

## Field notes of two hunters for *Nehalennia speciosa* in boggy Vasyugan Plain, West Siberia

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Sambusskoe bog, a typical landscape of West Siberian peat bogs with pools

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## Introduction

In July 2005, Rafal Bernard requested Oleg Kosterin to collect some samples of *Nehalennia speciosa* from West Siberia for a DNA analysis. Oleg replied that so far he had only seen one individual of this species 25 years ago but asked in which habitats it should be sought for exactly. Rafal sent him a draft of his paper (Bernard & Wildermuth, 2005) devoted to this subject. Having read it, Oleg came to the conclusion that this habitat (shallow water with *Sphagnum* and *Carex limosa* or *C. lasiocarpa*) might occupy the largest area in the world just in the boggy West Siberian Plain. Personal consultation with the geobotanist Dr. Nikolai Lashchinskii confirmed this notion. Then an almost automatic supposition followed that this area may serve as the main reservoir of *N. speciosa*, considered a local and endangered species in Western and Central Europe. At the same time, the existing records of *N. speciosa* from West Siberia were remarkably scarce. It was known from the Khanty-Mansi Autonomous Region (basins of the Tura and Konda Rivers), a small number of records from North Altai and adjacent areas north of it, a record from the steppe zone of Novosibirsk Province (Karasuk), a record in the basin of the Tuba River, and a dubious old record from Omsk (see the map in Belyshev (1973) and a review in Bernard & Wildermuth (2005)). There was no record from the boggy Irtysh-Ob' interfluvium, where we would expect the species to flourish. This could be explained by the lack of attention by odonatologists to that interesting area. In these circumstances, the project of a special expedition(-s) was put forward, aimed to check the presence, pattern of distribution, abundance and habitat preferences of *N. speciosa* in these areas. For a decisive expedition we chose the Vasyugan Bog, the largest bog in the world, more precisely its north-eastern margin where we could find a good base in Plotnikovo village, Bakchar District, Tomsk Province.

## Area

The West Siberian Lowland and the Amazon Lowland are the largest lowlands in the world. A great part of the former, which is within the taiga zone, is substantially boggy, and the total area occupied by bogs has increased at a speed of 0.8 km<sup>2</sup> a year. Especially famous is the Vasyugan Bog, the largest bog in the world (53 000 km<sup>2</sup>), which occupies the very slightly elevated and flat Vasyugan Plain situated between the rivers of Irtysh and Ob'. It extends for 500 km from the WNW (approximately 58°N 75°E) to the SSE (approx. 55°30'N 83°E) as a strip 75-175 km wide. It embraces about 800 000 lakes accumulating in total 400 km<sup>3</sup> of



water and is drained by the rivers of the Tara, Om', Vasyugan, Parabel', Chaya and their tributaries. Administratively, it is divided along its main axis between the Tomsk (north) and Novosibirsk (south) Provinces, with the western part belonging to Omsk Province. This mostly peat-moss bog is not continuous but somewhat resembles a fish skeleton: it has a fairly narrow axis of sublatitudinal orientation and side branches which like spurs protrude north and south from the axis. During our expedition, we explored the two northeasternmost spurs of the bog called Bakcharskoe and Iksinskoe Bogs, which comprise the upper 'tail fin' of that 'fish', and the Sambusskoe Bog forming its 'back fin'.

The elevations of the Vasyugan Plain descend from 160 to 100 m a. s. l. from south to north and northeast (Meshcheryakov 1962). The surface of the interfluves is flat with numerous shallow depressions of thermocarst and suffosion origin. The relief is very shallow and only near the rivers (such as the Shegarka, Iksa, Bakchar) erosion valleys of small water flows are expressed. The soils are formed from subaerial loess-like sediments which cover, with a layer 5-40 m thick, the clays and clayey sediments of lake origin. Hydromorphic soils play a great role in the area, with a variable expression of a relic humus horizon formed in meadow carbonate soils during the climatic optimum of the Holocene (Lapshina et al. 2000). The peat bogs covering a large part of the Vasyugan Plain are not connected with ground water and are formed due to the prevalence of precipitation over evaporation in conditions of a negligible water outflux on almost perfectly flat land surfaces (Sorokin et al. 1999). The growth of the peat layer led to the formation of an inverted relief, where the former ridges of mineral ground, bearing forest islands, appeared surrounded by rising peat-moss bogs. At last they became relief depressions with open quagmires locally called 'galya'. In these mires, the water usually flows through the vegetation and peat with quite a considerable speed (up to 20 cm/h). These mires form sources of brooks providing outflux of the bog waters into rivers (Lapshina et al. 2000). According to reconstructions reviewed in Lapshina et al. (2000), the bogs of that area appeared first at the end of the Atlantic period and the beginning of the Subboreal time: at places with a 3.6-3.8 m thick peat layer 5200-5500 years ago, in most areas, with a 2.5-3 m thick peat layer, 3000-3500 years ago. At first they were represented by swamps with horsetail, *Equisetum*, which occupied the relief depressions. Very soon they extended beyond depressions, merged and occupied interfluves, leaving buried relic meadow soils. At that time the bogs changed to eutrophic swamp biocenoses with domination of sedges, *Carex*, which existed for a long time leaving 1-1.8 m of peat. The impoverishment of mineral feeding and an increase in precipitation transformed them into



mesotrophic *Scheuchzeria-Carex*, *Scheuchzeria-Carex-Sphagnum* and *Carex-Eriophorum-Sphagnum* associations. At the crucial moment of development the bogs enlarged so that water outflux along the slopes of the watersheds began. This led to the mesotrophic bogging of dark-needle and mixed forest on the gentle slopes of the Vasyugan Plain, while the watershed bogs passed into the oligotrophic stage of development (which has persisted until now). This occurred at the border-time between the Subboreal and Subatlantic periods, between 2000 and 2200 years ago. At that time overmoisted *Sphagnum* and *Eriophorum-Sphagnum* bogs and pine-*Sphagnum* associations appeared. 1500-1000 years ago the fruticulose-pine peat-moss complexes (locally called 'ryam') spread and became dominating. In Russian scientific literature these formations are called ridge-fen ('gryadovo-toppanye'), ridge-lake-fen ('gryadovo-ozerkovotopyanye') and ridge-hollow ('gryadovo-mochazhinnye') complexes. In these Russian terms the "ridges" correspond to patches (with low pine) only slightly elevated above peat-moss open bog.

Out of the locations visited by us, we have precise structural and climatic information about the Bakcharskoe Bog: its size 10-25 x 150 km, the peat depth 2.6-3 m, the water pH=3.5-5 (Lapshina et al. 2000); mean annual precipitation 420 mm (7 mm in June), mean snow cover 90 mm, average humidity in the warm season 30-40% in the daytime and 100% at night (Sorokin et al. 1999). In 1986, some irrigation was started with the aim of peat digging, but it was not successful and left only a system of ditches.

There are also fairly numerous secondary water habitats in the Vasyugan Plain. They are represented by various, mostly small water bodies (pools and ponds on mineral substrate) situated mostly in rare villages and along the roads and tracks, and by fire-fighting pools, irrigation ditches and canals in peaty areas.

## Notes

12 July

We departed from Novosibirsk on July 12, 2006 and were driven northwards through even and regular wide meadows or fields alternating with birch-aspen groves in relief depressions, so characteristic for the forest-steppe of West Siberia. Soon after entering Tomsk Province first spruces and 'cedars' (*Pinus sibirica* Du Tour) appeared. An impressive very dark cedar forest near the village of Bozoi seemed to be the main source of income for its inhabitants, many of which sold cones and nuts by the road. However, further north the conifers soon disappeared. Only north of Kozhevnikovo the birch-aspen forest started to



predominate over the open areas, which meant that we were already in the so-called subtaiga zone. After Mel'nikovo spruces appeared first, later cedars and firs became visible among the deciduous trees. Although their proportion was still small, this was already considered the southern taiga zone. The village of Tyzrachevo (or Tazyrachevo, the former spelling was found on the road sign while the latter on the map) at the Shegarka River delighted us with its adjacent beautiful, dark cedar forest. Soon after we passed the first signs of the boggy plain, two places where the peat-moss bogs with depressed but dense pines were seen from the road. Then Plotnikovo, our destination, appeared quite suddenly, indeed with some fir forest seen behind the Iksa River.

We were accommodated at the field station of the Institute of Soil Science and Agrochemistry of the Siberian Division of the Russian Academy of Sciences. It was a village yard with several wooden buildings and metal trailers. Just behind the fence, some meadow patches descended to the high bank of the Iksa River (fig. 3), through a strip of birch, bird cherry and a spruce stand.



