

WORLDWIDE  
TRADE IN  
CERVID  
ANTLER  
USA

AN OVERVIEW OF WORLD  
TRADE IN CERVID ANTLER  
WITH AN EMPHASIS ON THE  
UNITED STATES AND CANADA

by

Christopher S. Robbins

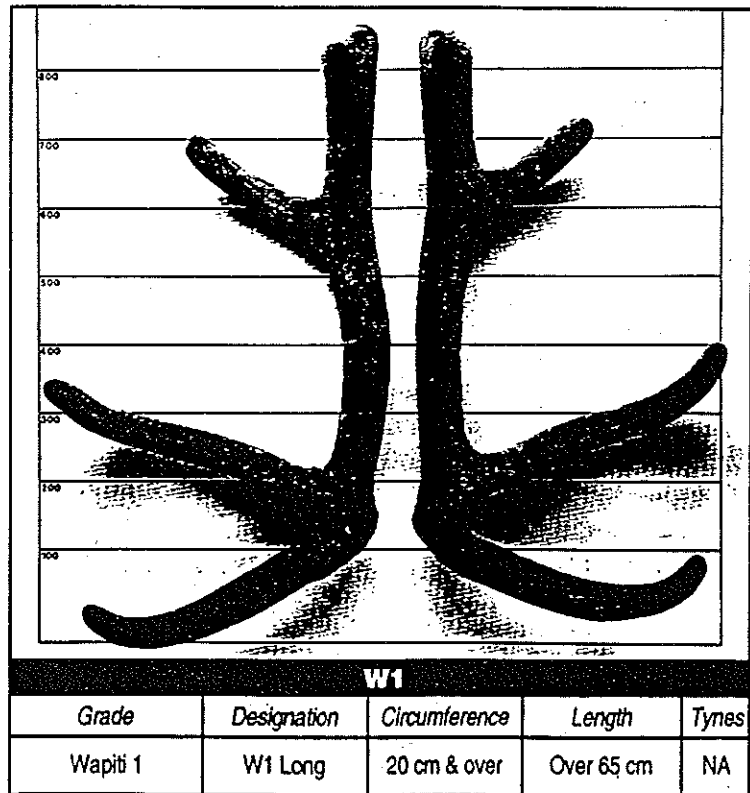
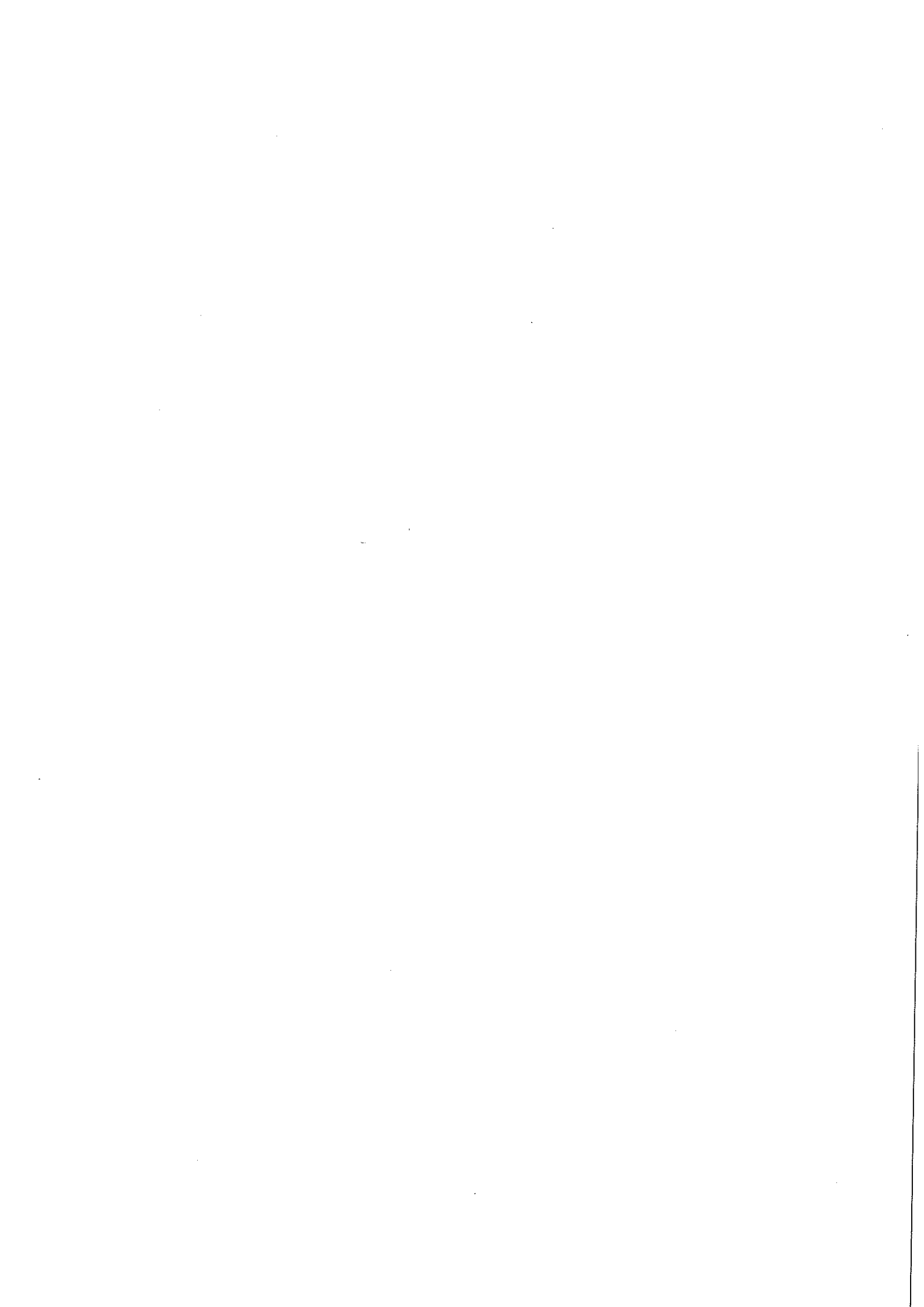


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**An Overview of World Trade in Cervid Antler**  
**With an Emphasis on the United States and Canada**

**August 1997**

**Christopher S. Robbins**

**TRAFFIC USA**

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## TABLE OF CONTENTS

Acknowledgments . . . . .	vi
Executive Summary . . . . .	vii
I. INTRODUCTION . . . . .	1
II. BACKGROUND . . . . .	3
III. METHODS AND SOURCES . . . . .	5
IV. CONSERVATION AND LEGAL PROTECTION FOR CERVIDAE . . . . .	7
Conservation Status . . . . .	7
International Protection: CITES . . . . .	12
United States Federal Law . . . . .	14
Canadian Federal Law . . . . .	16
Canadian Provincial and Territorial Law . . . . .	17
V. ANTLER BIOLOGY AND COMPOSITION . . . . .	19
VI. ANTLER UTILIZATION . . . . .	21
Grading of Antler in Traditional Chinese Medicine (TCM) . . . . .	21
Use of Antler in Traditional Chinese Medicine . . . . .	22
The Aphrodisiac Claim . . . . .	24
Clinical Application and Western Use of Antler . . . . .	25

Antler-Based Medicines and Markets . . . . .	26
Cervid Taxa in the Antler Trade . . . . .	34
<b>VII. ANTLER PRODUCTION, CONSUMPTION, AND TRADE . . . . .</b>	<b>36</b>
The Evolving Antler Trade . . . . .	37
Key Antler Trading Nations . . . . .	38
<i>Western Europe</i> . . . . .	38
<i>Russia</i> . . . . .	39
<i>Hong Kong</i> . . . . .	40
<i>Japan</i> . . . . .	47
<i>New Zealand</i> . . . . .	47
<i>People's Republic of China (China)</i> . . . . .	48
<i>Republic of Korea (South Korea)</i> . . . . .	51
<i>North Korea</i> . . . . .	53
<i>Singapore</i> . . . . .	61
<i>Republic of China (Taiwan)</i> . . . . .	61
North American Antler Trade . . . . .	62
A Summary of U.S. Antler Trade . . . . .	63
U.S. Trade in Horn Products of Native Taxa . . . . .	64
Cervid Farming . . . . .	70
<i>Commonly Farmed Cervid Taxa</i> . . . . .	71
<i>Regulation of Cervid Farming</i> . . . . .	71
Shed Antler . . . . .	73
<i>The Trade Dynamics and Value of Shed Antler</i> . . . . .	76
<i>Jackson Hole Antler Auction</i> . . . . .	76
Cervid Trophy Trade and Value . . . . .	79
<b>VIII. SUMMARY OF FINDINGS AND CONCLUSIONS . . . . .</b>	<b>84</b>
References . . . . .	86
Appendix . . . . .	93

## TABLES

Table 1.	Conservation Status of Threatened Cervidae . . . . .	8
Table 2.	Legality of the Collection and Export of Shed Antlers in Canada's Provinces . . . . .	18
Table 3.	List of Medicinally Used Deer Parts Documented in the Ancient Chinese Pharmacopeia ( <i>Pênts'ao</i> ) . . . . .	23
Table 4.	Traditional Chinese Medicines with Names Containing "Deer Derivatives, the Name of Patented Medicines Containing that Ingredient, and the Manufacturers of the Patented Medicine . . . . .	28
Table 5.	Cervid Taxa Whose Antler Is Harvested and Traded For Medicinal Purposes . . . . .	32
Table 6.	Antler Imports into Hong Kong . . . . .	42
Table 7.	Reexports of Velvet Antler from Hong Kong (1990-1995) . . . . .	45
Table 8.	China's Imports, Exports, and Reexports of Cervid Antler (1990-1995) . . . . .	50
Table 9.	Imports of Hard and Velvet Antler into South Korea (1988-1995) . . . . .	54
Table 10.	Hard Antler Imports into South Korea (1990-1995) . . . . .	55
Table 11.	Young (Velvet) Antler Imports into South Korea (1993-1995) . . . . .	58
Table 12.	Antler Exports from South Korea (1988-1995) . . . . .	60
Table 13.	Total U.S. Trade (Imports/Exports/Reexports) in Cervid ( <i>Cervidae</i> spp.) Horn Products, Trophies, and Medicinals for 1990-1993 . . . . .	66
Table 14.	Total Declared Volume and Value of Reported U.S. Trade in Cervid Horn Products (1994) . . . . .	69
Table 15.	Distribution of Farm-raised Wapiti and Restrictions on Commercialization in the United States . . . . .	72
Table 16.	Antler Curios and Products Available in the United States . . . . .	75
Table 17.	Antler Auction Data (Jackson Hole, Wyo., 1974-1995) . . . . .	78
Table 18.	1994 Trophy Exports from the United States . . . . .	81
Table 19.	Cervid Taxa Available to Sport Hunters in North America . . . . .	83

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## EXECUTIVE SUMMARY

Deer (*Cervidae* spp.) are among the most popular game species in the world exploited for meat, hides, antlers, and other body parts. Deer antler, which is traded extensively for medicinal and ornamental purposes, is harvested from wild and farmed deer in Russia, the People's Republic of China (PRC), New Zealand, the United States, Canada, and a growing number of other countries.

The importance of the deer antler trade to traditional Chinese medicine (TCM), the knowledge that North American trade is a significant part of the global trade, and a growing commercial deer antler industry in North America prompted TRAFFIC USA to begin a review of antler production and trade in the United States and Canada. The purpose of this analysis is to gain a better understanding of the trade, and its conservation implications for North American deer, by reviewing the scope, dynamics, and market of the domestic and international deer antler trade. With a few possible exceptions, TRAFFIC concludes that in North America the collection of antler, a naturally shed and renewable deer by-product, has not posed a trade threat to wild deer populations.

There are more than 40 living species of deer. Natural populations of deer occur throughout North America, South America, Eurasia, and northern Africa, while introduced populations have been established in New Zealand and other places where cervids do not naturally occur (Nowak 1991). The five species of deer native to North America are North American elk, or wapiti, (*Cervus elaphus* ssp.), moose (*Alces alces*), caribou (*Rangifer tarandus*), white-tailed deer (*Odocoileus virginianus*), and mule deer (*O. hemionus*). All these species are legally harvested for subsistence and recreation in the United States and Canada.

Unique to species of the cervid family, antlers are morphological appendages composed primarily of minerals, protein, carbohydrates, and limited fatty acids that grow from the base of the skull (Sunwoo *et al.* 1995). New antlers are called "velvet," owing to the numerous short, fine hairs adorning the outer layer of skin. As maturing antlers calcify, they lose their velvety skin and yield hard, spiked racks, which are used by males in establishing dominance during the mating season, or rut. After the rut, which occurs during the fall in North America, antlers become obsolete, and are shed in mid-late winter or spring (Goss 1985).

Internationally, the heaviest demand for deer antler is generated by Asian medicinal markets. Considered a tonic in traditional Chinese medicine (TCM), deer antler (also known as "deer horn" in oriental medicine) is consumed to restore the body and reduce the symptoms of aging. TCM recognizes the use of deer antler in the treatment of impotence, weakness in the lower back and knees, and blood abnormalities linked to physical or mental development disorders in children (Bensky and Gamble 1986). As a general rule in TCM, antler with the least amount of calcification--velvet antler--is the most efficacious. Antler is ingested in several forms--usually sliced, boiled in water, and prepared as tea or broth.

Total world trade is worth over \$500 million annually. South Korea is the top antler importing country--as much as 80 percent of all shed and velvet antler traded globally is consumed there, and somewhere between 60 and 90 percent of antler traded internationally may transit through Hong Kong (Barrie pers. comm. 1996, Isaacs pers. comm. 1996). New Zealand produces almost 60 percent of the velvet antler in international trade, with an additional 20 percent produced by Russia and China. North American exports represent about 5 percent of all velvet antler in global trade, while its share of hard, or shed, antler trade hovers around 20 percent (Korean Customs Service 1996). Increasing domestic trade and high tariffs on antler imports in consumer countries like South Korea and Taiwan, combined with a saturated global market, have resulted in a decrease in antler trade and prices in recent years.

### North American Trade

Deer antler was traditionally used by American Indians for spiritual, religious, and medicinal purposes as well as weaponry and decoration. Today, native North American deer antler is used by artisans, taxidermists, tourists, traders, and the Asian community. In the United States and Canada, deer antlers are procured in the form of wild-collected shed antler, velvet antler harvested from farmed deer, and trophies obtained from hunted deer. Antler trophies represent a comparatively small segment of trade in cervids.

The total value of U.S. cervid antler exports, reexports, and imports is approximately US\$13 million annually. During the four-year period for which U.S. trade statistics were analyzed for this report (1990-1993), the United States was a net importer of cervid antler, with imports of antler totalling 1.4 million items. An additional 240,000 kg of cervid antler were imported into the United States from 1990-1993. The number of reported antler items exported from the country during this period totalled 71,600 items. In addition, more than 700,000 kg of antler specimens were also exported. The vast majority of the trade was in antler products--both velvet antler and hard "shed antler"--destined for medicinal use. The primary destinations for U.S.-produced antler were South Korea and Hong Kong, while New Zealand and the former Soviet Union were the principal exporters of antler to the United States.

East Asia, particularly South Korea and Hong Kong, is the largest importer of caribou and elk antler exported or reexported from the United States. A significant portion of antler exported from the United States is shed elk antler, most of which is collected in the Rocky Mountain states and provinces. South Korea is the largest consumer of North American shed antler, annually importing up to 300,000 pounds (136 t), worth more than \$2 million, from Canada and the United States.

The United States and Canada trade on a smaller scale with a number of other nations. A smattering of European and Asian nations, including France, Germany, Indonesia, Japan, the Philippines, and Singapore import white-tailed deer, mule deer, and moose antler from the United States. Most U.S. antler imports, particularly caribou and elk, originate in

or are exported from Russia, New Zealand, the PRC, and to a lesser extent Hong Kong, India, Indonesia, and Germany. Some elk antler exported from the United States to Hong Kong and South Korea is reexported to the United States, probably in processed form, primarily for sale in Asian medicinal markets.

The flow of farmed antler into the United States and Canada from New Zealand and Russia, combined with the collection of North American shed antler, accounts for most of the antler in U.S. and Canadian trade.

More than 30 metric tons of dried velvet antler, worth at least \$12 million, are commercially produced and processed annually on a growing number of deer farms in the United States and Canada (Hudson 1996). The deer farming industry in the United States and Canada is still relatively small, producing only a tiny portion of the velvet antler currently entering international trade. It is estimated that 60 percent of North American velvet antler is produced by Canadian farms, while the remainder is generated by U.S. deer farms. Most of this farmed velvet antler is from elk, and is destined for foreign and domestic Asian medicinal markets. U.S. and Canadian companies also manufacture antler products for the North American health food market. The North American trade in shed deer antler is comprised of several species, most of which are native to North America, but only a select few, including native elk and nonnative red deer (*C. elaphus*), are also farmed for the harvest of their velvet antler.

Licensed sport hunting has created a market for trophy antlers in the United States and Canada. A total of 567 deer trophies with a declared value of \$157,000 were traded between the United States and Canada in 1995. In addition, a significant but unquantified number of trophies are traded domestically.

Globally, several deer are protected from international trade by the Convention on International Trade in Endangered Species (CITES)--13 taxa are listed in CITES Appendix I and 2 in Appendix II. Of those taxa protected by CITES, none are native to North America. Even though three native North American subspecies are listed as endangered under the U.S. Endangered Species Act and a few Canadian populations of caribou are deemed threatened in Canada, deer populations are generally healthy in the United States and Canada.



## I. INTRODUCTION

Around the world, an overwhelming number of people living in traditional societies depend on medicine derived from wild animals and plants for their primary health care needs. As naturally derived medicines become increasingly popular in industrialized nations, there is a surging commercial interest in animal-and-plant-based medicines. More than 120 plant extracts, with an estimated commercial value of \$160 billion, are used in Western pharmaceutical products; in the United States alone, one quarter of all prescription drugs contain a plant-derived compound.

It is a well-documented fact that wild animals and plants play a basic, critical part in traditional health care, and an increasingly important role in modern medicine. At the same time, many wildlife habitats and populations are declining due to pressure from human activities, not the least of which is the exploitation of raw animal and plant material for use in traditional medicines and Western pharmaceutical and herbal products.

Some of the world's most familiar species, such as the tiger and rhino, are severely threatened in large part due to illegal hunting to supply medicinal markets. A number of heavily exploited medicinal plant species, such as some African cycads, are also at risk.

In order to avert the disaster that has befallen species such as tigers and rhinos, the conservation community is trying to gain a better understanding of the scope of the medicinal trade, and identify and resolve problems that arise from such trade. To that end, the TRAFFIC Network, working with its parent organizations, World Wildlife Fund and the World Conservation Union (IUCN), and in conjunction with other conservation and intergovernmental agencies, is documenting the medicinal trade in wild fauna and flora. TRAFFIC's assessment of the wildlife medicinal trade involves a comprehensive review of trade at the regional, national, and international levels through the identification of potentially threatened medicinal taxa; documentation of their use and trade, and the extent to which such use or trade is incompatible with species survival; and working with other conservation organizations, medicinal practitioners, the medicinal industry, and governments to devise strategies to curb unsustainable wildlife trade.

As part of this global TRAFFIC effort, TRAFFIC USA is continuing to identify North American animal and plant taxa currently exploited for medicinal use and has initiated studies to determine possible trade threats. Two such studies involve documenting the status and trade of North American bears and the commercially valuable plant American ginseng. TRAFFIC USA undertook a study to document the deer (*Cervidae* spp.) antler trade after initial research suggested that deer antler appeared to be one of the most widely used ingredients in traditional Chinese medicine. The study's aim was to review the level and dynamics of antler trade in the United States and Canada in order to gain a better

understanding of antler use, particularly in the context of Chinese medicine, and assess the sustainability of the antler trade.

This report focuses primarily on the United States as a producer, exporter, and importer of cervid antler, but also discusses the equally important role of Canada in the antler trade for comparative purposes. In order to put the scope of the U.S. and Canadian antler trade in appropriate context, this report also discusses some of the other major antler trading countries and the role they play in global antler production and consumption.

The illegal commercial exploitation of North American cervid antler and its implications for the conservation and management of cervid populations in North America are not discussed in this report. However, instances of illegal take of antler and wild deer for commercial purposes have been reported in the United States and Canada. Therefore, a review of the extent to which illegal trade affects threatened cervid taxa and undermines conservation efforts is certainly warranted.

## II. BACKGROUND

Of the more than 40 cervid species that exist worldwide, only five species, and several subspecies, are native to the United States and Canada. North American cervid species are harvested commercially for meat, hides, velvet and shed antler, hunting trophies, broodstock, and other products for domestic and international trade. Unlike 19th-century exploitation of cervids, which was primarily to supply a moderate domestic meat market, the commercial use of North American cervids today is fueled largely by foreign demand for cervid parts and derivatives. The largest and fastest growing segment of this industry is the production of antler for the medicinal trade, particularly for the ubiquitous medicinal markets in Asia and Asian communities. Deer is considered one of the most important ingredients in Chinese medicine, with antler being the most-voluminously and frequently traded deer part used medicinally.

Native American Indian tribes hunted cervids and used their body parts for sustenance, decoration, weaponry, medicine, and spiritual and religious purposes (McCabe 1982). Cervid products were sometimes traded among North American Native American tribes, which suggests cervids held some value prior to colonization. In the 19th century, a growing market for cervid products such as meat and hides stimulated increased commercial exploitation of cervid species, with little regard for their conservation or long-term management. As a result of this uncontrolled harvest, by the early part of the 20th century the white-tailed deer (*Odocoileus virginianus*) population had declined to fewer than 500,000 individuals in the United States, while the combined Rocky Mountain elk (*Cervus elaphus nelsoni*) and Roosevelt elk (*C.e. roosevelti*) populations had shrunk to an estimated 41,000 animals.

Due in part to tightened state laws, successful conservation efforts, and better management, populations of white-tailed deer and both subspecies of elk have increased significantly--in some cases to the point of overpopulation. In fact, in some locales white-tailed deer and elk populations are so dense that they have become a nuisance to farmers, a danger to vehicle drivers, and a detriment to their own healthy population status. All other cervid populations in North America, with the exception of a few threatened subspecies, are considered either stable or growing.

Cervid antler is regularly harvested and traded in North America in the form of shed antler (also known as hard horn), velvet antler, and hunting trophies. "Shed antlers" are those naturally shed by North American cervids every spring. Much of the collected shed antler in the United States and Canada is found and sold to middlemen or dealers, and subsequently exported to Asian medicinal markets. A considerably smaller portion is collected for the arts and crafts industries, which manufacture furniture, jewelry, and other art objects for markets worldwide.

"Velvet antlers" are antlers in their early growth stages, when they are covered with a velvety layer of brown hair. It is the most highly prized antler used in Chinese medicine, and is considerably more valuable than shed antler in Asian markets.

The velvet antler stage usually occurs outside of the legal hunting season, so little velvet antler is taken through sport hunting. Traded velvet antler is sawed off animals on private cervid farms located throughout Canada and the United States, where it is typically frozen and prepared for export. While most of the velvet antler harvested in North America is exported to Asian medicinal markets, there has been an increase of velvet antler on the U.S. and Canadian health food market. The United States and Canada import velvet antler from New Zealand and Russia, most of which is processed and reexported to Asian markets. They also import processed products from Asia. A small portion of imported antler is sold in Asian pharmacies in the United States and Canada.

For the purposes of this report, the North American antler trade that is comprised of spiked antlers taken from legally hunted cervids is called the trophy trade. A number of native and nonnative big game species, including cervids, are legally hunted for sustenance and recreation in the United States and Canada during designated hunting seasons established by the states and provinces. Licensed hunters also purchase big game hunting packages through private outfitters to hunt a variety of cervids for sport on public and private land in the United States and Canada. While hunters take free-ranging wild cervids for their spiked antlers, or "trophy value," and may be permitted in some states and provinces to sell them to fur dealers and taxidermists, state and provincial laws generally require that the meat of the animal be used.

