

- photo A. Kenney

by Gabriela Yates and Mark S. Boyce

WILDLIFE'S 10-YEAR CYCLE: PEAK YEAR FOR GROUSE AND SNOWSHOE HARES IN 2009

The boreal forest of Canada is the best place in the world to observe wildlife's 10-year cycle. This pervasive cycle starts with a peak in the number of animals, followed by a 4-year crash to low abundance, and then 6 years during which populations rebuild to another peak, all spanning a 10-year period.

Although the duration of these population cycles is remarkably regular (average of 9.6 years for lynx), the height of the peaks (amplitude) can vary widely. In Alberta we've had peak years for lynx in 1961, 1971, 1981, 1991, and 2001, so the next peak in lynx harvests is expected in 2011. Snowshoe hares and ruffed grouse should be abundant this year. Ecologists know that these cycles have been maintained for hundreds of years because of long-term records of Canadian furs sold in fur markets.

Why does this remarkable peak/crash pattern occur primarily in the north? The secret seems to lie in the specific environment of the boreal forest. Species with population cycles usually have few direct competitors, and predators that specialize in eating one type of prey. They also live in highly seasonal environments with brief rapid growth of food plants and their own reproduction, followed by a long winter



Dr. Mark S. Boyce

season lasting 6-8 months. This combination of having few competitors, a "specialist" predator, and a highly seasonal environment sets the stage for a population roller-coaster ride.

Cycles are not limited to lynx. Indeed, cycles with a period of approximately 10 years have been documented in several species of grouse, as well as red fox, coyote, fisher, marten, mink, muskrat, wolverine, northern goshawks, great horned owls, and even striped skunk and Atlantic salmon. The most important connection amongst all of these animals appears to be their link (although some weaker than others) to snowshoe hares. In fact, the underlying cause of the 10-year cycle appears to be a three-way interaction between specialist predators (mainly lynx), the snowshoe hare, and the hare's food plants. The effects of this lynx-hare-vegetation interaction trickle through the food web to many other species.

The only exception to the link with the hare/lynx cycle appears to be interaction between muskrats and mink. Although mink may kill snowshoe hares the largest portion of their diet in northwest Canada is muskrat. In fact, muskrat-mink fluctuations do not align with hare-lynx fluctuations (muskrats peak 1-2 years prior to hares) and seem to be on a cycle all their own. This cycle is unusual in that it



Ruffed grouse should reach peak numbers in 2009-2010. - photo D. Herr

occurs largely in an aquatic environment. Some researchers have proposed that fluctuations in Atlantic salmon also might be driven by mink predation and therefore might follow the muskrat-mink cycle rather than the hare-lynx cycle. However, possible furbearer links with salmon have not been studied.

The dominance of the snowshoe hare in driving the population cycles can be seen in the strength of its 10-year signal, which is strongest in northern habitats. Snowshoe hare populations fluctuate the most violently, and of the furbearers, lynx (feeding mainly on



- photo G. Yates

A young female lynx in Nordegg, Alberta in March 2009. Lynx numbers peak about two years after the peak in snowshoe hares. Gabby Yates is monitoring dispersal by radiocollared lynx in the foothills of Alberta's East Slopes.

hares) have the most extreme fluctuations. Some hare populations show increases of over 40 fold during a cycle and lynx abundance can



- photo K. Laubenstein

The northern goshawk is a highly effective predator on snowshoe hares and forest grouse, flying with amazing agility through the forest. When snowshoe hares decline in abundance, goshawks disperse searching for food, causing periodic crashes in ruffed grouse as far south as Minnesota and Wisconsin.

increase over 10 fold. Harvests of lynx can be even more exaggerated due to increases in trapping effort during peak years. Red fox and coyote have relatively low-level fluctuations of about five fold when comparing peak versus low years.

Despite the dominant role that snowshoe hares usually play in the 10-year cycle, some populations show fluctuations in areas where there is no cycle in the abundance of hares. For instance, ruffed grouse populations have a consistent 7-10 year cycle even in some southern areas where hares are not cyclic. This occurs because northern goshawks that prey on hares migrate south periodically when snowshoe hares are in crash phase. This results in intense predation pressure causing populations of ruffed grouse as far south as Minnesota and Wisconsin to fluctuate in time with a cycle that originates much further north.

Just as the cycle can prevail without cyclic hares, the cycle also can occur without lynx as the dominant predator. Hare cycles have been observed on Anticosti Island in the Gulf of St. Lawrence, which is devoid of lynx. Here the specialist predators are northern goshawks and great horned owls. The predators' rise and fall is driven by lynx/hare dynamics on the mainland, but these avian predators easily fly to the island to feed on abundant snowshoe hares. The result is that hares on Anticosti Island cycle in time with the mainland hare despite the absence of lynx.

A closer look at the 10-year cycle shows that despite largely synchronous cycles, some slight timing differences exist. The cycles begin in northern Alberta, becoming less intense and slightly delayed farther away. The cycle can be visualized like a ripple emanating

continued on next page

BROWNING[®]

Silver, Mossy Oak[®] Duck Blind[™]

All Browning Firearms are shipped with a locking device for additional security.