**Figure 3:** An example of current waters draining the Vasyugan Plain, the Iksa River in Plotnikovo



The river had clayey banks, brown, peaty water, a very slow, almost unrecognizable current, and was rimmed with tall sedges (locally on muddy ground). Over the yard and, mostly, on meadow patches in front of tree stands, there were numerous foraging *Somatochlora*, flying 1-5 m high. They appeared to be mostly females: among them, remarkably dark-winged ones were noticeable. The darkest were two *S. arctica* and two *S. flavomaculata*, but we also collected two fully or almost fully clear-winged females of *S. arctica*, an intermediate female of this species, and a clear-winged male of *S. metallica* which flew low over the grass. Such individuals of *Somatochlora sp.* also frequented the space above other yards on our street, and everywhere closer to the river, also at tree crowns from the riverside, but not above the very river. On the river, there were abundant males of only *S. metallica* patrolling just above the water surface, and it seemed a very suitable habitat for this species indeed. A male of *Libellula quadrimaculata* and a male of *Aeshna grandis* were also observed above the water, and we collected a certainly strayed female of *Aeshna juncea*. All along the shore zone consisting of sedges individuals of *Coenagrion hastulatum* were always present, including a tandem attempting to oviposit.

In the early afternoon, we retraced our footsteps along the road to Tomsk to see some roadside water bodies. There was a belt of waste land along the road, bordered with birch/aspens forest. 500 m E of the village we reached a roadside pool with clear shallow water on a loess-like substrate. Its abundant emergent vegetation consisted of a stand of *Phragmites australis* and *Typha latifolia*, widespread *Eleocharis palustris* interspersed with scattered *Alisma plantago-aquatica*, some patches of *Equisetum fluviatile* and *Carex acuta*. On the water surface some leaves of *Potamogeton alpinum* were floating. Submerged vegetation was represented by abundant mosses and *Lemna trisulca*. Among the lower vegetation very numerous *Coenagrion johanssoni* and numerous *Coenagrion hastulatum* and *Lestes dryas* were active, also in tandems. Emerging *Lestes virens*, with features of the subspecies *vestalis* but remarkably small, occurred in rather moderate numbers, and emerging *Sympetrum danae* were very rare. There were many *Leucorrhinia rubicunda* and quite abundant *Libellula quadrimaculata*. Surprisingly, two or three males and two females of *Leucorrhinia dubia* (allochthonous?) were observed or collected. One of the *L. rubicunda* males captured a tandem of *C. johanssoni*. During the consumption of the male of this tandem, the female escaped. Two territorial males of *Aeshna crenata* patrolled the pool, and one female oviposited. Several exuviae of this species were found. *Sympetrum flaveolum* was recorded both at the pool and around it. A large glade was protruding from the pool towards the birch/aspens forest. Above the glade, apart from the pool, fairly numerous female



*Somatochlora* foraged, mostly *S. arctica* but also *S. flavomaculata*. The females of the former species varied greatly for the darkening of wings but all *flavomaculata* females were dark-winged.

We returned to the village and approached the bridge on the Iksa River. By the road we collected two foraging males and several females of *Somatochlora arctica*. Upstream and downstream, the banks were overgrown with a luxuriant sedge *Carex acuta* harbouring fairly abundant *Calopteryx splendens*. Among females, two were typical, one with a hardly smoked wing distal part, and, to our great surprise, three were androchrome, of which two had both wings coloured up to their tips and one represented f. *faivreii* with clear wing tips. It should be noted here that Oleg Kosterin examined the type specimen of *Calopteryx splendens johanseni* Belyshev, 1955 and it appeared identical to f. *faivreii* (O. Kosterin, unpublished). We also collected a male of *Ischnura elegans* above the water (it remained the only specimen of this species for the whole expedition) and a very old female of *Sympecma paedisca* in a sedge. A male *A. crenata* patrolled its territory above the river and a female *L. quadrimaculata* oviposited in the side zone. *S. metallica* was abundant and a tandem of *C. hastulatum* flew along vegetated banks.

13 July

In the morning we joined Dr. Glagolev and his students who departed for the Bakcharskoe Bog, to its part also known as the Bobrovskoe Bog. After 11 km on the road our special vehicle turned left, we followed a straight forest track for 3 km, which was very muddy and with numerous deep hollows. The track was accompanied by a drainage ditch with dark-brown water, flowing surprisingly fast through the dense and even forest of *Betula pubescens* and *Pinus sylvestris* with quite frequent cedar saplings. Our vehicle was pursued by extremely numerous and various *Tabanidae*, from small *Haematopota* to the huge wasp-like *Tabanus*, and thousands of mosquitoes. But other insects were very scarce. When the track appeared impassable we left the vehicle and started walking southwards. Coming close to the ditch we saw patrolling individuals of *S. metallica*. Along the ditch, birches and pines grew densely but other areas were covered with a remarkably low but quite dense and even pine stand grown on the peat-moss bog. The pines were about 3 m high, yet they hardly resembled pines from any forest and all this looked as if it were a pine forest diminished in size. The ground was covered by a dense shrubbery of *Chamaedaphne calyculata* and locally abundant *Ledum palustre*, *Betula nana* and *Andromeda polifolia*. We occasionally saw some solitary foraging *Somatochlora*, two of which turned out to be *S. arctica*, and we collected a male of *S. metallica* at the ditch.



After 2 km we reached the ecologists' hut. Above the ditch there ranged a male of *S. metallica*. Behind the hut a fire-fighting pool was situated, with black water, quite cold except for the warmed up surface level. Above it a male *A. crenata* controlled the situation, in the sedges at the banks *C. hastulatum* occurred, and nearby both sexes of *L. dubia* perched on low pine branches. We departed from the hut in the same southern direction via the same dwarf pine forest on a peat bog, along a forested ditch which now missed willows and most of its birches but retained pines. It was easier to go along the ditch due to a firm ground in its surroundings, but the path was very narrow and weak while the low trees were dense. Locally we met groups of *Rubus chamaemorus* with fruits, partly ripe. Dragonflies were represented mostly by *L. dubia* of both sexes and also flying *S. arctica*. At 3 km from the hut, the pines became taller and we soon entered a strip of 'normal' birch forest on a mineral substrate, surprisingly with no pines. At its edge an individual of *L. quadrimaculata* with heavily spotted wings was collected. Behind the forest the path, through the same low pine bog as earlier, became even less defined and hard to move along. After about 1 km, which seemed longer, we crossed a transversal ditch and entered a wide open area ('galya'), through which a plank path was laid, that strongly facilitated moving. Dr. Glagolev told us that on the satellite photographs these open places look like some flows, and the water in them flows indeed with a speed of ca 20 cm/h. The open fen was formed by a brownish peat moss and sedge leaves (mostly of *C. rostrata*), there appear *Drosera rotundifolia* and *D. anglica* in large quantities, and *Scheuchzeria palustris*. Behind the open belt, we entered a 'coppice' of truly dwarf pines, 1.5-2 m high and ca 100-150 years old, with remarkably short needles, which seemed like some fantastic vast bonsai park, with nobody to enjoy it.

At the end we came into some gaps/corridors in the pine bog where a chain of small pools of open water was situated, the so-called Tseepochka (chainlet) Lakes. We visited only two of them. At the first a Japanese automatic station, situated in the bog, measured a large set of physical and chemical parameters, including emission of the greenhouse gases, methane and carbon dioxide, for a long-term Japanese-Russian joint project. It was exactly here, at this very pool, that the first acidophylic methanogenic bacterium and the first facultative methanotrophic bacterium were discovered. Dr. Glagolev informed us that here the bog was 1000 years old, while the one at the hut, 5 km behind it, was 5000 years old. The clouds grew and produced three stormy, short but very heavy showers, with huge drops and hail, the size of a pea. The dragonflies on the pools seemed not to pay special attention to the rain until it was heavy. The bog was strongly suffused with water, so its penetration, especially close to water bod-



ies, was almost impossible. It was partly overgrown with *Rhynchosporetum* while the border zone of the open water table was occupied by a transition-mire vegetation predominated by *Carex limosa*, *Scheuchzeria palustris* and *Menyanthes trifoliata* with some *Utricularia* sp.. Nymphaeids were represented mostly by *Nuphar pumila* and locally by *Nymphaea tetragona*. Above each pool, there reigned males of *A. crenata* and above the bog, especially its depressions rich in water, we collected a male and a female of *Aeshna subarctica*. *L. dubia* was fairly abundant, *L. quadrimaculata* rare. Sparse *S. flaveolum* seemed to be immigrants from somewhere else. Damselflies were predominated by abundant, also teneral, *Lestes sponsa* and fairly numerous *C. johanssoni*, while *C. hastulatum* occurred in moderate numbers (copulation). Our great expectations were fulfilled early, *Nehalennia speciosa*, though fairly rare, occupied its typical habitat – the shore sedge zone of the second pool. *Enallagma cyathigerum* belonged to rarest species (only one male collected) similarly to *Lestes virens* of which only one teneral individual was caught. Very few males of *Erythromma najas* perched on floating leaves. Generally, the dragonflies were rather abundant on the pools but scarce in the surrounding bogs so these bogs looked pretty lifeless. Birds also were very rare: we heard and saw only *Motacilla alba* at the pools, and startled a wood-grouse with fledglings from the ditch bounded by forest, and that seemed to be all.

