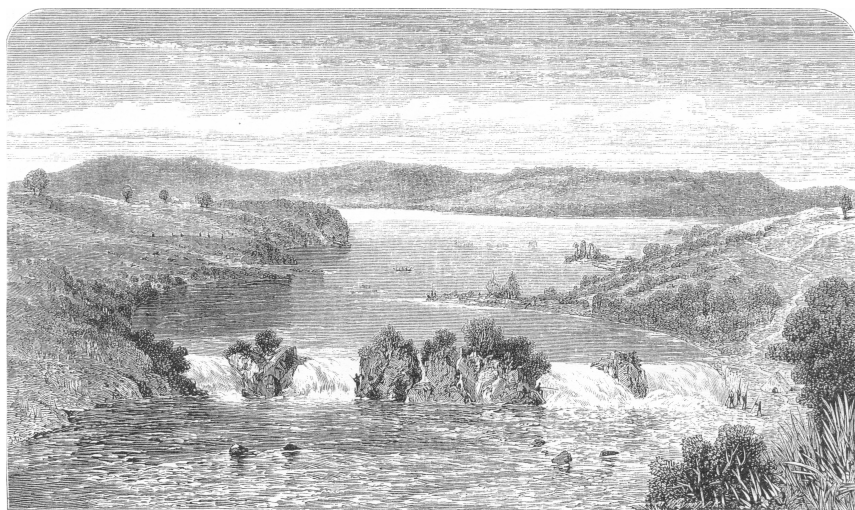


The British Simuliid Group Bulletin

Number 38

July 2012



The Ripon Falls - the Nile flowing out of Victoria Nyanza

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THE BRITISH SIMULIID GROUP BULLETIN

Number 38

July 2012

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Cover Image:

*The Ripon Falls, as shown in Speke's description of the source of the Nile. This site which is now almost submerged by the Owen Falls Dam is just visible as a line of three rocks at the outflow of Lake Victoria at the top of the photograph shown in Bulletin 33:(Feb. 2010) p. 13,. [Taken from: Speke, J.H., (1863). *Journal of the Discovery of the Source of the Nile*. xxxi + 658pp. William Blackwood, Edinburgh and London].*

From the Editor

This third "on line" number of the *Bulletin* contains notices of two upcoming meetings, and a book notice concerning the blackflies of New Zealand.

Peter Adler gives details of collections by Bob Peterson and others now housed in the Monte L. Bean Life Science Museum at Brigham Young University, Provo, Utah. There is a thought-provoking paper by Stephen Smith on the swarming behaviour of blackflies and the way in which observations should be interpreted. There may be readers who feel strongly for or against his arguments. Perhaps this should be a subject for discussion at the next International Simuliidae Symposium. Your Editor would be prepared to consider publishing any comments, observations or discussion in the next issue of the *Bulletin*.

For those who might want to replace missing numbers of the printed *Bulletins* 1 to 35 in their library, the editor has a stock of spare copies which he would be glad to get rid of. Nearly all numbers are represented. Send a request to the editor.

John Davies

FORTHCOMING MEETINGS

5th International Simuliidae Symposium

Will be held between 3rd and 7th September 2012 at the Comenius University
(Faculty of Natural Sciences), Bratislava, Slovakia..

The 3rd. September will be for registration and an evening welcome reception.
On 4, 6 and 7 September there will be lectures and on 5th September a whole
day field excursion.

Further information and registration forms can be found at
<http://zoology.fns.uniba.sk/simulium2012>

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2013 Annual Meeting of the North American Black Fly Association (NABFA)

at the Continuing Education Center at the University of Georgia, in Athens,
Georgia on February 9 and 10. 2013.

