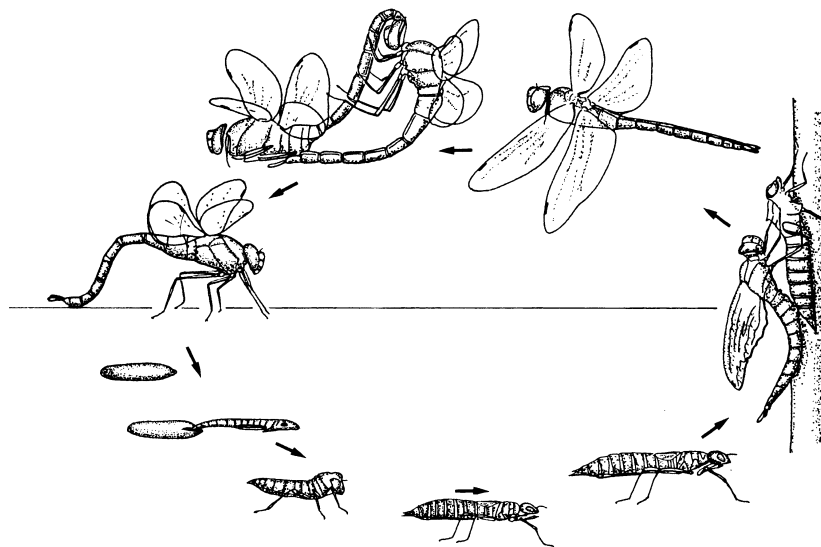


Report of

The Dragonflies

at Store Mosse National Park 2001



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County Administration, Jönköping 2001

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1. INTRODUCTION

During July and August 2001 I carried out practical training at Store Mosse National Park. I collected dragonflies between weeks 30 and 34. All my collecting was of the adult insects - the imagines, and my aims were as follows:

- to obtain a species list of dragonflies inhabiting the site.
- to estimate the frequency of each species recorded.

Identification was carried out in Sweden using a Swedish reference book, (Sandhall, Åke. 1987) and German references were used in the later compilation of the report.

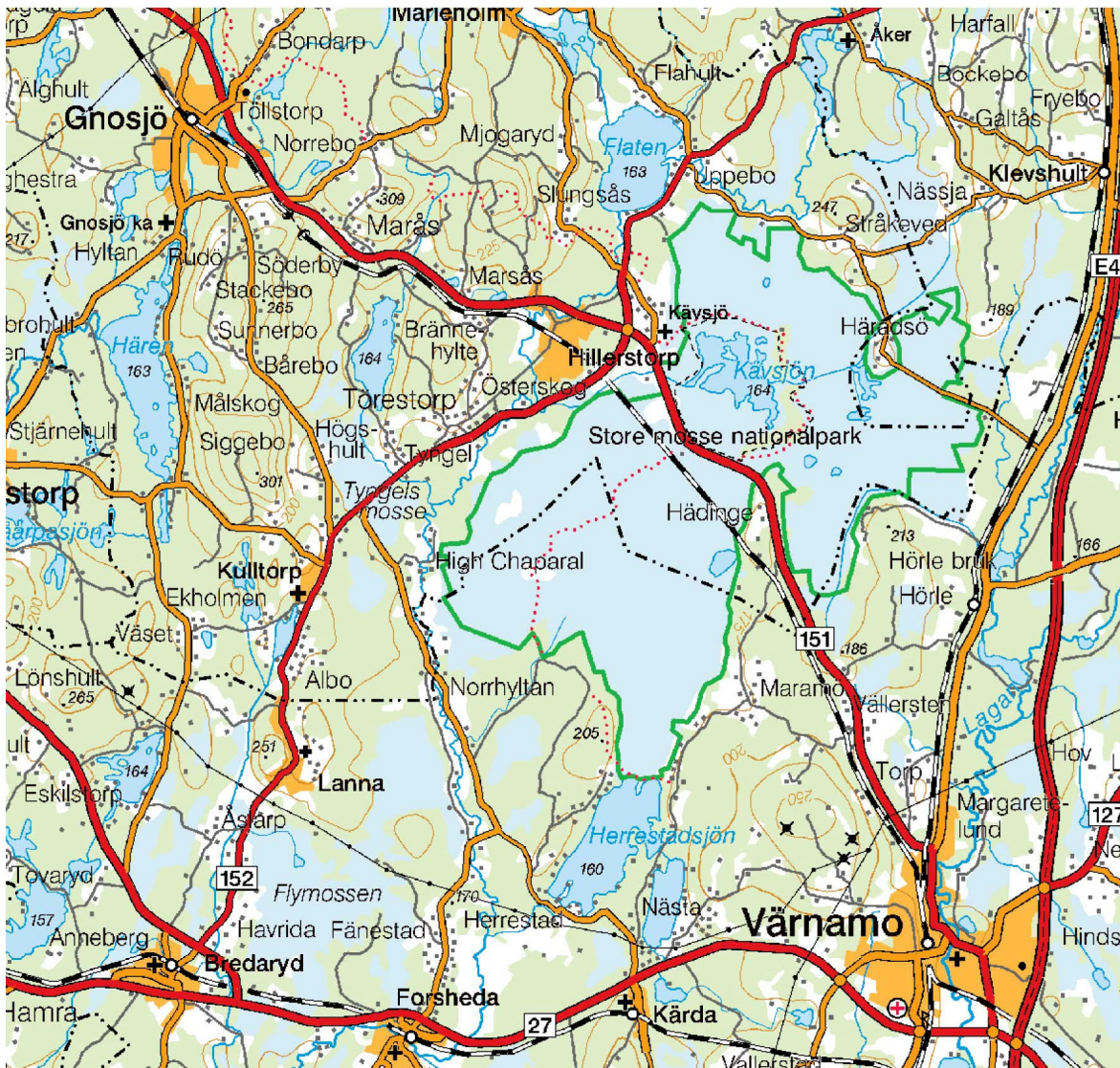
Most species recorded on Store Mosse are also found in Germany, with the exception of *Coenagrion armatum*. Sometimes there are