The values of cervid trophies mentioned in this report are based strictly on taxidermy price lists and the declaration values assigned to imports and exports of cervid trophies by the U.S. Fish and Wildlife Service. Price list and declaration values are used to compare the relative value of cervid trophies in U.S. trade only, and do not reflect the *actual* value of the U.S. and Canadian cervid trophy trade, for which only estimates can be given. It should also be noted that the total economic value of legal cervid hunting to the states and provinces is far greater than the revenue generated from trophy sales.



### III. METHODS AND SOURCES

The research for this report involved an extensive review of literature on the medicinal use of antler and the conservation of cervids; discussions with relevant experts; field surveys; review of taxidermy price lists and antler industry catalogues; and analyses of trade data obtained from the U.S. Fish and Wildlife Service (USFWS), foreign customs offices, and U.S. embassies in antler-trading nations. Because detailed published data on antler commercialization and trade are not generally available from governmental agencies, information presented here was gathered from representatives of the cervid farming industries of New Zealand and North America; individual cervid farmers; antler traders and processors; artisans; state and provincial wildlife officials; academics; and others.

The surveys and consultations conducted for this report included a review of the annual antler auction in Jackson Hole, Wyoming; a visit to antler warehouses and discussions with antler brokers in Montana; a visit to a major North American velvet antler processing plant in San Francisco; and a visit to a cervid farm in Montana.

International trade data on antler imports and exports are difficult to obtain because many countries use the Harmonized Commodity Description and Coding System (Harmonized System [HS]) or the Standard International Trade Classification (SITC). The HS, developed by the Customs Cooperation Council in Brussels, Belgium, classifies trade by raw or semi-raw materials. The SITC, developed by the United Nations at the same time as the HS for economic analysis purposes, classifies specific commodities. Neither system designates a specific category for antler or antler products. For instance, the HS generally groups antler under the catch-all code "worked ivory, bone, tortoise-shell, horn, antlers, coral, mother-of-pearl and other carving material, and articles of these materials (including articles obtained by molding)," making it virtually impossible to identify the actual amount of antler traded among countries that use this code. Some countries have modified, or further defined, their HS or SITC commodity categories so that they are more reflective of those commodities appearing regularly in commerce. For example, Hong Kong and the Republic of Korea, two of the largest antler trading nations, designate a specific HS code for antler that is useful in quantifying and analyzing antler imports and exports.

Due to the absence of detailed customs data, TRAFFIC contacted antler-trading countries directly for trade statistics on imports and exports of antler. In most cases, antler trade data was obtained through U.S. embassies in antler-importing countries, or, alternatively, from TRAFFIC offices with access to trade statistics.

Trade data on U.S. imports, exports, and reexports of antler were obtained from the USFWS computerized Law Enforcement Management Information System (LEMIS). LEMIS, which is maintained by the Division of Law Enforcement, records wildlife imports, exports, and reexports by species.

There are three main categories under which LEMIS designates U.S. imports, exports, and reexports of products which contain cervid parts likely to contain antler: horn products, trophies, and medicinals. LEMIS data do not specify whether these cervid-based "medicinals" contain antler. As antler is used extensively in Chinese medicine and is the most commonly traded cervid medicinal product, however, it is probable that a high percentage of these medicinals listed are antler-based. These products may also contain other cervid derivatives.

Canada does not have a national wildlife trade recording system. Therefore, TRAFFIC has extrapolated and relied on the trade data of Canada's trading partners to quantify and analyze that country's antler imports and exports.

#### IV. CONSERVATION AND LEGAL PROTECTION FOR CERVIDAE

##### Conservation Status

The cervid family, which occurs naturally throughout North America, South America, Eurasia, and northern Africa, is comprised of 17 genera and 45 species. Cervids have been introduced to countries such as Cuba, New Guinea, Australia, and New Zealand, where they do not naturally occur (Nowak 1991).

The World Conservation Union (IUCN), a membership organization comprised of governments, nongovernmental organizations, research institutions, and conservation agencies, publishes a list of those taxa it deems to be threatened with extinction. This IUCN Red List of Threatened Animals has no legal status, but it is universally recognized by the conservation community as a reliable source of information on the status of species, and is frequently used in according protection to species nationally and internationally.

According to the list's 1994 edition, 18 cervid taxa are classified as "endangered," 5 as "vulnerable," 2 as "rare," and 4 as "indeterminate" (see table 1). "Endangered" taxa are described by IUCN as species in danger of extinction, whose extirpation is imminent if the detrimental factors impacting their survival are not curtailed. The endangered category includes taxa whose numbers or habitats have been drastically reduced, and who, despite having reportedly been seen a few times in the wild in the last 50 years, may be extinct. "Vulnerable" taxa include those populations that are decreasing due to overexploitation, habitat loss, and other environmental disturbance. Populations of taxa considered vulnerable may still be abundant, but are under continued threat from detrimental factors throughout their range. Taxa designated as "rare" by IUCN have small populations worldwide and are at some degree of risk, but are not threatened enough to be considered endangered or vulnerable. Taxa described as "indeterminate" are known to be endangered, vulnerable, or rare, but there is not enough information on their status to accurately place them in one of these three categories. Taxa that do not qualify for classification in any of the three categories (endangered, vulnerable, or rare), and for which there is also a lack of information, are labelled "insufficiently known."

Table 1

Conservation Status of Threatened Cervidae						
Species/Subspecies	Listed on CITES Appendices		Listed as Endangered Under ESA*	IUCN Classification		
	I	II		Endangered	Vulnerable	Rare
<i>Axis porcinus annamiticus</i> Calmanian hog deer	✓		✓	✓		
<i>Axis porcinus calamianensis</i> Ganges hog deer	✓			✓		
<i>Axis porcinus kuhli</i> Bawean hog deer	✓		✓	✓		
<i>Blastocerus dichotomus</i> Marsh deer	✓		✓		✓	
<i>Cervus albirostris</i> Thorold's deer, white-lipped deer					✓	
<i>C. alfredi</i> Visayan spotted deer				✓		
<i>C. duvaucelli</i> Swamp deer	✓		✓	✓		
<i>C. elaphus bactrianus</i> Bactrian wapiti		✓	✓			
<i>C.e. barbarus</i> Barbary deer			✓			
<i>C.e. corsicanus</i> Corsican red deer			✓			
<i>C.e. hanglu</i> Kashmire red deer	✓					
<i>C.e. macneillii</i> McNeill's deer			✓			
<i>C.e. yarkendensis</i> Yarkand deer			✓	✓		
<i>C. eldii</i> Eld's deer	✓		✓		✓	

Conservation Status of Threatened Cervidae						
Species/Subspecies	Listed on CITES Appendices		Listed as Endangered Under ESA*	IUCN Classification		
	I	II		Endangered	Vulnerable	Rare
<i>C.e. eldii</i> Manipur brow-antlered deer				✓		
<i>C.e. siamensis</i> Thailand brow-antlered deer				✓		
<i>C. mariannus</i> Philippine brown deer						✓
<i>C. nippon grassianus</i> Shansi sika deer			✓	Probably Extinct		
<i>C.n. keramae</i> Ryukyu sika deer			✓	✓		
<i>C.n. kopschi</i> South China sika deer			✓			
<i>C.n. mandarinus</i> North China sika			✓	✓		
<i>C.n. taiouanus</i> Formosan sika			✓	✓		
<i>Dama dama mesopotamica</i> Persian fallow deer	✓		✓	✓		
<i>Elaphurus davidianus</i> Père David's deer				✓		
<i>Hippocamelus antisensis</i> Peruvian guemal	✓				✓	
<i>H. bisulcus</i> Chilean guemal	✓			✓		
<i>Hydropotes inermis</i> Chinese water deer					✓	
<i>Mazama chunyi</i> Chunyi				Indeterminate		
<i>Megamuntiacus vuquanghensis</i> Giant muntjac	✓					

Conservation Status of Threatened Cervidae						
Species/Subspecies	Listed on CITES Appendices		Listed as Endangered Under ESA*	IUCN Classification		
	I	II		Endangered	Vulnerable	Rare
<i>Muntiacus crinifrons</i> Black muntjac				✓		
<i>M. feae</i> Fea's muntjac				✓		
<i>M. gongshanensis</i> Gongshan muntjac				Indeterminate		
<i>Odocoileus hemionus cedrosensis</i> Cedros Island mule deer			✓			✓
<i>O. virginianus clavium</i> Key deer			✓	✓		
<i>O.v. leucurus</i> Columbian white-tailed deer			✓			
<i>Ozotoceros crinifrons</i> Pampas deer	✓		✓	Insufficient Information		
<i>Pudu mephistophiles</i> Northern pudu		✓		Indeterminate		
<i>P. pudu</i> Southern pudu	✓			Indeterminate		
<i>Rangifer tarandus caribou</i> Woodland caribou			✓			
<i>R.t. pearyi</i> Peary caribou				✓		

\* No species are listed as "threatened" under the U.S. Endangered Species Act (ESA)

The IUCN Species Survival Commission (SSC) Deer Specialist Group (DSG) has recently reviewed the conservation status of cervids and, in a forthcoming action plan, will make recommendations to improve the management of threatened cervid species worldwide. The action plan highlights conservation efforts that have helped overexploited and previously threatened North American taxa recover from near extinction. The plan underscores the remaining challenges facing threatened taxa and the urgency for action to ensure their long-term conservation.

North America has five indigenous species of cervids, including as many as four dozen subspecies distributed throughout the continent. The Deer Specialist Group identifies two cervid taxa as vulnerable. The Columbian white-tailed deer (*Odocoileus virginianus leucurus*) occurs in two separate populations in Oregon and Washington. The Peary caribou (*Rangifer tarandus pearyi*) is restricted to the Canadian high arctic island habitat, and has declined by 90 percent in the past three decades. The Key deer (*O. v. clavium*), which is found in parts of Florida, is classified as endangered. The tule elk (*C. elaphus nannodes*), restricted to portions of northern California, was near extinction a century ago but has recovered due to conservation efforts in the last century (DSG 1995).

Wild populations of native white-tailed deer and North American elk declined due to habitat loss and overexploitation throughout the late 19th and early 20th centuries. Both species have recovered to healthy levels, with the exception of two subspecies of native North American elk, *Cervus elaphus merriami* and *C.e. canadensis*, which have been extinct since the mid 1800s. The white-tailed deer population in the United States has increased enormously from the vastly reduced estimate of 500,000 at the turn of the century to around 20 million today. A decrease or loss of predators, growth of secondary forest cover with extensive undercover foliage for food, and better laws are responsible for this tremendous growth in white-tailed deer numbers. This population boom has placed some local populations in competition with humans for habitat and created numerous wildlife management challenges (DSG 1995). North American elk rebounded from a population of fewer than 100,000 at the turn of the 20th century to more than three quarters of a million animals today (Dratch 1993).

Excessive hunting had severely reduced North American populations of caribou (*R. tarandus*) by the late 19th century, and had led to the disappearance of the species in much of the southern portion of its range in the United States. That range extended from northern Minnesota and Wisconsin, the upper peninsula of Michigan, and the very northern tip of the lower peninsula of Michigan in the midwest to Maine and possibly New Hampshire in the east, and to northwest Montana and the northern part of the Idaho panhandle (Campbell pers. comm. 1996, Nowak 1991). By the late 1980s, however, owing to stricter limits on hunting, U.S. and Canadian caribou populations had rebounded, particularly in northwestern Alaska

where the caribou population climbed from an estimated 75,000 in 1976 to over 200,000 by 1984 (Williams and Heard 1986, Miller 1987). The largest herd, comprised of the great barren ground caribou subspecies (*R.t. groenlandicus*) with some 600,000 individuals, is found in northern Quebec and Labrador (Williams and Heard 1986). Conversely, the subspecies *R.t. pearyi*, found in the Canadian Arctic Archipelago, has dwindled to fewer than 4,000 individuals and is listed as endangered by IUCN (Gunn, Miller, and Thomas 1981, Burnett *et al.* 1989).

Caribou generally do not respond positively to disturbances and have not adapted to the symptoms of increased human population as have white-tailed deer and elk. For instance, herds of woodland caribou in the northeastern United States and southeastern Canada have been severely impacted by habitat alteration and the northward invasion of parasite-carrying white-tailed deer (Nowak 1991). Remaining caribou herds may be at risk from oil and gas exploration, blockage of migratory routes by transportation corridors, and other environmental modifications in the Arctic (Bergerud, Jakimchuk, and Carruthers 1984).

Despite the localized erosion of moose habitat in North America, moose populations in Canada and the United States, which increased an estimated 16 percent between 1982 and 1991, are relatively healthy (Timmermann and Buss 1995, Kelsall 1987). The increase in moose numbers is attributed to a number of possible factors, variable from place to place, including improved management through selective hunting and predator control; improvement of habitat following the reintroduction of beavers and beneficial forestry practices; a reduction in the number of white-tailed deer that are known to carry the parasite *Pneumoststrongylus tenuis*; the adaption to new ranges; and the reinvasion of unoccupied ranges by moose (Kelsall 1987). Of the estimated one million moose distributed among 22 U.S. states and Canadian provinces and territories, more than 70,000 moose are reportedly killed each year (Kelsall 1987).

#### International Protection: CITES

The United States and Canada are among more than 130 nations that are parties to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). In effect since 1975, CITES parties meet every two and one-half years at a Conference of Parties to discuss and adopt measures to regulate trade in wild animals and plants covered by the treaty's three appendices. International trade in these species must be accompanied by CITES permits or certificates issued by the CITES authorities of the countries of export, and, in the case of the most threatened species, by import permits issued by the CITES authorities of the importing country.



Fifteen cervids are listed in the CITES appendices (see table 1), none of which are native to North America. Two cervid taxa are listed in CITES Appendix II. These may be commercially traded only if a valid CITES export permit from the country of export or a CITES reexport permit from the country of reexport has been issued for the cervid specimen(s) intended for export. CITES export permits are approved only when a Scientific Authority of the State of export has advised that such export will not be detrimental to the survival of the species; a Management Authority of the State of export is satisfied that the specimens were legally obtained in accordance with relevant national laws of that state; and, in cases of trade involving live cervids, a Management Authority of the State of export is satisfied that measures will be taken to ensure minimal risk of injury, damage to health, or cruel treatment to live animals during transport. For the reexport of an Appendix II cervid specimen, a CITES reexport permit is granted and presented prior to the reexport only when the Management Authority of the state of reexport is satisfied that the specimen was imported into that state in accordance with CITES provisions.

Thirteen cervid taxa are included in CITES Appendix I, indicating that they are threatened with extinction and are, or may be, affected by trade. Cervids, and their parts and derivatives thereof, listed in Appendix I cannot enter international trade for commercial purposes except under special conditions. In particular, CITES provides that Appendix I species may be traded internationally for zoological or scientific purposes under a quota system. Through the establishment of a quota system approved by the Conference of Parties, a party can export Appendix I species, or specimens thereof. For example, the United States allows hunters to import hunting trophies of Appendix I animal species in conformance with U.S. Endangered Species Act regulations and CITES controls, and in accordance with restrictions promulgated by the U.S. CITES Management Authority. The quota system is founded on the belief that the take of some species on an animal-by-animal basis in defense of human life, livestock, and property is periodically necessary, particularly if the species is not endangered throughout its entire range. Quotas may also be established based on the premise that the take of individual animals may actually enhance the survival of the species (CITES Res. Conf. 4.13).

There are two conditions under which a party may be allowed to trade specimens of Appendix I species for commercial purposes: ranching and specific reservations. The Conference of Parties, through close consultation with the CITES Secretariat and the CITES Standing Committee, may approve a party's proposal to ranch an Appendix I species if it is satisfied that the wild populations of the species in the country proposing the ranching operation are not endangered and would derive some conservation benefit from ranching. A party seeking approval to ranch an Appendix I species--the rearing in a controlled environment of specimens taken from the wild--must propose to downlist its wild populations from Appendix I to Appendix II, and meet certain criteria prior to the approval of its ranching proposal by the Conference of Parties (CITES Res. Conf. 3.15). A party that

disagrees with an Appendix I species amendment may inform the CITES Secretariat within 90 days of the amendment's adoption by the Conference of Parties that it will ignore the Appendix I listing and trade controls. A party having entered a reservation regarding an Appendix I species is treated as a non-party with respect to trade in that species, and is expected to treat that species as if it were listed in Appendix II for all purposes, including documentation and control (CITES Res. Conf. 4.25). Conversely, parties in disagreement with a downlisting or deletion of a species may adopt stricter domestic trade control measures.

CITES-listed cervid taxa are not commonly exploited for commercial international trade, but do yield parts and derivatives, such as velvet antler and antler trophies, which resemble those of other less-threatened cervid taxa regularly exploited for commercial trade. It is important to be able to distinguish between antler of the various cervid taxa in trade so that accurate data can be compiled to monitor species exploited for trade, and to control or prohibit the trade in imperiled species.

According to the National Fish and Wildlife Forensic Laboratory in Ashland, Oregon, processed cervid antlers typically lack the morphological characteristics or serological properties that make species determination feasible. However, the laboratory has chemically analyzed blood samples taken from representative populations of North American white-tailed deer, mule deer, blacktail deer, and elk, European red deer and fallow deer, and Asian sika deer, and has identified characteristics of the hemoglobin. Forensic laboratory scientists hope the results of the blood analysis will provide baseline information for comparison with results obtained from an analysis of processed antler products. The laboratory has developed a method to identify cervid antler to the genus level, and is hopeful that the method will be successful in identifying cervid antler to the species level in the near future. The identification of processed antler by species should help wildlife officials determine the level and legality of trade in protected or threatened cervid species, and evaluate the impacts of trade on wild populations.

#### United States Federal Law

Trade in cervid species in the United States is regulated under the Endangered Species Act (ESA), the Lacey Act, CITES, and state law. Under the ESA, it is illegal to take, import, export or trade in interstate commerce any species listed under the act as endangered, except pursuant to a permit issued for scientific purposes or to enhance the survival or propagation of the species. The same trade prohibitions may be applied to species listed as threatened under the act. Twenty-one cervid taxa, three of which are native to North America (Key deer, Columbian white-tailed deer, and Woodland caribou) are listed as endangered under the ESA. Commercial trade is not considered a threat to native North

American cervids listed as endangered under the ESA. The following nonnative taxa listed as endangered under the act have been reported in U.S. trade: Corsican red deer (*Cervus elaphus corsicanus*), Formosan sika deer (*C. nippon taiouanus*), South China sika deer (*C. n. kopschi*), and swamp deer (*C. duvauceli*) (also listed in CITES Appendix I).

The U.S. Lacey Act prohibits the import, export, transport, sale, purchase, and ownership of any fish or wildlife taken or possessed in violation of any state or federal law, treaty, or regulation of the United States. Under the Lacey Act, it is also unlawful to import, export, transport, sell, receive, acquire, or purchase in interstate or foreign commerce any fish or wildlife taken, possessed, transported, or sold in violation of any U.S. or foreign law. Furthermore, the submission of false records or any other false identification of any wildlife imported, exported, sold, purchased, or received from foreign countries or transported in interstate commerce is also prohibited by the Lacey Act.

The removal of wildlife, plants, and parts thereof from most federal land is regulated, and in national parks generally prohibited.

Virtually all states have a system of mandatory licenses and permits, tags, stamps, certificates, applications, and other restrictions on the legal removal of fish and wildlife within their jurisdiction. Some methods of taking wildlife, such as the use of spotlights, poisons, dogs, traps, and vehicles, are also restricted. Many states also require certain commercial enterprises and businesses (e.g., trappers, taxidermists, etc.) involved in the use of wildlife to obtain licenses or permits (Musgrave and Stein 1993).

Federally listed endangered and threatened species often receive additional protection under state law. Most states follow the federal ESA model for making changes to their own endangered species lists, and give a state agency or interested citizens the opportunity to petition for additions, deletions, or changes in the species listings (Musgrave and Stein 1993). Most states also have adopted the same criteria by which the federal government lists, downlists, or delists a species.

While most states do regulate the harvest of cervids and require hunters to report their take to the appropriate state authorities for management purposes, only a few states also regulate and actively monitor the commercialization of cervid parts. Consequently, there is a lack of readily available data on the total exploitation and commercialization of cervids and cervid parts in the United States.

## Canadian Federal Law

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) is comprised of federal, provincial, and nongovernmental wildlife officials and annually designates Canadian species or species' populations as endangered, threatened, vulnerable, extirpated, or extinct (Dauphine pers. comm. 1996). Although federal law provides no special legal protection for designated species, a few Canadian provinces use the COSEWIC list to accord protection to species or populations within their jurisdiction.

Caribou populations designated as endangered by COSEWIC include a population of a few thousand Peary caribou (*R.t. pearyi*) located in the Arctic Islands, and a few hundred Woodland caribou (*R.t. caribou*) located at the southern part of their range near the St. Lawrence River. A few thousand more caribou located in the western provinces are designated vulnerable. These caribou populations are reportedly threatened by starvation, habitat loss or alteration, or exposure to the parasitic meningeal worm (*Parelaphostrongylus tenuis*) in eastern Canada (Dauphine pers. comm. 1996).

Most of Canada's public land and terrestrial wildlife is under the jurisdiction of provinces or territories. Provincial and territorial legislation provides the means of regulating wildlife exploitation through various controls, such as licensing, seasons, restriction of area, and specification of hunting techniques (Gregorich 1992). While Canadian provinces have constitutional jurisdiction over natural resources and wildlife, the federal government has constitutional jurisdiction over trade and commerce.

Until June of 1996, CITES in Canada was implemented by the Export and Import Permits Act and, to some extent, the Game Export Act (GEA). The GEA regulated the interprovincial trade in game. Under this act, export permits were required for the interprovincial transport and export of dead game as well as the possession of game killed in another province or territory. Each export of game must be accurately and clearly labelled with a description of the contents and the exporter's name and address.

On June 6, 1996, the federal government announced passage of the Wild Animal and Plant Protection and Regulation of International and Interprovincial Trade Act (WAPPRIITA). The passage of this new law effectively replaces the Export and Import Permits Act as it concerns wildlife and repeals the Game Export Act. WAPPRIITA regulates the import, export, or interprovincial transport of CITES-listed species by requiring that shipments be accompanied by permits issued by the Department of the Environment or under the authority of the minister of the Department of the Environment. This law makes it illegal to import into Canada any animal or plant that was possessed, distributed, or transported in contravention of any law or regulation of any foreign state or Canadian province.

## Canadian Provincial and Territorial Law

Canadian provinces and territories have the authority to regulate the import and export of wildlife taken across their borders. All provinces and territories except Newfoundland, Nova Scotia, Manitoba, and Saskatchewan require a provincial export permit to remove wildlife from their jurisdictions. In these four provinces, a validated nonresident hunting license may be used in lieu of a permit for non-CITES species.

The collection of shed antler from public land is regulated by the provinces and territories. No provinces or territories have restrictions in place for the collection of shed antlers from public land, with the exception of Newfoundland, where a permit is required for the collection and sale of moose and caribou shed antlers, and British Columbia which requires a permit for the possession of shed antlers. Four provinces (Alberta, Northwest Territory, Prince Edward Island, Yukon Territory) require permits for the export of shed antlers. See table 2 for a summary of the legality of shed antler collection in the Canadian provinces.