For further information please visit the website of NABFA (nabfa-blackfly.org)
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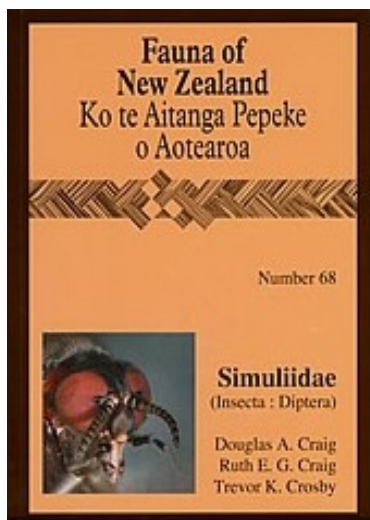
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BOOK NOTICE

Fauna of New Zealand Number 68 - Simuliidae



by Douglas A. Craig, Ruth E. G. Craig, Trevor K. Crosby
June 2012

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NOTES, VIEWS AND CORRESPONDENCE

The Simuliidae Collection, Including the B.V. Peterson Material, in the Monte L. Bean Life Science Museum at Brigham Young University, Provo, Utah

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Robert “Bobbie” or “Bob” Vern Peterson (1928-2006) worked in a professional capacity for nearly 40 years on the family Simuliidae, beginning with a doctoral program at the University of Utah in Salt Lake City (1955-1958), and following with employment at Agriculture Canada’s Medical and Veterinary Entomology Research Laboratory in Guelph (1958-1963), the Entomology Research Institute (now a part of Agriculture and Agri-Food Canada) in Ottawa (Canadian National Collection, CNC; 1963-1983), and the Systematic Entomology Laboratory of the United States Department of Agriculture (USDA) in Washington, DC (National Museum of Natural History, USNM; 1983-1994). Although assigned responsibility for a number of dipteran families in the CNC and USNM, Peterson worked primarily on bat flies in the Hippoboscoidea and on the Simuliidae, describing 42 new species of black flies (36% synonymy), and authoring or coauthoring 53 papers on them, of which the most significant included a bionomic study, with D.M. Davies, of the black flies of Algonquin Park (1956, Canadian Journal of Zoology 34: 615-655); a pair of bionomic and taxonomic studies, with Davies and D.M. Wood, of the black flies of Ontario (1962, 1963, Proceedings of the Entomological Society of Ontario 92: 70-154, 93: 99-129); a revision of the North American prosimuliines (1970, Memoirs of the Entomological Society of Canada 69: 1-216); the simuliid entry for the Manual of Nearctic Diptera (1981, Monograph 27, Agriculture Canada, Ottawa); and a taxonomic treatment of the black flies of Colorado with B.C. Kondratieff (1995, Memoirs of the American Entomological Society 42: 1-121).

When Bob Peterson retired from the USDA in 1994, he moved from Washington, DC, with a large amount of simuliid material, to his natal state of Utah where, at his request, he was provided bench space and supplies at the Monte L. Bean Life Science Museum (MLBM) on the campus of Brigham Young University. For the next decade, he continued to work at leisure on the Simuliidae in the Bean Museum and at his home.

At the invitation of the curators of entomology at the Bean Museum, I sorted the Peterson material and the independently acquired simuliids in the MLBM during the week of 5 March 2012. Of the sorted Peterson material, more than 800 vials of simuliids were distributed to various institutions, namely the CNC (303 vials), USNM (375 vials), Colorado State University (68 vials), and Texas A & M University (> 40 vials), depending on Peterson's place of employment when the collections were made or on the museum that originally held the material. Peterson had collected a large number of black flies into ethanol for his dissertation and for the Davies and Peterson (1956) Algonquin Park study. This material, along with a modicum of additional, miscellaneous simuliids that he collected, primarily from 1959 to 1962 (e.g., Mont-Tremblant, Quebec), is now housed in the MLBM.

Coupled with the museum's other holdings, the entire MLBM collection of Simuliidae consists of more than 2,000 ethanol vials arranged in double racks in one metal cabinet. The identified component, arranged alphabetically by the 48 represented species or species complexes, includes 1,238 vials of larvae, pupae, and adults, most determined by Peterson, and an unidentified portion of 416 vials of larvae and pupae and 180 vials of adults from North America, currently alphabetized by Canadian province and USA state, plus another 27 vials of exotic larvae, pupae, and adults, and four double racks of unsorted simuliids in 1-dram shell vials. The unidentified material is largely part of the museum's collection of Simuliidae that was acquired before and after the Peterson material arrived. Although the Peterson material does not include pinned specimens, the MLBM collection has a partial drawer of pinned adults, including a paratype of *Simulium pilosum* (Knowlton & Rowe).

The entire MLBM simuliid collection is rich in material from western North America, and is likely to reveal new distributional records as the unidentified specimens are evaluated. For instance, the collection holds the following new state record for *Prosimulium rusticum*, previously known from only five sites in Arizona:

New Mexico, Catron County, Gila National Forest, stream to Guyanas Tanque, 24 April 1994.