different subspecies in each country, but their ecology is perhaps similar. However, differences in the annual life cycles and diurnal behaviour are possible.

Store Mosse is a favourable place for Dragonflies. The moss has a varied structure, and former peat-diggings are an especially valuable habitat.

The peat-diggings have water for most of the year water, but the pools of water are not big enough for some of the enemies of the dragonflies, especially fishes. It is also difficult for fish to disperse to, and survive in an acid habitat where the only input is rain water. In spite of the large number of Dragonflies, the population of each species varies in relative abundance. Some of the species are very rare while others are observed very frequently in all biotopes where dragonflies occur.

1.1 MAP



Medgivande:

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Lantmäteriverket 2002-06-14.

1.2 LIST OF SPECIES AND DISTRIBUTION

ZYGOPTERA:

Calopteryx splendens: small dystrophic lake between the Kävsjön and the Rockne, rich in aquatic plants, only one species. Rare.

Calopteryx virgo: dystrophic canal between Kävsjön and Häradsösjön, water nearly standing, and dystrophic canal between Kävsjön and Nygård. Frequent.

Coenagrion hastulatum: dystrophic canal between Kävsjön and Nygård. Frequent.

Coenagrion armatum: fertile fen next the Björnekullakärret. None. Frequent.

Enallagma cyathigerum: Svartgölen, big lake with open banks, missing succession zone. Frequent.

Pyrrhosoma nymphula: dystrophic canal between Kävsjön and Häradsösjön. Rare.

Lestes sponsa: very common, typical for meadows around the Kävsjön, and all over Store Mosse.

ANISOPTERA

Aeshna grandis: the breeding site for this species is the small lake between the Kävsjön and the Rockne, and the lakes next to the V. Rockne, its

hunting territory in the open bog areas. Very frequent.

Aeshna subarctica: ex-peat workings and natural *Sphagnum* Bog, same breeding sites as *Aeshna grandis*, hollows and ex-peat workings. Frequent.

Somatochlora flavomaculata: ex-peat workings. Rare.

Somatochlora metallica: dystrophic canal between Kävsjön and Häradsösjön, and dystrophic canal between Kävsjön and Nygård. Ex-peat workings. Hunting territory in the natural *Sphagnum* Bog. Very frequent.

Leucorrhinia rubicunda: their breeding site is the small lake between the Kävsjön and the Rockne. Hunting territory is the bog near the eagle feeding place. Rare.

Libellula quadrimaculata: fertile fen next the Björnekullakärret, Kävsjön. Ex-peat workings. Very frequent.

Orthetrum cancellatum: fertile fen next the Björnekullakärret, observed on only one site. There, frequent.

Sympetrum danae: represent everywhere in the National park, especially at the ex-peat workings. Very frequent.

Sympetrum sanguineum: fertile fen next the Björnekullakärret. Rare.

2. SPECIAL DESCRIPTION OF HABITAT AND PHENOLOGY

2.1 ZYGOPTERA

Zygoptera are small dragonflies known as 'Damselflies'. They are smaller and thinner than the Anisoptera. The eyes are well separated. When the insects are at rest the wings are folded up above the back. Front- and hind wings have the same outline and pattern of venation. The Zygoptera larva are smaller than the larva of Anisoptera. They also have three conspicuous leaf-like anal gills

2.1.1 CALOPTERYX SPLENDENS

Calopteryx splendens belongs to the family *Calopterygidae*. That the dragonflies fly like butterflies is a particular feature of this family. They are our biggest Damselflies, and the ones with the most colourful wings.

