

Polar Bears and Brown Bears



What's in a name?

Ursus arctos is the scientific name for an animal known by several common names, including Brown Bear, Grizzly Bear, Kodiak Bear, and others. These names refer to the various subspecies that occur in different geographic regions of the world, but “Brown Bear” is recognized by scientists as the correct common name for the species.

Polar Bear and Brown Bear Distribution

Polar bears (*Ursus maritimus*) occur along the northern coasts and in the arctic waters north of Alaska, Canada, Greenland, Norway, and Russia.



Polar bear distribution

Brown bears (*Ursus arctos*) occur in Canada, the United States (primarily Alaska, with smaller populations in Montana, Wyoming, Idaho, and Washington), and across northern Europe and Asia.



Brown bear distribution

In North America, the ranges of the two species overlap in the arctic regions of northeastern Alaska and northwestern Canada. Recently, however, there has been evidence that climate change is allowing brown bears to expand their range northward into new areas previously occupied only by polar bears.

Polar Bear Genetics and Evolution: Implications for Endangered Species and Climate Change Issues

Polar bears are of current interest because of concerns about loss of sea ice habitat due to climate change. In 2008, they were designated as a Threatened Species under the U.S. Endangered Species Act (ESA). As a result, many aspects of polar bear biology are being researched, including genetics. Genetics has become a central part of conservation-related research because of the availability of DNA technology to assess the relationships of species and populations.

Polar bears and brown bears are genetically closely related. This is evident from similarity of both species' DNA as well as their anatomy. Another indication of the close relationship between polar bears and brown bears is the fact that they can interbreed and produce hybrid offspring. This has been known to occur in zoos for some time, but only in the last few years has there been genetic proof that brown bears and polar bears can successfully breed in the wild. In 2006, a hunter in Canada shot a white bear that he believed was a polar bear. Upon examining the animal, however, it was noted that it had brown eye rings and other brown patches, very long claws, a slightly dished face, and a shoulder hump, similar to brown bears. DNA analysis later determined that the bear was indeed a wild hybrid, with a polar bear mother and brown bear father. If polar bears are forced to spend more time on land with less sea ice, increased mating with their brown bear cousins could occur.



This wild hybrid, a cross between a polar bear and brown bear, was shot by a hunter in Northwest Territories, Canada, in 2006. At the time, it was the only wild bear proven by genetic analysis to be a hybrid. It exhibits the overall white coat of a polar bear, but the areas of areas of brown fur, dished face, extra-long claws, and slightly humped back are characteristics of a brown bear. Photo from Canadian Wildlife Service/AP.

Evolutionary studies suggest that polar bears evolved from brown bears during the ice ages. The oldest polar bear fossil, a jaw bone found in Svalbard, is dated at about 110,000 to 130,000 years old. DNA comparisons suggest the species may have split at least 150,000 years ago, and maybe longer. The timing of when polar bears first appeared as a species is important because it will determine when they experienced warm periods with little sea ice in the past, and help assess their response to current changes in sea ice.



Polar bear mother and cubs.

Recent TTU Research

In a cooperative project with polar bear researcher and animal geneticist Matthew Cronin of the University of Alaska Fairbanks, Dr. Robert Baker, Professor of Biological Sciences and Director of the Natural Science Research Laboratory at Texas Tech University, and his students are working on genetic comparisons of polar bears and brown bears to improve our understanding of the timing and processes involved in polar bear evolution.