Acknowledgements. I thank Richard Baumann and Shawn Clark for providing outstanding hospitality during my visit to the Monte L. Bean Museum.

SCIENTIFIC PAPERS

Logical fallacies and strong inference in biting-fly research, with some observations of the swarms of males of *Simulium (Eusimulium) bracteatum* Coquillett.

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"Swarming is obviously not a prerequisite for mating in *Simulium*. Black flies are practically ubiquitous, but swarms are rarely observed. ... Many, if not most, of the sympatric *Simulium* species breeding more or less in the same watercourses of a region are not observed to form any male swarms." (Wenk 1988).

This précis of mating behavior in *Simulium* derives from the following argument:

- **Observation:** some species of blackflies, including some species of *Simulium*, do or can be induced to mate without swarming — **true**.
- **Observation:** although blackflies are almost everywhere and are often abundant, swarms of blackflies are uncommonly encountered and, indeed, unknown in most species — **true**.
- **Conclusion:** in general (i.e. for the genus *Simulium*), swarming is not a prerequisite for mating.

This conclusion relies on the assumption that the rarity with which swarming is observed reflects reality — i.e. *swarming really is rare in the Simuliidae*. Most species must therefore mate without engaging in swarming. But, to assume, because a phenomenon, such as swarming, is rarely observed, that it is therefore *truly rare*, is an example of the *appeal-to-ignorance* logical fallacy, which takes either of the forms:

- There is no evidence against **p**; therefore **p**.
- There is no evidence for **p**; therefore, **not-p**.

For a very long time, this genre of fallacious argument has been — and continues to be — surprisingly and disappointingly pervasive in the

biting-fly literature. In almost all cases in which this flawed logic is used, there has been a failure to model — even conceptually — the dynamics of the observation of interest, and, as well, a failure to erect and prioritize a suite of competing hypotheses that predict the observation(s) of interest — i.e. a failure to apply *strong inference* (Platt 1964). If workers would model their observations and construct competing hypotheses to explain those observations, it would be impossible to fall into this logical snare.

So, given the importance of identifying this logical trap, I give two additional examples from the biting-fly literature, one old and one more contemporary, after which I'll consider swarming in a species of *Eusimulium* as an example of how strong inference might lead to new insights.

1. Failure to observe mating in swarms means that swarms are not involved with mating

"The swarms were found to consist entirely of males and to bear no direct relationship to mating" (Nielsen and Greve 1950).

Let us here ignore the immense problem that Nielsen and Greve (1950) also ignored — how to account evolutionarily for the persistence and near ubiquity of an energetically immensely expensive behavior (swarming) if the behavior is not related to male fitness. Let's just focus on *female* behavior with respect to swarms of males. A conceptual model of the dynamics of *female* behavior with respect to swarms would incorporate at least the following features:

- in most species, females emerge asynchronously over a prolonged period, leading to low and staggered or irregular rates of recruitment of uninseminated females to the population;
- teneral females feed on carbohydrates prior to mating (e.g. Nielsen 1950; Gadawski and Smith 1992), so the population density of uninseminated females may be further reduced at a local level by dispersal in search of sugar sources;
- carbohydrate-fed females seek mates by visiting sites at which males lek (swarm) — and there will be *many* such swarm sites;
- females entering a swarm are almost immediately removed by one or more males;
- if females are monogamous or remating is uncommon¹, then, once inseminated, they may not return to the swarm sites.

Even this simple conceptual model soundly predicts that the

¹. For all the families of bloodsucking Diptera there is an astonishing paucity of reliable *field* evidence of the extent of mono- or polygamy among females.

observation of copulation in swarms will be a rare event; therefore it is illogical to conclude that failure to observe the behavior implies that the behavior does not exist.

2. Specimens that are anthrone negative have not fed or do not feed on carbohydrates

"Female *Aedes aegypti*, collected with a hand-held aspirator inside inhabited houses were all fructose-negative, whereas more than half the males in the same collection were positive. Obviously, there were sugar sources in the environment on which the females refused to feed." (Van Handel 1994).

