ALTERNATIVE TRAPS


Badger


Beaver


Bobcat


Coyote

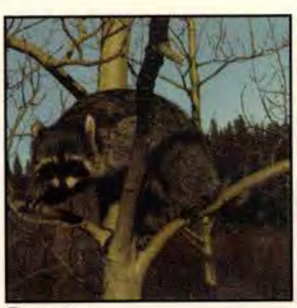

Wolf


Lynx


Ermine


Sable


Fisher


Raccoon


Otter


Muskrat


Marten

THE ROLE OF SPRING POWERED KILLING TRAPS IN MODERN TRAPPING, THE ROLE OF CAGE AND BOX TRAPS IN MODERN TRAPPING, and THE ROLE OF LEGSNARES IN MODERN TRAPPING

by Tom Garrett

ANIMAL WELFARE INSTITUTE

ALTERNATIVE TRAPS

The Role of Cage and Box Traps in Modern Trapping, The Role of Spring-Powered Killing Traps in Modern Trapping, and The Role of Legsnares in Modern Trapping

By Tom Garrett

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About the Cover:

In the center photograph, a wild lynx demonstrates the efficacy of an alternative to the steel jaw leghold trap, leaping unharmed from a log box trap in the Canadian woods. The other twelve species of animals listed in European Union Regulation 3254/91 are shown in the smaller photographs. Together they constitute the species on whose fur this regulation calls for an import ban into the EU unless the exporting countries have prohibited use of the leghold trap or adopted "internationally agreed humane trapping standards."

These provisions are consistent with the Regulation's prohibition of the use of leghold traps in EU member countries which has been in effect since January 1, 1995. The law was passed in response to public revulsion against the cruelty of the leghold trap, which is now banned by a total of 88 countries.

Photo credits: Ed Cesar: marten, muskrat, beaver, coyote, bobcat, ermine, raccoon, lynx. Hope Ryden: wolf, badger, otter. K.W. Fink: fisher. Oxford Scientific Films: sable.

ACKNOWLEDGMENTS

This monograph is the product of field observations and research beginning in 1984 and continuing intermittently to the present. During this investigation I have relied, to an extraordinary degree, upon the kindness and cooperation of persons in many walks of life: scientists, inventors, humane activists, trappers, business people, government officials. I am left with a deep sense of gratitude toward many persons, some friends of long standing, some persons whom, unfortunately, I shall not meet again. Among these are three gifted inventors I was privileged to know: Frank Conibear, Bill Gabry and Elmer Davies. I also thank Lloyd Cook, who pushed for humane trapping from within the trapping fraternity, and Dr. Frederick Thomson whose generosity initiated my work on alternative traps.

The following persons have been indispensable to carrying out the work underlying this monograph:

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—Tom Garrett
Garrett, Wyoming
1999

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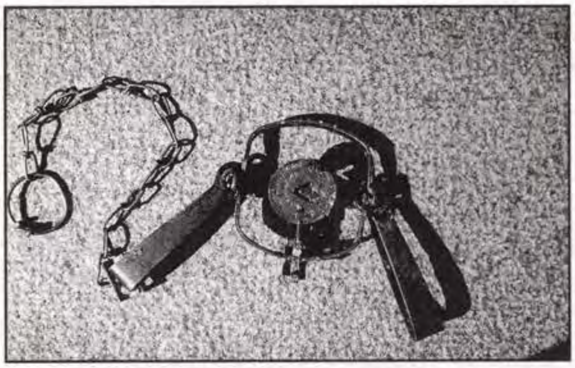


A steel jaw leghold trap.

A raccoon in a leghold trap. Note the exposed bone.

Daniel J. Kelly

Coyote caught by both front feet in double-longspring leghold traps being killed by a trapper.

Animal Rescue League of Berks County

Injuries sustained after capture in a coilspring leghold trap necessitated surgical amputation of this beagle's front leg.

FOREWORD

This artist's rendering accurately captures the United States Governments' aggressive assault on Europe in response to the European Union's noble attempt to use "trade barriers" to bring an end to use of steel jaw leghold traps all over the world.

Much has transpired in the decade since this material was first compiled to demonstrate the many alternatives to steel jaw leghold traps. Sadly, the International Association of Fish and Wildlife Agencies (IAFWA)* and the National Trappers Association (NTA) are still clinging to the barbaric steel jaw leghold trap, now prohibited in 88 countries.

In their fight to keep this dread device of destruction, the IAFWA and the NTA are utilizing a variety of public relations gimmicks. The gruesome twosome are claiming use of "sound science" in a "National Trap Testing Program" to demonstrate the supposed humaneness of leghold traps. Meantime their so-called science fails to even collect data on pain caused to animals in traps. More than a million U.S. taxpayer dollars are being siphoned from the U.S. Department of Agriculture, through the IAFWA, for animal trap studies. Most of these studies merely compare different types of leghold traps, guaranteeing an end result that endorses a steel jaw leghold trap!

The result of this scam will be a list of traps recommended for use on each species of furbearer in the U.S. Though the process is not yet complete, we expect the bulk of devices recommended will be leghold traps. How will the defenders of leghold traps reconcile these results with popular opinion (public opinion polls show that the vast majority of Americans are opposed to leghold traps, and the American Veterinary Medical Association and the American Animal Hospital Association have condemned them as "inhumane")? The IAFWA and NTA intend to solve this sticky problem by referring to the traps using a new name, "Best Management Practices." This term is expected to be far more palatable to politicians and the general public.

This public relations ploy has already worked in Europe where implementation of a law against cruel traps was gutted, and the remains used by the U.S. government (working hand-in-hand with the IAFWA and the NTA) to further entrench use of steel jaw leghold traps.

In a tragic turn of events, lobbying by U.S. trap interests led to a weakening of the European resolve to stop trade in furs obtained through use of inhumane traps. E.U. Regulation 3254/91, adopted in 1991, mandated a ban on use of leghold traps in the E.U. by 1995. A year later, fur from 13 species of furbearing species (see cover) was to have been prohibited from the U.S. to the E.U. because of our nation's failure to ban leghold traps or adopt "internationally agreed humane trapping standards."

The E.U. crumbled under threats of a World Trade Organization challenge brought by the Clinton Administration (at the urging of the IAFWA and NTA). Negotiations between the U.S. and the E.U. Commission led to the signing of an "understanding"—a non-binding (unenforceable) agreement that pays homage to the public relations campaign of leghold trap apologists.

How ironic that a law intended to stop use of leghold traps has led to increased testing of these self-same devices. And, rather than stopping their use in the U.S., steel jaw leghold traps will be defended as being the "Best Management Practices."

On a more positive note, the citizenry of Colorado, California andMassachusetts have adopted, by state ballot initiative, laws prohibiting use of steel jaw leghold traps, and Arizona, has prohibited use of these devices on its public lands. New Jersey, Florida, and Rhode Island have banned use of leghold traps too. We hope this movement away from leghold traps will continue until it has swept the United States clean of all steel jaw leghold traps. As clearly demonstrated by this document, there are myriad alternatives. There is no excuse for continued use of the archaic leghold trap.

— Cathy Liss
Executive Director
Animal Welfare Institute

**The International Association of Fish and Wildlife Agencies poses as a governmental body representing all state game departments, but dodges the Freedom of Information Act or anyother public accountability (because it is only a quasi-governmental body) and represents the lowest common denominator in state wildlife protection. It is our understanding that in 1998, each state game department paid dues of $14,885 to the IAFWA for a total of $744,250 to its war chest.*

The Role of Cage and Box Traps in Modern Trapping

INTRODUCTION

Commercial trapping has long been dominated by a device which is notorious for the pain and injury it inflicts: the steel jaw leghold trap. The steel trap holds animals by gripping a leg, or foot, between jaws powered by a spring, or springs. Traps used today are identical in principle to those brought from Europe to the New World 300 years ago.[1]

Over the past 75 years, public opposition to the use of steel jaw leghold traps has gradually intensified. In 1931, Norway became the first nation to outlaw the steel trap. Others followed suit. Between 1959 and 1965, "gin" traps (steel leghold traps with serrated jaws), in use since the 1500s, were eliminated from the British Isles. On January 1, 1995, a Regulation came into effect banning use of the steel leghold trap in all European Union countries.[2] In March 1995, the Russian Parliament passed a law under which "Use of foot gripping traps is prohibited exclusive of cases envisaged by laws and other regulatory legal acts of the subjects of the Russian Federation."[3]

Tomahawk Trap Company

Figure 1: Raccoons in Tomahawk cage traps.

During the fall of 1997, a binding three-party Agreement on trapping was concluded between Russia, Canada and the European Union. Under the Tripartite Agreement, Russia committed to eliminating all use of "conventional"[4] steel jaw leghold traps "not later than 31 December, 1999 provided that international financial assistance is available to cover a sufficient part of the cost of replacement of these traps." This failing, Russia will, none the less, phase out "conventional" leghold traps within four years after the Agreement comes into force. Since padded traps have not been introduced in Russia, this may have the practical effect of ending all use of steel jaw leghold traps in the world's second largest trapping nation.

Even in North America, where the steel trap has been defended by a powerful alliance of trappers and state and provincial wildlife managers, change is underway. In Canada, as of January 1, 1995, steel jaw leghold traps were prohibited for use on land against furbearers other than canids (fox, coyote and wolf) and felids (lynx and bobcat)[5] although they are still allowed for mink, muskrat, beaver and otter in drowning sets. This regulation was incorporated, in a modified form—without including raccoon—into the Tripartite Agreement. In addition Canada committed to ending land use of "conventional" steel jaw leghold traps for all furbearers by March 31, 2003.[6] Late in 1997, the United States acted to avoid a European Union boycott of U.S. furs by signing an "Understanding" with the European Union wherein, with certain possible exceptions, the United States commits to phasing out land use of "conventional" steel jaw leghold traps within six years from the date all parties have signed the Agreement.

Tomahawk Trap Company

Figure 2: Fox in cage trap.

The U.S.-E.U. Understanding and the Tripartite Agreement will not, of themselves, end the use of steel jaw leghold traps; what is in prospect is a large-scale conversion to padded (steel jaw leghold) traps and a substantial increase in the use of snares. However, particularly in the United States, the resistance of trappers and wildlife managers to reform is not only being eroded by pressure from the European Union and anti-trapping activism at the local and state level. It is also being overtaken by economic and demographic changes that encourage reliance on alternative means of trapping.

One trend is the massive, year-by-year expansion of urban and suburban populations into the habitat of wild animals, displacing some species and encouraging others to adapt and even rise to abnormal densities as human congeners, producing record numbers of human-animal conflicts. Another is the decline in the market for wild-caught furs and, with it, a sharp drop in the number of persons engaged in commercial trapping.

The convergence of these trends has overthrown the traditional relationship between pest trapping and commercial trapping. While commercial trapping, especially in the United States, has imploded, pest trapping has experienced explosive growth. There are now between 10,000 and 20,000 nuisance animal control firms employing an estimated 70,000 persons in the United States. One firm, "Critter Control," founded only 12 years ago, has 100 branch offices and franchises across the country.[7]

The boom in pest control has led to a corresponding increase in demand for traps to carry it out. The workhorse of pest control trapping—aside from small rodent trapping—is the wire cage (Figure 1). Tomahawk Live Trap Company of Tomahawk, Wisconsin, one of the two largest cage trap makers in the United States, has experienced a 300% increase in annual sales since 1993.[8] It now produces 80 different models of cage traps. Tru-Catch, of Belle Fouche, South Dakota, has seen its sales double in the same period.[9] In the United States alone, there are now at least 50 cage trap makers, many of them recent arrivals in the business. The infusion of "fresh blood" has brought technical innovation and greater attention to the needs of trappers.

In 1981, the Ontario Department of Natural Resources provided this assessment of cage traps constructed of galvanized wire mesh: "Although bulky and somewhat awkward to use, the live trap (i.e. cage trap) is a very effective means of harvesting marten, fisher and raccoon. Other species, including skunk, squirrel, ground hog, mink, weasel, muskrat, badger, opossum and beaver, can be taken in a live trap." To this list should be added Eurasian species, such as raccoon dogs, sable, kolinsky, ferret, European and Asiatic badgers and marten. Cage traps will also take a variety of "pest species" ranging from rats to feral hogs. Pest trappers use cage traps routinely to catch red fox (Figure 2) and bobcats. Scientists involved in marking and translocation found wire cage traps "adequate" for taking lynx. Otters, too powerful to be held in ordinary cage traps, can be taken in Hancock traps.

Idaho Department of Fish and Game

Figure 3: This two year-old female wolverine was trapped in a log box trap and released twice during a population study by biologists at the Idaho Department of Fish Game in consultation with trap inventor Ed Cesar.

As traplines have become increasingly mechanized, logistical problems deriving from the cage trap's bulk have become less significant. On wilderness traplines, where equipment must be hauled on sledges behind snowmobiles, through often difficult terrain, a trapping method pioneered by Ed Cesar on his trapline in the Canadian Rockies offers a valuable alternative. For over three decades, Cesar has successfully used box traps made of logs secured at the site to capture large- and medium-sized predators. The boxes have proven highly efficient for fisher, wolverine (Figure 3), lynx, bobcat and red fox. A number of coyotes, considered the hardest of all furbearers to trap, have been captured as well. During the winters of 1992-1993 and 1993-1994, Cesar traps were used, with notable success, by the Idaho Department of Fish and Wildlife to live capture wolverines for tagging and release. The Cesar system should be readily adaptable, not only to northern traplines, but to almost any area which is partially or wholly forested.

The following sections discuss the use of box and cage traps for trapping furbearers and pest animals, focusing largely, but not exclusively, on North America. Section One describes the types of cage traps currently in use. Section Two describes the use of box traps, particularly the log box trap. Section Three describes how mammals are trapped and discusses the use of cage and box traps for capturing them.

SECTION ONE: CAGE TRAPS

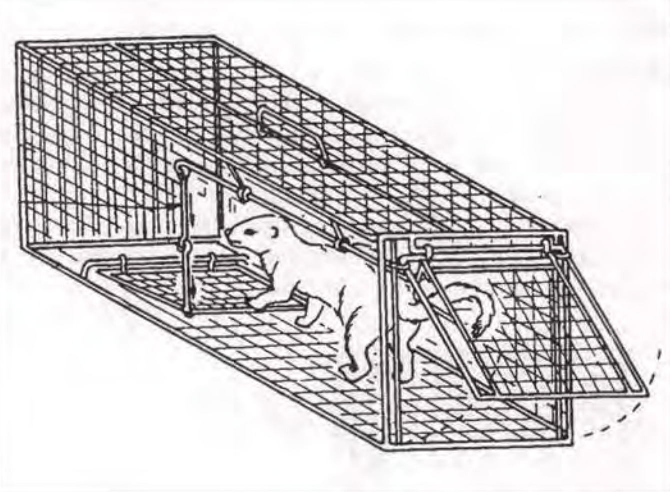
During the 1920s and 1930s a number of designs came on the market. Some were inspired by the Anti-Steel Trap League and other humane groups which encouraged development of alternative traps. Most of the basic designs in commercial production today were developed during that period. The cage trap industry in North America is dominated by two U.S. companies: the Tomahawk Live Trap Company of Tomahawk, Wisconsin and the Woodstream Corporation of Lititz, Pennsylvania. Woodstream was the world's largest producer of steel jaw leghold traps until 1998 when Ekco Group, the parent company, announced the discontinuation of these operations. The company stated that "the leghold trap business is no longer consistent with [our] strategic plans." Small firms, some made up of no more than a single person, appear to be absorbing an increasing chunk of the market.

Terrestrial Cages

Terrestrial cage traps marketed today in North America have many common features. All are oblong wire mesh enclosures with doors that swing from hinges at the top of the cage. Most models have only one door, but some have a door at each end of the cage. All are triggered by a pan, either of the treadle (centered axle) type or pedal type, linked to the door by some type of rod. Thus, when an animal enters the cage (usually to take a bait) and steps on the pan, the motion of the pan transmitted through the linkage unlatches the door, which swings shut.

The Tomahawk trap, invented by Elmer Foster in 1928, uses spring power to hasten closure of the doors, and has a characteristic linkage consisting of a trigger rod slanting from the pedal to the door latch. Features of this design, pictured in Figures 1 and 2, have been widely imitated by other firms. In the mid-1980s, the Woodstream Corporation began producing a virtual clone of the Tomahawk trap as its "professional" model.

Another design marketed by Woodstream is the Havahart, invented by Rupert Merkle in the 1930s. This trap has a sheet metal roof and doors. When it is tripped, the doors angle to the floor of the trap, giving it a distinctive, shed-like appearance. The Havahart has a flimsy and unreliable trigger mechanism that disqualifies it for commercial pest control or fur trapping. Its sole advantage is that the solid roof and doors provide a modest degree of shelter. The Havahart owes its survival to the fact that it was widely advertised for decades.



Tom Garrett

Figure 4: Tru-Catch trap

Most smaller cage makers do not use door springs, arguing that doors that close by gravity are simpler and equally effective. Tru-Catch (pictured in Figure 4) and Williams cage traps also employ an extremely simple locking system, using steel rings to join the rods framing the cage door to the vertical rods framing the entrance. As the door swings shut, the rings slide down the adjacent rods. This system cannot malfunction or wear out and allows a trapper to release unwanted animals by simply turning the trap over. If an animal succeeds in flipping the trap over, which raccoons frequently do, he or she can escape. When used for large animals that struggle intensely, traps of this type need to be pinned down. It is perhaps for this reason that other drop door designs, such as the Kness, employ mechanical latches.

Another difference in the design of cage traps is found in the positioning of the rods. The trigger rod in Tomahawk-type traps is vulnerable to the attentions of powerful animals such as badgers and raccoons and is frequently bent. Some designers attempt to put the rod out of harm's way by positioning it (as in the case of Tru-Catch) at the top of the cage, or even outside the cage.

Some cage makers have gained customers by specializing. Floyd Wickenkamp, of Albia, Iowa, builds a reinforced trap with metal rod doors and pan. Its sturdy, external trigger linkage proofs against the damage that is sometimes inflicted by raccoons on standard designs. His traps are highly prized by Iowa raccoon trappers. Tru-Catch applies a coating of electrostatic paint to its traps, partly to meet the wishes of customers who believe that animals sometimes avoid galvanized metal.

For many years Tomahawk was the only company marketing a "collapsible" trap that can be folded when not in use so as to reduce its bulk and make it easier to transport. Despite the fact that one person can carry at least twice as many collapsed traps as standard traps, and haul four times as many on a vehicle, the trap was avoided by some professional trappers because it was not considered strong enough for larger animals. Tomahawk has strengthened its trap, and in February, 1996, Woodstream began to market its own version. Tru-Catch now offers a 48-inch collapsible trap for large dogs. Other cage makers may soon enter the market. The current focus on collapsible traps and the availability of durable designs opens the way for cages on traplines where logistical problems have inhibited use of rigid models.

European Cages

In parts of Europe, such as the British Isles and southern half of Sweden, cage or box traps are the only legally available means for taking foxes and European badgers. In Finland and most of Europe they are the standard means of capturing raccoon dogs.

While cage traps modeled on the American pattern are sold in some European countries, the tendency—particularly in Scandinavia—is to use much larger traps. The closure modes are less uniform in Europe than in the United States. In addition to the direct-drop door, cages are sometimes used in which the animal enters through the top.

Muskrat Culverts

Wicker cages, usually fashioned of willow or hardwood saplings, have been used for thousands of years in North America to catch fish. Following their participation in the fur trade more than three hundred years ago, the Cree were known to have captured muskrats in baskets similar to those used to catch fish. It is likely that the current use of wire mesh cages to capture muskrats owes its inspiration to this Native American practice.

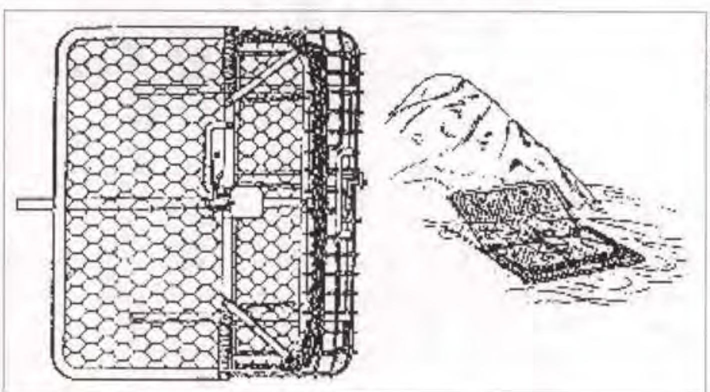
Cages designed to drown muskrats are the simplest of all cage traps. They consist of comparatively long, narrow galvanized wire mesh culverts with a door at each end. Some are rectangular, but most are cylindrical. The doors are made of light wire mesh flaps that swing inward when a swimming muskrat pushes from outside the trap, but cannot be opened by pressure from the inside. These traps catch multiple animals and are so efficient that they have been prohibited in some states.

Since a person with strong hands and a pair of pliers can make dozens of drowning culverts in a day, only a few small companies have ever produced the traps commercially.

Raft Traps

Raft traps are used in Western Europe to capture and drown muskrats from a population that originated with escapees from fur farms. Their descendants now colonize the low countries and adjacent areas of Germany and France. Raft traps are the primary means of controlling muskrats in the Netherlands, where from 300,000 to half a million animals are taken annually to protect dikes and drainage structures.

The trap consists of an anchored raft with a trap door, which drops the animal into the cage below when the animal climbs up on the floating platform to rest. Because they can make multiple catches, the devices are more efficient than traps that can only catch one animal at a time.



Tom Garrett

Figure 5: Hancock trap

Traps of this type are not used in North America, although Canadian trappers frequently take advantage of the muskrats' penchant for climbing onto floating objects by setting steel jaw traps on homemade floats. European raft traps could undoubtedly be adapted to some North American conditions.

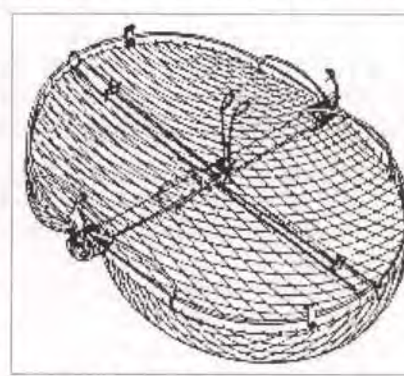
Hinged Beaver Traps

Bailey and Hancock traps each have spring-powered hinges that snap together two opened sections of the trap around an animal, enclosing the animal when he enters and jars the trigger. The Hancock trap, shown in Figure 5, somewhat resembles a wire trunk. The Bailey, Figure 6, could more accurately be likened to a wire mesh clam shell, since its shape and mode of closure are clam-like. Both traps were expressly designed for beaver, although the Hancock trap has proven effective for capturing otter and even terrestrial animals.

The Bailey trap was invented by Dr. Vernon Bailey of the U.S. Biological Survey to translocate beaver from areas where they were plentiful to areas where they had been extirpated. His patent was granted in 1926, and the traps have been used successfully ever since. The trap is designed to be set in water. When a beaver swimming with a stick enters the trap and jars an upright trigger prong, the trap's powerful springs are activated and bring the baskets violently together, trapping the animal inside. Bailey traps are built and marketed by the Tomahawk Live Trap Company.

The Hancock trap was patented in 1932 by C.L. Hancock of Tuthill, South Dakota, who made and sold several hundred of the traps each year, chiefly for translocating beaver, until he retired in 1968 at age 88. The present owner of the Hancock Trap Company, Blaire Waite of Custer, South Dakota, follows in Hancock's tradition. He still uses the inventor's homemade machinery and assigns a lifetime guarantee to each trap that leaves his shop.[10]

The Hancock trap, while also hinged and spring-powered, is otherwise very different from the Bailey. Where the Bailey trap is designed to lie, when set, with the sides of the cage open (180 degrees apart) on the same plane, the Hancock is set with the jaws approximately 120 degrees apart. The "back" of the trap is set in vertical position, and the "front," or basket, which is made of flexible mesh like that used for chain link fences, is set in a horizontal position. Typically the back is staked to, or hung from, the bank of a pond or river, with the basket a few inches under water. The trap is baited with twigs for beaver, or with fish for otter. If an animal tries to take the bait, this action will trigger the trap. If the trap is so triggered, the springs will drive the basket, or front, of the trap against the back, leaving the animal hanging, out of the water against the bank, in a flexible mesh sack.



Tom Garrett

Figure 6: Bailey trap

The Hancock trap has, on occasion, been used to capture terrestrial as well as aquatic animals. Advocates of the trap, such as the late Lester Barton of Deer Lodge, Montana, who captured over 2,000 beaver for translocation in Hancock traps, insisted that it is by far the most efficient trap, unit for unit, ever devised.[11]

SECTION TWO: BOX TRAPS

Portable Box Traps

Portable box traps, although they are "easier"—under most circumstances—on captives than cage traps, are far less widely used. The extra weight and/or cost of the traps has tended to limit them to specialized functions. Small box traps made of either aluminum or steel are widely used by biologists for capturing live specimens, especially small mammals subject to hypothermia. A marten, for example, caught in bitterly cold weather in a cage trap, is likely to freeze to death overnight. In a box trap containing bark, dried grass or other bedding material the animal can survive. A second reason why box traps are favored by researchers is that small animals remain calmer. Here, too, including bedding material is important. For example, packrats (genus *Neotomys*), bushy-tailed new world rats who are the bane of cabin owners in the Rocky Mountains, struggle violently in cage traps and occasionally injure themselves. If the trap contains bedding material, such as newspaper, the animals will invariably chew it up and construct a nest and sometimes sit calmly in the nest even when approached.

Figure 7: Mityling Plasti-Catch

The chief reason why pest control trappers, as opposed to scientists, keep box traps on hand is that skunks are less likely to become agitated in a box trap than in a cage trap. It is almost always possible to move a box trap occupied by a skunk without the animal spraying while moving a skunk in a cage is risky.

Most cage makers build box traps as a sideline. Mityling Development of Marshall, Minnesota, specializes in box traps made of heavy polyethylene plastic (Figure 7). The overall weight and cost of the boxes is comparable to that of similar sized cages. The Mityling trap is slightly tapered with a door constructed of either galvanized metal or wire mesh. A model with mesh at back end is also available, along with tunnel traps for small rodents. Whether this pioneering design will survive on the market remains to be seen.

