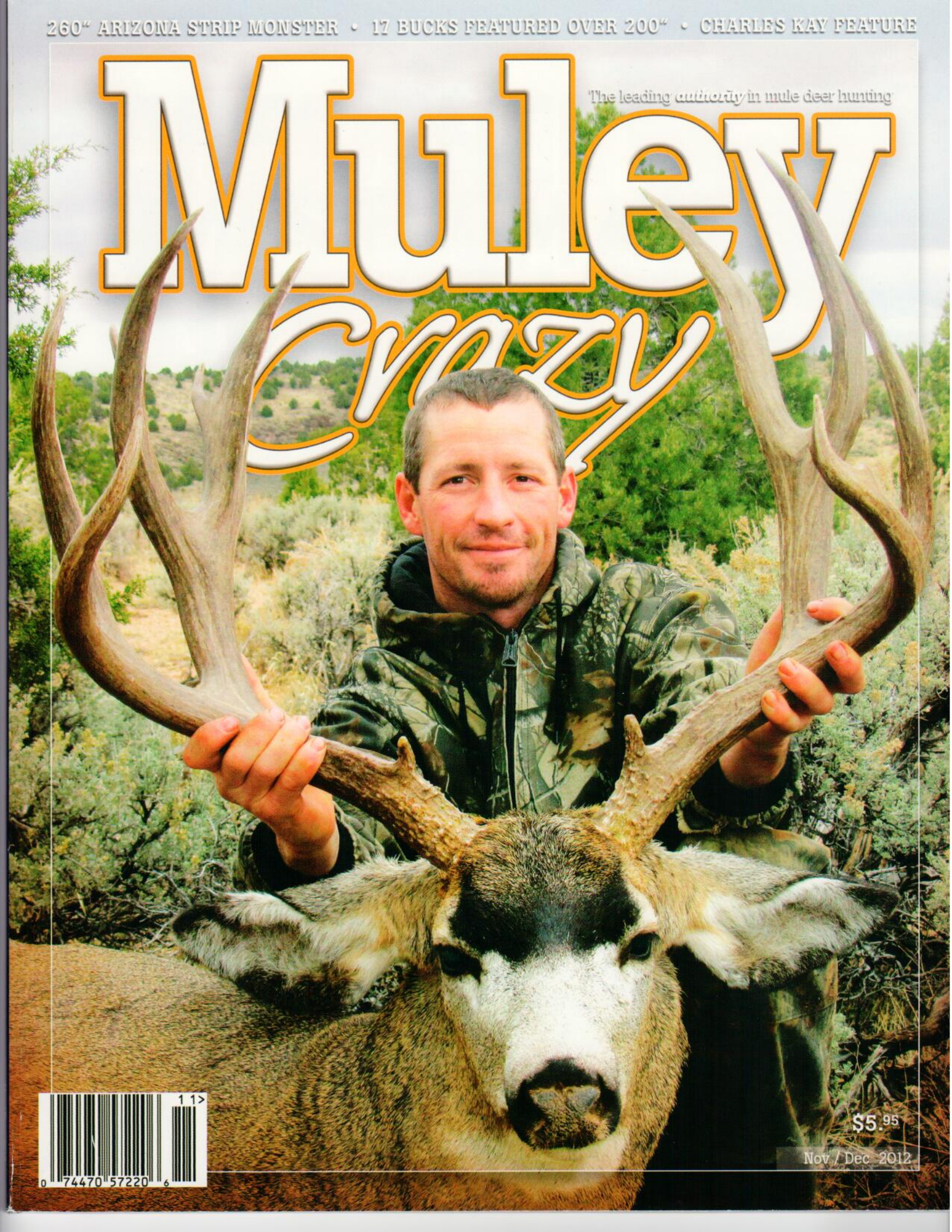


260" ARIZONA STRIP MONSTER • 17 BUCKS FEATURED OVER 200" • CHARLES KAY FEATURE

Muley

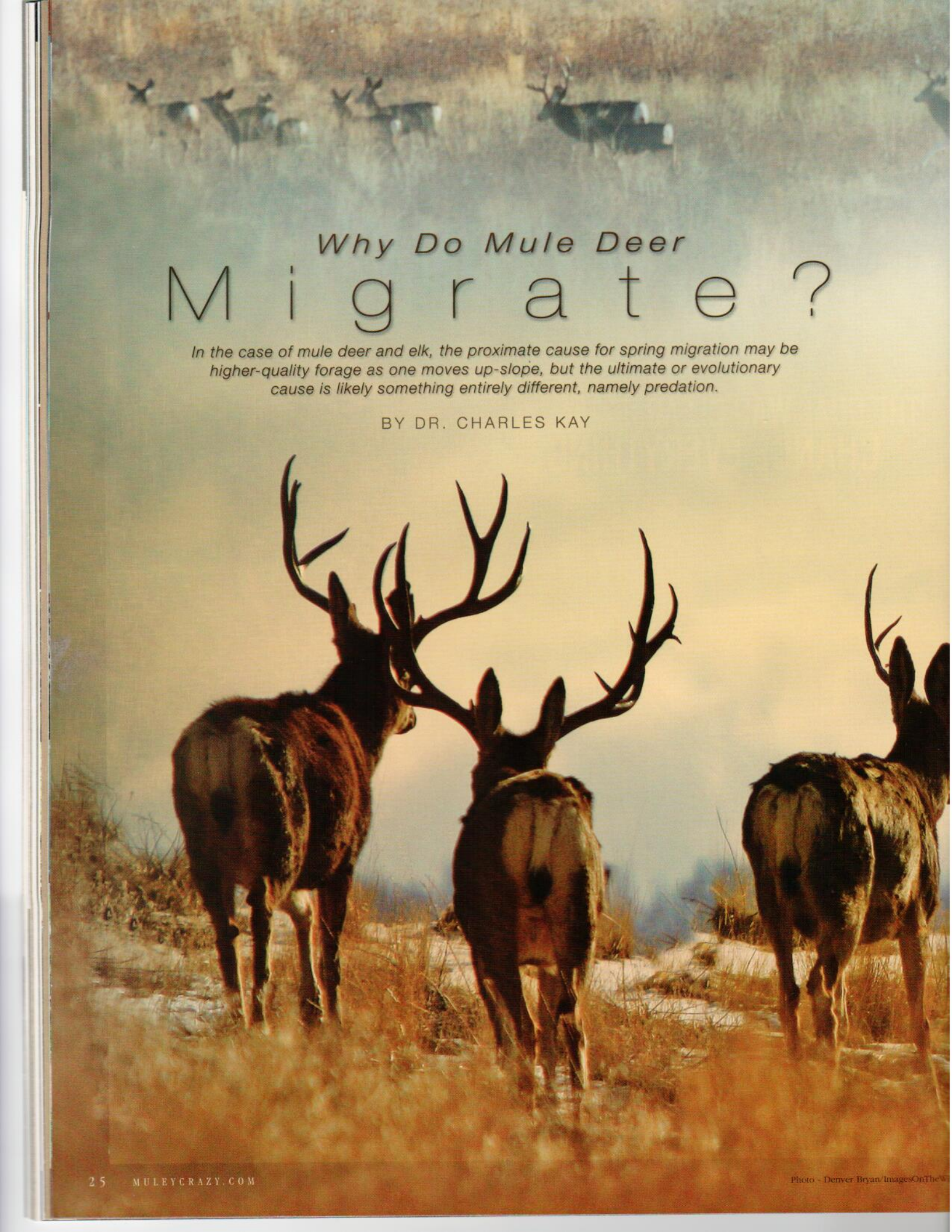
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The background of the page is a photograph of a herd of mule deer in a misty, mountainous landscape. In the foreground, three deer are seen from behind, standing in a field of dry, golden-brown grass. They have large, dark antlers. In the background, several more deer are visible, some standing and some lying down, in a hazy, mountainous area. The overall tone is warm and naturalistic.

Why Do Mule Deer M i g r a t e ?

In the case of mule deer and elk, the proximate cause for spring migration may be higher-quality forage as one moves up-slope, but the ultimate or evolutionary cause is likely something entirely different, namely predation.

BY DR. CHARLES KAY

Why do mule deer and other species migrate? And why are ungulates that undertake long-distance migrations, such as barren ground caribou or African wildebeest, much more abundant than those that do not migrate? It is commonly assumed that animals migrate to obtain better grazing or food, but is that really true? Or is something else driving migration? In the case of mule deer and elk, the proximate cause for spring migration may be higher-quality forage as one moves up-slope, but the ultimate or evolutionary cause is likely something entirely different, namely predation. Unfortunately, little work has been done on why mule deer migrate. However, research has been conducted on why caribou, wildebeest, and more recently elk, migrate.