Van Handel's interpretation is *plausible* — but *not proven* nor "obvious". The conclusion that females refused to feed on nectar sources at which males were feeding is utterly unjustified because there are several competing hypotheses that predict exactly the same observation.

In almost all the anthrone-derived data on sugar feeding in bloodsucking flies, there is insufficient information to permit discrimination among the competing models — indeed, few authors even *consider* alternative hypotheses. This same failure turns up more subtly in studies in which authors infer that anthrone-positivity rates are comparable across species without knowing how the across-species dynamic might influence *detected* rates of carbohydrate feeding independent of anthrone-positivity (e.g. Magnarelli 1978) or that anthrone negativity implies non-feeding on sugar (e.g. Edman *et al.* 1992)²— yet another example of the appeal-to ignorance fallacy.

The key issue is that the presence of sugar in the crops of bloodsucking insects reflects a complex and intensely dynamic process, not a static one. Consider the *many* variables that could and almost certainly do influence the response variable (the anthrone reaction): once again we produce an outline of a conceptual model, here a list of variables that could influence both within- and between-species dynamics (this list is not exhaustive, simply illustrative):

- diel periodicities of nectar feeding, possibly host-, sex-, season- and locale- or habitat-specific;
- metabolic rates and their interactions with environmental variables, mosquito physiology, behavior, gender and species;
- nectar or honeydew production and standing crop in host species

². Note that I am *not* disputing the *observation* of anthrone-negativity, just its interpretation in the absence of an understanding of the analytically challenging behavioral, physiological and environmental complex within which carbohydrate feeding might occur.

and the daily, seasonal, and spatial periodicities of that sugar supply;

- temporal and spatial variance of nectar or honeydew availability due to competitors (e.g. Hymenoptera) or environmental variables (e.g. rainfall);
- gender-specific variance in mosquito behavior as a function of present and past nutritional state.

It is obvious — having conceptually modeled the situation! — that in the absence of a quantification of these important and numerous covariates, the interpretation of anthrone-negative specimens will be a challenging exercise indeed, because the dynamic could lead to very impressive sampling artifacts, particularly given the observation that specimens fed carbohydrates may test negative to anthrone only hours after feeding (Smith and Kurtz 1994).

In my opinion, this practice of exhaustively listing the variables that might influence an observation, enumerating and then prioritizing the competing hypotheses that predict the observation, and then devising observational or experimental strategies to *test* the competing hypotheses (i.e. *strong inference*) is exceptionally rare in biting-fly research. In large measure that *experimental-design* failure accounts for our appalling lack of progress in understanding and managing these insects, and explains why so much of the biting-fly literature is so unrelentingly repetitive and unimaginative.

Swarming in Simuliidae

Now, with that polemic as prelude, let me return to the issue of swarming in the Simuliidae. Indubitably, Wenk (1988) was *partly* correct: swarms of simuliids *are* uncommonly observed. Of course, one hypothesis is that the rarity of swarming is real — most species do not swarm.

We certainly know of some species that do not swarm but instead mate on the ground, usually at or close to the breeding sites. Invariably, however, terrestrial-mating behavior is associated with profound changes in male anatomy, particularly of the morphology of the eyes (Crosskey 1990; McIver and O'Grady 1987). In the vast majority of male Simuliidae, however, the morphology and neurology of the male eye are as in the eyes of males of other Diptera that are highly adapted for in-flight pursuit and tracking of females (Kirschfeld and Wenk 1976; Wehrhahn 1985). That morphology predicts that swarming, or at least the initiation of mating in the air, is the norm in the family (Adler *et al.* 2004).

It is conceivable then that swarms of blackflies are only *apparently rare* because observers have not looked in the right places or at the right time or the swarm has a *gestalt* for which observers have not yet developed a reliable search image. So let's list competing hypotheses that predict that swarms might be only apparently rare (this list is almost certainly not exhaustive and the hypotheses are not necessarily mutually exclusive):

1. The swarm sites are unknown

Crosskey (1990) stated "Most swarms are formed at a height somewhere between 0.5 and 4.5 m above ground level (usually 2–3 m and rarely over 5 m)". But that summary almost certainly reflects a sampling artifact — the typical distribution reported (2–3 m) is close to the mean height of entomologists! Males might swarm at lower or much greater heights, or even in or above the forest canopy (a very poorly studied habitat), or males may adopt a hilltopping strategy, common among many male Diptera (Adler *et al.* 2004; Ilmonen 2005). And males of some species are known to swarm only over river rapids; other species might have preferences for similar, small, relatively inaccessible or seldom-visited locales.

