

DEVELOPING A METHOD TO USE THE SETTLING VOLUME OF ZOOPLANKTON AS EASY CONDUCTIBLE MEASUREMENT FOR THE NATURAL FOOD AVAILABILITY FOR COMMON CARP (*Cyprinus carpio*) IN PONDS.

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Introduction

In good managed Austrian carp ponds, the zooplankton genera evolve coherent with the life-stages of the common carp (*Cyprinus carpio* L.). In extensive pond farming, carp fry mainly feeds on ciliates and rotifers, while adult carps feed on larger zooplankton genera, such as *Daphnia sp.*. For good water quality and economic efficient management, it is advisable to use supplemental feed (e.g. grains) as needed instead of following feeding plans given in the literature. To determine the right amount of supplemental grain feed it is essential for the carp farmers to measure the given amount of zooplankton (Schlott-Idl 1991). Thus, they can adjust their feeding strategy in such a way as the carp get a balanced diet and both, insufficient utilization and overexploitation of zooplankton are avoided. As it is very difficult for carp pond farmers to assess the amount of zooplankton in the pond, the Federal Agency for Water Management, Ecological Station Waldviertel (BAW-ÖKO) has been working on an easy way for measuring the zooplankton in situ.



Fig. 1: Usage of a Schindler-Sampler, four samples on different places in the pond are taken for SV © BAW-ÖKO

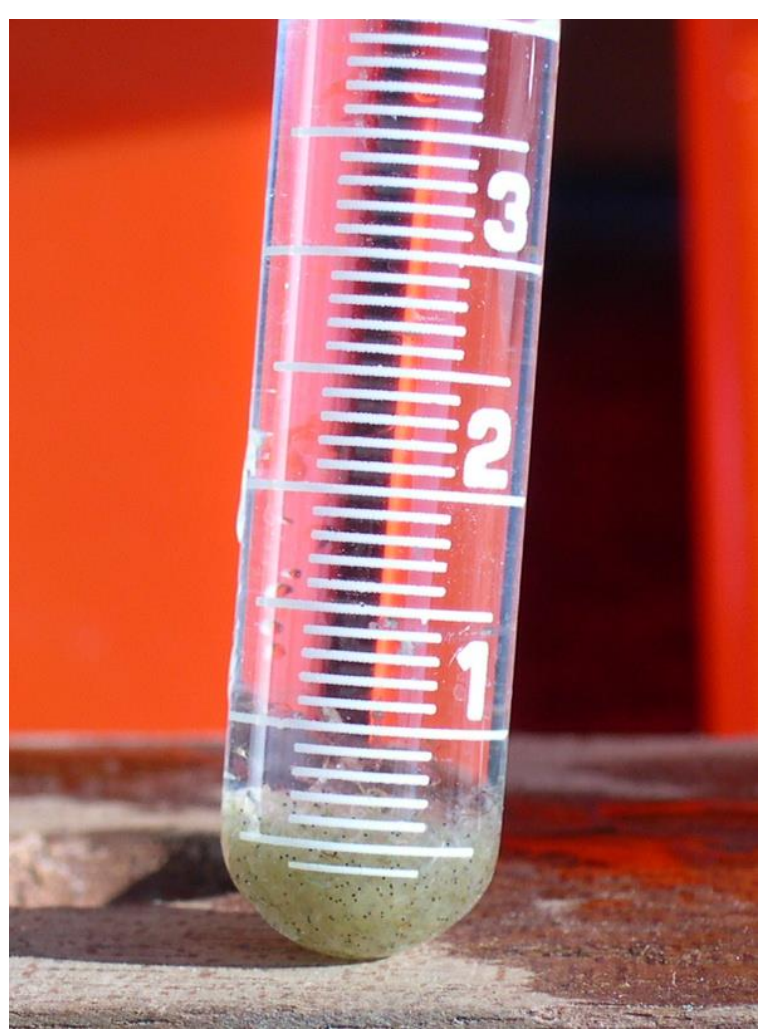


Fig. 3: The SV can be read easily from the tube-scale, which is in this case very low © BAW-ÖKO