Distribution:

C. splendens has its centre of distribution around the Mediterranean but it is also found as far as northern Scandinavia.

Life-cycle:

The time of emergence occurs from the middle of April to the end of July with a maximum emergence between the middle of May and the Middle of June. The insects can be observed flying up until the end of September. The larvae need 1-2 years to develop. Its rate of development is dependent on the temperature.

After emergence *C. splendens* needs around 10 days before sexual maturity. The adults live on the average 15-16 days.

Diurnal behaviour:

The males come to the sunny water between 7 and 9 a.m., and stay until the afternoon. If the day is cloudy, the rhythm is modified. The females arrive later and stay until 8 p.m. The main time of

mating is around midday. During the early morning and late evening the adults are looking for sunny trees and bushes in which to settle.

Habitat:

C. splendens lives in mesotrophic and eutrophic habitats. They are found in the middle courses and the lowland reaches of lakes. It is a typical species of eutrophic meadow-streams, lakes and ditches. If bog waters are too dystrophic *C. splendens* avoids them.

The Larvae need strongly growing water plants. These plants are necessary for protecting from the current. On the average the current in their habitat is between 2-70cm/s. The current should be approximately constant.

The water temperature is important for the larvae. They prefer warm water with a summer average of 16C. The optimal temperature for development is between 18-24C.

2.1.2 CALOPTERYX VIRGO

Distribution:

You can find *Calopteryx virgo* across nearly the whole of Europe. This species reaches further north than *C. splendens*. *C. splendens* needs higher temperatures for its development which however are bad for *C. virgo*. That is the reason for the difference in distribution.

Life-cycle:

The time of emergence takes place between the middle of April and the middle of August. Most insects emerge in May and June. The adults can be observed until the end of September. The species reaches its maximum numbers between June and July.

The Larvae need around two years for development. It takes longer than *C. splendens* because of the cooler environment. After

emergence *C. virgo* needs around 10 days to attain sexual maturity. The life expectancy is approximately 40 days.

Diurnal behaviour:

The time of appearance is comparable with *C. splendens*.

Habitat:

This species colonises streams, ditches, canals, headwaters and the middle courses. The flowing waters should be shady, although a mixture of shady and sunny places is optimal. The sunny places are important for the mating.

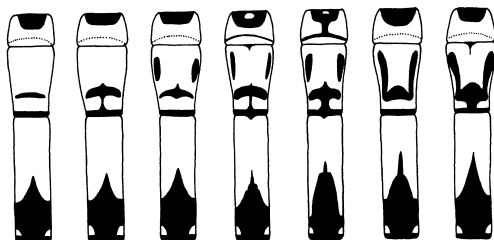
The aquatic larval habitat is often next to a forest because the adults like it to rest on twigs and branches.

The larvae prefer a slower current than the larvae of *C. splendens*. The reason is that its easier to pick up oxygen with still water. The current is always in one way and > 3cm/s.

The water temperature is cooler because of the shady places. The usual environmental temperature is 13-18°C. If the temperature is over 22°C, the larvae suffer thermal stress.

2.1.3 COENAGRION HASTULATUM

Coenagrion hastulatum and the next three species belong to the family *Coenarionidae*. In Europe it is the family with the most species. A lot of species resemble each other. Typical are the blue males and the brown or green females. For identification, the dorsal pattern is important.



different possibilities of the abdomen

Distribution:

The centre of distribution is in northern Europe. There it is the most commonly occurring

dragonfly. It prefers bog biotopes with a continental climate, with a cold winter and hot summer.

Life-cycle:

The time that emergence takes place is between beginning of May and beginning of July. The insects fly until the last days of September, with maximal emergence in June. There can be strong fluctuations in number with changes in the climate. The larvae can finish their development in a single year. In northern Europe 2-4 years are normal. After emergence *C. hastulatum* needs around 1-2 weeks to attain sexual maturity. The life expectancy is approximately 7-8 days.

Diurnal:

As soon as the rest places are in sun the adults are getting dynamic. In the morning they need a sunbath for getting warm. The insects occurs between 10 a.m. and 4 p.m.

Habitat:

C. hastulatum is a species of dystrophic or mesotrophic-eutrophic waters. A structurally strong transition zone is important.

It is a typical species of Sphagnum Bog and Ombrogenous Bog. *C. hastulatum* settles in dystrophic pools and seasonal pools in the middle or the edge of bogs. You can find them at the transition zone or around the reduction peat pools. If the species is found in middle of an intact Ombrogenous Bog, it is a sign for the beginning of eutrophication.

