

Sea stars: The benthic equivalent to the polar bear

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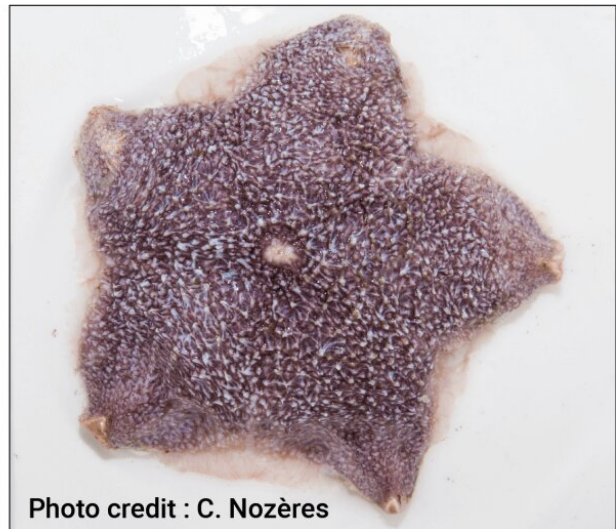


Photo of a polar bear (left) and a seastar from the Pterasteridae family (right).
Credit: University of Manitoba

A national research group led by researchers at the University of Manitoba has shown that polar bears share the position of top predator of the coastal Arctic marine ecosystem with seastars.

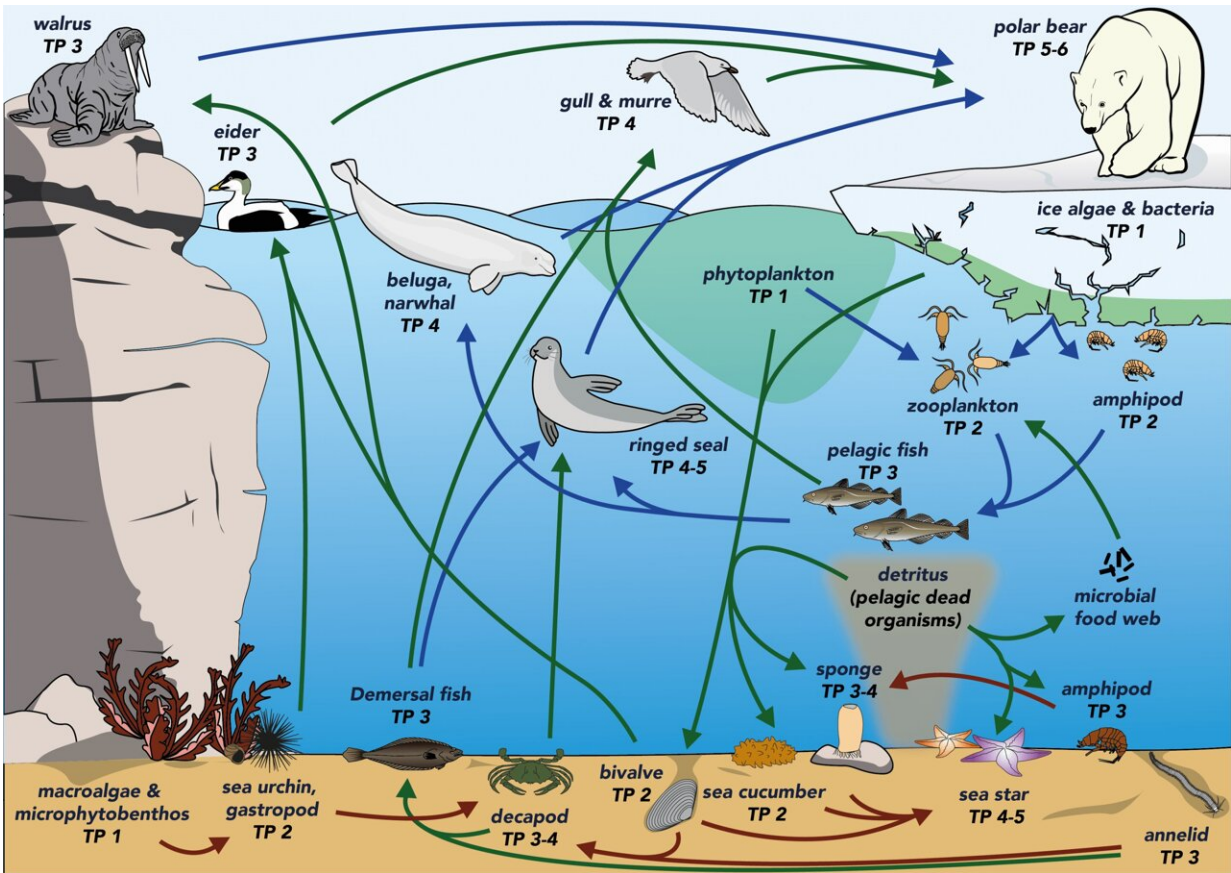
Within the framework of the Southampton Island Marine Ecosystem Project (SIMEP, 2018 and 2019 oceanographic research cruises aboard the RV William Kennedy), led by C.J. Mundy, and additional government-and university-based sample collections driven by D.J.