In the late afternoon we started our return journey. First, to the hut, where we spent about an hour. In an open area in front of it flew about a dozen *S. arctica* females, varying in wing darkness, and one female *S. flavomaculata*. This latter species might have originated from an adjacent, vast open fen overgrown mainly by *Carex lasiocarpa*. There was no open water table near the hut at present but the fen was still so suffused with water (which appeared locally above mosses) that it was completely impenetrable. In the spring the water must have occurred in greater quantities on the surface at least locally. On satellite photographs more distant areas of the fen even seem to have some open water. Very few individuals of *S. flavomaculata* penetrated the fen but a tandem was caught there. We also saw a few individuals of ubiquitous *S. flaveolum*. At about 19.00-20.00, blackflies (*Simuliidae*) were more active, followed with mosquitoes furiously biting while we were in the forest. When we reached the main road, we were lucky to observe a male *A. crenata* which captured a *Somatochlora* and flew with it.

14 July

It was again hot and sunny. At about 11 we crossed the bridge and descended from its embankment to a group of small secondary water bodies, probably



post-excavation remains. Due to bounding by willows and a spruce-birch taiga the glade was very warm, and the pools were additionally situated in depressions that increased this impression. Astatic, and even partly temporary shallow pools were overgrown with abundant *Ceratophyllum submersum* and *Lemna trisulca*, with *Spirodela polyrrhiza* and flowering *Hydrocharus morsus-ranae* covering a large part of the water tables. Locally, *Carex pseudocyperus*, *Alisma plantago-aquatica*, *Typha angustifolia*, and *Calla palustris* occurred. Numerous individuals of *Somatochlora* flew above the glade and between willow bushes, dark-winged among them. We collected several and all but one were *S. arctica*, the exception was a dark-winged female of *S. flavomaculata*. Territorial males of *A. grandis* flew above the largest pool, and two females were ovipositing. *L. quadrimaculata* and *L. rubicunda* were abundant. We also collected a male of *Leucorrhinia pectoralis* - 2° north of its northern known range limit in this region. Rather numerous *S. flaveolum* kept near the water and among the vegetation of the glade. Out of Zygoptera, fairly abundant *C. johanssoni* and *C. puella* dominated (tandems, ovipositions). We collected a tandem of the latter species composed of two males. These species were accompanied by rare *C. hastulatum* and single *L. dryas*, *L. sponsa*, and *E. najas*.

In the early afternoon we began to move upstream along the Iksa valley, along willow shrubs, via the site of a former village street, with some ruins of wooden houses covered with nettles, and through open areas with high herbaceous vegetation up to the place where the spruce taiga approached the river. Numerous individuals of *Somatochlora* still flew above: mostly females of *S. arctica* and some *S. flavomaculata*, but we also caught two males of *S. arctica*. Some *S. flaveolum* occurred there. But the greatest trophy of this walk were gomphids. Oleg had expected to find *Ophiogomphus obscurus* and *Nihonogomphus ruptus* in this region, although neither have yet been encountered west of the Ob' River. But we collected *Gomphus vulgatissimus* (2 males and 3 females) and a female *Shaogomphus postocularis epophthalmus*. These species were among the most remarkable discoveries of our expedition. The Iksa River in Plotnikovo, situated 185 km NNW from the nearest known population of *S. postocularis* (Kosterin et al. 2001), became the first site of this species west of the Ob' River, the westernmost locality of this species and the northernmost one in West Siberia. What is more, it was its first record on a perfect plain, for earlier it was considered to occur in the northern and western foothills of the Altai-Sayan Mountain System (Kosterin 2005). For *G. vulgatissimus*, this locality was also situated much further north (exactly 185 km NNW) than the sole area of distribution of this species known so far in Siberia, i.e. that one located ca 30-70 km south and 50-70 km east of Novosibirsk (cf Kosterin et



al. 2001). Both banks of the river were occupied by strips of *Nuphar lutea*. A male of *A. crenata* flew there, accompanied by numerous *L. quadrimaculata* and *S. metallica*. Several *C. hastulatum* were also present as usual, both above the water and in the herbaceous vegetation.

15 July

The early morning seemed colder than two previous mornings. We noticed that *Somatochlora*, which during the three preceding days were abundant above our yard and adjacent meadows, had disappeared. When we returned at 6 p.m., *Somatochlora* were also absent, so their disappearance at this place seemed to be complete. The butterfly *Nymphalis xanthomelas*, numerous in previous days, also became scarce this day. However, patrolling males of *S. metallica* at the river were in their place, as usual. In the following days, we confirmed that foraging *S. arctica* significantly decreased in numbers at other sites as well. Therefore, we assumed that most of the *S. arctica* individuals must have completed their maturation period at around the 14 July which was very hot, and moved to their breeding places. Many *N. xanthomelas* may have turned to aestivation.

At 10 a. m. we departed east to Mel'nikovo, to the swamps near the Ob' River. At about midday we reached a swamped western edge of the Ob' floodplain, the Obskoe Swamp. The very wide stripe of swamps (with some open water), crossed by our road, was overgrown with low birches, willow thickets and abundant herbaceous vegetation, such as *Carex paniculata*, *Carex pseudocyperus*, *Carex rostrata*, *Caltha palustris*, *Comarum palustre*, and *Menyanthes trifoliata*. Among this 'sogra' (a local word for such a type of land) there were patches of reed and quagmire, and a pool of open water, with *Typha latifolia*, *Acorus calamus* and *Carex lasiocarpa*. The place was astonishingly poor in dragonflies: during about 40 min of extremely difficult progress through the swamps we only saw three individuals of *L. sponsa*, four of *S. danae*, and one male and an ovipositing tandem of *S. flaveolum*. Above an open pool with a school of ducks, a territorial male of *A. crenata* appeared. *A. grandis* (a territorial male and an ovipositing female) and a number of *L. quadrimaculata* were also present. Along the high road, there flew several males of *S. flavomaculata*, which must have bred in this swamp. Then we moved to the firm land which separated the swamps from a side western branch of the Ob' River. At an overgrazed, rather ruderal meadow, bordered with a stand of tall *Salix alba* and by the swamps, scarce *A. grandis*, *S. flavomaculata*, *L. quadrimaculata* and *Sympetrum sanguineum* were observed. Near some willows we collected a late female of *Cordulia aenea*. Several individuals (also tandems) of *S. flaveolum* concentrated



at ruts temporarily filled with water. All these species must have originated from the swamps. A single *S. metallica* was the only species related to the fairly fast flowing waters of the river branch.

On the way back home we briefly visited the Shegarka River near Tyzrachevo, halfway between Mel'nikovo and Plotnikovo, where we collected a tandem of *C. splendens* and one female of *G. vulgatissimus*, the latter now representing the second locality in the Vasyugan Plain, 170 km N from the nearest locality known before our expedition.

In the evening Oleg rode a bike north of Plotnikovo, where he explored very large meadows being, in fact, old fallow lands. Above them hunting *Somatochlora* were rather abundant, but generally less numerous than in previous days. Females of *S. metallica* were excellently recognizable by their very low flight, 0.5-1 m above the ground. Other *Somatochlora* flew at 1.5- 3 (4) m, some of them smoothly, others with a frequent pulsation. On a vast meadow, which came close to the river, several females were captured: 4 of *metallica* (and 1 male), 3 of *flavomaculata*, and 2 of *arctica*. Weakly dark brown smoked wings of *S. metallica* had an intensive amber-yellow colouring along their costal margins. In comparison to them, the wings of *S. flavomaculata* were much more coloured: an intensive amber smoking extended along the anterior margins and comprised also broad bases, and slightly weaker more brownish smoking covered almost the whole remaining parts. Individuals of *arctica* were moderately dark-winged and clear-winged. It is worth noticing that in the area explored during the expedition, females of all three species of *Somatochlora* demonstrated a trend towards darkening of wings. This feature seemed to be most explicit in *S. flavomaculata*, less marked and more varying in *S. arctica* and weak in *S. metallica*.