The adults occupy a consistent habitat. They hunt and rest at the forest border, the clearing or meadows next the aquatic larval habitat. The water areas are fully or half enclosed by woodland.

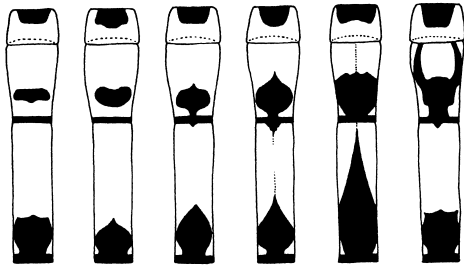
The larvae prefer standing waters but they tolerate slow-flowing waters. They can survive a drought for around three and half months. They dig into the mud or between *Carex* leaves. A lot of their enemies do not have this adaptation.

2.1.4 COENAGRION ARMATUM

2.1.5 ENALLAGMA CYATHIGERUM

Distribution:

This species is found over the whole Europe with the exception of Iceland. In the Mediterranean Region it is scarce, but over the rest of Europe it is a common species.



different patterns on the abdomen

Life-cycle:

The adult insects emerges from the end of April until the middle of September, maximum emergence being in May and June. Adults can be observed until the beginning of October but the best time is June and July.

The larvae need one year for development if conditions are very good, but in cooler climates it can take up to 4 years.

Mating can take place 10-12 days after emergence, and the adult dragonflies live around 12 days.

Diurnal Behaviour:

If the weather is sunny and warm the males are active between 9.00 a.m. and 8 p.m. Mating takes place during the afternoon but only if the weather is sunny. The temperature is not so important, the strength of the sunshine being the primary causative factor.

Habitat:

The larvae live in medium and big, open, mesotrophic and eutrophic lentic habitats with an area of open water. If the margin of the water is too full of aquatic plants *E. cyathigerum* will

avoid it. This species thrives in man-made aquatic habitats. Sometimes *E. cyathigerum* occurs in lotic habitats but only in still inlets. It is typically found in dystrophic bog waters where it can sometimes be found in abundance. The adults often fly close to the water surface of lakes surrounded by meadows.

The larvae live in the reed zone and on the mud. They are tolerant of current up to 10 cm/s. They prefer well oxygenated lakes. The larvae can also tolerate heavy metals. The eggs are laid under water in a distinctive string by the females. The abdomen of the females is immersed to such an extent that they need the help of the males to pull them free from the water surface.

2.1.6 PYRRHOSOMA NYMPHULA

Distribution:

P. nymphula is one of the most common Zygoptera in Europe. It is found in most parts of Europe. In Scandinavia it occurs only in the south.

Life-cycle:

Adults begin to emerge at the beginning of June and continue until the beginning of August. The main emergence takes place at the end of June and July. The dragonflies fly until the middle of September. July is the month of their greatest abundance.

The larvae need between 1-3 years for their development. After 5-16 days they are sexually mature and the life expectancy of adults is between 19-28 days.

Diurnal Behaviour:

Most of the adults emerge in the early morning and are flying around 9 a.m. Most matings occur during the midday, and by early afternoon most activity has ceased.

Habitat:

P. nymphula prefers biotopes full of nutrients. Favoured habitats are small areas of water which are seasonally dry, artificial ponds, pools, clean

ditches and streams. The species lay its eggs in muddy waters and it is a damselfly which is tolerate Ombrogenous Bogs. There it only settles in ditches, dystrophic pools, seasonal pools and peat reduction areas.

The adults like wood. They are avoiding bare banks and are valid as tolerant of shade. *P. nymphula* is faithful of the location.

The larvae are living during the vegetation at the ground of the water. They like a succession zone. The current should be low and regular. They can live in oxygen less waters. On the average the temperature of the water is 14-16 C. The larvae get along with dry up.

2.1.7 LESTES SPONSA

L. sponsa belongs to the family Lestidae. Typical for the genera *Chalcolestes* and *Lestes* is that these dragonflies spread their wings during rest. The larvae are very aggressive and sometimes cannibalistic.

Distribution:

L. sponsa is common in Middle- and Northern Europe. It is the *Lestes* species which be found in the most northern biotopes.

Life-cycle:

The adults emerge between the middle of May till the end of August. The main time of emergence being the first part of June. Sometimes it is possible to observe the insects as late as the end of October but the main time of abundance is during the summer months.

Development is rapid and the life-cycle is completed after the first winter. If conditions are very good the nymphs need 5-7 weeks, otherwise around 12 weeks.

After emergence *L. sponsa* needs around 2-3 weeks to become sexually mature. On average the

adults live 23 days. The life-cycle is complete after one year.

