data analysis, conservation planning, and furthering our information on dragonfly/damselfly species distribution and habitat, and fields are present on the Survey Site Visit Form and in the database for this information.

Each information field is discussed below, beginning with those that are on the New York Dragonfly and Damselfly Survey Site Visit Form and followed by a few other fields that appear in either the Survey Site Visit Form or the Specimen Record portion of the database. **Fields marked by an asterisk are the required fields.** The desired information for the field is briefly discussed and is followed by information related to actually entering the information into the database, for those that choose to enter their survey records themselves.

Within the database, we have incorporated easy to use “drop-down” lists for entering much of the information. Those fields that are drop-down menus within the database are indicated. Further instructions for entering the information into the database is included

with the database itself and will be available when you either download a copy of the database or receive a copy of the database on disk.

New York Dragonfly and Damselfly Survey Site Visit Form

*** Site Name**

Site name will generally be the name of the river, pond, lake, etc. at which you are surveying. Always use the names shown on the New York State Atlas and Gazetteer published by the DeLorme Company, topographic maps, or other maps. If you are at a water body that is not named on the maps, such as a small man-made pond, a new beaver pond, or an intermittent stream, make up a name that makes sense based on other names in the area. An example could include adding a road name before the descriptor of swamp, pond, or creek (“Smith Road Pond” or “Tributary of Black Creek”).

Within the database, the majority of the names shown on maps are available as a drop-down list. The list of name choices in the drop-down list was obtained from the USGS topographic map list of geographical place names and includes those names where observers are most likely to be surveying; specifically, lakes, ponds, reservoirs, rivers, streams, etc.

*** County**

Record the name of the county in which the location you are surveying is located. Within the database, you may type the county or select the name from a drop-down menu.

Town

While town names are usually easy to determine from the DeLorme Atlas or other maps they are less familiar to most people than the names of counties. Record the town name if you know it. The list of town name choices will appear as a drop-down menu within the database when you enter the county. The choices will be restricted to those towns that are present within the selected county.

Managed Area

This field is for recording the name of public lands including State Wildlife Management Areas, State Forests, State Parks, County Parks, Town Parks, etc. Private lands owned by conservation organizations such as the Audubon Society or The Nature Conservancy should also be listed here. We expect that a fair number of participants will choose to conduct at least some surveys on various public lands. It is very important that we be able to provide agency and conservation organization staff with lists of species occurring on their properties, so please record Managed Area names if your survey was on such lands. These lists may prove valuable to the agencies and organizations that own these lands in their management planning efforts, for producing species list in brochures, etc.

*** Additional Site Location Directions**

This field should provide more detailed directional information to the specific location surveyed, but it need not be lengthy. For example, one may list Carry Falls Reservoir (in St. Lawrence County) as the Site Name but then in the Additional Site Location Directions space list “south shore of the northwest bay”. Another example would be listing Hudson River (in Warren County) for Site Name, and listing “west shore, just south of the bridge at Route 8 in Riparius” under Additional Site Location Directions. This is a required field because we want to be able to produce maps showing specific locations for records obtained through the NYDDS. Providing more specific locational information will allow us to pinpoint observer’s locations for those observers that are not using Geographic Positioning Systems to determine locations.

*** Observer(s)**

If a number of observers are present together for a particular survey, list all observers’ names, but designate one person to serve as the “principal observer”. This persons name should be listed first and they should record information for the group as a whole.

*** Date**

Always record the date while in the field so you do not have to try and remember it later. If you are entering the date into the database it may be typed into the database in any format. However, the database will automatically standardize the date to the day - month year format (12 June 2005) for consistency.

Time

Recording the time actually spent surveying at a particular site will allow for some determination of how thoroughly the site was surveyed. Coupled with information on the number of individuals of different species observed this data can give us a sense of relative population sizes. This will be especially useful for those species believed to be uncommon or identified as Species of Greatest Conservation Need. Note: this should be the time actually spent surveying at a given site. Time spent getting to a site (driving, walking, etc.) should be included when recording your time and mileage, but not included on the Survey Site Visit Form.

Weather Conditions

Activity levels of dragonflies and damselflies are often closely tied to weather conditions. Recording general weather information such as approximate temperature and cloud cover will help you decide if you want to visit the site again under better weather conditions. There is also a box for entering air temperature.