Yurkowski, R. Amiraux and collaborators investigated 1580 samples of the wildlife around Southampton Island, Hudson Bay, Nunavut.

"The objective of the SIMEP project was to better understand the structure and function of the Southampton Island marine ecosystem that will help local through national governing bodies and organizations decide on how to best conserve and protect this important marine environment, currently an Area of Interest under consideration to become a Marine Protected Area," explains C.J. Mundy, Associate Professor at UM.

The marine food web: A paradigm shift

Food webs are a central concept in ecology that has provided considerable insight into ecosystem functioning. At the base of the food web, [primary producers](#) support lower trophic levels (i.e., feeding positions in a food web) that transfer the energy up to top predators. Generally, the trophic structure of organisms floating or swimming in the seawater, called pelagic organisms that include phytoplankton, invertebrates, fishes, and marine mammals, are studied extensively, whereas those inhabiting the seafloor, called benthic organisms, are studied much less often and typically assumed to only consist of a truncated food chain with lower trophic level species such as mollusks and sponges.



Southampton marine food web. Arrows indicate trophic interaction between species within the pelagic subweb (blue), the benthic subweb (brown), or between different subwebs (green). Credit: *Proceedings of the National Academy of Sciences* (2022). DOI: 10.1073/pnas.2216701120

R. Amiriaux and collaborators refuted this assumption, showing that organisms inhabiting the [ocean floor](#) can have all the constituents of a complete trophic chain, i.e., primary producers fueling several trophic levels from herbivores to predators, with notably the presence of a top predator: sea stars.

"We proved that the wildlife inhabiting the seawater and those inhabiting the sediment form two distinct but interconnected subwebs, together

constituting the [marine food web](#). It's a shift in our view of how the coastal Arctic marine food web works," says R. Amiriaux, Postdoctoral fellow at the University of Manitoba.

Sea stars: The world's top seafloor predators?

Around Southampton Island, Amiriaux and collaborators observed a great diversity of sea stars occupying various ecological niches. However, only the Pterasteridae family contained top predators. The authors argue that this family thrive as top predators due to their evolved defense mechanism associated with a diet of other predators, including marine mammal carcasses that settle onto the ocean floor.

However, members of the Pterasteridae family of seastars are present in all of the World's oceans where they exert a predatory influence on the local ecosystem. Therefore, it is likely that this family of sea stars is the top predator of much of the World's ocean floor. Consequently, if in the Arctic these sea stars are the benthic top predator counterpart to the [polar bear](#), it is likely that they are also the benthic top predator counterpart in other oceans of the world where different pelagic top predators are prevalent, e.g., orca, shark, etc.

Sea stars: Small organisms with huge impacts on ecosystem function

The presence of top benthic predators is not insignificant and can have a great impact on the functioning of our ecosystems. For example, if the top [predator](#) sea stars were to increase predation on the bivalves, i.e., clams, that walrus feed on, we can expect a decrease in the stock of bivalves with effects propagating to the pelagic compartment on the walrus stocks, and in turn, cascading up to polar bears.

This explains the numerous studies highlighting the worldwide deleterious effect of bottom trawling of benthic species on the pelagic subweb and strongly suggests that marine conservation initiatives should not overlook the benthic compartment.

The paper is published in the journal *Proceedings of the National Academy of Sciences*.

More information: Rémi Amiriaux et al, Top predator sea stars are the benthic equivalent to polar bears of the pelagic realm, *Proceedings of the National Academy of Sciences* (2022). [DOI: 10.1073/pnas.2216701120](https://doi.org/10.1073/pnas.2216701120)

Provided by University of Manitoba

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