

First records of *Siphlaenigma janae* (Ephemeroptera: Siphlaenigmatidae) from the North Island of New Zealand

D. R. TOWNS*

Department of Zoology, University of Auckland,
Private Bag, Auckland, New Zealand

In the North Island of New Zealand *Siphlaenigma janae* is common in some forested streams, in slow-flowing areas, on clumps of the alga *Bostrychia harveyi* forma *distans* and on overhanging *Elatostema rugosum*. Nymphs of *S. janae* are compared with those of the superficially similar siphonurids *Nesameletus* spp. and *Rallidens mcfarlanei*.

INTRODUCTION

Siphlaenigma janae Penniket is the only known species of New Zealand's sole endemic mayfly family, Siphlaenigmatidae. The family is of particular interest because the nymph of *Siphlaenigma* is baetid-like in external morphology but the adults are intermediate between Baetidae and the *Nesameletus* complex of Siphonuridae (Edmunds *et al.* 1963, Edmunds 1972).

The only published record of *Siphlaenigma* is from an 80-m section of Baxter's Creek, on the west coast of the South Island (Fig. 1, 1) (Penniket 1962). My discovery of nymphs in the Cascade Stream, a tributary of the Waitakere River in the North Island near Auckland, prompted further collecting and a check through museum collections for other localities. An account of the distribution of *S. janae* known so far is presented below.

It seems likely that the scarcity of records of *S. janae* can be attributed in part to the similarity between nymphs of this species and the more common siphonurids. The following account provides notes for distinguishing *S. janae* from the siphonurid genera *Nesameletus* and *Rallidens*. The habitats in which *S. janae* is most abundant are also described.

DISTRIBUTION

Few specimens of *Siphlaenigma* from outside the type locality are held in museum collections (Table 1). A nymph of *S. janae* from the Swanson Stream near Auckland is held in the Entomology Division (DSIR) collection (Fig. 1, 4); the Canterbury Museum has specimens of nymphs and adults from Oruawai, near Taumarunui (R. A. Savill, pers. comm.) (Fig. 1, 5); the University of Utah has nymphs from Nelson Province (G. F. Edmunds,

pers. comm.) (Fig. 1, 2); and material from the National Museum of New Zealand includes an unlabelled *Siphlaenigma* nymph from the Kaingaroa Forest (pers. obs.) (Fig. 1, 3). These and additional specimens which I have collected from the Waitakere Ranges, Auckland (Fig. 1, 7-12) and the Kauaeranga River, Coromandel Ranges (Fig. 1, 6) greatly extend the range of *Siphlaenigma* beyond the type locality in Westland.

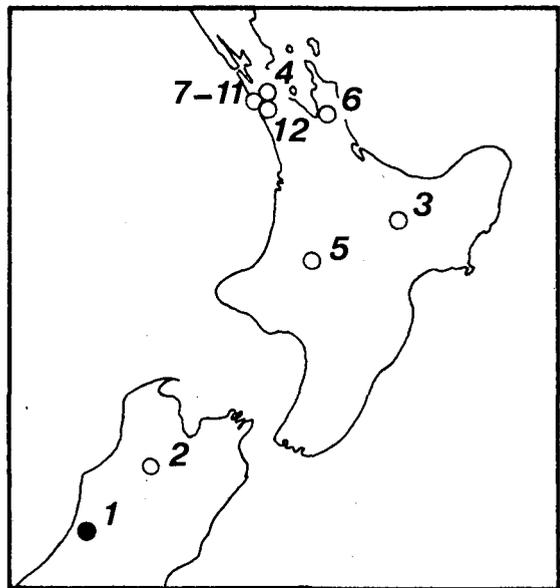


Fig. 1. Specimen localities of *Siphlaenigma janae*. For explanation of numbers, see Table 1 (●, type locality).

Received 26 July 1977

*Present address: Laboratory of Aquatic Entomology, Florida A & M University, Tallahassee, Florida 32307, U.S.