Table 2

Legality of Collection and Export of Shed Antlers in Canada's Provinces	
Province	Legal Status of Collection and/or Export
Alberta	No regulation prohibiting the collection of shed antlers; an export permit is required (Alberta Department of Environmental Protection, Natural Resources Division, 1996).
British Columbia	Permit required from the Wildlife Branch for the possession of shed antler (BC Wildlife Branch, 1996).
Manitoba	No prohibition against the collection of shed antlers; fur dealing, hunting, or trapping license is needed to sell, trade or barter antlers, with the exception of velvet antlers (Manitoba Wildlife Act).
New Brunswick	No regulation prohibiting the collection of shed antlers (Lonny Larson, New Brunswick Fish and Wildlife Division, 1996).
Newfoundland	Although shed antlers of moose and caribou may be collected and sold to craft manufacturers operating within the province, a permit to collect shed antlers must first be obtained from the Minister of Natural Resources (s. 38(5), Newfoundland regulation 17/84, the Wildlife regulations).
Northwest Territory	No regulation prohibiting the collection of shed antlers; an export permit is required (Wildlife Act, R.S.N.W.T. 1988, c. W-4, as amended).
Nova Scotia	The removal of shed antlers from a provincial park is prohibited, otherwise collection is permitted (Julie Towers, Nova Scotia Department of Natural Resources, 1996).
Ontario	No regulation prohibiting the collection of shed antlers (Ontario Ministry of Natural Resources, 1996).
Québec	No regulation prohibiting the collection of shed antlers (Serge Bergeron, Service de la Réglementation, Québec Department of the Environment and Wildlife, 1996).
Prince Edward Island	Export permit from the jurisdiction where antlers are collected is needed in order to import antlers (Randy Dibley, Prince Edward Island Department of Fisheries and Environment, 1996).
Saskatchewan	No regulation prohibiting the collection of shed antlers (Enforcement Officer, Saskatchewan Wildlife Division, 1996).
Yukon Territory	No regulation prohibiting the collection of shed antlers; an export permit is required (Yukon Wildlife Act, as amended).

## V. ANTLER BIOLOGY AND COMPOSITION

Antlers, morphological appendages comprised primarily of minerals, protein, carbohydrates, and fatty acids, are bonelike branches that grow from the base of the skulls of deer (*Cervidae* spp.) (Sunwoo *et al.* 1995). The only two cervid genera that lack antlers are the Asian genera musk deer (*Moschus* spp.) and water deer (*Hydropotes* spp.). Antlers generally occur in male cervids, but also in both sexes of caribou, and, in rare cases, in females of other species.

Antler growth is triggered and controlled by hormones, and is a temporal, seasonal phenomena, beginning with the development of new cartilage tissue in spring and ending with antler shedding, or casting, the following winter or spring. For example, in North America species of the genus *Cervus* usually cast their antlers in spring, while those of the genera *Odocoileus* and *Alces* drop their antlers in mid to late winter. The timing of the antler growth cycle is linked to male sexual development, testosterone secretion, physical health, and behavioral well-being (Goss 1985).

New antlers slowly form on the pedicle, a bony nub at the front of the skull. When the pedicle is hormonally stimulated, antler begins growing from it through the deposition of cartilage tissue (Goss 1985). Maturing antlers are typically covered with numerous short, fine hairs, making them appear velvety. Older animals generally produce larger, heavier, and higher quality velvet than younger ones. During this stage of its development, antler is called velvet antler, velvet, young or green antler. Young antlers grow at an average rate of 1 cm/day, approximately equivalent to 50 g/day in some species, and, depending on the age of the animal, reach maximum size in 90-140 days (Moore 1984). Tissue-producing cells called osteoblasts secrete a bonelike tissue (osteoid), and have a mineralizing effect on the cartilage. Osteoid is in turn replaced by bone material known as osteon (Goss 1985).

Velvet growth peaks when the vascular channels narrow and choke the antlers' blood supply (Goss 1985). This phase in antler development is characterized by increasing mineralization, or calcification, resulting in the formation of hard, spiked racks. Deer develop progressively larger antlers each year, and acquire additional "branches" or "points" in succeeding years until the animal has reached full maturity. These racks are used by stags in establishing dominance over other males during the mating season, known as the rut, which occurs in the fall. After the rut, antlers become behaviorally obsolete, and are cast or shed in the following weeks, usually in mid-late winter or spring (Goss 1985).

Velvet antler of maral wapiti (*Cervus elaphus*), reindeer (*Rangifer tarandus*), sika deer (*C. nippon taiouanus*), roe deer (*Capreolus capreolus*), red deer (*C. elaphus*), and possibly other cervids has been analyzed to determine its chemical composition. For example, various phospholipids (cerebroside, cardiolipin, sphingomyelin, etc.), steroids (oestrogen, progesterone, testosterone, etc.), amino acids, elements, and trace elements have been identified in velvet antler extracts of maral wapiti (Silaev *et al.* 1968, Sunwoo *et al.* 1995). The carbohydrate and lipid content of *C.n. taiouanus* antler was studied and found to contain a number of neutral sugars and amino sugars. An examination of the lipid content of *C.n. taiouanus* antler revealed that it had a concentration of two-thirds neutral lipids with the balance consisting of smaller but equal amounts of glycolipid, ganglioside, and phospholipid (Kong and But 1985). In one study where antler removed from 4-year-old wapiti was analyzed, the contents of dry matter, collagen, ash, calcium, phosphorous, and magnesium increased, and those of protein and lipid decreased, downward from the tip to the base of the antler (Sunwoo *et al.* 1995).

The physical and chemical properties of hard antler differ from those of velvet, and can also differ slightly among cervid taxa. Using elk antler as a general measure of antler composition, fully calcified, mature antler is predominately dead bone, which consists of dry matter composed of 21.8 percent calcium and 10.4 percent phosphorous (Fennessy 1991).



## VI. ANTLER UTILIZATION

### Grading of Antler in Traditional Chinese Medicine (TCM)

Velvet antler and shed antler are both valued for their medicinal properties. Shed antler (also known as hard horn in TCM and the trade) is considered of poorer quality and less value than velvet--Chinese herbal products containing velvet antler are generally more expensive than those made with hard horn.

In TCM, the degree of antler calcification has a direct bearing on its medicinal and commercial value. Antler which has reached an advanced stage of calcification is generally considered of lower pharmacological quality (Fennessy 1991). Thick, heavy velvet antler with a minimal amount of calcification is the most valuable. To produce a high quality product, deer farmers harvest velvet antler from living deer prior to calcification. According to Russian olympic coach Dr. Victor Shenynkin, who researches natural products that could be used as substitutes for harmful anabolic steroids, velvet deer antler must be removed at the right time of the year, and in the right proportion--otherwise the product becomes anabolically inactive and worthless (Duarte and Abdo 1995).

Though antler grading systems differ from one form of TCM to another, it is generally accepted that the tip of the antler contains the highest concentration of pharmacological properties, and is the most coveted in TCM (Fennessy 1991).

For example, the Asian system classifies velvet antler into four hierarchial sections, with the base (or bone) having the lowest pharmacological value, and the tip (or wax piece) having the highest. The midsection of developing antler just above the base is known as the honeycomb, while the upper section below the wax tip is called the blood piece (Fennessy 1991).

This grading system is also summarized in the popular Hong Kong-based magazine *Sudden Weekly*. The magazine explains that velvet antler, or "Hairy Deerhorn," is divided into two sections known as *Zui* and *Sha* (these two Chinese terms are based on the romanization system, pinyin, from the PRC). The *Zui* section, which has finer lines and a softer texture than the *Sha*, extends from the tip of the antler to two centimeters below the antler's tip, where the efficacy of the velvet is allegedly higher. The *Sha* section, the part of the antler below the first two centimeters of the tip to the base of the antler, has a higher rate of calcification than the *Zui* section, and is not considered as efficacious; pieces of *Sha* are often stewed with meat and eaten (Lam 1996).

The value of velvet antler depends on the standards (such as size and shape) by which velvet is graded, which vary from country to country. For example, maral deer (*Cervus elaphus maral*) and North American elk (*C.e. canadensis*), which produce thick velvet antler, are the preferred species in the Republic of Korea (South Korea) and Japan. By contrast, Chinese and Taiwanese markets favor antler of sika (*C. nippon*), sambar (*C. unicolor*), and white-tailed deer because these species bear velvet antlers with smaller dimensions (Barrie pers. comm. 1995).

Regardless of size, proper care in handling and storing velvet after harvest is a key consideration in retaining its value. Proper care typically involves preserving freshly removed velvet antler by freezing it prior to processing. Cut, broken, scarred, dirty, or otherwise damaged velvet decreases significantly in value.

New Zealand's deer farming industry has developed standardized velvet grading guidelines, which grade velvet antler based on antler symmetry, circumference, length, calcification, and weight. According to New Zealand's velvet antler scale, a velvet antler of high quality has rounded points at the end of each branched antler, nonindented bulbous at the tip of the antler, minimal calcification, symmetrical beams and points, and a minimal circumference of 18 centimeters (NZ Game Industry Board 1994).

### Use of Antler in Traditional Chinese Medicine

Deer, particularly spotted or sika deer which occur in mainland China, have long been recognized as spiritually symbolic animals in China and are believed to bring health and longevity. In Chinese mythology, spotted deer ride with the god of longevity as the symbol of medicinal values. Deer antler has been a standard ingredient in Chinese pharmacopoeia for over two millennia. Scrolls dating back to the Han Dynasty (206 B.C.- A.D. 220), indicate that deer antlers were used for treating snake bites and diseases. *Pênts'ao*, a collection of manuscripts on Chinese pharmaceutical natural history that has been periodically updated since its inception in the first century A.D., contains a list of Chinese *materia medica*, or herbs used in Chinese pharmacopoeia. (In TCM, plants, animals, and minerals are considered as herbs.) The first edition of *Pênts'ao*, known as *Shên Nung Pênts'ao*, listed only three deer parts that were used medicinally. By compiling the works of anonymous authors, Li Shih-chen (Li Shi Zhen in pinyin) expanded the total number of medicinally used deer parts to 21 in the renowned *Pênts'ao K'ang Mu*, or the Compendium of Materia Medica in 1590. By 1765, three additional deer parts were added to the Compendium, bringing the total number of deer parts used in Chinese medicine to 24.

Among the deer parts listed in *Pên-ts'ao* are velvet and shed antler, used for treating epilepsy, strengthening stamina, spurring tooth growth, and curing boils, as well as expelling "evil air" (table 3). Of the 28 deer products described in today's *Pên-ts'ao*, antler is reputedly the oldest and most efficacious. Today, TCM practitioners regard deer as the most important animal in Chinese medicine (Kong and But 1985). Antler-based herbal preparations are used to fortify and nourish the body (Chen 1973; Wu 1979). Velvet deer antler is categorized as a health tonic in TCM and is used to restore and replenish parts of the body, particularly the blood and organs.

Table 3

List of Medicinally Used Deer Parts Documented in the Ancient Chinese Pharmacopeia ( <i>Pên-ts'ao</i> )	
Antler	Stomach
Velvet	Stomachic concretion
Antler glue	Venison
Residue of antler glue	Fat
Bone	Gall bladder
Bone marrow/spinal cord	Penis and testes
Head glue	Semen
Bone of lower limb	Fetus
Head meat	Sinew
Brain	Excrement
Tooth	Meconium
Thyroid gland	Undigested milk
Skin	Shank
Blood	Tail

Source: Kong Y.C. and P.P.H. But, 1985

The National Institute of Control of Pharmaceutical and Biological Products under the Ministry of Public Health is the Chinese regulatory agency that sets standards for TCM by registering approved drugs in the official drug compendium, *The Pharmacopoeia of the People's Republic of China*. *The Pharmacopoeia* lists four deer parts: velvet, hard antler, antler glue, and residue of antler glue.

Velvet antler, known pharmaceutically in Latin as *Cornu cervi parvum*, is generally prepared in the form of tea or broth, and is used for impotence, weakness in the lower back and knees, and blood abnormalities linked to physical and/or mental development disorders in children (Bensky and Gamble 1986). Velvet has been clinically tested by Eastern medical clinicians, and found to reduce the symptoms of ulcerations, sores, uterine bleeding, and other problems associated with blood coagulation (Fennessy 1991). Although velvet antler is used primarily as a tonic or preventative and restorative in Chinese medicine, *The Pharmacopoeia* officially recognizes the use of velvet antler in the treatment of a number of specific medical conditions, including lumbago, tuberculosis, impotence, premature ejaculation, irregular menstrual bleeding, menopausal disorders, spermatorrhea, frequent urination, wet dreams, vertigo, and anemia (Pinney 1981; Ng 1982a,b; Kong and But 1985; Yoon 1989; Young 1990 cited in Fennessy 1991).

Derivatives of velvet antler, including deer antler glue (*Colla or Gelatinum cervi cervi*) and deer antler glue sediment (*Cornu cervi degelatinatum*), which is the residual material remaining after antler has been boiled, are not considered as high in quality as pure velvet extract. Evidence from clinical tests, however, suggests that deer antler glue may also be used to tonify the blood and facilitate coagulation.

TCM considers different parts of the antler to have different medicinal uses. Younger people are prescribed preventative medicines usually in the form of tonics from the upper two sections of the antler (wax and blood piece), while the lower part (bone piece) is regarded as being of noticeable benefit to older people subject to calcium deficiency (Yoon 1989; Young 1990 cited in Fennessy 1991).

### The Aphrodisiac Claim

Some of the literature reviewed for this report indicates that velvet antler is used as an aphrodisiac in TCM. For instance, velvet horns of sika deer are purportedly used by some Asian males as an aphrodisiac, a bone marrow tonic, and a blood food (Bernard 1982). Moreover, *Sudden Weekly* claims that "Hairy Deerhorn" (velvet antler) contains a small amount of a hormone which, among other things, promotes the function of sex glands (Lam 1996). A few Western laboratory tests indicate that velvet antler produces no significant sexual hormonal effects, while other tests conclude that it stimulates sexual hormonal activity (Bensky and Gamble 1986). Despite inconclusive scientific evidence that supports velvet antler's sexual hormone effects, velvet antler is prescribed for sexually related ailments in

Chinese medicine.

It is unknown, however, whether velvet antler has been historically prescribed as a sexual aid in TCM, or whether its current application in Chinese medicine to treat sexually related ailments has evolved out of modern marketing schemes promoting the aphrodisiac claim. Furthermore, the meaning of aphrodisiac in TCM may vary from the use of the word in Western culture, resulting in its misinterpretation. For example, velvet antler in TCM may be prescribed to treat problems relating to sexual ability, such as impotence, and have very little to do with influencing sexual drive.

There is no conclusive evidence linking the chemical composition of antler to the aphrodisiac values described for it in Chinese medicine. A number of clinical tests in which velvet antler has been administered to animal and human subjects reveal the presence of pharmacological properties, but the biochemical basis of these properties has yet to be determined (Hudson and Burton 1993). Because Western medicine has focused on disputed claims of velvet antler's effectiveness as an aphrodisiac, Western medical practitioners have dismissed velvet antler as a serious candidate for pharmacological application in the West (Fennessy 1991).

Deer tail, a highly valued cervid product which is usually marketed in its waxed and polished jet-black form, is also allegedly used to increase the beneficial effect of the velvet antler on virility (Kong and But 1985). In comparison to deer antler, deer tail use in TCM is a recent phenomena (Kong and But 1985).

### Clinical Application and Western Use of Antler

Clinical research in Russia and Japan reveals that doses of *pantocrin* (alcoholic extracts from antlers of sika deer, red deer, maral deer, and North American elk) and *rantarin* (alcoholic extracts from reindeer) strengthen muscles surrounding the heart, increase circulation, regulate heart beat and pulse, increase the flow of oxygen to vital organs such as the brain, liver, and kidneys, and in animals stimulate the development of the prostate (Bensky and Gamble 1986).

Laboratory tests conducted in Russia and Japan have also shown that pantocrin increases athletic performance and mental capacity (Brechman *et al.* 1969, cited in Fennessy and Taneyeva, cited in Brechman 1971 and Fennessy 1991). In addition, pantocrin and other naturally derived substances from velvet antler including calcium, magnesium, phosphorous, and traces of estrone, a hormone typically found in females, may reduce susceptibility to disease by accelerating the body's natural restorative processes (New Zealand Game Board 1992). Further evidence from Russian studies suggests that velvet or shed antler preparations may alleviate stress and shock-related conditions associated with traumatic events. For example, Russian patients who were administered rantarin before surgery for gastrointestinal

tumors experienced a reduction in the amount of stress during and after surgery (Fennessy 1991).

Although the touted medicinal benefits of antler are based on the collective experience of users over many centuries, Western medicine does not recognize antler products as a medicine, although the hormones and active ingredients of antler may be recognized. Nevertheless, claims of its therapeutic effectiveness in Asia and its growing popularity as a health food or dietary supplement in Western markets have prompted closer scientific scrutiny and experimentation in alternative medicine.

In the United States, health food manufactured products, such as those containing antler, are legally designated as dietary supplements and are regulated as foods, not drugs, if they don't claim to have therapeutic effects. Natural food companies in the United States and Canada, among other countries, cannot make unproven medical claims on dietary supplements, but may disclose information on the impact of dietary supplements on a particular bodily function. One U.S. company offers capsules containing powdered velvet antler from farmed red deer and wapiti, and calls velvet antler "the ultimate nutritional supplement to promote wellness and vitality." Another company specializing in developing nonsteroidal sports supplements that aid athletes in performance, stamina, and muscle growth, markets a velvet deer antler-based product (Duarte and Adbo 1995). According to an article in which this latter product is advertised, velvet antler contains hormonal substances that help stimulate the growth of tissue at a cellular level, and which can, theoretically, improve muscular development in animals (Duarte and Adbo 1995).

#### **Antler-Based Medicines and Markets**

Most deer products and derivatives used in medicines are available in a variety of forms, such as pieces, pills, powder, dried slices, wine, liqueur, extract, and jelly. Next to ginseng (*Panax* spp.), the most frequently used herb in Chinese medicine is velvet antler, which is often prepared with ginseng to enhance its efficacy (Kong and But 1985). Raw antler is usually cut or sliced, steeped in boiling water, and then taken in the form of a broth or tea. Most semi-processed or processed antler is encapsulated or made into wine, liqueur, extract, jelly or another form which can be easily stored, marketed, and consumed. Velvet antler from killed deer is usually prepared in whole pieces, dried slices or wine. Velvet antler removed from live deer is more commonly available in dried slices or wine; shed antler is processed and ingested in the form of pills or powder (Lee and Ch'ang 1985).

Many medicines containing deer parts are marketed in the form of patented Oriental medicines and manufactured primarily in Hong Kong, Japan, Malaysia, North Korea, the People's Republic of China, South Korea, Taiwan, and Thailand (Gaski and Johnson 1994). Medicines containing antler are also manufactured in Canada, New Zealand, the United States, and possibly other countries. At least 10 major pharmaceutical companies in Hong

Kong and the PRC purportedly produce antler-based tonics and medicines. However, hundreds of products containing deer antler may be manufactured and marketed in the PRC and Hong Kong primarily for domestic consumption (Isaacs pers. comm. 1995a). Because Oriental patented medicines are competitively priced over-the-counter (OTC) medicines, and are within the financial reach of the general public, there is a strong market demand for them in Asia and Asian communities worldwide.

The Chinese government supports an integrated health care system by fully recognizing the use of traditional Chinese medicine and subsidizing a large TCM pharmaceutical industry (Gaski and Johnson 1994). As a result, the Chinese drug and pharmaceutical factories mass-market a variety of herbs in readily available OTC formulas that can be purchased without consulting an herbalist or TCM practitioner. There are at least 76 OTC drugs containing deer parts available in the PRC, of which 48 are tonics, 23 are used to treat diseases unique to women, 3 are for rheumatism, 1 is for gastrointestinal problems, and 1 for cardiovascular complications (Kong and But 1985). TRAFFIC USA has documented 72 Oriental patented medicinals containing deer derivatives as possibly being sold in the U.S. marketplace (table 4). Many patented medicines manufactured in the PRC are exported to countries where Asian communities have been established (e.g., the United States, Canada, Europe, and Australia). Hong Kong is a major reexporter of Oriental patented medicines manufactured in the PRC.

However, the largest market for deer antler products is South Korea, generating an estimated \$26 million in sales annually. At least 30 products containing antler are produced by 8 different major pharmaceutical companies. Most of the raw antler and materials used in the manufacture of antler-based tonics are imported and most finished products are consumed domestically. Although Japan is not a major producer of antler tonics, 10 such products are known to be manufactured there and exported to South Korea. Taiwan is not a large manufacturing country of antler medicines, but reportedly produces 2 antler tonics available to local consumers in TCM apothecary shops. In New Zealand, 2 or 3 companies produce antler capsules; some are consumed domestically and others are exported to South Korea, Taiwan, Hong Kong, Europe, and the United States (Isaacs pers. comm. 1995a).

The Western health food industry also manufactures antler-based natural food products, particularly in the United States, Canada, and Australia. Natural food products labelled as containing antler and sold in U.S. health food stores and catalogs are often promoted by emphasizing antler's long history of use in TCM.

Table 4

Traditional Chinese Medicines with Names Containing "Deer" Derivatives, the Name of Patented Medicines Containing that Ingredient, and the Manufacturers of the Patented Medicines		
Target Ingredient	Target Medicines	MANUFACTURER
Cervi Degelatinatum, Cornu	Wu Ji Bai Feng Bolus +	Chen Li Ji Pharmaceutical Factory
Cervi Pantotrichum, Cornu	Crocodile Penis Potency Capsule	Lanzhou
Cervi Pantotrichum, Cornu	Gejie Nourishing Kidney Pills +	Yulin Pharmaceutical Factory
Cervi Pantotrichum, Cornu	Genital Tonic Pills +	Tientsin Drug Manufactory
Cervi Pantotrichum, Cornu	Ginseng-Antler Pills	Tianjin Drug Manufactory
Cervi Pantotrichum, Cornu	Huo	Kwangchow Pharmaceutical Company
Cervi Pantotrichum, Cornu	Jen Shen Lu Jung Wan	Peking Tung Jen Tang (Great Wall Brand)
Cervi Pantotrichum, Cornu	Sea Horse Genital Tonic Pills	Tientsin Drug Manufactory
Cervi Pantotrichum, Cornu	Shen Yung Wan	United Pharmaceutical Manufactory
CERVI PANTOTRICHUM, CORNU	Shenrongbian Wan	Da Ren Chinese Medicine Works
Cervi Pantotrichum, Cornu	Small Pills +	Peking Medicine Manufactory
Cervi Pantotrichum, Cornu	Tzep Ao Sanpien Pills +	Yantai Pharmaceutical Works
Cervi Pantotrichum, Cornu	Shen Jung Wei Sheng Wan	Peking Chinese Drug Manufactory
Cervi Parvum, Cornu	Lady Pearl	Hong Kong
Cervi Parvum, Cornu	Gui Ling Chi	Shansi Drug Manufactory
Cervi Parvum, Cornu	Hindu Magic Pills +	Wah Yan Hong Chemical Factory
Cervi Parvum, Cornu	Jan Kang Dan	Tianjin Drug Manufactory
Cervi Parvum, Cornu	Lady Pearl +	~(Not Translated #103)
Cervi Parvum, Cornus	Hu Ku Wan (Tiger Bone Pill)	Fu Sung Pharmaceutic Works
Cervi, Cauda	Royal Gold Tonica	Omi Medicine Mfg. Ltd.



