Evolution and It’s Underlying Consequences: Extinction

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**Abstract –** Extinction is the state or process of a species, family, or larger group being or becoming extinct, thus entirely dying off. Unfortunately this is.an occurrence that goes hand in hand with the process of evolution. Typically, when evolution occurs it is for a greater advantage or adaptation that causes one set of organisms or species to survive and others to ultimately die off which is a process known as natural selection. There are many examples of this process such as panda bears and bamboo with climate change or dodo birds lacking flight. Evolution and extinction will forever be an endless cycle of back and forth life and death, unless there’s the miracle of equilibrium between the two which is highly unlikely.

**Intro –** There are only two things that are for certain in life: death and taxes. Only humans pay taxes, so throughout this paper we are going to focus mainly on death, more specifically, extinction. Luckily for biologists, a lot of the time these deaths by extinction also may lead to life for another species. In many cases, evolution is thought of to be a good thing and allows for diversity within species, however, many studies do not look at the negative side that specific evolutionary mechanisms such as natural selection, concurrently causes the species that isn’t selected for to go extinct or become endangered. “Natural selection is one of the central mechanisms of evolutionary change and is the process responsible for the evolution of adaptive features (Gregory, 2009)”. Typically when a species is studied in terms of natural selection, the specific studies show only the positive outcomes, but never the negative. In this case, we are going to be focusing on how the negative side of natural selection works and examples of such. I believe that natural selection is an inevitable evolutionary mechanism that results in overall a positive outcome but generates a negative effect within the world of evolution.

**Body1 -** There are many examples of Natural Selection forcing Extinction, both on a level that is blatantly visible as well as somewhat hidden. Natural selection is an inevitable consequence of biology. Survival of the fittest is a good example of how natural selection works, in the fact that only the best equipped for the specific environment will thrive while the others will struggle and ultimately die out (Fig.1). Throughout this section, there will be both past examples (where the species is now extinct) and current examples (where the species is going extinct).

One example of ongoing natural selection forcing extinction is Pandas and Bamboo. This is actually an ongoing epidemic that scientists are trying to avoid. Global warming is affecting many ecosystems, including bamboo. Due to the changing of climate within China, bamboo is currently unable to grow where it has grown for thousands of years. Bamboo is actually going extinct in Northern China, leading to the label of “endangered” on Giant Pandas. Pandas are being saved due to the fact humans have created places such as Zoos and conservation exhibits. Pandas are very rarely seen in the wild due to the rapid decrease in their natural environments and habitats.

Another example of a past natural selection forcing extinction is actually quite a commonly known and taught example of how natural selection and extinction are linked: Dodo Birds lacking flight. “Some extinct species (e.g. the dodo Raphus cucullatus and the thylacine Thylacinus cynocephalus) are cultural and commercial icons and therefore familiar, and may appeal to the public as conservation flagships (Kyne, 2017)”. Dodo birds are a surprisingly common staple in the conservation community and are used to advocate on behalf of the fact that we didn’t assist in their conservation, so now they are extinct. Now, I know you are asking “But there are other birds who cannot fly that are still alive, so how does that work?” And that’s a good question that comes in the answer of: Well, it wasn’t just their lack of flight that caused them to go extinct, it was a few things that added together to cause this species ultimate demise. Some of the more noticeable things were obviously lack of flight and their small size. Due to their lack of flight and small size, dodo birds were heavily hunted by primitive humans and predators, causing for their rapid rate of extinction. Other birds you see today that cannot fly are typically very large such as Ostriches and Emus. The one example of a bird that cannot fly, that was about the same size as dodo birds, were penguins, but they live(d) in completely different environments typically with few predators.

**Body2 -** On the other side of natural selection causing extinction, in some cases extinction may accelerate the process of evolution in species. Extinction is typically seen as a negative connotation as it involves the process of a species completely dying out, but it can actually lead to a positive outcome. This outcome is the acceleration of evolution. When a species is naturally selected for, it is typically due to better adaptations to an environment, while a species going extinct happens to be the exact opposite in worse adaptations within an environment.

One example of extinction leading to evolution is when a species dies out, it may allow other species the chance to thrive in an environment they once weren’t able to. If two species are competitors in an environment, typically if one species goes extinct it would lead to two potentially outcomes: either the second species thrives in the environment or it also dies out. If that species went extinct for reasons such as lack of food, lack of water, or habitat loss, then the competitor would more than likely also die out. But, if the species went extinct on the basis of being overly hunted or higher predation rates, then there’s a solid chance that the competitor species may thrive in their absence.

Another example is that when species are close to going extinct, they may adapt or naturally select a new environment or niche to allow for their survival. One of the most recent and ongoing examples of this is polar bears that live in arctic regions. Due to global warming, their ice caps are slowly but surely melting away, causing polar bears to have to migrate and ultimately adapt to new locations and environmental factors.