Diurnal Behaviour:

The first active adults reach the water around 9 a.m., and the time of mating is around midday. The insects are active until the evening. Sometimes *L. sponsa* has been caught at night in light-traps set up to catch moths.

Habitat:

L. sponsa like sunny, still water like seasonally dry ponds and pools. If ditches and streams contain still water, they also are found in the transition zones of eutrophic and mesotrophic lakes, fertile fens and Ox-bow lakes.

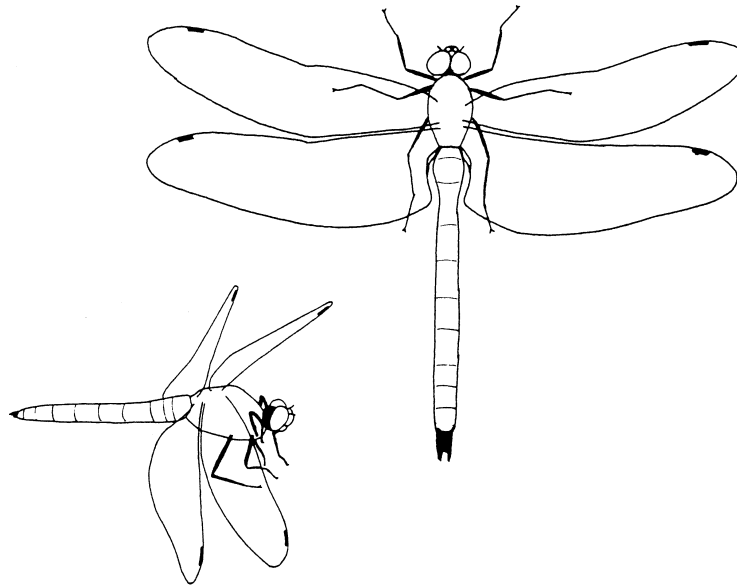
The adults remain in the meadows and forest biotone near the water where reproduction takes place. Sunny conditions are needed for mating and they often sit on the shoots of *Juncus* species.

The larvae can survive drought for a short period of time. Aquatic plants are necessary for them, and the larvae try to avoid predators by hiding and hunting . during the night.

2.2 ANISOPTERA

Anisoptera are all Odonata which called dragonflies in English. Most are large with a strong body. The eyes are also large and meet each other on top of the head. In some species only a small part of the eye is touching, in others the two eyes meet over the whole dorsal region of the head. Only the family *Gomphidae*, with eyes widely separated, make an exception to this rule. The wings are spread out when the adult insects are at rest. The front- and back wings haven't the same outline and pattern of veins. Nearly the whole wing is same width. The larvae are thick like a cigar. Striking are the five sharp thorn-like spines, called mid-dorsal spines.

2.2.1 AESHNA GRANDIS



A. grandis and *A. subarctica* belongs to the family Aeshnidae. They are one of our biggest dragonfly families. Their bodies are between 6-8cm long and the wing span is around 11cm. The big eyes touch each other over a relatively large distance. Their bodies are normally colourful like a mosaic. These insects can fly very quick, and are agile and with high endurance.

Distribution:

A. grandis is found in Middle- and Northern Europe but most Mediterranean countries lack this species.

Life-cycle:

The adults emerge between the middle of May and the end of September, the main time of emergence being June and July. Adults can be observed until the end of October but their abundance is greatest between the middle of June and the end of July. They need 3-4 years for their growth and development. After 1-2 weeks of adult life the dragonflies become sexually mature. Most adults do not survive for more than a few weeks.

Diurnal Behaviour:

The insects begin to hunt early in the morning and they begin to search for a mate at some time after 10 a.m., and mating may take place at any time after this. *A. grandis* is active until dusk, and in favourable weather it continues to hunt during the night. If there is no moonlight, the sounds of its wings can sometimes be heard. The dragonfly is such a good flyer that the only chance to hunt it, is during this time when it is flying low over and around the water.

Habitat:

A. grandis needs mesotrophic or eutrophic water, standing or slow flowing. A zone of newly exposed land is important, with a lot of plants. Mostly they use seasonally dry artificial ponds, pools, lakes, Ox-bows, ditches, streams, canals, swamp and bog-water for oviposition. In Scandinavia they prefer the transition zone of fertile fens. The aquatic larval habitat is often not the imaginal habitats and for proof of the larval habitat, exuviae are necessary. The water should surround by trees and the adults often hunt along the aquatic/terrestrial forest biotone, by clearings and bog-meadows. They may fly large distances, and often they hunt at around 5-25m above the ground. The aquatic larvae stay amongst the

vegetation. During the winter, they stay at the ground of the pool. The larvae are very slow-moving, and perhaps because of this, fish don't see them, and capture them as prey so readily.