Traditional Chinese Medicines with Names Containing "Deer" Derivatives, the Name of Patented Medicines Containing that Ingredient, and the Manufacturers of the Patented Medicines		
Target Ingredient	Target Medicines	MANUFACTURER
Cervi, Cauda	Yi Boo Ven Chun Wan +	Third Guangzhou Drug Manufactory
Cervi, Colla Cornus	Crocodile Penis Potency Capsule	Lanzhou
Cervi, Colla, Cornus	Hou	Kwangchow Pharmaceutical Industry Company
Cervi, Colla Cornus	Lady Pearl	Hong Kong
Cervi, Colla Cornus	Lady Pearl +	~(Not Translated #103)
Cervi, Colla Cornus	Wu Chi Pai Fen Wan	Tientsin Drug Manufactory
Cervi, Colla Cornus	Wu Ji Bai FengBolus +	Chen Li Ji Pharmaceutical Factory
Cervi, Cornus	Shen Jung Wei Sheng Wan	Peking Chinese Drug Manufactory
Cervi, Cornus	Ginseng Tiger-Bone Pills +	Fu Sung Pharmaceutic Works
Cervi, Cornus	Ginseng Tiger-Bone Pills	Fu Sung Pharmaceutic Works
Cervi, Cornus	Pearl Pai Feng Wan	United Pharmaceutical Manufactory
Cervi, Cornus Pantotrichum	Tzepao Sanpien Jiu +	China National Native Produce and Animal By-Products Import and Export Corp.
Cervi, Penis	Royal Gold Tonica	Omi Medicine Mfg. Ltd.
Cervi, Penis	Small Pills +	Peking Medicine Manufactory
Cervi, Penis	Tzep Ao Sanpien Pills +	Yantai Pharmaceutical Works
Cervi, Penis	Tzepao Sanpien Jiu +	China National Native Produce and Animal By-Products Import and Export Corp.
Cerviparvum, Cornu	Dragon Black Pill +	Imada Pharmaceutical Co., Luen Wah (H.K.) Medicine Co.
Cervus Nippon Temminck	King Nan Capsules	Beijing Tia An Tong
Cervus Nippon Temminck	Tiger-Bone Glue +	~(Not Translated #102)

Traditional Chinese Medicines with Names Containing "Deer" Derivatives, the Name of Patented Medicines Containing that Ingredient, and the Manufacturers of the Patented Medicines

Target Ingredient	Target Medicines	MANUFACTURER
Cervus Sika Temm	Moschus Tin Tzat To Chung Pill	Yu Lam Medicine Factory
Cervus Sika Temm	Tiger-Bone Glue	~(Not Translated #14)
Cervus Sika Temm	To Chung Fu Quat Pills	Kwong Cheong Medicine Manufactory
Cervus Sika Temm	Tin Tzat To Chung Pills +	Pat Yuen Shan Medicine Manufacturer
Cervus Sika Temm	Tin Tzat To Chung Pills	Shan Sai Hang Lam Medicine Man
Cervus, Penis	Powerful Lu Bian Wan	Guangzhou Pharmaceutical Industry
Deer Antler	Powerful Deer Penis Capsules +	Guangzhou Pharmaceutical Industry Corporation
Deer Horn	Jen ShenLu Jung Wan (condensed) *	Tianjin Drug Manufactory
Deer Horn	Nan Bao Capsules: Strong Man Bao *	Shanxi Drug Manufactory
Deer Horn	Sea Horse Herb Tea *	Tianjin Drug Manufactory
Deer Horn	Shen Kue Lu Jung Wan *	Min Kang Drug Manufactory
Deer Horn	Tzepao Sanpien Extract *	China National Native Produce and Animal By-Products Import and Export Corp.
Deer Horn	Xiong Bao *	Tianjin Drug Manufactory
Deer Horn Glue	Wu Chi Pai Feng Wan - Tientsin Formula *	Tientsin Drug Manufactory
Deer Horn Glue	Wu ChiPai Feng Wan: White Phoenix Pills (Condensed)	Tientsin Drug Manufactory
Deer Ligament	Feng Shih Hsiao Tung Wan *	Tientsin Drug Manufactory
Deer Ligament	Sea Horse Herb Tea *	Tianjin Drug Manufactory
Deer Penis	Dragon Man Pills +	Wuzhou Drug Manufactory

Traditional Chinese Medicines with Names Containing "Deer" Derivatives, the Name of Patented Medicines Containing that Ingredient, and the Manufacturers of the Patented Medicines		
Target Ingredient	Target Medicines	MANUFACTURER
Deer Penis	Powerful Deer Penis Capsules +	Guangzhou Pharmaceutical Industry Corporation
Deer Penis	Tiger Deer Tonic Pill	Fatshan Union Medicine Works
Deer Penis	Tzepao Sanpien Extract *	China National Native Produce and Animal By-Products Import and Export Corp.
Deer Tail	Dragon Man Pills +	Wuzhou Drug Manufactory
Deer Tailbone	Tiger Deer Tonic Pill	Fatshan Union Medicine Works
Deer's Antlers	Nu Zhi Bo (Woman's Treasure)	Guangzhou Pharmaceutical
Deer's Tail Extract	Deer's Tail Extract +	Changchun Pharmaceutical Works
Deer's Tail Extract	Deer's Tail Extract - Tonic Oral	Changchun Pharmaceutical Works
Deer Antler, Sika	Dragon & Tiger San Bien Wan	H.K. Shanghai Lam Lee Yuen Medicine
Deer Antler, Sika	Wo Lung Wan +	United Pharmaceutical Works of Kwangchow
Deer Fetus	Capsules of Horn of Deer	China National Chemicals Import and Export Corp.
Deer Penis, Sika	Dragon & Tiger San Bien Wan	H.K. Shanghai Lam Lee Yuen Medicine
Deer Penis, Sika	Wo Lung Wan +	United Pharmaceutical Works of Kwangchow

Source: Gaski, A. & Johnston, K.A. 1994. Prescription for Extinction: Endangered Species and Patented Oriental Medicines in Trade. TRAFFIC USA, Washington, D.C.

NOTES:

+ Medicine information compiled from U.S. National Fish and Wildlife Forensics Laboratory inventory.

\* Medicine information taken from lists in Chinese Herbal Patent Formulas: A Practical Guide (Franklin 1986).

Table 5

CERVID TAXA WHOSE ANTLER IS HARVESTED AND TRADED FOR MEDICINAL PURPOSES				
Average Wholesale Price in South Korea				
Species	Fresh Frozen Price US\$/kg	Wholesale (dried) US\$/kg	Countries of Production	Distribution of Species
Red deer <sup>1</sup> ( <i>C. elaphus elaphus</i> )	\$73	\$450	Australia,* Canada,* Hungary, New Zealand,* United States*	N Africa, Middle E, Russia, Turkestan E to Siberia, Mongolia, W & N China and Ussuri region in Russia; introduced Morocco, United States, Canada, Argentina, Chile, Australia, New Zealand, Malaysia, Thailand
Maral deer <sup>2</sup> ( <i>C.e. maral</i> )	\$112	\$650	Mongolia, North China, Russia	Crimea, N Persia, Asia Minor, the Caucasus
North American elk/wapiti <sup>3</sup> ( <i>C. elephas ssp.</i> )	\$100-148	\$550	Canada, United States, New Zealand,* Australia*	N America; introduced New Zealand, Australia
White-lipped deer ( <i>C. albirostris</i> )	Unknown	Unknown	China	Tibet, Tsinghai, Kansu, Szechwan Provinces (China)
Sika or spotted deer ( <i>C. nippon</i> )	\$73	\$450	China	Japan, Taiwan, E China, Manchuria, Korea; introduced UK, Europe, New Zealand, United States
Rusa deer ( <i>C. timorensis</i> )	\$110-132	\$300-450	Malaysia, Australia*	Java; Bali, introduced Lesser Sunda Isls, Moluca Isls, Sulawesi and Timor, Kalimantan, PNG, New Britain, Aru Isls, Mauritius, Comoro Isls, Australia, New Zealand, New Caledonia, Irian Jaya, Thailand

CERVID TAXA WHOSE ANTLER IS HARVESTED AND TRADED FOR MEDICINAL PURPOSES				
Average Wholesale Price in South Korea				
Species	Fresh Frozen Price US\$/kg	Wholesale (dried) US\$/kg	Countries of Production	Distribution of Species
Sambar deer ( <i>C. unicolor</i> )	\$110-132	\$300-450		India & Sri Lanka east to S China, Hainan Isl and Taiwan, S to Peninsular Malaysia, Sumatra, Borneo, Siberut, Sipora, Pagi & Nias Isls; introduced to Australia and New Zealand
Reindeer/caribou ( <i>Rangifer tarandus</i> )	\$40-55	\$250	United States (Alaska), Canada, China, Russia (Siberia)	Scandinavia, Russia, Alaska (US), Canada, N Idaho & Great Lakes region (US), Greenland, N Mongolia; introduced Iceland
Fallow deer ( <i>Dama dama</i> )	\$44-55	\$250-300	Australia,* Canada,* New Zealand,* United States*	S Turkey; introduced Europe, S Africa, Australia, New Zealand, United States, S America, Fijian Islands, W Canadian coast, Lesser Antilles
White-tailed deer <sup>4</sup> ( <i>Odocoileus virginianus</i> )	Unknown	Unknown	Canada, United States, New Zealand*	W & S Canada, United States to Northern S America; introduced Czech., Finland, New Zealand, W Indies
Mule deer <sup>4</sup> ( <i>O. hemionus</i> )	Unknown	Unknown	Canada, United States	W United States, W Canada, Alaskan panhandle; introduced Argentina

\* Countries where taxon does not occur naturally

<sup>1</sup> Wapiti and red deer, which may be indistinguishable from a genetic standpoint, but whose physical appearance and mating calls are considerably different, are generally considered the same species, *Cervus elaphus*.

<sup>2</sup> Maral is typically used to describe a group of Asiatic wapiti, including *C.e. sibiricus* and *C.e. xanthopygus*.

<sup>3</sup> Includes Rocky Mountain elk (*C.e. nelsoni*), Manitoban elk (*C.e. manitobensis*), and Roosevelt elk (*C.e. roosevelti*).

<sup>4</sup> White-tailed deer and mule deer are not widely commercially harvested for velvet, although white-tailed deer farm velvet production may be increasing. Shed antler of both species is valued at \$5-10/lb

Source (Prices, Countries of Production): Isaacs pers. comm. 1994a; Hudson pers. comm. 1996; Renecker pers. comm. 1994. Source (Distribution): Wilson, D.E. and D.M. Reeder. 1993. *Mammal Species of the World: A Taxonomic and Geographic Reference*. 2nd Edition. Smithsonian Institution Press. Washington, D.C. 1,206 pp.

## Cervid Taxa in the Antler Trade

Of the 40-plus deer species occurring worldwide, about a dozen are valued for their antler. At least 8 cervid taxa are farmed for the commercial production of velvet antler. The principle cervid taxa whose velvet antler is used medicinally are listed in table 5. (This list is not exhaustive, but contains those taxa most commonly exploited.)

Elk, *Cervus elaphus*, which is widely distributed throughout the northern hemisphere, includes three subspecies that are raised in captivity and whose velvet is highly prized in Asian medicinal markets: Eurasian red deer (*C. elaphus elaphus*, *C. e. scoticus*, etc.), North American elk, or wapiti (*C.e. nelsoni*, *C.e. roosevelti*, *C.e. manitobensis*), and maral deer, also known as Chinese malu or horse deer (includes *C.e. maral*, *C.e. sibiricus*, *C.e. xanthopygus*, and other Asiatic wapiti). These and Arctic reindeer (*Rangifer tarandus*), or caribou, are the source of the majority of dried velvet antler in trade, which is an estimated 300 tons of dried product, or 30-35 percent of freshly cut antler a year (Renecker 1993).

Maral deer are farmed in Mongolia, Russia, and the PRC, which are the primary producers and exporters of maral antler. Red deer are commercially farmed in New Zealand, Australia, Canada, the United States, Hungary, and Europe. New Zealand has developed a highly competitive velvet antler industry by successfully breeding red deer, wapiti, and wapiti/red deer hybrids.

Shed antler of North American elk, which is collected every spring in the wild and on private elk farms in the United States, is exported to Asian medicinal markets and used domestically in arts and crafts industries. Wapiti are also raised on farms in Australia, Canada, New Zealand, South Korea, and the United States, where their velvet antler is removed, processed, and sold to medicinal markets. Most farmed wapiti are descendants of the Yellowstone National Park Rocky Mountain elk (*C.e. nelsoni*) herd, members of which were captured and sold by the U.S. government to domestic and foreign farming enterprises in the 1950s (McCabe 1982, Teer *et al.* 1993).

There is widespread dispute over the taxonomic classification of North American elk. Wilson and Reeder (1993) recognize wapiti as the subspecies *C.e. canadensis*, and indicate that there are other related subspecies. Conversely, taxonomists do not recognize subspecies of North American elk, with the possible exception of tule elk (*C.e. nannodes*), Roosevelt elk (*C. e. roosevelti*), and Merriam elk (*C.e. merriami*).<sup>1</sup> In addition to tule and Roosevelt elk, two other

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<sup>1</sup> These three subspecies (excluding the Merriam elk, which became extinct by the early 1900s from overhunting and competition with domestic livestock) have the most restricted ranges and, according to Bryant and Maser (1982), meet the basic criterion--geographic isolation--necessary for the evolution of genetically distinct biological subspecies.

named subspecies of wapiti, Manitoban elk (*C.e. manitobensis*) and Rocky Mountain elk (*C.e. nelsoni*) are often cited in literature. Proponents of Manitoban and Rocky Mountain elk subspeciation argue that these subspecies have distinguishable physical characteristics, while taxonomists argue that there is no genetic basis for their subspeciation. For the purposes of this report, subspecies names accepted by both taxonomists and industry are used.

In addition to *C. elaphus*, four other species belonging to the genus *Cervus* are farmed for antler: sika deer (*C. nippon*), rusa deer (*C. russa*), sambar deer (*C. unicolor*), and white-lipped deer (*C. albirostris*). Sika deer, recognized by *Chinese Materia Medica* as the premier antler-bearing deer species, are raised by the hundreds of thousands on state-controlled cervid farms in China, and captive populations are scattered throughout East Asia, particularly in South Korea, Japan, Taiwan, and Manchuria China. Sambar deer are widely distributed from India to southern China, including locations in Taiwan, Peninsular Malaysia, and Indonesia (Luick 1983). Introduced populations of sambar deer have been established in Australia and New Zealand, where they are a popular big game animal (Luick 1983). Rusa deer occur naturally in Indonesia (Java and Bali), and have been introduced to, among other places, New Zealand and Australia, where they are farmed for velvet antler (Luick 1983, Wilson and Reeder 1993). White-lipped deer are native to China, where the species is protected, and occur in four Chinese provinces (Tibet, Tsinghai, Kansu, and Szechwan) (Zhigang pers. comm. 1996, Wilson and Reeder 1993).

A handful of other cervids are farmed for velvet antler, including reindeer, or caribou, fallow deer (*Dama dama*), white-tailed deer, mule deer (*Odocoileus hemionus*), and, albeit infrequently, moose.

The reindeer is indigenous to the arctic region of the northern hemisphere (including North America) and is one of the first North American cervid species whose velvet antler was commercially harvested. Reindeer are now exploited for velvet antler production in Alaska, Canada, China, Siberia (Russia), and Greenland.

Alaska's large free-ranging herds of nonnative reindeer, whose populations declined sharply during the middle of the 20th century before rebounding, total about 43,000 animals and are increasing, owing to the growth of the velvet antler industry and improvement in husbandry methods (Teer *et al.* 1993). By comparison, Canada's reindeer population is smaller and is primarily confined to one herd in the Northwest Territories. In addition to velvet antler, meat, and hide production, Alaskan and Canadian reindeer are also hunted for recreation during designated seasons.

Fallow deer is indigenous to portions of southern Turkey, but has a wide distribution as a result of its introduction to several countries, including Australia, Canada, Chile, South Africa, and the United States (Wilson and Reeder 1993). In North America, fallow deer are hunted and farmed primarily for the meat and carcasses, while the antlers are harvested for

medicinal use and trophies. Fallow deer are the most abundant farmed cervid species in North America, and account for most of the 25 tons of venison produced on farms in the United States and Canada (Teer *et al.* 1993).

White-tailed deer, mule deer, and moose are seldom farmed commercially for the production of velvet antler in the United States and Canada, but are legally hunted for meat, hides, and mountable trophy parts. Over 12,500 moose, white-tailed deer, and mule deer are farmed in Canada alone (Teer *et al.* 1993). Deer farms in Canada and the United States are beginning to experiment with farming white-tailed deer for velvet antler production. The shed antlers of white-tailed deer and mule deer are collected and marketed domestically, and exported to Asian medicinal markets, although in much smaller quantities than shed elk antler.

## VII. ANTLER PRODUCTION, CONSUMPTION, AND TRADE

Velvet antler is typically removed from live cervids in a controlled, or captive, environment. Velvet antler is also harvested from thousands of free-ranging wild reindeer in Russia, Canada, and Alaska that are farmed under open grazing systems. These reindeer are periodically herded into makeshift corrals where their velvet antler can be easily harvested (Luick 1983).

Farming deer for venison, antlers, glands, organs, and other by-products is reportedly a 2,000-year-old practice in Asia (Luick 1983), but a relatively new industry in North America, Australia, and New Zealand. Today, farming cervids for the commercial production of cervid body parts, including antler, is a large industry in New Zealand, Russia (from Siberia to Kazakhstan), China, Mongolia, and South Korea. While the Chinese and Russian deer farming industries are generally sustained by the commercial production of velvet antler, New Zealand depends on the production and sale of velvet antler, venison, and other by-products to keep its deer farming industry commercially viable (Isaacs pers. comm. 1994).

Even though velvet antler is medicinally superior to shed antler in oriental medicine, the long-term market for shed antler has been more consistent than for velvet antler for several reasons: ease of storage and transport, availability of a larger supply, and reduced processing costs (Johnson, date unknown). As a result, shed antler is generally less expensive than velvet antler. However, because of its hard texture and clean appearance shed antler is valued more than velvet among artisans.

Smaller-scale, but rapidly growing deer farming enterprises exist in Europe, Australia, Canada, and the United States, and increasingly contribute to the global trade in cervid products, particularly velvet antler (Teer *et al.* 1993).



## The Evolving Antler Trade

The dynamics and consumption patterns of the antler trade have changed frequently and unpredictably over the last decade due to the restrictive trade policies of consumers (South Korea and Taiwan), economies in flux (Russia), the role of intermediate trading centers (Hong Kong and Singapore), and the increase in the number of countries producing antler for export (New Zealand, the United States, and Canada). Despite these influences on trade patterns, South Korea has been and continues to be the world's chief importer of velvet and shed antler. It is estimated that South Korea imports 80 percent of the antler and manufactured antler-based medicines in international trade, although Hong Kong is also considered a major antler market. Based on Korean customs data, most velvet antler imports from the 1960s to the early 1980s were of Russian or Chinese origin. A considerable amount of hard antler has also been imported into South Korea from Russia, the United States, China, and the European Union in recent years. The remaining 20 percent of antler in world trade is generally imported into Hong Kong, Singapore, China, Taiwan, and Japan. Small amounts, destined for apothecary shops in Asian communities, are imported by the European Union, the United States, and Canada.

Hong Kong and Singapore have been key antler trading centers, importing velvet antler from Russia, China, and New Zealand for processing and redistribution to North Korea, South Korea, Thailand, and Taiwan (Isaacs 1994b). (An unknown portion of velvet antler imported into Hong Kong and Singapore is consumed domestically.) Today, antler producing countries are increasingly avoiding intermediary countries and exporting their product directly to consumer countries.

The dynamics of the antler trade have changed dramatically since the early 1980s due to an increase in velvet antler production and processing primarily in New Zealand, where velvet antler exports have grown by over 1,000 percent (Hutching 1995, Isaacs 1994).

Today, New Zealand is the primary exporting country of velvet antler and produces almost 60 percent of antler in trade worldwide (Isaacs pers. comm. 1994). Other countries exporting velvet antler include Canada, China, Germany, Hungary, Mongolia, the Netherlands, Russia, Sweden, the United States, Bulgaria, Scandinavia, Spain, and Poland. A few Southeast Asian countries, such as Indonesia, Malaysia, Thailand, Singapore, and Vietnam, also produce and export velvet antler.

East Asian nations, such as South Korea, Japan, and Taiwan (ROC), which have historically imported much of their antler, are establishing deer farming industries and increasingly relying on domestic antler production to meet local market demands. New Zealand deer industry representatives are concerned that increased domestic production of antler in East Asian consumer countries, coupled with the imposition of tariffs, could reduce the demand for imported antler from New Zealand.

## Key Antler Trading Nations

The United States and Canada collectively produce approximately 35 metric tons of dried velvet antler<sup>2</sup> annually, which is a fraction of the estimated 4.4 million metric tons of antler (velvet and hard) produced for the global market. An estimated 50-100 t of hard antler is exported annually from North America, primarily the United States, to South Korea. U.S. and Canadian production of velvet antler is forecast to grow by 25 to 30 percent a year (Macallister pers. comm. 1996). This growth, however, will depend largely on continued strong demand for North American products by the major importing countries, some of which are reducing the competitive advantage of imported products by imposing high tariffs on antler and subsidizing domestic antler production. Furthermore, there are a number of other countries competing for a portion of the lucrative antler market, some of which have well-established deer farming industries and the infrastructure to harvest, process, and market antler. Additionally, the U.S. and Canadian cervid farming industry faces evolving regulatory requirements and opposition from those who argue that raising cervids in captivity is biologically and ethically unsound.

Although domestic issues, such as disease prevention and regulation, are shaping deer farming practices, the continued growth of the antler industry in the United States and Canada will largely be influenced by external market forces. In understanding the antler trade, it is necessary to review how major antler trading countries have shaped global supply and demand. A brief examination of major antler trading nations is presented below to put the volume, value, and mechanics of the antler trade in perspective, while clarifying the evolving role of the United States and Canada in this trade.

### *Western Europe*

Customs data indicate that 1990-1992 antler exports from Europe were destined principally for South Korea, followed by Hong Kong, Bangladesh, and Taiwan. A total of 658 t of antler were reportedly exported in 1992 (the latest year for which data are available), from the following countries: former USSR (309 t); Hungary (130 t); Germany (122 t); Finland (40 t); Sweden (40 t); Spain (8 t); United Kingdom (5 t); and Norway (4 t). As of 1994, most of the antler exported from Western Europe was a by-product produced by the growing number of deer farms in Germany, Italy, the Netherlands, and the United Kingdom. Meat-producing farms in several European countries, including France and Spain, also breed deer for recreational hunting (De Meulenaer pers. comm. 1994).

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<sup>2</sup> One kilogram of dried velvet antler is approximately equal to 13.75 kg (27.5 lb.) of green/freshly cut antler.

## *Russia*

Today, the largest producer of antler in Europe is Russia. According to deer farmers and antler traders, Russian stockpiles of velvet antler, particularly reindeer antler, flooded the international market in the early 1990s and created an "antler glut." The saturation of the global market with Russian antler had a resounding impact on the wholesale value of antler, which decreased by more than 20 percent from 1991 to 1993.

Velvet antlers are harvested primarily from cervid farms in western Russia (particularly the Altai mountains of Novosibirsk), Siberia, and far eastern Russia, and are exported to Hong Kong, China, and, to a lesser extent, Japan, South Korea, and Macao. Farmed maral and sika deer account for about 34 t, or just under 53 percent, of Russia's velvet antler production, while the remainder comes from herds of wild and farmed red deer and reindeer, which are located in northern Russia. Free-ranging reindeer are typically herded into facilities where their antlers are removed (Judin 1993). Over 60 percent of antler harvested from reindeer is exported to East Asia, the United States, and Canada, where it is dried, processed, and reexported or marketed domestically. Russian Customs data indicate that the velvet antler of sika deer, most of which is farmed, is also harvested for export to Oriental medicinal markets. There is ostensibly a market for Russian broken antlers (presumably shed antlers) in the PRC, Germany, and South Korea (TRAFFIC Europe-Russia *in litt.* 1996).