Mapping Method/GPS

If you use a Geographic Positioning System (GPS) to record latitude and longitude (or UTM coordinates) in the field, it is probably easiest to enter this information directly on the field form although the information can also be saved and retrieved from your GPS at a later time. Remember to record which datum (NAD27, NAD83, or WGS84) your GPS was recording in. If you do not use a GPS, but wish to determine the coordinates for your site it is still very easy to do this using free software available at www.topozone.com.

This software gives NAD83/WGS84 as the default choice and we recommend that you enter that as your datum. At this time, we also recommend recording and entering coordinates as **UTM coordinates** rather than latitude/longitude coordinates because there is only one way to record these coordinates which makes them less confusing and because the mapping software (ArcGIS) that we are using for this project works best with UTM coordinates. There are three zones in New York State. Nearly the entire state is in zone 18, but the far, east end of Long Island is in zone 19 and portions of the westernmost counties are in zone 17. Most GPS units can record your location as UTM coordinates and will display the zone that you are in when you collect the coordinates. In most cases, a single set of coordinates per site should be sufficient for display of species maps at a scale that we would be likely to use for this project. If you encounter a number of distinctive habitat types during the course of a survey, it would be best to record these on separate Survey Site Visit Forms and record a set of coordinates for each.

Habitat

There are several fields that relate to noting the habitat type where you surveyed. The general categories we would like everyone to use in order to provide consistency are shown as check-off boxes on the Survey Site Visit Form. The first set of boxes refer to the general aquatic habitat type (marsh, swamp, bog/fen, pond/lake, running water, or open areas that are nearby aquatic habitats). Under each of these general habitat types are other boxes that provide additional detail. For example, under Swamp, one may indicate that the swamp was dominated by deciduous, coniferous, or mixed (deciduous/conifer) forest vegetation. As stated in Mapping Method, if you spend a significant amount of time surveying very different habitat types in close proximity to one another it is best to complete a separate Survey Site Visit Form for each type. For example, if you spend an hour on a pond then spend another hour on a stretch of stream that feeds into the pond; complete a Survey Site Visit Form for each of these habitats. If habitats grade into one another you may complete one form and indicate multiple habitat types by checking off more than one habitat type in the check-off boxes.

Bottom Substrate

Where possible, please record the substrate type for the habitat that best fits the aquatic habitat surveyed. You may enter more than one category. The larvae of some species appear to require certain types of substrates. Recording this information may greatly enhance our understanding of the habitat preferences of a number of uncommon species.

Surroundings

These are very general categories aimed at giving an impression of the terrestrial habitat(s) around the surveyed water habitat. Some species appear to require forested buffers either because the surrounding forest is important to the adults or because removal of the buffers alters the aquatic habitat preferred by the larvae.

Water Quality

These very general categories will give us some indication of the water quality at the collection location. Some dragonflies are particularly intolerant of reduced water quality, while some others seem to do very well under poorer water quality conditions.

Other Notes (including habitat notes)

If there are other notes that you want to add, such as what species of aquatic plants were most common in the water or in the near shore areas, this is the place to list that information. If you feel the habitat type you were at does not fit well into any of the categories shown, check the “Other” box and provide additional information here. Other notes of general interest can also be recorded here.

Species List

Record species collected, photographed, or observed in the field. If you can only identify the species to genus or even family write it down as such. If you think you have multiple species within a genus but aren't sure what species they are, it is probably best to record them separately (for example as Bluet 1, Bluet 2, or Gomphus 1, Gomphus 2, etc.).

Within the database, the species list is set up as a drop-down list based on scientific name. All species recorded in New York to date, as well as some species not yet recorded for NY, but likely to occur here, are included in the drop-down menu. One may enter genus name only, if that is all you know. Common names will also be displayed when you select the scientific name, but the drop-down list is sorted and arranged by scientific name.

Genus: Select the genus name first. You can type this in or scroll through the list using the drop-down box. As you type the genus name, the program is designed to auto-complete the name based on what you type. The program alphabetically selects the first name that corresponds to your entered data. For example, if you begin to type *Argia* you will note that as you type each letter a different genus appears. By the time you reach "Ar", the entire name of *Argia* should appear. Continue typing until the name you desire appears or use the drop down box to select the proper name. Once the genus you want appears, tab over to the species box.

Species: This field is limited to species in the selected genus. For example, you will not find the name *inaequalis* if you select *Argia* as the genus, but you will find *inaequalis* if you select *Lestes* as the genus.

Subspecies: We are only dealing with a few odonate subspecies in this database and again, the subspecies are limited to those listed for the selected genus and species.