Table 1. *Siphlaenigma janae* specimen localities and collection data (numbers in parenthesis refer to site numbers in Fig. 1)

| Stadium | n | Locality | Habitat | Date | Collector | Repository |
|---------|------|--|---|-------------|---|-----------------------------------|
| — | | Baxter's Creek, Westland (1) | See Penniket (1962) | — | — | — |
| Nymph | ? | Clay Bank Creek, Murchison, Nelson (2) | — | 6 Mar 1966 | G. F. Edmunds | University of Utah |
| Nymph | 1 | Ngapuketuruua, 610 m, Kaingaroa Forest (3) | Pool on east side of lookout | 30 Dec 1965 | M. M. Neill | National Museum of N.Z. |
| Nymph | 1 | Swanson Stream, Auckland (4) | — | 9 Oct 1966 | J. A. McLean | Entomology Division, DSIR |
| Nymphs | 16 | Oruairiwi (5) | Includes 2 reared | 6 Jan 1963 | P. Aston | Canterbury Museum |
| Adults | 4 | | adults | | | |
| Nymph | 1 | Small tributary of Kauaeranga River, Coromandel Ranges (6) | Overhanging and emergent dead vegetation | 21 Jan 1977 | D. R. & E. L. Towns, B. W. & G. C. Hayward | D. R. Towns Coll. |
| Nymph | 1 | Kitekite Stream, Waitakere Ranges, Auckland (7) | Overhanging vegetation | 27 Dec 1976 | D. R. & E. L. Towns, B. W. & G. C. Hayward | Florida A & M Entomology Coll. |
| Nymph | 1 | Kitekite falls plunge pool, Waitakere Ranges, Auckland (8) | Overhanging vegetation | 27 Dec 1976 | D. R. & E. L. Towns, B. W. & G. C. Hayward | D. R. Towns Coll. |
| Adult | 1 | Ex Cascade Stream, Waitakere Ranges, Auckland (9) | Lab. reared | 25 Feb 1976 | D. R. Towns | D. R. Towns Coll. |
| Nymphs | c.10 | Cascade Stream, Waitakere Ranges, Auckland (10) | Overhanging vegetation and <i>Bostrychia</i> | 23 Feb 1976 | D. R. Towns | Entomology Division, DSIR |
| Nymphs | c.30 | Cascade Stream, Waitakere Ranges, Auckland (11) | Overhanging vege- tation, <i>Bostrychia</i> and <i>Cladophora</i> | 23 Mar 1976 | D. R. Towns | Entomology Division, DSIR |
| Nymphs | 2 | Karamatura Stream, Waitakere Ranges, Auckland (12) | Overhanging vegetation | 9 Jan 1977 | D. R. & E. L. Towns | Florida A & M Entomology Coll. |

HABITAT

Of three Waitakere Range streams sampled, the Cascade Stream produced most specimens of *Siphlaenigma*. This is a small stream (4 m wide) with normal discharge ranging from 0.11 m³/s (July) to 0.05 m³/s (January). Water temperatures and temperature range were relatively low; daytime spot temperatures in winter (June, July) and summer (December, February) were 10.3°C, 11.0°C, 12.5°C, and 13.0°C respectively. Max./min. thermometers in the stream over 1 month in summer and winter provided approximate upper and lower limits of 17°C (January - February) and 7°C (June - July). Details of other physicochemical features of the area are given in Towns (1976).

The stream flows through an almost closed canopy of mixed broadleaf/podocarp forest containing large stands of mature and regenerating kauri (*Agathis australis*). The stream banks are covered with *Elatostema rugosum*, which in some areas trails into the water.

Nymphs of *Siphlaenigma* were not obtained in collections from riffles and cascades in the Cascade Stream, but were common at a few sites where flow

rate was low. At one site nymphs occurred where the substrate was coated with extensive growths of green algae (*Cladophora* sp.) and numerous tufts of the red alga *Bostrychia harveyi* forma *distans*. At a second Cascade Stream site *Siphlaenigma* was common where *Elatostema* entered the water.