The wildlife management regimes that had been implemented by the Soviet government to protect Russia's wildlife all but disappeared after the dissolution of the Soviet Union in the early 1990s. The collapse of the central government left the task of managing Russia's wildlife to the newly independent Russian republics, many of which have inadequate funding to protect wildlife and enforce laws. Moreover, many financially struggling Russian republics view wildlife as a source of foreign currency. Due to the far-reaching political and economic developments in Russia, it appears that harvest and trade controls for wildlife have deteriorated significantly, triggering a corresponding increase in legal and illegal exploitation of wildlife.

At present, the Russian trade in cervid antler is largely unregulated, which raises concerns about the impacts of unchecked exploitation on Russia's populations of threatened cervids. It is possible that the Russian trade in antler is actually greater than is reported because of widespread underreporting and instances of illegal trade (TRAFFIC Europe-Russia *in litt.* 1996). There is also some evidence that shipments of antler exported from Russia, a CITES party since 1992, are being used to smuggle parts of protected and threatened wildlife to foreign markets. In fall 1995, a legal shipment of reindeer velvet antler originating from the Russian Far East was seized upon entry into Anchorage, Alaska. USFWS inspectors discovered 60 dried bear gallbladders hidden among 87 boxes of velvet antler (Paganno 1995). Although reindeer is not a protected species and its parts are not

subject to trade controls, all bears (*Ursidae* spp.) are protected and trade is regulated by CITES with valid CITES permits required prior to export or import.

In the Russian Federation, taxa of conservation concern that may be exploited for velvet antlers include CITES-listed Bactrian wapiti (*Cervus elaphus bactrianus*) in southern former-Soviet Central Asia and adjacent parts of Afghanistan, as well as the maral deer, considered to be declining rapidly and in danger of extinction in Asia Minor and the Caucasus (Nowak 1991, Smit and Van Wijngaarden 1981).

### *Hong Kong*

Hong Kong is probably the world's largest trading center for unprocessed animals and plants used in medicines in terms of both trade volume and the number and variety of animals and plants traded. Hong Kong is sometimes called a mecca of TCM because it supplies and markets the greatest number and variety of fresh Chinese herbs at the most reasonable prices (Kong and But 1983, Reid 1993). Hong Kong's large Chinese population relies on the availability of animal-and-plant-based herbal remedies used in TCM (Lee 1980).

According to Hong Kong trade statisticians, Hong Kong's imports of hard antler are reported under the same customs code used to group imports of velvet antler, making it difficult to quantify and analyze separately imports of hard and velvet antler. As the declared value and volume of Hong Kong's antler imports are consistent with the declared value and volume of South Korea's reported "velvet antler" imports, however, it is presumed that the majority of Hong Kong's antler imports are comprised of velvet antler.

There is conflicting information concerning the extent to which Hong Kong acts as an intermediary in the antler trade. Canadian antler industry representatives indicate that as much as 90 percent of all antler traded on the international market may transit through Hong Kong, while New Zealand representatives estimate the amount is closer to 60 percent (Renecker pers. comm. 1996, Isaacs pers. comm. 1996). Apparently, the high import tariffs, foreign exchange barriers, and trade restrictions that are erected by some importing countries are not as prevalent in Hong Kong. Consequently, traders may take advantage of Hong Kong's comparatively relaxed trade policies by shipping antler there for processing and reexport (Isaacs pers. comm. 1996).

Because Hong Kong is the Asian center for the TCM trade, it has historically been the most cost effective and convenient transshipment point for antler traders. However, the flow of antler routed through Hong Kong may be decreasing because producer countries are increasingly circumventing Hong Kong by exporting antler directly to consumer countries. This is due, in part, to the fact that producer countries now also have the technology to process velvet antler prior to export which, in the past, may have been sent through Hong

Kong for processing en route to the final destination (Isaacs pers. comm. 1994b).

Despite this shift, trade data indicate Hong Kong continues to be a major importer and reexporter of antler. Hong Kong's Census and Statistics Department reports that over 312 t of antler was imported in 1995, an increase of 80 percent compared to 1994 antler imports. Hong Kong cervid antler imports have increased steadily over the last few years from just under 105 t in 1990, to over 150 t in 1992, to 257 t in 1994, to more than 310 t in 1995 (Hong Kong Census and Statistics Department 1993; 1995; 1996). Over the last five years, with the exception of 1995, New Zealand has ranked first in volume of velvet antler imports into Hong Kong, followed by Singapore, the PRC, Russia, Germany, and more recently South Korea. Despite the increase in the volume of velvet antler imported since 1991, the total declared value of these imports fell off from about \$45 million in 1990 to less than \$26 million in 1994, a drop in value of 60 percent, not adjusted for inflation (Hong Kong Census and Statistics Department 1993; 1995; 1996). One possible explanation for the disparity between increasing volume and decreasing value is the infusion of low-grade stockpiled antler from Russia that flooded global markets in the early 1990s. The steady rise in antler imported from New Zealand between 1990 and 1994, combined with a 15-fold increase in imports from Germany over a 3-year period from 1992 to 1994, may have also forced antler prices down.

Based on available trade data from Customs, Hong Kong appears to be a much larger reexporter of antler than producer or exporter. Most of Hong Kong's reexports of antler, which are classified as velvet antler, have been destined for South Korea, China, Taiwan, Japan, and the United States in recent years. It is unknown what proportion of these reexports are comprised of unprocessed, semi-processed, and processed antler.

In addition to trading large volumes of unprocessed herbs, Hong Kong is a major conduit for patented Oriental medicines containing deer parts that are manufactured in China. From 1982 to 1992, most patented Chinese medicines containing antler or other deer derivatives marketed in the United States were manufactured in the PRC, and reexported to the United States via Hong Kong (Gaski and Johnson 1994). In addition to its transshipping role, Hong Kong also appeared to be a producer of antler-based patented medicines. For instance, a Hong Kong-based herbal company noted that it had prepared 3,500 distinct herbal formulas, almost all of which contained velvet antler (Barrie pers. comm. 1996). It is unknown, however, whether these herbal preparations are sold as 3,500 distinct individual medicines or are variations in formulas.

Table 6

Antler Imports <sup>1</sup> into Hong Kong (1990-1995)			
Year	Country of Export	Quantity (kg)	Declared Value
1990	New Zealand	51,295	\$ 13,271,117
	China	25,943	\$ 9,571,374
	Singapore	16,934	\$ 16,447,754
	Former USSR	3,511	\$ 3,823,107
	United Kingdom (UK)	1,896	\$ 50,064
	Other <sup>2</sup>	4,426	\$ 1,315,149
	<b>TOTAL</b>	<b>104,005</b>	<b>\$ 44,778,565</b>
1991	New Zealand	55,499	\$ 6,666,066
	Singapore	16,587	\$ 15,083,130
	Former USSR	15,208	\$ 3,416,677
	Finland	11,000	\$ 112,341
	United States	5,850	\$ 2,153,391
	Other <sup>3</sup>	13,848	\$ 3,098,570
	<b>TOTAL</b>	<b>117,992</b>	<b>\$ 30,530,175</b>
1992	New Zealand	71,034	\$ 8,966,192
	Former USSR	27,097	\$ 5,886,399
	Japan	13,874	\$ 4,149,871
	Singapore	11,396	\$ 6,160,104
	China	10,275	\$ 2,882,643
	Other <sup>4</sup>	19,462	\$ 3,083,808
	<b>TOTAL</b>	<b>153,138</b>	<b>\$ 31,129,017</b>
1993	New Zealand	80,013	\$ 8,336,788
	Russian Federation	34,303	\$ 8,985,492
	Germany	15,763	\$ 2,272,021
	China	15,010	\$ 1,237,824

Antler Imports <sup>1</sup> into Hong Kong (1990-1995)			
Year	Country of Export	Quantity (kg)	Declared Value
	South Korea	13,986	\$ 5,381,736
	Other <sup>2</sup>	13,461	\$ 6,062,904
	<b>TOTAL</b>	<b>172,850</b>	<b>\$ 32,276,765</b>
1994	New Zealand	94,323	\$ 8,698,462
	Germany	82,221	\$ 2,583,333
	Russian Federation	28,246	\$ 9,753,333
	United States	25,079	\$ 634,872
	South Korea	8,952	\$ 2,249,487
	Other <sup>6</sup>	17,646	\$ 4,000,641
	<b>TOTAL</b>	<b>256,827</b>	<b>\$ 27,920,128</b>
1995	Russian Federation	157,178	\$ 13,055,110
	New Zealand	88,258	\$ 9,815,524
	Germany	23,204	\$ 683,312
	China	18,122	\$ 1,481,371
	Sweden	17,271	\$ 103,364
	Other <sup>7</sup>	8,255	\$ 535,576
	<b>TOTAL</b>	<b>312,288</b>	<b>\$ 25,674,257</b>

<sup>1</sup> According to Hong Kong's Census and Statistics Department, hard antler is classified under the same Harmonized System (HS) code as velvet antler.

<sup>2</sup> Includes imports from Denmark (1,888 kg, \$11,297), Germany (953 kg, \$491,656), Australia (772 kg, \$471,245), Japan (302 kg, \$135,687), South Korea (200 kg, \$130,167), Canada (165 kg, \$24,647), Former Czechoslovakia (51 kg, \$12,580), Mongolia (50 kg, \$26,060), Vietnam (32 kg, \$6,547), and Macau (13 kg, \$5,263).

<sup>3</sup> Includes imports from United Kingdom (3,395 kg, \$48,128), China (3,181 kg, \$1,310,900), South Korea (2,766 kg, \$1,022,262), North Korea (2,169 kg, \$365,847), Mongolia (800 kg, \$177,969), Austria (634 kg, \$40,664), Taiwan (ROC) (400 kg, \$3,088), Australia (175 kg, \$14,155), Canada (100 kg, \$49,543), Former Czechoslovakia (97 kg, \$18,659), Sweden (68 kg, \$34,101), and Vietnam (63 kg, \$13,254).

<sup>4</sup> Includes imports from South Korea (8,279 kg, \$1,580,570), Germany (5,390 kg, \$255,052), United States (3,199 kg, \$982,124), United Kingdom (1,122 kg, \$37,694), Taiwan (ROC) (934 kg, \$178,238), Australia (418 kg, \$20,855), and Canada (120 kg, \$29,275).

<sup>5</sup> Includes imports from United States (4,665 kg, \$933,938), Singapore (3,703 kg, \$4,163,860), Canada (1,703 kg, \$455,649), Macau (1,643 kg, \$292,228), Japan (1,091 kg, \$113,990), Mongolia (344 kg, \$32,254), Sweden (314 kg, \$25,130), Taiwan (ROC) (250 kg, \$42,228), and the United Kingdom (62 kg, \$3,627).

<sup>6</sup> Includes imports from China (8,299 kg, \$2,517,949), Canada (4,534 kg, \$59,872), Singapore (3,370 kg, \$1,255,128), Japan (453 kg, \$11,667), United Kingdom (432 kg, \$12,564), Republic of Kazakhstan (430 kg, \$120,128), and Thailand (128 kg, \$23,333).

<sup>7</sup> Includes imports from Australia (3,849 kg, \$173,868), South Korea (1,993 kg, \$152,523), United Kingdom (1,472 kg, \$16,559), United States (513 kg, \$73,221), Canada (399 kg, \$111,643), Japan (15 kg, \$4,140), and Country Unknown (14 kg, \$3,622).



Table 7

Reexports of Velvet Antler from Hong Kong (1990-1995)			
Year	Importing Country	Quantity (kg)	Declared Value (U.S.\$)
1990	South Korea	5,283	\$ 2,734,403
	China	2,586	\$ 404,878
	Japan	2,195	\$ 773,171
	United States	1,867	\$ 529,782
	Thailand	1,653	\$ 832,606
	Other <sup>1</sup>	597	\$ 263,158
	<b>TOTAL</b>	<b>14,181</b>	<b>\$ 5,537,998</b>
1991	South Korea	42,297	\$ 8,629,487
	Japan	3,757	\$ 918,333
	China	1,515	\$ 147,436
	United States	1,468	\$ 588,333
	Thailand	728	\$ 405,513
	Other <sup>2</sup>	655	\$ 253,846
	<b>TOTAL</b>	<b>50,420</b>	<b>\$ 10,942,948</b>
1992	South Korea	26,903	\$ 11,842,692
	Japan	5,510	\$ 1,496,026
	Taiwan (ROC)	3,140	\$ 196,282
	China	2,146	\$ 224,744
	United States	1,712	\$ 244,359
	Other <sup>3</sup>	629	\$ 179,102
	<b>TOTAL</b>	<b>40,040</b>	<b>\$ 14,183,205</b>
1993	South Korea	48,035	\$ 13,002,461
	China	5,864	\$ 349,870
	Japan	2,718	\$ 599,611
	Taiwan (ROC)	850	\$ 52,850
	United States	779	\$ 156,606
	Other <sup>4</sup>	380	\$ 88,600

Reexports of Velvet Antler from Hong Kong (1990-1995)			
Year	Importing Country	Quantity (kg)	Declared Value (U.S.\$)
	<b>TOTAL</b>	<b>58,626</b>	<b>\$14,249,998</b>
1994	South Korea	29,269	\$ 10,395,984
	China (PRC)	2,737	\$ 166,321
	Taiwan (ROC)	2,539	\$ 121,891
	Japan	1,746	\$ 646,114
	United States	656	\$ 23,834
	Other <sup>5</sup>	479	\$ 114,249
	<b>TOTAL</b>	<b>37,426</b>	<b>\$ 11,468,393</b>
1995	South Korea	75,144	\$ 11,389,521
	China (PRC)	56,554	\$ 713,066
	Taiwan (ROC)	12,483	\$ 299,741
	Japan	1,997	\$ 794,179
	United States	1,634	\$ 393,014
	Other <sup>6</sup>	856	\$ 312,888
	<b>TOTAL</b>	<b>148,668</b>	<b>\$ 13,902,409</b>

<sup>1</sup> Includes reexports to Canada (421 kg, \$180,873), Singapore (119 kg, \$45,828), New Zealand (30 kg, \$21,566), Malaysia (22 kg, \$11,297), and U.S. Oceania (5 kg, \$3,594).

<sup>2</sup> Includes reexports to Canada (224 kg, \$68,718), Singapore (172 kg, \$114,103), Malaysia (170 kg, \$35,000), Mongolia (76 kg, \$25,641), New Zealand (7 kg, \$8,974), and Indonesia (6 kg, \$1,410).

<sup>3</sup> Includes reexports to Singapore (312 kg, \$84,616), Canada (176 kg, \$52,692), Thailand (120 kg, \$37,051), Indonesia (20 kg, \$4,102), and Malaysia (1 kg, \$641).

<sup>4</sup> Includes reexports to Malaysia (162 kg, \$20,466), Canada (122 kg, \$13,083), Thailand (95 kg, \$52,720), and the Philippines (1 kg, \$2,331).

<sup>5</sup> Includes reexports to Canada (328 kg, \$ 55,700), Singapore (78 kg, \$47,150), Indonesia (45 kg, \$5,440), and Macau (28 kg, \$5,959).

<sup>6</sup> Includes reexports to Canada (603 kg, \$59,897), Singapore (170 kg, \$195,731), Macau (80 kg, \$54,334), and Malaysia (3 kg, \$2,070).

## *Japan*

At the time of this writing, few useful trade data were available to evaluate Japan's antler trade because Japanese customs does not use an independent category to record antler imports and exports. Deer antler imports are recorded under the customs code "Horns, including powder and waste thereof, and hooves." The vast majority of specimens classified under this code in 1994 were imported from China (2700 t, \$200,000), India (1900 t, \$106,000), Pakistan (750 t, \$37,000), Bangladesh (260 t, \$5,600), and Thailand (63 t, \$29,000), among 20 other countries (Ishihara pers. comm. 1995). More than half of the countries exporting material classified under this code to Japan in 1994 were African nations (Ishihara pers. comm. 1995).

An extrapolation from the trade statistics of other antler trading countries might provide a more accurate reflection of Japan's role in the antler trade. According to Hong Kong and South Korea trade data, it would appear that Japan is both an exporter and importer of deer antler. Hong Kong reportedly reexported velvet antler to Japan in 1991 (3.7 t), 1992 (5.5 t), 1993 (2.7 t), 1994 (1.8 kg), and 1995 (2 t) at a total declared value of \$6.4 million (Hong Kong Census and Statistics Department 1993; 1995; 1996). According to government sources, South Korea imported 4.3 t of hard antler, valued at \$22,300, and 10 kg of velvet antler valued at \$7,500, from Japan in 1990 and 1995, respectively. Hong Kong imported over 15.7 t of velvet antler from Japan, valued at approximately \$4.4 million, from 1990 to 1995.

## *New Zealand*

New Zealand's velvet antler industry has grown dramatically since the 1980s, when fewer than 20 t of velvet antler were exported in one year. By 1994 New Zealand was one of the world's leading producers, exporting in excess of 200 t of velvet antler annually (Hutching 1995). Red deer (introduced in the late 1800s), wapiti (introduced in the early 1900s), and fallow deer are the predominate species farmed in New Zealand for the production of antler, venison, and other products.

Since 1985, New Zealand has exported most of its velvet antler to South Korea, and smaller quantities to Hong Kong, Japan, Taiwan, the United States, Germany, Australia, and, more recently, Canada, Malaysia, and Singapore. New Zealand exporters route antler shipments to Asian consumer nations via Chinese coastal cities to avoid the high tariffs some countries impose on antler imported directly from New Zealand (Barrie pers. comm. 1996).

Although much of the velvet antler is processed prior to export, some is also exported in unprocessed or frozen form primarily to Hong Kong, the United States, and Canada for additional processing and reexport. Some antler imported into the United States and Canada from New Zealand is destined either for reexport or for domestic Asian communities, which

allegedly prefer the smaller velvet antler from New Zealand over North America's larger velvet antler (Hudson 1996).

### *People's Republic of China*

China is a major antler trading country, comprising about 16 percent of the global volume. According to the CITES Management Authority of China, the majority of China's deer antler imports are of Russian origin, with the balance coming from Mongolia and Hong Kong. China imported over 310 t of deer antler from 1990 to 1995, 52 percent of which was of the red deer subspecies, *C.e. xanthopygus*, and the other 48 percent of which was reindeer, sika deer, and the red deer subspecies, *C.e. sibiricus* (*C.e. sibiricus* and *C.e. xanthopygus* are likely synonyms for maral deer) (Chinese Management Authority to CITES 1995). See table 8 for a summary of China's trade in antler from 1990-1995.

The Law of Wild Animals Protection of the People's Republic of China affords "special state protection" to several cervid taxa. Cervids under special state protection are divided into two classes: "species under first class protection" and "species under second class protection." Cervid taxa protected under the first class include white-lipped deer, Eld's deer (*Cervus eldii*), sika deer, hog deer (*Axis porcinus*), and Père David's deer (*Elaphurus davidianus*). Red deer, sambar deer, and moose are protected under the second class. Take of any first class species from the wild must be approved at the national level by the Ministry of Forestry, while licenses for the take of second class species can be obtained from provincial forestry departments.

South Korea is the largest importer of deer antler from China. China also exports antler to Hong Kong, Japan, and Taiwan. China's reported exports and reexports of cervid antler totalled more than 140 t from 1990 to 1995, and were comprised of maral deer antler (71 percent) and sika deer antler (29 percent) (Chinese Management Authority to CITES 1995).

Cervids are farmed in China for the commercial exploitation of a number of products, including velvet antler, venison, sinews (penis), and tails. Of these, velvet antler is believed to be the largest and most lucrative cervid-derived product produced from the numerous state-run deer farms scattered throughout the country. The majority of China's deer farms are state-controlled facilities owned and managed by the State Pharmaceutical Administration of the PRC, the Ministry of Forestry, or local collective farms. Domestic and local distribution of velvet antler falls under the jurisdiction of the PRC's Pharmaceutical Administration, while international marketing and sale of antler falls under the purview of the National Native Produce and Animal By-products Import and Export Corporation; both are under the jurisdiction of the Ministry of Forestry (Pinney 1981).

Up to half of the velvet antler produced in China is consumed there (Pinney 1981). In 1994, 20,700 t of deer antler were sold in China (Blumenthal 1996). Until recently, antler was typically dispensed domestically through rural and urban communal hospitals; smaller amounts were sold directly from farms to apothecaries (Luick 1985). In light of recent market reforms, however, antler now may be disseminated differently. The remainder is exported directly to South Korea and through intermediate countries such as Hong Kong, Japan, and the United States.

A total of 20 native and introduced cervid taxa occur in China, of which velvet antler is derived from two key species, maral deer and sika deer, also known as malu deer and meheilü deer, respectively. In addition to an estimated one million wild deer, there were about 300,000 farmed deer in China as of 1981, of which an estimated 75 to 90 percent were sika deer and 10 to 20 percent malu deer, including various subspecies. Maral antler, which is considered superior to sika deer antler in China, is primarily exported to South Korea via Hong Kong, Japan, and the United States, while the lower quality sika deer antler is consumed in China (Pinney 1981).

Table 8

China's Imports, Exports, and Reexports of Cervid Antler 1990-1995	
IMPORTS	VOLUME (kg)
Red deer ( <i>C. elaphus xanthopygus</i> )	163,101
Red deer ( <i>C.e. sibiricus</i> )	53,000
Reindeer ( <i>Rangifer tarandus</i> )	53,000
Sika deer ( <i>C. nippon</i> )	42,500
TOTAL ANTLER IMPORTS (1990-1995)	311,601
EXPORTS	
Red deer ( <i>C.e. xanthopygus</i> )	71,658
Sika deer ( <i>C. nippon</i> )	500
TOTAL ANTLER EXPORTS (1990-1995)	72,158
REEXPORTS	
Red deer ( <i>C.e. xanthopygus</i> )	29,178
Sika deer ( <i>C. nippon</i> )	42,000
TOTAL ANTLER REEXPORTS (1990-1995)	71,178

Source: CITES Management Authority of the People's Republic of China (PRC)

### *Republic of Korea (South Korea)*

South Korea is the world's largest market for antler; it imports about 1,000 t, or 80 percent of total world production annually. According to trade data provided by the U.S. Embassy's Office of Agricultural Trade, South Korea imported more than 7,000 t of hard antler and approximately 750 t of velvet antler from 1988 through 1995, or an annual average of 1,000 t of hard antler and 107 t of velvet antler (see table 9). Imports of hard antler (hard antler generally weighing more than velvet antler) accounted for 90 percent of South Korea's antler imports by weight, but represented only 23 percent by value (Korean Customs Service 1993; 1996). Using these data to gauge the relative value of velvet and hard antler, it would appear that the average export value of velvet antler was \$333/kg, compared to hard antler at \$10/kg.

South Korea imported nearly 160 t (worth more than \$42 million) of velvet antler in 1995, nearly half of which came from New Zealand. China ranked second in volume of velvet antler exports to South Korea in 1995, followed by Russia, Canada, the United States, Hong Kong, the Netherlands, and Australia. See tables 10 and 11 for summaries of hard antler and velvet antler imports by country of export into South Korea.

Over the last five years, South Korea has imported most of its hard antler from the United States, Russia, and the PRC, as well as from Mongolia, Germany, and European Union nations. In 1995, for example, South Korea imported more than half of its hard antler from the United States, Mongolia, and China. The United States alone supplied South Korea with over 160 t of hard antler, or nearly 20 percent of South Korea's hard antler imports, in 1995, making Korea the principal destination for U.S.-produced antler. South Korea exports a fraction of antler that it imports; in 1995, it reportedly exported over 25 t of velvet and hard antler to Hong Kong, Russia, and China (see table 12).

In quantifying South Korea's antler trade, the level of illegal or unreported antler imports should also be considered. Unofficial estimates indicate that South Korea's actual antler imports may be 150 t higher than what is recorded by the South Korean customs agency (Renecker 1993). In 1993, for instance, Hong Kong reportedly exported nearly 50 t of velvet antler to South Korea. However, South Korean import statistics indicate that no velvet antler was imported from Hong Kong in 1993. This discrepancy cannot be readily explained, but it is purported that large-scale but unconfirmed smuggling, and alleged efforts by importers to avoid high tariffs, may have resulted in underreporting. In another example of dubious trade, undocumented shipments of antler, particularly from Russia, were allegedly imported illegally into South Korea in the early 1990s (Renecker 1993).