For years it was assumed that barren ground caribou in northern Canada and Alaska undertook long-distance migrations in search of food. Recent analysis, though, has shown that is not

the case. Barren ground caribou usually winter in boreal forests near arctic treeline and then during early spring, the females migrate hundreds of miles, often over snow-covered ground, to reach high-tundra areas, or barrens, where the caribou calve and then summer. Males, on the other hand, do not, as a general rule, migrate during spring, but instead remain at northern treeline where they summer. Only towards fall do bulls migrate north to join the females for the rut. Why the difference in female and male migratory behavior? It is because bulls and cows have entirely different strategies to maximize their respective inclusive fitness—that is passing on their genes to the next generation.

Male barren ground caribou maximize their inclusive fitness by growing large bodies and antlers in order to dominate breeding opportunities during the rut. Bulls do this by summering at arctic treeline, where spring comes earlier and forage is both higher in quality

and quantity, needed to fuel antler and body growth. Females, however, maximize their inclusive fitness by ensuring survival of their young. The key to understanding all this is predation. Because wolves den early in the spring before the female caribou migrate, breeding wolves cannot follow the cows to the distant, high-tundra areas where the caribou calve.

There are also very few bears on the barrens, as there simply is not enough vegetal food to support either blacks or grizzlies. Thus, by migrating long distances to lower quality, but largely predator-free barrens, female caribou significantly reduce the predation pressure on their newborn young. Chemical analysis of both plant and fecal samples has confirmed that caribou on the barrens have a lower-quality diet than bulls that do not migrate north in the spring. By measuring the nitrogen content of caribou, or any species, fecal droppings, it is possible to obtain proxy data on diet quality. The higher the fecal





It is widely known that ungulates which avoid predators, simply produce more surviving young. Thus, predation is undoubtedly a major factor as to why mule deer migrate annually.

nitrogen, the higher the protein content of the ungulates' diet.

Young caribou have virtually no defense against wolves and if non-breeding wolves follow the caribou to their calving grounds, as sometimes happens, the result is widespread surplus killing. As documented by various observers, in a matter of minutes, lone wolves can kill 20, or more, young calves, most of which are not even eaten. This is why female caribou that are about to calve avoid wolves at all possible costs—even at the cost of lower quality and quantity forage on the barrens.

Bulls that remain near treeline are willing, in an evolutionary sense, to bear the cost of wolf predation because those that survive maximize their inclusive fitness by breeding as many cows, as their larger body size allows. One super fit bull can breed a large number of cows in a matter of days, but each cow produces only a single calf each spring. If she loses that calf, her inclusive fitness for that year is zero. Some bulls do join the cows on the latter's early spring migration, but since the sparse vegetation on the barrens is of low quality, those bulls do not grow as large

as their competitors, who remain at treeline where there is better, and more abundant forage. Needless to say, smaller bulls lose out during the rut. A large bull during one rut can breed more cows, that is father more calves, than a cow may give birth to in her entire life, which is why bulls take the high stakes gamble of maximizing body and antler growth. Caribou migrations, both north in

spring and south during fall, also tend to be unpredictable because random movement makes it even more difficult for predators to locate their prey. Without predators, including human hunters, caribou would have little reason to migrate.

Predators have also been shown to drive the migratory behavior of wildebeest and other species on Africa's Serengeti. Some animals remain in the Serengeti's woodlands year-round and those populations are limited by predation, primarily from African lions and spotted hyenas. Like wolves, though, spotted hyenas are tied to densities, while both hyenas and lions are tied to territories. Territories, unlike home ranges, are defended against members of other clans, in the case of hyenas, and different prides in the case of lions. Thus when wildebeest and other species migrate to Serengeti's short grass plains to give birth, many of their normal predators are left behind. Unlike barren ground caribou, though, Serengeti's short grass plains provide high-quality forage during the wet season when ungulates use the area. Nevertheless, migratory animals on the Serengeti are more



Yellowstone's Sunlight Basin elk herd used to winter on low-elevation public and private lands and then migrate into Yellowstone to summer. However, with the recent and drastic increase in wolf numbers, The Sunlight Basin elk are now summering on the winter range to avoid predators in the park.

Photo - Dave Peterson/MooseHollowProductions

abundant than their counterparts that do not migrate, because migration ultimately reduces predation.