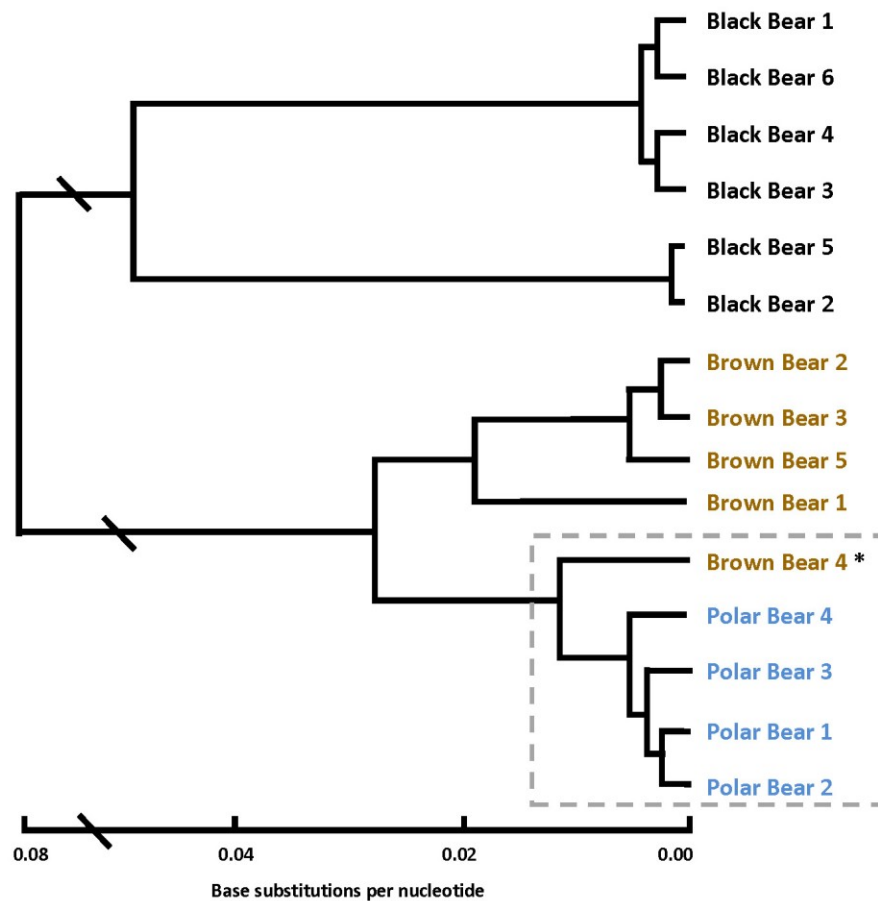


Molly McDonough, PhD candidate, and Dr. Robert J. Baker, Horn Professor of Biological Sciences, recently removed tissue samples from the toenails of the polar bear and brown bears in this exhibit for DNA isolation and analysis.



Molly McDonough is shown here loading a gel with a DNA sample from a polar bear. In a cooperative effort with Dr. Matthew Cronin of the University of Alaska Fairbanks, Dr. Robert Baker and his students are working on genetic comparisons to improve our understanding of the timing and processes involved in polar bear adaptation and evolution.

The close relationship of polar bears and brown bears is evident in an interesting genetic pattern. The figure below shows the relationships based on differences in a group of genes referred to as mitochondrial DNA (mtDNA). In this case, brown bears in southeastern Alaska have mtDNA more similar to that of polar bears than to that of other brown bears. This is an example of discordant patterns of molecular genetic relationships and actual species relationships. Polar bears probably adapted rapidly to living in the sea ice environment, while their brown cousins stayed on land and continued their typical bear lifestyle. The DNA changes simply haven't progressed as rapidly as the adaptation of the whole animal. Dr. Baker and his students will be applying their experience on this kind of science with many other species to help understand the timing and nature of the adaptation process in polar bears.



Tree diagram of relatedness of three bear species' mitochondrial DNA (mtDNA) sequences. The branches of the tree that cluster together include bears that have more closely related mtDNA.

* Note that the Brown Bear 4 mtDNA sequence, which was from southeastern Alaska, grouped with the polar bears in this analysis. This indicates that Brown Bear 4 mtDNA is more closely related to that of polar bears than it is to brown bears from other regions. Also note that mtDNA represents only one gene, and other data show all brown bears and polar bears are different species.

The diagram below illustrates how polar bears may have evolved from brown bears in response to the last ice age. Despite the fact that the bears now appear quite different physically (most notably in coat color), the genetic differences are very slight.