**Body3-** An exciting, an ever-growing practice in the field of evolution is predicting and mapping out future extinctions and evolutions. One of the most famous “predictions” to be made was that there had to be something that went between amphibians and reptiles in an evolutionary system. Through fossil research as well as evolutionary mapping, they found this missing link to be a species known as “tiktallik”. While most people are familiar with the idea of paleontology and fossil records, there’s also now many other ways to map out and predict these phenomena with one being phylogenetic trees.

One way, as previously mentioned, to map out and/or predict evolutions or extinctions is paleontology. Paleontologists map out and predict why species will / have gone extinct. This could possibly tie into natural selection, or locate other evolutionary mechanisms to explain specific extinctions. When many people think paleontology, they think dinosaurs because those are some of the most extreme discoveries known today. However, through further studying dinosaurs, there are new discoveries everyday such as the recent finding that tyrannosaurs rex’s bodies were covered in feathers, most likely for heat retention.

Another exciting way of mapping out and predicting evolutions and/or extinctions is phylogenetic trees. Phylogenetic trees are considered to show “hypotheses of past events”. Phylogenetic Trees have been used to map out when specific traits were selected for, thus leading to potential analysis of predicting which species may go extinct based on natural selection alone. Through the observation of phylogenetic trees, it may be possible to predict future selected traits as well as potential future species. Every day, new phylogenetic trees are being made due to the fact new species are being determined as well as the fact new traits are being selected for.

**Body4-** In the same sense of there being evolutionary mechanisms that drive extinction, there may also be phenomenon that completely skip over these mechanisms or may cause these mechanisms to increase in speed exponentially. An example of this phenomenon is humans. Specific technologies that humans have invented as well as the lifestyle that many humans live in the present day drives a lot of unnatural occurrences in nature. One human caused method of extinction is over hunting species or poaching. Poaching is the act of illegally hunting or catching (game or fish) on land that is not one's own, or in contravention of official protection. Poaching of species is a widespread epidemic that’s seen with trophy animals such as Rhinos, Elephants, Giraffes, Lions, and more. Poaching is an unnatural method of extinction that leads to no sort of future evolution (other than potentially opening the space up for species to enter and thrive, as previously mentioned in the paper). Another human caused method of extinction is environment damage / removal. In the past, humans have been known to expand and build wherever they please with no thought of what species or ecosystems are in the area. While this was a widespread issue, there are actually now laws that force expanding efforts to survey the area they are going before anything may begin or be finalized. This legislation has assisted in the saving of ecosystems throughout the world. Humans were, are, and will always pose a threat to species worldwide, but day by day activists and environmental scientists are working to change that one step at a time.

**Body5-** There are various solutions that biologists and ecologists are coming up to ultimately slow the process of extinction factors, and help increase the survival rate of less adaptive organisms in the wild. A few common “solutions” or “remedies” for this include conservation sanctuaries, natural reservations, and zoos. There are many people who are against the idea of having zoos, due to the fact we essentially lock the animals in cages or pens and it is very unnatural for them. Another reason zoos may be unfavored is the fact that humans are using these animals for their own entertainment, as opposed to just focusing on keeping them alive and well. However, zoos have been shown to increase certain species numbers and help with keeping endangered animals from going extinct, with a solid example of mammals. As shown in Figure 2, big cats in zoos on average have had an extended lifespan along with a lower mortality rate whereas big cats in the wild of average have had shorter lifespan along with a higher mortality rate.

**Conclusion-** Natural selection is an inevitable evolutionary mechanism that results in overall a positive outcome but generates a negative effect within the world of evolution. In natural populations, the mechanisms of evolution do not act in isolation. Typically, the mechanisms of evolution occur simultaneously. Unfortunately, extinction and evolution are almost always bound to be found together in a rotation. This rotation may be knocked out of balance if it happens to be an unnatural extinction, such as over hunting and other human related causes. Evolution is a complex area within many different disciplines of science, such biology, botany, geography, earth science, anthropology, and more, that is ever-changing. On the other side, ultimately, extinction will almost always be an inevitable occurrence, but there are definitely ways for us to help make sure it is a slowed process such a natural reservations and conservation sanctuaries for animals. These do not always work, but they are step in the right direction to slow the inevitable process of extinction in the cycle of evolution. There are many different mechanisms that affect how evolution and extinction work out. Evolution and Extinction are an endless cycle of life and death that will continue to occur for billions and billions of years.

**Graphs / Tables / Figures**

**Figure 1. An outline of Natural Selection showing that one route leads to adaptation while the other route leads to extinction, but both play a role in the ultimate outcome.** 

**Figure 2. This figure shows the correlation between mortality rate and age from a comparison of wild populations vs. zoo populations. The mortality rate is lower, with an extended life span within zoo populations with the inverse being shown in wild populations where mortality rates are higher with a shorter life span.**

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