In December 1992, the South Korean government banned all imports of reindeer velvet due to possible contamination and disease. Although the ban reduced the direct legal flow of reindeer velvet antler from Russia to South Korea, some reindeer antler from Russia

may have been rerouted through Alaska for processing and reexported to South Korea.

Overseas antler exporters often bemoan the high tariffs imposed by South Korea's government on imports of frozen and dried velvet antler. Taxes on imports may increase the wholesale price of dried velvet antler by as much as 150 percent. By imposing high tariffs on velvet antler imports, South Korea is trying to promote the sale of velvet antler produced by its domestic cervid farms. The Korean Pharmaceutical Trader's Association (KPTA), the sole South Korean agency responsible for inspecting the quality and condition of antler imports, also charges a fee to inspect imported antler. The KPTA inspects and assigns values to imports of dried velvet antler based on the species, size, smell, color of the product, level of antler calcification, overall physical condition, and other qualities (Hughes 1986, Luick 1985).

South Korea produces over 20 t of velvet antler a year, which supplies about 24 percent of domestic consumption. Velvet antler is commercially produced in South Korea on its 7,000 to 8,000 deer farms. The reported number of cervids on Korean farms ranges from the conservative estimate of 63,500, provided by the National Livestock Experiment Station (NLES), to 145,000, according to the Korean Deer Farmers Association (KDFA). According to KDFA figures, about 128,000, or more than 80 percent, of South Korea's farmed deer are sika deer, which are native to South Korea but have been interbred with various races from other parts of Asia. The balance of South Korea's deer farm population is comprised of wapiti, which were first introduced to South Korea from Alberta, Canada, in 1974; red deer, which were introduced from New Zealand around the same time; and wapiti/red deer hybrids (Hudson and Barrie *in litt.* 1995).

Because South Korea's economy is growing at 6 percent annually, antler consumption may increase as rising numbers of Koreans are able to afford antler products (Hudson and Barrie *in litt.* 1995). As of 1985, the average Korean family purchased about 30 grams of dried velvet antler per month at a retail price of \$1/gram, or \$30/month (Luick 1985). The longer-term market for antler in South Korea may be contingent on its recognition as a viable medicine among younger Koreans, many of whom have begun to demonstrate a preference for Western medicine. On the other hand, antler use could increase if the results of research on its pharmacological efficacy are promising (Hudson and Barrie *in litt.* 1995).

According to South Korean pharmacopeia standards, cervids occurring at northern latitudes yield antlers that are medicinally superior to antlers produced in southern latitudes. Thus, Koreans generally prefer the velvet antler of Russian maral and wapiti over the velvet antler produced by other cervids. This preference is reflected in higher retail prices and therefore more limited use. Other types of velvet antler, particularly less-costly red deer antler, which is produced domestically and imported into South Korea from New Zealand and North America, is used much more commonly (Luick 1983).



## *North Korea*

According to North American antler industry representatives, historic levels of antler consumption were probably quite high in North Korea, but a weak economy and a lack of hard currency preclude North Koreans from importing any significant amount of antler today. Because North Korea has no formal trade relations with most countries, no information on North Korea's antler imports and exports was available for analysis during the preparation of this report. As a result of insufficient data, this trade was not evaluated.

Table 9

Imports of Hard and Velvet Antler into South Korea (1988-1995)				
Antler Type	Year	Total Volume (kg)	Total Declared Value <sup>1</sup>	Average Price/kg
Hard	1988	624,437	\$ 2,221,000	\$ 3.60
Velvet	1988	43,741	\$ 14,607,000	\$ 334.00
Hard	1989	1,027,253	\$ 9,852,000	\$ 9.60
Velvet	1989	50,442	\$ 20,437,000	\$ 405.20
Hard	1990	1,120,619	\$ 11,553,000	\$ 10.30
Velvet	1990	44,525	\$ 24,405,000	\$ 548.00
Hard	1991	902,263	\$ 10,385,000	\$ 11.50
Velvet	1991	83,850	\$ 35,333,000	\$ 421.40
Hard	1992	954,343	\$ 10,868,000	\$ 11.40
Velvet	1992	105,950	\$ 43,870,000	\$ 415.10
Hard	1993	908,617	\$ 9,106,000	\$ 11.10
Velvet	1993	118,904	\$ 38,069,000	\$ 320.00
Hard	1994	1,006,664	\$ 10,936,000	\$ 10.90
Velvet	1994	144,177	\$ 42,713,000	\$ 296.00
Hard	1995	858,939	\$ 9,581,000	\$ 11.20
Velvet	1995	159,815	\$ 42,190,000	\$ 264.00
<b>TOTAL HARD</b>	1988 - 1995	7,403,135	\$ 74,502,000	\$ 9.95
<b>TOTAL VELVET</b>	1988 - 1995	751,404	\$ 296,668,000	\$ 333.71
<b>TOTAL HARD &amp; VELVET</b>	1988 - 1995	8,069,559	\$ 371,170,000	

Source: Agricultural Trade Office, U.S. Embassy-Seoul

<sup>1</sup> Values are rounded off to the nearest thousand dollars.

Table 10

Hard Antler Imports into South Korea (1990-1995)			
Year	Country of Export	Quantity (kg)	Value
1990	Other (Country Not Specified)	435,375	\$ 4,750,334
	United States	266,760	\$ 3,150,677
	India	121,425	\$ 742,873
	West Germany	102,237	\$ 997,927
	Sweden	79,949	\$ 755,052
	Other <sup>1</sup>	84,873	\$ 1,156,204
	<b>TOTAL</b>	<b>1,120,619</b>	<b>\$ 11,553,067</b>
1991	United States	220,993	\$ 2,863,812
	Former USSR	210,020	\$ 2,164,403
	Germany	121,500	\$ 1,346,907
	Hungary	91,222	\$ 1,196,086
	China	64,850	\$ 832,733
	Other <sup>2</sup>	170,275	\$ 1,981,320
	<b>TOTAL</b>	<b>902,263</b>	<b>\$ 10,385,261</b>
1992	Former USSR	308,509	\$ 3,198,735
	Hungary	130,060	\$ 1,616,710
	Germany	121,500	\$ 1,437,853
	United States	96,505	\$ 1,146,276
	Mongolia	83,950	\$ 1,002,125
	Other <sup>3</sup>	213,819	\$ 2,466,247
	<b>TOTAL</b>	<b>954,343</b>	<b>\$ 10,867,946</b>
1993	Russia	195,000	\$ 2,040,000
	United States	147,918	\$ 1,771,000
	China	121,165	\$ 1,331,000
	Hungary	97,767	\$ 1,082,216

Hard Antler Imports into South Korea (1990-1995)			
Year	Country of Export	Quantity (kg)	Value
	Mongolia	85,470	\$ 950,984
	Other <sup>4</sup>	175,827	\$ 1,931,183
	<b>TOTAL</b>	<b>908,617</b>	<b>\$ 9,106,383</b>
1994	China	256,770	\$ 2,813,408
	Mongolia	189,384	\$ 1,989,885
	United States	138,625	\$ 1,666,200
	Hungary	115,664	\$ 1,182,838
	Germany	103,000	\$ 1,130,000
	Other <sup>5</sup>	203,221	\$ 2,153,760
	<b>TOTAL</b>	<b>1,006,664</b>	<b>\$ 10,936,091</b>
1995	United States	167,319	\$ 2,124,981
	Mongolia	166,786	\$ 1,760,414
	China	140,317	\$ 1,482,525
	Hungary	136,300	\$ 1,471,019
	Germany	69,500	\$ 830,000
	Other <sup>6</sup>	178,717	\$ 1,911,908
	<b>TOTAL</b>	<b>858,939</b>	<b>\$ 9,580,847</b>

Source: Monthly Foreign Trade Statistics, South Korean Customs Administration, Republic of Korea, South Korean Customs Research Institute; Agricultural Trade Office, U.S. Embassy-Seoul

<sup>1</sup> Includes antler imports from Spain (30,000 kg, \$306,099), Finland (22,758 kg, \$208,625), Canada (14,033 kg, \$190,778), Indonesia (14,722 kg, \$90,989), Taiwan (ROC) (12,478 kg, \$171,918), Norway (7,969 kg, \$71,721), Argentina (4,787 kg, \$48,354), Japan (4,250 kg, \$22,319), United Kingdom (1,960 kg, \$27,420), and New Zealand (1,916 kg, \$17,981).

<sup>2</sup> Includes antler imports from Canada (51,345 kg, \$537,684), Sweden (50,488 kg, \$507,790), India (20,090 kg, \$122,576), United Kingdom (20,090 kg, \$227,583), Spain (18,100 kg, \$222,508), Poland (15,000 kg, \$185,413), Finland (5,660 kg, \$59,921), Hong Kong (3,450 kg, \$41,882), New Zealand (4,100 kg, \$47,707), and Norway (2,042 kg, \$28,256).

<sup>3</sup> Includes antler imports from China (78,258 kg, \$1,081,926), Finland (39,964 kg, \$443,060), Sweden (39,760 kg, \$355,516), Canada (18,052 kg, \$165,886), Russian Commonwealth of Independent States (18,000 kg, \$180,000), Spain (8,000 kg, \$106,883), United Kingdom (4,679 kg, \$58,448), Norway (4,006 kg, \$40,191), New Zealand (1,600 kg, \$20,837), and Hong Kong (1,500 kg, \$13,500).

<sup>4</sup> Includes antler imports from Germany (84,000 kg, \$946,000), India (21,000 kg, \$188,180), Canada (14,586 kg, \$148,970), Greenland (13,500 kg, \$148,949), Spain (12,000 kg, \$158,742), Sweden (8,140 kg, \$106,280), Finland (6,050 kg, \$48,644), Poland (6,000 kg, \$71,238), United Kingdom (5,101 kg, \$58,041), Bulgaria (4,000 kg, \$40,138), and New Zealand (1,450 kg, \$16,001).

<sup>5</sup> Includes antler imports from Spain (99,552 kg, \$1,057,619), Russia (83,495 kg, \$873,596), Poland (10,000 kg, \$108,831), United Kingdom (6,113 kg, \$67,279), and New Zealand (4,061 kg, \$46,435).

<sup>6</sup> Includes antler imports from Spain (75,670 kg, \$830,739), Russia (52,000 kg, \$547,512), Canada (20,000 kg, \$200,504), Poland (10,000 kg, \$108,410), Myanmar (10,000 kg, \$95,752), United Kingdom (5,560 kg, \$65,309), Argentina (3,000 kg, \$36,228), and New Zealand (2,487 kg, \$27,454).

Table 11

Young (Velvet) Antler Imports into South Korea (1993 - 1995)			
Year	Country	Quantity (kg)	Value
1993	New Zealand	66,508	\$ 18,266,821
	Russia	25,858	\$ 10,548,508
	China	22,640	\$ 8,220,450
	United States	2,041	\$ 367,759
	Canada	1,321	\$ 448,195
	Other <sup>1</sup>	536	\$ 217,705
	<b>TOTAL</b>		<b>118,904</b>
1994	New Zealand	81,117	\$ 20,884,203
	China	31,492	\$ 10,846,336
	Russia	20,159	\$ 8,523,138
	United States	6,789	\$ 898,915
	Canada	3,560	\$ 1,182,947
	Other <sup>2</sup>	1,060	\$ 375,986
	<b>TOTAL</b>		<b>144,177</b>
1995	New Zealand	72,829	\$ 17,573,053
	China	32,400	\$ 11,023,181
	Russia	23,057	\$ 9,821,621
	Canada	6,275	\$ 1,602,955
	United States	2,036	\$ 652,402
	Other <sup>3</sup>	977	\$ 360,821
	<b>TOTAL<sup>4</sup></b>		<b>159,815</b>

Source: Monthly Foreign Trade Statistics, South Korean Customs Administration, Republic of Korea, South Korean Customs Research Institute; Agricultural Trade Office, U.S. Embassy-Seoul

<sup>1</sup> Includes velvet antler imports from Germany (200 kg, \$70,000), Singapore (100 kg, \$60,164), Swaziland (100 kg, \$30,000), Others (60 kg, \$21,000), Mongolia (50 kg, \$17,548), and Japan (26 kg, \$18,993).

<sup>2</sup> Includes velvet antler imports from Mongolia (494 kg, \$180,303), the Netherlands (300 kg, \$90,164), Hungary (166 kg, \$69,836), Others (50 kg, \$21,297), and Australia (50 kg, \$15,384).

<sup>3</sup> Includes velvet antler imports from Hong Kong (630 kg, \$261,148), the Netherlands (314 kg, \$94,200), and Australia (33 kg, \$5,473).

<sup>4</sup> Includes pieces of velvet antler from New Zealand (21,531 kg, \$1,098,893), Russia (500 kg, \$35,000), China (200 kg, \$14,289), and Japan (10 kg, \$7,499).

Table 12

Antler Exports from South Korea (1988 - 1995)				
Year	Antler Type	Country of Import	Quantity (kg)	Value
1988	Velvet antler	Hong Kong	240	\$ 76,936
1989	Velvet antler	Germany	200	\$ 87,038
		Hong Kong	123	\$ 52,500
		New Zealand	50	\$ 14,328
1990	Velvet antler	Hong Kong	200	\$ 104,286
1991	Velvet antler	New Zealand	60	\$ 22,200
		United States	76	\$ 39,750
1992	Velvet antler	Hong Kong	250	\$ 161,124
	Hard antler	Malaysia	2,000	\$ 2,073
1993	Velvet antler	Mongolia	9	\$ 2,975
1994	No antler exports reported			
1995	Velvet antler (whole)	Hong Kong	16,000	\$ 1,100,869
		China	42	\$ 16,170
	Velvet antler (pieces)	Russia	5,494	\$ 54,940
	Hard antler	China	5,000	\$ 50,880
<b>TOTAL 1988-1995</b>			<b>29,744</b>	<b>\$ 1,786,069</b>

Source: Korean Customs Administration



## *Singapore*

Singapore, like Hong Kong, is a major international redistribution center for raw materials, herbs, and pharmaceuticals. However, it is virtually impossible to determine actual trade volumes of antler because Singapore Customs uses commodity codes of the Harmonized Tariff Schedule, which do not distinguish antler from other commodities such as bone, horns, hooves, nails, claws, etc. Trade statistics from other countries confirm that Singapore is a redistribution center for antler.

In the mid-1980s, velvet antler that was produced in Russia was routed to China and South Korea via Singapore, which at the time was a temporary repository for high-grade maral velvet antler (Lee and Chiang 1985). Based on trade data obtained from major antler importing countries such as South Korea, Hong Kong, and Taiwan, Singapore is still a transshipment point for velvet antler from Russia to other East Asian markets, but its role in the antler trade may be diminishing as countries import directly.

## *Republic of China (Taiwan)*

Although Taiwan imported over 400 t of antler with a declared value of nearly \$1 million from 1990 to 1993, high tariffs imposed on antler imports have apparently reduced imports from New Zealand, Russia, North America, and the PRC. Taiwan's import tariffs of 45 percent on velvet antler and 15 percent on hard antler were imposed in order to nurse the domestic deer industry through a tuberculosis depopulation program and bolster domestic production and prices of antler (Friedel and Barrie 1995).

From 1990 to 1993, Germany ranked first in volume of antler imports into Taiwan (35 percent), followed by Singapore (23 percent), India (14 percent), the United States (7 percent), Indonesia, China, Vietnam, and New Zealand (Lu pers. comm. 1994). During the same period, imports into Taiwan from Singapore had a declared value of \$238,000; from Germany, \$192,000; from India, \$137,000; from Indonesia, \$68,000; and from the United States, \$59,000 (Lu pers. comm. 1994).

As noted above, Taiwan meets some of its internal demand for antler through domestic production. There are 36,478 deer located on farms throughout Taiwan: 52 percent are sambar deer, 42 percent sika deer, and the remaining 6 percent red deer, fallow deer, and wapiti. The high cost of land and limited availability of open space in Taiwan require deer farmers to raise deer intensively, often confining them to large concrete barns with tiny pens that house either individuals or small groups of animals (Friedel and Barrie 1995). The annual average production of velvet antler in Taiwan is approximately 35 t, reportedly worth an estimated \$28,000 (Freidel and Barrie 1995), although the value of antler produced domestically may be considerably higher.

Imported and domestically produced cervid velvet antler is used by three distinct markets in Taiwan. Velvet produced from smaller Taiwanese farms located in the mountainous regions is marketed fresh directly to consumers at a retail price of \$803/kg, while velvet antler produced on farms in the flatlands is purchased by the government-owned tobacco and wine monopoly, which processes antler into wines and tonics. Lower quality antlers are imported from New Zealand at a retail price of \$77/kg, and are sold primarily to the traditional Chinese pharmaceutical industry (Freidel and Barrie 1995). Typically, Taiwanese consumers prefer fresh velvet antler to the preserved or frozen material imported from abroad, and will personally visit local cervid farms to obtain the fresh product (Luick 1985).

### North American Antler Trade

In North America, native cervids, along with several introduced cervid taxa, are commercially exploited for their antler. North America accounts for less than three percent of global velvet antler production, but a much higher percentage of shed antler trade, with the United States the main source. The combined U.S. and Canadian trade in velvet and shed antler is valued in the tens of millions of dollars each year: globally, according to declared import/export values, the trade is worth over \$500 million annually.

On average, 30 t of velvet antler produced by U.S. and Canadian deer farms are consumed domestically each year, in addition to several tons that are imported annually by North America for internal use (Macallister pers. comm. 1996, Teer *et al.* 1993). South Korea imports more than 8 t of velvet antler from North America--75 percent of it from Canada and 25 percent from the United States. The remainder of velvet antler produced in North America is exported to China, Hong Kong, Taiwan, and Asian communities in Pacific Rim countries and Europe. The United States and Canada import an estimated 15 t of antler from New Zealand and Russia, with most of the product imported entering via Alaska, where it is processed and reexported to East Asia. Based on South Korea's customs statistics and discussions with U.S. exporters, South Korea has imported as much as 180 t of shed antler (\$2.3 million) from North America, virtually all of which is imported from the United States.

North American velvet antler and wild-collected shed antler exports to East Asia are used primarily in Chinese medicines. Based on local advertisements and large network marketing initiatives, antler is also being taken as a dietary or herbal supplement in New Zealand, the United States, and Canada. Artisans and manufacturers of furniture, jewelry, and curios represent another market for antler and antler products, albeit a much smaller one than the medicinal market. Sport or trophy hunting accounts for some exploitation of cervids for their antlers, which are mounted either with or without the full head.

## A Summary of U.S. Antler Trade

According to USFWS Law Enforcement Management Information System (LEMIS) data, the five most heavily traded North American cervids are elk, caribou,<sup>3</sup> moose, white-tailed deer, and mule deer. All North American cervids produce antler that is traded for ornamental purposes. Most of these taxa produce antler that has also been traded for medicinal use, with elk antler being the preferred species in TCM and Western medicinal products. Taxa appearing less frequently in U.S. trade for their antler are axis deer, Corsican red deer, swamp deer (*C. duvauceli*), Formosan sika deer (*C. nippon taiouanus*), and South China sika deer (*C.n. kopschi*), none of which are native to North America. According to the LEMIS data, there is also a sizeable U.S. trade in unspecified cervid antler, which are cervid products that are not readily identifiable by taxon.

TRAFFIC tallied and analyzed total U.S. trade (imports, exports, and reexports) in cervid antler for 1990-1993 using the following LEMIS standard categories: horn products, trophies, and medicinals. Using LEMIS data, TRAFFIC also analyzed 1994 imports, exports, and reexports of horn products of North American cervids. "Horn products," the LEMIS category that records the largest portion of U.S. trade in antler specimens, is the term used to describe cervid specimens made from antler, and is used synonymously with "antler products" in this section. Horn products excludes antlered trophies and antler-based processed medicinal products. Most U.S. exports of horn products are antler-handled knives or daggers (manufactured mostly in western states), shed antlers (originating primarily from western states), or whole, partially whole, or sliced velvet antlers. Most U.S. imports of horn products, particularly from New Zealand and Russia, are probably comprised of whole, partially whole, or sliced velvet antlers (Einsweiler 1996).

LEMIS does not specify whether its "medicinals" category contains antler or antler derivatives. However, as antler is one of the most frequently used cervid medicinal products, a high proportion of cervid-based medicinals are certainly antler-based or contain some antler derivatives. Therefore, all cervid-based medicines were treated as antler-based medicines for the purpose of this analysis.

The combined value of U.S. imports, exports, and reexports of cervid horn products, trophies, and medicinals declined steadily from more than \$23 million in 1990 to \$9 million in 1994. Of the total declared value for 1993, elk imports, exports, and reexports accounted for 37 percent, or \$3.5 million, of the value of trade, followed by caribou at 36 percent, or less than \$3.5 million, and the category of unidentified cervid taxa at 24 percent, or \$2.2 million. Moose, mule deer, white-tailed deer, and a small group of other nonnative cervids made up the balance (3 percent) of the total value.

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<sup>3</sup> In LEMIS, caribou and reindeer are classified under the same code.

The value and volume of the reported U.S. trade in elk, caribou, white-tailed deer, and mule deer horn products from 1990 to 1993 was notably higher than the combined reported trade in trophies and medicinals. In 1993, for instance, elk horn products with a declared value of \$3.2 million were traded, compared to elk trophies and elk-derived medicinals valued at \$215,000. Similarly, in 1993, horn products represented more than 90 percent of the trade by value in caribou antler, 60 percent of the total value of the U.S. trade in white-tailed deer antler; and 55 percent of the total value of trade in mule deer antler. The value and volume of the U.S. reported trade of moose horn products (valued at \$62,600) and trophies (valued at \$63,000) were nearly equal in 1993.

There was a substantial trade in moose, white-tailed deer, and mule deer trophies and horn products, but no reported trade in medicines containing these species in 1993. This is consistent with assertions that antler of these taxa are not typically used in the preparation of Chinese medicines.

In terms of volume and value, reported trade in antler specimens of unidentifiable cervids was comparable with the voluminous trade in elk and caribou antler specimens. The largest portion of the trade in unidentified cervid antler was the horn products trade, followed by a relatively large trade in medicinals.

Table 13 provides a summary of U.S. trade in cervid horn products, trophies, and medicinals for 1990-1993. For additional information on U.S. imports, exports, and reexports of antler products by cervid species, refer to the appendix.

#### **U.S. Trade in Horn Products of Native Taxa (1994)**

In 1994, the United States imported, exported, or reexported more than 160 t of horn (antler) products reported to have come from North American cervids, all of which, with the exception of reindeer, are native to the continent. An additional 19,500 items categorized as horn products of these taxa were reportedly imported, exported, or reexported that year (table 14). The total declared value of this trade was just under \$6 million, with exports making up the largest portion of U.S. trade, followed by imports and then reexports. Nearly two-thirds (100 t) of U.S. trade was comprised of exports. Approximately 85 percent (85 t) of exports were comprised of elk horn products, followed by moose, caribou (AKA reindeer), white-tailed deer, and mule deer. Most 1994 U.S. exports of elk antler were destined for South Korea and Hong Kong; caribou for Canada, Hong Kong, and Taiwan; white-tailed deer for the Philippines and Germany; and mule deer for France and Japan. U.S. imports of horn products in 1994 totalled 51 t, with elk horn products (36 t) accounting for the largest volume of imports. The bulk of 1994 U.S. imports of elk antler reportedly originated from South Korea, New Zealand, Hong Kong, and Canada; caribou/reindeer from Russia and Canada; and white-tailed deer and mule deer from Canada. Reexports of horn products from the United States in 1994 totalled just under 9 t and were comparatively lower than exports and imports.