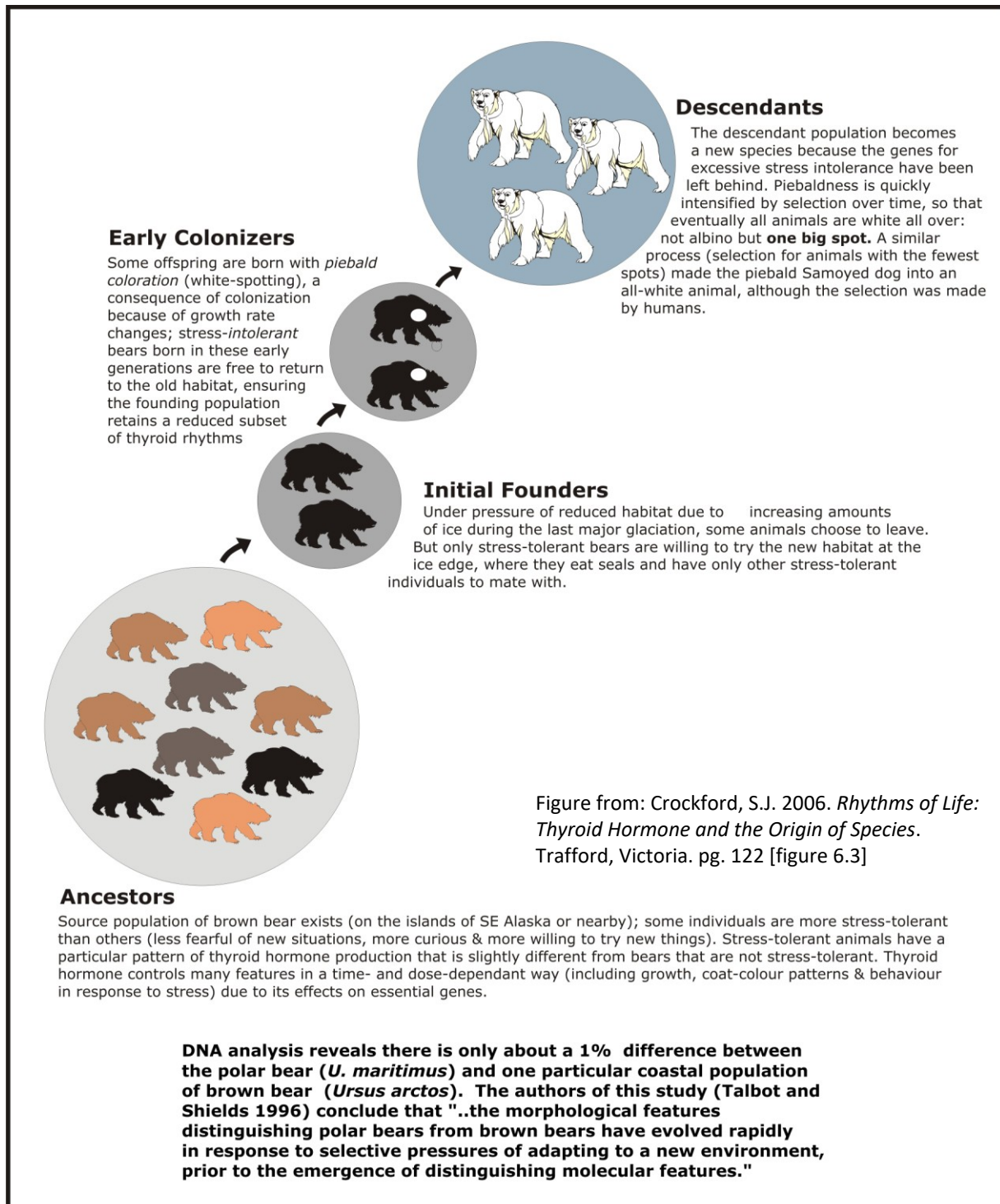


Figure from: Crockford, S.J. 2006. *Rhythms of Life: Thyroid Hormone and the Origin of Species*. Trafford, Victoria. pg. 122 [figure 6.3]