Just as the ability of box traps to retain heat can prevent captive animal suffering in the winter, it can cause acute suffering if a captive is left in a box trap exposed to the summer sun. The humane potential of portable box traps, like that of cage traps, is met only if they are judiciously used.

Log Box Traps

By far the most interesting use of box traps involves a return to something closely akin to the log boxes of Native Americans who once inhabited northwestern Wyoming. The person who has pioneered this method of trapping in the late 20th century is the Canadian filmmaker and inventor Ed Cesar.

Cesar, a rugged six-footer now in his late sixties, is known in western Canada for his documentary films. He is also a trapper. Each winter he returns to his trapping cabin on Dutch Creek in the Rocky Mountains north of Glacier-Waterton International Park.

Cesar began building and using log box traps (see Figures 8 and 9) over 30 years ago as a means of capturing animals unharmed to sell to zoos, fur farms and other live markets. Today, the live animal market has largely dried up. Cesar continues to use his homemade box traps for obtaining fur because he considers them not only more humane, but far more efficient than any other system.

The boxes are about four feet wide, six feet long and four and one-half feet high. Aside from wire, spikes and an occasional piece of sheet metal, they are made entirely of native materials secured on the spot.

Each box has a heavy log lid. Posts are set on either side of the box with a crosspiece between them, above the lid. This crosspiece serves as the fulcrum for a lever, in the form of a pole loosely wired to it, that is used to raise and lower the lid. One end of the pole is fastened to the front of the lid, so that a person wishing to open it pulls down on the other end of the pole. To secure the rear of the pole in place, and thus keep the lid tipped open, a post is set behind the box. A loop of wire fastened to the pole is slipped around a headless spike driven horizontally into the post.

This rudimentary fastener is also part of the trigger to set the trap. Bait, typically a road-killed hare or carcass from previous trapping, is hung inside the box, dangling from a piece of wire. The other end of this wire extends from the bait, through a small hole at the rear of the box, to the post. There it is tied at a right angle to the loop of wire holding the pole down. When an animal enters the box and seizes the bait, the animal's tugs, transmitted through the wire, soon pull the loop off the headless spike. The lid crashes down and the animal is trapped.

This triggering method, although crude, appears to be efficient. When failures do occur, there is little cost. Animals do not escape only to die or become cripples—as is the case with steel jaw leghold traps. Nor do they become "trap shy" since, once captured, there is no escape.

There are obvious economic advantages to the system. If a trapper is trapping on his own land, or on a registered trapline in Canada, or has some other stable arrangement, it is possible to set up and maintain a trapline with practically no out-of-pocket expense for traps. All that is required is readily available building material and the time and energy to build the boxes. With maintenance, the life span of a box in the Canadian mountains is said to be at least 20 years.

This kind of trapping system is virtually impervious to deep snow, which can make leghold trapping difficult or even bring it to a halt. The traps will readily catch most of the larger furbearers. Wolverines and other mustelids enter the boxes with surprising readiness, as do lynx, cougar, bobcat and fox. Coyotes remain wary, but can be caught if they are hungry. Wolves, now rare in southern Canada, have not been exposed to Cesar's boxes.

Figure 8: Log box trap in set position

Figure 9: Log box trap in triggered position

Economics aside, log boxes are, beyond question, the most humane live capture system in use. Animals inside are sheltered from the weather. There is no steel for them to break their teeth on. While a few species, notably wolverines and cougars, struggle continuously, others—including lynx and bobcats, make little or no attempt to escape. Many of Cesar's traps, even well-seasoned boxes that have captured scores of animals, show little sign of chewing.[12]

The ongoing ecological study of wolverines begun by the Idaho Department of Fish and Game in 1991 is providing the first scientifically acquired data on log box trap performance. The study has successfully proved that log boxes are both efficient and humane. Twelve wolverines were captured and released a total of 37 times from the ten traps in operation. These powerful mustelids—difficult to trap with legholds, impossible to hold in conventional cages—did not find the boxes sufficiently unpleasant to develop an aversion to them but continued to go back for the bait. No injuries were observed. Foxes were frequently captured, and, according to the authors "rarely chewed and were always very subdued in the traps."[13] Wolverine biologists in Canada are now using log boxes also.

Ed Cesar's almost atavistic system of trapping would seem to meet modern needs astonishingly well. It can be used in northern forests and mountains, on the Pacific coast and can be adapted to the farmscapes of the eastern and midwestern United States and Canada. It is inappropriate only in open country. The log boxes are as humane as a live trapping method can possibly be, harmless to herbivores and highly efficient.

The Cesar system meets the requirements of those managers who foresee a time when it will be necessary to kill or release wild furbearers on the basis of individual characteristics. Perhaps it is the Cesar trapping system which has the most in common with the past and best mirrors the future of trapping.

SECTION THREE: FIELD TRAPPING WITH CAGES AND BOXES

Since animals live and behave very differently in different environments, trapping methods are also diverse. There are, for example, at least six highly distinctive sets of circumstances under which muskrats are trapped. In each case different trapping strategies are employed. The purpose of this section is to proceed systematically, order by order, through the roster of trapped mammals to determine the circumstances in which they can be taken with cage or box traps.

CARNIVORES (Order Carnivorae)

CANIDEA (DOG FAMILY)

The canids are a wide ranging and successful family of blunt-clawed terrestrial hunters, varying in size from the wolf who often reaches 150 pounds, to the North African fennec who rarely exceeds five pounds. The larger members of the family are, with the sole exception of the maned wolf, cooperative hunters with strong family or multi-family bonds. Among most smaller members, social bonding is limited to mated pairs with the young dispersing after they are weaned. Most hunting is solitary. Divergence from the main line of active, cursorial predators is limited to a few species. The African bat-eared fox has altered its dentition to become an insectivore and spends much of its life in underground burrows. Fennecs, maned wolves, gray foxes, raccoon dogs and crab-eating foxes of northern South America have become omnivores. Gray foxes, alone among canids, have evolved a modest ability to climb trees. Only two South American canids, the bush dog and the wolverine-like small-eared zorro, show an affinity for water.

Discounting kit and swift foxes, who are occasional victims of traps set for other species (incidental catch), seven canids are trapped for fur. Two species, coyotes and gray foxes, are exclusively North American, the large fox (genus *Psuedalopex*) occurs in Argentina and the raccoon dog has a Eurasian distribution. Wolves and arctic foxes are found in the northern hemisphere. The red fox has spread to every continent except Africa. All of these species, except for arctic fox, along with at least two other canids—the Australian dingo and the black-backed jackal—are subject to pest control trapping.

During the early and mid-1980s demand for long-haired fur soared, and prime coyotes sold for as high as $200. Currently, most wild canid pelts, which compete directly with farmed fox pelts, are priced well below the range at which trapping is profitable. For example, coyote pelts at $30 will hardly pay "acquisition costs."

Coyote (*Canis latrans*) The coyote once had a fairly restricted range south of the boreal forest and west of the Mississippi River. This remarkable canine, even in the face of the most implacable human hostility, has been able to expand its range eastward and northward. The coyotes' range now covers nearly every state in the U.S. and stretches throughout the southern part of Canada and into Alaska. Humans evidently cleared the way for this expansion by wiping out the dominant canines: the gray wolf across the Great Plains and intermountain region, and the red wolf in the southeastern United States. Coyotes are the most ubiquitous of North American predators.

During the period of high fur prices, around 400,000 coyotes entered the fur market annually. The current "fur harvest" is at about one-third this level, with a comparable number killed as pests. The chief means of taking coyotes in the United States is with steel jaw leghold traps ranging from #1 1/2 coilspring to #4 longspring. However, 20 to 30% of coyotes taken in the United States are snared (86% with strangling snares) and about two thirds of coyotes taken in Canada are snared. Steel jaw leghold traps have dropped to third place, behind shooting from aircraft and snaring, among killing methods employed by USDA animal damage control agents to take coyotes.[14]

Coyotes are among the hardest of all animals to trap. Coyotes can evidently be taken in Cesar boxes, but except for animals that have become habituated to living in close proximity to humans they are virtually impossible to take in cage traps. Legsnares may prove to be the most feasible alternative trapping system for coyotes.

Red Fox (*Vulpes fulva, Vulpes vulpes*) Like the coyote, the range of the red fox has expanded since the arrival of Europeans in North America. The native red fox, who chiefly inhabited the tall and intermediate grass prairies, interbred widely with introduced European foxes. It is this, some say, that altered the animal's behavior and led to expansion into eastern forests where they had not originally occurred. In Europe, where larger carnivores have been chiefly exterminated, the fox has achieved an almost universal distribution. In the meantime, colonizing populations are found across the globe, most notably in Australia and Argentina.

When fur prices are high, about 400,000 wild red fox pelts enter the fur market from North America and at least that many more from Europe. Scandinavia alone has provided up to 150,000 wild fox pelts. Approximately 50,000 red fox are killed every year in Australia. Around three million farmed fox pelts enter the fur market annually. Finland is the largest producer.

As with coyotes, the primary means of taking fox in the United States is the steel jaw leghold trap. In Canada, the most common way to take fox is with strangling snares. A survey of trappers in New Brunswick showed that 83% of foxes taken by trappers were snared.[15]

In Sweden the Aberg legsnare, designed to eliminate the cruelty of the steel jaw leghold trap, is the chief means of capturing fox. The cable coated legsnare avoids the pain and fear inflicted by wire neck and body snares or steel traps. Aberg legsnares are used in Finland and legsnares of both Canadian and European design are now in use in France as replacements for leghold traps. Elsewhere in Europe, cage traps and killing traps of vintage design are used. In Australia and Argentina, steel jaw leghold traps are the most common trapping tool.

Red fox are less wary than coyotes. They readily enter log box traps. However, Swedish trappers, who have accumulated a great deal of experience in using cage traps for foxes, regard them as far less efficient than legsnares, by some accounts only 25% as efficient.[16] In the United States, where pest trappers are frequently called upon to remove foxes, the consensus is that it can be done if the trapper is prepared to "think like a fox." Some trappers, for example, have learned that animals are less likely to be repelled by a trap if the mesh floor is covered with dirt. Foxes—in common with many other species—are more likely to enter a larger cage. Longer cages are particularly correlated with greater efficiency. Because there is agreement on the need for a large pan that the animal must step on in order to get to the bait, many trappers insert pieces of plyboard. It is also important to choose a good lure and an enticing bait. Many control trappers, like Gary DePalma of Leesburg, Florida, use cage traps routinely for the species.[17] He recounts having "trapped over 30 foxes in two and a half years with Tomahawk live traps... without having any problems catching them."

Gray Fox (*Urocyon cineroargenteus*) The gray fox is a North American fox restricted chiefly to forested regions east of the Mississippi and to the brush country of the Southwest. The foxes' favored habitat is deciduous forest. Unlike their more aggressive cousins, the gray fox has shown little disposition to extend their range as a human congener.

The gray fox is generally considered easier to trap than red fox. Gray foxes are also more fragile and tend to struggle self-destructively in steel traps. Broken bones are common, even with so-called "padded" traps—steel jaw leghold traps with hard rubber or plastic pads attached to the holding surfaces. Damage scores are far higher for gray foxes taken in leghold traps than for red foxes and coyotes.

During past booming markets, approximately 300,000 gray foxes were trapped annually. During the 1990s, with gray fox pelts being worth less than $20, trapping has been at low ebb. Since the gray fox is uncommonly taken as a pest, the base of experience on catching this omnivorous, short lived and rather delicate fox in cages and boxes is limited.

Arctic Fox (*Alopex lagopus*) As creatures of the Arctic barrens, arctic fox are superbly adapted to bitter cold. Healthy populations exist in Greenland, the Canadian Arctic and the North Slope of Alaska. In Scandinavia, the animal is endangered because overbrowsing by domestic reindeer has reduced the vegetation upon which voles and lemmings—the foxes' prey animals—depend. Although *Alopex* is common in the Siberian tundra, the status of the western Russian population is unclear.

Around 30,000 to 40,000 arctic foxes are trapped each year in North America, almost all with steel jaw leghold traps.[18] It has been demonstrated that arctic fox can be taken efficiently with killing traps in baited cubbies. Authorities in Canada's North West Territories are now conducting an exchange program with native trappers. Trappers can exchange their steel jaw leghold traps for killing traps. There is little doubt that arctic fox could be taken efficiently in naturalistic box traps. Unfortunately, in most of the barrenlands there is a paucity of building material, and trappers typically visit traplines no more than twice a week. Killing traps, under these circumstances, are the most humane and feasible alternative.

Gray Wolf (*Canis lupus*) The gray wolf were exterminated in their U.S. ranges outside of Minnesota and the upper peninsula of Michigan during the first three decades of the century. The animal is rare in Canada south of the Canadian Shield, but fairly common in northern Canada and Alaska. The wolf's range in Europe south of the taiga is confined to a few mountain ranges, notably the Italian Appennines, where relict populations exist. There are very small populations in northern Scandinavia, but the major distribution is on the Russian taiga from the Finnish border to the Pacific Ocean. An Indian subspecies is sparsely distributed in the Indian subcontinent and mountain ranges to the west.

About 1,000 wolf pelts enter the fur trade each year from North America. A larger number are taken in Russia to supply a booming domestic fur trade. In North America, wolves are taken chiefly with #4 leghold traps and with strangling snares through some are also taken with spring-powered Aldrich and Fremont legsnares. Wolves are generally considered less difficult to trap than coyotes. There is no data on whether the animals can be taken effectively in log box traps.

Raccoon Dog (genus *Nyctereutes*) This small, omnivorous canid (normal weight under 15 pounds) was once confined to Northeast Asia and northern Japan. The species is now widely distributed across Europe, thanks to releases by Soviet fur farmers in the 1930s and after World War II. Raccoon dogs are now found in much of European Russia and range as far south as Germany. A substantial population exists in southern Finland and a much smaller population in northern Scandinavia.

Raccoon dogs are the only canids who go into hibernation during much of the winter. When abroad, the animal is easy to take in cages and this is the only method used in Scandinavia. Finnish trappers take advantage of the species' devout monogamy by setting out twin compartment, or multiple entry, cages. If one raccoon dog is taken in a cage, the animal's mate will stay nearby and, given an opportunity, enter the cage as well.

Large Fox, Argentine Gray Fox (*Pseudalopex griseus*) *P. griseus* is the largest of a taxonomically distinct genus of South American foxes ranging from Patagonia to southern Brazil and onto the Bolivian and Peruvian altiplano. The large fox, only slightly smaller than its North American cousin the coyote, is confined chiefly to Argentina. The fox has been subjected to trapping and poisoning because of attacks on sheep and other domestic livestock. Despite this, the foxes have maintained their numbers. During the 1980s, an average of around 100,000 *P. griseus* pelts entered the fur market annually. Most of these animals were trapped with steel jaw leghold traps, which continue to be Argentina's primary trapping method.

Dogs (*Canis dingo, Canis familiaris*) The planet abounds with feral, stray, abandoned and untended dogs. These canids are the bane of sheep raisers everywhere. The Australian dingo, descended from dogs released by Polynesians thousands of years ago, is the only feral dog to have been exposed to natural selection for long enough to have formed a distinct species. Dingos evidently share the trap-wariness of other wild canines, and are taken chiefly with leghold traps with some use of legsnares. Elsewhere, stray dogs and dogs involved in depredations can usually be captured in baited cages. Several thousand 36 and 48-inch cages are sold annually to North American humane societies and animal control agencies involved in removing stray and abandoned dogs.

PROCYONIDAE (RACCOON FAMILY)

Procyonides are a New World family of medium-sized and small carnivores including raccoons, coatis, kinkajous, olingos and cacomixtles. Some taxonomists also classify the lesser Panda as a procyonide. They are omnivorous and adaptable, as well as being excellent climbers and adept swimmers. All of the family are tactile and manipulatory. One member, the kinkajou, has a prehensile tail. Only the two most northward ranging procyonides, the raccoon and the cacomixtle, or ring tail, are known to be trapped in sizeable numbers.

Raccoon (*Procyon lotor*). The raccoon is undoubtedly the most common medium-sized predator in the United States. The heart of its range is the American farm belt, but they now occur everywhere in the United States and Canada south of the boreal forests except for high mountains in the deserts, and short grass prairies of the American west where raccoons are found only along major watercourses. The raccoon thrives in areas of human disturbance. In urban and suburban areas the animal has become a virtual human congener. In some agricultural areas raccoons reach densities as high as 40 to 100 animals per square mile.[19]

Raccoons are now, with the practical eclipse of the market for muskrat pelts, the most commonly trapped animal in North America. While the numbers taken for the fur market are far below the four million a year level of the mid-1980s, there are large numbers of unrecorded captures for pest control. Aside from the chronic raccoon-human conflicts in intensely settled areas, there are acute agricultural conflicts. Raccoons descend in often extraordinary numbers on sweet corn growing areas as the corn ripens.

Raccoons are easy to capture in cage traps. Where the trapping site is too remote to carry in cages, it is usually possible to use killing traps with baited cubbies. Even during off-season trapping, when the animals are surrounded by an excess of food, baited traps with lures appear to be effective. Nonetheless, the majority of raccoons taken for fur in the United States (83% according to a recent survey) are trapped with steel jaw leghold traps.[20]

There is no better illustration of the ideological character of the dispute over trapping than the fact that U.S. trapping groups and state wildlife managers have continued to insist that steel jaw leghold traps are indispensable for trapping raccoons. Some have shamelessly touted the so-called EGG trap, a modified steel trap with holding surfaces encased in an egg-shaped plastic shield to prevent the animals from chewing their feet off (something for which raccoons are well known), as the "humane" replacement to conventional steel traps.

In fact, prior to the fur crash (which has had the effect of inhibiting investment in new equipment) there was a distinct movement among commercial trappers away from leghold traps to cages. Iowa trapper Tom Monroe, then head of the Iowa Trappers Association, discussed cage trapping raccoons in the Winter 1986 edition of *Voice of the Trapper*. "On a trap for trap basis," Monroe wrote, "they [live traps] catch as many coon for me as any trap I use. They are also the safest traps a novice can use."[21] Other experienced Iowa trappers, such as biologist Jaime Beyer, who preceded Monroe as President of the Iowa Trappers Association, agreed that cage traps are, on the average, as efficient for raccoons as leghold traps.[22]

One reason why farm belt trappers invest in cage traps is that raccoons are attracted to buildings, where steel traps cannot be used without endangering farm animals, pets and children. "My best all time producers are buildings," Monroe wrote. "All kinds of buildings. New buildings, old buildings, barns, feed sheds, corn cribs, machine sheds, garages, cattle sheds. Anywhere there is shelter or food, or better yet, a combination of both should be investigated for sign."[23]

The same affinity has made raccoons the staple of the animal damage control industry. In most surveys, pest control operators say that they respond to more calls from suburban and rural neighborhoods about raccoons than about any other species. In strictly urban neighborhoods, raccoon complaints are second only to squirrel complaints.[24] Most complaints involve the animals entering, or taking up residence in buildings, not infrequently the attic of a house. Raccoons show amazing dexterity and enterprise in making their way into buildings. Lacking a convenient means of entry, such as a heating or air conditioning duct, a raccoon can gouge an entrance hole directly through a roof.

The overwhelming majority of raccoons captured by control trappers are taken with cage traps. The comparatively small number of "nuisance coons" who prove to be "trap shy" are probably animals that have been captured in cages previously. Around two-thirds of the raccoons captured as pests are released alive. Many of the released undoubtedly make their way back to suburban, or urban, locales. "Trap shy" raccoons are usually taken with Conibear killing traps set in entrance holes. Both the ease with which suburban raccoons can be taken in cage traps, and the extraordinary population densities which sometimes form, are illustrated by the experience of Florida control trapper Tod Hartwick. When a ten-acre wooded tract in the suburbs was slated for development, Hartwick was given the job of removing the raccoons. It was known that numerous raccoons had taken up residence because of supplemental feeding by kindly residents. The trapping outcome was astonishing. Just by using ten Tomahawk cage traps, Hartwick captured 90 raccoons in seven days.[25]

Cacomixtles (*Bassariscus astutus*) This smaller relative of the raccoon, often called the ringtail or miner's cat, ranges in the desert southwest and the brush country of western and central Texas. During the 1980s, as many as 100,000 of these engaging little animals were trapped annually for fur. Cacomixtles are said to be easy to take in cage traps or with killing traps in cubbies.

MUSTELIDEA (WEASEL FAMILY)

The mustelids are a wide ranging family of carnivores varying in size from the tiny least weasel (weight 40 grams) to the sea otter and the giant otter of the South American rainforests, either of which can approach a weight of 100 pounds. Mustelids have evolved numerous successful specializations. Badgers are fossorial, marten are arboreal, otters and mink are semi-aquatic or—in the case of the sea otter—fully aquatic. Skunks, otherwise undistinguished ground predators with a taste for insects, along with Asian stink badgers and the African zorille, have evolved a startling ability to defend themselves with noxious scent. Aside from certain otters, mustelids show no disposition to hunt cooperatively. The tendency toward omnivory is confined to a few genera: skunks, Old World badgers, the ratel—or honey badger of southern Africa—the tayra of the American rainforests, and certain martens.

Weasels (*Mustela frenata, Mustela erminea, et al.*) One or another of the three species of North American weasels is found in practically every habitat in the United States and Canada. Up to a dozen Eurasian weasels are similarly distributed. Ermine, called stoats in Britain, occur in both Eurasia and North America and were once prized for their fur. Today, raw ermine pelts are practically valueless. Nonetheless, around 100,000 weasel (chiefly ermine) enter the fur trade each year from North America and a somewhat larger number from Europe. Weasels are typically taken as incidental catch in leghold traps or Conibears. They can easily be caught in cages using one by one-inch mesh to prevent escapes through the sides.

Ferrets (*Mustela putorious, Mustela nigripes, et al.*) Ferrets, although classified with weasels, are highly distinctive. The North American black-footed ferret has declined to near extinction, probably because of poisoning campaigns against their chief prey species, the prairie dog. The European polecat, *M. putorious*, on the other hand, is extremely common. Polecats are trapped—usually with killing traps— both for fur (polecat fur is called "fitch") and as a pest. Like all small mustelids, polecats can easily be captured in baited cages.

Skunks (*Mephitis mephitis, et al.*) Skunks range throughout North and South America. Four species are found north of the Rio Grande. The spotted skunk occurs mainly east of the Mississippi. Hognosed and hooded skunks are found only in the Southwest. The striped skunk has taken advantage of ecological changes accompanying civilization—such as the proliferation of rodents accompanying agricultural expansion—to extend its range through the lower 48 states and as far north as the Canadian Sheild. Skunks abound in farming areas, particularly in what was once tallgrass prairie, and are common in suburbs.

At one time, up to a million skunks a year were consumed by the fur trade. In recent decades, the pelts have had little commercial value. Most skunks entering the market are probably incidental catch in steel jaw leghold traps. No one with good sense would set a steel jaw leghold trap for a skunk. The victim often—though, surprisingly, not always—sprays, and is very likely to escape by chewing off the trapped foot.

But if skunks are ignored by fur trappers, they are outranked only by raccoons and squirrels as the objects of control trapping. Since the animals are remarkably easy to catch in cages or boxes, this is the standard trapping method with hundreds of thousands taken in this way every year. While the majority of raccoons captured are released alive, it appears that a majority of skunks are killed, often by immersing the cage or box in water.[26] This bias is unfortunate. Aside from their potential for spraying, skunks are remarkably inoffensive. Skunks rarely enter buildings or turn over garbage cans, and they perform a valuable service as mousers.

Badgers (*Taxedea taxus, Meles meles, et al.*) The American badger (*T. taxus*) is an animal of the western Great Plains and intermountain zone, but is nonexistent east of the Mississippi. Every autumn, badgers dig out vast numbers of aestivating ground squirrels and prairie dogs. Badger holes are a characteristic feature of the western prairies. One will look hard for a Western rancher who has never had a horse fall in one.

During the late 1970s and early 1980s when badger pelts sold at up to $50 each, around 50,000 were trapped annually, mostly with steel jaw leghold traps. Today, with the market at under ten dollars a pelt, most trapping is done for pest control. Just as skunks are persecuted for their scent, badgers are persecuted for digging holes. The animals can be readily taken in cage and box traps baited with meat. But badgers are not, in my experience, as gullible as skunks or raccoons so it is advisable to make badger traps as naturalistic as possible. Since a large male badger can easily weigh 45 pounds, it is also necessary to choose a well reinforced trap.

The European badger (*Meles meles*) has wide distribution in temperate Europe. The fact that the badger is the largest carnivore remaining in the British Isles and many parts of the Continent provides a commentary on the impoverished state of European fauna. Unlike American badgers, *Meles* is omnivorous and spends considerable time foraging and hunting above ground and can be efficiently captured in cage traps. On the Continent, badgers are often taken in killing traps, some of dubious design.

In the past, large numbers of European badgers have entered the fur market. Evidently, there is also some traffic in Asiatic hog badgers, although I have no information on how they are trapped.

Marten (*Martes americana, Martes martes, et al.*) American marten, European pine marten and sable marten are creatures of the boreal and coniferous forests. Where the forests have been destroyed, the animal cannot survive. Today, marten—having survived an era of unrestricted trapping—are threatened anew by the wholesale devastation of Canadian and Russian forests by multinational timber and paper companies. Only the stone marten, adapted to deciduous forests, has been able to persist in grossly altered landscapes and is still fairly common in western Europe. Except for sable, which is today the world's most valuable fur animal and is raised in considerable numbers in Russian fur farms, marten will not breed in captivity. The market for marten fur has strengthened—presumably because the booming internal Russian fur market has absorbed Russian production—and is now above pre-crash levels.

Approximately 100,000 American marten are trapped each year. In Canada, most marten were taken with killing traps in cubbies even before the imposition of a national ban on using leghold traps for terrestrial animals other than canids and felids. Instant-killing marten traps, such as the Kania, are available. In the United States, the most common method of taking marten is still the leghold trap. 72% of U.S. marten trappers report using them at least part of the time. In Alaska, the main U.S. marten trapping state, 83% of trappers use legholds.[27] Since it is much more efficient to catch marten in trees, or on "running poles" than on the ground, one can be confident that many of the victims wind up hanging by a foot. This is one of the most atrocious things done on traplines. There is not the slightest excuse for it.

