THE EFFECT OF MESH SIZE ON THE INTERPRETATION OF THE LIFE HISTORY OF TWO MAYFLIES FROM SOUTH AUSTRALIA

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ABSTRACT

Using a Surber-type benthic sampler with a double net collecting system, the efficiency of nets having aperture sizes of 480 µm and 110 µm was assessed over a twelve month period in two streams in South Australia. Efficiency was defined as the percentage increase in yield (numbers) of animals obtained by use of 110 µm mesh instead of 480 µm mesh. The average annual increase in sampling efficiency of the fine net as compared with the coarse for mayfly nymphs was 412% and 235% for Spring Creek and Deep Creek respectively. The life cycles of two species of mayfly *Tasmanocoenis tillyardi* (Lestage) and *Baetis soror* Ulmer from Deep Creek are presented and the effect of the two mesh sizes on the interpretation of the life histories is discussed. Interpreted from the coarse mesh only, the life cycle of both species is bivoltine, each having one winter generation and one summer generation. Combining both fine and coarse net collections, the life cycle interpretation is distinctly different, illustrating the difficulties in drawing conclusions from coarse mesh samples. Not only is the number of generations misinterpreted in *B. soror*, but conclusions on the duration of the egg stage and length of each generation are also inaccurate for both species.

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INTRODUCTION

The effect of net mesh size on sampling efficiency in lotic habitats has been discussed by various authors, including Jonasson (1955, 1958), Macan (1958), Hynes (1961), Maitland (1964), Tanaka (1967), Mundie (1971), Frost *et al.* (1971), Zelt and Clifford (1972), Clifford *et al.* (1973) and Barber and Kevern (1974). All of these

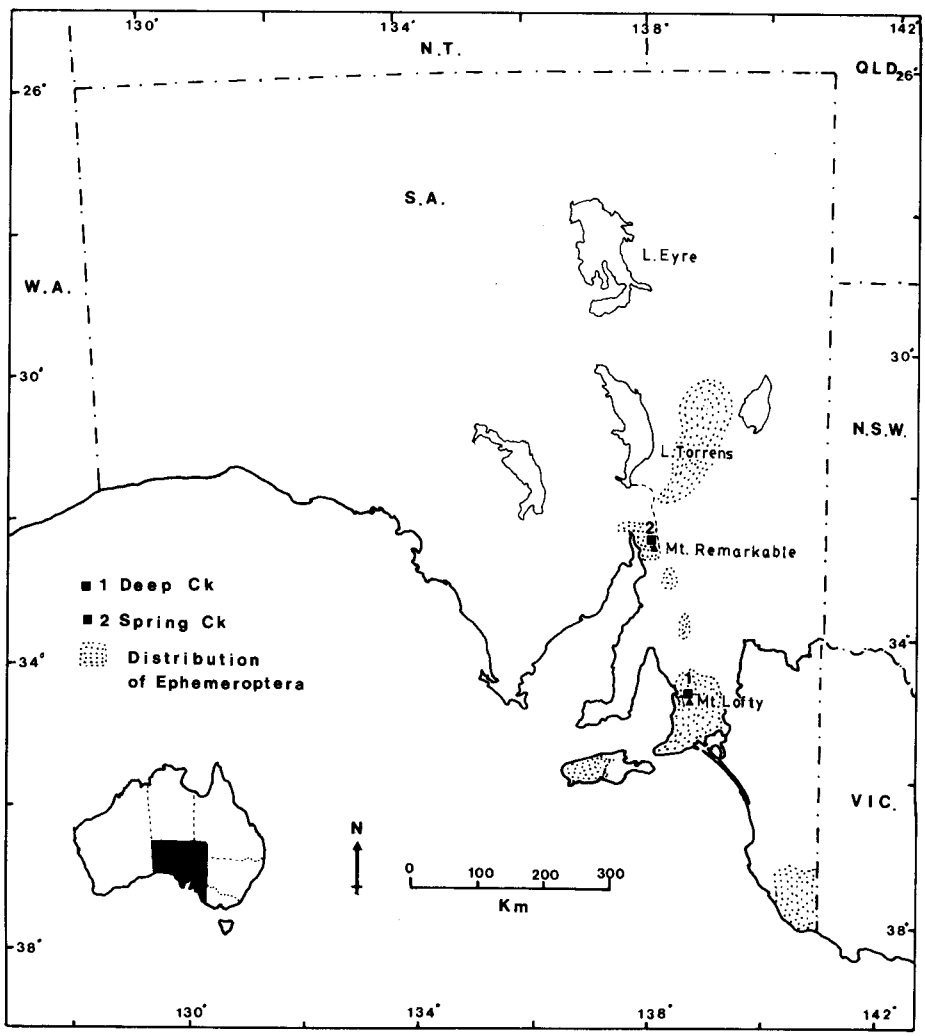


Figure 1. The location of the study sites and the distribution of Ephemeroptera in South Australia.

studies showed the deficiencies of coarse mesh sampling, but Zelt and Clifford (1972) and Clifford *et al.* (1973) showed specifically that inaccurate life cycle conclusions could be drawn using only coarse net samples.

In our study of the life cycles of some South Australian mayflies, a dual net Surber-type sampler was used. This allowed an assessment of the relative efficiency of retaining all nymphal size groups of both the inner 480 µm pore size net, and the outer 110 µm pore size net, in terms of numbers and life cycle interpretation.

STUDY SITES

The study was conducted from October 1976, to October 1977, in two creeks in South Australia; Deep Creek, draining the Mt. Lofty Ranges just north of Mt. Lofty; and Spring Creek, draining the slopes of Mt. Remarkable in the Southern Flinders Ranges (Fig. 1).

Deep Creek is a permanent flowing tributary of the R. Torrens draining a catchment of approximately 40 km^2. The creek is slightly alkaline (pH range 7.75-8.82) with ionic dominances $Mg^{2+}>Na^{+}>Ca^{2+}>K^{+}$ and $HCO_3^{-}>Cl^{-}>SO_4^{2-}$. The water temperature range observed during the study period was 5°C (August, 1977) to 23°C (March, 1977). Discharge ranged from 14 L/s in the summer to 696 L/s after a winter downpour. The study site was 24 km from Adelaide just above the confluence with the R. Torrens at an elevation of 140 m a.s.l. At the study section the stream is fifth order and drains the entire catchment. The stream is 10-15 m wide and the depth varied from 0.12-0.42 m in the riffles and pools respectively. Substrate was predominantly coarse to very coarse gravel (Φ = -4 to -6) and the erosional zones almost attained small cobble size (Φ = 6) as defined by Doeglas (1968).

Spring Creek is an intermittent or temporary stream which is a tributary of the Willochra Creek, a large intermittent stream flowing northwards towards the dry salt pan of Lake Torrens. Its catchment area is approximately 50 km^2. The creek is slightly alkaline (pH range of 7.4-8.3) with ionic dominances $Ca^{2+}>Na^{+}>Mg^{2+}>K^{+}$ and $HCO_3^{-}>Cl^{-}>SO_4^{2-}$. The Ca^{2+} and Na^{+} dominance was reversed, with Ca^{2+} dominant only when there was no surface flow. The stream water temperature was warmer than Deep Creek: minimum of 9°C in October 1976, and maximum of 29°C in March 1977. Discharge varied from zero in January to May 1977, to an estimated 30 cumec during flash flood periods. The study section was 13.5 km from the source at an elevation of 350 m a.s.l., some 8 km south of Wilmington. At the study site the stream is fifth order and drains the entire catchment. The stream bed is 15-30 m wide and depth varies from zero in summer months to approximately 2 m deep during flash floods, but is usually less than 0.5 m. Substrate was fine to coarse gravel (Φ = -3 to -5)

