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Rise of the jellies

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Think of a creature that's top of its food chain, and chances are you'd pick something with big teeth and a large brain. You'd be pretty certain not to choose something that doesn't even *have* a brain.

Credit: istock/Wiesiek

Yet in some marine food chains, the top spot belongs to a no-brain, boneless, heartless lump of blubber: a bag of gel encasing a mouth (that doubles as an anus), a stomach (or more than one) and some gonads. It's not exactly king of the jungle, but sometimes all you need do to rule is to survive.

Jellyfish are good at surviving. They thrive in conditions where other species fail. They've been around – essentially unchanged – since the Cambrian Period, more than 500 million years ago. There are fossils to prove it. Not so much fossils as we generally understand them – there's no bone to petrify – but impressions in sediment, some very detailed.

Once the dominant species on the planet, jellyfish are now regaining that status in some ecosystems, thanks, in part, to changes wrought by human beings.

In many of today's oceans and seas, the bases of marine food chains – masses of tiny single-celled plants known as phytoplankton – are becoming better suited to jellyfish than fish. In fact, jellies are generally out-competing fish for food resources. In doing so, they also pose a threat to the human race, which depends on healthy oceans and fish populations for its survival.

While jellyfish aren't plants, they are, in a very real sense, weeds, according to CSIRO marine scientist, Dr Lisa-ann Gershwin, author of Stung!, an internationally acclaimed book on jellyfish.

As Dr Gershwin points out, weeds are opportunistic generalists. They can tolerate a wide range of conditions and eat almost anything. They have a short life cycle, breed prolifically and are hard to eradicate – the basic job description for jellyfish. And, in the same way that clearing a block of native vegetation means that – left to itself – an area will become infested with weeds, what humans have been doing to the oceans has opened the door for a jellyfish invasion.

Credit: Nick Hobgood, Wikimedia Commons

Overfishing is part of it, but there are other factors at play, like the growing fad for health supplements. To satisfy our appetite for krill oil in particular, we've fished further down the food chain and taken a lot of krill, a staple for penguins. In many areas, krill have now been replaced by copepods: tiny crustaceans less than one-hundredth the size of krill. While copepods are too small for penguins to eat, they're just fine for jellyfish.

In fact, because they eat anything, jellyfish can flourish in overfished waters. A case in point is the Bering Sea, the source of many a fast-food chain fishburger. So high is the jellyfish biomass in the Bering Sea that areas near an intensively fished spot called the 'Donut Hole' have now become known as the 'Slime Bank'.

The problem of jellyfish blooms doesn't end when they die. The mass of carcasses sink to the seafloor and decompose. In large enough numbers, the rotting mass creates an environment that is depleted of oxygen and rich in hydrogen sulphide – in short, a lifeless desert.

Ballast water from ships is another human intervention that's aided the spread of jellyfish. In both their medusa and polyp phases, jellyfish are able to survive long voyages and rapidly establish themselves in their new location. The Australian spotted jellyfish, for example, has established colonies in the US, the Mediterranean, and off the coast of Brazil.

Another example occurred when a type of *Mnemiopsis* – or sea walnut – arrived in the Black Sea via ballast water in 1982. With the ecosystem already weakened by massive overfishing of anchovies (which live on phytoplankton), the jellies flourished, feeding on the excess plankton and out-breeding the fish. By 1989, the population of Black Sea *Mnemiopsis* was estimated at 400 individuals per cubic metre.

Credit: Marco Faasse, World Register of Marine Species

Marine pollution from agricultural runoff also creates ideal conditions for jellyfish. The nutrient-rich runoff causes phytoplankton blooms. When the phytoplankton die, bacteria decompose them, depleting oxygen in the surrounding water. This kills or forces out other marine creatures. The jellyfish, meanwhile, can thrive in water with far lower levels of oxygen than fish, making use of oxygen stored in their jelly.

As already mentioned, jellyfish can eat just about anything – fish eggs, microbes, mud, each other if necessary, enabling them to flourish in denuded seascapes. When times are good, they can eat more than half their own body weight in food per day.

Some also possess the remarkable ability to 'de-grow' when food is scarce. This isn't like losing weight; the organism literally shrinks – by up to 90 per cent or more of its original size. Unhampered by a skeleton, jellies can simply regress to the size of a juvenile organism until the food supply recovers, when it regains full size.

Because of their adaptability and resilience, jellyfish are likely to flourish under global warming. While marine creatures with shells and skeletons made of calcium carbonate – such as corals, sea snails and oysters – are vulnerable to ocean acidification caused by climate change, jellyfish are not. A jellyfish's hard statolith, which it uses to orient itself in the water column, is made of calcium sulphate, which is largely unaffected by acidification.

According to Dr Gershwin, there's a great deal we don't understand about jellyfish, but citizen science could help fill the gaps. For example, there have been recent reports of unusual jellyfish from three different phyla washing up on beaches in the Great Australian Bight.

'A member of the public sent photos of the phenomenon,' says Dr Gershwin. 'This is useful. This is important. We don't yet know whether this is something normal, and we need to study it. If it's not normal, we need to know what happened, and what triggered it.'

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