American marten are quite easy to take in baited cage traps or wooden boxes. In the mid-1980s, Fred Keister of Kamiah, Idaho, who traps along the Clearwater and Lochsa rivers of northern Idaho, agreed to supply marten and fisher to Washington State University. He was amazed to find that he could catch as many animals with cage traps as with the steel jaw leghold traps he had previously used. Additionally, he was able to avoid non-target catches by using marshmallows or strawberry jam for bait. Keister subsequently switched to cage traps for all mustelid trapping. Keister's experience was typical of commercial trappers who have overcome their biases sufficiently enough to test the efficiency of cages and boxes.[28]

Pine marten (*M. martes*) in Scandinavia are taken with deadfalls, killing traps in cubbies and, occasionally, in box traps. Most stone marten (*M. foina*) trapped in western Europe are taken less satisfactorily with killing traps set in the open. At least some pine marten and sable marten trapped in Russia are taken with steel jaw leghold traps. Fortunately a feasible Russian-designed instant killing trap for marten is entering production.[29]

The **fisher** (*Martes pennanti*) is a large and extremely powerful North American marten with adults often weighing 12 pounds. Fisher were extirpated from the lower 48 states, and became rare in Canada, during the fur craze of the 1920s. They have largely recovered in Canada and have been reintroduced into New England, New York, Michigan, Wisconsin and Minnesota.

Like their smaller cousins, the fisher is easy to trap with killing traps in baited cubbies, cage traps, and will readily enter log box traps. Trapping fisher with steel jaw leghold traps is now prohibited in Canada and Massachusetts. However, the steel jaw leghold trap remains the primary capture method in Alaska and much of the lower 48 states. At least 10,000 fisher are killed for the fur trade each year.

Wolverines (*Gulo gulo, Gulo luscus*) Wolverines are creatures of the arctic barrens and northern forests and are sparsely distributed across northern North America and Eurasia. The wolverine is the largest terrestrial mustelid. A large male can weigh 60 pounds. Wolverines are terrestrial hunters, renowned for their ferocity. During the winter and spring of 1992, a single male wolverine killed over 300 domestic reindeer in northern Finland, leaving the meat for female wolverines pregnant and parturient with his offspring.[30]

Like grizzly bears and wolves, the wolverine cannot tolerate major human incursions. The fierce mustelids were long ago extirpated from all but a few wilderness areas near the Canadian border, such as Glacier Park in the United States. About 1,000 are trapped each year north of the Canadian Shield and in Alaska. In Canada, where steel jaw leghold traps are banned for the species, they are taken in #330 Conibear killing traps and, less frequently, snared or taken in deadfalls. In Alaska, the most common trapping method is steel jaw leghold traps set in "gang sets" (groups of traps set together) so that if a wolverine is caught in one, many traps will clamp down on the victim as the animal struggles, preventing escape. The wolverine is rare and protected in Scandinavia, but a substantial number are trapped annually in Russia, evidently with steel jaw leghold traps.

Wolverines are too powerful to be held in standard cage traps. When wolverines were caught in Tomahawk cages set by Mowak and his associates to study lynx, they invariably tore the cages apart and escaped. As noted earlier, however, wolverines readily enter log box traps.

Otters (*Lutra, Pteronura, Amblonyx, Anonyx, Enhydra*) Otters are wide-ranging and successful semi-aquatic and aquatic mammals found on every continent except Australia. Otters also populate most of the world's major river systems. *Enhydra lutra*, as noted earlier, has even gone to sea. Otters, unlike most mustelids, are quite social, have a wide range of vocalizations and are noted for their playfulness. Otters manipulate objects in a remarkably sophisticated way. The sea otter is a tool user, routinely utilizing stones to break open mussels.

Otters have been relentlessly hunted for their fur. In the late 19th century, the sea otter was virtually exterminated to supply fur to imperial China. Between the 16th and early 20th centuries, European and North American otters were extirpated throughout much of their range. In addition to being hunted for their pelts, otters have suffered much persecution because of their consumption of game fish. Four species of otter, including *Lutra lutra*, the European otter, are on CITES Appendix I as highly endangered species. Most others are considered threatened.

The only otter widely trapped is *Lutra canadensis*, the common otter of North America. They live in most Canadian waterways and are widely distributed in Alaska. In the United States, *Lutra canadensis* were eliminated from parts of their range during the era of unrestricted trapping, and they have also suffered loss of habitat. The largest concentrations in the United States are in the southeastern wetlands. Louisiana has long been the largest producer of otter pelts within the United States, outproducing Alaska by almost three to one. Florida, Georgia, Mississippi, North and South Carolina are substantial producers as well. When the market for otter pelts is strong (as it currently is) about 50,000 otters are taken, 60% from the United States, the remainder from Canada north of the Canadian Shield.

In Canada, it is still legal under the 1995 regulation to take otter in drowning sets with steel leghold traps. However, this is done, according to a recent survey, in less than 25% of cases.[31] Most trapping of otter is done with underwater Conibears or—less commonly—with underwater necksnares. In Alaska, about half of otters trapped are taken with leghold traps in drowning sets, and the remainder with underwater killing traps. In the southern United States, however, the marsh meadows where otter search for food often do not have enough standing water for drowning sets. Many otters are trapped with steel jaw leghold traps in ordinary terrestrial sets.

Hancock cage traps, as described earlier, are an efficient means of catching otter. Like wolverines, otters are too powerful to be consistently held in conventional cage traps.

Mink (*Mustela vison, Mustela lutreola, et al.*) Mink are small, semi-aquatic mustelids with lustrous coats. The North American species (*M. vison*) rarely exceeds four or five pounds, although animals raised in fur farms may be larger. They occur almost everywhere between the Arctic barrens of the north and the Sonoran and Chihuahan deserts of the south where streams and lakes are found. Escapees from fur farms have formed populations in many parts of Europe. The Asiatic species, collectively known as Kolinsky (for the Kola Peninsula) are widely distributed in Siberia. The European mink (*M. lutreola*) is depleted in most of their European range.

The mink is the staple species of the fur farming industry. During the late 1980s, over 40 million mink a year were being pelted by fur farmers. Currently, production of farmed mink is around 25 million animals. Between the 1994-95 and 1995-96 season, the price of farmed mink pelts doubled, although this increase did not buoy up the price of wild mink. Denmark, largely responsible for the overproduction that led to the price crash of the 1980s, is the largest producer of farmed mink with about 40% of the world market.

With strong wild fur prices, 300,000 to 500,000 mink enter the fur market from North America annually. The combined European/Asian production, centered in Russia, is evidently larger. Scandinavian production from descendants of mink that escaped from fur farms is around 100,000 and rising.

Mink are comparatively easy to capture with killing traps in baited cubbies, underwater killing sets or underwater snares. Despite this, the most common means of trapping mink in North America is with "slide wire" sets. A slide wire set consists of a steel jaw leghold trap set on a bank that is wired to a taut length of smooth wire leading from the bank to a submerged rock. When the mink begins to struggle, or seeks refuge in the water, the trap attachment readily slides down the wire. When the animal attempts to regain the surface, the attachment binds, holding the captive underwater. Fortunately mink, unlike beaver, drown quite rapidly. The mean time to death in drowning sets is approximately two minutes.

Canadian trapping regulations allow steel jaw leghold traps to be used in this way. About half of Canada's mink trappers use this type of set instead of killing traps and similar pattern is present in the northern United States. In the southern United States, where the largest number of mink are taken, the predominant trapping tool is the "stoploss." This steel jaw leghold trap has an auxiliary bail that prevents the animal from chewing off his trapped foot.

Mink can be efficiently captured in cage traps when smeared with lure and baited with fish or liver. Idaho trapper Fred Keister said the chief disadvantage of the method is the need to camouflage the traps with meticulous care. He was forced to do it not to fool mink, who are indifferent, but to keep other trappers from finding and stealing his expensive cages!

FELIDAE (CAT FAMILY)

The felids are the most purely carnivorous and the least divergent of the carnivores. Felids, from house cats to tigers, share the same structural form, and the same basic stalking and pouncing motor patterns. The familial affinity of different species is instantly obvious. There is no tendency to omnivory in the family. Small cats may eat insects on occasion. Most cats—even tigers—will eat stranded fish and some scoop fish from shallow water, but no cat gives evidence of adapting to insectivory or aquatic life. While there are specialized adaptations, such as those which permit the serval to catch birds and the lynx to survive in the far north, the only major departures from the highly disciplined pattern of felid evolution are found on the African plains. Lions, at the apex of a family of solitary hunters, hunt cooperatively and maintain lasting social bonds. The cheetah, the planet's fastest sprinter, specializes in the capture of small antelopes and has diverged not only behaviorally but structurally. Cheetahs are the only cats who cannot retract their claws and do not use them for hunting or self defense.[32]

While many cats, including the tiger—whose very survival is imperilled by poachers—are snared or trapped in steel jaw leghold traps, the chief species being openly trapped by fur trappers and control agents are the lynx, the bobcat, the mountain lion and the common domestic cat.

Lynx (*Lynx lynx, Lynx canadensis*) The lynx is adapted to survive in the deep snow and cold of boreal and montane forests. Lynx are rangy animals with very large feet that enable them to travel in deep, powdery snow. Unlike other medium-sized cats, the lynx does not hesitate to run down prey if stalking fails. During mating season lynx emit booming, very low frequency vocalizations which can be heard by conspecifics for a distance of seven to ten miles.[33]

The fate of lynx in North America is bound to the fate of the snowshoe hares upon whom they prey. Hare populations oscillate dramatically on a seven to ten-year cycle. Lynx numbers, as proven by over 200 years of Hudson Bay Company catch records, rise and crash in response. This creates a snowshoe hare-lynx cycle, meaning that fur yields vary by a factor as high as five. Typically, Canada contributes from 15,000 to 20,000 lynx pelts annually to the fur market. Alaska usually ships from 2,000 to 2,500 pelts, although it has contributed over 9,000. A few hundred are shipped each year from Montana and Minnesota.

Neck snaring is evidently the most common means of taking lynx in Canada, although considerable numbers are caught in legholds, and, in certain areas, up to a quarter are taken with 330 Conibears. According to a 1992 Alaskan survey, 21% of trappers employ snares, 85% use steel jaw leghold traps and only 5% use killing traps.[34] Spring-powered Aldrich type legsnares are reasonably effective for lynx, and are used by some Canadian trappers.

Relict populations of the European lynx persist in Scandinavia. Finland allows a small number of animals to be hunted or trapped. The Swedish Aberg legsnare, which has been shown to work well for lynx, is an approved trapping device. Comparatively large numbers of lynx are believed to remain across the Russian taiga. The demand for fur by Russia's nouveau riche, has stimulated the market for lynx. Recently, very substantial lynx catches in Russia have been reported. The bulk are believed to be taken by hunting and with steel jaw leghold traps.

Log box traps appear to work extremely well for lynx. The animals enter readily and remain passive while confined. Tomahawk cage traps were extensively deployed by Mowak *et al.* in a three year "mark and release" study of lynx in Canada's Yukon territory. The cages were considerably less efficient than Fremont legsnares, but were adjudged by the authors to be "adequate" for scientific taking. There were no observed injuries.[35]

Bobcats (*Lynx rufous*) While many people equate lynx and bobcat, they are quite dissimilar animals. The lynx is a creature of northern wilderness who persists only as the wilderness persists. The bobcat—an efficient, general-purpose predator—has succeeded in maintaining populations in all but the most grossly altered North American landscapes. Except in the Northeastern and mid-Atlantic states, where the animal was wiped out and has yet to recover, the bobcat is fairly common in most of the United States wherever there is forest or broken terrain, and in Canada south of the Canadian Shield. The heaviest concentrations are found to the southern tier of states west of the Appalachians and north of the marshes and in northern Mexico. The bobcat is much stockier than a lynx—a robust adult can weigh up to 40 pounds—and remarkably strong; one must look to the most ferocious mustelids to find animals with comparable, pound for pound, fighting ability.

Trapping bobcats is rather laborious and the annual catch is very much a function of price. For example, the bobcat harvest in the United States surged from 10,000 animals in 1970-71, when their pelts were worth ten dollars, to 72,000 in 1976-77 when they were worth $125.

Most bobcats taken in Canada (2,000 to 5,000 yearly) are necksnared. The bulk of the U.S. catch is taken with steel leghold traps, with cages in second place. Mechanical legsnares, which are more effective for felids than for coyotes since the former do not chew cable, are beginning to find use. The indications are that cages, if skillfully used, are fairly efficient for bobcats. Log boxes work well for bobcats as well as for lynx.

Mountain lions, cougars (*Felis concolor*) The mountain lion is found from the Canadian Shield south through the mountains, high plains, desert and rainforest, all the way to the brush country of Patagonia. The eastern cougar was virtually exterminated during the 19th and early 20th centuries, and the animal is extremely rare in the United States east of the Rocky Mountains. In the West, mountain lions have made a rather startling comeback. Sightings have multiplied in recent years and complaints of lion depredations against livestock have mounted.

The usual methods of trapping lions have been with large #3 and #4 steel jaw leghold traps and strangling snares. However, USDA damage control trappers in California, prevented by a state referendum (upheld by California voters in 1996) from using lethal control methods, have found that the animals can be quite readily captured in ordinary cage traps providing the traps are "naturalized." Naturalized traps are camouflaged, provided with dirt floors, de-scented and, of course, properly lured and baited.[36]

House cats (*Felis catus*) *Felis catus* is the world's most widely distributed predator. House cats, feral and domestic alike, are found in every continent and even on remote islands. Every urban and suburban neighborhood in North America has its share of stray and abandoned "alley cats" that manage, somehow, to survive and, on occasion, to raise kittens. Feral cats abound in agricultural areas. Even in the U.S. mountain west, where I grew up, there was a population of feral cats. The cats were usually dark colored, since light colored cats can be seen at night by great horned owls.

Cats and other small non-native predators, such as the gray mongoose, can have a profound impact on native wildlife. This is especially true where native fauna has evolved in the absence of predators or, as in Australia, in the absence of efficient placental predators.

The Humane Society of the United States estimates that six million cats, many simply lost and abandoned, some genuinely feral, are captured annually in North America. Cage traps are the primary means of capturing cats.[37]

Bears (*Ursus, Euarctos, et al.*) Bears are widely distributed across Eurasia and North America. The spectacled bear (*Tremarctos*) is found in the Andes Mountains of South America. Like other large predators, bears have suffered mightily at the hands of humans. Only the polar bear, protected by the U.S. Marine Mammal Protection Act, and a four-nation international agreement, is at anything close to a normal population level.

The spectacled bear is depleted and endangered throughout its range. The European brown bear, aside from disjunct relict populations in mountain ranges, is extinct in Europe outside of Russia and Scandinavia. Spectacled bears are still sparsely distributed across the Eurasian taiga and occurs in the Caucasus and the mountain ranges to the east.

The North American brown bear, which once ranged throughout the western United States and northern Mexico, has been exterminated from the lower 48 states outside of the Yellowstone and Bitteroot-Selway ecosystems. Grizzlies are common in the Canadian Rockies and Alaska. Black bears occur in most of Canada, and in the major mountain ranges of the United States with disjunct populations in Florida and elsewhere. Sloth bears, Asiatic black bears and sun bears occur from the slopes of the Himalayas into southeast Asia. Most taxonomists now classify the critically endangered greater panda with the Ursines.

The fur industry has always consumed bear skins. In 1743, during the time of the voyageurs, the French port of La Rochelle, one of the centers of the trade with Canada, received 16,000 bear skins. In recent years the number of black bear skins entering the fur market from North America has ranged from 3,000 to 5,000. A grave new threat to Asian bears and, more recently, the North American black bear comes from gangs of poachers who sell the galls to Asian medicine traders.[38]

The standard means of trapping bears in North America is the Aldrich bear legsnare. Modified Aldrich-type legsnares, such as the Fremont, are also used.

ORDER RODENTIA (RODENTS)

Rodents are by far the most successful order of mammals with close to 1,800 species, almost as many species as are contained in the other 19 mammalian orders. Rodents are arrayed in three great suborders, distinguished by the characteristics of their jaws, most particularly the positioning of the masseter muscles. These are the sciuromorphs, or squirrels, the myomorphs, or rat-like rodents. The hystricomorphs, New World caviomorphs lumped together with the Old World porcupines, make up the third great suborder. There are enough families that do not seem to belong with any suborder, such as the pocket gophers and the African springhaas, to maintain rodent taxonomy in a state of constant turmoil.

Rodents have filled a vast number of niches, and have evolved extraordinary specializations. Rodents dominate the world of small mammals providing a prey reservoir for predators ranging from shrews to wolves. Some, such as the dormouse, are themselves predators. Rodents have taken fossorial living to a point rarely encountered. They are preeminent hibernators. They have also developed complex societies, even paralleling—in the case of naked mole rats—the caste system of social insects. Rodents are consummate nest builders, with only humans surpassing them as modifiers of their habitats. Some arboreal forms such as the African anomalures and the North American flying squirrels have taken to the air as gliders. Running across the open plains, the delightful mara of the Argentine grasslands have assumed a niche usually reserved for hares and small antelope. Jerboas and kangaroo rats have adapted to aridity as no other mammals have, living in barren deserts with little need for water. The beaver has evolved extraordinary behavior combined with the ability to break down and digest cellulose. While the largest rodents, such as the capybara of South America and the beaver are semi-aquatic herbivores, a smaller aquatic form, the beaver rat of New Guinea, lives like an otter, catching fish and amphibians.

But the very reason for the rodents' success, their four—two above and two below—constantly growing incisors, has also limited their evolutionary horizons. While rodents can certainly inflict a nasty bite, their teeth prevent them from becoming really efficient predators. While rodents can clip vegetation, they are precluded from going forth as grazing animals.

Rodents are, without doubt—if one considers mice and rats—trapped in larger numbers than any other order. Some rodents, such as squirrels, beaver, muskrats, woodchucks and nutria, are trapped for fur. One species, the beaver, figures mightily in the history of North America.

Beaver (*Castor canadensis, C. fiber*) Beaver are classified with the sciuromorphs. However, they have evolved far from the main line of the suborder, and occupy their own family, which only consists of the North American and European beaver. Castoroides, the extinct giant beaver of the Pleistocene, may have weighed up to 400 pounds. Even today, the beaver, who can weigh up to 70 pounds, is the second largest rodent. Among the larger rodents, the beaver is the most completely adapted to aquatic life, with webbed hind feet and a unique, paddle-shaped tail. Beaver modify their environments by building dams and creating impoundments in which they store food for the winter. Beaver dams and their solid, dome-shaped houses, along with felled trees, give unmistakable evidence of the presence of beaver. Beaver meadows are characteristic features of the northern forests. Indeed, there can be no doubt that over millennia beaver have profoundly altered the ecology of the North.

Trade in beaver furs began in the ninth century, centered in Kiev. Later trade was dominated by the Hansa merchants who shipped furs, gathered by nomadic tribes, out of Novgorod and other Baltic ports to Western Europe. As furbearers became more scarce and prices rose, the centers of trade moved eastward to Moscow and Kazan. Eventually, merchants set up outposts far into the Siberian taiga to trade with natives for fur.

The beaver was wiped out in Britain in the 13th century. By the end of the 15th century, the European beaver had been exterminated in Spain and southern Europe, and was scarce east of the Urals. By 1800, even the vast reaches of Siberia had been ransacked of vulnerable animals, and European beavers were either extinct or depleted throughout their range.[39]

The process of providing trade goods to Native Americans in return for beaver began in North America during the mid-1500s and was initially dominated by the French. As competition with the British Hudsons Bay Company became intense, French trappers, "voyageurs," joined native trappers. Once the French and Indian wars had established British dominance over the fur producing hinterland, British determination to prevent settlers from moving west and interfering with the fur trade created great tension with the colonies. No lesser authority than Theodore Roosevelt called this the primary underlying reason for the Revolutionary War.[40]

As wars were fought and vast fortunes accrued, the beaver progressively disappeared from their North American ranges. The final phase came in the early 1800s with the invasion of the West by "mountain men" who succeeded, in a remarkably short time, at destroying most of the beaver in the Rocky Mountains. Had the European craze for beaver hats not been supplanted by an equally intense demand for silk hats, the extinction of the beaver—particularly the European beaver—might well have been consummated. Perhaps the silk worm saved the beaver.

The near terminal result of the beaver's encounter with commercial man can be simply explained. The beaver is sedentary and vulnerable. Beaver do not, and in fact cannot, move from their home before spring breakup. It was far easier and more efficient—and hence profitable—to simply wipe out the beaver within reach of a given trading post than to trap sparingly over a wide area. During the time of slaughter, the primary tool of trappers was the iron or steel jaw leghold trap. Indeed, there is no doubt that the near extinction of the beaver could not have been accomplished without the cruel instruments.

Interestingly, while the steel trap brought the beaver to near extinction, the cage trap was closely involved in beaver restoration. Both the Bailey and Hancock traps were designed to translocate beaver to ranges from which they had been exterminated. The first use of the latter was to restore beaver to the Black Hills of South Dakota. Translocation began in the 1920s and has carried through to the present day. Without it, the North American beaver's prodigious recovery through the second half of the 20th century would hardly have occurred.

Today, the beaver is distributed throughout most of North America south of the barrens, wherever watercourses and vegetation are available. While recovery of the European beaver lags far behind that of *C. Canadensis*, and is further threatened by releases of American beaver in their range, population recovery is well underway. In Scandinavia and Russia, the European Beaver is locally abundant.

In Canada, most beaver are taken with underwater Conibears, although some are snared underwater and about one in ten are taken with steel jaw leghold traps in slide wire drowning sets similar to those described for mink. In Alaska, underwater snares are the most common means of trapping. In the lower 48 states, outside of the West, underwater Conibears are most used. In the western United States, 70% of trappers surveyed in 1992 report using legholds.[41]

With commercial beaver trapping at low ebb in the lower 48 states, the demand for beaver control to prevent them from cutting trees, damming culverts and ditches, and flooding roads with their impoundments, is constantly rising. Damage can often be prevented by various stratagems such as using culverts with "T" shaped ends, protecting trees with woven wire, and so on. Large numbers of beaver are now trapped for control purposes. The efficiency of Hancock and Bailey traps has been long since established. However, if one understands beaver behavior, it is also possible to take the animals with ordinary cage traps. One thing to remember when live trapping beaver in Bailey traps or common cages, which must be partially submerged, is not to leave them in the water for too long. Cages should be frequently checked.

Arboreal Squirrels (*Sciurus, Tamasciurus, et al.*) Squirrels are typical sciuromorphs, the most primitive of the rodent suborders. Their close relative, the sewellel, or mountain beaver, a small (two to three pound) rodent of the Pacific Northwest, is little different from rodents that appeared during the Eocene period 50 million years ago. While there are large numbers (40 genera and 175 species) of squirrels throughout the forests of the world, especially tropical moist forests, and some of them are strikingly beautiful, only three species are particularly relevant to a treatise on trapping. These are the Tamasciurus, the native red squirrel of the boreal North American and mountain forests, the Glaucomys, or northern flying squirrel, and Sciurus carolinensis, the eastern gray squirrel.

The **red squirrel** *(Tamasciurus)* is the dominant squirrel of the Canadian forests and the chief prey animal of the American marten. Up to two million squirrels a year are trapped for the fur trade. Most are snared in "hanging" sets made of light copper wire placed upright on branches. The flying squirrel is mentioned only because of their penchant for entering and triggering baited traps set for other species. This little squirrel occurs in such number that trapping marten in areas of concentration is difficult. Trap designers and trappers have yet to devise means of keeping the flying squirrels, whose fur is valueless, out of traps.

There are at least nine species of arboreal squirrels in the lower 48 states. However, the only species commonly trapped is the eastern gray squirrel. The eastern gray is the common squirrel of cities, towns and suburbs of North America even outside of the animal's normal range. Gray squirrels also are found in the British Isles, where they have driven the native red squirrel to remote haunts. The squirrels were released in Britain because their fur was once prized by British royalty. In the United States, gray squirrels were imported to towns and cities across the country as attractive additions to urban parks. Like all rodents, gray squirrels gnaw, often into cables or through walls. Squirrels are the bane of urban and suburban gardeners, particularly those who plant bulbs, which the animals frequently dig up, and they sometimes girdle small trees. Millions of dollars are paid out every year to trappers to remove squirrels. Squirrel cages are the number-one seller for most cage makers. The number of animals so involved (most are eventually released elsewhere) is unknown, but it almost certainly exceeds a million annually.

Like all squirrels, gray squirrels are easy to catch in baited cages. It should be remembered, however, that squirrels are excitable animals and can injure themselves, or even die, in cages. It is for this reason that use of cage traps is prohibited in areas frequented by the endangered Delmarva fox squirrel. When trapping squirrels, one should put nest material in the cages if the animals are to be left for any time and be sure not to allow cats or dogs to harass the captives.

Ground squirrels (*Spermophilus colombianus, et al.*) While some squirrels became arboreal, a number of genera became fossorial. Numerous closely related species of ground squirrels are distributed across the grasslands of the northern hemisphere. Richardson's ground squirrel of the Rocky Mountains and northern Great Plains is perhaps typical of such animals. Ground squirrels aestivate and hibernate at least six months of every year, typically from late August until early April, living on accumulated fat. Ground squirrels, such as the California ground squirrel and the 13-lined ground squirrel, build up enormous numbers in a short time. Millions of dollars are spent annually, especially in California, trying to keep the animals out of truck gardens, alfalfa and other crops.

The method usually resorted to try to control ground squirrels, who readily dig under fences and even underground barriers, is poison. However, it is obviously possible to devise a fairly effective trap. On our ranch in Wyoming, we noticed that ground squirrels would enter lengths of six-inch diameter plastic pipe. My brother, Roger Garrett, counted 14 ground squirrels in a 20-foot length of irrigation pipe. He subsequently built traps consisting of lengths of pipe with one-way woven wire flaps on each end, which, in localities where ground squirrels were densely concentrated, also sometimes filled up with the animals.