There is an active cross-border trade between the United States and Canada, with moose being the antler most heavily traded between the two countries. Virtually all 1994 U.S. moose antler exports were bound for Canada, while most imports originated from Canada. Moose antler exported from the United States to Indonesia was reportedly reexported from Indonesia to the United States in 1994, probably as partially processed or carved items.

Table 13

Species/ Product	Total U.S. Trade (Imports/Exports/Reexports) in Cervid (Cervidae spp.) Horn Products, Trophies, and Medicinals for 1990-1993											
	1990			1991			1992			1993		
	KG	ITEMS	VALUE \$	KG	ITEMS	VALUE \$	KG	ITEMS	VALUE \$	KG	ITEMS	VALUE \$
<b>Elk</b> ( <i>Cervus elaphus</i> )												
Horn Products	96,883	15,688	\$4,631,624	265,482	2,736	\$10,673,065	113,775	5,717	\$6,138,126	87,393	12,216	\$3,271,666
Trophies	0	422	\$91,995	0	406	\$56,979	0	2,023	\$115,074	7	295	\$78,649
Medicinals	1,456	0	\$517,165	1,629	0	\$346,294	7,719	0	\$1,183,044	1,638	418	\$136,967
<b>TOTAL</b>	<b>98,339</b>	<b>16,110</b>	<b>\$5,775,888</b>	<b>267,111</b>	<b>3,142</b>	<b>\$11,076,338</b>	<b>121,494</b>	<b>7,740</b>	<b>\$8,000,596</b>	<b>89,038</b>	<b>12,929</b>	<b>\$3,487,282</b>
<b>Caribou</b> ( <i>Rangifer tarandus</i> )												
Horn Products	68,413	11,494	\$15,353,124	26,799	1,554	\$7,040,833	27,037	845,558	\$3,736,265	41,923	388	\$3,270,628
Trophies	0	189	\$117,141	0	138	\$41,338	0	502	\$147,641	0	200	\$196,453
Medicinals	1,170	0	\$65,000	1,375	300	\$242,270	200	0	\$10,000	18	0	\$1,500
<b>TOTAL</b>	<b>69,583</b>	<b>11,683</b>	<b>\$15,535,265</b>	<b>28,174</b>	<b>1,992</b>	<b>\$7,324,441</b>	<b>27,237</b>	<b>846,060</b>	<b>\$3,893,906</b>	<b>41,941</b>	<b>588</b>	<b>\$3,468,581</b>
<b>Moose</b> ( <i>Alces alces</i> )												
Horn Products	6,444	158	\$85,208	1,014	541	\$24,221	2,199	1,275	\$35,401	375	7,261	\$64,281
Trophies	0	230	\$126,160	0	174	\$66,670	65	242	\$64,601	55	236	\$63,197
Medicinals	0	0	\$211,368	0	0	0	0	0	0	0	0	0

Total U.S. Trade (Imports/Exports/Reexports) in Cervid (Cervidae spp.) Horn Products, Trophies, and Medicinals for 1990-1993

Species/ Product	1990			1991			1992			1993		
	KG	ITEMS	VALUE \$	KG	ITEMS	VALUE \$	KG	ITEMS	VALUE \$	KG	ITEMS	VALUE \$
<b>TOTAL</b>	6,444	388	\$422,736	1,014	715	\$90,891	2,264	1,517	\$100,002	430	7,497	\$127,478
<i>White-tailed deer (Odocoileus virginianus)</i>												
Horn Products	10,506	615	\$123,978	14,868	6090	\$249,459	3,990	216	\$827,535	554	2,977	\$13,672
Trophies	0	58	\$2,340	0	70	\$38,179	0	128	\$33,641	0	157	\$20,515
Medicinals	0	0	0	0	0	0	0	0	0	0	0	0
<b>TOTAL</b>	10,506	673	\$126,318	14,868	6,160	\$287,638	3,990	344	\$861,176	554	3,134	\$34,187
<i>Mule deer (Odocoileus hemionus)</i>												
Horn Products	22,244	7049	\$305,878	24,488	5,418	\$467,578	2,502	598	\$53,091	1,552	152	\$30,741
Trophies	0	83	\$6,313	0	73	\$21,013	0	697	\$28,922	0	111	\$20,111
Medicinals	0	0	0	0	8	\$100	0	0	0	0	0	0
<b>TOTAL</b>	22,244	7,132	\$312,191	24,488	5,499	\$488,691	2,502	1,295	\$82,013	1,552	263	\$50,852
<i>Unspecified Cervid (Cervidae spp.)</i>												
Horn Products	41,772	51,225	\$1,245,665	11,697	127,880	\$727,413	11,101	82,225	\$1,209,452	25,143	75,945	\$2,138,583
Trophies	0	46	\$4,754	0	52	\$3,260	0	119	\$20,600	0	86	\$5,595
Medicinals	130	836	\$34,664	20	303	\$1,896	191	691	\$12,300	1,242	1,001	\$140,341

Species/ Product	Total U.S. Trade (Imports/Exports/Reexports) in Cervid (Cervidae spp.) Horn, Products, Trophies, and Medicinals for 1990-1993														
	1990				1991				1992				1993		
	KG	ITEMS	VALUE \$	KG	ITEMS	VALUE \$	KG	ITEMS	VALUE \$	KG	ITEMS	VALUE \$	KG	ITEMS	VALUE \$
TOTAL	41,902	52,061	\$1,285,083	11,717	128,235	\$732,569	11,292	83,035	\$1,242,352	26,385	77,032	\$2,284,519			
Other Cervid <sup>1</sup>															
Horn Products <sup>2</sup>	0	0	0	0	65,331	\$109,010	0	77,276	\$134,201	0	1,994	\$15,273			
Trophies	0	16	\$975	0	20	\$1,540	0	16	\$1,636	0	25	\$1,555			
Medicinals	0	0	0	0	0	0	0	0	0	0	16	\$160			
TOTAL	0	16	\$975	0	65,351	\$110,550	0	77,292	\$135,837	0	2,044	\$16,988			

Source: U.S. Fish and Wildlife Service, Law Enforcement Management Information System (LEMIS) Data

68

<sup>1</sup> Species in trade include axis deer (*Cervus axis*); Corsican red deer (*C. elaphus corsicanus*); swamp deer (*C. duvauceli*); Formosan sika deer (*C. nippon taiouanus*); South China sika deer (*C.n. kopschii*).

<sup>2</sup> Axis deer (*Cervus axis*) accounts for 100%, 100%, and 99% of the U.S. trade in horn products under "Other Cervid" species for 1991, 1992, and 1993, respectively.



Table 14

Total Declared Volume and Value of Reported U.S. Trade in Cervic Horn Products <sup>1</sup> (1994)									
Species	Exports		Reexports		Imports		TOTAL		Value
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	
Caribou	51 items 5,300 kg	\$ 82,040	11 items 6,267 kg	\$ 680,153	3,450 items 11,721 kg	\$ 1,012,000	3,512 items 23,288 kg	\$ 1,774,193	
Elk	10 items 85,846 kg	\$2,547,283	117 items 2,220 kg	\$ 149,927	11,491 items 36,623 kg	\$ 1,263,316	11,618 items 124,689 kg	\$ 3,960,526	
Moose	87 items 9,163 kg	\$10,772	322 items	\$ 3,109	1,877 items 1,141 kg	\$ 34,040	2,286 items 10,304 kg	\$ 47,921	
White-tailed deer	324 items 452 kg	\$ 1,711	12 items 215 kg	\$ 1,276	963 items 1,513 kg	\$ 15,941	1,299 items 2,180 kg	\$ 18,928	
Mule deer	188 items 2 kg	\$ 8,776	2 items 110 kg	\$ 645	544 items 92 kg	\$ 6,054	734 items 204 kg	\$ 15,475	
TOTAL	660 items 100,763 kg	\$ 2,650,582	464 items 8,812 kg	\$ 835,110	18,325 items 51,090 kg	\$ 2,331,351	19,449 items 160,665 kg	\$ 5,817,043	

<sup>1</sup> This does not include antlered trophies or antler-based processed medicinal products.

Source: U.S. Fish and Wildlife Service, Law Enforcement Management Information System (LEMIS) Data

## Cervid Farming

Private North American deer farms intensively raise cervids for meat, velvet antler, hides, trophies, and tails. Nearly 56,000 cervids were commercially farmed on 291 game farms in at least 16 U.S. states in the early 1990s (Teer *et al.* 1993). In 1992, Canada's farmed deer population was estimated at 70,000, with more than 800 deer farms countrywide (Canadian Venison Council 1993).

The U.S.-based North American Elk Breeders Association (NAEBA), the North American Deer Farmers Association (NADFA) and the Canadian Venison Council, whose membership consists largely of deer farmers, actively promote the cervid farming industry in North America. The growth of NAEBA from a few dozen to more than 600 members in the last few years is testament to the explosive interest in and expansion of deer farming in North America. The NADFA's membership also grew from about 100 in the mid 1980s to a few hundred members by the mid 1990s.

North American deer farms are increasing their velvet antler production by an estimated 25 to 30 percent a year. In 1993, the United States and Canada together produced 20 metric tons of velvet antler valued at an estimated \$2 million (Renecker 1993). By 1995, North American velvet antler production had increased to more than 36 metric tons a year, which may exclude Alaskan production of reindeer velvet antler (Macallister pers. comm. 1996). Canada accounts for about 60 percent of North American velvet antler production, reflecting the intensity with which velvet antler is harvested in Canada, not the total number of animals available. The cervid population is actually greater in the United States than Canada, but fewer cervids are harvested for their velvet antler in the United States. U.S. and Canadian velvet antler exports represent between 5 and 10 percent of the global velvet antler trade.

Private deer farms, which are the primary source of velvet antler in North America, compete with foreign producers of velvet antler such as New Zealand, Russia, Eastern Europe, and China, which together account for more than 80 percent of total global antler production. These countries have recently dominated the antler market because they have the capability to produce large volumes of velvet antler, and are located near the major markets. The U.S. and Canadian deer farming industry predicts that U.S. and Canadian production and export of velvet antler will continue to increase over the next 5 to 10 years (Barrie pers. comm. 1996).

There is significant potential for growth in North American antler exports, but this is largely dependent on access to the market in South Korea, which in turn is affected by South Korean trade policies. Even though global market forces have influenced U.S. and Canadian antler production, North American deer farming industry representatives believe that the future of the velvet antler industry will be shaped by domestic factors. On the one hand, domestic sales of antler-based medicines may be bolstered by the increasing popularity of natural medicines and dietary supplements in the United States and Canada as well as by the fact that U.S. consumers can purchase a barrage of dietary supplements without a prescription. On the other hand, sales may be limited by the fact that U.S. and Canadian law prohibits labeling of dietary supplements with unsubstantiated and unproven

medical claims.

### *Commonly-Farmed Cervid Taxa*

Wapiti is the cervid most commonly farmed for production of velvet antler in the United States and Canada. The abundance of wapiti coupled with high demand for its velvet antler in Asia makes this species an investment attractive to North American game farmers. As of 1990, the United States farmed wapiti population was growing at a rate of 14 percent per year (Renecker 1993). In 1992, there were approximately 20,000 farmed wapiti in the United States and about 11,000 in Canada (Canadian Venison Council 1993, Teer *et al.* 1993). Of the subspecies of wapiti, Rocky Mountain elk is the most abundant and represents approximately 75 percent of elk located on private farms in North America. Rocky Mountain elk are naturally distributed throughout 13 states, predominately in the Rocky Mountain region and the West, with stable to increasing populations.

Other indigenous species that are farmed but not necessarily used for the production of velvet antler include caribou, white-tailed deer, moose, and mule deer. These species are primarily farm-raised for meat, hides, and trophy hunting. Canadian deer farmers are experimenting with the farming of white-tailed deer for the harvest and domestic sale of their velvet antler (Hudson 1996). Introduced European red deer and fallow deer are also farmed in North America for the commercial production of velvet antler, particularly in Canada where an estimated 6,000 red deer and 27,000 fallow deer were farmed as of 1992. A smaller captive population of other exotic deer, such as sika deer and axis deer, are also farmed, although probably not much for velvet production (Hudson pers. comm. 1996).

### *Regulation of Cervid Farming*

Controls on cervid farming vary significantly from state to state and province to province. Some states and provinces that are home to large populations of indigenous cervids permit the farming of cervids native to that state or province, but ban the farming of nonnative cervids in order to minimize the risk of the transmission of disease or hybridization.

At least 20 states permit some form of elk farming (see table 15). However, as of 1994 seven states permitted game farms to raise elk only under a "grandfather clause" which allows farming if it began before a specified date. Five states permit the farming of wapiti, but prohibit the hybridization of wapiti and red deer. Cervid farmers in New Zealand, a country with no native deer species, regularly breed red deer-wapiti hybrids, because they produce a larger and heavier set of antlers that fetch a higher price. This practice, however, is either prohibited or strictly regulated in U.S. states and Canadian provinces in which native free-ranging wapiti occur. Although red deer and wapiti probably descended from the same Eurasian cervid species and are taxonomically related, geneticists believe that if red deer interbreed with wapiti they may possibly contaminate the wapiti gene pool. As of 1994, deer farming was allowed in 16 range and non-range states with no grandfather clause or restrictions prohibiting the crossbreeding of native elk and red deer.

Table 15

Distribution of Farm-raised Wapiti and Restrictions on Commercialization in the United States		
States Where Most Wapiti Are Farmed	Wapiti Farming Permitted by Grandfather Clause	Only Pure Wapiti Farming Permitted (No Hybrids)
Colorado	California	Colorado
Idaho	Nevada <sup>1</sup>	Idaho
Illinois	New Mexico	Montana
Iowa	Oregon	North Dakota
Kansas	Utah	South Dakota
Michigan	Washington	
Minnesota	Wyoming	
Missouri		
Montana		
New York		
North Dakota		
Ohio		
Oklahoma		
South Dakota		
Texas		
Wisconsin		

<sup>1</sup> Elk farming is under the jurisdiction of the state agricultural department. In all other states it is under the jurisdiction of the department of wildlife, or fish and game.

Source: Renecker, L.A., *Overview of the Western Domesticated Elk Farming Industry*, in Wildlife Professionals Proceedings on Game Ranching and Elk, February 1993; Hainstock, W. North American Elk Breeders Association.

In the United States, cervid farming licenses or permits must be obtained from state fish and wildlife agencies or agricultural agencies. Cervid farmers and velvet processing plants are also subject to the health and sanitary requirements of the Animal and Plant Health Inspection Service (APHIS) at the U.S. Department of Agriculture (USDA). Through its Uniform Methods and Rules for Bovine Tuberculosis Eradication, the USDA has developed minimum program standards and procedures to control and eradicate tuberculosis in farmed Cervidae in the United States (USDA 1994). The USDA has also developed a volunteer program for cervid farms to minimize the transmission of other diseases in farmed cervids. Velvet production is regulated at the state level. Permits may be required for removing, handling, and processing velvet. Interstate commerce, imports, exports, and reexports of cervid products are regulated by USFWS.

In Canada, cervid farming is regulated by the provinces. Prior to establishing a cervid farm in Canada, a farmer must obtain the necessary licenses or permits from the relevant provincial agency. On Canadian deer farms, only animals that are the same species as wild deer, or animals that are incapable of crossbreeding with indigenous deer, are permitted (Barrie pers. comm. 1996, Canadian Venison Council 1993). Farmed cervids that are imported, exported, or shipped within Canada undergo mandatory quarantine and a series of tests for disease (Canadian Venison Council 1993).

Producers of velvet antler must comply with regulations issued by two federal agencies: Agriculture Canada and Health and Welfare Canada. Agriculture Canada issues Animal Health Certificates for whole antlers, and inspects antler processing plants for proper sanitation. Health and Welfare Canada inspects the processing plants in which velvet slices and powder capsules are manufactured and conducts spot checks of retail outlets for inconsistencies in packaging and labelling. Provincial wildlife officials also conduct random inspections at processing plants and retail outlets to ensure that antler products being marketed originate from licensed farms and processors (Barrie pers. comm. 1996).

The commercial production of velvet antler and other cervid products on U.S. and Canadian cervid farms has prompted a number of concerns: that farmed cervids can harbor and possibly transmit harmful parasites to wild cervids; that nonnative cervids can escape from farms, breed with native cervids, and contaminate the gene pool of native species; that residual drugs and compounds used to tranquilize cervids prior to the removal of velvet antler can have human health implications; that farmed stock can be illegally supplemented with wild cervids; and that removal of antler may involve inhumane treatment of the animals (Canadian Wildlife Federation 1992, Dratch 1993, Geist 1988).

### Shed Antler

Shed antler is collected opportunistically by a loose network of people living primarily in rural areas in the United States and Canada. According to collectors, shed antlers (also known as sheds) are found near agricultural, geological, or geographical attractions where cervids tend to congregate to take advantage of food sources and protection during the winter months (Lebaron 1994). Antlers of North American deer are typically shed and collected from late winter (January) into early spring (March).

Wapiti, moose, caribou, white-tailed deer, mule deer, and blacktail deer each develop antlers bearing unique physical characteristics. Moose antler, for example, is broader than the antlers of other species, making the material easier to carve and therefore desirable to artisans. One Wyoming artisan noted that he prefers moose antler to ivory because it has more surface area and is much more affordable and can be obtained legally. He indicated that he purchases an annual supply of 1,200 lbs (545 kg) of wild-collected shed moose antler from dealers in Montana, Wyoming, and Idaho, and sells carved antler to individuals, resort lodges, and corporate buildings located primarily on the East and West coasts of the United States as well as in Europe, Japan, and Canada.

According to antler traders, most of the shed antler collected in North America is from wapiti and up to 80 percent (or approximately 100 t) is exported to East Asia annually, primarily to South Korea, for medicinal use. By contrast, the shed antlers of caribou, white-tailed deer, mule deer, and blacktail deer are collected and marketed primarily for ornamental purposes in U.S. and Canadian markets, and a much smaller quantity is exported to East Asia for medicinal use. A sample of the broad array of shed antler products marketed in the United States is presented in table 16.

Table 16

Antler Curios and Products Available in the United States	
Antler Item	Retail Price
Candleholders	\$95
Lamps	\$125-395
Antler-handle knives	\$38-500
Pipes	\$119
Moose antler carvings	\$350-1,600
"Naturally shed" elk and moose antler earrings	\$10/pair
Deer horn electric chandeliers	\$385-8,500
Elk horn electric chandeliers	\$1,700-3,200
Moose candle chandeliers	\$1,200
Elk candle chandeliers	\$500
Bookends	\$95
Shelves	\$135
Coffee mug rack	\$175
Coatracks	\$150-200
Belt buckles	\$25-95
Silverware	\$3/ea

Source: Catalogs; 1994 Antler Auction in Jackson Hole, Wyoming

## *The Trade Dynamics and Value of Shed Antler*

The trade in North American shed antler is decentralized and involves thousands of local gatherers, or pickers, across Canada and the United States who work independently or in small groups collecting antler to supplement their annual incomes. Pickers interviewed by TRAFFIC at the 1994 antler auction in Jackson Hole, Wyoming, indicated that an individual might collect anywhere from 20 to a few hundred pounds of shed antler annually. This estimate reflects antler collection in the Rocky Mountain region, which is home to a dense cervid population. The abundance of antler here may differ significantly from that in other regions in the United States and Canada.

Shed antler is traded in a variety of ways in North America. The majority of shed antler collected in the United States and Canada is sold to dealers located in Idaho and Montana who in turn export it or sell it domestically to artisans. Most shed antler sales to dealers are conducted at auctions and trade shows. Antler dealers frequently advertise in taxidermy and hunting magazines, and attend antler craft shows and auctions to establish contacts with individuals from across the country who collect and sell shed antler. Antler trophies, artwork, furniture, curios, and other antler products are sold at arts and crafts shows such as the Charlie Russell Show in Great Falls, Montana, the Indian Art Show in Kansas City, Kansas, and the elk auction in Jackson Hole, Wyoming. These gatherings are attended by craftspeople, local vendors, regional and national buyers, and taxidermists from many regions in North America. Although private U.S. and Canadian wapiti farms generate a small supply of shed antler from their farmed herds for the trade, they are not considered a major source.

The value of shed antler has fluctuated in recent years, particularly in response to the flood of Russian antler on the market in the early 1990s. An analysis of antler prices from the Jackson Hole auction showed that shed elk antler sold for more than \$14/lb (\$31/kg) in the late 1980s, falling to \$11/lb (\$24/kg) in 1991, \$10/lb (\$22/kg) in 1992, under \$8/lb (\$18/kg) in 1993, and back up to about \$10/lb in 1994 and 1995 (Lindeburg 1995).

### *Jackson Hole Antler Auction*

The antler auction held every May in Jackson Hole, Wyoming, is a microcosm of North America's shed antler trade and market. An estimated 60 t of shed elk antler was collected from the National Elk Refuge in Jackson Hole from 1974 to 1995. Antler collected from the refuge over winter is auctioned to brokers, exporters, taxidermists, furniture manufacturers, tourists, and curious onlookers. Wholesale dealers purchase up to a few metric tons of antler each year, which is subsequently manufactured into antler furniture or exported to Asia.



In comparison to total U.S. antler exports, the amount of shed antler actually bought at the auction is small (average 7t/year), and probably represents less than 10 percent of total U.S. antler exports. In speaking with traders, however, TRAFFIC learned that the auction is a reliable measure of the economics of the North American shed antler trade, providing an accurate barometer of the antler trade's profitability. In 1994, for instance, TRAFFIC learned that Jackson Hole area pickers sold shed elk antlers for \$7/lb (\$15.2/kg) which were resold by buyers to antler exporters and furniture manufacturers for \$10/lb (\$4.5/kg), a 30 percent profit. Data on the value and volume of antler auctioned in Jackson Hole for the last two decades is presented in table 17.

Table 17

Antler Auction Data (Jackson Hole, Wyoming, 1974-95)						
Year	Quantity Auctioned (lbs)	Quantity Auctioned (kg)	Average Price/lb (US\$)	Average Price/kg	(%) Change in Average Price from Last Year Available	Total Value of Antler Auctioned <sup>1</sup>
1974	3,712	1,687	\$ 1.65	\$ 3.63	NA	\$ 6,124
1975	NA	NA	NA	NA	NA	NA
1976	4,739	2,154	4.25	9.35	158%	\$20,141
1977	NA	NA	NA	NA	NA	NA
1978	8,435	3,834	6.00	13.20	41%	\$50,610
1979	9,088	4,131	6.00	13.20	0%	\$54,528
1980	8,522	3,874	6.00	13.20	0%	\$51,132
1981	NA	NA	NA	NA	NA	NA
1982	7,830	3,559	6.30	13.86	5%	\$49,329
1983	7,254	3,297	6.05	13.31	- 4%	\$43,887
1984	7,582	3,446	6.01	13.22	- .6%	\$45,568
1985	7,887	3,585	6.69	14.72	10%	\$52,777
1986	5,750	2,614	6.46	14.21	3%	\$37,145
1987	6,271	2,850	6.66	14.65	3%	\$41,765
1988	6,122	2,783	8.92	19.62	34%	\$54,608
1989	9,119	4,145	14.07	30.95	58%	\$128,304
1990	6,293	2,860	10.85	23.87	- 23%	\$68,299
1991	7,652	3,478	11.12	24.46	2%	\$85,090
1992	7,300	3,318	9.47	20.83	- 15%	\$69,131
1993	10,149	4,613	7.78	17.12	- 18%	\$78,959
1994	7,600	3,455	10.77	23.54	27%	\$81,850
1995	9,567	4,349	9.75	21.45	- 9%	\$93,295
Total	131,305	59,684	7.50	16.50	NA	\$1,112,542

<sup>1</sup> Rounded off to the nearest dollar.

