



SPECIES IN DANGER

THE WORLD
TRADE IN
RHINO HORN:
A REVIEW

Nigel Leader-Williams

A TRAFFIC NETWORK REPORT

TRAFFIC
— International —

This report was published
with the kind support of



 National Westminster Bank

Published by TRAFFIC International,
Cambridge, United Kingdom.
With financial support from
WWF UK (World Wide Fund For Nature).

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ISBN 0 947613 86 2

Cover drawing by Bryan Poole.

Printed on recycled paper.

**THE WORLD TRADE IN RHINO
HORN: A REVIEW**

Nigel Leader-Williams¹

The People's Trust for Endangered Species
provided financial support for the compilation of
the data presented in this publication.

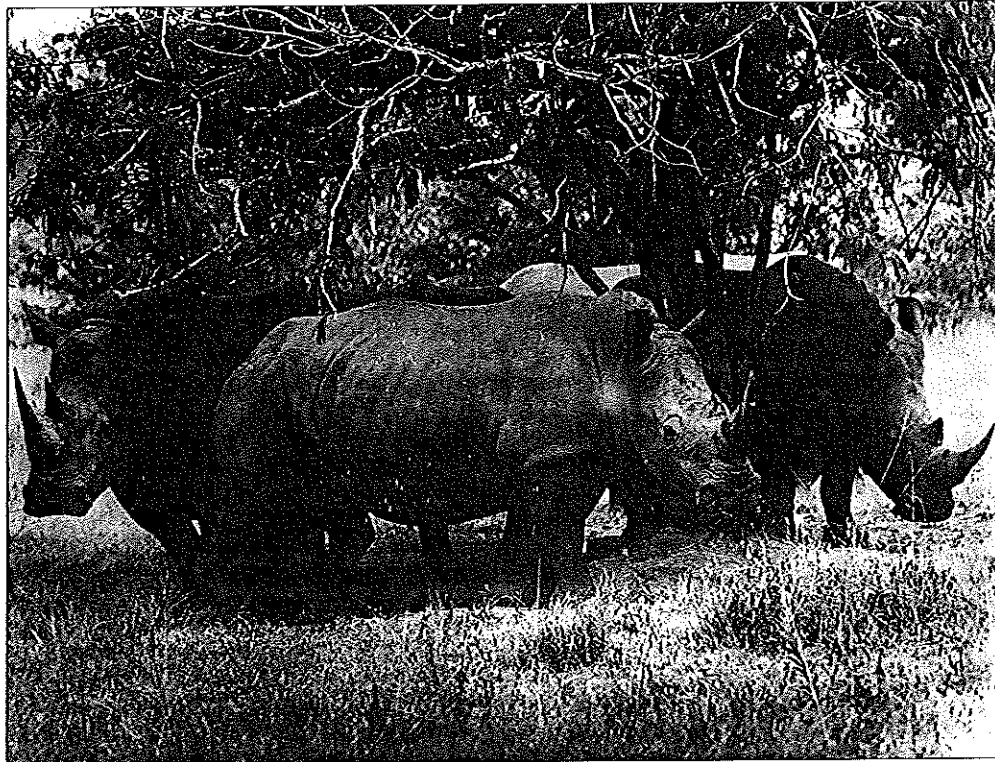
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ACKNOWLEDGEMENTS

The author would like to thank the People's Trust for Endangered Species for their financial support while this review was compiled and John Beddington for his encouragement. Richard Luxmoore of WCMC and Jorgen Thomsen of TRAFFIC kindly provided access to data and reprints. The manuscript was reviewed constructively by Jorgen Thomsen, Esmond Bradley Martin, Kristin Nowell, Tom Milliken and Martin Brooks. Alison Rosser provided much support while the manuscript was prepared. Finally, the author would like to acknowledge Esmond Bradley Martin's pioneering work in unravelling the intricacies of the trade in rhino horn.

INTRODUCTION

Rhinos are amongst the world's most endangered large mammals. Two species of rhinos in Asia (Javan *Rhinoceros sondaicus* and Sumatran *Dicerorhinus sumatrensis*) and one sub-species in Africa (northern white *Ceratotherium simum cottoni*) teeter on the edge of extinction. Over the past two decades, the formerly numerous black rhino *Diceros bicornis* has plummeted from an estimated 65,000 to 3,000 and has become locally extinct over large areas of Africa. By contrast the southern white rhino *C. s. simum* is currently well conserved in limited areas of its range in southern Africa, as is the Indian rhino *Rhinoceros unicornis* in India and Nepal. However, with total world populations in only the low thousands, the continued survival of southern white and Indian rhinos is by no means guaranteed (Cumming *et al.* 1990; Khan 1989).