2.2.2 AESHNA SUBARCTICA

Distribution:

A. subarctica is a species, which live in the Arctic Circle. It can be found in the middle and the northern part of Europe, reaching far in the north.

Life-cycle:

Adults begin to emerge at the middle of June and the beginning of August. The main emergence takes place during July, but the insects may can fly in the late autumn.

The abundance is greatest between the middle of August and the end of September.

Diurnal Behaviour:

This species has have two periods of maximum activity; the first during the morning and the second period during the afternoon. Normally they are active until the dusk, but sometimes they are flying as late as 11 p.m.

Habitat:

A. subarctica is a typical Ombrogenous Bog species although its habitat range extends as far as mesotrophic fertile fens. It is possible to find this species over quaking bog formed by *Sphagnum* spp., and also areas of ex-peat workings and seasonal pools.

The adult hunts along the forest biotones and clearings. They rest at the tops of trees.

The larvae prefer to live between the *Sphagnum* moss plants in the top 20cm beneath the dystrophic water. Normally the larvae are very tolerant but if the water has too much calcium, they die. The water temperature is also an important habitat factor for *A. subarctica*. In each phase of their life cycle they have a characteristic temperature optimum. These habitat requirements they can find only in bog biotopes.

2.2.3 SOMATOCHLORA FLAVOMACULATA

S. flavomaculata and *S. metallica* belongs to the family *Corduliidae*. These species are very good flyers over medium distances showing a high endurance. Most dragonflies of this family have a metallic green body with yellow markings.

Distribution:

S. flavomaculata is found in Europe and Siberia. In Europe the largest populations are found in northern parts. In Sweden they are established in the south of the country.

Life-cycle:

Adults begin to emerge in the middle of May and also in the middle of August. June is the month, where the most larvae are emerge. The animals are on the wing until the end of September. Between July and August their abundance is at its highest. The metamorphosis of the larva takes place after 3 years. They then need 11-21 days for finishing the development and become sexually mature. Altogether the adults are live for around 2 month.

Diurnal Behaviour:

Adult imagines may be seen flying over the water between 10.30 and 18.00. Often there are more males than females. The best time for catching them is around midday, and during the afternoon.

Habitat:

The larvae of *S. flavomaculata* live in mesotrophic-eutrophic rivers and bigger lakes, with a succession zone with *Carex* species and *Juncus* species. Typical aquatic habitats, where breeding takes place are swamps, fertile fens, extensive wet meadows, and transition zones by bogs. They avoid Ombrogenous bogs.

The adults have aquatic and terrestrial habitats. Sometimes the terrestrial habitat is at some distance from the aquatic habitat. The terrestrial habitats are sunny clearings, or the forest biotone. This is the place where mating takes place. The water should be next to a forest, or with trees surrounding the lake/river margin.

For a part of the day the water should have direct sunlight. Typical places are areas of ex-peat workings. The insects fly very rapidly over the water, and also over the ground. The larvae prefer lentic habitats. They stay between the thick vegetation or in the mud. If the water dries out, they can survive for 6-8 weeks in the mud.

2.2.4 SOMATOCHLORA METALLICA

Distribution:

Like *S. flavomaculata*, *S. metallica* is found in Europe and Siberia. But this species is established in Middle, North and East Europe.

Life-cycle:

Adults begin to emerge at the beginning of May and continue until the end of July. June and the first half of July are the main time of emergence. They fly until the middle of September. The best time for observation is July and August. The larvae need 2-3 years for development.

Diurnal Behaviour:

S. metallica is active from 9 a.m. until the dusk. Sometimes the females are flying after night-fall.

Habitat:

The larvae live in large areas of standing water like lakes, Ox-bows, peat workings, fertile fens and transition zones. Often the waters are dystrophic. They may also be found in flowing water where they are found in the tributary and the drain zones. It is a typical 'lentic-lotic habitat species'. The hunting territories of the adults are often some 100m far away from the water where they mate and lay their eggs. For reproduction they prefer water with a woodland surround. Normally banks are often steepened by erosion. The females need these steep banks for their egg strings.

The males fly 0,1-1m above the water. The larvae stay between the plants on the muddy substrate. They can live in water without shade, and in strong currents. The larvae are also tolerant of cold water. That is the reason why they often

live in cold forest water. The larvae can survive being frozen in ice for a few days. They can co-exist with fishes if the fish population is not too high.