Description: Receiver - Aluminum alloy
• Semi-humpback design

Barrel - Lightweight profile • Ventilated rib
Action - Gas-operated autoloader
• 3 1/2" chamber • Active Valve reliably cycles a wide range of loads
Stock - Composite stock and forearm
• Dura-Touch[®] Armor Coating
• Mossy Oak[®] Duck Blind[™] camo finish
Features - Three Invector-Plus[™] choke tubes

Bashaw Sports Centre

50th Street, Bashaw, Alberta www.bashawsports.com
(on Hwy 21, about midway between Edmonton and Calgary)



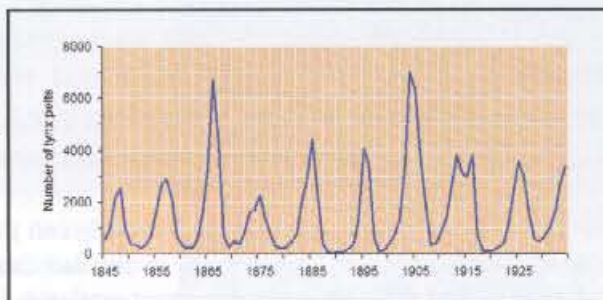
PHONE: (780) 372-4440 • Fax: (780) 372-4447



Muskrats and their primary predator the mink appear to be on a 10-year cycle that is all their own. In western Canada muskrats peak 1-2 years prior to mink.

from Alberta and reaching the east coast of Canada about two years later. Curiously both the hare/lynx cycles and the muskrat/mink cycles have their epicentre in the boreal forests of northern Alberta. No one knows why the cycles should start in northern Alberta. The spread of the cycle appears to be explained largely by predator dispersal. Canada lynx are amazingly mobile, capable of traveling over 1,500 kilometres in their desperate search for snowshoe hares during the crash phase of the cycle. Migratory

birds can travel hundreds or even thousands of kilometres, carrying cyclic predation pressure



Lynx fur returns from the MacKenzie District that includes northern Alberta. This chart was compiled from Hudson's Bay Company records by Charles Elton in 1942.

over vast distances helping to synchronize populations.

Weather might be another mechanism causing synchrony of populations over vast areas. For instance, the timing of the 10-year lynx cycle can be divided into three zones from west to east. These regions of synchrony align

with three regional weather zones (Pacific-maritime, Continental, and Atlantic-maritime), which are differentially affected by the Pacific

Decadal Oscillation in the west and the North Atlantic Oscillation (NAO) in the east. The NAO is a phenomenon that creates cyclic weather trends influencing snow quality, winter temperatures, and open water freeze-over dates. These large-scale weather events also might influence the 10-year cycle through broad shifts in forest fire cycles and vegetation productivity.

Fur returns from Hudson's Bay Company posts and provincial records of lynx harvest have shown changes in the 10-year cycle over the years. After 1900, both the height of the population peaks and cycle synchrony decreased across the continent. In recent years, cycles in southern portions of the range of the lynx have dampened to the point where they have lost both the clear 10-year signal and large-scale synchrony. Furbearer cycles are still strong in Wood Buffalo National Park in northern Alberta, but less well defined further south.

We are currently researching why the 10-year

cycle in lynx shows signs of collapse in the southern portion of the range. Our investigation includes how new weather patterns that impact lynx, hare, and food plants; expansions of aggressive generalist predators like coyotes and bobcats; and



Mark Boyce skinning a lynx trapped near Nordegg, Alberta.

fragmentation of habitats due to urbanization and industry might disrupt the historical predator-prey-vegetation interaction.

Canada has had the benefit of long-term hunting and trapping records. Furs shipped from Canada show the 10-year cycle of lynx in London fur sales as early as 1763. Beginning in 1821 the Hudson's Bay Company recorded fur returns at posts across Canada. Since 1919 Statistics Canada has recorded fur sales each year for each province and territory of Canada. Detailed studies such as those in Kluane National Park show how the cycles cause complex ecological interactions in the entire food web of species. Although this "pulse" of the boreal forest is strongest in the north, we now understand how its influences are felt over vast distances due to dispersing predators. Ecologists everywhere are indebted to harvest records by trappers and hunters that have allowed us to piece together the incredible interconnections that make up wildlife's 10-year cycle. ■

GLENDON MOTORSPORTS

301 Railway Ave,
Glendon, Alberta

Ph: (780) 635-3936

Special introductory pricing \$1000⁰⁰ retail rebate

Reg \$7999⁰⁰ Now \$6999⁰⁰

COMES STANDARD WITH:

- ▶ Maxxis Zilla Tires / Aluminum Rims
- ▶ Front Locking Differentials
- ▶ Magnesium Alloy A-Arms
- ▶ 5 Storage Compartments / 2 Locking
- ▶ Two Up Riding Capability

DINLI CENTHOR 700
Uncompromised Quality
Unbeatable Price



www.glendonmotorsports.ca