In western North America, it is generally believed that mule deer and elk migrate up-slope during spring to track the flush of new, high-quality plant growth following snowmelt. While that may be a proximate cause, recent work on elk has shown that the ultimate cause is predation. In the Rocky Mountains, wolves den during

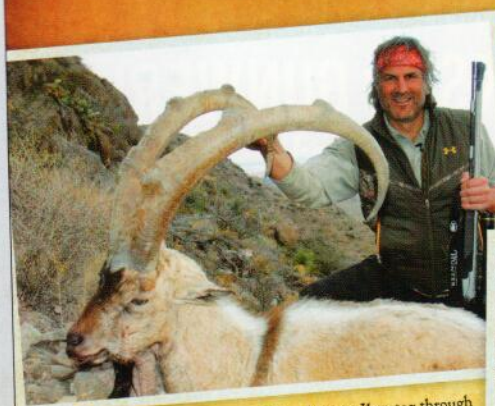
early spring when elk and deer are still on their low-elevation winter ranges. Then as the snow melts, the deer and elk move up-slope to feed and calve, leaving denning wolves behind. But what if the situation is reversed? What if the summer range is full of wolves, bears, and other predators, while there are fewer predators on the winter range? Will the deer and elk still migrate into the mountains? Again, there are no data on mule deer, but we do have data for elk.

To the east of Yellowstone National Park, the Sunlight Basin elk herd used to winter on low-elevation public and private lands and then migrate into Yellowstone to summer. As we all know, the park has filled with wolves and grizzlies over the last 15 years, and now fewer and fewer Sunlight Basin elk migrate into Yellowstone. Instead, elk numbers have steadily increased on privately owned, low-elevation areas, where there are fewer wolves and even fewer bears. That is to say, elk are now summering on the winter range to avoid predators in the park.

A similar situation has been documented in the Canadian Rockies. As late as 1980, elk wintered on the Ya Ha Tinda grasslands to the east of Banff National Park and then migrated to high-elevation summer ranges in the park. In recent years, however, the number of wolves, bears, and other predators has built up in Banff. Wolves and bears, however, can be legally shot once they leave the park. So we now have a situation where predation pressure is much greater in the park than on the adjacent, lower-elevation winter range. How have elk responded? The majority of elk, and especially cows about to calve, no longer migrate into Banff National Park, but instead summer on the Ya Ha Tinda where there are fewer predators. Ultimately, staying alive is more important than being well fed.

In the anthropological literature there has been a debate about whether or not bison migrated long distances prior to European settlement, or if bison were largely confined to resident herds. Historical accounts are ambiguous. Nuclear physics, though, has provided an answer. There are types of grass that grow during cool seasons and there are other species of grass that grow only during the warm, summer season. Cool season grasses and warm season grasses fix carbon by different photosynthetic pathways. In addition, there are two natural isotopes of carbon, which are fixed in different proportions by the two types of grass.

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As bison, or any other ungulates, forage, carbon isotopes find their way into the animals' bones and remain there even after the animals die. So by performing carbon isotopic analyses on bison, or any species', bones we can tell what proportion of the animals' diets were cool season versus warm season grasses, even if the bones are thousands of years old.

Bison bones recovered from archaeological sites in Waterton National Park just north of the U.S. border, at Crowsnest Pass, and all along the east slopes of the southern Canadian Rockies have tested hot. That is to say, the bone samples indicate that those bison once spent a great deal of time foraging on warm season grasses. The problem is that there are no warm season grasses anywhere near where the bison died. In fact, the nearest warm season grasslands are in southeastern Alberta or eastern Montana, several hundred miles away. The only plausible explanation is that bison summered in one place and then moved long distances to winter. In this case, the main predator bison were trying to avoid most likely was Native Americans, or First Nations, if you are a Canadian.

Returning to our original question, why do ungulates migrate? While food may be a proximate cause, the ultimate factor is to avoid predation. Ungulates that avoid predators simply produce more surviving young than those that fail to minimize the risk of predation both to themselves, and more importantly, their newborn young. Similarly, ungulates that undertake long-distance migrations are much more abundant than those that do not because migration significantly reduces predation. Barren ground caribou that migrate long distances are seven to thirty-five times more abundant than caribou that do not migrate to distant lands. It has even been suggested that pregnant baleen whales in the Pacific migrate to high arctic waters "to reduce the risk of killer whale predation on their newborn calves in low-latitude waters."



Ungulates that undertake long-distance migrations are much more abundant than those that do not because migration significantly reduces predation.

They are called killer whales, not orcas, for a reason. Even great white sharks fear killer whales.

Pronghorn antelope that summer in Wyoming's Jackson Hole migrate 100 miles or more to winter in the Red Desert where there is less snow. Every antelope that has ever tried to winter in Jackson Hole has been killed by coyotes. Ungulates tend to avoid deep snow areas because as snow depth increases, so does predation. It is not

just a matter of seeking food at low-snow sites, but of avoiding predators in deep-snow areas. If the snow is deep and crusted, even coyotes can annihilate antelope or mule deer, let alone wolves. It is really quite simple, migrate or be eaten!