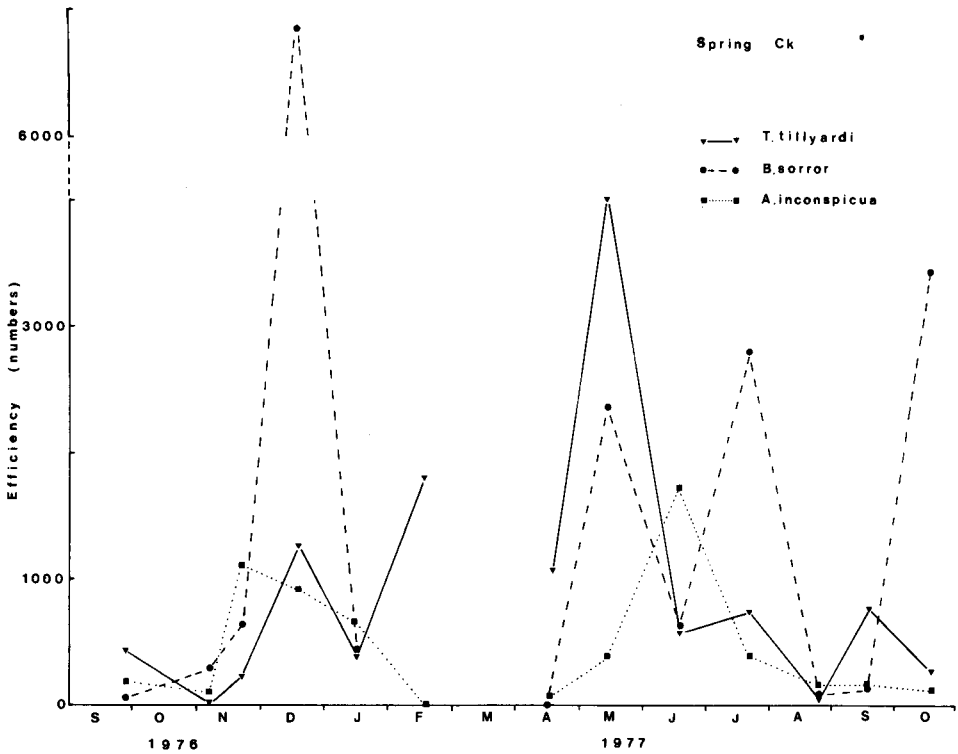


Figure 2. Seasonal variation in sieving efficiency of Ephemeroptera from Spring Creek.

as defined by Doeglas (1968).

Both localities were used in the assessment of collecting efficiency of the two nets, but life cycle interpretation is based only on material from Deep Creek.

MATERIALS AND METHODS

The general characteristics of the two streams were such that a Surber-type sampler could be used (Hellawell 1978). Although the primary aim of the study was to determine the life histories of the Ephemeropteran species occupying each stream, the selection of a dual net box sampler, based on the sampler described by Mundie (1971) and the sampler used by Bishop (1973), allowed a comparison

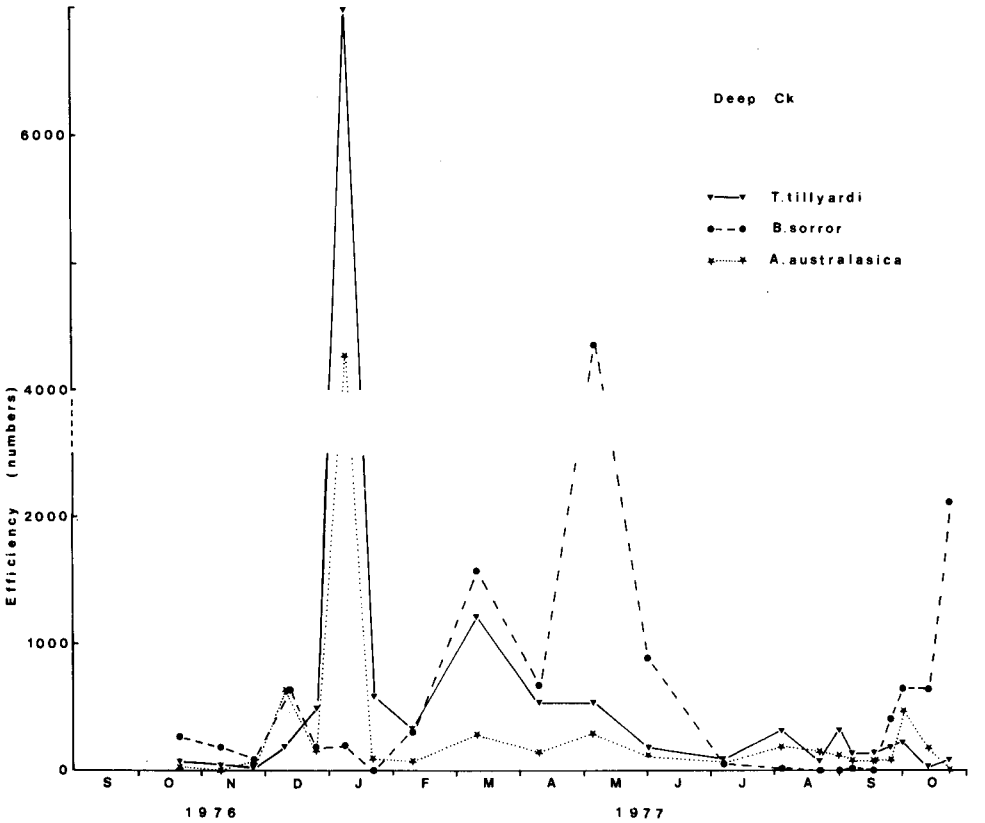


Figure 3. Seasonal variation in sieving efficiency of Ephemeroptera from Deep Creek.

of the efficiencies of different mesh apertures in the collection of the mayfly fauna.

The sampler was a galvanised steel box enclosing 0.1 m^2 of stream bed. Into a rear steel groove were inserted two nets, an inner coarse mesh net ("Nytal" 500 µm mesh aperture; actual measured aperture of 460-480 µm; diagonal aperture of 678 µm) and an outer fine mesh net ("Nytal" 106 µm mesh aperture; actual measured aperture of 98-120 µm; diagonal aperture of 155 µm). The coarse net inside the fine retained larger animals and detritus carried in by the current after physical disturbance of the substrate, and protected the fine net, which retained material down to 80 µm diameter, from damage.

Both nets were a tapering design with the inner coarse net 60 cm long and tapering to a 10 x 10 cm trailing end, and the outer net 2 m long also tapering to a 10 x 10 cm trailing end. This tapering design ensured that the inner coarse net did not come in contact with the outer net, thus maintaining the sieving effectiveness of both nets. The long length of the 110 µm net overcame the major problems experienced with fine net samplers, those of blockage by fine organic and inorganic material and creation of backwash.

At each site on each sampling date four samples were taken from visually selected habitats, broadly categorised as pool, run, flat and riffle (after Allen 1951). The sampler was forced into the substrate until an effective seal was formed, and the substrate was disturbed and brushed by hand. Once the sampling was completed, the nets were removed from the rear groove and the contents of each washed into separate polyethylene bags and preserved with 10% formalin. During the periods of zero flow at Spring Creek a 2 m kick sample using both nets (c.f. Hynes 1961), was used to collect the benthos in the pools and slack reaches.

In the laboratory each coarse net sample was poured into a 250 µm aperture copper sieve and washed with a large volume of water. The sample was then hand sorted for Ephemeropteran nymphs in a white sorting tray. When there were more than 300 specimens of any one species in a sample, a subsample was taken such that a minimum of 150 animals were measured in any subsample.

The fine mesh net samples were washed in a fine sieve and the organic material was separated from the inorganic fraction by repeated (5 x) flotation in saturated calcium chloride solution, and elutriation through the 110 µm mesh. The organic fraction was washed in water, and when the volume of material was too great to sort in its entirety subsampling was carried out using the technique of Bishop (1973). The sample or subsample was sorted in a plankton sorting tray, based on the Fenwick pattern as illustrated by Hellawell (1978), using 25 x magnification.

Each nymph, from both of the above sets of samples, was identified, the head with measured at 50 x magnification, and stored in ethyl alcohol-glycerol solution.

The sampling efficiency of each net was calculated as the percentage increase in yield (numbers) of nymphs obtained by use of 110 µm mesh instead of 480 µm mesh (c.f. Jonasson 1955,1958; Barber and Kevern 1974).