Marmots (*Marmota*) Marmots are the largest of the terrestrial sciuromorphs. They are stout-bodied animals widely distributed across the northern hemisphere south of the boreal forest. They range in size from the eastern woodchuck (*Marmota monax*), who weighs about 15 pounds, to the hoary marmot, a creature of the alpine tundra who may well exceed 30 pounds. Marmots are noted for their shrill, piercing whistles. What distinguishes marmots, however, is an extraordinary capacity for hibernation. The animals emerge from hibernation in the spring only long enough to allow the young of the year to perfect their motor patterns, to breed—and in the case of male hoary marmots, determine who shall breed through stylized wrestling contests—and rebuild body weight so as to resume hibernation. This can take as little as three months.

A marmot in hibernation is not merely "holed up." Heartbeat drops to as low as three to six beats per minute and body temperature may retreat to 68°F. The process of aging, as has also been shown for tenrecs, is distinctly retarded. There are frequent suggestions that the growing knowledge of the chemistry and physiology of hibernation should be put to use in human medicine.

When in their alpine redoubts, the hoary marmot has been little persecuted by humans. Other members of the genus, however, have been intermittently exploited for fur. The last large-scale epidemic of bubonic plague began in 1927 among fur handlers processing pelts of Eurasian marmots. The epidemic spread from the receiving points in northern Manchuria to the major processing center in Harbin, and eventually took at least 60,000 lives.[42]

At the moment, North American trapping is chiefly for control purposes. The eastern woodchuck, abominated by horse raisers for digging holes in pastures, and by suburban homeowners who invaded their habitat for digging in lawns and gobbling up gardens, is the chief object of attention. In most surveys, woodchucks come in number four on the list of animals producing complaints to control trappers. Woodchucks are not as easy to catch in cage traps as some other animals, not because of wariness, but because they are vegetarians who prefer growing plants. It is not always easy to find baits that attract marmots in summer, as vegetation is abundant. There is a tendency among control trappers to lose patience and put Conibears in their holes. However, as winter approaches well baited cage traps can succeed.

Rats (*Ratus ratus, et al.*) Rats and mice are myomorphs, the suborder whose multitudes have radiated forth to seek and fill the minor niches of mammalian existence. Altogether, the suborder contains at least 1,200 species arranged, depending on which taxonomic scheme is adopted, into five families with at least 17 subfamilies. There are hundreds of species of rats, including both Old World and New World forms. Most of them are comparatively inoffensive. Some, like the cloud rat, are strikingly beautiful. Two rather obscure and unprepossessing rats, the arboreal black rat of Indonesia (*R. ratus*) and the fossorial brown rat (*R. norwegius*) have become inseparable, if unwelcome, human congeners. As such, they have penetrated every continent and taken up residence virtually everywhere humans have settled, proliferating in enormous numbers, even infesting remote islands. Rats have altered the planet's ecology and subtracted from its roster of extant species. They have vectored vast epidemics and changed human history, colored human language and invaded the human psyche. Most medical testing and research begins with rats. Even behavioral research—supposedly extrapolatable to humans—is carried out on captive rats. Never mind that after hundreds of generations in captivity, "lab rats" are a species that never existed in the wild.

The dominant rat in North America is *R. norwegieus.* Municipalities across Europe and North America budget for rat control. Countless millions of rats are poisoned yearly often, as an emergency room doctor treating a warfarin poisoned child would be quick to aver, at great cost. The animals are also taken with an assortment of killing traps, most of which—aside for those approved for use in Sweden—could not possibly effect a rapid kill.

Cage traps are perfectly adequate tools for homeowners dealing with individual rats, whether *Ratus* or native species such as pack rats. All one has to do is set a properly baited box trap where rats occur.[43] What remains to be done, in order to supplant poisons in municipal and agricultural settings, is to devise effective multiple-catch rat traps. A clue as to how to proceed is found in the well-established fact that rats mark out runways with scent which they can then follow, even in pitch blackness, without difficulty.

Mice (*Mus, et al.*) To describe the myriad smaller forms with which myomorphs have populated the planet is far beyond the purpose of this monograph. While there is no shortage of native forms, such as genus *Peromyscus*, who abound in North America, it is *Mus musculus*, the European house mouse, that has become our species's most devout and ubiquitous congener. What house has never been visited by mice? The cumulative damage from mice to things human is incalculable.

Aside from poisoning, the chief means of catching mice in private homes is with common snap traps. The Woodstream trap kills instantly when it strikes the head or neck. Unfortunately, even with careful baiting, there are bad strikes. If the traps are placed in mouse runways, which is where most people place them, a certain number of mice trip the traps by running across them, rather than taking bait. What is needed for very small animals, just as with furbearers, are killing traps in some type of "cubby" to position the victims. Glue traps do not cause structural injury and they would be fairly benign if the animals were immediately retrieved. Over time, however, the victims become increasingly mired in and covered with the adhesive, and many suffocate. It is hard to imagine a crueler trapping method.

Multiple-catch box traps, operated like windup toys with a wound-up spring, have been on the market for decades. The mouse triggers the trap by stepping on a pan positioned inside the entrance. The spring then rotates the threshold at the entrance, tossing the mouse into a capture chamber and recocking the trap. The spring has enough energy to repeat the process several times.

These traps work well as long as one is careful not to ruin the spring by overwinding. While multiple-catch traps are efficient, whether or not they are humane depends strictly on how long the animals are left in them. Very small mammals can starve to death quickly, in some cases in less than 24 hours. Mortality begins in a box trap after 12 hours. It is often accompanied, with a multiple catch, by cannibalism. A trap put out at night should be promptly tended the next morning.

Muskrats (*Ondatra zibethicus*) At the beginning of each winter there is a curious phenomenon on the lakes of northern and central Canada. Conical piles of vegetation begin to appear on the ice. These are "push-ups," produced by muskrats who chew holes in the ice, cut vegetation from the bottom of the lake and then bring the vegetation to the surface to construct a shelter. Thousands of miles to the south, the same species constructs houses and digs a maze of tunnels across the vast marshes of Louisiana.

The muskrat, weighing between two and five pounds, is the largest member of the vole family (subfamily *Microtinae*). They are one of the most widely distributed—as well as one of the most versatile and interesting—animals in North America. From the delta of the Mississippi to the delta of the McKenzie, wherever there are swamps or marshes, lakes or ponds, rivers or streams, one is likely to encounter muskrat. They are absent from the state of Florida, absent or uncommon in the southwest and high mountains or arctic tundra, but otherwise ubiquitous. Muskrats thrive on subclimax vegetation, such as the meadows of *Scirpus olnei* that follow the burning of southern salt and intermediate marshes. In addition to the North American populations, there are colonizing populations in western Europe, Scandinavia and western Russia.

In the past, the muskrat's overall range has expanded, rather than contracted, because of human intrusion. But this may be changing. In the marshes of Louisiana, which produced ten million muskrats in 1946, ecological changes and competition with nutria (see below) have greatly reduced their numbers. Marked population declines are in evidence in the mid-Atlantic coastal marshes, especially those on Delaware Bay.

Like most semi-aquatic animals, muskrats have lustrous coats. Until the collapse of the fur market, which reduced the price of pelts to a level below the costs of acquisition, muskrats supplied more victims to the fur trade than any other wild animal. The annual North American catch often exceeded ten million, about three-quarters of it from the United States. Currently, muskrat trapping in the southern United States has all but ceased and it is at low ebb elsewhere.

Because of the muskrats' amazing adaptations to different habitats, trapping methods vary greatly from area to area. In the mid-Atlantic marshes, and wherever else there are stable, water filled "muskrat runways" in which the animals swim, Conibear 110s set underwater and—where legal—underwater cage traps are used. No trapper in his right mind would set steel jaw leghold traps under these circumstances. But there are places where killing traps cannot be used effectively, or where none are available. These include:

- "Push-up" trapping on northern lakes. Here, leghold traps are fastened to the ice with long chains in the expectation that the animal will seek refuge in the water. When the trap clamps onto the animal's leg, the captive should be unable to resurface, and eventually drown. One trouble with killing traps is that the trap frames are usually too wide to pass through the muskrats' hole in the ice, even if the victims are able to reach their hole after being struck. Trappers do not want dead muskrats on the ice because lynx, coyotes and other predators continually prowl among push-ups looking for sick and unwary animals.
- "Float" trapping on river floodplains in the spring. Here trappers fasten leghold traps onto an anchored float—usually a length of plank or flattened log—with a long chain and attached weight. Muskrats climb on board to rest or investigate, trigger the trap, dive to escape and never again gain the surface. In this case—although there is some

pecking of dead animals by ravens—scavenging is less a problem than the availability of an efficient killing trap. The Hansen trap was originally designed with this kind of trapping in mind; unfortunately it is not now in production.

• "Pond" trapping in fresh water swamps characterized by masses of floating vegetation. Here the traditional procedure has been to set leghold traps in the expectation that the animal will plunge into the water and be unable to rise. Changing this trapping method awaits the availability of an adequate killing trap. Those tested thus far, including the British Fenn, have not worked.

•Unflooded marsh meadows, such as those in much of Louisiana. The marsh surface is too unstable for the animals to create water filled runways to swim through. The muskrats are able to scurry or bound across the surface of the marsh. Under these conditions, the notorious cruel "stoploss" leghold trap, banned in Canada, is the standard tool.

Can cage or box traps help with these problems? There is little doubt that muskrats living in push-ups would enter well-baited cages or boxes. But in anything other than a box filled with nesting material, the captives would unquestionably freeze to death during the night. And, of course, setting out boxes would involve far more labor than most trappers would, or could, expend.

Once on site, Dutch-type drowning cages would work in floodplain and pond trapping. Setting aside the questions of cost and logistics, it is well to recall that experiments conducted by Dr. Fred Gilbert in the 1980s established that muskrats in cages actually took more time to die, and struggled more violently, than those that plunged below the surface after being trapped. The relative mean times to death were slightly over three minutes versus five minutes. As for the southern marshes, unless an effective multiple-catch trap can be devised, cage and box traps are out of the question.[44]

On the other hand, if it were possible to overcome the barriers imposed by cost and logistics, well-baited cages would probably work for float and pond trapping. Certainly, muskrats can be captured readily enough, at least in winter and spring, with baited cages. The Tomahawk cage trap was initially designed for precisely this purpose.[45]

Nutria (*Myocaster coypu*) South American caviomorphs evolved in isolation for much of the Age of Mammals. While some, notably the agouti, succeeded in establishing themselves as far north as central Mexico following the appearance of a land bridge between the continents two to three million years ago, the only caviomorph to have successfully colonized north of the Rio Grande is the common porcupine (*Erethizon*).

In the late 1930s, however, *Myocaster coypu*, an aquatic rodent native to southern Brazil and northern Argentina, was introduced into Louisiana. The animal, called "nutria" by the fur trade, spread rapidly to become the dominant rodent throughout the freshwater and intermediate segment of the marshes. Isolated populations, evidently from animals released by fur farmers, have shown up at other points. A substantial population is now established in Belgium. By great effort, another population was exterminated (along with colonizing muskrats) in Britain.

Today, the nutria is the only caviomorph to be trapped on a large scale. Before the collapse in fur prices brought trapping to a standstill, around two million a year were taken in Louisiana alone. The normally inoffensive, strictly herbivorous 12 to 25 pound rodent is now the most numerous furbearer in Louisiana. With the cessation of trapping, populations in the marshes are becoming immense and there has been much talk of beginning state-funded control programs.

Nutria in Louisiana are normally taken on canal banks with #2 steel jaw leghold traps. Where natural bayous are absent, canals have been dug expressly to allow trappers to use boats to trap nutria and large areas of the marshes are crisscrossed with them. In addition, large numbers of nutria were taken as incidental catch in muskrat traps. Conibear traps, although they can be used effectively against nutria in Maryland, are inefficient in Louisiana. Legsnares have not been seriously tested.

Can nutria be taken in cage traps? The Dutch method of taking muskrats in floating cage traps might well be adapted to nutria. Given the year-round profusion of vegetation, it is unlikely that baited terrestrial cages would be effective. The animals will follow discrete trails and might enter double-doored cages placed along them. Another possibility is suggested by the fact that nutria are frequently seen sleeping on top of muskrat houses. Assuming that they would climb on top of cage traps as well, a cage trap with trap doors on top might work.

ORDER LAGOMORPHIA (Rabbits, Hares and Pikas)

Unlike rodents, the lagomorphs have evolved comparatively few forms. There are only two families, one encompassing rabbits and hares, the other pika. The later are compact little animals of the alpine tundra who look nothing like rabbits. Pika are noted for storing winter fodder in tiny "hay stacks," and for their loud cries, which exceed in volume even those of the marmots who share their alpine fastnesses. There is only one North American species, but scores of distinct forms inhabit each of the Eurasian mountain ranges.

There are, all told, about 28 species of rabbit. Thirteen of these are North American cottontails (*sylvilagus*). The rest, aside from the European rabbit, occupy limited habitats. Some, like the volcano rabbit of central Mexico, are critically endangered. The hares have produced slightly fewer species than rabbits (about 23), ranging in size from two to ten pounds. Hares have diverged chiefly in such features as foot size (northern hares have large feet), ear size (desert hares are rangy animals with big ears to diffuse heat) and coloration.

Despite their conservatism, some extant rabbits are hardly different from the lagomorphs that appeared in the Oligocene 35 million years ago, rabbits and hares have been enormously successful. They range naturally throughout the northern hemisphere, Africa and northern South America. Perhaps the order has been able to escape direct competition with rodents by having four upper incisors instead of two. This has enabled hares, the more evolved members of the family, to find lives on the grasslands without recourse to tunneling and hibernating.

The 20th century has seen an explosive expansion of European rabbits in the southern hemisphere where they have been transported and released. The European rabbit, who once had a comparatively limited range in southern Europe, was first brought to the British Isles from Spain. The animal was released into Australia in 1859. In a few years, little threatened by inefficient marsupial predators, rabbits began a relentless invasion of the island continent. Even a thousand-mile-long rabbit-proof fence built between 1902 and 1907 to keep rabbits out of western Australia was eventually breached. By 1950, with the rabbit population estimated at half a billion, the Australians introduced myxomatosis, which wiped out all but a handful of immune individuals. Today, descendants of the survivors of earlier outbreaks are gradually increasing in number. Rabbit populations in Britain, also visited by myxomatosis, have now climbed to pre-outbreak levels. Rabbits were also released in Chile and Argentina and they now occur in immense numbers in Tierra del Fuego where they have established prodigious underground warrens. Hares have also been released in various places. In Argentina, colonizing populations persist, competing for resources with the native mara. Without rabbits' habit of tunnelling, however, hares are relatively easy to contain.

Rabbits and hares have been trapped and snared for centuries, both for food and for their pelts, which are still widely used for garment trimmings. The use of gin traps (steel leghold traps with serrated jaws) to catch rabbits in the British Isles led to a protracted, and ultimately successful, campaign during the 1940s and 1950s to ban the trap. Today, the animals are chiefly taken with strangling snares. Observations of necksnared hares show a mean time of death of 18 minutes.[46]

In North America, cottontails annoy homeowners by eating gardens and girdling shrubs and small trees. They are not particularly easy to trap in cages during the summer simply because it is difficult to find bait that is more attractive than the surrounding greenery. In the winter, on the other hand, the rabbits are hungry enough to respond and can be easily captured. The same, no doubt, holds true of European rabbits.

ORDER MARSUPALIA

Marsupials existed in North America far back in the Age of Dinosaurs. They were subsequently crowded out by the generally more efficient placentals (who rose in Europe) everywhere except Australia and, to a lesser extent, South America. In Australia, marsupials, left to themselves for most of the Age of Mammals, radiated prodigiously. They filled every imaginable ecological niche. The large kangaroos became grazers with hard enameled, hysodent teeth and the ability to break down and digest coarse fodder. A large number of marsupials became arboreal, with many acquiring prehensile tails. Some of the largest and most efficient mammalian gliders are found in Australia. One animal, the wombat, has taken up a rodent-like fossorial role, complete with unrooted continually growing front incisors. Only the aquatic niche has been conceded. It was left to the platypus, one of three survivors of an order of mammals—Monotremata. These ancient animals were in residence 50 to 100 million years ago when the marsupials themselves evidently came across what is now Antarctica to Australia.

Marsupials have suffered mightily from the arrival of Europeans. Some, like the Thylacine wolf, were deliberately wiped out. But the most lethal day-to-day attrition comes from habitat modification. Grazing by domestic animals and a hoard of introduced placental animals that formed wild populations have been particularly devastating to the marsupials' environment. Australia has populations of feral hogs and water buffalo in the north and camels and horses in the central deserts. Rabbits, foxes, dingoes, feral dogs, feral and untended cats range across the continent.

Today, only two marsupials are extensively trapped: the Australian brush-tailed possum and the common opossum of North and South America. A rugged old timer, the common opossum of North and South America, has survived and changed little for at least 50 million years.

The brushtail possum was first marketed as "Adelaide Chinchilla." In 1932, over one million pelts were shipped from New South Wales alone. In recent years, the bulk of the catch has come from New Zealand. The adaptable three-foot long possum—perhaps the only Australian native to actually thrive on human interference—has now thoroughly colonized the island country. The typical harvest in New Zealand is about two million animals a year, with the average trapper taking from 1,000 to 2,000 animals per season. Fur prices have normally ranged from $10 to $20 per pelt. Most of the animals have been poisoned and collected by the trappers or trapped with steel jaw leghold traps. The New Zealand government is currently in the process of developing national standards which should lead to the outlawing of the steel jaw leghold traps currently in use. Considerable experimenting has been done with killing traps of various kinds, but are not yet in wide use. This is partly due to concern over damage to the pelt and partly because it seems difficult to attract the animals with baits placed inside cubbies.

The element that precludes the use of cage traps in New Zealand, setting aside cost, is logistical. It would be virtually impossible for trappers who trap on this large a scale, and typically walk their traplines, to move the number of traps that would be required. There is little doubt that the animals, who are anything but wary, would enter traps if they were sufficiently attracted by baits and pheromones. A homemade trap consisting of a box with several compartments surmounted by trap doors might work.

Common Opossums (*Didelphis virginiana*) The durable opossum, along with the murine and water opossums and mouse-like caenestoles of South American forests, are the last survivors of the myriad marsupial forms that once inhabited North and South America. Far from being daunted by the invasion of humans, the adaptable and omnivorous opossum has actually taken advantage of human disturbance. In the United States, the opossums' enormous range stretches all the way from the mid-Atlantic to the southeastern portions of the country, wherever winters are not too severe. Opossums have moved into new territories, now occurring in the coastal regions of Oregon and suburbs across the country.

At one time, as many as one million opossums were trapped for fur annually. The market, aside from a stirring of interest among Asian fur dealers, is currently dead. On the other hand, increasing numbers of opossum are being trapped as pests. Control trappers report that from five to eight percent of the animals they remove are opossums. Possums do, occasionally, penetrate buildings and will gobble up anything edible, such as a dish of dog food or accessible garbage. Given an opportunity a possum may even make off with a chicken, but the animals are essentially inoffensive. The possum who wanders through a suburban yard is making her rounds through what was probably her territory before development. One can be sure that a good many of the opossum hauled away by control officers for relocation or disposal were taken off not because they have caused any damage, but because they are considered repulsive. With a modestly prehensile scaly tail, small eyes, long nose, and unkempt fur, the animal is far from cuddly. Perhaps an animal that has persisted, barely touched by time, from the very dawn of the Age of Mammals, can be excused for putting function first.

Catching an opossum in a cage trap, if it must be done, requires nothing more than baiting it with a foodstuff sufficiently pungent to attract the animal's attention.

ORDER EDENTATA (XENARTHRA)

The Edentata, or Xenarthra, South American animals who evolved during eons of continental isolation, have retained many primitive features. Among the edentates who made their way to North America with the rising of the Pliocene land bridge between the continents, were the immense ground sloths, Mylodon and Megatherium. Mylodon grew to the size of a small horse. Megatherium, one of the largest land mammals to have ever lived, towered to 20 feet when browsing for leaves in the treetops. Glyptodon, an enormous, massively carapaced 12-foot long armadillo, also appeared. With the waning of the Pleistocene era the giants perished. Fewer than 30 species remain of the order. Most are hard pressed to survive.

Surprisingly enough, a member of this rather archaic order, the nine-banded armadillo, has expanded its range northward in the past few decades. The armadillo showed up in southern Texas in the 1880s and reached Louisiana by 1925. The species' range now includes all of Texas, Louisiana, Oklahoma, Missouri, Arkansas, Mississippi, Alabama, Florida, Georgia and South Carolina. Armadillos are continuing to expand their range, there are reports of the little animals in the Rio Grande valley of southern Colorado!

Armadillos, like many other animals who succeed in the time of humans, is medium-sized (up to 20 pounds), reasonably unobtrusive, quite fecund and omnivorous. Both because of their armored skin and their fossorial inclinations, the animals are largely immune to predation. Armadillos scavenge dead animals heedless of the state of decomposition, eat insects, grubs, birds' eggs, small mammals and a variety of plant material. Like other armadillos, nine-banded armadillos are powerful diggers.

It is the latter habit that has brought the nine-banded armadillo into disrepute in suburban centers. An armadillo can dig up a lawn, if so minded, between suns. The only problem in catching one in a cage trap, for the species is not noted for intelligence, is finding bait that the animal finds attractive. The Tomahawk Live Trap Company recommends "Meal worms, other worms or insects enclosed in a little cloth bag: maggots, sardines, fish." A well reinforced trap should be chosen, for armadillos have powerful forelegs.

ORDER ARTIODACTYLA

Artiodactyls, hoofed animals with an even number of toes, long ago evolved multi-chambered stomachs to enlist the power of fermentation in breaking down vegetation. These animals radiated forth to conquer the grasslands of all of the continents except Australia and South America. Artiodactyls exist today, in varied and multitudinous forms. Their habitat includes the high peaks of the Rockies and the Tien Shan to coastal swamps, encompassing tallgrass prairies and the most pitiless deserts. One form, the Hippopotami, have become semi-aquatic. Other grazers and browsers, like the okapi and the koupray, have returned to the forest. A few, notably the tragulids, and primitive cervids (deer) never left. One family of artiodactyls, the pigs (suidae) did not evolve rumens, nor become grazers, but proceeded on their own terms as omnivores and gramnivores.

Where artiodactyls did not exist, they have now been transported by humans. Vast herds of cattle (derived from the now extinct European auroch) sheep, goats, camels, llamas and even domesticated cervids (reindeer) are found practically everywhere there is grass or browse. Pigs, derived from the European wild boar, have been introduced across the planet.

Given an opportunity, captive artiodactyls will, of course, escape to form wild populations. While the damage caused by such animals pales in contrast to that inflicted by domestic herds, feral pigs are becoming the source of increasing concern. Luckily, these feral herbivores, for the most part, are fairly easy to control.

Feral Hogs (*Sus scrofa*) The European wild boar, from which domestic pigs are derived, is a characteristic animal of the European deciduous forest. While its European populations declined as the forests were destroyed, the species is still widely distributed across Eurasia and occurs on the Indian subcontinent.

Unfortunately, populations of *Sus scrofa*, have entrenched themselves in areas with heavy ground cover, namely forests, swamps, and chaparral. These populations were established by escaped domestic hogs and animals deliberately set loose to be bagged as hunting trophies. As is so often the case, the once-domesticated animals appear to spread with particular virulence. Queensland, Australia has such dense populations of feral hogs that provincial authorities have attempted, with no particular success, to eradicate them by shooting from helicopters. Hawaiian rainforests, besieged by corporate loggers, are also populated by wild hogs who cause no small damage in areas where endangered birds are clinging to existence. Here the Nature Conservancy has resorted to setting out strangling snares which are certain to produce a protracted and agonizing death. In addition to living on eight of the Hawaiian Islands, feral hogs are also present in the Galapagos. They are found in disjunct populations in much of Central and South America, Indonesia, New Guinea, Puerto Rico and the Virgin Islands.

Tomahawk Trap Company

Figure 10: Wild pig in Tomahawk cage trap.

In the continental United States, there are populations of wild hogs throughout the southeast. "Razorbacks" are common in the Great Smokies National Park in Tennessee where, after scores of generations, they may have come into equilibrium with their environment. The west coast population, concentrated in brush and scrub oak country of central California, is continuing to expand its range. The brush country of southeast Texas is heavily infested with descendants of Russian wild boars deliberately released as hunting stock by landowners who make a living by selling hunting rights. These hogs have shown up in other states, including Florida, where the animal shown in Figure 10 was captured.

Control trappers are being increasingly called upon to capture feral hogs. As might be expected, the hogs demolish ordinary 48-inch cage traps designed for dogs. Tru-Catch custom builds cage traps for Florida control trapper Tod Hartwick. The traps are made of 7/16-inch rod, and are 60 inches long, 36 inches high and 30 inches wide. Each trap weighs 150 pounds and is equipped with wheels.

Whether this is an optimal design, or whether better results might be had with an enlarged, and perhaps redesigned version of the Hancock trap, or with Cesar boxes, remains to be seen. It is clear, however, that effective and humane means of taking not only hogs, but other hoofed animals, is badly needed, and that the need will intensify.

END NOTES

1. For a definitive technical history of the steel jaw leghold trap, see: Gerstell, Richard. *1985. The Steel Trap in North America*. Stackpole Books.

2. This was accomplished through European Council Regulation 3254/91, passed by the European Parliament and approved by the Council of Ministers in 1991. The regulation also requires a European Union embargo on fur derived from 13 (mainly North American) furbearers, unless the exporting nations either ban the steel jaw leghold trap or adopt "internationally agreed humane trapping standards." Enforcement of this provision, scheduled to begin in January, 1998, has been deactivated with respect to Canada, Russia and the United States by the incorporation of trap standards (which will eventually govern the performance of traps used to take 19 listed furbearer species) into the Tripartite Agreement between Canada, Russia and the European Union, and by the "Agreed Minute" between the E.U. and the U.S.

3. Article 40: Federal Law 1462 on Wildlife, Adopted by State Duma on March 22, 1995.

4. The term "conventional traps," originally coined by Canadian officials to differentiate between steel jaw leghold traps with steel holding surfaces and those whose holding surfaces are fitted with hard rubber or plastic pads, is not actually defined in either the agreement between Canada, Russia and the European Union or the "understanding" between the U.S. and the European Union. In fact, U.S. negotiators refused to define the term. There are currently no padded or other "non-conventional" steel jaw leghold traps in use in Russia; unless padded traps are deliberately introduced, the elimination of "conventional" traps should end all use of steel leghold traps. Canada, on the other hand, clearly intends to retain the option (with respect to canids and felids) of converting from "conventional" leghold traps to padded traps. The so-called EGG trap, in which the holding surfaces are shielded to prevent raccoons from mutilating captured feet, is doubtless considered "nonconventional" as well.

