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Determining head capsule width of the mayflies *Deleatidium* spp. from labia lengths (Note)

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Abstract A method is described that enables determination of the head capsule width of *Deleatidium* spp., from labia length measurements only. This method has proven useful for gut analysis of recently emerged chinook salmon (*Oncorhynchus tsawytscha*) of fork length 29–34 mm.

Keywords diet; salmon; *Deleatidium*; labium length; head capsule width; food size; prey width

INTRODUCTION

The dietary analysis of small fish (approximate fork length (FL) < 34 mm) is limited because of their small size. The fact that their stomachs are so small increases the chances of finding little or no food, especialy if the fish are juveniles with naive feeding behaviour. Sampling during times of maximum feeding activity, and taking an adequate sample size, are but partial solutions to this problem. During a study of the biology of emergent chinook salmon fry (29–34 mm FL) it was noted that certain body parts of some prey species remained intact throughout the intestinal tract and were readily identifiable; in particular, these included the labia of mayfly nymphs, *Deleatidium* spp., and head capsules of Chironomidae larvae. However, this may not be so for larger fry (> 50 mm FL) because their larger, more active stomach breaks down the food more efficiently and the labia of *Deleatidium* spp. become fragmented (P. M. Sagar, Ministry of Agriculture and Fisheries, Christchurch, pers. comm.).

This note describes the use of the labia of *Deleatidium* spp. as an indirect method of determining the size of this prey group in the diet of young chinook salmon.

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METHODS

Deleatidium spp. head capsules with associated labia were obtained by sampling the invertebrate drift for 24 hours in a salmon spawning tributary of the Rakaia River: Double Hill Stream, South Island, New Zealand, in February 1984. February was chosen because at this time the majority of head capsule width classes in *Deleatidium* spp. is present (Sagar 1983). The drift sample contained 215 specimens of *Deleatidium* spp., for which individual labium lengths and head capsule widths were measured to the nearest 0.01 mm using a Wild electronic micro-length sensor. The data were plotted using a simple linear regression analysis.

RESULTS AND DISCUSSION

The mean of head capsule widths for *Deleatidium* spp. from the drift sample was 1.12 mm (range 0.47–2.01 mm) and the mean labium length was 0.62 mm (range 0.20–1.4 mm). Linear regression of head capsule width (H) on labium length (L) gave the relationship $H = 0.19 + 1.53L$, with a correlation coefficient of $r=0.98$ ($P < 0.001$) (Fig. 1).

The nymphs of *Deleatidium* spp. are a major component of the drift and benthos in New Zealand streams (McClay 1968; Sagar 1983), and an important prey species for fish (Sagar & Eldon 1983). Therefore it is important that their size be determined in fish diet studies, especially of small fish. However, the reduced stomach size of small fish often limits the extent of the gut analysis undertaken. Williams (1981) found this to be a problem with salmon and trout alevins (25–30 mm FL), and I have had similar problems with chinook salmon fry (unpubl. data). These problems exist because of the naive feeding behaviour, and the very small stomach volume of these fish fry; often only one prey item is present (depending on prey size) or the stomach is empty. This limits severely the conclusions that can be made about fish fry diets — a problem that is not solved totally by increasing the number of fish sampled. However, by using the length measurements of labia retrieved from intestine and stomach I could obtain, indirectly, a larger sample of *Deleatidium* spp. head capsule widths per fish, establish the size of prey, and thus assess the

size range of food consumed. This apparent close relationship between labium length and head capsule width for *Deleatidium* spp. enables a greater perspective to be obtained from salmon fry diet analysis, because more questions can be answered with a greater degree of confidence. For example: what size of *Deleatidium* spp. do young salmon capture; is this feeding size selective; how does prey size relate to mouth gape; does prey size vary between night and day; or possibly, what is the calorific value of the major prey item *Deleatidium* spp.

This relationship need not be limited to fish diet studies. Aquatic birds that feed along the margins of rivers consume aquatic insects, hence diet analysis by the examination of bird droppings may benefit also from the labia-head capsule relationship if *Deleatidium* spp. nymphs have been consumed.

The correlation between head capsule width and labium length of *Deleatidium* spp. enables reasonably accurate estimates of head capsule width to be calculated from labia length. This allows more information about fish diet to be generated from *Deleatidium* spp. labia found in small fish guts. As well, it could benefit diet studies of birds which feed on aquatic insects that include *Deleatidium* spp.

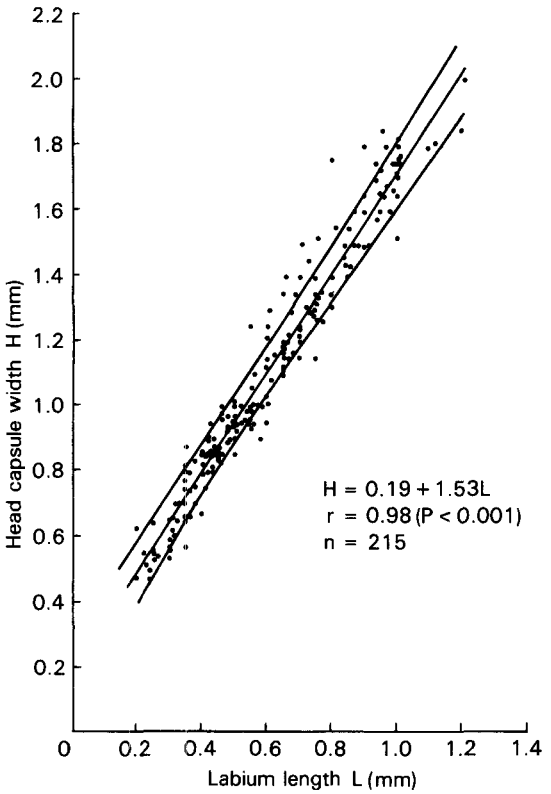

Fig. 1 The relationship between head capsule width and labium length showing the regression line and ±95% confidence limits for estimated H.

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