16 July

The morning was warm but overcast, with few gaps in the clouds. The sun appeared at about 10, but clouds still prevailed. At 11 we came to the southern part of Plotnikovo. Near the river, *Somatochlora* females "swarmed": numerous *flavomaculata* and some *arctica*. Following the student Nikolai Shnyrev we crossed the river and entered the spruce taiga, with birches, some cedars and rowan trees. At first it was grassy with nettles, later the nettles disappeared while *Oxalis acetosella* became the most abundant herb. Going along a path, very muddy and with fallen spruces, was not easy. The first oxbow took the form of a long clearing evenly overgrown with reeds, *Thelypteris palustris*, and *Carex lasiocarpa*, with hardly a recognizable water surface partly covered with *Lemna minor*. There were no dragonflies. The second former oxbow, situated



0.6 km west of the river, seemed to be more promising. A long and quite wide, bow-shaped open area was totally covered with a peat-moss quagmire predominated by *Sphagnum* and very abundant *Oxycoccus palustris*, with *Carex rostrata*, *C. lasiocarpa*, *C. diandra*, *Drosera rotundifolia* and *Scheuchzeria palustris*. In the middle, an interrupted line of flowering *Comarum palustre* with sparse *Typha latifolia* and *Menyanthes trifoliata* showed that the water was more abundant there, locally appearing on the surface. Probably this area was inhabited by *S. flaveolum* hanging around in considerable numbers. Surprisingly, we also observed a female of *A. crenata*, with a hooked abdomen, flying out of the *Comarum* which suggested a possible oviposition. Other species native for this oxbow were represented by only single or few individuals. One exuvia of *A. juncea* and one of *L. quadrimaculata* were found during the first minutes in a 'window' of open water among the peat-moss, 50x20 cm in size and quite deep. But it was the only 'window' we managed to find. We did not record any imagines of *A. juncea* and only few of *L. quadrimaculata* in the clearing. In the air, several foraging *Somatochlora* were always in view. Test sampling brought 3 females and 1 male of *flavomaculata*, 1 female *arctica* and 2 male *metallica*. A probably strayed individual of *A. grandis* completed the picture. At the end, a pair of typical birds of the taiga, *Perisoreus infaustus* (Siberian Jay, "kuksha" in Russian), appeared at the edge of the dark forest. They made an impression of seeming to be quite interested in us (and vice versa), and after a longer moment of mutual observations they disappeared back into the spruce taiga. In the afternoon, in view of a thunderstorm approaching for some reason from the east, we visited the man-made pond situated at the northern border of Plotnikovo, next to the road to Borodinsk, seemingly on a brook descending to the Iksa river, with a pasture on one side and an aspen grove on another. Its water was not clear and the vegetation was rather poor, especially emergent vegetation, represented only by rare *Alisma plantago-aquatica*, *Glyceria* and *Carex*. Locally, a narrow shore belt of *Ceratophyllum submersum* covered with *Spirodela polyrrhiza* was attractive to damselflies. The dragonfly fauna, composed of eurytopic and common species, reflected rather low values of this eutrophic and degraded pond. *L. quadrimaculata* reached there the greatest numbers out of all localities visited by us during the expedition. *C. hastulatum* and *E. najas* were also abundant, and *C. puella* was fairly numerous. Characteristic was a total absence of *C. johanssoni*, the species inhabiting waters of lower trophic with abundant but rather low emergent vegetation. We also collected two males of *L. sponsa*, a teneral *S. paedisca* (only four days after recording an old individual), a male of *E. cyathigerum* (only single!), and a male of *C. aenea*. Emergence of *S. danae* must have begun as two teneral individuals



were recorded. A male of *A. crenata* patrolled over the water. The previous evening, males of this species had been slightly more abundant there, and *S. metallica* was also observed (today absent).

The rain forced us to take shelter but the next thunderstorm coming from the east passed Plotnikovo to the south. Therefore, in the evening Rafal Bernard walked along the road to Bakchar, 0.2-0.3 km W of the bridge on the Iksha River, on a roadside swamp. He saw several foraging *Aeshna*, supposed to be *juncea*, and also a beaver swimming towards its hut.

17 July

After a rainy night, several showers separated by short periods of hot sun impeded our activity in the morning. However, at 1 p.m. we departed by bus east to Tyzrachevo village, to the Shegarka River briefly visited by us two days earlier. This river borders the slightly elevated and boggy Vasyugan Plain from the east. Compared with the Iksha River, the water of the Shegarka was colder (a bath was quite refreshing), not dark-brown but slightly turbid with a lighter greenish tint. A faster current, less vegetated shore zones, and bottom deposits, not only muddy but also sandy-gravelly and clayey, completed this difference.

It was sunny and hot with impressive clouds when we get off the bus. The tenor state of the first encountered dragonfly, a male *Sympetrum vulgatum*, and low numbers of this species during the expedition suggested that an emergence of this species might have only begun. In the meadows surrounding the river, numerous *S. flaveolum* occurred but several individuals (including tandems) kept also to sedges and *Butomus umbellatus* in a lentic area near the river bank. There was a patch of a flat and partly clean clayey bank in this place, sheltered by quite high river slopes overgrown with willows. Approaching the river, a mature male of *S. sanguineum* and a tandem of *L. sponsa* were netted. The latter species also penetrated the vegetation at the clayey bank together with very rare *C. puella* and *C. hastulatum*. An individual of *G. vulgatissimus* arrived and sat on the barren ground. However, in contrast to the Iksha River, this gomphid was generally rare at the Shegarka River (two individuals during two visits). Also *C. splendens* seemed to be rarer, and only two females (one androchrome) were recorded. A complete absence of *A. crenata* and *L. quadrimaculata*, and almost complete lack of *C. hastulatum*, stressed the difference compared to Iksha. However, as usual, *S. metallica* males ranged along the bank and an ovipositing female was observed. Lentic shore zones seemed to be appropriate for *A. grandis* which was represented by one male and an ovipositing female. The behaviour of *Aeshna viridis*, represented at least by two males



(one captured) and one female, was striking. One individual, mostly a male, appeared several times above the water as soon as the sun hid behind a cloud but very rarely in sunshine. It flew along an irregular route but mostly downstream and remained over the river only for a short time (the female really briefly), coming back to the bank willows. In Siberia, it is mostly a crepuscular species, and its appearance in the early afternoon was obviously correlated with the ceased sunshine. Such *A. viridis* may be interpreted as foraging(?) individuals originating from another locality nearby.

Afterwards we moved upstream to a bridge. A track descended to the left river bank, to a place where the remains of an old wooden bridge - its piles still protruding from the water - accompanied a modern one. In a gap between bushes we collected a female of *S. arctica*. The shore zone of the water, overgrown with *Butomus umbellatus* and *Sparganium emersum*, was occupied by abundant *S. metallica* and *A. grandis*, accompanied by *C. splendens* and very rare *C. hastulatum*. To our surprise, a male of *C. aenea* ranged among *metallica*-individuals.

Not far from the river a large oxbow was situated in a rather wide glade covered with a degraded meadow, with the very abundant presence of *Geranium pratense* and nettles. On the high bank, the oxbow was bounded by a beautiful 'cedar' forest, and from the river side, the oxbow's depression was bordered mostly with birch groves. The long oxbow had a muddy ground and eutrophic but clear water. It was bounded by a thick rim of high *Bolboschoenus maritimus* (rather a strange situation), with some *Cicuta virosa*. The water surface was partly covered with *Spirodela polyrrhiza*, under which *Lemna trisulca* and *Ceratophyllum submersum* were hidden. In the middle, leaves of *Nuphar lutea* floated in groups. Aeshnids were represented by three species. *A. grandis* reached numbers observed nowhere else during our expedition: numerous males and ovipositing females were a distinguishing feature of this dragonfly assemblage. In contrast, *A. crenata* was rather rare, its male was collected in the neighbourhood and two ovipositing females were observed. The lack of *crenata*-pressure allowed *A. viridis* to be active above the water. Its male appeared only once but at least two females were repeatedly seen flying over the *Nuphar*-groups and between them and the *Bolboschoenus*-belt. Their specific flight over the *Nuphar* suggested a search for oviposition sites. And in fact, one of them (later collected) oviposited a longer moment into a leaf stalk of *Nuphar lutea* which served as a surrogate for the favourite but absent *Stratiotes aloides*! Rich floating and submerged vegetation was certainly the reason for the abundant occurrence of *E. najas*. Other coenagrionids did not reach such numbers: *C. hastulatum* was fairly abundant, *C. puella* rare and *E. cyathigerum*



very rare. Besides fairly abundant *L. sponsa* we also recorded similar numbers of very teneral *S. paedisca*. *S. danae* was another emerging species, a number of its teneral individuals kept to *Bolboschoenus* and the willows. One individual of *L. rubicunda*, a number of *L. quadrimaculata* and numerous *S. flaveolum* were also found.

Several *S. flavomaculata* were flying quite high above the adjacent glade, whereas two female and one male *S. metallica* were collected low above the grass there. At some distance, in the same valley there was another round oxbow with some *Salix alba* trees and an aspen forest on the rather steep slope behind it. This oxbow had green water due to algae and was remarkable for a wide and continuous rim of vigorously flowering *Cicuta virosa*. During a short visit there we found the same common species of odonates. When we returned to Plotnikovo at about 5 p.m. it became clear that we had been lucky at Tyzrachevo. In Plotnikovo, roads were wet and misty after heavy rains.