NA = Data not available. Source: Boy Scouts of America

## Cervid Trophy Trade and Value

A market for antler trophies exists in North America; however, the extent to which cervids are specifically hunted for their antlers is not fully known. According to USFWS LEMIS data, 1,400 trophies of elk, caribou, moose, white-tailed deer, mule deer, and a handful of other cervids valued at more than half a million dollars were reportedly imported into or exported from the United States in 1994. (An additional 1,256 kg of caribou trophies and 130 kg of elk trophies, valued at \$153,000, were imported.)

Elk comprised the majority of U.S. cervid trophy imports, exports, and reexports in 1994, followed by moose and caribou, white-tailed deer, and mule deer. Most elk trophies were imported from Mongolia, New Zealand, and South Korea, while exports and reexports were destined for Europe and Canada, respectively. Most caribou trophies were imported from and exported to Canada, with the exception of 1.2 t of trophies (declared valued of \$150,000) imported from Russia and Hong Kong. (Although the 1,200 kg were reported as caribou trophies, the high value is not consistent with the value of caribou trophies and suggests the specimens may have been processed antler and intended for medicinal use. This is based on the assumption that antler prepared for medicinal use commands a higher price than trophies and other antler ornaments.) About two-thirds of all moose trophies in U.S. trade were imported from Canada; more than 75 percent of white-tailed deer trophies originated from Mexico; and half of the 48 mule deer trophies imported into the United States came from Canada. A breakdown of caribou, elk, moose, white-tailed deer, and blacktail deer trophies exported from the United States is provided in table 18. The U.S. trade in cervid trophies from 1990-1993 is also discussed in the appendix.

LEMIS data do not take into account the informal cervid trophy trade within the United States, which is largely undocumented. Of the 3.5 million<sup>4</sup> deer reported taken annually by sport hunters in North America, an unknown but presumably large number are hunted specifically for their antlers for personal trophies. The U.S.-based Boone and Crockett Club, one of a few trophy record-keeping organizations, reportedly certified 2,150 antlered trophies of *Odocoileus virginianus* and *O. hemionus* between 1992 and 1994. Antlered trophies of other cervid species were certified by Boone and Crockett during the same three-year period, but a figure on the total number of other trophies was not available for this report. A smaller but unknown quantity of North American antlered trophies taken each year are sold to collectors, to taxidermists, and to lodges for decoration.

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<sup>4</sup> In order of volume, the most commonly hunted cervids in North America are white-tailed deer (2,982,000), blacktail deer (500,000) including all subspecies of *O. hemionus*, wapiti (85,000), moose (54,000), and caribou (50,000) (Payne 1989).

The value of trophies generally is based on the location and rarity of the species, and any lasting, unique, or impressive physical characteristics differentiating specimens of the same species (Stelfox, date unknown). A review of U.S. taxidermy catalogs and pricelists showed that a variety of native North American cervid antlers ranging in price from \$25 to \$1,500 may be purchased. Another indicator of trophy values is the range of appraisal values that trophy record-keeping organizations assign to big game trophies based on the value of guided hunts. One such organization appraises more than 200 big game species, including more than 20 native North American cervid taxa. Cervid appraisals range from \$2,700 to \$14,000 per head, and from \$4,000 to \$16,300 per mounted whole animal. For example, tule elk (*C.e. nannodes*), a North American subspecies of elk indigenous to California, was appraised at \$13,850/head, and at more than \$16,000/whole animal.

TRAFFIC reviewed a number of commercial hunting packages to determine the variety of cervids available to hunters in the United States and Canada. Most commercial trophy hunts are organized through private outfitters selling guided and nonguided hunting packages to individuals or small groups. Most U.S. and Canadian packages offer a variety of big game, including cervids, which may be hunted on private, public, or leased land. In general, TRAFFIC found that the more expensive North American trophy hunts were comprised of native cervids such as caribou, moose, Rocky Mountain elk, white-tailed deer, and mule deer, while trophy hunts involving nonnative cervids such as axis deer, fallow deer, and sika deer were less expensive (table 19).

Table 18

1994 Trophy Exports From the United States											
Country of Destination	Caribou ( <i>Rangifer tarandus</i> )		Elk ( <i>Cervus elaphus</i> )		Moose ( <i>Alces alces</i> )		White-tailed deer ( <i>Odocoileus virginianus</i> )		Mule deer ( <i>O. hemionus</i> )		Declared Value (\$)
	Qty	Declared Value (\$)	Qty	Declared Value (\$)	Qty	Declared Value (\$)	Qty	Declared Value (\$)	Qty	Declared Value (\$)	
Argentina							2 items	80			
Austria	8 items	0			7 items	\$1,185			1 item	\$150	
Australia	10 items	\$955			2 items	0	1 item	\$245			
Canada	67 items	\$1,465			79 items	\$3,125	1 item	0			
France			1 item	\$750			2 items	\$800	1 item	\$50	
Germany	7 items	\$210	2 items	\$1,290	9 items	\$6,775	2 items	\$145			
Italy	3 items	\$210			1 item	\$135	8 items	\$790			
Japan					2 items	\$4,350	7 items	\$1,375			
Mexico	1 item	\$150	4 items	\$1,825			3 items	0	1 item	\$130	
The Netherlands							2 items	0			
Norway					1 item	0	2 items	\$300			
South Africa					2 items	\$25					
Spain	1 item	0	2 items	\$255	1 item	0	4 items	\$395			

1994 Trophy Exports From the United States										
Country of Destination	Caribou ( <i>Rangifer tarandus</i> )		Elk ( <i>Cervus elaphus</i> )		Moose ( <i>Alces alces</i> )		White-tailed deer ( <i>Odocoileus virginianus</i> )		Mule deer ( <i>O. hemionus</i> )	
	Qty	Declared Value (\$)	Qty	Declared Value (\$)	Qty	Declared Value (\$)	Qty	Declared Value (\$)	Qty	Declared Value (\$)
Switzerland										
Taiwan (ROC)					1 item	\$5,100			1 item	\$495
United Arab Emirates			3 items	\$3,450			6 items	\$1,775	2 items	\$2,245
United Kingdom										
Unknown	2 items	\$530							1 item	\$150
<b>TOTAL</b>	99 items	\$3,520	10 items	\$7,570	105 items	\$20,695	40 items	\$5,905	7 items	\$3,220

Source: U.S. Fish and Wildlife Service, Law Enforcement Management Information System (LEMIS) data

Table 19

Cervid Taxa Available to Sport Hunters in North America					
Location of Hunt	Common Name	Scientific Name	Native to North America	Cost of Hunt <sup>1</sup>	
Alaska	Caribou	<i>Rangifer tarandus</i>	Yes	\$2,750	
Maine	White-tailed deer	<i>Odocoileus virginianus</i>	Yes	\$425	
Manitoba	White-tailed deer	<i>O. virginianus</i>	Yes	\$1,600 - \$2,000	
Missouri	Wapiti, Rocky Mountain elk	<i>C.e. nelsoni</i>	Yes	\$2,500 - \$10,000 & †	
Missouri	Japanese sika deer	<i>Cervus nippon ssp.</i>	No	\$550 & †	
Missouri	Indian axis deer	<i>Cervus axis</i>	No	\$1,400 - \$2,000	
Missouri	European fallow deer	<i>Dama Dama</i>	No	\$550 - \$1,500	
New Mexico	Mule deer	<i>Odocoileus hemionus</i>	Yes	\$1,000	
Newfoundland	Moose	<i>Alces alces</i>	Yes	\$2,400	
Newfoundland	Caribou	<i>Rangifer tarandus</i>	Yes	\$2,400	
New York	European fallow deer	<i>D. Dama</i>	No	\$500 - \$1,000	
Wyoming	Mule deer	<i>O. hemionus</i>	Yes	\$1,800	
Wyoming	Rocky Mountain elk	<i>C.e. nelsoni</i>	Yes	\$2,500 - \$4,500	
Yukon Terr.	Moose or caribou	<i>A. alces/R. tarandus</i>	Yes	\$6,100	

<sup>1</sup> Cost of hunt varies depending on type of weapon employed (firearm, archery, etc.) and additional costs such as hunting licenses, trophy fees, tags, transport, accommodation, retrieving and dressing the carcass.

## VIII. SUMMARY OF FINDINGS AND CONCLUSIONS

The purpose of this review was to quantify the extent to which native North American cervids--namely caribou, elk, moose, mule deer, and white-tailed deer--are exploited and traded for their velvet antler, shed antler, and trophies, and to try to make a preliminary assessment of the impacts of this trade on wild cervid populations in the United States and Canada. Although this review uncovered a thriving cervid antler trade, it found no evidence that the legal take of North American cervid antler is, at this time, impacting most wild cervid populations in the United States or Canada. In fact, most wild populations of native North American cervids whose antler is exploited for Asian medicinal markets and the domestic ornamental, curio, and trophy trade are stable or increasing. With the exception of a few threatened subspecies which are vulnerable to overhunting, poaching, and/or habitat loss, some North American cervids, such as white-tailed deer, have grown at such a dramatic rate that they are increasingly competing for disappearing habitat and sources of food.

This report concludes that the legal take of shed, velvet, or trophy antlers is not impacting wild deer populations in the United States and Canada because a) deer naturally produce and shed antlers each season, so collection of shed antlers has no biological impact on the deer; b) it is assumed that virtually all velvet antler harvested in the United States and Canada is taken from farmed deer, so that few deer are poached solely for their velvet antler; and c) trophies harvested in the United States and Canada are generally obtained from well-managed deer populations in accordance with state and provincial hunting regulations.

It is projected that a large percentage of antler exports, particularly from the United States, will continue to be in the form of antlers shed by wild cervids and trophies taken by recreational hunters. Unlike the body parts of many other animals that are harvested for commercial trade, most antler in trade is a renewable and naturally shed deer byproduct that is collected with no apparent biological impact on cervids. (This report did not address the conservation implications of antler removal from the wild on the ecosystem, although this issue certainly merits review.) The majority of trophies traded within and exported from the United States and Canada are obtained from cervids hunted on public and private land during designated hunting seasons in accordance with state and provincial hunting regulations. All states and provinces control the take of wild cervids by issuing mandatory hunting licenses and setting seasonal bag limits.

Countries with well-established deer farming operations, such as the PRC, Russia, and New Zealand, are the primary suppliers of antler for the Asian medicinal market, with smaller volumes of antler supplied by U.S. and Canadian producers. The market for North American velvet antler is expected to increase, and, correspondingly, a rise in Canadian and U.S. velvet antler production will likely ensue. However, a growing number of private cervid farms in the United States and Canada should be able to meet increasing commercial demand and produce a sufficient supply of velvet antler for global markets. Moreover, the fact that velvet antler from farmed cervids is of better quality and more expensive than velvet from wild animals should keep commercial demand high and poaching to



a minimum. Typically, poaching for meat and trophy antlers is more prevalent than poaching for velvet antlers for international trade. A survey of convicted deer poachers in Missouri in the mid-1980s revealed that 50 percent of the poaching was for the venison meat. Only 2 percent of those surveyed poached deer for commercial purposes (Glover and Baskett 1984). The nature of the velvet trade makes poaching economically prohibitive because velvet antlers must be carefully removed at the right stage of development and preserved to ensure freshness and top value in medicinal markets.

Even though cervid farms appear to reduce incentives to poach wild cervids for velvet antler, the potential for supplementing private stock with wild cervids or laundering antler obtained from wild cervids still exists. Illegal take of wild cervids and velvet antler could be minimized by requiring licensed cervid farmers to register and tag their private stocks of cervids or establish an identification system for cervids, or antlers derived from such cervids, with their respective state, province, or territory.

Most occurrences of poaching for deer antlers in the United States and Canada involve deer that are taken for noncommercial purposes by individuals who knowingly violate state or provincial regulations by hunting out of season and exceeding game bag limits. Of greater concern is the unknown number of violators who intentionally take deer illegally for commercial gain. It is assumed that this illegal take has been for meat or for illegal hunts for trophy-size animals.

There have been several instances of poaching or illegal commercialization of cervids for their antlers in recent years. For instance, a few cases involving the killing of bull elks for their trophy antlers have been documented in Yellowstone National Park. In addition, the Wyoming Department of Fish and Game reported that antler heists were on the rise in 1994, with most antlers disappearing from residences, national parks, and private businesses (Wyoming News 1994). In April 1997, the Wyoming agency stated that as competition for shed antlers grows there appears to be a corresponding increase in the number of individuals acting unethically and perhaps violating laws (Wyoming News 1997).

Although evidence does not currently indicate that illegal deer antler trade in North America exists on a large scale or is adversely affecting U.S. and Canadian populations of wild cervids, as a precautionary measure state and provincial wildlife agencies should monitor patterns of illegal antler harvest and trade. Furthermore, TRAFFIC recommends that states and provinces monitor antler use, value, and trade so that emerging trends can be identified and conservation problems averted.

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## APPENDIX: U.S. Imports and Exports of Cervid Antler (1990-1993)

### Elk

#### Horn Products:

In 1990, the United States imported elk horn products with a value<sup>5</sup> of more than \$2.7 million, of which 89 percent was imported from New Zealand. As New Zealand is the world's largest producer of velvet antler, it is very likely that most of the horn products imported from New Zealand are partially comprised of velvet antler, some of which may be frozen and unprocessed, or dried and processed.

The United States also imported elk horn products from the former Soviet Union (7%), Canada (3%), India ( $\approx 1\%$ ), Hungary ( $\approx 1\%$ ), United Kingdom ( $\approx 1\%$ ), Mongolia ( $\approx 1\%$ ), and Germany ( $< .1\%$ ) in 1990. The value of U.S. imports of elk horn products declined to a little more than \$1.2 million--nearly half the value of 1990 imports--by 1993. This decline may reflect the entry of lower-grade Russian antler onto the global market in the early 1990s. Similarly, the United States imported a higher volume (kg) of elk horn products from Russia in 1993 than it did in 1990, which may have lowered the overall value of imports. Countries exporting elk horn products to the United States in 1993 were New Zealand (31%), the former Soviet Union (31%), Canada (9%), Germany ( $\approx 1\%$ ), China ( $\approx 1\%$ ), and Spain ( $< 1\%$ ).

In 1990, the United States exported elk horn products with a value of \$1.9 million. The majority of U.S. exports of elk antler products have gone to South Korea in recent years. For instance, 75 t or 90 percent of elk antler products exported from the United States in 1994 were destined for South Korea.

#### Trophies:

Canada was the largest supplier of elk trophies by volume and value to the United States in 1990, exporting over 180 elk trophies to the United States that year, followed by Mongolia (135), Spain (22), and the United Kingdom (17). By 1993, Canada had dropped to the third largest exporter of elk trophies to the United States, behind New Zealand and UK. The value of elk trophy imports fluctuated from \$91,995 in 1990, to \$57,000 in 1991, to \$115,074 in 1992, and back down to \$79,000 in 1993.

According to LEMIS data, the United States exports far fewer elk trophies than it imports. In 1994, the United States exported only 12 elk trophies (\$11,400) in comparison with nearly 400 trophy

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<sup>5</sup> All values in the appendix are based on declared values unless noted otherwise.

imports (\$65,000).

#### Elk-derived Medicinals:

From 1990 to 1993, the United States imported more than 12,000 kg of elk-derived medicinals, valued at more than \$2 million, the majority of which were imported from New Zealand. By contrast, the United States exported no elk-derived medicinals in those years.

#### Caribou

##### Horn Products:

In 1990, more than \$15 million in caribou horn products were reported in U.S. trade, compared to only \$3 million in trade in 1993.

The countries that exported caribou horn products to the United States from 1990 to 1993 remained virtually unchanged, with Russia ranking first (declared value of \$3.1 million), followed by Canada (declared value of \$33,627). The majority of caribou horn products imported from Russia arrived via Hong Kong, South Korea, and Canada.

In 1993, the United States exported or reexported caribou horn products with a declared value of \$132,000, which was down from \$1.2 million in 1990. The plunge in overall value of U.S. exports and reexports of caribou horn products is a reflection of the poor quality of stockpiled reindeer antler (classified as caribou in LEMIS) imported into the United States from Russia in the early 1990s.

##### Trophies:

Although the reported volume of U.S. imports of caribou trophies was lower in 1993 than in 1990, the value of U.S. trade in caribou trophies was higher in 1993 (\$196,000) than in 1990 (\$117,000). From 1990 to 1993, Canada was the main exporter of caribou trophies to the United States.

##### Caribou-derived Medicinals:

Comparatively fewer caribou-derived medicinals have been imported into the United States than caribou horn products or trophies, with Russia being the primary exporter of these medicinals to the United States in recent years. The United States imported caribou-derived medicinals with a declared value of \$44,000 from Russia in 1990. That figure more than doubled in 1991 but fell to only \$1,500 in 1993. Finland also exported \$13,000 worth of medicinals to the United States in 1991.

No reported U.S. imports of medicinals containing caribou derivatives were recorded in 1992.

From 1990 to 1993, the United States exported or reexported 2,700 kg and 500 items of caribou-derived medicinals, valued at more than \$160,000, of which 80 percent were imported from Russia and subsequently shipped to South Korea.

## Moose

### Horn Products:

The value and volume of the U.S. trade in moose horn products is comparatively smaller than the trade in elk and caribou horn products. Moose horn products with a declared value of \$85,000 were imported into the United States in 1990, primarily from Canada. By 1993, while the average volume of moose horn product imports remained constant, the value of imports, most of which came from Canada (43 percent) or Russia (29 percent), had dropped slightly to \$62,600.

According to LEMIS data, the list of countries importing moose horn products from the United States has changed in recent years. In 1990, for instance, reported U.S. exports and reexports of moose horn products went to South Korea (79%), Hong Kong (9%), Germany (1%), Sweden (1%), and the UK (1%). In 1993, by comparison, the United States exported or reexported the majority of its moose horn products to Canada (56%), Australia (42%), and Sweden (2%).

### Trophies:

The number of moose trophies in U.S. trade from 1990-1993, almost all of which originated in Canada, hovered around 230 items. Reported U.S. exports and reexports of moose trophies were destined primarily for the European Union, including Germany, Switzerland, Austria, and Belgium.

### Moose-derived Medicinals:

There were no reported U.S. imports, exports, or reexports of moose-derived medicinals from 1990 to 1993.

## Mule Deer

### Horn products:

The volume of U.S. exports and reexports of mule deer horn products dropped from about 22,000 kg and 7,000 items in 1990 to 1500 kg and 152 items in 1993. The drop in volume is reflected in lower values of the trade in 1990 (\$300,000) versus 1993 (\$31,000). Fewer reported U.S. exports of mule deer horn products may be related to the sparse demand for mule deer antler for medicinal use in Asia.

Imports of mule deer horn products into the United States have gradually been rising. In 1990, only 244 kg and 42 items were imported, compared to 395 items in 1991, 319 kg and 454 items in 1992, and 1,889 items in 1993. Canada has been the primary exporter of mule deer horn products to the United States. In 1993, the United States imported nearly 1,900 items, or 93 percent of all its mule deer horn product, from Canada.

### Trophies:

Reported U.S. exports and imports of mule deer trophies are more or less equal. The United States reportedly exported no trophies in 1990, 12 trophies in 1991, 41 trophies in 1992, and 14 trophies in 1993. As regards imports, 16 mule deer trophies were imported in 1990, 59 trophies in 1991, 74 trophies in 1992, and 88 trophies in 1993. Canada and Mexico were the largest exporters of mule deer trophies to the United States. In 1993, the United States imported 34 trophies (valued at \$13,656) from Canada, and 54 trophies (valued at \$4,800) from Mexico.

### Mule deer-derived Medicinals:

There was no reported trade in U.S. imports, exports, or reexports of mule deer-derived medicinals from 1990 to 1993, with the exception of 8 items, valued at \$100, which were imported into the United States from Canada in 1991.

## White-tailed Deer

### Horn Products:

In general, U.S. exports of white-tailed deer horn products have experienced a decline while U.S. imports have increased. Most U.S. imports of white-tailed deer horn products have originated from Canada or Mexico recently, while virtually all U.S. exports of horn products have been sent to Canada, Japan, Thailand, Taiwan, and Germany. As is the case with moose and mule deer, white-

tailed deer is not commonly used in Chinese medicines and is traded primarily for its ornamental value.

The reported U.S. trade in white-tailed deer horn products in 1990 was valued at \$124,000; in 1991, \$249,000; in 1992, \$828,000; and in 1993, \$13,672. While the value of this trade has fluctuated since 1990, so has the volume. In 1990, 10,000 kg and about 440 items of horn product were reportedly exported from the United States; in 1991, 14,000 kg and over 5,600 items; in 1992, 1100 kg and 28 items; and in 1993, 13 kg and 4 items. In comparison, U.S. imports increased slightly from 1990 to 1993. In 1990, the United States imported 506 kg and 185 items; in 1991, 798 kg and 425 items; in 1992, 2,748 kg and 188 items; and in 1993, 541 kg and 2,970 items.

#### Trophies:

The majority of white-tailed deer trophies imported into the United States come from Canada or Mexico. Japan ranked first by number of trophies (750) exported from the United States in 1990, followed by Germany (150), Mexico (125), Italy (10), and South Korea (5). In 1993, the United States exported 22 trophies to Canada, Japan, Taiwan, the Netherlands, Belgium, the UK, and a few other countries.

#### White-tailed deer-derived Medicinals:

There was no reported trade in U.S. imports, exports, or reexports of white-tailed deer-derived oriental medicinals from 1990 to 1993.

#### Unspecified Cervid (Cervidae spp.)

Reported U.S. imports, exports, and reexports of unspecified cervid horn products, trophies, and unspecified cervid-derived oriental medicinals were valued at \$2.2 million in 1993. Based on declared value, this is the third most valuable category of cervid antler in U.S. trade following elk and caribou.

#### Horn Products:

The volume of U.S. imports of horn products of unidentified cervid taxa was higher in 1993 than in 1990, whereas 1993 exports were lower than 1990 exports. India exported a reported 43 t of items of horn products (\$370,000) to the United States in 1990 and 24 t of items (\$508,000) in 1993, accounting for 85 percent and 38 percent of U.S. imports those years, respectively. Other notable exporters of horn products to the United States in 1990 were Germany (4800 kg; \$113,000) and Canada (2700 kg; \$48,000); in 1993, imports of horn products into the United States were reported

from Germany (28,639 items; \$444,000), Italy (5,700 items; \$66,300), Spain (5,445 items; \$34,500) and Indonesia (418 items; \$5,100).

Over 41 t of horn products, valued at \$510,000, were reportedly exported from the United States to South Korea in 1990. In 1993, a reported 23 t and 10,000 items of horn product, valued at \$651,000, were exported from the United States to South Korea. Trace amounts of unspecified cervid horn products were exported to Taiwan, India, and Japan.

#### Trophies:

The United States imported several dozen unspecified cervid trophies, valued at \$5,400, from New Zealand, Russia, the United Kingdom, and a handful of other countries in 1993.

#### Unspecified cervid-derived Medicinals:

Of the 1,500 kg of unspecified cervid-derived medicinals, valued at \$122,300, imported into the United States from 1990 to 1993, about 730 kg (\$18,247) were imported from China. Medicinals reported by weight were also imported from New Zealand (392 kg), China via Hong Kong (141 kg), Hong Kong (45 kg), and South Korea (45 kg). An amount of unspecified cervid-derived medicinals totalling 100 kg (\$42,000) was imported from Russia and subsequently reexported to South Korea. Of the 2,830 items of medicinals (\$16,900) imported, 1,000 originated from New Zealand (\$9,400), while another 536 medicinal items (\$3,960) were imported from Hong Kong, 120 items (\$42) from China, 431 items (\$2,690) from South Korea, 6 items (\$20) from Vietnam, 79 items (\$790) from Australia and several items from unknown origin. There were no reported exports of medicinals from the United States from 1990 to 1993.





WWF

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