2. Perch-and-pursue as an alternative to sustained swarming

The males of many Diptera do not swarm continuously; instead, they perch and watch for passing females. Mating is still initiated in flight following a visually guided chase, so species adopting this strategy are predicted to have the usual eye anatomy. Perch-and-pursue strategies may involve populations of males at exceptionally low densities, which, combined with the small size of simuliids, may make detection difficult.

3. Swarms may be very small

The word *swarm* itself may bias an observer to look for assemblages; but there are accounts of single males engaged in normal "swarming" flight. Individual- or very-small-group swarming might have readily evolved from the perch-and-pursue strategy, in which it is not uncommon to find single or only very small groups of males in a single habitat. Alternatively, perch-and-pursue behavior might have evolved from species in which the normal "swarming" mode was of individual males. If single- or very-small-group swarming were to occur in a rare, low-density species, detection of the mating-assembly sites could be very difficult indeed.

4. Species swarm for only brief periods or at "unusual" times

We know almost nothing of the temporal distribution of swarming in the Simuliidae. It is possible that males of some species swarm for only brief periods and/or are crepuscular/eocrepuscular, swarming at twilight

and under poor light conditions, both of which features might make detection challenging. Given the anatomy of the male eye and the light requirements for high-speed pursuit of females, it is unlikely that any species swarms at night, but that possibility should not be discounted *a priori*. Could some species swarm under bright moonlight?

5. Search-image deficiencies

When I first began studying Tabanidae, I knew of some species of *Chrysops* and *Hybomitra* that used a perch-and-pursue mating strategy (e.g. Taylor and Smith 1990) but swarming behavior was unknown to me. When eventually I learned to *hear* and *see* hovering males of *Hybomitra* and *Tabanus*, I discovered that swarming males were *extraordinarily* abundant in a great many places — provided that I looked for them in the right places at the right time and with a practiced search image.

One would predict that, by comparison with the Simuliidae, the much larger size and noisy flight of the Tabanidae would make it *much* easier to detect swarms. Nevertheless, even in this family, the mating behaviors of most species remain completely unknown.

I am confident that the rarity with which species of Simuliidae are observed swarming largely derives from the challenges of where and when to look, swarm detectability and search-image deficiencies. I illustrate this with a brief description of the swarms of males of *S. bracteatum*, the first observations of male swarms of *Eusimulium*.

Swarms of *Simulium* (*Eusimulium*) *bracteatum*

This work was conducted in the mid-1960s in the vicinity of the Wildlife Research Station, Lake Sasajewun, Algonquin Park, ON, Canada (45°35'31" N, 78°31'22" W) , and at nearby locales surrounding Mew Lake, south of the Research Station (45°34'19" N, 78°30'56" W); all the swarm sites were about 450 m a.s.l. and were *not* hilltops.

At the time the observations were made, the species was known as *S. aureum* (Fries); it is now known that that species is European. The identity of the Algonquin specimens remains to be determined but, based on the current catalog (Adler and Crosskey 2012) and Adler *et al.* 2004, is *Simulium* (*Eusimulium*) *bracteatum* Coquillett, 1898 (Dunbar's "*aureum* A").

I observed male swarms of *S. bracteatum* on repeated occasions at 9 sites. The very first swarm was discovered in the gravel parking lot of the Research Station on 17 September 1962. During the late summer of the following year several more swarming sites were found within a 3-km radius of the Research Station. Flies were observed to swarm at these

sites on repeated evenings, permitting observations of the behavior as well as an assessment of the type of habitat in which swarming occurred and the size of the swarms.

Most of the behavioral observations were made at a single swarm site discovered on 14 July. The site consisted of a large opening (Fig. 1) in a grove of White Pine (*Pinus strobus*) east of Mew Lake. The pines at this site were all submature, about 12 m in height. At the site was also a small (6 m) White Spruce (*Picea glauca*). The forest was closed on both the east and west sides but was completely open at both the north and south ends. The ground cover consisted mostly of pine needles, although toward the periphery of the site there was some Bracken Fern (*Pteridium*



Fig. 1. Algonquin Park, Ontario, near Mew Lake. Typical swarm site (#2) of male *Simulium* (*Eusimulium*) *bracteatum*.