The effect of the two meshes on interpretation of the life cycle of *Tasmanocoenis tillyardi* (Lestage) (Caenidae) and *Baetis soror* Ulmer (Baetidae) was qualitatively assessed only from Deep Creek by comparing the life cycles as interpreted from collections

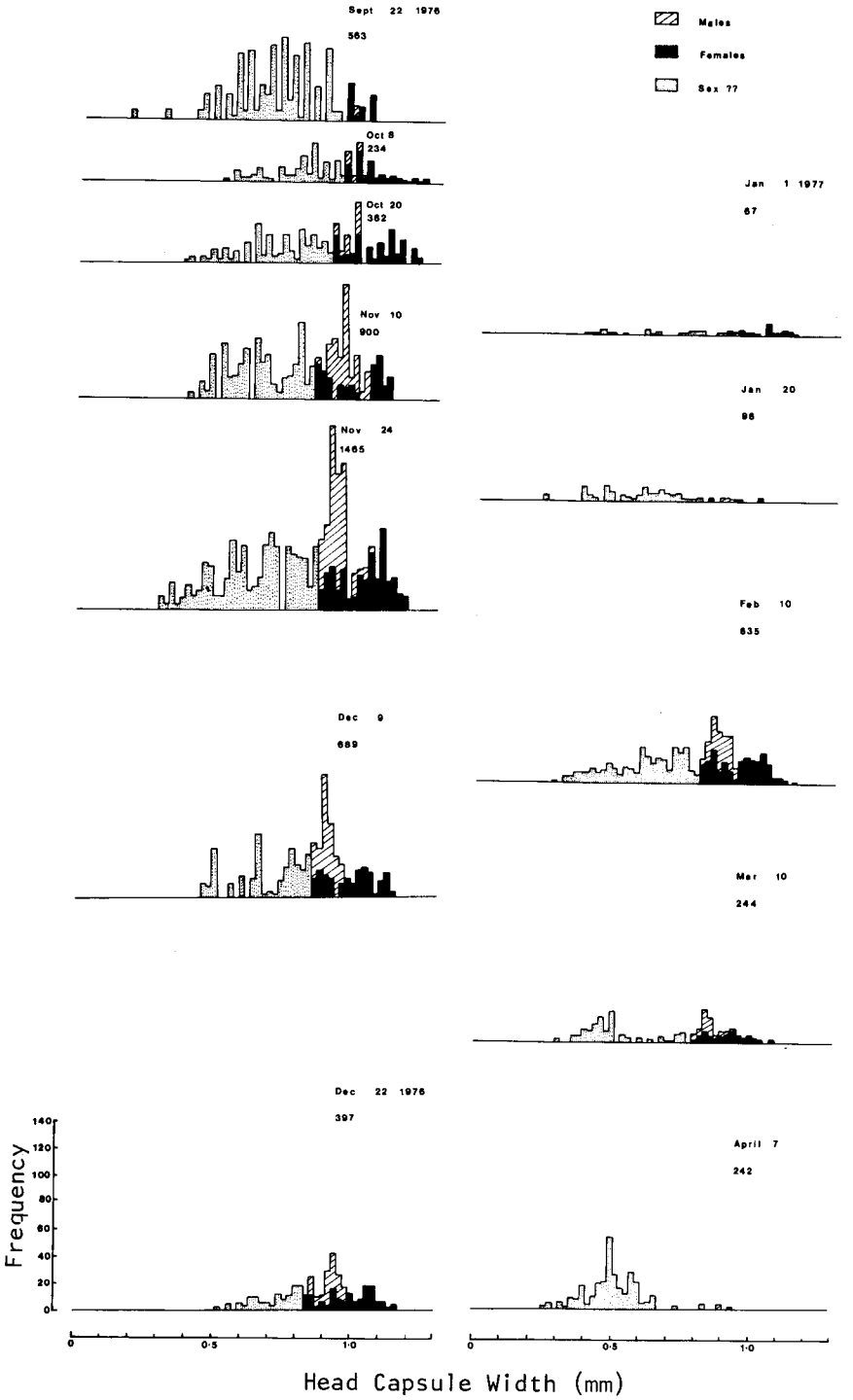
made with the coarse net with the life cycle obtained with the combined fine and coarse nets. Interpretation of the life cycle necessitated the recognition of distinct polymodal distributions. A computer program NORMSEP, developed by Hasselblad (1966), for fitting a series of normal curves to frequency data, was used to aid the determination of modes. However, this technique depends on the decision on the number of modes present (Cohen 1966). Similar results to those obtained using NORMSEP were obtained using visual selection of distinct distributions from which a mean size class was calculated. NORMSEP also required at least 100 specimens (preferably 400) and when this requirement was not met the mean size classes were calculated from visually selected distributions. The calculated mean values were plotted to represent the seasonal growth pattern of each species.

RESULTS

The seasonal variations of sieving efficiency for the two study localities, Spring Creek and Deep Creek, are given in Figures 2 and 3. The average annual sampling efficiencies of the fine compared with coarse net for mayfly nymphs were 421% and 235% for Spring Creek and Deep Creek respectively. At both localities the average annual efficiencies, as measured for each species, were *T. tillyardi* 838% (19-4050%) and 575 (8-6997%) respectively; *B. soror* 1263% (0-6890%) and 595% (0-4350%) respectively; *Atalophlebia australasica* Pictet (Deep Creek only) 339% (0-4267%); and *Atalonella inconspicua* (Eaton) (Spring Creek only) 430% (0-1738%). These values represent large increases in the number of specimens collected throughout the annual cycle, but the larger efficiency increases were invariably associated with periods of recruitment. The Leptophlebiid species, *Atalophlebia australasica* and *Atalonella inconspicua* , with large pre-emergent size showed consistently lower efficiency results than the smaller *T. tillyardi* and *B. soror*.

Tasmanocoenis tillyardi

The size frequency histograms of the 'coarse net' population of *T. tillyardi* from Deep Creek, are given in Figure 4. From these histograms interpretation is difficult, but the seasonal growth curves (Fig. 7) show that *T. tillyardi* has a bivoltine life cycle with one generation (G1) emerging in November-December 1976, and a second generation (G2) emerging in April-May 1977. This suggests that G2 originated with eggs laid by generation G1, and developed completely over the summer months. At the end of the May emergence, another generation was found (G1'). This generation apparently originated from eggs oviposited during the latter half of the emergence period G1. Growth of G1' was rapid during the summer and autumn months but very slow during winter. With the onset of warmer


Sept 22 1976
563
Oct 8
234
Oct 20
382
Nov 10
900
Nov 24
1465
Dec 9
689
Dec 22 1976
397
Males
Females
Sex ??
Jan 1 1977
67
Jan 20
86
Feb 10
635
Mar 10
244
April 7
242
Frequency
0
20
40
60
80
100
120
140
0
0·5
1·0
Head Capsule Width (mm)