Shortly before sunset (which was at 10:07 p.m. this day), we crossed the river in Plotnikovo for a large roadside swamp, also visited the previous day, which appeared not without the help of beavers. This swamp overflowed a spruce forest with an admixture of birch, with most trees being already dead. Its surface was covered with *Lemna minor*, and there were large patches of *Calla palustris*. During an hour, fighting with millions of mosquitoes, we attempted to observe the crepuscular activity of aeshnids. In the first phase, *A. juncea* prevailed: 2-3 individuals were in view continuously, with an admixture of rarer *A. grandis*. Some *juncea* sometimes rose to the road and flew above it for a while. We collected one male and four females of this species. Two females were blue, one greenish, and one green. Because of our collecting or as a result of natural rhythms, *juncea* soon became rare and *grandis* prevailed. Within a short time all the aeshnids, avoiding areas with a glow, concentrated in one dark corner of the swamp where they were 'swarming'. Among them *A. grandis* predominated, being accompanied by scarce *A. juncea* and one female of *A. viridis*. This extremely intensive 'swarming' activity finished at about 10:55-57 p.m., a few minutes before the end of the civil twilight (11:05).

18 July

At 8 a.m., by coach to Tomsk, we departed east, towards the Iksinskoe bog. The sky was dull but the layer of clouds was thin. We got off the bus 'in the middle of nowhere' and moved into the southern part of the bog with the aim of reaching a small lake 2.4 km south of the road, where no path led. Sense of direction was possible only thanks to GPS with the use of coordinates inferred



from the Google Map satellite photographs. This worked excellently. This part of the bog, close to the road, appeared to be drained in the same way as the part of the Bakcharskoe bog which we had visited previously. Ditches, full of water but with no flow, run until the open part ('galya'). The sequence of vegetation was also similar. At first a birch forest almost without any understorey, next pine formations with dense shrubs of *Chamaedaphne*, with an admixture of *Ledum* and, to a lesser extent, *Andromeda*. Deeper in the bog, the dominance in the understorey was attained by *Betula nana*. Then the pines became lower (ca 3 m) while low bushes became sparse, with some patches of peat covered by lichens, where *Rubus chamaemorus* grew, having already half-ripe fruits. However, these patches occurred probably due to the peat being severely disturbed through ditch digging. The ditches had water almost filled with mosses, and some *Eriophorum vaginatum* bunches. We passed three subsequent fire-fighting pools with clear dark water and peaty shores. Finally, we reached the northernmost margin of the open areas having the form of a latitudinal strip several hundred meters wide, and being a partly reddish *Sphagnum* bog with *Scheuchzeria*, *Rhynchospora*, *Drosera (anglica)* more abundant than *rotundifolia*, *Oxycoccus palustris*. More firm tussocks of *E. vaginatum* were helpful for walking, while 'sucking' reddish-black patches of pure *Sphagnum* did not bear the weight of a human. The pines bordering the open part were 1-2 m high and grouped into elongated ridges ('gryady'), with some white *Cladonia* and even *R. chamaemorus*.

Two lakes were situated 800 m west along this open part. They were separated and surrounded by mesotrophic fens with a dense stand of *Carex rostrata* and by more oligotrophic bogs. Flowering *Nuphar pumila* and rarer *Nymphaea tetragona* floated on the open water. Several adjacent metres of *Sphagnum* mire were partly flooded and so suffused with water that reaching the open water was possible only with great risk in several places. This zone was overgrown by abundant *Carex limosa* and *Carex rostrata*, mostly in separate formations, with some admixture of *Menyanthes trifoliata* and *Scheuchzeria palustris*. At ca 11 a.m., whitish clouds and subdued sunshine was replaced with a clearer sky and stronger sunshine and it became very hot and moist. Fortunately, the refreshing eastern wind soothed these sensations and a distant thunderstorm did not approach us. The odonate fauna of lakes was rich. In the favourable weather conditions of the morning, fairly rare individuals of *N. speciosa*, one copulating pair inclusive, were easily detectable in stands of *C. limosa*. The relatively small numbers of the population as well as the fact that all females were old (reddish bronze) suggested the final phase of the flight period of the species. In sedge zones *L. sponsa* was the most abundant, *C. johanssoni* fairly



numerous, both species were represented also by teneral individuals. In contrast, *C. hastulatum* was very rare and, which was rather surprising, also *E. cyathigerum* occurred only in small numbers, partly in more melanistic forms with black narrow lateral stripes. The last species also perched on leaves of nymphaeids in the open water table. Among many individuals of *L. dubia*, continuously buzzing at and over the water, a male of *L. albifrons* was distinguished. Due to its mobility and difficult access to the water it took a long time to catch it. This record considerably expanded the knowledge of the distribution of *L. albifrons* since it was situated more than 200 km north of the nearest known locality of the species (O. Kosterin, unpublished data). *L. quadrimaculata* occurred generally in moderate numbers, more numerous at the second lake. The open water was patrolled by very abundant males of *A. crenata* (always several in view), clashing with each other permanently; we also startled an ovipositing female. Once *A. grandis* appeared for a while, its autochthonous but marginal occurrence could not be excluded there. Rather rare *S. flaveolum* occurred at this site as on the rest of the bog without water, however, we saw two tandems during copulation and oviposition. The only individual of *S. danae* (teneral) was found stuck to the leaves of *Drosera*. A high flying dark-winged female of *S. flavomaculata* unexpectedly appeared above the bog between the lake and first low pines. Rafal Bernard found several old exuviae each of *A. subarctica*, *C. aenea*, and *L. dubia*. In the neighbourhood of the lakes, dark very wet moss patches with some water surface glistening were patrolled by males of *A. subarctica* occurring rather in moderate numbers; they sometimes also reached small pools. *A. subarctica* was absent when we arrived, in overcast weather, but appeared with the sun. Its males differed from *A. crenata* not only in their smaller size and the occupied space but also in flight, being lower (0.5-1 m) and distinguished by lengthy stops while hovering against the wind. These males did not visit the main open water of the lakes, the only daredevil attempting to do this was chased away by the all-powerful *crenata*.

During the return through the pine parts of the bog ('ryam'), *S. flaveolum* and, less frequently, *L. dubia* were recorded. The latter species concentrated at fire-fighting ponds, at which we also found some *S. danae*, *E. cyathigerum* and *C. hastulatum*. A foraging female of *S. arctica* was collected among rather high pines, while an immature *S. vulgatum* among lower trees. The ditches looked excellent for *Somatochlora*, but the only individual we saw was a male *S. metallica* slowly ranging to and fro along a ditch full of open water among pines. The smallest of the *Tringa* waders, a slim and graceful Wood Sandpiper *T. glareola*, was also observed at ditches. We returned to the road after 4 p.m., enormously tired. Fortunately, at the very moment we emerged from the forest the same



coach from which we had departed in the morning appeared from around a bend in the road.

19 July

The morning was rather cold and the sky cloudless. The air at the horizon soon became dull but the sun was shining and the temperature increased fast. At 9 a.m. we departed west for the town of Bakchar. The road passed through infinite walls of birch/aspen forest, with very scarcely seen spruces, and some more open stands with dead large birches, young birches, and always some pines. The huge bogs were hidden behind the forest belt. We began our exploration from the bridge across the Galka River situated at the northern border of the village. The dew had still not evaporated and the activity of insects was not very high. At the river, there were *S. metallica* and *C. splendens*. The latter appeared very numerous but still not very active mostly perching on vegetation on the riverbank. A male of *A. crenata* ranged over the river. Along the right bank, there was a nice grassy meadow with some bushes between the river and a system of water bodies. A small, and it seemed secondary pool visited by us was surrounded by high herbaceous vegetation and *Carex rostrata*, and totally covered by *Spirodela polyrrhiza* and *Hydrocharus morsus-ranae* under which *Lemna trisulca* was submerged. Scattered *L. spona*, *C. puella*, *C. hastulatum*, *E. cyathigerum* and teneral females of *S. danae* were encountered on the surrounding meadow. At the pool, dragonflies were still scarce, represented by a territorial male of *A. crenata*, a male *L. rubicunda* occupying a floating log, and *L. spona*, *L. quadrimaculata*, *S. flaveolum*, *A. grandis*.

We again approached the river, the opposite bank of which was sunny, and stopped there for a couple of hours until our bank got to be sunny as well. At this point, the river was 12-17 m wide, extremely slow and rather deep (max. 1.7-2 m). The water was brown and warm as in Iksa, and 20-30 cm of warm muddy deposits covered the riverbed. At its banks *Sparganium emersum*, *Butomus umbellatus* and *Sagittaria sagittifolia* grew, between them rosettes of *Callitriche verna* occurred. The banks were quite high and overgrown with willow bushes; many dead tree trunks and branches were concealed in the water. *C. splendens* was numerous, besides typical males, rare ones with the wings coloured to the tips occurred. Among females, androchrome individuals were as equally abundant as typical or even predominated! Some of them represented f. *faivreii* with gradually clearing tips of fore wings, but most had the wings coloured up to the tips inclusive while the inner end of the coloration varied. In the most extensively coloured females it reached 50-60% of the length between the nodus and the wing base. In the least coloured, colouration occurred at the nodus level or



only slightly exceeding it, and such cases were not rare. Another population with a high proportion of androchrome females (including f. *faivre*) and males with the wings coloured to the tips was earlier discovered by O. Kosterin in the Todzha Hollow in northeastern Tyva Republic, Central Siberia in 2000 (Kosterin & Zaika 2003) and 2004 (unpublished). Before these records, androchrome females were considered extremely rare in Siberia, but nevertheless provoked a persisting false notion of the existence of a second species, *Calopteryx johansonii* which is in fact identical to f. *faivre*. Visual counting and collecting at the Galka River in Bakchar on this day brought: 21 typical males and 6 males with wings coloured to the tips, 15 typical females, 7 androchrome females f. *faivre*, and 12 androchrome females with all wings coloured to tips.

