Biological assessment

Version: February 2018

Background to sampling zooplankton

1 Purpose and scope

This document provides background information on sampling zooplankton.

2 Associated documents

Biological assessment: Sampling zooplankton with a Schindler-Patalas trap

Physical and chemical assessment: Manual collection of surface water samples (including field filtration)

3 Introduction

Zooplankton comprise a complex group of predominantly microscopic animals such as radiolarians, foraminifera, tintinnids, thecate amoeba, amphipods, krill, copepods, cladocerans but also include the immature stages of larger animals such as animals such as sea urchins, many crustaceans, marine worms, marine snails and most fish. These organisms can be found free floating, (drifting) in the water column of non-marine (freshwater), brackish and fully marine environments. They are an essential component of all aquatic food webs because they provide the link between the primary producers (bacterioplankton, phytoplankton) and larger animals such as fish.

Zooplankton species occupy particular niches within their aquatic habitats (ponds and lagoons, rivers and streams, lakes and estuaries, open ocean) and are influenced by a number of environmental factors. These include light, temperature, turbulence, and salinity. Zooplankton are also directly and indirectly affected by pH, dissolved and particulate metals (whether present as essential trace elements or as toxic contaminants) and the availability of food. Nutrients such as nitrogen and phosphorus can also have an indirect impact on zooplankton growth, because growth of phytoplankton (which forms the primary food source for zooplankton) is affected by the availability of these nutrients in the water, which in turn impacts on zooplankton survival (bottom-up control). Zooplankton populations are also controlled through predation (top-down control). Both phytoplankton and zooplankton abundance and species diversity are therefore highly responsive to environmental conditions ranging from nutrient availability, temperature, light, pollution, food quality and the degree of predation by other animals.

Changes in zooplankton communities over time may indicate subtle environmental changes to their habitats. Therefore, indices of zooplankton abundance and species diversity can be used to determine the health of an ecosystem. Many local councils and water managers collect phytoplankton and zooplankton samples as indicators of water quality, often in response to the increasing incidence of algal blooms in rivers and estuaries.

4 Sampling zooplankton

The most common method for sampling zooplankton is by dragging a fine mesh net, either horizontally or vertically through the water. This method can filter a large volume of water, but the results will only be qualitative or at best, semi-quantitative, despite the availability of standard methods that specify sampling procedures such as rope length to be used and time of net drag. For quantitative results in surface waters, a Schindler-Patalas zooplankton trap can be used. Because the trap holds a known quantity of water, the number of zooplankton per litre can be calculated. It is almost entirely constructed of transparent material, which helps prevent avoidance reactions from some planktonic organisms. The trap is also light-weight and easily operated by a single operator, however can only be used to collect samples in the top 60–70 cm of a water body. If

quantitative samples are to be collected from a discrete depth/s, a Van Dorn water sampler or a Niskin bottle can be used as for water sampling (see *Manual collection of surface water samples (including field filtration*) document). Water in the water sampler is filtered from the water sampler through a plankton net/sieve with appropriate mesh size (based on the size of the target organisms).

5 References and additional reading

Baranyi, C, Hein, T, Holarek, C, Keckeis, S and Schiemer, F 2002, 'Zooplankton biomass and community structure in a Danube River floodplain system: effects of hydrology', *Freshwater Biology* 47, 1-10.

Chabot, F and Maly, E 1986, 'Variation in diet of yellow perch (*Perca flavescens*) in a Quebec reservoir', *Hydrobiologia* 137, 117-124.

De Bernardi, R 1984, 'Methods for the estimation of zooplankton abundance' in JA Downing and FH Rigler (eds), *A Manual on Methods for the Assessment of Secondary Productivity in Fresh Waters*, IBP Handbook Number 17, Blackwell, Oxford, England, pp 59-86.

DeVries, DR and Stein, RA 1991, 'Comparison of three zooplankton samplers: a taxon-specific assessment', *Journal of Plankton Research* 13, 53-59.

Dowd, M, Martin, J, Legresley, M, Hanke, A and Page FH 2004, 'A statistical method for the robust detection of interannual changes in plankton abundance: analysis of monitoring data from the Bay of Fundy, Canada', *Journal of Plankton Research* 26, 509-523.

Downing, JA, Pérusse, M and Frenette, Y 1987, 'Effect of interreplicate variance on zooplankton sampling design and data analysis', *Limnology and Oceanography* 32, 673-680.

Evans, MS and Sell, DW 1983, 'Zooplankton sampling strategies for environmental studies', *Hydrobiologia* 99, 215-223.

King, AJ 2004, 'Density and distribution of potential prey for larval fish in the main channel of a floodplain river: pelagic versus epibenthic meiofauna', *River Research and Applications* 20, 883-897.

Knudsen, F and Larsson, P 2009, 'Discriminating the diel vertical migration of fish and *Chaoborus flavicans* larvae in a lake using a dual-frequency echo sounder', *Aquatic Living Resources* 22, 273-280.

Nicholson, G, Jenkins, G, Sherwood, J and Longmore, A 2008, 'Physical environmental conditions, spawning and early-life stages of an estuarine fish: climate change implications for recruitment in intermittently open estuaries', *Marine and Freshwater Research* 59, 735-749.

Patalas, K 1954, 'Comparative studies on a new type of self acting water sampler for plankton and hydrochemical investigations', *Ekologia Polska* 2, 231-242.

Pinel-Alloul, B, Downing, JA, Pérusse, M and Codin-Blumer, G 1988, 'Spatial heterogeneity in freshwater zooplankton: variation with body size, depth and scale', *Ecology* 69, 1393-1400.

Redfield, G 1984, 'Modifications to the Schindler-Patalas zooplankton trap', *Verhandlungen des Internationalen Vereiin Limnologie* 22, 1417-1424.

Schindler, DW 1969, 'Two useful devices for vertical plankton and water sampling', *Journal of Fisheries Research Board of Canada* 26, 1948-1955.

Seda, J and Devetter, M 2000, 'Zooplankton community structure along a trophic gradient in a canyon-shaped dam reservoir', *Journal of Plankton Research* 22, 1829-1840.

Seda, J, Dostalkova, I 1996, 'Live sieving of freshwater zooplankton: a technique for monitoring community size structure', *Journal of Plankton Research* 18, 513-520.

Shiel, RJ, Walker, KF, Williams, WD 1982, 'Plankton of the Lower River Murray, South Australia', *Australian Journal of Marine and Freshwater Research* 33, 301-27.