Spider colonies benefit from economies of scale

Richard Kemeny

A new study suggests that group-living spiders invest less of their own silk to maintain webs as colonies grow, representing the first report of economies of scale in a non-caste cooperative animal society (*J Anim Ecol* 2021; doi.org/10.1111/1365-2656.13628).

Larger organisms spend less energy relative to their mass than smaller ones do, an effect known as metabolic scaling. A research team led by Samantha Straus (University of British Columbia; Vancouver, Canada) wondered if similar rules applied to groups of co-living spiders. Such social spiders, which exhibit cooperative behavior when performing activities like web construction, hunting, and brood care, are rare: of the more than 45,000 described species of spiders worldwide, only a few dozen colonial varieties are known.

Straus and her colleagues set up a series of experiments in Ecuador to measure silk use in both solitary spiders and *Anelosimus eximius*, a social spider that lives in tropical rainforests in colonies up to tens of thousands-strong, on large, complex webs.

The team first calculated the amount of silk needed per spider – both solitary and group-living – to build three different web types of increasing complexity. They then examined 30 colonies of *A eximius* to estimate how many individual spiders worked to maintain webs, and to calculate the energy budget of each colony based on the amount of silk produced ("spent") and prey captured.

As body size increased, both solitary and social spiders individually used less silk relative to their body mass, and similar economies of scale were observed in *A eximius* colonies; per capita silk costs fell as either the colony size or number of spiders maintaining the web increased. Moreover, colonies above a certain size began to acquire more energy (in the form of more prey caught) than was spent on web maintenance, suggesting this could be an underlying driver of the cooperative behavior.

Social spiders "tend to emerge in groups that build dense, three-dimensional webs", says Straus, and in locations where prevailing weather conditions, such as intense wind and rain, interfere with web construction. Group living may therefore be an adaptation that allows spiders to live in areas with otherwise inhospitable conditions.

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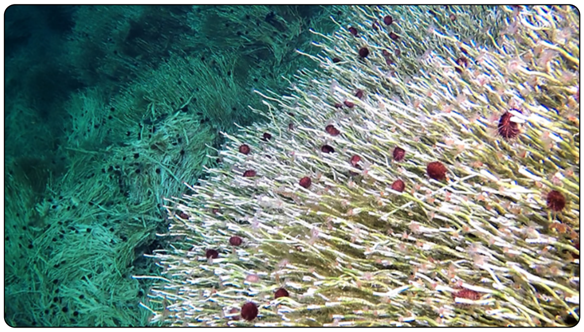
Complex polychaete reefs in East Antarctica

The majority of Antarctica's biodiversity inhabits marine benthic ecosystems. Shallow-water habitats represent vitally important oases for productive and thriving benthic communities, with links to higher trophic levels. Scientists have only a limited understanding of these coastal ecosystems across most of the continent, as there are many vast areas – including the highly complex Antarctic fjord systems – that have never been surveyed. The biodiversity in these habitats provides invaluable ecosystem services such as refuges for ecologically important species, along with carbon storage and sequestration (that is, blue carbon), acting as a natural negative feedback to climate change (*Glob Change Biol* 2021; doi.org/10.1111/gcb.15392) (*Glob Change Biol* 2020; doi.org/10.1111/gcb.15055). Limited surveys of the Vestfold Hills fjords in East Antarctica have identified several rare and unusual benthic communities, such as these stunning and structurally complex serpulid polychaete reefs in Ellis Fjord. Found only in the Antarctic and subantarctic, and formed by the polychaete worm *Serpula narconensis*, these reefs were first observed in 1985 and reported in 1988 as "one of the largest known tubeworm reefs in the world" (*Mar Biol* 1988; doi.org/10.1007/BF00397776), estimated to be over 8 km long and covering the seafloor from depths of 5 to 30 m. Such habitats beneath sea ice are hypothesized to be vulnerable to the effects of environmental change (*Glob Change Biol* 2013; doi.org/10.1111/gcb.12337) (*Austral Ecol* 2015; doi.org/10.1111/aec.12237). The multidecadal gap in sampling across the past 34 years or so is due in part to the logistical challenges of conducting remote Antarctic marine science, but if we find a way to explore these environments more thoroughly, who knows what else could be discovered?



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doi:10.1002/fee.2461