An indication of the microhabitat preference of *Siphlaenigma* and the composition of its associated invertebrate fauna is given in Table 2. These results were obtained with a 30 × 30-cm hand net swept for

Table 2. *Siphlaenigma janae* and associated invertebrates from *Cladophora* (A), *Bostrychia* (B), *Bostrychia* + liverworts (C), and *Bostrychia* + overhanging *Elatostema* (D) in the Cascade Stream (+, present; *, most abundant species)

| | A | Microhabitat | | D |
|------------------------------------|---|--------------|----|---|
| | | B | C | |
| MOLLUSCA | | | | |
| <i>Potamopyrgus antipodarum</i> | | + | + | + |
| CRUSTACEA | | | | |
| <i>Paraneohrops planifrons</i> | | + | + | + |
| EPHEMEROPTERA | | | | |
| <i>Ameletopsis perscitus</i> | | | | + |
| <i>Nesameletus</i> sp. | + | + | + | * |
| <i>Siphlaenigma janae</i> | 5 | 5 | 22 | 4 |
| <i>Zephlebia dentata</i> | | + | + | + |
| <i>Zephlebia scitainodularis</i> † | + | | | |
| <i>Zephlebia</i> n.sp. B | | + | + | + |
| <i>Atalophlebioides</i> n.sp. A | + | + | + | + |
| Gen. nov. sp. A | | | | + |
| PLECOPTERA | | | | |
| <i>Megaleptoperla</i> sp. | | | | + |
| TRICHOPTERA | | | | |
| <i>Pycnocentroides</i> sp. | + | | | |
| <i>Pycnocentria evecta</i> | + | + | | |
| <i>Triplectides obsoleta</i> | | | | + |
| <i>Oxyethira albiceps</i> | + | | | |
| <i>Neurochorema armstrongi</i> | | + | | |
| <i>Zelolessica cheira</i> | + | + | | |
| DIPTERA | | | | |
| Dixinae indet. | | | + | + |
| Tanypodinae indet. (1 sp.) | + | + | | |
| Orthocladiinae indet. (1 sp.) | + | + | | |
| <i>Polypedilum opimus</i> | + | | | |
| Sciomyzidae | | + | | |

†See Towns (1976), appendix IV

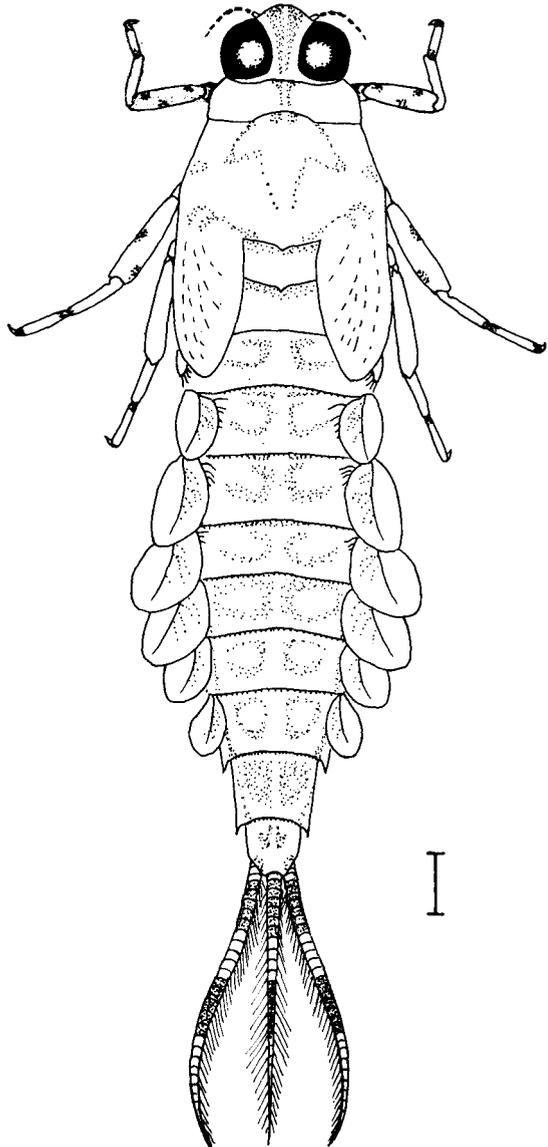


Fig. 2. *Rallidens mcfarlanei* nymph (scale 1 mm).