2.2.5 LEUCORRHINIA RUBICUNDA

The last 5 species belongs to the family *Libellulidae*, and this is the family with the most representatives is on Store Mosse. The dragonflies are a shorter abdomen. The adults are not so good at flying as the *Aeshnidae*. It is possible to see them sitting on the ground or on vegetation. *L. rubicunda* lives in the lagg-zone, dystrophic ponds, bog pools or peat-diggings. At Store Mosse the peat-diggings are really important for them, especially the one done by hand. The biotops need buffer zones. This species is strong in danger, they live in rare biotops. Important is the care of the breeding area.

2.2.6 LIBELLULA QUADRIMACULATA

Distribution:

L. quadrimaculata is found in Siberia and the Holarctic. The species lives in most parts of Europe outside of the Mediterranean countries and the northern part of Scandinavia.

Life-cycle:

The adult insects emerge from the beginning of May until September, most emerging at the end of May. Adults can be observed on the wing until September, the greatest abundance being during June and July. If all conditions are favourable, the nymphs need one year to develop into adults, and 12-18 days are needed to become sexually mature. The maximum life of the adults is 48 days. Often birds catch the powerless older insects as they become weaker.

Diurnal Behaviour:

Whether the dragonflies are active or not is dependent on the temperature. If the weather is warm *L. quadrimaculata* reaches the water around 7 a.m., later if the weather is cooler. Normally

they stay there until 5 p.m., although sometimes, when the day is warm and sunny, the dragonflies may fly until the sunset.

Habitat:

The nymphs of *L. quadrimaculata* live in mesotrophic-eutrophic water, in pools, swamps, fertile fens, seasonally dry artificial ponds, oxbows or in dystrophic bogs. The adults need forests, meadows or bogs as hunting territory. For oviposition they prefer lakes with margins which show a moderate amount of succession. These lakes are often surrounded by woodland but are nevertheless sunny.

The larvae stay in the reed zone, or sometimes in the open water area. They need standing water. Often the water is slightly acidic and the water temperature of their habitat should not show large variations. They can survive in water with a lot of fishes because they live in the benthic zone. They survive drought by burrowing into the mud.

2.2.7 ORTHETRUM CANCELLATUM

Distribution:

O. cancellatum is found in most part of Europe, although not in northern parts of England and Scandinavia, but eastwards up to Asia.

Life-cycle:

Adults begin to emerge at the beginning of May and continue until the beginning of September. The maximum emergence takes place during the first part of June. The dragonflies fly until the end of September, with the largest population flying during the months of July and August. The development of the larvae needs 3 years. After emergence of the adults, they require between 10 and 21 days to become sexually mature.

Diurnal Behaviour:

In the morning *O. cancellatum* reach the water between 7-9.00 a.m., depending on the temperature. After 5 p.m. the population goes to rest.

Habitat:

The larvae live in mesotrophic and eutrophic standing water like lakes, pools, ponds and bog water. This species tolerate humid damaged areas and it is typical of water intensively used by people.

The adults need a medium or large area of standing water for their courtship and mating behaviour. The surrounding area is often open. For hunting they prefer meadows or areas which lie fallow.

They are big vagabonds and often change their position. The larvae stay at the shallow water zone without vegetation and dig into the mud. They can live in lakes full of fishes and which are used for swimming. They prefer water without current. Sometimes the water is oligomictic.

2.2.8 SYMPETRUM DANAE

Distribution:

S. danae has a circumboreal spreading. It is common in Europe. The population more common in the South and Atlantic parts. The imagines like a moderate climate.

Life-cycle:

The adults emerge late, at the end of June. The larvae of peat water are 1-3 weeks later because the climates are more cold.

The main emergence takes place at the end of July until the middle of August. The dragonflies fly until the end of October and the best time egg stage, and the larvae need between 2-6 month for their development. This depends on the temperature and the prey available. The maturation period is 10-13 days after emergence of the adult.

Diurnal Behaviour:

S. danae reaches the breeding area between 9-11 a.m. After 3 p.m. their activity strongly decreases.

Habitat:

The dragonflies live in oligotrophic-mesotrophic lakes, pools or seasonally dry artificial ponds.

Often the succession towards a terrestrial habitat is well advanced. They may live on the border of high moor and transitional bog. There they prefer peat-diggings and dystrophic ponds. If this species is found to be established on ombrotrophic high moor, it indicates degeneration of that moorland. The adults need the forest biotone, or clearings for hunting, and bushes on which to rest. They only breed in areas of water below 200m, and this water should be sunny and sheltered from wind. The imagines are not very timid and it is easy to catch them. With increasing age the males get more and more dark.

The larvae live between the vegetation on the lake bed. If they live in swamp, they prefer warm water areas. Normally they live in standing water but they can tolerate slow currents with the water full of chemical nutrient and sometimes eutrophic. The environmental temperature may be very high and the larvae live in the shallow water zone. The larvae are very mobile and that is the reason why they are often seen and killed by fish. They only live in large lakes.