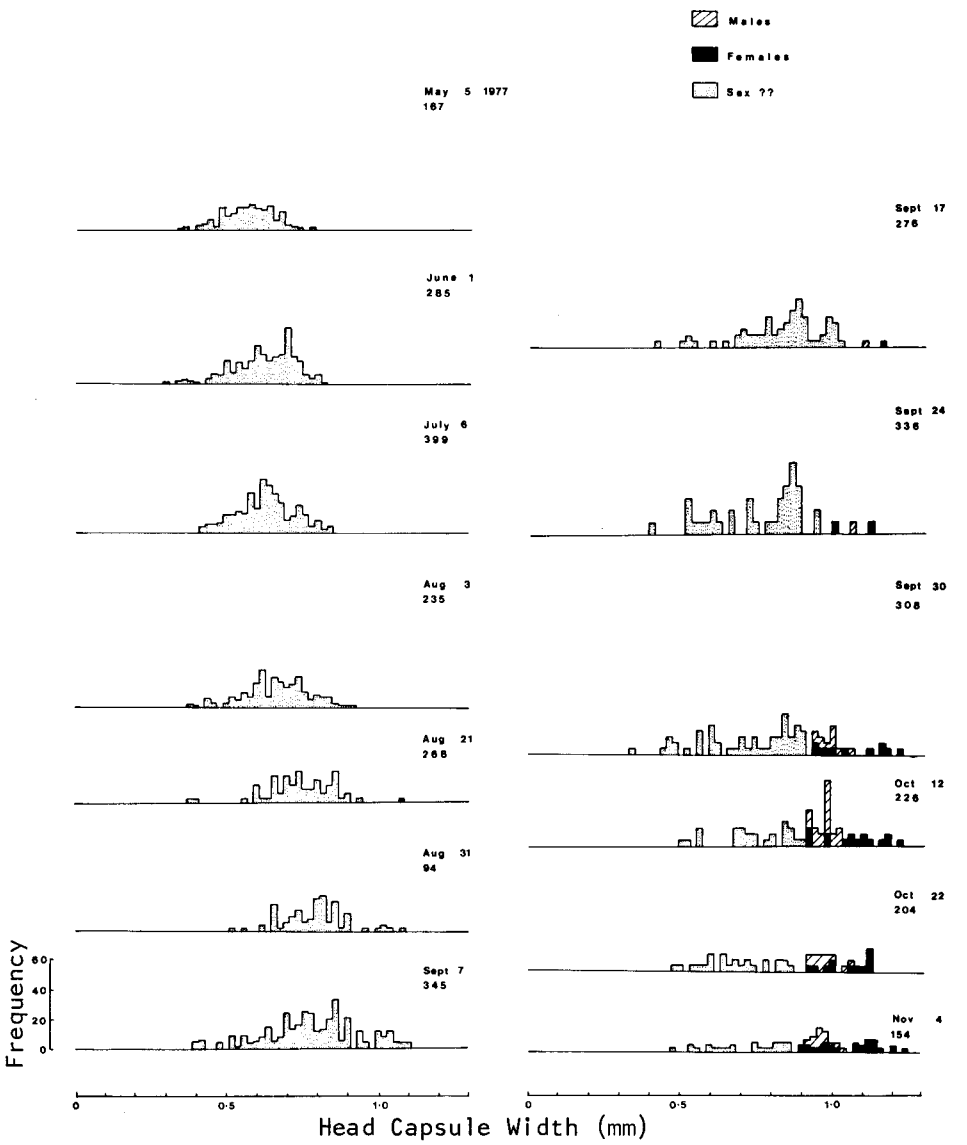
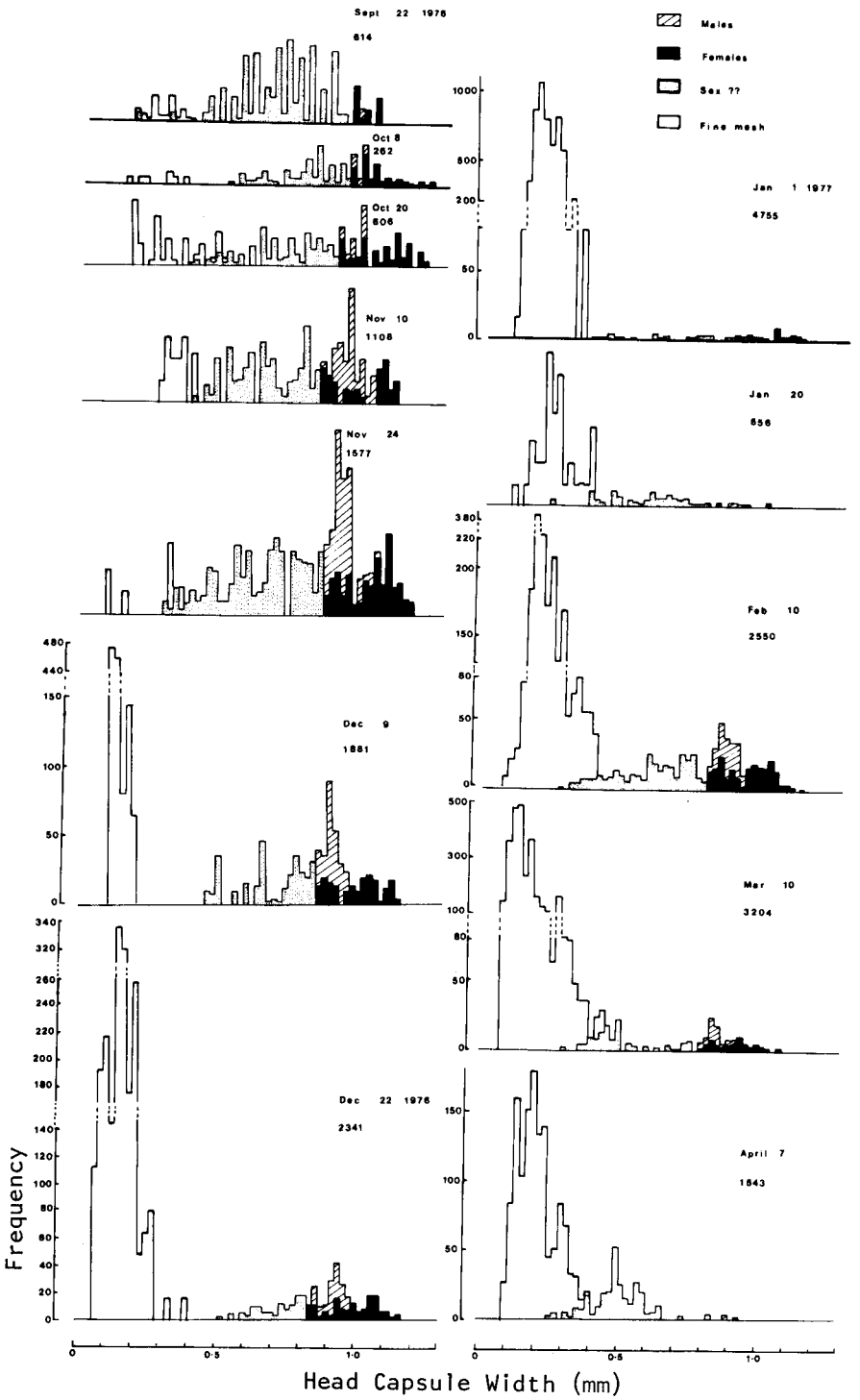


Figure 4a & 4b. Life cycle size frequency histograms of *Tasmanocoenis tillyardi* from 500 µm net samples only.


Males
Females
Sex ??
Fine mesh
Sept 22 1976
614
Oct 8
262
Oct 20
806
Nov 10
1108
Nov 24
1577
Dec 9
1881
Dec 22 1976
2341
Jan 1 1977
4755
Jan 20
856
Feb 10
2550
Mar 10
3204
April 7
1643
Frequency
Head Capsule Width (mm)

