

Historic extinctions:

Extinctions have happened many times during the Earth's history.

- In this case we are not considering the simple disappearance of a species or two, but rather the “mass” disappearance of a whole number of species.
- Text points out that first we need to know what the “normal” or background rate of extinction is:
 - The number of species disappearing / unit time.
 - Species are constantly going extinct, and new ones are constantly evolving.
 - Unfortunately, the fossil record is rather fragmented, so we don't have a very good idea as to this background rate. It appears to vary depending on the time period considered.
 - Table 2.2 lists the extinction rate for mammals in North America. The figures have been adjusted to give a “per million years” rate. The average rate of extinction is 0.175 for the time period listed in the table.
 - Two other points:
 - rates are for genera
 - rates for other taxa can be higher or lower.
 - Bottom line, it's not a very satisfactory method, but we need to be aware that there is a “background” rate.
- Given this, there are numerous mass extinction events. The text lists several others, but let's concentrate on two:
 - The most severe: At the end of the Paleozoic, 54% of marine families and 83% of the genera were wiped out.
 - Land extinctions were not quite as severe (?), but the record is scanty.
 - Possible causes?
 - Reduction of continental shelf area due to land masses being combined.
 - Asteroid? An article not too long ago claims to have found

evidence for another meteor impact.

- [supernova explosion - cosmic radiation may have wiped out most life on earth (sounds like something out of Star Trek, but the idea is sound and recent evidence may bear this out)]

- bottom line, no one knows. But in terms of magnitude, life had a close call.

- The most famous - Mesozoic/Cretaceous

- Not nearly as severe as the one at the end of the Paleozoic.

- But arguably more spectacular - dinosaurs disappeared, though recent evidence shows that dinosaurs merely changed into birds.

- Many fossilized dinosaurs are being found in China that show them having feathers.

- Cause => most likely an asteroid that impacted about 65 mya. The crater has been found buried deep under the Yucatan peninsula.

More recent extinction events (Pleistocene)

- There is a bias that seems to show that the need to conserve is recent. Unfortunately humans seem to have a long history of driving species to extinction.

- Africa - acts as a control. There is little evidence of “mass” extinction events during the Pleistocene, unlike some other continents.

(some geologic “periods” are not explained well in the text.)

- Europe shows a rather uniform loss of large mammals.

- Australia shows a large spike in the loss of large mammals, reptiles and birds at the end of the Pleistocene.

- North America also shows a spike during the late Pleistocene.

- South America does not have as good a record, but what exists seems to mimic North America.

- The two main causes that are discussed are:

- climactic

- human

- Both “theories” have problems. The climactic interpretation requires special events in different locations, and the human interpretation does not have enough solid evidence linking the arrival of humans with the disappearance of species.

More recent extinction events (Holocene)

[- ignore the variance explanation stuff (their definition of standard error seems a little screwy - it might be specific to the problem at hand).]

- Madagascar - fossil evidence shows that 7 genera of lemur (mostly larger) went extinct with the arrival of humans. Evidence from pollen in Africa does not support a climate change hypothesis.

- New Zealand - Since 900 A.D., 6 families, 32 genera and 44 species of bird went extinct in New Zealand. This is tied to the arrival of Polynesian settlers. Reptiles and amphibians were also impacted.

- numerous fossil sites showing a mix of bird fossils and human artifacts.

- the cause for the extinction of many smaller species can be tied to the arrival of the Polynesian rat, *Rattus exulans* (closely related to the typical “rat”). Fossil evidence exists showing its spread.

- Pacific Islands - without going into the details, most of the Pacific shows the same trend as New Zealand. As humans arrive, there is a distinct decline in bird species (e.g., Hawaii - 50% of avifauna went extinct).

- Nice: two controls exist: Galapagos in the Eastern Pacific and the Mascarene Islands in the Indian Ocean.

- Galapagos - first settled in 1832. The fossil record indicates no good cases of vertebrate extinctions during the Holocene (of course, this is changing now with the arrival of humans - goats are a particular problem just now).

- Mascarene Islands - show a long record of extinctions, but none so far prior to discovery by Europeans in the 1500’s.

- Summary - The authors very suggestively point out that the extinction rates following colonization of the Americas and Australia are very similar to those seen in the Pacific.

But they admit there is no good evidence.

- Some comments:

- the theory that humans wiped out a large part of the megafauna in North America has been around for a long time. It's very controversial, though recent trends seem to be in its favor.

- just because a theory sounds outlandish (asteroids, cosmic radiation, etc.), don't dismiss it outright. Given a long enough time, even the improbable can happen.