2.2.9 SYMPETRUM SANGUINEUM

Distribution:

S. sanguineum is found in West, Middle and East Europe, reaching Western Siberia. It is a common species.

Life-cycle:

The adults emerge between the middle of June and the middle of October, the main time of emergence being July and August. The animals fly until the end of October. August and the first half of September are the months of their greatest abundance.

The nymphs need 6-8 weeks for development. The maturation period continues for around 8 days.

Diurnal Behaviour:

Between 10 a.m. and 4 p.m. they remain by the water. The rest of the day, they spend the time on meadows or at the forest biotone.

Habitat:

The larvae live in standing and slow flowing water. Mostly, the habitat is mesotrophic or eutrophic. Normally they can be found at lakes, ponds, seasonally dry artificial ponds, streams, fertile fens, swamps and dystrophic lakes in Sphagnum Bogs. This species avoid oligotrophic bogs and the centres of ombrogenous bogs. Most waters where it breeds have a zone of newly formed land and they should be sunny.

The larvae of *S. sanguineum* live close to the bank amongst the aquatic plants. They avoid open water areas and prefer standing water. Normally the water is mesotrophic or eutrophic, sometimes hypertrophic. The eggs can tolerate being frozen in ice, as well as relatively high temperatures, in the dark bog waters. The larvae can survive drought for around 4 weeks.

2.3 DRAGONFLY CONSERVATION

Many dragonflies are endangered species, and the care of our native dragonflies has international, as well as national, importance. All dragonflies are protected by the German BNatSchG law. Of the species recorded on Store Mosse, only *Leucorrhinia rubicunda* is a species of the EU Red List noted as "+" (Taxa known to be threatened but currently under review by IUCN; EU Red List).

None of the species are covered by the Berne Convention or the FFH (Flora Fauna Habitat) lists. Nevertheless, a lot of the species recorded on Store Mosse are rare and deserve attention. The reason why the most Dragonflies are endangered is due to their specialised habitat requirements. Most species prefer natural biotopes which are under threat, such as the different kinds of bogs, swamps, pond, and oligotrophic lakes, or clear flowing water with slow current. A lot of our waters are artificial, (anthropogenic) and caused at least partly, by human activity.

It is necessary to build a buffer zone to conserve the dragonfly habitats, and to protect them from intensive fish stocks.

Different species have different habitat requirements. Some species prefer both sunny and

shady places, like *Calopteryx virgo*. Other prefers sunny places for mating. Normally the larvae need vegetation for hunting and as a hiding-place. *Orthetrum cancellatum* is an exception. If the succession towards a drier terrestrial habitat is too advanced, it may be necessary to stop it by active habitat management. Often peat-diggings become filled in, and it is necessary to dig them out again, by hand. Rare species like *Aeshna subarctica* or *Leucorrhinia rubicunda* all benefit from this kind of work. Woody litter in the water is important for the structure of the larval habitat of *Aeshna grandis*.

If a suitable habitat and area of water is rare in a region, new habitats can be created. In an

area such as Store Mosse a large variation in habitat structures is important for a rich species diversity. For example, open bog, grassland, forest clearings or bushes may be situated next to areas of water.

Different species of dragonflies have different needs for hunting, resting, and mating. For example, a species like *Somatochlora metallica* can become established only if all its necessary habitats are close together. All necessary care should be taken to create or retain this habitat mosaic. If a habitat must be changed, then the important old structures should be retained.

3. SUGGESTIONS FOR FURTHER WORK

When the distribution maps of Swedish dragonflies is studied, it seems that the present list of species from Store Mosse is probably incomplete and, in order to try and correct this, observations should be made regularly throughout the full season. Last year during the month June, Students of the Hochschule Anhalt (FH) found *Cordulia aenea* and *Aeshna juncea*.

The location of the larval habitat of *Calopteryx splendens* on Store Mosse is not certain, an more observations need to be carried out on this species.

I found only one specimen and this could have been a visitor from an outlying biotope. *Calopteryx splendens* is a good flyer and so to see one specimen is not a sufficient proof of autochthony. The canals are a typical habitat for *C. virgo*, which were observed often, but not for *C. splendens*.

Other areas of the national park, such as the area around the Kävsjön and the Häradsösjön should also be studied. The abundance of the different species was only estimated during the current study. For more accurate results the exuviae should be collected. This is time-consuming work. The exuviae should be searched for 3 times a week during the month when the adults are emerging. Sometimes the larvae emerge onto the land where they may be found up to 10 m from the water. Some climb onto trees for their final ecdysis. However, there are many advantages to counting exuviae.

PRESERVATION FOR STORAGE:

These insects do not preserve well in alcohol and when pinned and set dry, the colours are more lasting.

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