**Figure 4:** A *Gomphus vulgatissimus* hunt by Rafal Bernard in the Galka River.



Another distinguishing element of the river fauna here, as in the Iksa River, was locally abundant *G. vulgatissimus*. This was the third river inhabited by this species and the northernmost one studied by us (57°02' N). So, the species



seems to be a regular inhabitant of the Vasyugan Plain. At first two males of the species, which sat on barren ground near the water, were collected. Then we saw an uncoordinated tandem of gomphids which was startled from our bank, crossed the river and landed quite high onto a willow bush. Rafal Bernard also crossed the river and in an equilibristic jump out of the water managed to catch - a male-male tandem of *G. vulgatissimus*! As usual in rivers, the permanent component of the Galka odonate fauna was also *S. metallica*. Its abundant males patrolled along the river edge of the vegetation and we also observed a female ovipositing in the shade at its base. It must be stressed that all individuals of this species, collected by us during the expedition, had dark blackish pterostigma (under a stereomicroscope between dark brown and blackish, in fact). At the base of the hind wings, a yellow coloration occurred in all males and in some females being, however, very weak and occupying only a very small area, mostly only the anal triangle. The amber yellow colour along the proximal margins of the wings was common and quite intensive in females but much weaker in males. Females also had a tendency towards a brownish 'smoking' of wings but only to a small degree incomparable with the intensity of colour in the females of *flavomaculata* or some *arctica*. This 'smoking' if present was only barely recognizable in males. Summing up, it seems that these individuals fit to the subspecies *abocanica*, described by Belyshev in 1955 from the upper catchment basin of the Yenisei River, but which may be in fact an environmental modification.

*A. crenata* and *E. cyathigerum* belonged to other species regularly seen over the water. Both species occurred at the Galka river in moderate numbers being recorded at every place visited by us. The presence of *E. cyathigerum* distinguished this river in comparison to the current waters studied earlier. We considered this occurrence to be allochthonous, related to the extremely large population inhabiting the pond in Bakchar (see below). However, the autochthonous presence of this species in the lentic parts of the vegetation-rich river is also possible. The same could be also true for *A. grandis* which appeared twice and the very rare *C. hastulatum*, while a dead female *S. arctica*, floating on the water, was certainly allochthonous.

Several hundred meters south of the bridge we approached the river once again. It was a lovely, serene and desolate place, with the houses of Bakchar distantly appearing behind the gentle grassy slopes of the valley. An open sunny bank, a spruce taiga on the opposite bank, a calm current and abundant vegetation (*Carex acuta*, *Phalaris arundinacea*, *Glyceria* sp., a lot of *Sparganium emersum*) composed the picture of the river there. *C. grandis* was very abundant, accompanied by all the species mentioned earlier. we observed a gomphid



female several times, obviously of *G. vulgatissimus*, which oviposited in the middle of the river between belts of *Sparganium* for quite a short time. Of particular interest was the spatial segregation between *A. crenata* and *A. grandis*. The latter species apparently avoided *crenata* patrolling only in places free of its males and passing *crenata* at a much higher ceiling. Unexpectedly, a male of *A. subarctica*, certainly strayed far from its favourite bogs, was collected above the vegetation on the slopes.

Afterwards we crossed the town, which appeared cosy and very calm, although large. It was full of *Enallagma* males, which were everywhere if at least some grass was present. Next to one house, two females of *Somatochlora flavomaculata* flew 1-3 m high. In the central part of the town we found a large made eutrophic pond with clear water and with hard grassy banks practically without shore vegetation. In contrast, floating and submerged vegetation was well developed, represented by a narrow rim of *Hydrocharis morsus-ranae* and a 5-15 wide belt of *Spirodela polyrrhiza*, under which there were *Lemna trisulca* and especially abundant *Ceratophyllum demersum*. This zone was a paradise for some damselflies. Very abundant *E. cyathigerum*, crowding particularly at the outer margin of the *Spirodela* zone, and similarly numerous *E. najas*, more evenly distributed in this zone, predominated in the assemblage. *Enallagma* males did not have the black lines along the lower parts of segments of abdomen, characteristic of the melanistic forms, which we recorded in the bogs. However, some of them had a larger black pattern on their upper parts than seen on typical European individuals. Females were mostly typical but we also collected a blue one and a blue one with a greyish-green upper surface of its pterothorax and abdomen. The pond also appeared to be very favourable for *Coenagrion*, although it did not look so at a first glance. Fairly abundant *C. puella* reached in Bakchar its northernmost known locality in Siberia which was situated significantly further north than the site given by Belyshev (1973). *C. pulchellum*, so far also unknown at such northern latitudes, occurred in moderate numbers (also in tandems). In contrast, only single males of *C. hastulatum* and *C. lunulatum* were recorded, and *C. johanssoni* was absent. This last fact confirmed the notion that this species frequently avoids anthropogenic water bodies, especially those being eutrophic and poor in emergent vegetation. So, at last we found *C. pulchellum* and *C. lunulatum* which we had expected from the very beginning. It seems that the peat-moss Vasyugan Plain is not a favourite area for these species; they seem to be rare and scattered there. Anisoptera were very rare at the pond, represented only by *A. grandis* and *A. crenata*. And once *S. vulgatum* flew by. At 5 p. m., we departed by coach to our base.



20 July

The morning was cold. At 9 a.m. we departed for a long journey westwards. The flat land was rather boring since it was overgrown with uniform birch/aspens forests, with some open fields. Between the villages of Vysokii Yar and Parbig, during a short stop, we observed *S. flavomaculata* and *A. grandis* foraging over the road. Behind the Kyonga River, some undulating relief appeared, rather unusual for these areas. The patches of tall forests became represented mostly by cedars (with an admixture of fir) rather than birch. Having crossed the Emelich River, we at last arrived at our destination, the Sambusskoe bog, situated 175 km WNW of Plotnikovo (Fig. 1 & 2).



**Figure 1.** In the vastness of West-Siberian peat bogs, Sambusskoe bog.



It was margined with tall fir/cedar forests which produced narrow capes into the bog, with the border between the tall trees and the bog being quite abrupt, unlike the bogs visited earlier. Near the border, areas of even *Eriophorum* looked like former pools. The very bog resembled the previous ones, with dense

**Figure 2:** Typical landscape of West Siberian peat bogs with pools, Sambusskoe bog.



stands of medium and low pines, and bushes of *Ledum*, *Andromeda* and predominating *Chamaedaphne*. The difference consisted in the abundance of low cedars among common pines, especially at the forest edges, and of *Vaccinium uliginosum* (with berries) among shrubbery, and in the presence of moist peat-moss openings with *Oxycoccus palustris*. Having only a 1:500000 map we wandered for a time until we found the lake we wanted. It was situated in a small opening, so the rim of the open *Sphagnum* bog around the lake was a few dozen metres broad only. The wide quagmire zone around the water table was the most flexible and impenetrable out of all the lakes visited by us, and looked the most oligotrophic: *Carex rostrata* was totally absent and vegetation consisted of predominating *Carex limosa*, and of *Rhynchospora alba*, *Scheuchzeria palustris*, and very numerous *Drosera anglica*. Nymphaeids were represented by *Nuphar pumila*. The odonate fauna was rather poor. Among imagines, abundant *L. sponosa* and fairly numerous *C. johanssoni* prevailed, being accompanied by ranging males of *A. crenata*, several individuals of *L. dubia* (with a copulating pair), rare *A. subarctica* and *N. speciosa* (only three old females recorded), some *L. quadrimaculata* and a single male of *E. cyathigerum*. Among exuviae collect-



ed on sedges and on the moss, the two mentioned aeshnids (especially *subarctica*) were fairly abundant. Having 5-6 hours of return journey in perspective, we could not spend much time there and came back to the road. Halfway, we startled a copula of *A. subarctica* from the margin of a grassy and wet patch ('mochazhina'), above which another male flew.

Between 6:30 and 7 p.m., on the way back, before the Emelich River, we were impressed by a great number of *Aeshna*, possibly *juncea*, flying low above the road. It looked like a crepuscular flight, although the slanting sunshine was still quite bright. At about 8 p.m., during a brief stop next to the bridge across the Emelich River, we collected a male of *A. crenata* and a female of *S. metallica*.

