Manner in which different types of extinction affect evolution

It is impossible to know exactly how many species have ever lived on Earth; there are of course estimates, but we can never truly be certain. Part of this is due to humans not having discovered every species, but a larger part is the sheer volume of species that have gone extinct. Billions of species have evolved, flourished, and died out, some without leaving so much as a fossil with which to identify them. Yet it is common knowledge that many species have gone extinct before and during the era of Homo sapiens. As is expounded upon by PBS (2001), this is due to the fact that no species lives or dies without affecting the species around them. In short, although an innumerable amount of species have gone extinct, they have all left their mark on the species that outlived them in the process. With this in mind, the proceeding paragraphs will examine the evidence that supports this statement, by focusing in on the way the extinction of one species affects the evolution of the others around it, the way mass extinction events affect the evolution of species, and the way that the " Sixth Mass Extinction" in which we are living is affecting current evolution.

A subject that was explored in all elementary science classes, and that is still pertinent to this subject, is the way in which the extinction of one species affects those in its environment – more specifically, its food chain. For instance, were a predator with a large population be subject to circumstances that led to its extinction (but not that of the other species around it) there would be rippling consequences throughout its surroundings. " When a predatory species becomes threatened or extinct, this removes a check and balance in the food chain on the population of prey previously consumed by that predator. Consequently, the prey population can explode."

(Dowd, PhD, 2018) Now one might think that an increase in a population would be beneficial, since it then would make it harder for that species to go extinct in some cases, but really having a population of one species suddenly explode does more harm than good. In summary Dolph (2018) writes that the largest changes that occur in prey after their major predators go extinct are: an explosion in population, a degradation of habitat due to the increased demand for food with increased population called a trophic cascade, behavioural changes such as remaining in one location due to lack of danger from predators, and eventually either extreme malnutrition resulting in death, or migration when the population becomes too large for its habitat to support. There is also the case in which a prey species goes extinct, be it through over hunting, natural circumstance, or any other situation, leaving their predator without a food source. Of course lack of food correlates with lack of survival, and thus in this way one species' extinction again can lead to others. Overall, no species lives or dies without affecting those around it, be it by destroying a food web, disrupting behaviours of its prey, or limiting the availability of food to its predators. As such, even the extinction of one species, can have a cascading affect on those around it.

The greatest way in which extinction affects evolution is when a mass extinction event occurs. The exact definition of a mass extinction event is " Theextinctionof a large number of species within a relatively short period of geological time, thought to be due to factors such as a catastrophic globaleventor widespread environmental change that occurs too rapidly for most species to adapt." (www. dictionary. com, 2018) The most notable time periods in which mass extinction was present are, in chronological

order, the Ordovician-Silurian Extinction approximately 439 million years ago, the Late Devonian Extinction approximately 364 million years ago, the Permian-Triassic Extinction approximately 251 million years ago, the Triassic-Jurassic Extinction approximately 207 million years ago, and the Cretaceous-Paleogene Extinction approximately 65 million years ago. (Pariona, 2018) Since life on Earth didn’t end in any of these mass extinction events, evolution evidently occurred after each one, allowing the remaining species to adapt to their new/altered surroundings. According to UC Berkeley (2018), mammals evolved into their current form in this manner, having existed as small rodents until the Cretaceous-Paleogene extinction, after which they began to evolve in the absence of the non-avian dinosaurs. This was ostensibly an important period in the evolution of all organisms as mammals, and more specifically humans, are now the dominant species on the planet. Overall, mass extinction events are large reductions in life, but from them springs new species to fill in the niches left behind by the newly extant species, and often an entirely new dominant species. Thus, in the above ways, mass extinctions can both negatively and positively affect evolution.

The previous two points have centered largely around the extinction of species through natural circumstance, however in the modern era it is humans that are the driving force behind extinction. “ The sixth mass extinction is happening now, but this time, the extinctions are not being caused by natural disasters; they are the work of humans.” According to Phys (2018) – a high sciences news organisation. This new extinction period has been baptised as the Holocene extinction, named after the current

epoch. (En. wikipedia. org, 2018) Its common knowledge that many species have recently gone, or are going extinct at time of writing, but a newer theory suggests that this may all be part of a sixth mass extinction period to follow the five aforementioned; and it not only the fact that species are going extinct at the hands of humans, but that they are going extinct at an alarming rate. “ When we look at loss of genetic diversity across vertebrates, invertebrates, plants, fungi, and other living things [in the Holocene epoch], the extinction rate compounds somewhere between 1, 000 and 10, 000 times the normal rate.” (Muscato, 2018) This is the cause for concern, as extinction rates this high would never occur under normal circumstances, hence the comparison to normal rates. Now since the Holocene extinction is currently underway, and being driven by the human race, it is implied that there may still be time to stop it, though not much. As written by J. D. Sutter (2018) in an interview with Anthony Barnosky of Stanford University, there are only between 10 and 20 years remaining to reverse the Holocene extinction. In summary, the danger of extinction comes not only from nature but also from mankind. The only question remaining on the matter is what evolutionary steps will follow, as they always do after severe extinction periods.

Evolution is a complex natural process that is both incredibly complicated, and plain to see. It does not however happen on its own as there are many exterior factors that influence it, one of the larger ones being extinction. As has already been expounded upon, factors like the extinction of an individual species, mass extinctions of the past, and even the present mass extinction, all have large roles in the evolution of surviving animals. This intricate

connection between life and death is of course fragile, as too much death is of course bad for life, but for as long as there has been life on Earth, this cycle has been in effect; and so as long as balance is maintained, this syzygy of nature will continue to run its course.

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