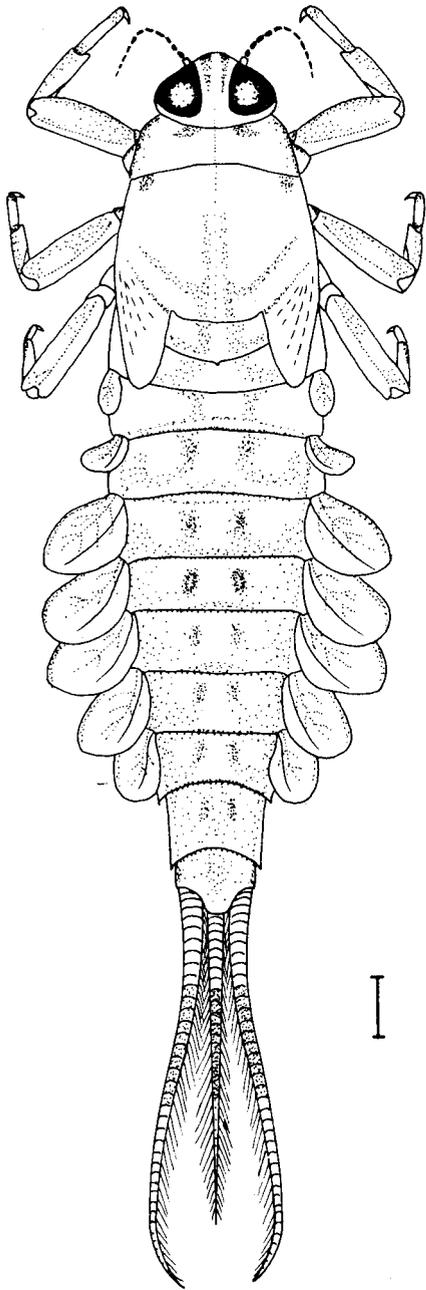


Fig. 3. *Nesameletus* sp. nymph (scale 1 mm).