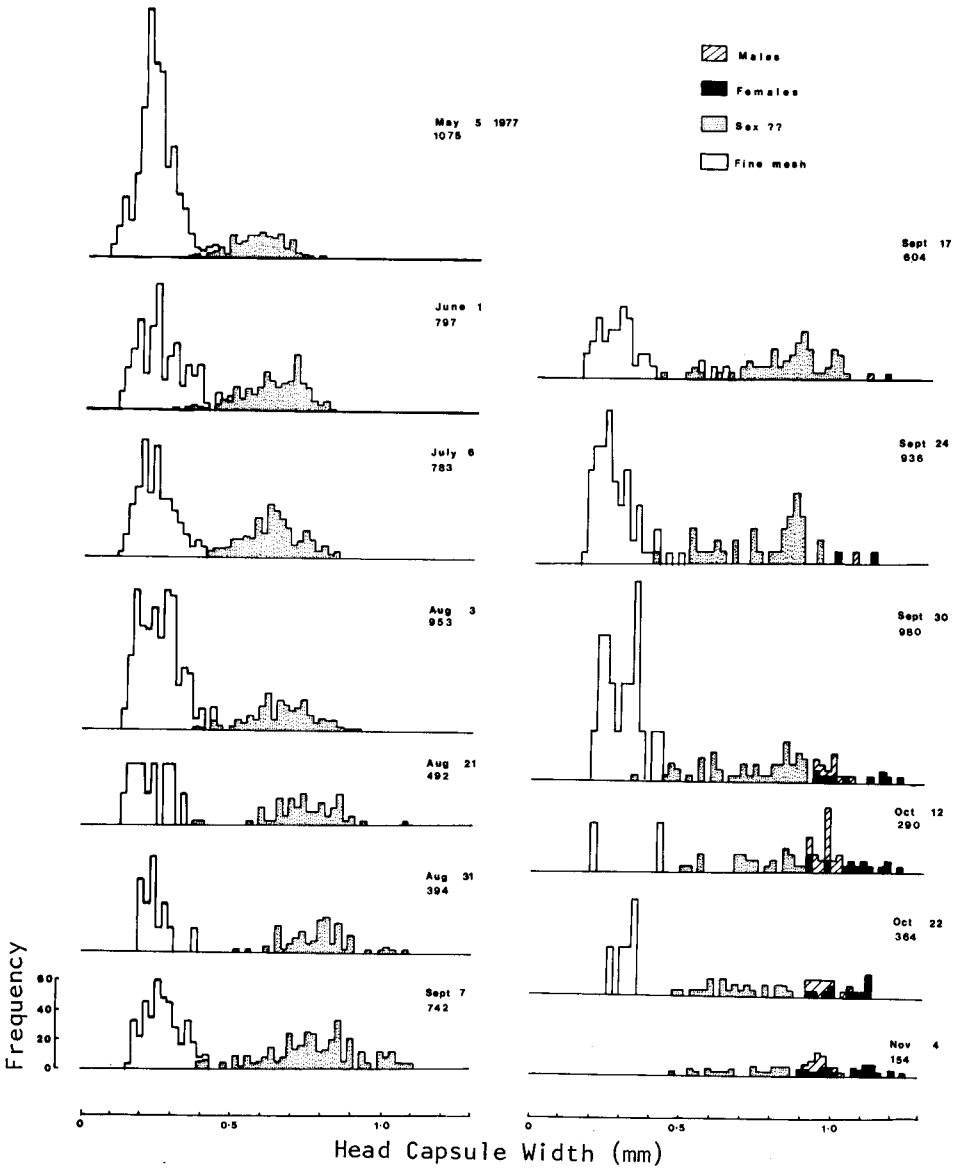


Figure 5a & 5b. Life cycle size frequency histograms of *T. tillyardi* from combined 110 µm and 500 µm net samples.

spring temperatures in August-September the growth rate increased and emergence commenced in September and continued to October 1977. Emergence continued after the completion of the sampling program, and with the exception of the precocious emergence in September-October, this generation can be equated with generation G1 of the previous year. The life cycle as described, is equivalent to the bivoltine life cycle classification B1 in Landa's (1968) scheme, with G1 giving rise to G2 and part of G1', and G2 giving rise to part of G1'.

In comparison, histograms from both coarse and fine nets combined (Fig. 5) and the seasonal growth curves (Fig. 8) show that *T. tillyardi* has, in fact, a bivoltine life cycle, but with both generations present throughout the annual cycle. The emergence times are similar, but the hatching times and duration of nymphal development are totally different from those derived from the coarse net collections.

The life cycle of *T. tillyardi* at Deep Creek is bivoltine with two generations present in September 1976, one nearing emergence (G1) and one of early instar nymphs (G2). Adults from G1 were first recorded in November 1976 and emergence continued until December, and possibly into January, 1977. Hatching of eggs laid by generation G1 was first recorded in November 1976 and hatching was continuous until May 1977. Laboratory egg development experiments suggest that the length of the recruitment period was exaggerated by the hatching of eggs laid by generation G2 in April-May 1977.

Generation G2 developed relatively rapidly in November 1976-January 1977, and although last instar animals were recorded in early February 1977 no adults were recorded until late February, early March. The emergence of G2 completed the two generations present at the beginning of the sampling program. Both were replaced, however, by their respective offspring forming distinct cohorts, G1' and G2'.

Generation G1' commenced in November 1976 and recruitment was continuous throughout the long emergence period, depressing the average size of this generation. Growth rate therefore appeared slower during the summer months that it was in March-April 1977, when recruitment ceased. Generation G2' was distinguishable in early March 1977, and recruitment continued until early May 1977.

Development of G1' and G2' was slow during the cooler months of May to August 1977, but as the water temperature began to increase in August and September (Fig. 6), growth rate increased, and a short period of recruitment was observed in September. These early instar nymphs were indistinguishable from G2' by early November 1977. This recruitment occurred at least one week before any last instar nymphs were collected. Laboratory egg development experiments suggested

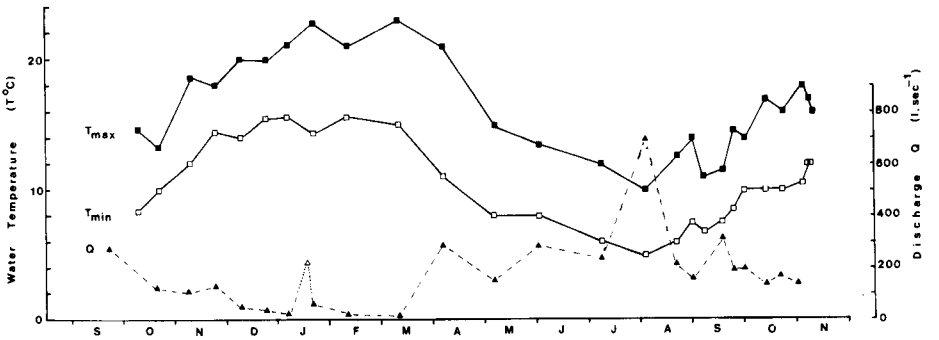


Figure 6. Seasonal changes of water temperature (°C) and discharge (L/sec) in Deep Creek.

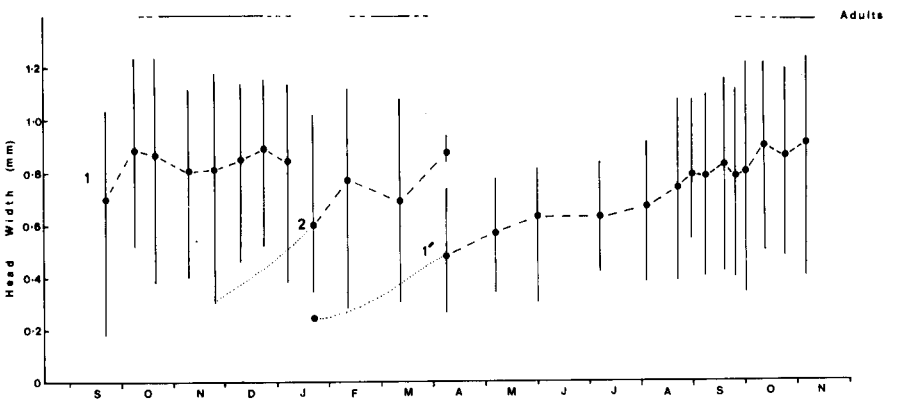


Figure 7. Seasonal growth curves of *T. tillyardi* from coarse mesh samples only.

that *T. tillyardi* eggs may become dormant at low temperature. Therefore this hatch was probably from eggs laid by G2 adults in late autumn, with the eggs over-wintering in a dormant state.

By October when the sampling program ended both G1' and G2' had attained similar sizes to generations G1 and G2 of October 1976, suggesting the above is an annual cycle. Consequently both generations G1 and G2 require 12-13 months for complete development.

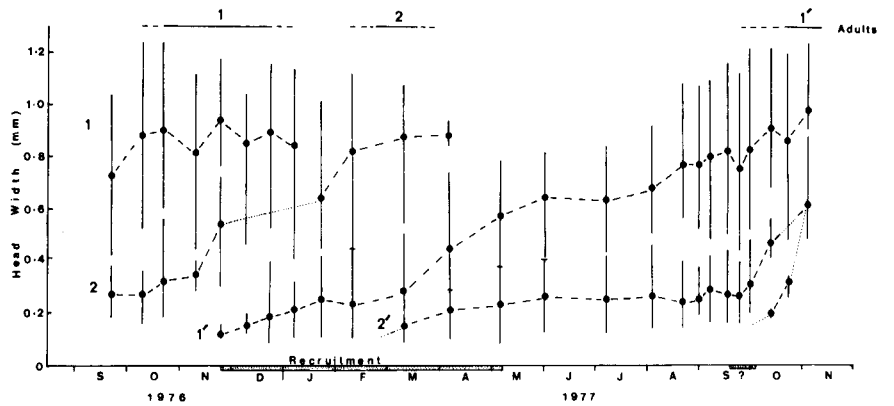


Figure 8. Seasonal growth curves of *T. tillyardi* from combined coarse and fine mesh collections.