5. The only exception in the 1995 Canadian regulations is for the province of Nova Scotia, which insisted upon being allowed to use steel jaw leghold traps for raccoons. Raccoons were exempted in the Tripartite Agreement, presumably so they can be taken with EGG traps.

6. What the Canadian "declaration" actually says is: "two full field testing seasons, plus one year after the end of the second full testing season commencing after the final conclusion of the agreement by the Council of the European Union." Testing seasons are deemed to begin on October 1st and conclude on March 31st.

7. In deriving this estimate, I have placed particular credence in the views of Kevin Clark, president of Critter Control. One difficulty in determining the actual number of firms involved in removing so-called "nuisance animals" arises from the fact that some firms specializing in invertebrate control also involve themselves to varying degrees in vertebrate control. Critter Control offices and franchises, along with many other vertebrate control specialists, offer "full service," repairing damage and effecting structural modifications to prevent future damage as well as removing the offending animal.

8. Personal communication with Greg and Mary Smith, owners of Tomahawk Live Trap Company, January, 1996.

9. Personal communication with Cyrus Bidwell, President of Tru-Catch, January, 1996.

10. Personal communication with Blair Waite, April, 1996.

11. Personal communication with (the late) Lester Barton, 1988.

12. In December 1986, I spent a week with Ed Cesar on his trapline north of Glacier-Waterton Park.

13. Copeland, Cesar, Peek, Harris, Long and Hunter. 1995. A Live Trap for Wolverine and Other Forest Carnivores. *Wildlife Society Bulletin*. 23(3): 535-538.

14. Trap use in Texas, which has the largest animal damage control program of any state, has been carefully researched by Robert Phillips and Gary Nunley. They found that in 1973, Texas Animal Damage Control (ADC) took 10,058 coyotes with steel jaw leghold traps, representing 67% of the coyotes taken by other methods. By 1994, the

number of trapped coyotes had dropped to 1,666, or 8% of the total kill. In 1972, the Texas ADC necksnared 1,576 coyotes; in 1994, the Texas ADC necksnared 5,879 coyotes, 28% of the total. 3,692 coyotes were taken in Texas in 1994 by shooting from aircraft, and 8,250 coyotes were taken with "coyote getters" (cyanide ejectors). Their findings were published as *Historical Perspective on Coyote Control Methods in Texas: Proceedings of Symposium on Coyotes in the Southwest*; Texas Parks and Wildlife, 1995.

In most other states, animal damage control operatives take more coyotes by shooting from aircraft than by any other method, with necksnaring second and trapping third. Trapping is considered more labor-intensive than the other methods.

15. Report of the Federal-Provincial Committee on Humane Trapping, 1981.

16. Personal communication with Tommy Svensson, Chief Technical Officer for Hunting and Trapping, Swedish Ministry of the Environment, 1992. Also conversations with instructors at the Swedish National Hunting Academy at Oster Malma.

17. Letter from Gary DePalma to Mary Smith, Tomahawk Live Trap Company, dated April, 1993.

18. In 1994-95, 11,000 Sauvageau traps and a few hundred Kania traps were traded to native trappers for steel jaw leghold traps. Many of the Sauvageau traps distributed were designed for Arctic fox. Since 1988, over 200,000 steel jaw leghold traps have been received and melted down in trap exchange programs conducted by the governments of the Yukon and Northwest Territories. Ian Ross, personal communication, May, 1997.

19. Chambers. *Status of the Coyote in the Northeastern U.S. in 1987.* Proceedings of the 3rd Eastern Wildlife Damage Control Conference.

20. International Association of Fish and Wildlife Agencies. 1993. *Ownership and Use of Traps by Trappers in the United States, 1992.*

21. Monroe, Tom. 1986. Bandits Behind Bars. *Voice of the Trapper.* Winter: 25-27.

22. Personal communication with Jaime Beyer, Ames, Iowa, 1988.

23. Monroe, Tom. 1986. *Voice of the Trapper.* Winter: 25-27.

24. *Wildlife Control Operations in New York 1986-93* and *Characteristics of the Private Nuisance Wildlife Control Industry in New York, Proceedings of the 6th Eastern Wildlife Damage Control Conference.*

25. Personal communication with Tod Hartwick of Pesky Critter Control, April 1996.

26. *Wildlife Control Operations in New York 1986-93.* Instruction booklets printed by cage and box trap makers typically contain instructions for drowning skunks.

27. International Association of Fish and Wildlife Agencies. 1993. *Ownership and Use of Traps by Trappers in the United States, 1992.*

28. I went out with Fred Keister on his trapline in December, 1986.

29. Personal communication with Serge Minkov, Russian Research Institute of Game Management and Fur Farming, April, 1996.

30. Personal communication with Finnish biologist Erik S. Nyholm, Kuusamo, Finland, March, 1993.

31. Personal communication with Neal Jotham, Humane Trapping Coordinator for the Canadian Wildlife Service.

32. The Asian flat-headed cat's claws can only be partially retracted.

33. Personal communication with Erik S. Nyholm, 1993. It is not known if the results of Nyholm's field work with European lynx have been published.

34. International Association of Fish and Wildlife Agencies. 1993. *Ownership and Use of Traps by Trappers in the United States, 1992.*

35. Nowak, Slough and Rivard. 1994. A Comparison of Three Live Capturing Devices for Lynx: Capture Efficiency and Injuries. *Wildlife Society Bulletin: 18.*

36. Personal communication with Guy Hodge, Humane Society of the United States, and Shuler, J.D. 1992. A cage trap for live-trapping mountain lions. *Proceedings of the 15th Vertebrate Pest Conference.*

37. Personal communication with Guy Hodge, Humane Society of the United States. His estimate is based on calculations done by Dr. Stanley Temple at the University of Wisconsin.

38. Knights, Peter. Devastating Bear Parts Trade Uncovered in Canada. *Animal Welfare Institute Quarterly.* 44(4): 8.

39. Hall, S. 1987. *The Fourth World: The Heritage of the Arctic and Its Destruction.* Knopf. Also see: Wishart, D.J. 1979. *The Fur Trade of the American West: A Geographical Synthesis.* University of Nebraska Press.

40. Roosevelt, Theodore. 1902. *How the West Was Won.* Charles Scribner & Sons.

41. International Association of Fish and Wildlife Agencies. 1993. *Ownership and Use of Traps by Trappers in the United States, 1992.*

42. Reader's Digest Associations, Inc. 1976. *Strange Stories, Amazing Facts.*

43. To kill captured rats painlessly, place the cage trap and its occupant into a large garbage can with torn up newspaper; then put a block of dry ice on the paper in the can, making sure the dry ice is not in direct contact with the rat or rats. Close the lid tightly. Carbon dioxide (CO_2), as it evaporates from the dry ice, will sink to the bottom of the can, causing the rats to fall asleep and pass directly into death.

44. This is because of the difficulty in transporting traps on foot across the marsh meadows.

45. Personal communication with Greg and Mary Smith, January, 1996. See also: Tomahawk Live Trap Company. 1985. *Trapped the Humane Way.*

46. Proulx, Gilbert, *et al.* 1994. A Snowshoe Hare Snare System to Minimize Capture of Marten. *Wildlife Society Bulletin*: 22. 639-643.

The Role of Spring-Powered Killing Traps in Modern Trapping

INTRODUCTION

During the winter of 1929, a young man named Frank Conibear spent every spare moment in his trapping cabin in Canada's Northwest Territories tinkering with pieces of spring wire. Conibear was motivated by disenchantment with his chosen profession and revulsion at the suffering he saw daily on his trapline, which he was later to describe eloquently in print.[1] From a practical standpoint, Conibear was also concerned that up to a third of the valuable mink he caught escaped by "wringing off," chewing or twisting off the trapped foot. By spring he had done what he had set out to do; he had devised the prototype of a spring-powered trap that could catch furbearers efficiently and kill them quickly.

The trap Frank Conibear built was far from the first spring-powered killing trap. Traps to kill furbearers had been on the market, in a variety of types, for 50 years. Even the basic scissors frame design of the Conibear trap was not new. It had been anticipated by an Ohio farmer named Merle Bigelow, who began selling a trap with eggbeater-like jaws in 1925. Further, not all killing traps had remained obscure. The Gibbs Two Trigger , designed by Walter Gibbs to prevent wringoff in muskrats, set all-time sales records for a single trap during the 1920s.

Two elements spared the Conibear trap from perishing commercially, as did the famous Gibbs Dope Trap[2] and scores of other designs, or from remaining in obscurity, as has the Bigelow. One was the trap's separate double-armed spring and two-way "whisker" trigger, sensitive to pressure from either direction. Both of these were new and useful features. The other was its inventor's tenacity. In 1957, 28 years after creation of his prototype, long after Conibear himself had renounced trapping and become a fairly well known author, the Animal Trap Company of America, the world's largest trap maker, adopted his trap for manufacture. The impact of the trap on small mammal trapping was profound. Within two seasons the small Victor Conibear (VC) 110 had virtually supplanted the leghold trap in the prolific marshes of the U.S. Atlantic coast.[3] Larger models of the Conibear were produced. It was touted as a universal trapping device that could replace the leghold trap and killing snare and make the dream of humane trapping a reality. Canadian humane groups began programs to provide trappers with Conibears in exchange for leghold traps.


Tom Garrett

Figure 1: Marten in Gabry Challenger trap.

It was Frank Conibear's dissatisfaction with the Animal Trap Company version of his trap, in which the clamping force was reduced to minimize danger to trappers, that first pierced the bubble of optimism. Tests undertaken at Conibear's behest at the University of British Columbia showed that the deaths of mink in VC 110s, and even in the more powerful original design, were often protracted and agonizing.[4] In 1969, Canadian humane groups set up a privately funded organization called the Humane Trap Development Committee (HTDC). Work commissioned by HTDC at Guelph and McMaster Universities in Ontario, along with provincial testing and films by Canadian filmmaker Ed Cesar, established that neither Conibears nor any other commercially available traps consistently killed animals rapidly in terrestrial sets.

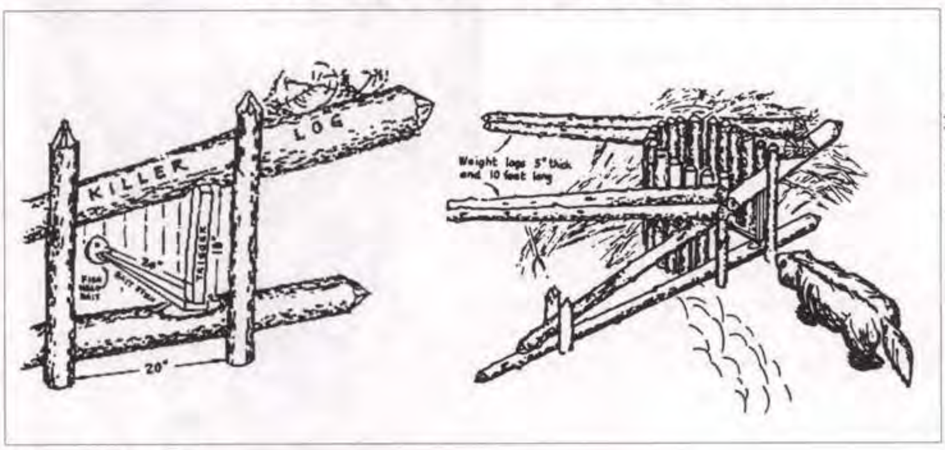
In 1973, HTDC's scientific work was taken over by the government-funded Federal Provincial Committee on Humane Trapping (FPCHT). After much testing, FPCHT concluded that it was possible to kill furbearers with spring-powered traps within three minutes. To determine the energy required to effect three-minute kills, FPCHT developed a trap simulator, a machine in which momentum and clamping force could be varied. Anesthetized victims were subjected to the machine until enough data was available to establish values of momentum and clamping force capable of killing animals of each species within three minutes. A second machine was built to provide a mechanical analysis of traps. Those with enough energy to meet or exceed the "threshold" for given species were tested on live, unanesthetized animals. Sixteen traps were eventually approved for certain species.[5]

After FPCHT closed its doors in 1981, responsibility for trap testing was assumed by the Fur Institute of Canada (FIC), a non-profit corporation funded jointly by the fur industry and federal and provincial agencies. Since 1985, traps have been tested under FIC auspices at a laboratory and compound at Vegreville, Alberta.[6] Thousands of hours of videotaped footage of animals approaching, investigating and caught in traps are on file. While the research conducted at Vegreville has been far more sophisticated than that undertaken in the 1970s and early 1980s, the earlier program's focus on trap development seems to have been lost. The "logical next step" to FPCHT, namely a program to bring effective new trap designs into production, and make use of the genius of aging designers such as Bill Gabry (see the Gabry Challenger trap in Figure 1)and Ed Kania, did not materialize. Instead, Canada got more academic research while its most valuable humane trapping resource, the talent of its trapper-inventors, has been allowed to wither. Brilliant prototypes are fading into obscurity while testing continues, ad nauseam, on mutant Conibears.

Since 1970, knowledge of how animals of various species approach traps, what happens to them when they are struck, and what a trap must do to kill rapidly had increased prodigiously. Vastly improved Conibear-type traps have been developed. For certain species, such as the marten, new designs that are both highly efficient and rapidly lethal are at hand. For all that is known of killing traps, most of those in use in North America are still Victor Conibears, which are barely distinguishable from those that came off the company's production line 40 years ago. This will change in Canada and, hopefully, in the United States if the Tripartite Agreement and the "Agreed Minute," which require traps to perform to a standard, are implemented early in the next century.[7] Thus far, only one nation, Sweden, subjects killing traps to scientific testing and withholds registration for those that cannot kill effectively.

The greatest disadvantage of killing devices large enough to kill furbearers is that they are inherently dangerous. This disqualifies them for use in open, settled areas where pets, farm animals and children are likely to encounter them. Where killing traps can be safely used—wilderness traplines, in marshes and swamps, for underwater trapping, and in holes and tunnels—they are often the best alternatives. A killing device of sufficient power, used in the correct way, is infinitely less inhumane for terrestrial trapping than steel jaw leghold traps.

SECTION ONE: VARIETIES OF KILLING TRAPS



Manitoba Trappers Manual

Figure 2: Deadfall trap

When Europeans invaded the New World, many North American peoples were using deadfalls to kill animals. Until the steel jaw leghold trap was introduced to North America around 1700, most of the fur shipped to Europe was obtained by deadfalls. As late as the mid-19th century, this method remained the main trapping system of northern Native Americans, such as the Cree. The deadfall in Figure 2 was taken from the Manitoba Trappers' Manual. It cannot be greatly different from those in use hundreds or even thousands of years ago.[8]

Exactly how long killing traps with iron or steel springs have been in use is not known. By 1800 an array of spring-powered mole traps, with stabbing tines or tongs to crush or strangle their victims, were in use in Europe. The common "snap" trap used to kill mice and rats appears to date from the middle of the last century. The first killing trap for furbearers in North America appeared on the market in 1878, and by 1900 a disparate assortment of killing devices were available. With the appearance of the Bigelow trap in 1925, the dozen or so mechanical principles enlisted to kill animals in traps were represented. Only spring-powered strangling snares remained to be invented.

The Gibbs Two Trigger

While killing traps have been available throughout the 20th century, most models sold poorly. For example, during the period 1919 to 1924, Oneida Ltd., then the world's largest trap maker, sold 25,000,000 steel leghold traps, but only 94,000 killing traps.[9] To the present time, only two killing traps can be said to have exerted a major influence on the history of trapping. These are the (now defunct) Gibbs Two Trigger and the Conibear.

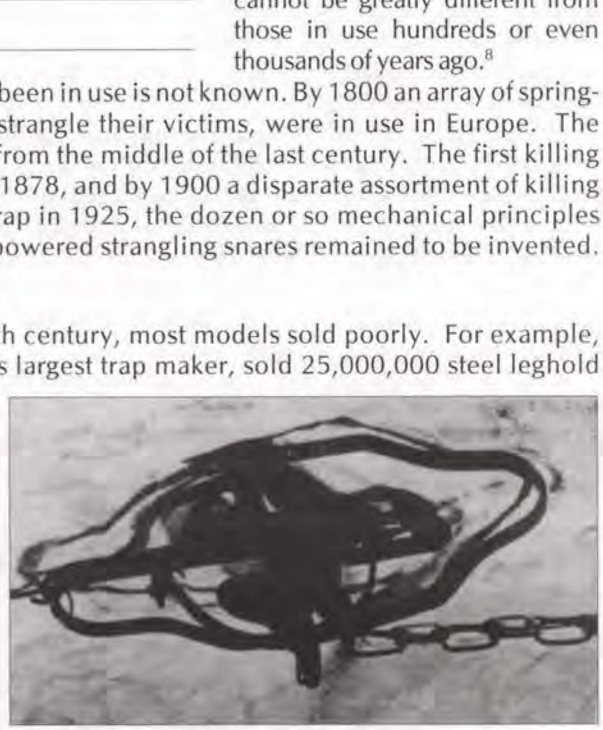


Figure 3: The Gibbs Two Trigger

In 1912, Walter Gibbs, a retired electrical engineer, purchased an 800-acre tract of tidal marsh on Chesapeake Bay in Maryland. There were thousands of muskrats on the property. When Gibbs learned that up to a third of those trapped each year in steel leghold traps escaped by "wringing off," he decided to do something about it. In 1919, he placed the Two Trigger on the market. As may be seen in Figure 3, the trap has an auxiliary striker that is released, along with the leghold trap jaws, when an animal steps on the pan. The striker hits the animal on the side and back, driving the victim against the base of the trap. While it could hardly, in most cases, have conferred a rapid death, the trap did kill muskrats. A trapper could be reasonably sure that the victim would be found dead in the trap when he made his morning rounds. For a period in the 1920s, the Two Trigger was the largest selling trap in North America and became standard equipment in tidal marshes from Nova Scotia to Louisiana.

Unfortunately, the ultimate result of Walter Gibbs's well-meaning effort to alleviate muskrat suffering was far from that which he had intended. The Animal Trap Company of America (formerly Oneida, and subsequently the disbanded Woodstream Corporation) developed a competing design that came up under the victim's leg: the sides of the bail striking the animal on either side of his trapped limb. This steel jaw leghold trap, illustrated in Figure 4, is called the "Stoploss." The Animal Trap Company acquired Gibbs's company in 1936, and ceased making the Two Trigger altogether in 1955. Thereafter, the Stoploss, in the absence of competing designs, dominated the market.

Figure 4: Stoploss trap

Tom Garrett

Figure 5: Stoploss trap with wrung-off muskrat limb.

The Stoploss is undoubtedly one of the cruelest traps ever made (see Figure 5). It appears, depending on ambient conditions, to kill from half to three-quarters of its victims within 24 hours, and 90% within 48 hours. Mink caught in these traps can continue to struggle, if not retrieved, for several days.[10] The Stoploss, although banned in Canada, is legal in most U.S. states.

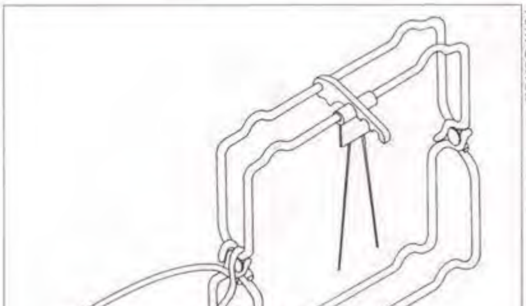
The Conibear Trap

Today, the Conibear trap is easily the most widely used killer trap in the world. It has been imitated, redesigned, readapted, tested and analyzed by dozens of inventors and engineers. At the time of his death in 1987 in Victoria, British Columbia, at age 90, Frank Conibear was still working to improve his design. Development on the trap continues to flourish.

The original Victor Conibear (VC) is very simple. The trap frame consists of two wire rectangles, scissor hinged in the center with steel pins. On one hinged side with the VC 110, and on each side with other models, a spring is affixed. The spring is a coil with (in the case of the 110 and 120 models) five-inch arms, the ends of which are looped around the sides. When the trap is set, as in Figure 6, the springs are compressed until their ends meet at the center of the trap. When the trap is triggered, the springs expand and force the rectangles violently against each other.

The trigger has two components. One is the fastener, which has semi-circular indentations designed to fit over, and hold, the other side. The trigger hinge hangs on the opposite side from the fastener. It is so constructed that if the wire "whiskers" are moved appreciably in either direction when the trap is cocked, the fastener is pried loose and the trap snaps shut.

Any animal that walks or swims through a Conibear set in an upright position and brushes the whiskers will be struck by the jaws. If the whiskers hang down from the top or project from the bottom, the animal will be struck dorso-ventrally. If the whiskers are positioned on the side, the animal will be struck laterally. The positioning of the strike, or strikes, will depend on what part of the animal touches the whiskers as the animal passes through the opening.



Tom Garrett

Figure 6: Victor Conibear in set position

The Animal Trap Company followed the VC 110 with the double-springed 120. In the early 1960s, the VC 330, a powerful double-springed model with ten-inch frames, designed to kill beaver, otter, lynx and wolverine, came on the market. Finally, in 1965, the Company marketed the VC 220, a double-spring model with seven-inch frames designed for raccoon, nutria, badger and opossum, and also touted as a fox trap. In 1971, sales of the VC 110 alone surpassed one million, a mark previously reached only by the #1 leghold trap and the Gibbs Two Trigger.[11]

Improved Conibears

With the expiration of the Victor Conibear patents in the late 1970s, a spate of competing Conibears entered the market. Several of these designs attempted to remedy the mechanical defects identified in HTDC and FPCHT testing of the Victor Conibear, especially its lack of clamping force. One way to prevent the springs from opening fully at impact—and thus exhausting clamping force—is to alter the shape of the jaws. Another means of accomplishing this, which has the added advantage of increasing the trap's effective mass, and hence its momentum, is to weld additional striking bars to conventionally shaped traps. The Magnum 120 Conibear, adapted at Vegreville, uses this system, as does the Sauvageau 2000 series produced by Marcel Sauvageau of Ste. Hyacinthe, Quebec. The trap shown in Figure 7 is the Sauvageau 2001-8, adapted for Arctic fox. Several thousand Sauvageau traps have been distributed to native trappers in the Yukon and Northwest Territories in a trap exchange program being carried out by the territorial governments.

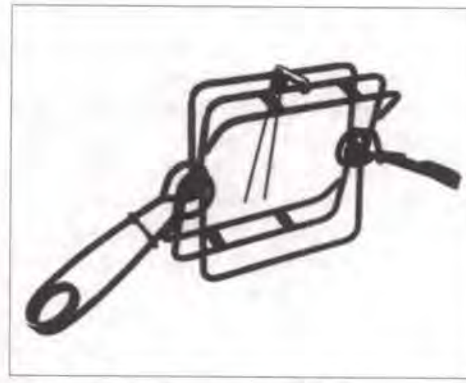
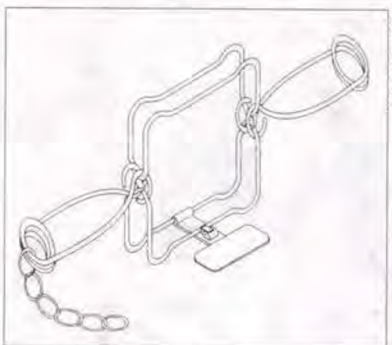


Figure 7: The Sauvageau 2001-8

Frank Conibear's early prototypes, developed chiefly for mink, were equipped with pans. Ironically, one of the recommendations emerging from Vegreville 50 years later has been that Magnum 120 Conibears used in trapping mink be fitted with pans.[12] Figure 8 is a standard Conibear 120 with a pan designed by Milan Novak and the late Lloyd Cook.



Tom Garrett

Figure 8: Conibear 120 equipped with pan

The Conibear has a well deserved reputation for being dangerous to use. As a result, many trappers have been reluctant to adopt "beefed up" designs with augmented clamping force. Edouard Belisle of Ste. Veronique, Quebec, has succeeded in configuring the Conibear springs so as to accommodate a self-activating safety. As may be seen in Figure 9, a light coil spring pushes a safety clip up the arms of the Conibear spring when they are sufficiently compressed. With this system, a trapper can release himself, even if he is caught by both hands, by compressing the spring arms with his feet.

Figure 9: The Belisle Safety

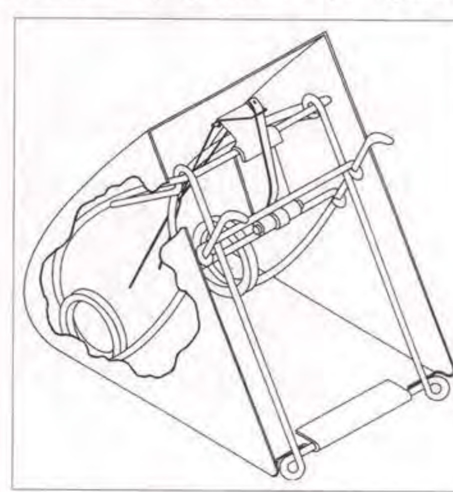
The Gabry Traps

Some of the most versatile and effective traps ever built were those designed by Bill Gabry, who died in 1993 at age 85.[13] Both of the traps illustrated, the Challenger and the Bionic, were approved at FPCHT for mink and marten. The Bionic was retested at Vegreville and approved for fisher as well as smaller mustelids.[14]

The Challenger, shown in Figure 10, is designed mainly for smaller furbearers, such as marten. It is constructed entirely, except for the trigger assembly, of .179-inch diameter steel wire. The opening into which the animal inserts his head is only five inches wide and four and a quarter inches high. The trap weighs only a third as much as the Kania or Hansen designs.

As may be seen, the trap is made up of two springs constructed from the same piece of wire. Each has an upper and a lower arm of approximately the same length. The upper arms are joined together at the front of the trap, above the opening. The bottom arms are also joined with two separate crossbars. These are the killer bars. Another piece of wire is shaped to frame the entrance to the trap and form its base.