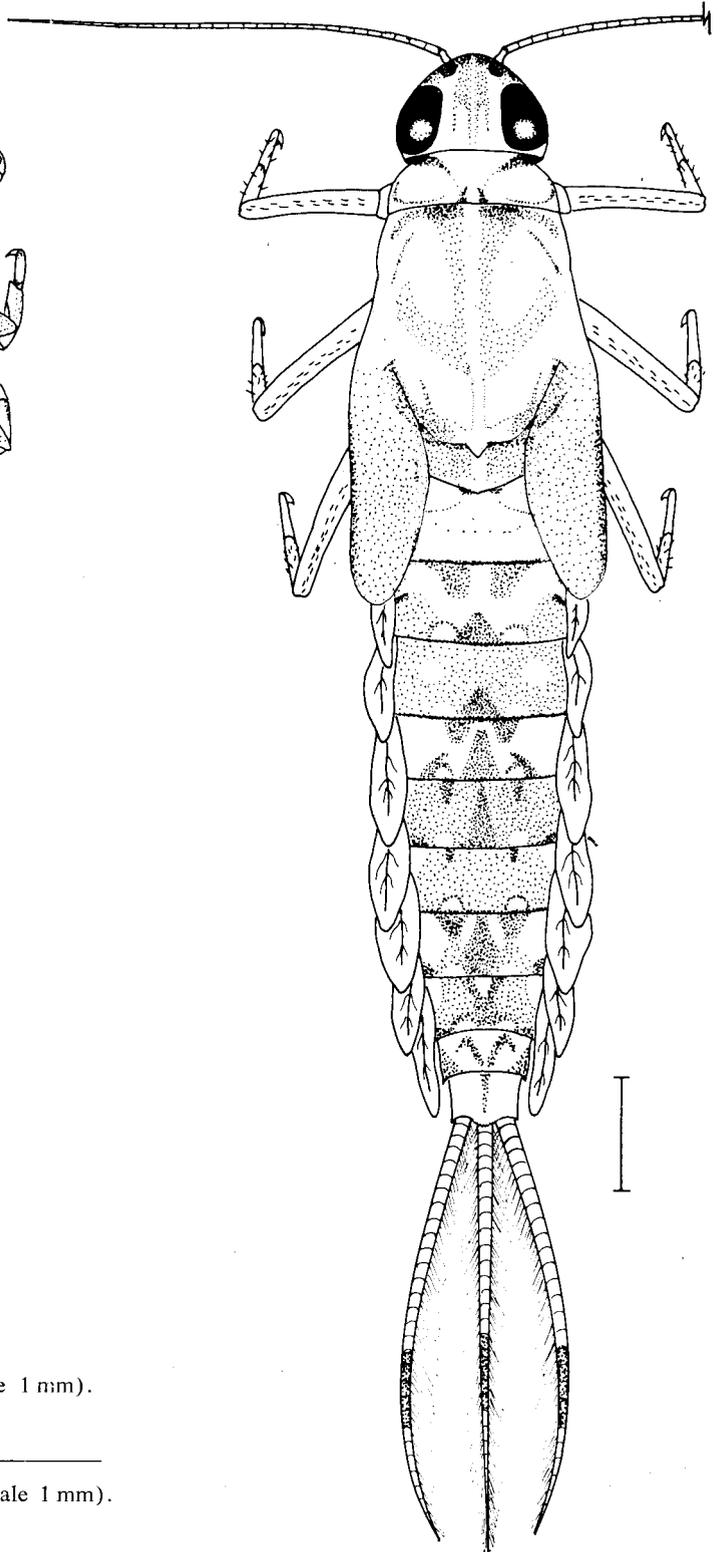


Fig. 4. *Siphlaenigma janae* nymph (scale 1 mm).

2 min through four vegetation types at one site in the Cascade Stream. The *Cladophora* clumps occurred in areas with moderate flow rate (approx 0.5 m/s), whereas all other samples were obtained where flow was negligible.

A small but distinctive invertebrate fauna was obtained in the samples with *Siphlaenigma*. The most abundant species were usually leptophlebiid and siphonurid mayflies, including *Nesameletus* sp. and an undescribed *Zephlebia* species [*Zephlebia* sp. B of Towns (1976)]. An undescribed leptophlebiid genus [Gen. nov. sp. A of Towns (1976)] and an undescribed species near *Atalophlebioides* [*Atalophlebioides* sp. A (Towns 1976)] were also commonly obtained (Table 2).

DISTINGUISHING FEATURES OF *SIPHLAENIGMA*

Siphlaenigma is one of three genera of New Zealand mayflies with nymphs of fusiform shape and having short, feathery caudal filaments and rapid swimming movements involving dorsoventral flicking of the abdomen. However, they can be interdistinguished readily by examination of the gills and mouthparts. The mandibles are particularly useful because their well sclerotised incisors are usually visible without dissection.

A key to the nymphs of the three genera is presented below. Both *Siphlaenigma* and *Rallidens* are

monotypic genera. Two species of *Nesameletus* have been described (see Phillips 1930), but identity of the nymphs remains unclear. The species figured here (see Fig. 3) is from the Tarawaere Stream, in the Kauaeranga Valley (Coromandel Ranges).

1. Abdominal gills with double lamellae, dorsal lamella flat, ventral lamella tufted; outer margins of mandibles with more than 2 incisors, forming a series of complex crests; antennae with less than 10 segments *Rallidens* (Fig. 2, 5a)
- Gills single; mandibles with 2 incisors or less; antennae with more than 10 segments 2
2. Mandibles each with a single, blade-like incisor; antennae with less than 20 segments; gills ovate, subapical margin serrate *Nesameletus* (Fig. 3, 5b)
- Mandibles each with 2 incisors, each incisor with 3 apical teeth; antennae with more than 20 segments; gills elongate, subapical margin smooth *Siphlaenigma* (Fig. 4, 5c)

DISCUSSION

The area inhabited by *Siphlaenigma janae* nymphs in the Cascade Stream resembles the type locality in several respects. Like Baxter's Creek, the well forested Cascade Stream provides areas of low light intensity. As with Penniket's material, many Cascade Stream specimens were found in aquatic vegetation. However, it is not clear whether the "water weeds" referred to by Penniket (1962) are macrophytes or algae.