Baetis soror

Field data for *B. soror* from Deep Creek, as collected by the coarse net only, are presented as size frequency histograms in Figure 9. Figure 11 illustrates the seasonal growth curves as interpreted from these histograms. The life cycle of *B. soror* appeared to be bivoltine with one generation (G1) having a long emergence period from October 1976 to January 1977, and a second generation (G2) emerging in April to May 1977. From the seasonal growth curves, generation G1 apparently emerged and gave rise to generation G1'. There was no evidence of the presence of this sibling generation during the summer months, but it appears in May to June 1977, suggesting that eggs laid by G1 did not hatch during the summer, but remained dormant until temperatures began to fall.

Generation G2 developed rapidly during the summer and emerged, and oviposited in April-May 1977, but no recruitment became evident until September 1977 when generation G2' appeared. Throughout the winter period only generation G1' developed slowly until emergence commenced in August 1977. Therefore it appears that the eggs laid by G2 remained dormant throughout the winter.

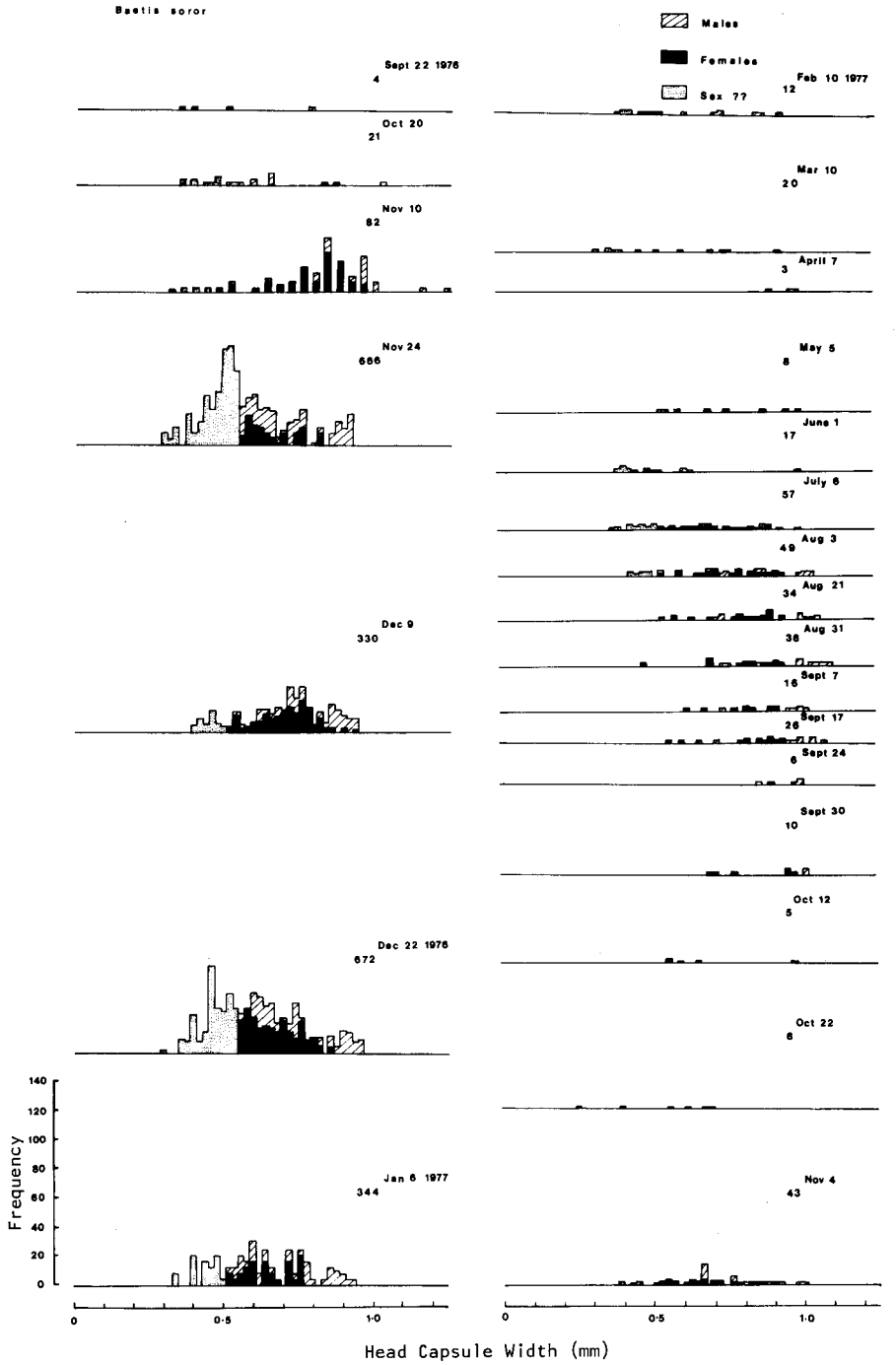


Figure 9. Life cycle size frequency histograms of *Baetis soror* from the coarse net samples only.

By October 1977 both generations G1' and G2' had attained the size of their counterpart generations of the previous year, 1976. Thus an annual cycle is indicated, with G1 giving rise to G1' and G2 giving rise to G2'.

The interpretation of the life cycle of *B. soror* differs dramatically once the fine mesh portion of the sample is included. Size frequency histograms, (Fig. 10) and seasonal growth curves (Fig. 12) both suggest a polyvoltine life cycle with three generations per year.

From Figure 10 a drastic decrease in the number of nymphs collected after January 6, 1977 is evident. During early January (2-4) 1977, a spate scoured the stream bed removing much of the *Cladophora*, clearly affecting the population numbers of *B. soror* (Fig. 6). The absence of subsequent recovery during the study period suggests that the effect of the spate was at least semi-permanent.