The trigger consists of the "belt buckle" hanging above the opening and the whiskers extending to the center of the trap. To set the Challenger, the tongue of the buckle must be flipped up, hooked from the back with a wire loop, and temporarily secured by a safety. Then the bottom arms of the trap are pulled up until the cross piece resets on top of the hinge of the buckle. The trap, with the safety removed, is triggered by a forward pull on the whiskers, to which a bait is attached. The trap is converted into a cubby by folding a plastic envelope partially around it.



Tom Garrett

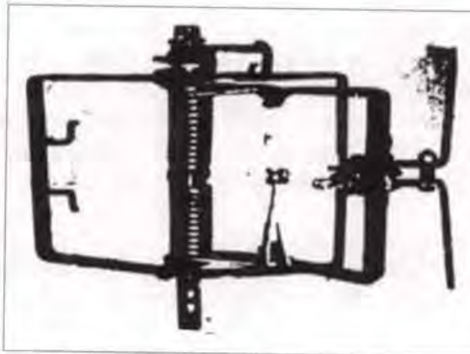
Figure 10: Gabry Challenger trap

The Bionic, shown in Figure 11, represents the inventor's effort to build a single killer trap that can be adapted to take mink, marten, fisher, lynx, bobcat, wolverine, otter and even canids. It is, in form, nothing less than a gigantic mouse trap.

The Bionic consists of a steel frame. Through the center is an axle on which the striker (which is exactly the dimension of one-half the frame) is hinged. The two multi-coil springs that power the trap encircle the axle. The trap is cocked by rotating the striker back and fastening it. When tripped, just as with a mouse trap, it describes a 180 degree arc.

The Bionic, however, is far more sophisticated than a mouse trap. The striker is pulled into place and fastened without tension. Then the springs are "wound up" by means of a ratchet and pawl attached to the axle, enabling the force to be adjusted according to the size of the intended victim.

To bait the trap, a plastic flap is folded around the axle and secured with tabs to make a small bait chamber. Bait is placed inside the chamber and attached to a wire connected to the trigger. An animal who reaches in and tugs the bait triggers the trap, bringing the striker, at tremendous velocity, onto his head or neck. The Bionic may be made—to some degree--species specific by adjusting the size of the bait cone; a small cone prevents larger animals from reaching the bait and triggering the trap.



Tom Garrett

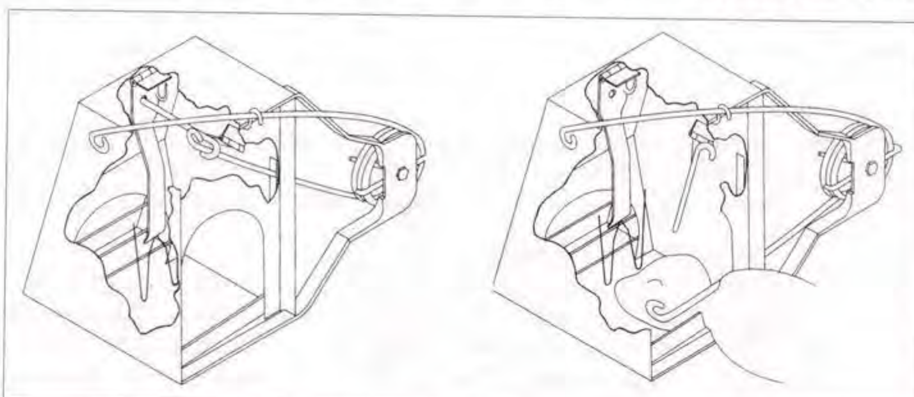
Figure 11: Gabry Bionic trap

The Kania Trap

Ed Kania, now in his early seventies, lives with his wife Lydia on a small farm in the Kootenay mountains of southeastern British Columbia. For over 30 years, the Kanias derived much of their income form a trapline where marten are the primary species. In the early 1970s, dismayed by evidence of protracted struggle in his Conibear and Mohawk traps[15], Kania decided to build his own, combining the trap mechanism and cubby into one unit so as to guarantee uniform positioning of the trapped animal. In 1981, the FPCHT approved the trap for small furbearers. It was retested, with the same outcome at Vegreville.

The Kania trap looks, at first appearance, like a small metal birdhouse to which has been attached an ungainly steel handle. The "birdhouse," however, is the cubby, and by removing the sheet metal plate of its left side, one can see the mechanism and perceive quickly how the device works. At the rear of the cubby is a bait chamber. Directly above the door, aligned with its threshold, is the striker bar; one arm of a powerful spring bolted outside the cubby. The other arm of the spring, the "handle," is at a 90 degree angle to the striker when at rest. To tense the spring, thereby cocking the trap, it must be depressed 90 degrees and hooked to the side of the cubby.

The simple components inside the cubby, pictured in Figure 12, constitute the trigger mechanism. Once the trap is cocked, any animal that enters to secure the bait and brushes the prong hanging down from the trigger will release the striker, which descends with a violence that must be seen to be appreciated. For marten, the traps are nailed, entrance down, about four feet above the snowline, on tree trunks liberally swabbed with bait to attract the animals. All of the marten I saw in Kania traps in several days of traveling with Kania on his trapline look very much as the animals shown in Figures 13 and 14: beautiful, two-foot long mustelids hanging lifelessly from the cubbies. There were no signs of struggle, no scratches on the tree trunks or bark under the claws. Many of the animals still had bait locked in their jaws.



Tom Garrett

Figure 12: Kania trap in set and triggered position

Tom Garrett

Figures 13 and 14: Marten in Kania traps: "No sign of struggle."

The Kania trap is one of the safest killer traps ever designed, and one of the easiest to use and repair. Trapper Norm Blaney of Prince George, British Columbia, summarized the trap's virtues: "Kania, my favorite. Bait once a season out of weather. Kills instantly, no sign of struggle."[16] Some trappers, however, have objected to the trap's bulk and high initial cost and complained that the bait chamber is too small. In response, Kania now sells it either with the sheet metal cubby or as a separate mechanism that trappers can mount in cubbies of their own design. Quantities of Kania mechanisms without cubbies have been delivered to native trappers and exported to Europe.

Kania traps are now available commercially only in mink/marten size. The larger models Ed Kania had hoped to build for Arctic fox, fisher and raccoon remain on the drawing board.

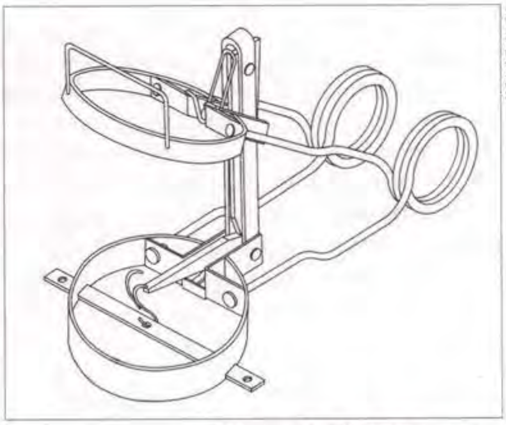

Tom Garrett

Figure 15: The Hansen trap

The Hansen Trap

The Hansen trap (see Figure 15), invented by Mike Benz of Horsefly, British Columbia, is among those approved by the FPCHT. As may be seen in Figure 16, the striker is circular on the theory that the victim will be properly positioned without regard to the angle of approach.

Figure 16: A mink dead in a Hansen trap.

European Killing Traps

Since 1984, Tommy Svensson, the Swedish Environment Ministry's chief technical officer for hunting and trapping, has tested over 160 traps, both in the field and at a compound located at the National Veterinary Center at Uppsala. About 30 Swedish-designed killing traps have been approved for small furbearers. Most of these devices are oversized mouse traps.[17]

Almost no hard scientific information has been acquired on the performance of traps in use in Europe outside Sweden and Finland.[18] The powerful trap shown in Figure 17 is of a type long used for taking foxes in Norway, France, Germany and elsewhere on the Continent, but information on their performance is limited to postmortem examinations and anecdotal accounts. These traps are reportedly set in horizontal position, in shallow water, with the bait attached to the trigger mechanism at the center of the trap projecting above the surface of the water. In order to receive a rapidly lethal blow on the neck, instead of being gripped on the torso or abdomen, it is necessary for the victim to reach over the trap jaws to take the bait rather than stepping inside them. It strains credulity, given the circumference of the jaws, to suppose that foxes always do this.

If trap testing is undertaken pursuant to the Tripartite Agreement, many European killing traps will have to be redesigned or discontinued. Unfortunately, two of the most commonly trapped European species, the stone marten (*Martes foina*) and the ferret (*Mustela putorious*) are not on the list of 19 furbearers to which the agreement applies.

Figure 17: Peik Benixson with a European killing trap.

Power Necksnares

The technique of using some kind of external pressure, such as a bent sapling, to enhance the killing effect of the common snare is a venerable one. The first man to emerge with a feasible spring-powered killing necksnare was a trapper named Lawrence Edward King from Manitoba, Canada. The King Necksnare consists of two flat metal bars about two feet long, joined in the center by a powerful coil spring. One bar (the power bar) opens and closes 180 degrees, like the blade of a pocket knife. To cock the snare, the power bar is rotated under tension to within a few degrees of the other (base) bar, and fastened. The snare cable is threaded through the free end of the base bar.

The King Necksnare is set like a common necksnare, with the noose opened at the proper diameter for the species being sought, and strung at the proper height along a trail. The base bar can either be nailed to a log, or held upright at an angle by stabbing an attached prong into the ground.

When an animal inserts his head into the noose and jerks the cable, the snare is triggered. The power arm moves 180 degrees, wrenching the victim against the base bar (through which the cable is threaded) and tightening the noose violently around his neck.

In 1978, FPCHT investigators tested prototypes of the

King Necksnare and two other designs. Seven foxes were killed with variable results. One animal became unconscious and lost blinking reflex in 27 seconds. Another had to be euthanized after 18 minutes in the same (unidentified) necksnare. In 1988, a test of foxes in the King, Olecko and Mosher necksnares occurred at the Vegreville, Alberta, test facilities of the Fur Institute of Canada. The mean time to death was reportedly under five minutes. Although the extreme variability in time to death which characterized the 1978 tests was less evident with current designs, none of the power necksnares has yet demonstrated the ability to consistently kill canids quickly.[19] Since the late 1980s another power necksnare, of simple design, developed by Bruce Bertram of Birtle, Manitoba, has been marketed in Manitoba and western Canada as the "Bert Power Ram" and 25,000 have reportedly been sold. [20] While compound testing of the device has not yet been carried out, twenty coyotes taken by Ram necksnares in southern Manitoba during the 1988-89 season were necropsied by one of Canada's most experienced wildlife pathologists, Dr. Harry Rowsell. Dr. Rowsell estimated, from pathological evidence, that 11 of 20 coyotes making up the sample had succumbed or become irreversibly unconscious within three minutes. Four catches were "obstructed" by one or both front legs inside the snare noose; two animals were caught around the abdomen.[21]

SECTION TWO: KILLING TRAPS IN THE FIELD

Because a trap works well under controlled laboratory conditions does not mean it will necessarily work in the field. Numerous theoretically effective designs have proven ineffectual on traplines. Similarly, the fact that a trap is effective against a species in one habitat does not insure that it will work in another. A trap's performance can vary tremendously, even when applied against the same species, under different sets of conditions. Learning to use a potentially effective trap efficiently in different habitats can be extremely exacting.

This section provides some glimpses of how killing traps are used under different terrestrial and aquatic conditions and provides examples of the problems encountered in adapting them for use. For most trappers, "killing trap" still means "Conibear." But an increasing number of trappers are turning to new designs. Two such traplines are described: one equipped with the Gabry Challenger, the second operated by power necksnare inventor W.I. Mosher.

Terrestrial Use of Conibears

To make a clean kill with a Conibear trap, the victim must be positioned correctly. If the animal is not correctly positioned, even the most powerful Conibear modifications may yield grisly results, as seen in Figures 18 and 19. Knowledgeable trappers agree that Conibear sets in the open are usually not desirable. Though still widely used, the traditional "running pole" sets for marten with the trap in the open atop a pole, propped against a tree or fastened between trees, yield miscatches and claim numerous non-target victims.

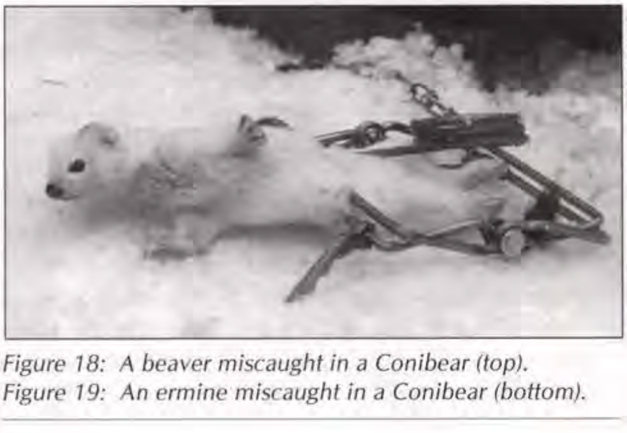
The ermine shown below has been, typically, miscaught in an open set with a VC 110. He died slowly and painfully from constriction. The recommended way to set Conibears on land is in a baited cubby.

For marten and fisher, a cubby is typically a box made of one-inch lumber, with the trap positioned at the opening and bait placed in the rear. When an animal attempts to enter to get the bait, the dangling whisker triggers are brushed, setting the trap off. An identical system for taking raccoons in marshes has now become standard. "Raccoon boxes" are even sold commercially by some trapper supply firms.

Mink can be taken in Conibear boxes as well, although some trappers prefer to set the traps at the entrance of holes in banks, or in more naturalistic cubbies. Lynx and bobcat sets are typically made in cubbies constructed of brush or light poles. Most trappers report the best results by positioning the trap (usually a VC 330) at about the height of the animal's head. In November, 1988, Dr. Frank Mallory of Laurentian University demonstrated that Arctic fox could be caught successfully with Conibears by simply digging a hole in the snow with bait at the rear and a trap (mounted in a frame) at the opening. Mallory's results were confirmed in field tests conducted in 1990 and 1991 by Gilbert Proulx, then chief of trapping research at Vegreville, with the Sauvageau 2001-8. None of the 64 foxes (62 Arctic fox and two Red fox) were found alive. Most of the animals had been struck on the head, the rest on the neck.[22]

Brian Clark of Pink Mountain, British Columbia, uses ordinary Conibear boxes for marten and fisher. But instead of relying on the animal's pushing the trigger to get at the bait, he pushes the whiskers inward and ties the

Frank Wassenberg



Ed Ceasar

Figure 18: A beaver miscaught in a Conibear (top).
Figure 19: An ermine miscaught in a Conibear (bottom).

bait directly to them. "This," Clark writes, "results in the jaws hitting the animal just behind the ears, which gives an almost instant death."[23] The Clark system for Conibears is almost exactly the system that Bill Gabry has employed with his Challenger trap.

No matter how cleverly Conibears are deployed, however, there is an element of indeterminance resulting from the nature of the trigger and because it is hard to guarantee that the center of the trap will not change position when it discharges.[24] These features have led some trappers to seek more consistent killing devices from among the new designs.

The Challenger

Early one morning in January, 1985, I drove into the yard of the Molliet ranch on the Big Thompson river near the town of Vavenby, British Columbia, and got out of my car amid a ring of fiercely growling huskies and shepherds. Bill Gabry dismissed the dogs with a wave of his mitten, and stepped forward to shake hands. A tall, comely young woman with auburn braids projecting from a red stocking cap introduced herself as Valerie Molliet. Her trapline, she explained, was 36 miles each way, and we were already late in starting.

Tom Garrett

Figures 20 and 21: A dead marten in a Gabry Challenger trap.

After mounting snowmobiles and roaring along for a few miles up a mountain trail, we came to the first trap, a white object which proved to be a plastic envelope folded around the trap to form a cubby, positioned chest high on a tree. The entrance faced down, with killing bars poised above, and bait tied to the whiskers.

Valerie swabbed scent on the tree trunk, a process she repeated with the next two traps, which were also empty. At the fourth stop, a marten was hanging from the cubby. He was a large male, with a coppery sheen to his luxurious coat. His short, powerful legs hung at his sides without a trace of bark under the claws. There were no scratches on the tree trunk, nor bits of bark in the snow. His jaws, frozen in the instant of death, still clutched the bait. Four of five additional marten retrieved during the day, including the animal shown in Figures 20 and 21, were also gripping the bait in their mouths.

It was on this trapline, which ascends spectacularly from 2,000 feet altitude to alpine tundra, using a Challenger trap, that Valerie caught the most commercially valuable American marten to enter the world fur trade in 1985.[25]

The Mosher Necksnare

In December, 1986, I drove to Mayerthorpe, Alberta, north of Edmonton to observe the necksnare in use and talk to its inventor, W.I. Mosher. Mosher is an affable man, now in his mid-seventies, with a musical "down east" accent. He and his wife, Vera, moved to Alberta from New Brunswick in the early 1980s. Mosher takes up to 40 coyotes a winter with his necksnare and has trained a number of local residents in its use.

The operation of the Mosher necksnare can easily be grasped by the photographs of the device in set and sprung position in Figures 22 and 23. Rather than simply having a power arm and a base arm, Mosher has hinged a separate rod to draw the snare tight. This, discounting friction, gives Mosher's device more acceleration than other snares. He deliberately uses a thin cable without a lock so that if a miscatch occurs, the animal can chew out.

The Mosher Necksnare is lighter and easier to hide than the King Necksnare. Mosher uses it in light brush without elaborate attempts at concealment, and insists that he has as many catches, snare for snare, as he would with common snares. As for humaneness, the only scientific data, aside from the results at Vegreville showing the time to death for foxes between two to six minutes, are necropsies performed in 1984 by Patricia Dwyer for the Province of Alberta. Dwyer necropsied 13 coyotes taken by Mosher in his necksnare. She found that the animals died rapidly of circulatory failure. In all 13 cases, both common carotid arteries were closed, while the trachea remained open.[26]

The coyote pictured in Figure 24 was captured in light bush country near Mayerthorpe after a fall of fresh snow. The animal's tracks in the snow showed very little movement after seizure by the necksnare. In contrast to most victims of common snares, the animal had no appreciable edema or bleeding of the neck muscles in the area of capture.

Aquatic Use of Conibears

Despite its comparatively small size, Maryland is a major trapping state. This is primarily because of the prodigious network of marshes bordering the Chesapeake Bay which yield large numbers of muskrats, as well as raccoon, nutria and fox.

Tim Morris makes drowning sets for muskrats on his trapline in tidal marshes near the mouth of the Backwater River on the Eastern Shore of the Chesapeake Bay. When I visited Morris's trapline in February, 1985, the marsh had been burned over and walking was fairly easy. The marsh was dotted with muskrat houses and thickly laced with winding, water-filled channels up to two feet deep—runways worn in the marsh by pullulating generations of the little rodents. Here and there one could see a bamboo shaft sticking up in the marsh, marking a point where Morris had set a trap.

Morris and his fellow trappers along Maryland's Eastern Shore use Conibear traps almost exclusively. They place the Conibears upright in the narrow, well defined runways with the tops of the traps a few inches under the water so muskrats will swim through them. "You simply can't catch a muskrat in a runway with a leghold trap," Morris told me. "They swim right over them. You have to set leghold traps on their toilet stools or around their houses. It takes three times as long. You get a lot of females and little ones near the houses, but mostly males out in the channels."

Ray Willy, who had trapped nearly 40 years and had used legholds early in his career, was even more emphatic. "It's the difference between daylight and dark," he said. "I can catch as many muskrats with 100 Conibears as with 600 leghold traps. No wringoffs, no problems. I'd quit trapping before I'd go back to legholds. So would most trappers I know."

The trappers believe that the deaths of muskrats taken underwater in Conibears are swift. "A couple of times I've set traps and had muskrats hit them while I was close enough to hear," Morris said. "They thrash furiously for 30 seconds. Then it's over." A necropsy report by Dr. Dianne Ferris of Washington, D.C., confirmed the impression of quick death. In four of the six randomly chosen trapped muskrats she examined, the spine was severed; in five the lungs were collapsed or full of blood. In one animal, the atrium of the heart had burst, and in the others there was cardiac contusion. According to Dr. Ferris, "This trap appears to cause almost instantaneous deaths by way of spinal cord transection and evacuation of air from the thorax as well as cardiac contusion. None of the animals had fluid other than blood in the lungs."[27]

Tom Garrett

Figure 22: Mosher necksnare in set position.

Figures 23: Mosher necksnare in triggered position.

Figure 24: A coyote in a Mosher necksnare.

The Louisiana Bayous

Louisiana is the largest trapping state in the U.S., leading all others in numbers of nutria, mink and otter taken. It also accounts for up to ten percent of the U.S. muskrat catch, and large numbers of raccoons and canids. The source is an immense expanse of marshland stretching all the way from Mississippi to the Texas line.

Louisiana marshes, by and large, are less stable than those further north. Because of this, muskrat runways, instead of being deep, water-filled channels as in most northern marshes, fill in almost as rapidly as they are worn down. It is unusual to find a runway more than a few inches deep. This means that the animals run, or bound, along the runways rather than swim in them. This completely changes the economics of trapping with Conibears versus leghold traps.

Benny Welsh of Grand Chenier, Louisiana, demonstrated this to me on the marsh he traps each year. "When we first got Conibears," he said, "we thought all we would have to do is set them in runways, where we set legholds. But we found that only about one rat in twenty will run through a Conibear on a runway. They dodge around it and keep going. The only time you can catch rats that way is early in the season, when the marshes are still flooded."[28] What I observed while doing fieldwork in Louisiana tidal marshes on the State Wildlife Refuge south of New Iberia in 1988 was consistent with Welsh's experience. Conibears were at least as efficient as leghold traps during periods of rain and high water, but far less efficient when the marshes dried up. Conibears appeared to work indifferently for nutria, who are now the most numerous furbearer in the marshes.[29]

Figure 25: A trapped nutria in a "stoploss" leghold trap.

The nutria shown in Figure 25 was caught in a Stoploss leghold trap set for muskrat. The animal struggled until he died, caked with mud, of exposure and exhaustion. Nutria, a South American rodent, were released into the Louisiana marshes in the late 1930s. Prior to the collapse of the fur market in 1990, as many as two million a year were trapped.

END NOTES

1. In 1946 Frank Conibear wrote a pamphlet called *Testimony of a Trapper*. He was best known as an author for a book on beaver called *The Wise One*.

2. In 1925 Walter Gibbs vigorously, although unsuccessfully, marketed his answer to inhumane trapping of larger animals: The Gibbs Dope Trap. The dope trap was a leghold trap with a separate bail or arm, similar to that of the Stoploss pictured in Figure 5, which it doubtless inspired. The arm came up under the animal's trapped leg, positioning the vial of cyanide with which it was tipped in perfect position for the animal to bite.

3. Mr. Howard Zeller wrote an article in the July, 1959 issue of *Maryland Conservationists* concerning muskrat trapping on Maryland's Eastern Shore. "The new Conibear Trap," he concluded, "is so much more efficient that trappers simply cannot afford not to use it, and in a short time it will replace the leghold trap that has been the workhorse for over 300 years for trapping furbearers."

4. The tests were undertaken by Dr. McTaggart Cowan over several years in the mid-1960s. They showed that lateral strikes with killer traps are far less likely to be lethal than dorso-ventral strikes. This result was subsequently confirmed, and quantified, by the Federal Provincial Committee on Humane Trapping. It requires approximately twice the force to kill rapidly with a lateral strike. Even with dorso-ventral strike, the blow must fall on the head, neck or upper torso to be rapidly lethal.

5. Report of the Federal Provincial Committee on Humane Trapping, Canadian Wildlife Service, 1981.

6. The Fur Institute of Canada testing site is a specially prepared ten-acre compound in aspen woods. Along with housing for furbearers, a number of naturalistic pens, ranging from a few hundred to thousands of square meters in size, have been prepared for trap testing. Each testing pen has a hook-up for an infrared video camera that can be controlled remotely from a central laboratory and focused on a trap that is to be tested.

7. For a trap to achieve certification under the tripartite standard for species other than ermine and marten (for which the temporal thresholds are 45 seconds and 120 seconds respectively), 80% (16 of 20) of the test animals taken must be irreversibly unconscious within five minutes. This requirement is less rigorous than those established in the voluntary 1984 Canadian killing standard or in the final draft of the defunct ISO killing standard developed under the auspices of the International Organization for Standardization.

8. Small deadfalls, set five to eight feet off the ground, are extensively used in Scandinavia to take Pine marten (*Martes martes*) and have been approved for use by the Swedish Government.

9. Gerstell, Richard. 1985. *The Steel Trap in North America*. Stackpole Books.

10. This appreciation derives from talks with trappers and the author's own observations.

11. Gerstell, Richard. 1985. *The Steel Trap in North America*. Stackpole Books and personal communication with Woodstream researcher Peter Askins.

12. Proulx, Gilbert, Barren and Cook. 1990. The C-120 Magnum with Pan Trigger: A Humane Trap for Mink (*Mustela vison*). *Journal of Wildlife Diseases*. 26(4): 511-517. Also see Novak, Milan, et al. *1994. Trapping Martens with Kania, LDL and Conibear Traps*. Ontario Ministry of Natural Resources. Also Novak, Milan. *Trapper's Opinions of Marten Traps and Sets Field Tested From 1988 to 1990 in Northern Ontario*.

13. In the author's view, Bill Gabry's contribution to instant-kill trapping has been greater than that of entire roomfuls of self-important scientists and officials who met to discuss the issue. Unfortunately, no real effort by decision makers was made to exploit his talent.

14. Dr. Gilbert Proulx, former chief FIC scientist at Vegreville, tested the Bionic for fisher with complete success. Proulx told the author that he regards it as the most effective design tested for that species. See Proulx and Barrett. 1993. Evaluation of the Bionic Trap to Quickly Kill Fisher (*Martes pennanti*) in Simulated Natural Environments. *Journal of Wildlife Diseases*. 29(2). Before he died, Bill Gabry designed a larger version of the Bionic specifically for coyotes.

15. The Mohawk trap is a Conibear-type trap powered with a coil spring that can be wound up to adjust the force of the strike.

16. Letter from Norm Blaney to the author, July, 1985.

17. Personal communication with Tommy Svensson, Chief Technical Officer for Hunting and Trapping, Swedish Ministry of the Environment. The author visited the Uppsala facility in March, 1992.