Method

Over several years, the populations of *Daphnia sp.* in carp ponds of the Waldviertel (Lower Austria) have been studied to identify insufficient, adequate and excessive amounts of zooplankton. The first experiments to use the settling volume (SV) of large zooplankton (>1 mm) as measurement technique for the natural food amount for carps have been conducted in Austria in 1984. To assess the SV, 5 L water samples on four different places at 0.5 m depth are taken from the pond with a Schindler-Sampler (Fig. 1). We use a plankton net with a patch of 500 µm net on the bottom to catch only daphnia > 1 mm (Fig 2). After flushing the smaller plankton out, the daphnia are concentrated in the cod end and killed with 20% formaldehyde. They are flushed into a volumetric tube with distilled water. After a short settling time the SV can be read from the scale on the tube (Fig. 3). To determine the reliability of the SV we compared the SV with standard operating procedure (SOP) for daphnia analysis under a stereoscopic microscope.

Results

The longtime studies showed, that an amount between 20 and 40 daphnia per liter are an adequate population. Our research showed, that this abundance of daphnia has a SV between 0.2 and 0.55 ml. The results of the SV correlated highly with the SOP (Spearman's $r_s = 0.95$, $n = 261$) (Fig.4). < 10% of SV samples were incorrect, because of contamination with pollen or big algae (e.g. *Volvox sp.*). Besides cladocerans, also copepods can be part of the SV. As adult carps also consume them, this doesn't falsify the informative value of the SV. SV < 0.2 ml shows an insufficient, 0.2 – 0.55 ml an adequate, 0.55 – 0.8 ml too much and > 0.8 an excessive amount of zooplankton in carp ponds.