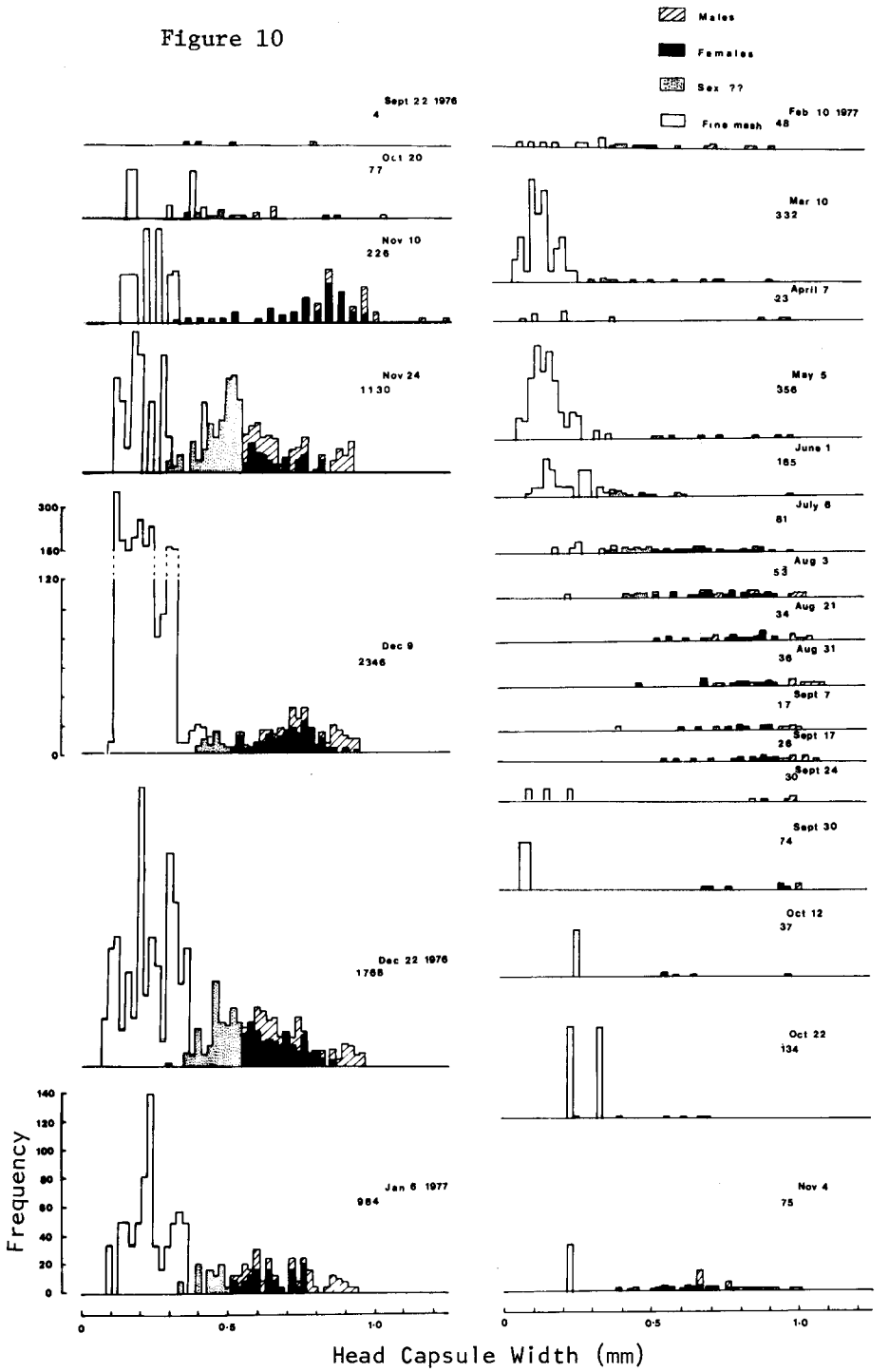
The field data for October 1976 suggest the presence of three generations, one emerging and with nymphs approaching last instar (G1); a second generation with head widths between 0.30 mm and 0.66 mm (G2) and a third generation of early instar animals (G3).

Generation G1 commenced emergence in November 1976 but continued over an extended period to January 1977. Generation G2 developed rapidly over this period and commenced emergence in late April to early May 1977. The growth curve discontinuity of the third generation, G3, during December and January was caused by recruitment from early hatchings from eggs laid by G1 females. Not until March could offspring of G1 be distinguished from G3, commencing generation G1'. Generation G3 developed rapidly during March and April 1977 and began to emerge in early June.

As mentioned, G1' had its origins from eggs laid by G1 females emerging in the second half of the emergence period. Hatchings from eggs of earlier emergers were indistinguishable from generation G3, and therefore were included in the calculation of the G3 mean size classes. Generation G1', therefore began in February-March 1977. Recruitment from eggs of G2, oviposited in April and May, caused the depression of the mean size of G1', and from June to August 1977 the two hatches, appeared as one generation G1'. Therefore, G1' was the sole generation developing throughout the winter period. Last instars were collected and emergence commenced in late August continuing through until the end of the study in November 1977.

Figure 10. Life cycle size frequency histograms of *B. soror* from combined coarse and fine net samples.

Figure 10


Males
Females
Sex ??
Fine mesh
Sept 22 1976
4
Oct 20
77
Nov 10
226
Nov 24
1130
Dec 9
2346
Dec 22 1976
1768
Jan 6 1977
984
Feb 10 1977
48
Mar 10
332
April 7
23
May 5
356
June 1
185
July 8
81
Aug 3
53
Aug 21
34
Aug 31
36
Sept 7
17
Sept 17
26
Sept 24
30
Sept 30
74
Oct 12
37
Oct 22
134
Nov 4
75
Frequency
Head Capsule Width (mm)

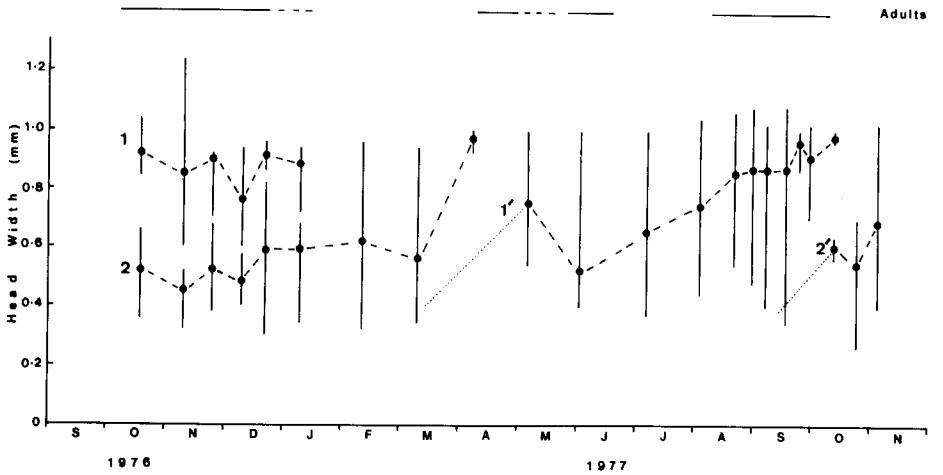


Figure 11. Seasonal growth curves of *B. soror*, interpreted from coarse net samples only.

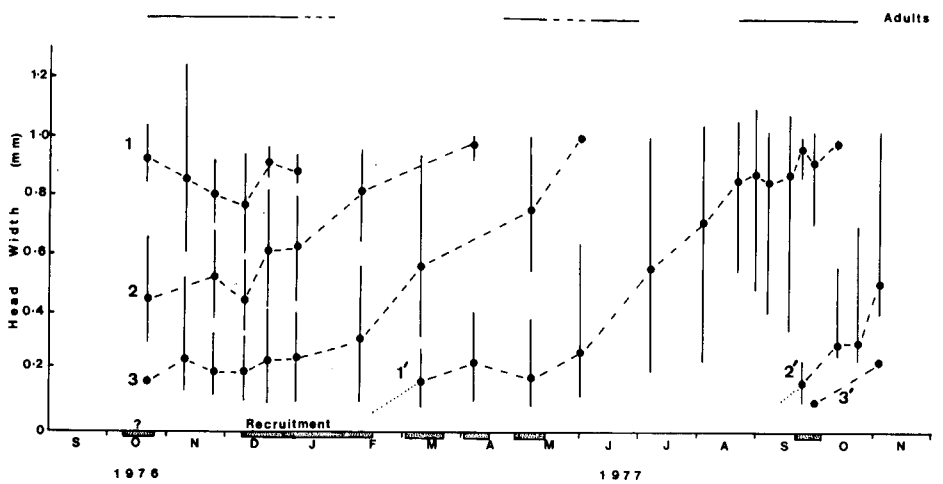


Figure 12. Seasonal growth curves of *B. soror*, interpreted from combined coarse and fine net samples.

Although first instar nymphs were missed in the August-early September 1977 period, evidence of a new generation (G2') in the form of 3rd^{+} instar nymphs was apparent. These perhaps, recruited from the eggs laid by G3 females in May to June, developed slowly in the low temperatures of winter. Laboratory experiments showed that no quiescence or diapause occurred in eggs of *B. soror*, and at the winter temperatures experienced, (greater than 5°C) development was continuous although very slow. Recruitment was observed in late September-early October 1977, from eggs laid by the early emerging adults of G1' beginning generation G3' and completing the annual cycle of three generations.

The duration of each generation from earliest hatching to last emergence, as extrapolated from the annual cycle, is as follows, G1 (G1') eleven months (February-January); G2 (G2') eight months (September-May) and G3 (G3') eight months (November-June).

DISCUSSION

The effect of inadequate sampling with nets of large pore size has been discussed by many authors. Those studies by Macan (1958), Maitland (1964), Tanaka (1967), Mundie (1971) and Frost *et al.* (1971) were based on samples taken on a single occasion, and although in all cases the fine mesh collection showed the deficiencies of the coarse mesh samples, the influence on the interpretation of life cycle within the lotic habitat was not investigated.