18. A commonly used British killing trap, the Fenn, was field tested against muskrats in southern New Jersey in 1988. Necropsies performed by Dr. Harry Rowsell of the Canadian Council on Animal Care on Fenn captured muskrats secured by the author, confirmed that several victims had experienced protracted deaths. Subsequent mechanical evaluation showed that the Fenn is seriously deficient in clamping force. Another trap, used in Belgium to take muskrats (and, in a larger version, nutria) is so deficient in clamping force that it is possible to insert one's hand, without serious discomfort, between the closed jaws of the trap.

19. A discussion of the 1978 necksnare tests may be found in the report of the Federal Provincial Committee on Humane Trapping. Information on the 1988 tests derives from a presentation by Gilbert Proulx in Vegreville, November, 1988.

20. Letter from Bruce Bertram to the author, May 12, 1997.

21. Rowsell, Harry. 1989. *Post-Mortem Examination Summaries and Scores of Specimens.* Canadian Council on Animal Care. While common necksnares are, unfortunately, exempt from the Tripartite Agreement, the author understands that power necksnares are included and will be forced to meet the standard. Accordingly, if the Agreement is implemented, all power necksnares marketed in Canada will have to be tested, or retested, within the next five years.

22. Dr. Frank Mallory's field work, while demonstrating that Arctic foxes can be captured in killing traps as efficiently as in leghold traps, was undertaken with traps that do not have enough energy to kill their victims rapidly. Eight of the 44 Arctic foxes found in 230 Conibears were still alive. Tests of the more powerful Sauvageau 2001-8 are described in Proulx, G. 1991. Ontario Ministry of Natural Resources.

23. Letter to the author from Brian Clark, October, 1985.

24. A commercial device called the Grauberger holder is available to fix the axis of Conibear traps in place. Unfortunately, few trappers use it.

25. Letter to the author from Valerie Molliet, June, 1985. The marten in question commanded a price of $240, as compared to an average for American marten that season of about $50.

26. Personal communication with Patricia Dwyer, July, 1986.

27. Necropsy report by Dr. Dianne Ferris, April, 1985.

28. Experience on Benny Welsh's 400-acre marsh provides an example of the fluctuations in muskrat numbers in Louisiana, and perhaps of the acute ecological problems afflicting the entire delta as well. In 1983-84, the marsh yielded 6,600 muskrat! By 1987-88, muskrat numbers were so low that Welsh did not trap.

29. The two million nutria formerly trapped each year in Louisiana were chiefly taken in leghold traps. The delta is crisscrossed with shallow canals dug for the express purpose of trapping nutria from boats. While the majority are trapped along canal banks, many, like the animal pictured, were also taken as incidental catch in traps set in marsh meadows for muskrat. The same is true of mink and raccoon.

The Role of Legsnares in Modern Trapping

INTRODUCTION

Mechanically Activated Legsnares

In 1959, the Weyerhauser Timber Company hired a man named Jack Aldrich of Castle Rock, Washington to trap bears on some of its timber lands. At the time the only way of trapping the animals was with steel bear traps, some of which weighed up to 30 pounds[1] and could crush a human's leg. The devices were so dangerous that many U.S. states had outlawed them. So cruel were the traps that a single exposure to a trapped bear in 1925 led Edward Breck to found the Anti-Steel Trap League.[2]

Aldrich quickly decided that there must be a better way to catch bears. He devised a legsnare in which a spring-powered arm cinched a noose, fashioned of 3/8-inch flexible steel cable, around the animal's leg. The Aldrich legsnare worked. It was far lighter and easier to set than a bear trap and captured animals efficiently. Instead of grossly maiming its victims, it caused little visible damage. Within a few years of being patented in 1962, the Aldrich legsnare had turned the bear trap into a gruesome relic found in museums, on the weathering walls of backcountry barns, and in the hands of collectors of the macabre. Maine is the only state which continues to permit use of steel jaw traps for bear.[3]

Rene Rivard

Figure 1: A lynx in a Fremont legsnare.

The dramatic success of the Aldrich legsnare for bears was not readily duplicated with smaller animals. Scaled down Aldrich legsnares worked reasonably well for live-capturing wolves, but undependably, at best, for smaller canids. Adaptations of the design, notably the Novak and Victor (Woodstream) legsnares, marketed after the basic Aldrich patent expired in 1979, caused unexpectedly severe damage to their captives' legs. However, in field tests conducted in 1985-86, an Aldrich modification developed by retired park superintendent Al Fremont of Candle Lake, Saskatchewan, caused less than one-sixth as much damage to trapped coyotes, based on a cumulative injury scale, as did steel traps.[4] Brian Slough, Wildlife Biologist for the Yukon Territories, began using Fremont legsnares in 1986-87 to live-capture lynx for translocation to New York State. During the winter of 1987-88, 18 of 19 lynx snared in the Yukon were captured without injury and released in the Adirondacks (see Figure 1). While lynx taken for translocation earlier in #3 padded leghold traps lost toes because of freezing, even in comparatively mild temperatures, those captured in Fremont legsnares were able to survive temperatures as low as -30° F without frostbite.[5] Subsequent experience has confirmed that the Fremont legsnare, set clear of possible entanglement and with rubber tubing around the contact surface of the cable (note Figure 9), can catch both lynx and coyote with few serious injuries and with reasonable efficiency.[6]

As Aldrich legsnares gained acceptance in North America, a very different type of spring activated legsnare came into use in Scandinavia. The Aberg legsnare, initially called Jan's Catcher, was invented by Jan Aberg of Skellefteå, Sweden, in 1973. After years of testing, it was approved for trapping foxes in the northern half of the country. Aberg legsnares are the chief means of trapping foxes in Sweden. They are now being used for foxes in Finland as well and have been successfully adapted to catch lynx for scientific purposes.[7]

The coil spring activating the Aberg legsnare is housed in a long plastic tube. The snare cable is coated with Neoprene, and holds the animal's leg by spring pressure rather than with the cable lock employed by most other snares. Used to trap foxes in deep snow, and attached to a drag rather than secured to a fixed spot, this legsnare has been shown to produce practically no leg injuries. It is considered more efficient for foxes than the steel jaw leghold traps (banned in Sweden in 1968 and in Finland in 1991) that were previously used.

Since 1990, the search for effective legsnares has been stimulated by the intensifying international controversy over use of steel jaw leghold traps. Development has been further encouraged by the willingness of the U.S. Department of Agriculture's Wildlife Research Center to work directly with inventors by testing legsnares on coyotes, both at the Millville, Utah, research station and in the field. Since the steel jaw leghold trap was banned in European Union countries in 1995, two new designs, the Belisle and Godwin legsnares, have achieved substantial European sales.

The Belisle legsnare, invented by Edouard Belisle of Ste. Véronique, Quebec, is triggered by an ordinary pan, and uses elongated steel jaws to transport the snare noose up onto the animal's leg. The jaws are weakly powered and fall away as soon as the animal begins to struggle. The noose—as with Aldrich type designs—is maintained by a snare lock. The snare cable is either staked down or attached to a drag.

The principle employed by the Godwin legsnare, invented by Saskatchewan trapper Barry Godwin, is familiar to anyone who remembers a once popular toy, the "Jack-in-the-box." Godwin employs a coil spring six inches in diameter, which can be compressed to a thickness of about an inch when the device is set, to bring the noose onto the animal's leg. The pan is centered inside the coil with the noose, in set position, placed on top of it. When an animal steps on the pan, the motion of the coil cinches and properly positions the noose.

Several other legsnares with evident potential have been tested and are in an advanced stage of development.

Common Snares

Common snares, such as the one shown in Figure 2, are simple lengths of cable with nooses and locks used in vast numbers to strangle furbearers ranging from squirrels to wolves. The deaths they inflict on their victims are unarguably agonizing. Moreover, such snares are notorious for non-target captures. Since steel airplane cable came into use in the 1920s, millions of herbivores—deer, pronghorn antelope, elk (wapiti), moose and domestic animals—along with millions of hares and rabbits, have perished as incidental victims of killing necksnares. It is with this cruelty and destruction that most people, quite correctly, associate common snares.

During the 1980s, however, common snares came into wide use for capturing animals alive. The results, both with respect to efficiency and relative humaneness, have been surprisingly good. In the Great Plains and Rocky Mountains of the United States, hundreds of trappers are now "stringing" common snares in areas of grass or low brush to capture coyotes, foxes and bobcats by one, or both, front legs. Non-target capture has been addressed by developing "breakaway" snare locks, designed to open and release the captive at a level of pressure just above that of which a coyote is capable of exerting. Breakaway locks have by no means eliminated the problem of incidental capture, but they do allow cattle—other than small calves—and most healthy adult deer and pronghorn caught by the leg to escape. Unfortunately, deer caught around the neck in strangling snares set for coyotes are often unable to activate the breakaway before being choked down. To date, mortality from head catches has not been documented from snares set close to the ground as legsnares.[8]

During 1986 and 1987, Dr. Fred Knowlton and Mark Collinge at the U.S. Department of Agriculture's Millville, Utah, research station, tethered a total of 25 coyotes in common snares by a front leg. Each animal was held in above-freezing temperatures for 24 hours, then released into a compound for observation. The animals exhibited severe swelling. Some were cut. But not one, in contrast to survivors of steel traps, who often lose the capture foot from limb ischemia or gangrene, suffered long-term damage.[9]

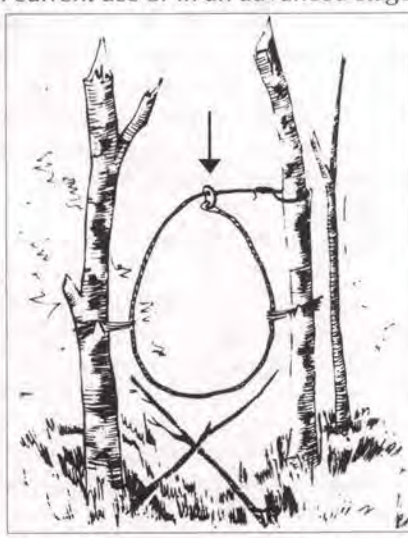
Knowlton subsequently refined his capture method by threading a short length of rubber tubing onto the cable to form the contact with the captive's leg. He then attached a rubber bulb containing Tranvet, a commonly used tranquilizer. In compound testing of this system, captured coyotes bit into the bulb and ingested enough tranquilizer to become passive for up to 24 hours with virtually no injuries sustained. Unfortunately, this capture method—conceived as a means of capturing coyotes uninjured from wild populations for use in sterilization experiments—has not been fully field tested. Despite its promise, it probably cannot be brought into general use because of restrictions on the distribution of tranquilizers.[10] It could, however, be used by federal and state damage control agents.

A very different way of holding coyotes alive in common snares is now used in eastern Canada. Damage control officers in Quebec province fix the circumference of the snare noose (usually at 11 inches) by pounding a ferrule, or stop, on the cable so that it cannot pass through the snare lock beyond that point. The snare is then strung along a trail (exactly as a strangling snare would be) so that the victim will insert her head into it, and be left tethered to an uncomfortable, but non-lethal collar.[11] This method has been used successfully in the Yukon Territories to live-capture wolves.[12] Regulations requiring stops on snares used to take foxes are now in effect in New Jersey.

The following sections describe and illustrate snaring devices and systems in current use or in an advanced stage of development. Section One discusses common snares. Section Two is concerned chiefly with the Aldrich legsnare, and its most successful offspring, the Fremont legsnare. Section Three describes the Swedish Aberg legsnare. Section Four describes the Belisle and Godwin legsnares, and mentions three designs now in development. Section Five discusses technical factors in efficiency and relative humaneness.

SECTION ONE: COMMON SNARES

The common snare shown in Figure 2 is made of light steel cable threaded through a snare lock (marked by an arrow) in order to form a noose. Snare locks, designed to strangle animals, allow the noose to progressively tighten, but prevent it from relaxing. The more an animal caught in such a locked snare struggles, the tighter the noose becomes (see Figures 3 and 4).[13]



Ontario Trappers Association

Figure 2: A common snare set to strangle.

The necksnare shown in Figure 2 has been strung along a trail to catch a bobcat. The noose is eight inches in circumference and suspended about ten inches above the ground, about the height of a bobcat's head when the cat trots along. The other end of the cable has been tied solidly to a tree. If an animal inserts her head into a snare noose that has not been modified for live capture, and continues to pull and struggle, the animal will eventually be strangled.[14] Such a death, particularly for canids who have evolved thick musculature to protect the trachea and common carotid arteries, is likely to be prolonged. Canids often struggle for hours (Figure 3). Gums are often lacerated from attempting to chew out. A thick suffusion of bloody lymph fluid beneath the skin of the victim's head and neck is the mark of such a death. Trappers who skin necksnared coyotes refer to animals who have died in this ghastly way as "jelly heads."

Two ways in which a snare can be adapted for live capture are illustrated. In Figure 5, a ferrule (marked by an arrow), in the form of a small nut, has been pounded onto the snare cable so as to fix the diameter of the noose. This is to insure that the victim is not choked. This type of collar snare is strung in exactly the same way as the necksnare in Figure 2. The snare in Figure 6 is equipped with a Gregerson breakaway lock. It has been prepared for legsnaring by inserting five inches of light rubber tubing on the noose cable to form contact with the victim's leg, helping to prevent injury.[15] To catch canids by the leg, the snare noose is positioned vertically with the bottom just far enough above the ground so that it will not freeze down. The top of the snare noose is at about the level of the top of the animal's leg.

This legsnaring technique is now spreading rapidly across the Great Plains and the mountain and intermountain regions of the American West. Legsnares are lighter, cheaper and less susceptible to adverse weather than steel jaw leghold traps. They have also proven effective against coyotes, the hardest of all animals to trap.

Tom Garrett

Figure 3: A wolf in a necksnare. The victim wore a trail on the frozen ground before dying. Saturation snaring—when dozens of snares are set at one location with the purpose of capturing an entire pack of wolves at one time—is the favored method of wolf bounty trappers in Alaska. Bounty trappers infrequently check their remotely located trap lines, leaving snared wolves and other incidental catch animals to die protracted, anguished deaths. Bounty trappers care not for the suffering of the wolves, nor even for the quality of the fur, but only for the bounty paid to them by the state for the animal's body.

Figure 4: A cruel wire body snare caught this fisher by the neck and slowly strangled him.

SECTION TWO: SPRING ARM (ALDRICH TYPE) LEGSNARES

With the Aldrich legsnare and other spring-activated legsnares, the snare noose is positioned horizontally on the ground instead of being hung vertically above the ground. Rather than relying on the animal's own motion to tighten the snare noose, spring-activated legsnares employ a spring-powered mechanism to cinch the noose on the leg when the animal steps on the pan. The Aldrich mechanism, as may be seen in Figure 7, is made up of a large "safety pin" type spring, a U-shaped pan fashioned of metal rod, and a tine which is pushed into the ground to hold the unit in place. When the mechanism has been positioned, the end of the snare cable, which is separate and equipped with a lock, is tied to a tree. The cable is fitted into a C-shaped hook on the end of the upper arm of the spring. The noose is then laid out so as to encircle the pan, and the spring is cocked. When a bear, or other animal, steps on the pan, the spring arm flies up, jerking the noose around the captured leg. Once struggling begins, the cable detaches from the hook and the captive is left tethered directly to the tree.

Figures 5 and 6: collar necksnare (left) and legsnare with tubing (above)

Aldrich legsnares are now manufactured by Dave Schinetz of Sekiu, Washington. He builds three sizes, unaltered from the original pattern, filling orders from around the world. Aldrich legsnares have been used to capture polar bears at Churchill, Manitoba, feral goats on Micronesian Islands, deer on Malaysian tree farms, wild horses at desert watering holes and wild wolf-wolfhound crosses in Italy's Apennines Mountains.[16] Jack Aldrich's invention remains the most widely used bear legsnare. Aldrich's legsnare is also the parent of a spate of devices that have striven, with varying success, to apply its operating principles to capture medium-sized furbearers.

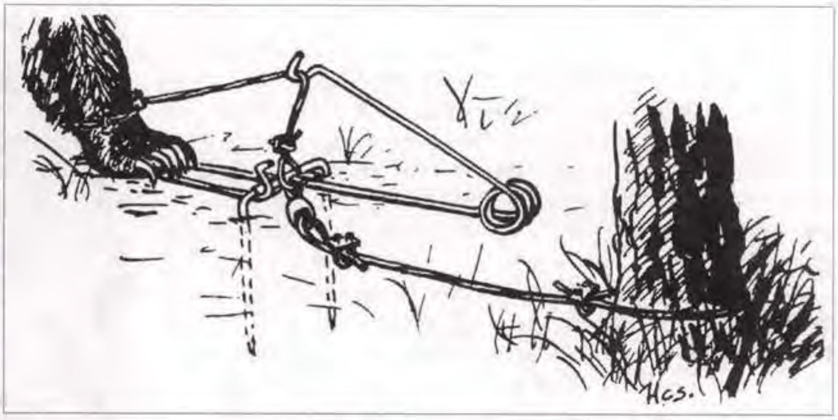


Figure 7: the Aldrich legsnare

The Novak legsnare, pictured in Figure 8, was one of several unsuccessful spring arm traps that appeared in the early 1980s.[17] It differs from the Aldrich legsnare by using a coil spring that rotates the spring arm a full 180 degrees, and by employing a standard flat pan similar to those used on steel leghold traps. The device was withdrawn from the market after it inflicted almost six times as much injury to coyotes in the 1986-87 Alberta field tests as did the competing Fremont legsnare.[18]

Figure 8: the Novak legsnare

The Fremont Legsnare

At first glance, the Fremont legsnare (Figure 9) is almost indistinguishable from the Aldrich legsnare (Figure 7). Yet it has been designed, with admirable economy of effort, to be deployed and function quite differently. The inventor, Al Fremont, began working to improve the Aldrich legsnare in 1980. His current design is the product of years of trial and error on his trapline near Candle Lake, Saskatchewan.

The Fremont legsnare retains the basic Aldrich spring, although it is somewhat reshaped. It also employs an identical pan, made of steel rod. Fremont has, however, abandoned the prong used to secure the device in place by replacing it with a U-shaped rod welded at a slight downward angle to the lower spring arm. This stabilizes the mechanism, forms a base, and elevates the pan. With the mechanism cocked, the end of the pan is two inches above the bottom of the (U-shaped) base.

Fremont uses the same sized mechanism to capture both bears and smaller furbearers. For legsnaring the former, he employs a 1/4-inch cable that separates from the mechanism exactly as with the Aldrich legsnare. For smaller species, a 1/8-inch cable is threaded through a loop on the end of the upper spring arm. The end of the cable, rather than being attached to a stake or a tree trunk, is fastened to a ring on the bottom arm. The spring mechanism itself is then chained, or wired, to something solid. This means that a captive animal, lunging on the cable, is never solidly jerked. Instead, the animal's rushes are absorbed by compressing the spring arm, which (like the Aldrich) opens only about 110 degrees (Figure 10).

Fremont has also devised a novel way of setting the legsnares. He scoops out a shallow, dish-shaped hole, about eight inches in diameter, in earth or snow. He places the base in the bottom so that the pan is at ground level. Then he places chips or twigs between the lip of the hole and the pan. Over these, Fremont lays a piece of plastic screen, on which he sprinkles dried, shredded leaves, followed by a thin layer of dirt or snow. The arrangement is encircled by a noose up to ten inches in diameter, twice the size used with other legsnares. Any animal stepping on the screen should trip the device, which means that the area in which an animal's foot can activate the snare is several times as great as with steel jaw leghold traps or other legsnares. Fremont maintains that this factor alone makes his system more efficient than a leghold trap.[19]

In fact, tests of the snare's efficiency have had mixed results. C.R. Frotag of the Saskatchewan Department of Natural Resources, who first field tested the legsnare in 1984, reported that under northern conditions, "due to the large snare loop, speed at which the snare is drawn up and out of frozen snow, and large pan area, these traps are extremely efficient at catching the animal."[20] Yukon biologist Brian Slough reported in 1989 that modified Fremont legsnares were at least as efficient in capturing lynx as leghold traps. A larger sampling, involving approximately 200 lynx taken in the Yukon from 1989 to 1993, suggests that the efficiency and injury scores are, to a high degree, a function of trapper skill. Both improved from year to year as the trappers gained experience. Overall, the legsnares achieved comparable efficiency to that of the padded leghold traps used in the same area.[21] No comparable multi-year test exists for canids. Efficiency scores in the Alberta field test were depressed by defective snare locks, and by the failure of the technicians to use the setting technique developed by the inventor.[22]

Figure 9: Fremont legsnare in sprung position (note tubing).

Figure 10: Coyote in Fremont legsnare.

At least two Aldrich-type legsnares have been developed outside of North America. In the mid-1980s, Australian biologist Peter L. Stevens,[23] at the Keith Turnbull Research Institute in Frankston, Victoria, designed and tested a legsnare, called the "treadle snare," to catch dingo. The treadle snare has a coil spring-powered throwing arm, apparently similar to that on the Novak legsnare, that tightens the noose on the animal's leg. According to Stevens, it has "design features which...are major improvements on any previous [1988] snare type trap." These are described as "...a racquet shaped baseplate of very solid construction to hold and support the snare noose when the trap is in set position, a secondary snare thrower housed within the head of the baseplate which, when the trap is sprung, breaks the soil and throws the snare noose up and around the animal's leg, and a tension screw with which to adjust the pressure required to trigger the device."

Matched against steel jaw leghold traps for 3,898 trap nights, the treadle legsnare showed marginally greater efficiency in capturing target species (dingo and fox) and was more selective. The legsnare produced only a fraction of the serious injuries caused by Australian-manufactured steel traps. In a smaller test, the legsnare caused only about one-quarter as many injuries as Victor #3 Softcatch padded steel jaw leghold traps.

Unfortunately, this promising legsnare from "down under" does not appear to have gone into production. However, a more recent spring arm legsnare developed in France by Baptiste Vetal is in production, marketed as the *piège à lacet de l'ONC*. It also appears to have a racquet shaped baseplate and a conventional pan. The Vetal legsnare is competing for the French market against legsnare designs (described later in the text) from North America.

SECTION THREE: THE ABERG LEGSNARE

The Aberg legsnare, shown in the hands of its inventor, Jan Aberg (Figure 11), was designed expressly to catch foxes in the deep powdery snow of northern Scandinavia. In use, the 26-inch long white plastic tube containing the coil spring is laid out horizontally just under the surface of the snow, with the noose and pan extending onto a fox trail. The neoprene-sheathed cable is fixed to the back of the spring and tunnels through the coil and out a small hole in the end of the plastic tube to form a noose. When the snare is set by compressing the spring, the noose is about five inches in diameter. When the snare is triggered by an animal stepping on the pan, the spring is released and maintains a constant, although mild, pressure on the object in the noose. When a captive animal attempts to escape, the spring is compressed and the noose tightens. The harder the animal pulls, the tighter the noose becomes. But, unlike a "locked" snare, Aberg's noose relaxes when the animal ceases pulling.

Figure 11: Jan Aberg

Dr. Jan Englund of the Swedish Museum of Natural History examined 123 foxes caught in the legsnare for dental injuries, and 117 for injuries to limbs. Only two animals suffered severe dental injuries. Among the foxes examined for leg damage, 83% were uninjured, and 15% had skin galls or dislocations, and three had broken bones. The legsnared foxes displayed only a small fraction of the injuries Englund found earlier among 1,374 foxes taken, under identical conditions, with steel jaw leghold traps. Approximately 30% of the foxes taken in steel jaw leghold traps suffered broken bones, in most cases phalanges and metacarpals, and 38% had severe dental injuries including damage to the jawbone.[24]

Figure 12 shows an undamaged fox jaw (top) in contrast to two jaws that Dr. Englund found with severe damage from biting at steel jaw leghold traps. The jaw in the center shows many broken teeth. In the lower, all the fox's teeth have been broken and the jawbone eroded in the struggle to escape. Dental injuries were virtually eliminated by use of the legsnare.

Jan Englund

Figure 12: Fox jawbones

Cathy Liss

Figure 13: Coyote in an Aberg legsnare.

Swedish scientists have long insisted that when used with a light drag and under Swedish conditions, the Aberg legsnare has proven to be more, not less, efficient than steel jaw leghold traps, and that "escapement has been almost zero."[25] When I visited Swedish traplines during the winter of 1993, my interviews with trappers appeared to confirm this claim. The experience of the trappers interviewed, one of whom had trapped for 50 years, was that steel leghold traps and Aberg legsnares caught approximately the same number of foxes. They also reported that while a substantial number of animals caught in steel traps managed to pull out or wring off, none escaped from the legsnares. Erik S. Nyholm, the famous Finnish naturalist whom I interviewed in Kuusamo in March, 1992, had recently captured ten lynx "without injury or loss" with Aberg legsnares equipped with 2.6 and 3.2 mm cables attached to light drags.[26]

The efficiency of the legsnares for taking fox in northern Europe is now established beyond question. Additionally, Dr. Nyholm's work strongly suggests that the Aberg legsnare can be adapted for lynx under similar conditions. What is not at all clear, however, is that the Aberg legsnare can be adapted to trapping conditions elsewhere. The Swedish government does not allow commercial trapping with legsnares in southern Sweden where it would often be necessary to make dirt hole sets rather than set traps in snow. To avoid losing them, the snares would need to be either tied to a fixed point or attached to a heavy drag. A base of experience for conditions other than those found in northern Scandinavia does not exist. The only data available on taking foxes in dirt hole sets with legsnares was conducted by Carl Erik Vesterman, a Swedish trapper who has taken advantage of the expiration of Aberg's patent to begin making a virtual clone of the Aberg legsnare. Vesterman had no difficulty in catching foxes in dirt hole sets, but his videos do suggest greater struggling by foxes staked to fixed points.

Cathy Liss

Figure 14: Research team at Millville Research Station. From left to right: Tommy Svensson, Tom Garrett, Kenneth Gruver, Dr. Mariana Roetto, Robert Phillips, John McConnell.

Jan's Catcher was first tested, unsuccessfully, on coyotes in a compound at the Millville, Utah research station by biological technician Wells Stevenson in 1984. In December, 1993, Tommy Svensson, the Swedish Environmental Ministry's chief technical officer for hunting and trapping, came to Millville, where over 100 captive-raised coyotes are now housed, with a supply of Aberg legsnares. The legsnares were tested, along with a number of other designs, on coyotes released into the compounds. Catches were observed and—in some cases—videotaped.

