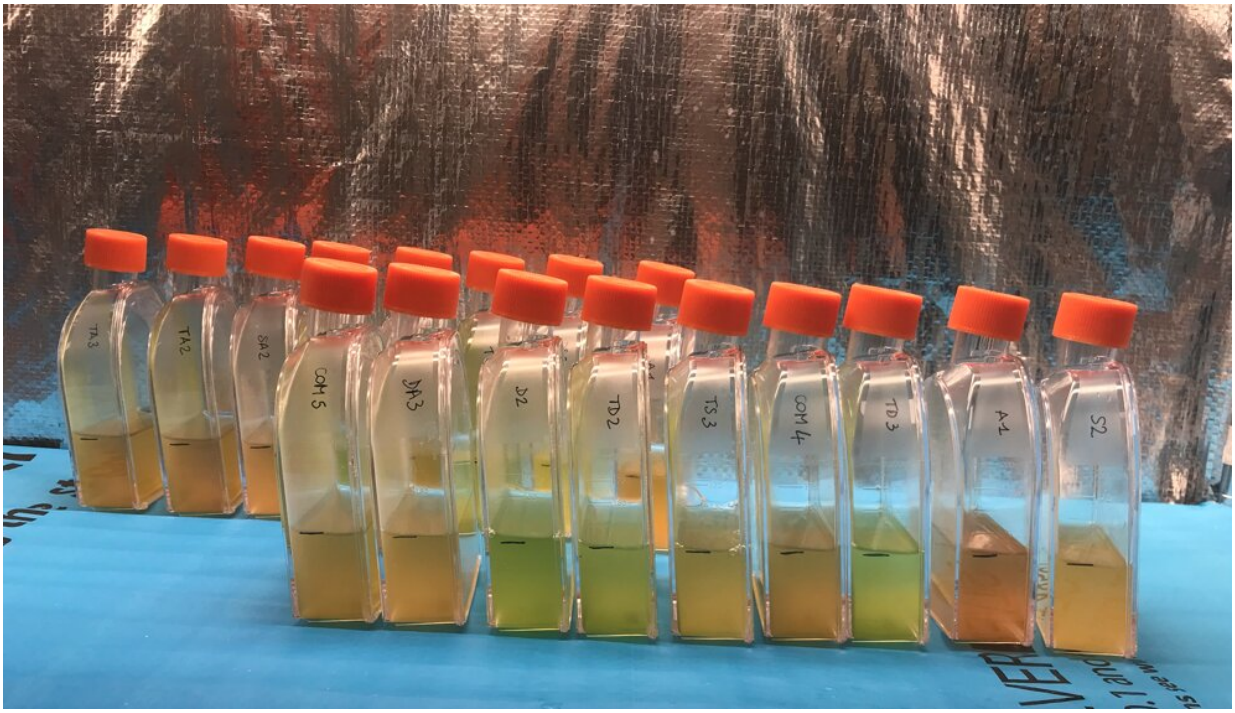
Size may not matter when estimating community energy use

August 20 2020



Phytoplankton communities are made of different species which were used to understand how size and composition affect total metabolism. Credit: Dr Giulia Ghedini

Ecologists often want to understand how a community functions. For example, how much food does a community of animals consume every day? Or how much oxygen do plants produce every day? These functions are often assessed by measuring the energy use (or metabolism) of a

community, and it is typically thought that energy use is closely related to the size of the organism.

But a new study published today in the *Proceedings of the Royal Society B* and led by Monash University researchers at the School of Biological Sciences has found that we might in fact be better off ignoring everything we know about the relationship between metabolism and size when estimating energy use in a community.

"Functional measures can be difficult to collect, especially for an entire community," said lead study author Dr. Giulia Ghedini, an ARC DECRA Fellow at the School of Biological Sciences, and the Monash University Center for Geometric Biology. "A community is made up of many species.Estimating the total metabolism from the metabolism of each species separately is a way around this problem. But the methods we use, and the data required, vary and may not be validated against actual data because these are rarely available."

The research team tested six different ways of estimating the energy use of a community. They measured actual metabolic rates in communities of phytoplankton (tiny marine microalgae) and compared these actual measures with the six estimates. Since metabolism and size are tightly correlated, the team expected to find that methods incorporating size-related metabolism would provide the best estimate of overall community metabolism.

"But, this wasn't the case," said Dr. Ghedini. "Instead we found that simply knowing the average metabolism per gram of biomass gave a better estimate of community metabolism. It turns out that for measurements of whole community metabolism, size didn't matter."

This was because the usual relationship between size and metabolism had changed.

Metabolism usually increases with size, but to a lesser extent for larger organisms, which is known as an allometric relationship.

"When we measured energy use across all species in the community, the average energy use of species increased in direct proportion to their average size, in other words an 'isometric relationship,'" said Dr. Ghedini. "This is why we can predict the total metabolism from the energy use per unit biomass."

But the researchers found toward the end of the experiment, when communities were dominated by larger cells, this "perfectly proportional" relationship broke down. The scientists believe that when large species are very abundant, they suffer more from competition and reduce their metabolism more than smaller species.

"The good news is that we may be able to estimate community energy use from easy-to-collect biomass data," said Dr. Ghedini. "But first, we need to see if this result applies to different communities and we also need more studies on how competition affects energy use."

More information: Giulia Ghedini et al. How to estimate community energy flux? A comparison of approaches reveals that size-abundance trade-offs alter the scaling of community energy flux, *Proceedings of the Royal Society B: Biological Sciences* (2020). DOI: 10.1098/rspb.2020.0995

Provided by Monash University