Identification Method

Check-boxes for four identification method codes are included on the Survey Site Visit Form. The codes are as follows:

- SPEC for a collected specimen
- PHOT for a species that was photographed and for which you are submitting the photos as “photographic vouchers”

- CAPT for a species that was captured, examined in hand, and released (but not photographed or collected)
- OBS for species identified while perched or flying, either with the aid of close focusing binoculars or without (i.e. sight records)

You may record more than one code for any given species. For example, you may collect a specimen of a species and also observe many others of the same species while at the site. In this case check both SPEC and OBS. If you collect exuviae at a site and have identified them to genus or even family level include them on your species list checking the SPEC identification code as these also qualify as collected specimens that will be turned in at the end of the season for identification verification. Within the database, one simply clicks within the appropriate box to record the correct identification method code.

Number Estimated

Check-boxes for estimates of the number of individuals observed are included on the Survey Site Visit Form. The codes are as follows:

- Few 1-5 individuals
- Frequent 6-20 individuals
- Common 21-100 individuals
- Abundant 100+ individuals

Note: This information is important for those species that are **Species of Greatest Conservation Need (in bold on the Dragonflies and Damselflies of New York State list, Appendix II)** or have not yet been recorded in the state, as it will help us to identify those sites that may be particularly important for these species. These sites may be taken into consideration as part of conservation planning efforts of various organizations or agencies and will be taken into account during environmental review of development projects that are reviewed by the New York State Department of Environmental Conservation and the New York Natural Heritage Program.

Please try and provide an estimate of numbers observed for the Species of Greatest Conservation Need or species new to the state if you think you have recorded one at a site you are surveying (regardless of identification method). If you are not sure if your species is one of these species, don't worry about it. If you want to provide estimates for species that you do identify, even if they are not Species of Greatest Conservation Need, that would be great!

Reproductive Behaviors Observed

Check-boxes for five reproductive behaviors that you may observe are included on the Survey Site Visit Form. The codes are as follows:

- GRD guarding or territorial behavior observed
- TAND for a male and female pair in tandem
- COP for a pair that are in the wheel position (copulating)
- OVIP for a female that is laying eggs (ovipositing)

- TEN for individuals that are emerging or are observed in the general (recently emerged) condition

Note: As with Number Estimated, this information is important for those species that are **Species of Greatest Conservation Need (in bold on the Dragonflies and Damselflies of New York State list, Appendix II)** or have not yet been recorded in the state, because the behaviors listed indicate that the species is actually breeding and resident at the location where you have observed it.

Additional Fields in the Survey Site Visit Form portion of the database

Site Record Id

This field is automatically populated within the database

Find a Record Button

This “button” is not a field to enter information, but a means to allow you to find records that have been previously entered.

Transfer Button

This “button” is not a field to enter information, but allows you to transfer information for that particular species over to the Specimen Record portion of the database.

Additional Fields in the Specimen Record portion of the database

The Specimen Record is designed for the purpose of allowing participants to print specimen labels for any specimens being submitted as voucher records. It can also be used to produce “specimen labels” for records being substantiated by the submission of photographic records. Using the Transfer Button on the Survey Site Visit Form, much of the information that has been filled in on that form can be transferred directly over into the Specimen Record portion of the database so that it need not be re-entered. At the same time, one may transfer information over, but then add to or delete some of the transferred information. For example, if one took a single GPS point at a general survey location, but then took a second GPS point at the specific portion of the site where a Species of Greatest Conservation need was collected, one could replace the UTM coordinates or latitude/longitude for the general site location with the more specific reading for this particular species. The Habitat fields do not transfer over automatically but can be transferred over by hitting the "Copy habitat from site" button. An example where you may not want to copy over the habitat information would be where the Survey Site Visit Form includes a Marsh grading into a Swamp with both checked on the form, but the collected species was recorded at only one of those habitat types.

Fields that are specific to the Specimen record include:

Sex

Indicate whether your specimen or photograph is a male, female, tandem pair, or unknown if you are unsure. Tandem pairs are generally retained together in the same envelope.

Photo

Check this box if you have listed a species on your Survey Site Visit Form and are submitting the photo(s) as a photographic voucher.

* **Collector** (use also for Photographer in the case of “photo vouchers”)

Enter your full name.

Collection ID and NYDDS Voucher #

Both of these fields are automatically populated. The voucher number consists of the Volunteer ID that you entered on the Volunteer Registration Form, followed by a number that is sequentially added as you transfer information for your specimens over from the Survey Site Visit Form to the Specimen Record portion of the database.