Distinctive body type aids long life and predation

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By incorporating large volumes of water into their bodies, jellyfish are able to grow to a size disproportionately larger than other animals relative to their carbon content. Credit: ? ?

Jellyfish (Cnidarian medusa) have unique body plans that violate a universal law of biology and facilitate their longevity and their propensity to form blooms, according to an international study involving UWA scientists.

Most physiological and ecological processes in animals relate to body size and such relationships, called allometrics, predict a broad range of functions in animals.

However jellyfish, exhibit allometric differences that cannot be explained solely by their unusually high water and low carbon content.

UWA Oceans Institute director and co-author Professor Carlos Duarte says, "the differences provide insights into jellyfish's evolutionary and competitive advantages conferred by their unique body plans."

He says the jellyfish's allometrics help to explain their tendency to form spectacular blooms.

The study tested differences in allometric relationships for several key parameters: rates of respiration, excretion, longevity and swimming velocity, between jellyfish and other pelagic (open sea dwelling) animals.

Jellyfish were 3.2 times larger than other pelagics of equivalent carbon content and 2.5 times larger than those of equivalent nitrogen content.

Furthermore, respiration rates were 28 times slower, excretion rates 257 times slower and jellyfish grew 3.5 times faster than other similarly sized pelagic marine animals.

"The study highlights that gelatinous marine organisms differ from other marine organisms in fundamental ways," Prof Duarte says.

"These differences are not simply a matter of high water content, but reflect consequences of their fundamentally different life histories, body plans and interactions with surrounding water flows."

By incorporating large volumes of water into their bodies, jellyfish are able to grow to a size disproportionately larger than other animals relative to their carbon content.

This offers many adaptive advantages; such as being less vulnerable to predators and being able to catch larger prey.

Prof Duarte says the most outstanding anomalies of jellyfish are differences in swimming speed with size, and the short seasonal lifespan exhibited by animals that can weigh up to 200kg.

"Jellyfish violate an almost universal law, that the life span of species is scaled to size," he says.

"Our analyses showed that the giant jellyfish in Japan (2m in diameter and weighing a ton) lives just as long as species 1000 times smaller.

"We've shown that jellyfish are extremely efficient organisms, in terms of their metabolism, growth and motion, generating blooms even under conditions of relatively low marine production, when other zooplankton cannot form bloom."

The research is part of a broader international effort to understand the ecology of jellyfish blooms and how it affects the ocean.

More information: Pitt KA, Duarte CM, Lucas CH, Sutherland KR, Condon RH, et al. (2013). "Jellyfish Body Plans Provide Allometric Advantages beyond Low *Carbon* Content." *PLoS ONE* 8(8): e72683. DOI: 10.1371/journal.pone.0072683

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