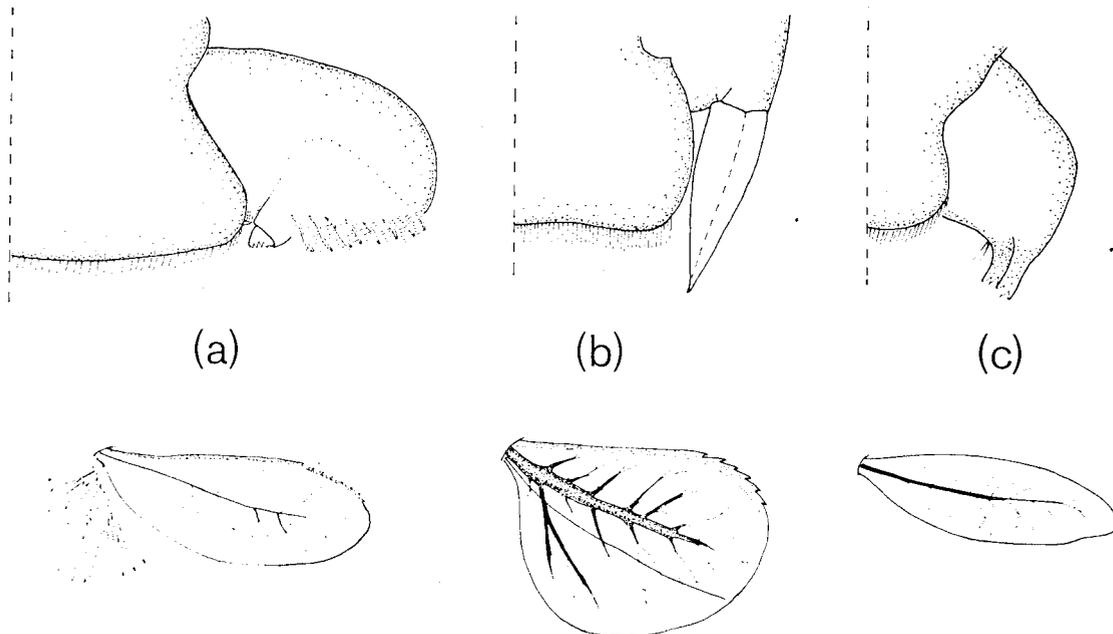


Fig. 5. Left mandible (above) and 5th abdominal gill (below) of: (a) *Rallidens mcfarlanei*; (b) *Nesameletus* sp.; (c) *Siphlaenigma janae*.

All sites in which I found *Siphlaenigma* were areas of low flow rate in small, stable streams with fringing vegetation hanging into the water. Many Baetidae occur in similar habitats in North America. *Siphlaenigma* therefore resembles this family in some aspects of its nymphal ecology as well as morphology.

ACKNOWLEDGMENTS

I thank Harry Savage, Mike Hubbard, Mrs Jan Peters, and Drs Wills Flowers, Manuel Pescador, William L. Peters, and Annelle Sopton for their comments on the manuscript; and my wife Elizabeth and Bruce and Glenys Hayward for some memorable hours spent collecting. This study was supported by a New Zealand University Grants Committee Post-graduate Scholarship. The writing of this manuscript was supported by a grant from the Co-operative State Research Service, United States Department of Agriculture, U.S.A., P.L. 480, to Florida A & M University (William L. Peters, Principal Investigator).

REFERENCES

- EDMUNDS, G. F. 1972: Biogeography and evolution of Ephemeroptera. *Annual Review of Entomology* 17: 31-42.
- EDMUNDS, G. F.; ALLEN, R. K.; PETERS, W. L. 1963: An annotated key to nymphs of the families and subfamilies of mayflies (Ephemeroptera). *University of Utah Biological Series* 13(1): 3-55.
- PENNIKET, J. G. 1962: Notes on New Zealand Ephemeroptera III. A new family, genus, and species. *Records of the Canterbury Museum* 7(5): 389-98.
- PHILLIPS, J. S. 1930: A revision of the New Zealand Ephemeroptera Part 1. *Transactions of the N.Z. Institute* 61: 271-334.
- TOWNS, D. R. 1976: Dynamics of benthic invertebrate communities in a northern New Zealand kauri forest stream ecosystem. Unpubl. Ph.D. thesis, University of Auckland library.