### 21 July

All the hot day of July 21 there was no cloud, yet the sky was dull white and hazy, so that sunshine was reduced. We spent the whole day in Plotnikovo and its vicinity. At about 1 p.m. we visited the river bank near our base. There were *S. metallica*, *A. crenata* and *L. sponsa*, as usual. In the sedge not far from the water a male *G. vulgatissimus* was captured. No *Somatochlora* females were flying at the tree crowns or above meadow patches. At about 4 p.m. Oleg Kosterin visited the bridge area. At the water, besides two males of *C. splendens*, *A. crenata* and *S. metallica* occurred regularly. Two hours later he visited the pond in the north of the village, already explored five days earlier. Zygopterans appeared to be scarce (among them juvenile *S. paedisca*), *L. quadrimaculata* rather abundant, *A. crenata* and *A. grandis* still patrolling. Then he revisited briefly the roadside pool visited by us for the first time on the 12 July. In the meantime *L. virens* had become very numerous there, being accompanied by some *L. dryas* and no *Somatochlora*. Rafal Bernard revisited the pools W of the bridge, studied the week before. There a female of *L. dubia*, ready for oviposition, was collected. Then Rafal left Plotnikovo going southwards. Near the southern border of the village, a 2-4.5 m wide rivulet, the Yarushka ran through the forest, bringing brownish water with a slow current between *Callitriche* mats. Males of *S. metallica* continuously patrolled the rivulet, met and chased conspecifics away while nearby, over the track, a foraging female of *S. arctica* (still present) was caught. Two small secondary pools situated 2.2-3 km S of the road to Tomsk were overgrown with very abundant *Ceratophyllum submersum*, covered with *Spirodela polyrrhiza* and *Lemna minor*, and bounded by abruptly ending walls of *Carex* and *Glyceria*, and locally by *Typha latifolia*, *Eleocharis palustris* and *Alisma plantago-aquatica*. Their odonate fauna was rather monotonous, predominated by abundant *L. sponsa*, accompanied by rare *L. dryas* and *L. rubicunda*, 2 territorial males of *A. crenata*, single *C. puella*, *C. johanssoni* and



*S. danae*. In the neighbourhood, *S. flaveolum* (also in tandem) was present, as everywhere.

22 July

In the morning the sky had the same bleached appearance as the day before but later the sky cleared, and it became very hot. At 2-4:30 p.m. Oleg revisited the former oxbow with its peat-moss bog near Plotnikovo, the same one as on 16 July. There were many individuals of *S. flaveolum*, including perching mature males and tandems, and several *L. quadrimaculata*. *A. grandis* and several individuals of *Somatochlora* flew: one of them, flying 2-2.5 m high (foraging), appeared to be a male of *S. metallica*. At the same time Rafal revisited pools W of the bridge. The smaller pools had almost dried out while the larger one was still full of water. *L. rubicunda* and *L. pectoralis* were still present. A female of the latter species oviposited for a time in the larger pool until it was captured by a male of *rubicunda*, and just seconds later - already in a heterospecific tandem - by Rafal. *S. danae*, both mature and teneral, a male of *S. sanguineum* and a female of *L. dryas* were also recorded.

23 July

Our destination was the Iksinskoe Bog, but this time the part situated north of the road. When we disembarked from the coach, at 8:30 a.m., the sun was hidden and a rain cloud was approaching from the SW direction, which later brought several very light showers. We started to move north between old parallel ditches through a terrible mixture of nettle and raspberry or birch and willow coppice. It was very hard to move on without a machete, additionally being persecuted by numerous mosquitoes and horse flies. After 2 km, the birches were replaced with a regular pine peat bog, half-burnt out. Its distinguishing element was an abundance of *Vaccinium uliginosum* rich in berries; *R. chamaemorus* was also quite common. After 2.6 km we abandoned the 'path' moving the next 2 km only according to the GPS and a satellite photograph. The only dragonflies were single *S. flaveolum* seen from time to time. Struggling through the bog Rafal flushed a family of willow grouse *Lagopus lagopus*, partly escaping on feet, with at least three already flying juveniles. After two hours of very slow progress we reached the first lake, ca 80 m long, with ranges of low pine approaching to it for 15-20 m, separated by wide very wet light-green patches of *Sphagnum* and *Rhynchospora*. The lake appeared to be rather mesotrophic: surrounded by a belt of *Carex rostrata* with an admixture of *C. limosa* here and there. Submerged *Sphagnum* reached the water surface, making it looking dirty for several meters from the shore. *C. johanssoni* and variably melanised *E.*



*cyathigerum* were fairly rare and *L. sponsa* appeared in moderate numbers. They were accompanied by a few *L. quadrimaculata*, *L. dubia*, two males of *A. juncea* and an ovipositing female of *A. crenata*. It did not look well for *Nehalennia*, yet we encountered two old females: one four metres from the water with *Carex limosa*, another at the water where only *Scheuchzeria* grew.

Here we must say that individuals of *Enallagma* collected during our expedition represented two distinct types. Specimens obtained at the pools in *Sphagnum* bogs, where they were never numerous, structurally represented the typical *E. cyathigerum cyathigerum*, with the yellowish lip protruding behind the black hook of the superior appendages. Some of them exhibited an abdominal melanisation (to a variable extent), with dark stripes of different expression appearing at the tergite sides. It was hypothesized that such melanised forms are environmental modifications (Dumont et al. 2005). A male from the pond in Plotnikovo belonged to the same subspecies. In contrast, a series of 19 males collected at the pond and the Galka River in the town of Bakchar structurally represented the subspecies *E. cyathigerum risi* (or the species *E. risi*), with the yellowish lip not protruding behind the robust black hook but directed inwards and down beneath the hook (cf. Kosterin 2004). In Bakchar, especially at the pond, individuals of *Enallagma* were astonishingly numerous and were not melanised. According to numerous observations by O. Kosterin in many regions of South Siberia, a strong preference for large lentic or slow current water bodies with an open surface, a great abundance of individuals and an absence of melanisation are characteristic of *risi*. Hence, during our expedition we faced a correlation between the morphological characteristics distinguishing the two taxa and the habitat type, and possibly the presence/absence of the variable abdominal melanisation (which, however, may be only a consequence of different habitat conditions). This correlation seems to support recent molecular data suggesting that these taxa are bona species (Stoks et al. 2005). However, reproductive isolation may be incomplete, since among 30 collected males of *Enallagma* two individuals looked intermediate between the two taxa having only a very narrow part of the yellowish lip protruded distally and much larger its part situated proximally of the hook as in *risi*: one from the Sambusskoe bog and one from the southern part of the Iksinskoe bog. In Novosibirsk, just 200 km southwards, only *E. cyathigerum risi* occurs while in northern West Siberia only the nominotypical subspecies is known (Kosterin 2004). The area of our study may represent a zone of contact of both taxa, most probably separated spatially but also possibly intergrading to a some extent.

After 500 m there was another lake, a bit less mesotrophic. It was rimmed with *C. rostrata* but behind it there was a second belt of *C. limosa*, standing not in



open water but in *Sphagnum* very suffused with water. We collected 3 females and 1 male of *N. speciosa* there. *L. sponsa* were more numerous at this lake and several exuviae of *L. dubia* and *S. danae* were found.

Adjacent to this was another lake, about 80 m long and 15-20 m wide. It looked poorer in nutrients and best fitted for *Nehalennia*: *C. rostrata* occurred in smaller amounts and a belt along the shores was formed mostly by *Carex limosa*, *Menyanthes trifoliata* and *Scheuchzeria palustris*. *Nuphar pumila* on the water surface was accompanied by *Nymphaea tetragona*. A female and a male of *N. speciosa* were found but it seems that this rarity of the species 'on the surface' of vegetation may have been related to recently changed weather conditions: it had become windy and sunny. When photographing, Oleg noticed that the female moved deeper into the sedge, closer to the water, in gusts of wind. *C. johanssoni* and *E. cyathigerum* were present, and *L. sponsa* was abundant, including numerous teneral specimens. Many times Oleg observed a male trying to grasp a female which, in order to escape dropped down into the sedge and immediately flew away. He saw no successful attempts and not a single tandem. *L. dubia* was seen rather frequently, males occurred on the bank and flew above the water, and we observed a copula and an ovipositing female. *L. quadrimaculata* was also continuously present and once ovipositing but scarce. Once a -winged *Somatochlora* flew above the lake and disappeared.