View northeast toward the Madawaska River showing the closed sides and open ends of the typical swarm site. Note the low vegetation or lack of vegetation over the central portion of the site above which males swarmed.

Photo by Paul Joslin (15 July 1963)

aquilinum) and shrub Speckled Alder (*Alnus rugosa*), all <1.2 m in height.

In some of the swarm sites the canopy was broken immediately above but *all* swarm sites had openings at the front and back. Downes (1969) drew attention to the importance of swarm *markers* in the

assembly of male Nematocera. On the assumption that the swarm "marker" for *S. bracteatum* is a long, broad forest clearing closed on 2 or 3 sides and open at one or both ends, and with a view of the sky (this is similar to the swarm sites used by many forest-dwelling male *Hybomitra* (Tabanidae) (e.g. Smith *et al.* 1994)), a search was made for similar sites and I found 7 more swarm sites, all with the features of open ends and canopy open to the sky above; 6 of the sites bordered Mew Lake, where campsites had been cleared at right angles to the lake, providing at least one open end and making for ideal swarm sites for *S. bracteatum*.

Males of *S. bracteatum* formed **immense but very-low-density, highly dispersed swarms**. At site #2 where most of the behavioral observations were made, the swarm measured 12.5 x 2.5 x 1.5–2 m (length, width, height), so occupying a volume of about 45–60 m³. The swarm usually contained only about 200 males (a coarse estimate, given the difficulty of enumerating the highly dispersed, active males over such a large volume), so the swarms consisted of, at most, 4–5 males/m³. Having been taken to the swarm sites, **several experienced biting-fly entomologists walked right through the swarm without noticing the swarming males** — the low density in sharp contrast to the *as-yet-known*, mostly compact swarms of other Simuliidae, which are visually detectable at some distance. If this dispersed, low-density swarm is typical of *Eusimulium* or other groups, it may explain why the swarm sites have remained undiscovered.

Downes (1969) suggested that male Nematocera respond individually to the swarm marker and the appearance of the swarm of *S. bracteatum* lends credence to this hypothesis. There is nothing in the behavior of the swarm that is characteristic of a group; rather, one is struck by the independence of the members of the swarm.

Observation of individual flies in the swarm is difficult. However, by viewing the swarm with a 7 x 35 binocular against the sky (either overhead or at the end of the swarm site) observations could be made of the behavior of individual males. The males perform two forms of "dance". The most common type was a bobbing motion in the vertical axis, the fly tending to remain stationary over one spot. Occasionally, while performing this bobbing dance, the males describe small circles in the air, but they do not move any great distance.

Close observation of many males showed that they rapidly changed their orientation in space; i.e. for a few seconds they performed the bobbing dance while facing south, then they rapidly turned 90° to face west, then turned again to face south, then east, etc., all the while remaining over one spot — a behavior that suggests that females may enter the arena from many different directions. Bobbing males were frequently seen speeding off rapidly; I don't know if this is a part of the

swarm "dance" or whether (and more likely) the males were in pursuit of females. Coupling was not observed, although females were netted from several swarms.

Because of the stationary positioning of males while bobbing, the entire swarm, to the naked eye, presents the appearance of being almost stationary; the movements performed by the bobbing males are only slight so that at a distance the swarm appears to be almost static, in strong contrast to the active movements of other *Simulium* and Culicidae.

Although bobbing males re-oriented themselves from time to time, the predominant orientation was at right angles to the long axis of the swarm, so that males were turned 90° from the direction of the open end(s) of the swarm.

On one occasion, again at Site #2, a different type of flight behavior was observed. On 17 July, a swarm was observed in a type of behavior similar to that described by Downes (1958) for *Aedes hexodontus*. At the time there was no perceptible wind movement. Instead of being oriented along the north-south axis as was almost always the case of this site, the swarm was oriented east and west and was much more compact than normal. The males still performed their typical bobbing flight, but at the same time they drifted slowly to the east. The drift axis was about a meter in length; when the males had reached the western terminus, they would quickly turn around and fly rapidly to the eastern terminus, where they would again bob and drift slowly east. I have observed Empididae swarming in this fashion, except that the males flew rapidly both to and fro instead of flying in one direction and drifting slowly in the other.