Fig. 2: The plankton net has a 500 µm patch on the cod end. © BAW-ÖKO

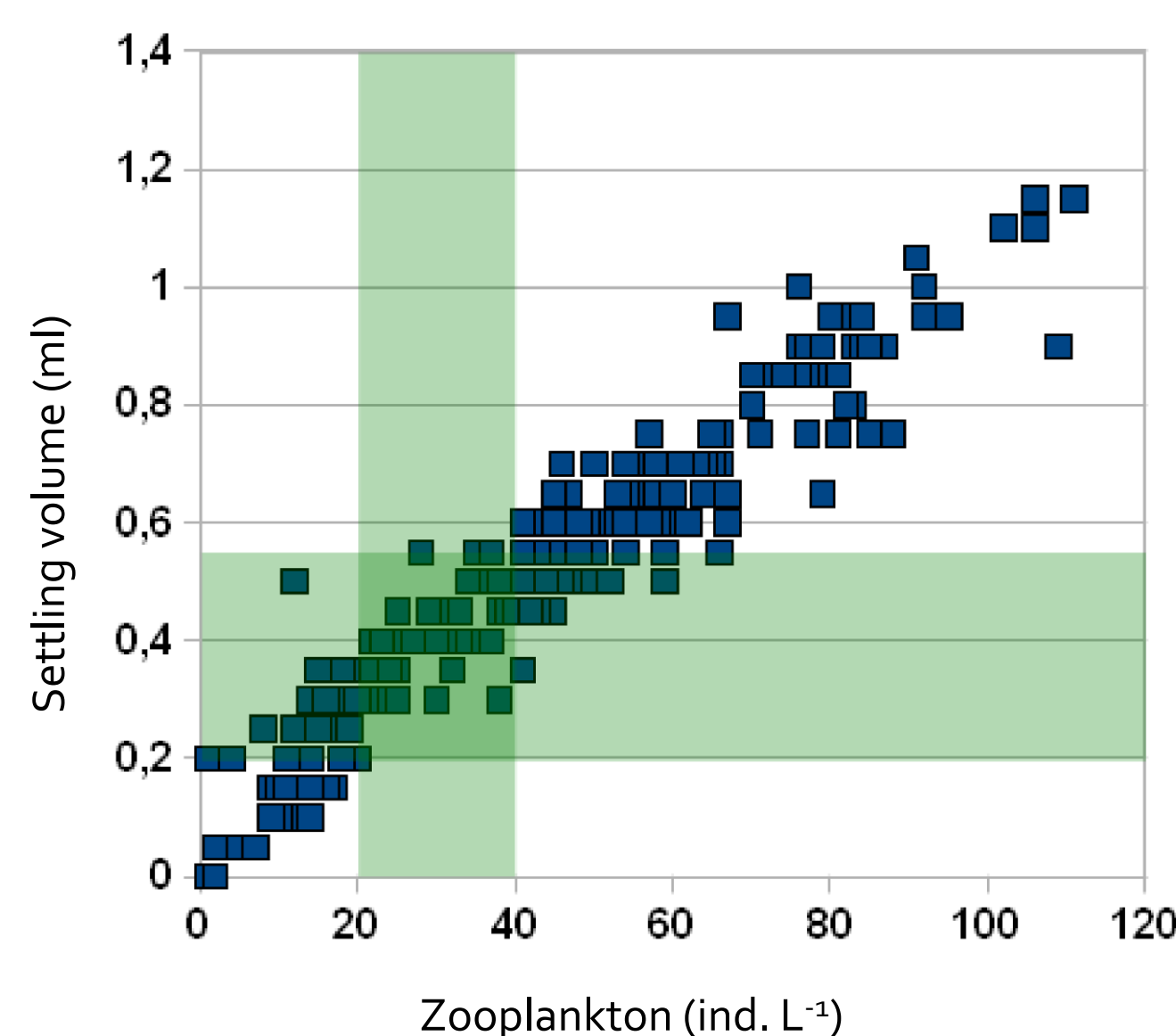


Fig. 4: The SV plotted against the SOP, green areas mark range of good abundance ($n = 261$)

Discussion

Antón-Pardo and Adámek (2015) conclude in their review, that the role of the zooplankton as food for adult carp has been underestimated. Susta (1887) and Wunder (1968) already realized the importance of daphnia as food source for common carp. Carp fed with *Daphnia magna* showed better fish growth, feed intake and health (Abdel-Tawwab et al. 2020). Our methodology uses the abundance of large zooplankton organisms as an indicator for the availability of natural food. As cladocerans constitute the biggest part of the zooplankton biomass in summer in fishponds of Lower Austria (Schlott-Idl 1991), the SV is an adequate measurement for the natural food availability for adult carps. In contrary to the longsome commonly used way of counting zooplankton under the microscope, this method of measuring the amount of daphnia is an easy and practical way for every carp farmer to assess the stability of the zooplankton population.

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A comprehensive brochure on the SV and the demand-oriented feeding can be found online ->

- Literature**
 Abdel-Tawwab, M., Abdulrahman, N. M., Baiz, A. I., Nader, P. J. and Al-Refaiie, I. 2020. The using of *Chlorella pyrenoidosa* and *Daphnia magna* as feed supplements for common carp, *Cyprinus carpio*: growth performance, somatic indices, and hemato-biochemical biomarkers. Journal of Applied Aquaculture DOI:10.1080/10454438.2020.1787291
 Anton-Pardo, M. and Adámek, Z. 2015. The role of zooplankton as food in carp pond farming: a review. Journal of Applied Ichthyology. 31: 7 – 14.
 Schlott-Idl, K. 1991. Development of zooplankton in fish ponds of the Waldviertel. Journal of Applied Ichthyology. 7: 223 – 229.
 Šusta, J. 1887. Die Ernährung des Karpfens und seiner Teichgenossen. Herrke & Lebeling, Stettin, Poland. [german]
 Wunder, W. 1968. Das Plankton als wichtiger Bestandteil der Naturnahrung des Karpfens. Methoden der Planktonvermehrung. Österreichs Fischerei 21: 97 – 103. [german]