When we had arrived at that lake, it was still overcast. Aeshnids were represented only by *Aeshna juncea*, a species still not recorded by us on such peat-bog lakes. Males regularly patrolled over the water along the border line of vegetation mats just before them or, at most, exactly over the border line of vegetation and open water. They sometimes visited places 1-2 metres (occasionally several metres) distant from the open water. During the patrolling flight over the water individuals stopped and hovered in flight with the head directed at the border vegetation, most probably searching for females. We collected several males and Oleg photographed a copulating pair in sedge at the very water. There was also an ovipositing female of *A. crenata*. Then the sun, at first subdued, then clear, appeared. At the same time, males of *A. crenata* and *A. subarctica* immediately appeared. The former ranged above the water occupying a niche typical of the species (Bernard 2002), and the latter remained above the *Sphagnum/Rhynchospora*, especially in very wet places ['mochazhiny'], flying 30-80 cm above the low vegetation, and frequently hovering. Spatial segregation was strict, and when the heterospecific males met near the border of water and the quagmire, any intruder was chased away. It was interesting that if the meeting took place above the land, *A. subarctica* was the winner in spite of being smaller. At first the impression arose that *A. juncea* had completely dis-



appeared suggesting a weather separation with *A. crenata*. However, later we noticed and collected several males of *A. juncea* which flew typically low along the very shore even in the sun, but never were male *A. crenata* nearby. When appearing, they chased *juncea* away thus confirming the dominant position of *A. crenata* over the water table as described already by Belyshev (1973) and Bernard (2002). These observations showed the partially temporal/weather and partially spatial nature of segregation in the 'triangle' of peat bog aeshnids. We should make a reservation here that different diagnostic characters to distinguish *A. subarctica* and *A. juncea*, given in literature, have different degrees of usefulness, some of them are unreliable and may result in numerous misidentifications. This has been studied and checked during our expedition and earlier investigations by Rafal Bernard at many localities in Poland and the Baltic States. In fact, the two species are markedly different. Firstly, in their secondary genitalia. The fore processes of the hamuli in *A. subarctica* are wider throughout their length and widely rounded versus those in *A. juncea* which are clearly narrower, often slightly turned along their axes and with a slightly inflated, 'shoe-like' apex. Hamular folds situated below, are smaller and significantly less visible in *subarctica*. A quite good figure of this area is given in the venerable book of Schmidt (1929). Also a very good feature is the shape of anal appendages of females, which in *subarctica* are leafy, horizontally flat and widely rounded, while in *juncea* they are narrower and turned along their long axes to a more vertical position in their distal parts. This difference is not so distinct in males, however, also their superior appendages are flatter and slightly wider in *subarctica* as opposed to the somewhat turned along their axes and narrowed appendages in *juncea*. A relatively good picture presenting their dorsal and lateral view is given in Askew (2004). The presence of a specific patch below the mesothorax spiracle is one of the best distinguishing features. In both sexes of *A. subarctica*, there is a clear cut light patch there which, very importantly, has a characteristic narrow projection ('leg') beneath it directed downwards along a suture. In *A. juncea*, there is no such patch or there is only a very small one, always without the projection – 'leg'. This feature, very useful in the field, was tested in hundreds of specimens, always with a positive result. It is underestimated in literature, although sometimes shown, as e.g. on a figure in Nielsen et al. (1987). All these diagnostic characters between the two species are reliable throughout their range, including North America (e.g. see illustrations in Hudson & Armstrong 2005). Other distinguishing features, such as coloration, pattern of thoracic spots, presence of light spots behind eyes, should be treated as helpful but not as decisive. Some of them, being variable or not repetitive in all individuals, may lead to misidentifications. For example, the width of the



black stripe between the frons and clypeus, is given by Belyshev (1973) and Dijkstra (2006) as the most important feature, being of constant thickness or even widened at the eyes in *subarctica*, and narrowed at the sides in *juncea*. In fact, the pattern in this area of the head is more complicated and the feature is different in some individuals, especially those of *subarctica*. According to this feature, one individual collected during the expedition would have been incorrectly determined as *juncea*, another one would bring very serious doubts. In one *juncea* male it was even observed that the black line is narrowed at the one side of the head but not narrowed at the other side. The presence / absence of light spots behind eyes seems not to be completely reliable as well. Although in the practice of Rafal Bernard, the pattern: absent in *subarctica*, present in *juncea*, was repetitive but there are signals that these spots are sometimes absent in *juncea* as well (Belevich 2005). Hence, the feature needs to be studied on a wider range of material. Finally, we would like to stress that according to our observations given above and the experience of Rafal Bernard in Europe, the difference in behaviour of territorial males may also be helpful in determination in many cases, as well as the habitat. *A. subarctica* is a stenotopic species related to *Sphagnum* peat bogs, while *A. juncea* demonstrates a greater ecological plasticity.

During these observations an unusual event recalled us to the remoteness of these areas. While standing on the bank, Rafal noticed a juvenile godwit *Limosa limosa* clearing its feathers at the opposite shore, 15 m from him. Then the godwit went around the lake, approached Rafal to a distance of 4 m, where it stopped for a longer time, carefully listened to 'a speech of welcome' tilting its head, and later collected insects from the sedge for a time. It flew away only when Oleg taking a series of photographs approached closely. On the bog, there were almost no blood-sucking insects, just a few horse flies, and the slightly overcast and windy weather provided a very pleasant early afternoon. We abandoned the lake at 15:40 and went back.

It was the last day of our field studies in the Vasyugan Plain. On July 24, we returned to Novosibirsk.

### Summary – Main results

One important result of our expedition is the picture of the summer aspect of the odonate fauna in these mostly primeval and remote boggy areas. In total, 34 odonate species were recorded, that is quite a few for an area of that size situated at such latitudes in Siberia and having a rather narrow spectrum of



habitats predominated by large complexes of *Sphagnum* peat bogs and fens, and specific rivers bringing peaty waters.

Our supposition that the boggy areas of the Vasyugan Plain in the West Siberian Lowland are a huge reservoir of *Nehalennia speciosa* was confirmed splendidly. It is worth noticing, however, that, although seemingly omnipresent in pools of *Sphagnum* peat bogs, it is not so abundant there. Possibly we visited this area near the end of the flight period of *N. speciosa* there, but nevertheless, the pattern of the species occurrence in the plain seems to be based on very numerous and dense but small local populations. Therefore, taking into account the total size of this giant boggy area, the population numbers in the Vasyugan Plain is certainly enormous. However, it is a rather recent picture, since the bogs are 5200 years old at most in some restricted areas, while the peat-moss prevailing stage of their development began just some 1500 years ago.

Generally, the complex of peat-moss bog species is flourishing in the studied area. Along with *N. speciosa*, in all such habitats we recorded tyrphobiontic *Aeshna subarctica*, the records of which had hitherto also been scarce in Siberia. The species is certainly very abundant in the Vasyugan Plain and is well separated spatially from two other co-occurring aeshnids in *Sphagnum* peat bogs – *A. juncea* and *A. crenata*. The picture we have drawn of the spatial, temporal and behavioural segregation between these aeshnids confirmed and developed earlier observations from Europe (Bernard 2002, unpublished data). One of the members of the mentioned complex of species, *C. johanssoni*, abundant in primary habitats – small bog water bodies - is completely missing in large oxbows and man-made large ponds. This absence seems to be related to higher nutrient levels and inappropriate or too poor vegetation. One mystery of peat-moss complexes remained undisclosed: this is the breeding places of the generally very abundant *S. arctica*. According to our observations the majority of so numerous individuals ceased their maturation period and disappeared, most probably to their breeding places. However, despite visiting various places in the peat-moss complexes, we failed to observe a single territorial male or ovipositing female. This resembles the situation described by Dijkstra & Koese (2001) from the Belarussian Polesse, where huge numbers of immature *arctica* were observed while at the same time there was no observation of true *arctica* reproduction or its original habitats. It seems that the original, stem habitats of this species may be situated in more central, largely flooded or more sinking parts of large *Sphagnum* complexes, may be also in large areas of mesotrophic fens overgrown with *Caricetum lasiocarpae*.

The study area brought an interestingly high percentage of androchrome females of *Calopteryx splendens* and dark-winged *Somatochlora* individuals,



especially noteworthy in *S. flavomaculata*. Worth noticing was also the spatially separated occurrence of two subspecies (species?) of *Enallagma cyathigerum*: *cyathigerum* and *risi*.

The records of *Gomphus vulgatissimus* and *Shaogomphus postocularis* extended the known range of these species ca 170-185 km to the north. The former species, earlier known in Siberia from the only group of localities near Novosibirsk, turned out to be widely distributed and fairly abundant in the area of studies, and the latter was for the first time found west of the Ob'. From the zoogeographical point of view, records of *Leucorrhinia albifrons* and *Leucorrhinia pectoralis* were also very interesting, shifting their known northern range limits significantly to the north. *Lestes virens*, *Coenagrion puella*, *Coenagrion pulchellum* and *Sympetrum sanguineum* also reach or cross their hitherto known northern range limits in the studied area (cf Belyshev 1973).

To conclude, some absences should be stressed, both of the typical northern (boreal-alpine) species, such as *Aeshna caerulea* and *Somatochlora alpestris* (although theoretically they could be recorded, see Belyshev 1973) and some species which are common 200 km to the south, at Novosibirsk, such as *Aeshna mixta* or *Sympetrum pedemontanum* (Kosterin et al. 2001). We quite expected to meet *Aeshna serrata*, which is known even more northerly (Belyshev 1973), but there seemed to be no suitable habitats for it.

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