While swarming, males of *S. bracteatum* are exquisitely sensitive to motion by the observer. On many occasions, even slight movements of a white insect net were sufficient to cause the flies to immediately disperse — possibly a reflection of an anti-predator strategy. The sensitivity to the movements of the net made it difficult to capture specimens; I had to crawl slowly *beneath* the swarm and then make several rapid sweeps with the net after rising quickly. This behavior is in sharp contrast to Nematocera that use sound rather than vision while swarming (e.g. Chironomidae and Culicidae); for these flies one can pass the net right through the middle of a swarm without disturbing the flight behavior of flies outside the upper and lower boundaries of the net.

Monty Wood (*in litt.* 16 October 2010) has made a few observations of male swarms of the *S. aureum* group; his observations are not unlike mine:

"I have encountered male swarms of the *aureum* group on several occasions on the hilltop behind my cottage, years ago. The swarms were not dense, and were made up of relatively few individuals, so perhaps they were not substantially different from yours. What I remember is

that they were in the afternoon, on cloudy days and they were diffuse, spread out over the clearing, not in a tight clump next to a tree trunk like *Prosimulium* in Algonquin Park. I didn't think much of it at the time — certainly not enough to suppose that you or anyone might write for more information, and so the exact species is unknown to me! Perhaps the size of the swarm is dependent on the size of the population available at the time."

Admonition

Let us not assume, illogically, that not having seen something implies that it doesn't exist. Perhaps our meager knowledge of assembly and mating behaviors in *all* the families of the bloodsucking Diptera is due in large part to a narrowness of approach and a deficiency of disciplined imagination — in the life sciences it is likely that many phenomena remain undetected because they are so utterly different from our *a-priori* expectations. Such expectations can be rewardingly inflated by rigorously conceptualizing *all* the possible models or hypotheses that could predict an observation. All these decades later, Platt (1964) is still so relevant!

"When I think of all the peculiar things I have taken in the Yukon and Alaska in Malaise traps, while seeing hardly anything around me, I realize that all the different possibilities are scarcely understood.

— Monty Wood (*in litt.*, 29 April 2012)

Acknowledgements

I thank John Davies for extensive consultation on this manuscript and, as always, for his sage advice. And I thank Peter Adler, Jari Ilmonen, Monty Wood and Peter Wenk for their comments.

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THE BRITISH SIMULIID GROUP

The British Simuliid Group (BSG) is an informal assemblage of scientists of any discipline, from many countries, who have an interest in the Simuliidae. The group's members include entomologists, parasitologists, environmentalists, ecologists and medics, with interests in ecology, bionomics, taxonomy, cytotaxonomy, disease transmission, freshwater biology etc. Our aim is to assemble as diverse a group as possible in order to encourage a wide interchange of ideas and information.

At present the BSG has about 130 recorded members in the UK, Europe, Africa, Australia, New Zealand and the Americas. Membership is FREE - there are no restrictions. If you are not already a member of the BSG and you wish your interest to be known, all you have to do is send your name and postal and e-mail addresses to the editor at daviesjb@liv.ac.uk. Annual meetings have been held at different locations in the UK since 1978. Abstracts of papers presented are published in our *Bulletin* which is now available for downloading from the internet.

The Group also runs an electronic news list with the name "Simuliidae" which is now on JISCmail. To join "Simuliidae" send the following command as one line of text in an e-mail message without subject heading- join Simuliidae your-firstname lastname to: jiscmail@jiscmail.ac.uk. The Simuliidae list owner is the Editor of the Bulletin. Current and back numbers of the *Bulletin* can be viewed on the World Wide Web at URL:

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Inquiries about the Group and its activities should be made to John Davies: address inside the back cover and e-mail: jaybeedee@gmail.com

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Content covers papers presented at the Group's Annual Meeting, which is usually held in September, short research notes, notices and accounts of meetings, and articles of anecdotal or general interest that would not normally be found in international journals. Geographical cover is world-wide, and is not restricted to the British Isles. Reports of research carried out by graduates, young scientists and newcomers to the subject are particularly encouraged. It is an ideal medium for offering new ideas and stimulating discussion because of the very short interval between acceptance and publication.

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