Zelt and Clifford (1972) assessed the efficiency of Surber and dip nets with 720 µm and 320 µm pore size. Their rationale was that "Recent studies have shown that numerically much of the stream fauna can pass through nets having pore size as small as 300 µm. However in the past most of the inferences about stream faunas have been based on samples collected with coarser-mesh nets". Zelt and Clifford used a double net system attached either to a dip net, or to a Surber sampler and found that 45% of the total collections of insects passed through the coarse dip net, and 54% passed through the coarse mesh of the Surber sampler. Of the total animals passing through the 720 µm mesh in both samplers, the Ephemeroptera accounted for 58%. In terms of biomass, the lost animals were almost insignificant, only 3% and 6% for the dip net and Surber sampler respectively. The percentage increase in numbers of animals collected with the finer mesh (320 µm) was obviously significant. However, as they themselves discussed, the fine mesh net was itself relatively coarse, allowing many smaller animals to escape.

Barber and Kevern (1974), using preserved animals (therefore eliminating the active escape behaviour of nymphs and larvae), found that a sieve of 0.25 mm pore size instead of 0.50 mm increased the sampling efficiency by 300-600% for mayflies, chironomids, simuliids,

"other dipterans", water mites and plecopterans throughout an annual cycle. "For the fauna as a whole, efficiency varied from 95% to 325% over the study period." This order of magnitude increase in sampling efficiency is obviously important to any study of benthic fauna. In terms of biomass, Barber and Kevern calculated the increase in efficiency to be 10% but reached 174%, 60% and 80% for chironomids, simuliids and water mites respectively. Consequently they concluded, "a smaller-mesh screen (about 0.25 mm or 0.20 mm mesh openings) should be employed if the purpose is to quantitatively estimate numbers or to obtain first instars of all invertebrates. Also the mesh size will somewhat influence the estimate of production if one used the method proposed by Hynes and Coleman (1968: modified by Hamilton 1969), a method which depends on the changes in numbers of organisms in different length categories, as numbers of the smaller lengths will not be estimated quantitatively."

This conclusion is substantially correct, but the present study has shown that a finer mesh than Barber and Kevern proposed (i.e. finer than 200 µm) would be required to obtain first instars of many living aquatic invertebrates. In the present study the mesh aperture sizes of 480 µm and 110 µm produced similar results to those obtained by Barber and Kevern (1974), but on many occasions the efficiency gained by the fine mesh was considerably greater than that recorded by those authors.

At both localities the increase in efficiency obtained using both nets throughout the annual cycle illustrated the effect of coarse net sampling in terms of numbers and life cycle interpretation. That the presence of one generation of *T. tillyardi* throughout the autumn, winter and spring of 1977 was not evident in the coarse net sample, leads to obvious incorrect conclusions based on those samples. Similarly, the incorrect assessment of the number of generations of *B. soror* in Deep Creek from the coarse net samples is also the result of the inadequate sampling. Conclusions drawn from the coarse net samples may not reflect the true nature of life histories. Clifford *et al.* (1973) and Zelt and Clifford (1972) recorded that the 720 µm mesh led to inaccurate interpretation of life cycles of some mayflies and stoneflies from the foothill streams of Alberta. Zelt and Clifford (1972) illustrated the erroneous conclusions drawn from coarse net samples with the stonefly *Nemoura decepta*. The life cycle of this species appeared to be a summer type with dormant eggs during the winter, however, fine net samples revealed small nymphs in February. The similarity between those observations and those made with *T. tillyardi* emphasize the need to use fine mesh nets in life history studies, especially when classification of life cycle (i.e. Landa 1968) is considered.

Using Landa's (1968) classification system the evidence obtained using the coarse net suggests a B1 cycle for *T. tillyardi* with two generations per year. One generation develops over the winter

months, emerges and oviposits in spring, and eggs from this generation hatch giving rise to a second generation which completes its development during the summer months. However, the life cycle, as interpreted using the combined nets (which did successfully collect all instars of *T. tillyardi*), cannot be classified using Landa's scheme. There are in fact two winter generations present at any one time, and therefore a modification of Landa's classification is required by the inclusion of bivoltine species with two winter generations, one hatching in spring and emerging the following spring, and a second hatching in autumn and emerging in the following autumn (perhaps a B5?).

The life cycle of *B. soror*, as interpreted from coarse samples only, cannot easily be classified in Landa's system. Although bivoltine, the two generations differ. One commences in autumn and develops over winter to emerge during spring and summer, but its eggs appear to remain dormant during the summer months. The second generation commences in the spring and develops over summer to emerge in autumn; its eggs remaining dormant over the winter period. Data from both coarse and fine samples suggest not two, but three generations per year; one commencing in summer and emerging in the following spring; one commencing in early spring and emerging in early autumn; and one starting in late spring and emerging in late autumn. This system is similar to a B3 cycle as proposed by Landa. Although there are differences, especially in the origins of generation 2 (i.e. generation 2 in Landa's scheme has its origins from the overwintering generation 1, whereas for *B. soror* generation 2 has its origins from eggs laid by the second summer generation (3) which has slow development over winter) the similarities are obvious, with two "summer" generations and one "winter" generation.

In summary, evidence from this study therefore strongly supports the conclusions of Zelt and Clifford (1972) who recommended that nets of pore size of 100 µm even 76 µm be used for life cycle studies. The inaccurate interpretation of life cycles derived from coarse net samples alone are obvious from these studies on the two populations of the South Australian mayflies *T. tillyardi* and *B. soror*. Use of a fine mesh net (110 µm) allowed direct collection of hatching and early instars of these species and is preferred to the reliance on extrapolated conclusions, which may not be justified, from coarse net samples.

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RESUME

Utilisant un échantillonneur benthique de type Surber muni d'un système collecteur à double filet, on a évalué l'efficacité des filets d'une ouverture de 480 µm et de 110 µm durant une période de douze mois dans deux cours d'eau d'Australie méridionale. L'augmentation moyenne annuelle de l'efficacité de la prise d'échantillons des nymphes d'éphéméroptères dans le filet fin par rapport au gros filet fut de 412% pour le Spring Creek et de 235% pour le Deep Creek. Les cycles de vie de la *Tasmanocoenis tillyardi* (Lestage) et la *Baetis soror* Ulmer recueillis dans le Deep Creek sont décrites de même que le rôle de la grosseur des mailles dans l'interprétation de la vie des insectes.

Le cycle de vie des deux espèces, interprété uniquement à partir des grosses mailles, est celui de bivoltins. Si l'on combine les échantillons recueillis par les filets aux mailles fines et grosses, l'interprétation du cycle de vie est nettement différente, ce qui montre combien il est difficile de tirer des conclusions à partir de spécimens obtenus au moyen d'un filet à grosses mailles.

ZUSSAMENFASSUNG

Beim Gebrauch eines benthischen Samplers vom Type "Surber" mit Doppelnetz Sammelsystem wurde die Wirksamkeit von Netzen mit einer Öffnungsgröße von 480 µm und 110 µm während einer Periode von zwölf Monaten überprüft. Der durchschnittliche, jährliche Probe Effektivitätszuwachs des feinen Netzes betrug, verglichen mit dem groben Netz, beim Fang der Eintagsfliegen jeweils 412% und 235% beim Spring Creek und Deep Creek. Die Lebensyklen von *Tasmanocoenis tillyardi* (Lestage) und *Baetis soror* Ulmer aus dem Deep Creek werden hiermit in diesem Aufsatz dargestellt, und die Wirkung verschiedener Maschengrößen in Bezug auf die Interpretation der Lebensgeschichten wird erörtert. Der Lebenszyklus beider Arten, nur vom grobmaschigen Netz her interpretiert, ist bivoltin. Wenn Sammlungen von feinen und groben Netzen kombiniert verwendent werden, ergibt sich eine ganz unterschiedliche Lebenszyklus Interpretation. Daran erkennt man, welche Schwierigkeiten auftreten, wenn man Schlüsse zieht von Proben, die mit einem grobmaschigen Netz genommen wurden.

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