The Aberg legsnares caught the coyotes efficiently. In cases where they were tied to light drags, the animals tolerated the legsnares, which are not painful, for the limited duration of the tests. The coyotes showed irritation, expressed by displacement biting at grass, rather than distress (note Figure 13). However, when a large male was caught by an Aberg legsnare staked to a fixed point, the animal chewed through the snare cable, between episodes of struggling, in approximately one hour.

It should come as no surprise that a legsnare invented for taking foxes in deep snow conditions proved too fragile to hold coyotes, which are several times stronger than foxes and immeasurably more aggressive. To make this legsnare hold coyotes, whether it is tied to a drag to limit distress and injury or attached to a fixed point, a much larger snare cable—one about 1/8-inch in diameter—is called for. A means of shielding the cable from chewing may be needed as well. If the legsnare is tied to a fixed point, the long tether, designed for a drag, will have to be drastically shortened so the animal cannot jerk himself by "running" on it.

SECTION FOUR: GODWIN AND BELISLE LEGSNARES

Barry Godwin, inventor of the Godwin legsnare, lives in Candle Lake, Saskatchewan, which is also the home town of snare inventor Al Fremont. Godwin's legsnare, patented in 1992, brings the snare noose around the animal's leg in a simple but dramatic, way. As may be seen in Figures 15 and 16, the pan is positioned inside a compressed coil spring six inches in diameter with the snare noose resting in set position on top of the coil. When an animal steps on the pan the coil springs around his leg to a height of 12 inches, jerking the snare noose. The noose is threaded through an eye at the bottom of the coil and looped around one side, then pulls tight around the animal's foot.

The Godwin legsnare has been designed without a snare lock. When a captive attempts to remove his foot from inside the coil (the trap chain is pinned to the ground or tied to an object) it compresses one side of the coil. The harder an animal pulls, the tighter the noose becomes, when the victim ceases pulling, the noose relaxes accordingly.

In the initial tests of the Godwin legsnare, undertaken in 1993 on captive coyotes at the Millville facility, all animals triggering the trap were caught. There were no escapes and no noticeable injuries. The only difficulty encountered was with defective trigger mechanisms on two of the six traps tested.

Figures 15 and 16: The Godwin legsnare set (above) and sprung (below).

The experience of trappers asked to "try out" the legsnare seems to have been generally positive as well. For example, R.H. King, who lives in the sandhill country of central Texas near Odessa uses the Godwin legsnares to protect sheep and goats from marauding dogs. He reports that the legsnares are "as efficient as leghold traps and far less injurious." In 1995, the French Ministry of Agriculture purchased several hundred Godwin legsnares to try out against foxes. The French were sufficiently impressed to order an additional 1,300 in 1996.[27]

None-the-less, tests conducted by USDA biologists in the Chihuahuan desert near Laredo, Texas, early in 1997 yielded discouraging results. Over a dozen coyotes were caught by Godwin legsnares; not a single animal remained tethered long enough to be retrieved by the research team. One coyote chewed through the snare cable, and the remainder initially held but succeeded in loosening the noose sufficiently to extricate themselves.

The Godwin legsnare has obvious virtues. It is simple, compact and readily concealable and the spring is powerful enough to be proof against "weathering in." Bob Phillips, biologist in charge of the USDA trap testing program (now retired), suggests that the devices be retested after being fitted with snare locks. This would settle the question of whether or not, the Godwin mechanism is genuinely efficient at placing a noose around an animals leg.[28]

Figure 17: Edouard Belisle

THE BELISLE LEGSNARE

The Belisle legsnare, invented by Edouard Belisle (Figure 17), is rapidly coming into wide use. After traveling to France in 1995 to exhibit his legsnare and demonstrate his method of catching foxes with it, Belisle sold 10,000 to the French Ministry of Agriculture. The French were sufficiently impressed to place a second order in 1996, this time for 25,000 legsnares.

As may be seen in Figure 18, the Belisle is triggered by a pan identical to the pans found on ordinary steel jaw leghold traps, and contains elongated steel jaws that actually strike the animal on the leg. The function of these jaws, however, is not to hold the victim, but to transport the snare noose, positioned on top of them, up onto the animal's leg. As soon as the noose is secured and the captive begins moving the trap mechanism, the jaws detach from it and fall away. The animal is held by a locked noose. The cable, free of the trap mechanism, is either staked down or attached to a drag.

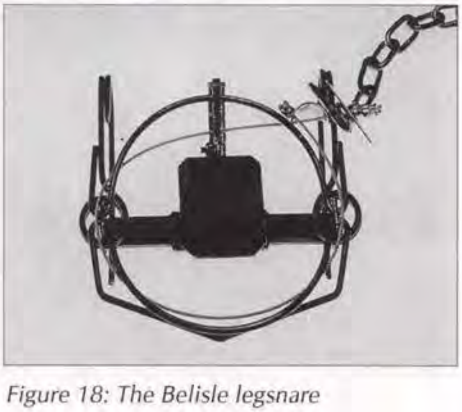


Figure 18: The Belisle legsnare

If became immediately clear during field tests conducted near Laredo in February, 1996, that the Belisle catches coyotes. Its catch per trap night was comparatively high. There were, however, a higher percentage of escapes than with the steel jaw leghold traps used as controls. Three animals chewed through the snare cable.

Unfortunately, failure to equip the traps with pan tension devices to prevent small animals from triggering the trap led to a number of non-target deaths and injuries. The jaws, although non-injurious to larger animals, proved fatal to a number of birds. This is a problem that can be largely solved by inclusion of a pan tension system.

Of the 30 coyotes taken by Belisle legsnares at Laredo and necropsied in Laramie, Wyoming, in March 1996, one sustained broken carpals and three had major periosteal abrasions. The remainder of the injuries consisted of swelling and edema and minor cuts. The mean injury score for the sample was slightly under 20 points. This injury profile was consistent with results of an earlier test conducted in Quebec.[29]

OTHER LEGSNARES

THE EASY LEE

During the 1930s, a number of legsnares were patented which employed chain or cable loops rather than nooses, and in which the trap mechanism remained in direct contact with the animal's leg. None of these rather ingenious designs succeeded on the market and those remaining are in the hands of collectors. However, at least two legsnares have been tested and remain in development. The "Easy Lee" (Figures 19, 20 and 21) pinions the animal's leg between a molded pad and a loop formed of plastic coated chain. The Lee trap appears benign, and there are indications, based on informal field experience, that it may be effective against foxes.

Field tests near Laredo in 1996 established that the device, at that stage of development, could not hold adult coyotes. The only animal retained of a dozen that sprung the trap, was an 11 pound juvenile that lacked the power to pull loose. An improved version of the Easy Lee was informally tested at Laredo in 1997 by the inventor, Don Lee (now deceased), and consulting engineer Ed Medvetz. At least four adult coyotes were held.[30]

THE EZYONEM

The Ezyonem (Figures 22 and 23), invented by the late Elmer Davies of St. Regis Falls, New York, is shown in set and triggered positions. As may be seen, it is triggered by a pan and imprisons

Figure 19: The Easy Lee, shown set.

Figure 20: The Easy Lee, shown sprung.

Figure 21: The Easy Lee, holding a coyote.

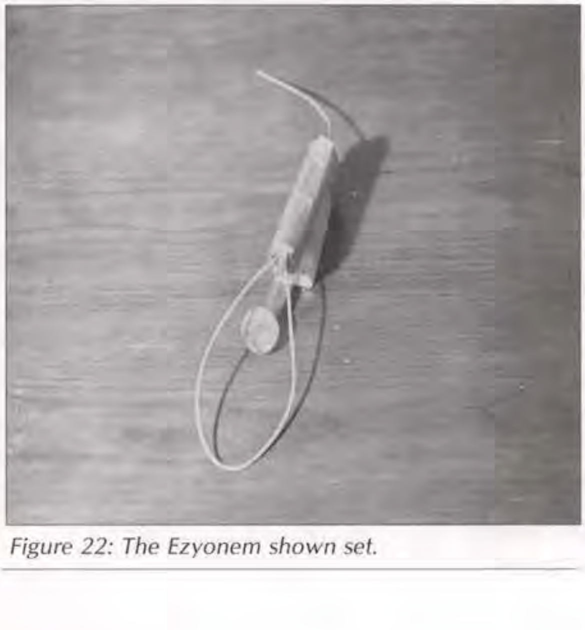


Figure 22: The Ezyonem shown set.

Figure 23: The Ezyonem shown sprung.

the captive's leg between a telescoping piece of lexan plastic pipe and a loop, formed by a doubled cable, which protrudes from the pipe.

The Ezyonem has unique advantages. It is lighter and more compact than any other trap or legsnare on the market, and it does not rust or corrode. The looped cable resists the twisting and kinking to which snare nooses are subject and can be used repeatedly. Unfortunately, in the form pictured, the device could not hold coyotes and was marginal against foxes.

Technical fixes designed to preserve the Ezyonem's advantages by allowing it to hold its captives are now being pursued at the Fur Institute of Canada trap testing facility at Vegreville, Alberta. The major change, which seems to have wrought an improvement in the legsnare's ability to hold canids, has been to replace the slick plastic coated cable with a flexible Kevlar rope which clings to the captive's foot rather than slipping off. Apparently the Kevlar rope cannot be dismembered by chewing.[31]

SECTION FIVE: TECHNICAL FACTORS IN HUMANENESS AND EFFICIENCY

The performance of any trap is acutely sensitive to the manner in which it is used. The tremendous disparity in the skills of trappers testing trapping devices make efficiency ratings, particularly of new designs, suspect from the onset. Injury ratings can also be biased by trappers. For example, during their initial trapping season, Mowak, Slough and Rivard found that 11 of 54 lynx captured with Fremont legsnares had major injuries resulting from trapped animals becoming entangled in brush. Careful placement of the devices eliminated such injuries entirely during the final period of the test.[32]

Recent scientific tests, along with the observations of trappers and inventors, have provided insight into purely technical reasons why some legsnares are benign while others are not. A number of technical elements that govern the efficiency of holding snares, independent of trapper performance, can now be identified as well.

Snare Cable Diameter

One of the most important factors in both humaneness and efficiency is illustrated in Figure 24. The snare cable on the left is of the type used for coyotes on Novak legsnares during the 1986-87 Alberta field tests. It is only half of the diameter of the cable on the right, which was used with the competing Fremont legsnare. The probability of a legsnare lacerating a victim decreases as the diameter of the cable increases. This may well be the major reason why the Fremont legsnare caused only one-sixth as much injury as the Novak legsnare in this test.[33] In Finland, Dr. E.S. Nyholm found that injuries to foxes taken with Aberg legsnares virtually disappeared when he increased the cable diameter from 1.8 mm to 2.6 mm.[34]

The cross section of the cable is also an important element in efficiency. Snare maker Keith Gregerson reports that up to 15% of coyotes legsnared in the field with standard 5/64-inch airplane cable, and eight percent taken with stainless steel cable, chew free.[35] Fremont has found that his 1/8-inch cable is proof against coyotes, but that wolves can sometimes dismember it and escape.[36]

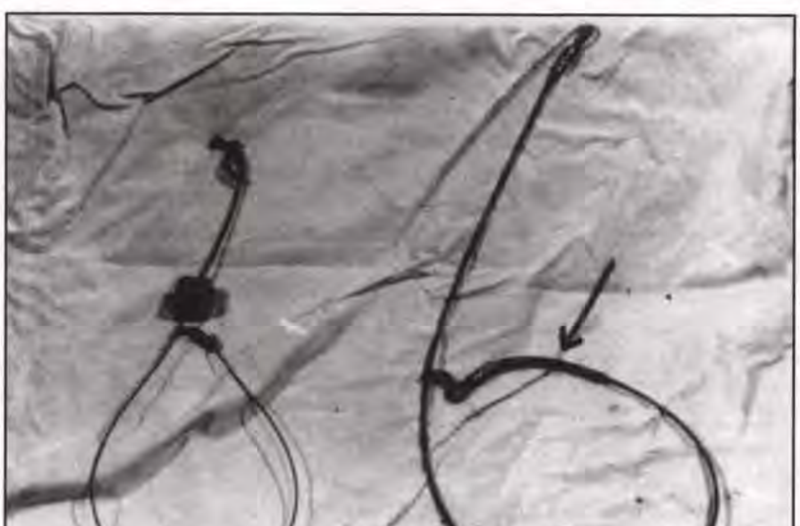


Figure 24: Novak snare cable (left) and Fremont snare cable (right)

Cable Coating

The Fremont legsnare cable in Figure 24 is fitted with five inches of surgical tubing with which Fremont is currently experimenting. This should further reduce injury, both by increasing cross section and by girding the animal's leg with yielding, non-abrasive material. Mowak, et al. reported a dramatic decrease in cuts and minor injuries to lynx taken with Fremont legsnares after he and his associates added tubing to the snare cable. Virtually all legsnare manufacturers now either coat the snare cable with neoprene or add a length of tubing.[37]

It is possible that coated cable may eventually be replaced by flexible Kevlar rope. But while work at Vegreville on the Davies legsnare strongly suggests that Kevlar rope is more efficient at holding an animal than coated cable, we have no information on its relative humaneness.

Absorption Springs

Another means of reducing injury and escape is to use springs to absorb the energy of captive animals' lunges. Three of the legsnares now on the market, the Aberg, the Godwin and the Fremont, leave the snare cable attached to the mechanism. The spring that activates the device also helps prevent the captives from throwing themselves solidly against the cable. Even with common snares and designs such as the Aldrich and Belisle in which the mechanism detaches from the cable, it is possible to gain some degree of spring cushioning by attaching springs to the snare cable. This is increasingly being done.

It is also extremely important, if the cable or snare mechanism is tied to a fixed point, that the cable is a short one so that the animal does not have an opportunity to gain momentum "running" on it. This requirement was illustrated at Millville. When Aberg legsnares, designed to be tied to drags, were pegged solidly at the end of a two-foot cable attached to the snare tube. The captured coyotes had a full four feet of slack to run on, and one animal lacerated his toe. This would not have occurred if the snare had been tied to a drag, which is certainly the way the Aberg legsnare should be used when conditions permit. The injury could also have been prevented by simply shortening the tether to a few inches rather than two feet.

Snare Locks

When snare locks are used to hold captives, the characteristics of the lock are extremely important both to efficiency and humaneness. The lock must slack-off sufficiently to avoid cutting off circulation. If it is too loose, however, the victim may either pull out or "saw" the leg by rotating it inside the noose. It is important, as well, that the lock be properly shaped and free of sharp or rough edges upon which the animal might be cut.[38]

Non-Target Captures

Non-target captures cause immense suffering and waste. They also prevent the trap from catching the animal for whom it is intended and thus reduce its efficiency. Snares of all types, with the possible exception of common snares fitted as collars, are notorious for catching herbivores. One of the major preoccupations of legsnare designers in recent years has been to develop breakaway locks, which will allow deer and livestock to escape but hold furbearers. The fact that a large coyote can exert as much pressure as a juvenile deer or a domestic sheep prevents breakaways from being more than a partial solution even when the technical problems afflicting current designs are overcome. Fortunately, if traplines are tended on a daily basis, herbivores caught by a foot are unlikely to be badly injured. If the trapper is equipped to release them, it can usually be done without great difficulty, providing the largest and strongest animals have already freed themselves by means of breakaways.[39]

The development of pan tension devices, which can be set so that traps do not go off when animals below a certain weight step on them, provides a means of keeping birds and small mammals, particularly rabbits and hares, from triggering traps. The unhappy results attending tests of the Belisle, which was tested in Laredo without the pan tension device, killing numerous birds and small mammals with its elongated jaws, illustrate the absolute need to require pan tension devices of some kind on most mechanically activated legsnares.[40]

Adverse Weather

One more factor to consider is the ability of a device to operate under adverse weather conditions. Snow, ice and mud, especially freezing mud, are the chief causes of leghold trap failure. Common snares are definitely less affected by bad weather than traps. But spring-activated legsnares, being positioned on the surface, are subject to being weathered in.

Aldrich-types do have an advantage over steel leghold traps in this respect. Leghold trap users can only "beef up" springs to make a trap function in bad weather at the cost of further injury to its victim. This is because the springs that draw the jaws from ice or mud are the same springs that grip captives. But legsnare designers are free to strengthen spring arms to cope with adverse conditions without affecting the animal. The Fremont and Aldrich legsnares, with their long, powerful spring arms, perform well under winter conditions.

Tranquilizer Tabs

It has been recognized since Fred Knowlton's original research with tranquilizer tabs in Texas in the 1970s that injuries sustained by coyotes taken in steel jaw traps are not caused solely by the traps' initial momentum and subsequent clamping force. Many injuries are also caused by the animals' struggles to escape the excruciatingly painful device.[41] By attaching tranquilizer tabs to steel traps, Knowlton was able to reduce injuries to trapped coyotes by at least 60%. Research at the Millville, Utah Research Station with bulbs containing Tranvet attached to common snares set as legsnares produced similar results. Experimental use of another tranquillizer, propiopromazine hydrochloride (PPHZ) in trapping wolves in Minnesota in 1992, again demonstrated that injuries could be "significantly reduced" by attaching tranquilizer tabs to traps. Tranquilizer tabs also reduce the trauma caused to non-target animals who are caught. Unfortunately, there is little prospect of the U.S. Food and Drug Administration allowing use of such "controlled substances" by commercial or private pest control trappers. With expanded research, however, a compelling case might be made for allowing their use by federal control trappers.

END NOTES

1. One hand-forged bear trap noted by Richard Gerstell in his 1985 book, *The Steel Trap in North America* (Stackpole Books) weighed 38 pounds. The average weight, particularly of mass-produced bear traps, was, of course, substantially less. Black bears were sometimes trapped with comparatively light #$4^{1}/_{2}$ longspring steel jaw leghold traps.

2. Amory, Cleveland. 1974. *Man Kind? Our Incredible War on Wildlife*. Harper and Row.

3. Onderka, Skinner and Todd. 1990. Injuries to Coyotes and Other Species Caused by Four Models of Footholding Devices. *Wildlife Society Bulletin* 18: 175-82. The Fremont legsnare caused an average of 9.9 points of leg damage on the Olson Injury Scale, a scale used to qualify cumulative injury to the legs of trapped animals. This compared with 63 for the steel leghold trap, 59.4 points of damage for the Novak legsnare, 24.8 for the padded leghold trap produced by the Woodstream Corporation. The damage inflicted by steel traps was understated, in that one or more traps contained amputated stumps, "wrung off" by the victim. These cases were not considered in calculating mean damage scores, according to field test supervisor Arlen Todd, addressing an international symposium on trapping wild furbearers sponsored by the Fur Institute of Canada in November, 1988.

4. Personal communication with Brian Slough, July 1989. Slough letter to Cathy Liss dated August 9, 1989. Slough reports that the "Woodstream #3 soft-catch ... commonly causes freezing of digits even at fairly mild (14° to -6° F) temperatures." This pattern was confirmed through a subsequent multi-year study described by Mowak, Slough and Rivard. 1994. A Comparison of Three Live Capturing Devices for Lynx: Capture Efficiency and Injuries. *Wildlife Society Bulletin*. 18(22): 640-650.

5. Mowak, et al. Also see: Skinner and Todd. *Evaluating Efficiency of Footholding Devices for Coyote Capture*. The low efficiency reported for the Fremont legsnare for coyotes in this study is contrary to well documented experience with lynx, and almost certainly resulted from use of defective snare locks and failure of trappers to set the snares as the inventor recommends.

6. Interview with Erik S. Nyholm, Kuusamo, Finland, March, 1993.

7. Personal communication with Keith Gregerson, December, 1986. For an assessment of the efficiency of breakaways, see: Phillips, R., F.S. Blom and R.E. Johnson. 1990. An Evaluation of Breakaway Snares for Use in Coyote Control. *Proceedings of the 14th Vertebrate Pest Conference*. 14:255-259.

8. Interview with Dr. Fred Knowlton and Mark Collinge, November, 1986.

9. The author visited Dr. Knowlton's Millville, Utah laboratory in November, 1986. Biological technician Mark Collinge, who carried out tests with tranquilizers at Millville, believed that the technique requires additional field testing to prove its effectiveness.

10. The author observed collar snares in use by Quebec damage control officer Roger Provost in November, 1986. It is very important to deploy the snares so that the captive is not likely to become tangled in brush.

11. Personal communication with Brian Slough, July, 1989.

12. Interestingly, the Gregerson lock used in the Millville tests is not expressly designed to relax. However, most locks, even those made to kill, back off slightly when pressure on them is relaxed.

13. Some coyotes cease struggling before they are choked to death and are found alive.

14. Kansas trapper James Lucero was the first to recommend use of rubber tubing. Lucero also recommends a fairly large loop set close to the ground so as to catch animals by both front legs. Some trappers set a smaller loop to obtain a single leg catch.

15. Personal communication with the late Alton Chittester, March, 1987. Chittester, who purchased the business from Jack Aldrich, continued to manufacture the devices until his death in 1992.

16. Some Novak legsnares, along with another defunct design, the Bouffard, are doubtless still in use. The author interviewed Bouffard and observed his trapline in November, 1986. The arm on the Bouffard legsnare begins its rotation towards the animal's foot rather than away from it.

17. Foxes, being far less powerful than coyotes are less likely to injure themselves lunging on snare cables. Earlier field tests showed comparatively minor damage to foxes taken in Novak legsnares.

18. It will be recalled that the area of a circle increases with the square of the radius. The average pan has a diameter of only two inches.

19. Unpublished report by C.R. Frotag to the Saskatchewan Department of Natural Resources.

20. Slough modified Fremont legsnares for lynx by shortening them and using a somewhat different setting method than that recommended by the inventor. These adaptations enhanced the efficiency of the device for lynx, but reduced its efficiency for canids. Slough letter to Cathy Liss, August, 1989. Also see: Nowak, Slough and Rivard. 1994. A Comparison of Three Live Capture Devices for Lynx: Capture Efficiency and Injuries. *Wildlife Society Bulletin*.

21. Personal communication with Al Fremont. Also see Skinner and Todd.

22. Stevens, Peter L. 1987. Alternative Traps for Dog Control. *Proceedings of the Australian Vertebrate Pest Control Conference*.

23. Englund, Jan. 1982. A Comparison of Injuries to Leg-hold Trapped and Foot Snared Foxes. *Journal of Wildlife Management*. 46(4).

24. This view has been emphatically expressed by Englund before the US House of Representatives Energy and Commerce Subcommittee on Health and the Environment in September 1984, and by Thorsten Morner of the Swedish National Veterinary Institute before a symposium hosted by the Fur Institute of Canada, November, 1988. It appears to be almost universally held by Swedish trappers.

25. Interview with E.S. Nyholm, March, 1993. It should be stressed that the factors employed in proper deployment of the Aberg legsnare and of snares that hold with locks, are quite different. It is critically important with both common snares and spring arm legsnares to prevent entanglement of the cable in brush. Practically all of the serious injuries recorded with Fremont legsnares have been caused by entanglement. On the other hand, the recommended deployment of Jan's Catcher is with a light drag, in the expectation that the animal will eventually become entangled. The explanation for this seeming paradox is found in the fact that with the Fremont legsnare, entanglement occurs between the animal's leg and the spring mechanism. This can lead to the victim's leg becoming wrapped up in brush. On the other hand, with Jan's Catcher, the cable can only become entangled behind the tube containing the spring. The animal's leg itself cannot become entangled, and the spring mechanism continues to function even when the captive is hung up in brush.

26. Personal communication with Barry Godwin and M.L. King, March, 1996.

27. Letter from USDA biologist Ken Gruver to the author, April, 1997. Personal communication with Bob Phillips May, 1997. It must be emphasized that results with coyotes cannot be extrapolated to foxes. Foxes have proven far easier to hold.

28. Personal communication with Bob Phillips, National Wildlife Research Center. Also see: Phillips, R.L., F.S. Blom and P.E. Johnson. 1990. An Evaluation of the Breakaway Snares for Use in Coyote Control. *Proceedings of the Vertebrate Pest Conference*. 14: 255-259.

29. Personal communication with Bob Phillips and the late Don Lee, May, 1997.

30. Personal observations and communication with FIC wildlife technician A. Kolenoski, Alberta Environmental Center, June 1997. Testing of the device has been suspended, it is not known if development will be resumed.

31. Mowak, Slough and Rivard, 1994.

32. Onderka, Skinner and Todd, 1990. Also Al Fremont, personal communication, 1987.

33. Interview with Erik Nyholm.

34. Keith Gregerson, interview, December 1987. In Texas/Arizona field tests of Novak legsnares equipped with light cable, 18 of 19 coyotes captured in the snare escaped. According to Tom Krause, writing in The Trapper, August 1981, the bulk of the animals chewed loose.

35. Al Fremont, personal communication, 1987.

36. Mowak, Slough and Rivard, 1994.

37. Milan Novak reported the sawing effect in his article, The New Foot Snare Live Trap and the Leghold Trap—A Comparison. 1979. *Ontario Fish and Wildlife Review*. Fall. Sawing may have been a factor in the Alberta damage scores.

38. Phillips, R.L. 1994. *Evaluating the Performance of Three Types of Breakaway Snares for Capturing Coyotes*. U.S. Department of Agriculture, National Wildlife Research Center.

39. Exceptions to this requirement may be the Aldrich and Fremont, which are harmless to birds and unlikely to catch small mammals, and Aberg, which does not lend itself to pan tension system. The Godwin, on the other hand, promises to be dangerous to smaller non-targets.

40. Bosler, Don. Tranquilizer Tabs for Capturing Wild Carnivores. Journal of Wildlife Management. 29: 448-442. See also the following publications: Zemlicka, Sahr, Savarie, Knowlton, Blom and Belant. 1997. Development and Registration of a Practical Tranquilizer Trap Device for Foot-Hold Traps. Thirteen Great Plains Wildlife Damage Control Workshop. Kansas State University. Savarie, P.J. and J.D. Roberts. 1979. Evolution of Oral and Central Nervous System Depressants in Coyotes. Special Technical Publication 680, American Society for Testing and Materials. Savarie, P.J. Pharmacoloigcal Review of Chemicals Used in Capture of Animals.

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