WWF International

White Rhinos in Kruger National Park. One of the few rhino populations not in decline.

Rhino numbers have declined for two main reasons. First, loss of rhino habitat has been especially serious in the rainforests and floodplains of Asia, but is less of a problem in African savannas. Second, rhino horns are used in medicines and as dagger handles, and other rhino products such as skin and blood are used to a lesser extent. As a result of high demand for rhino horns, unprotected populations of rhinos have been exploited unsustainably and the trade in their products has largely been responsible for reducing rhinos to their presently endangered status. Therefore, when the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) entered into force in 1975, rhinos were among the first species included on the CITES Appendices. In July 1975, three species (Sumatran, Javan and Indian) and one sub-species (northern white) were placed on Appendix I, while one species (black) was placed on Appendix II. In February 1977, both the black and southern white rhino were placed on Appendix I, therefore prohibiting international commercial trade in the whole family of rhinos and their products.

This review has two aims. The first is to collate the available information on volumes and prices of rhino horn on world markets and to determine if the quality of the available data on the rhino horn trade is comparable to that on ivory. Recently, the Ivory Trade Review Group (ITRG) has been very successful in documenting volumes and prices of ivory on world markets as part of the

international effort to achieve more successful conservation of African and Asian elephants (Cobb 1989). Indeed, the data on volumes of ivory traded over time are more complete than data on elephant numbers, due largely to the difficulties of censusing elephants in rainforests. Estimates of world rhino numbers are even less complete and less accurate than those of elephants. Three species of rhino (Javan, Sumatran and black) are primarily solitary and live in forested or wooded habitats which make accurate total counts difficult. The main conclusion from this section of the review, unfortunately, is that data on volumes and prices of rhino horn on world markets are much less complete than data for ivory. Two major factors are responsible for the difference in data quality between rhino horn and ivory. First, rhino horn has not been differentiated from other types of horn and animal products in the customs statistics of most producing, entrepôt and consuming nations even when the trade was legal, whereas ivory appears as a separate commodity. Second, by 1977 all species of rhinos and their products were placed on CITES Appendix I, and many of the producing and consuming nations had instituted their own trade bans or became parties to CITES. Thus, most trade in rhino horn became illegal, so by definition should not have appeared in declared customs statistics (though it does in one case, as discussed below).

The second aim of the review is to compile our present knowledge on the extent of the rhino horn trade, in order to question whether policies attempting to halt the rhino horn trade, followed over the last 15 years, have succeeded, or are likely to succeed. Since CITES was formulated and all species of rhinos were placed on Appendix I, it has been hoped that successful conservation of rhinos would be achieved most cost-effectively by halting the trade in horn. While being afforded the supposed benefit of an international trade ban, unprotected populations of the most widely distributed sub-species of black rhino have continued to be over-exploited for their horns, to the extent that black rhinos have the dubious distinction of showing the fastest known rate of decline of any species of large mammal. The fate of the widely distributed Sumatran rhino in Asia has been less well documented. However, successes in rhino conservation have been achieved or consolidated, for example, the continued increase in numbers of southern white and Indian rhinos in southern Africa, and India and Nepal, respectively. Other efforts have begun to show signs of success, for example, the initial recovery of two of the four sub-species of black rhinos in Kenyan and in South African and Namibian sanctuaries, respectively and of northern white rhinos in Zaire. The recipe for success of these endeavours has involved the rounding up of stragglers, concentrating resources in small areas, and once the population has built up sufficiently, making translocations to unoccupied habitats in areas of former range (reviewed in Leader-Williams 1992). Affording protection to rhinos costs money and the crucial questions are whether rhinos could contribute to the costs of their conservation through a legal trade in horn, and whether a legal trade in horn would reduce the considerable pressures on unprotected populations of rhinos that have resulted from the illegal trade in their horn. If this review stimulates further informed debate on this topic, then it will have achieved its second aim.

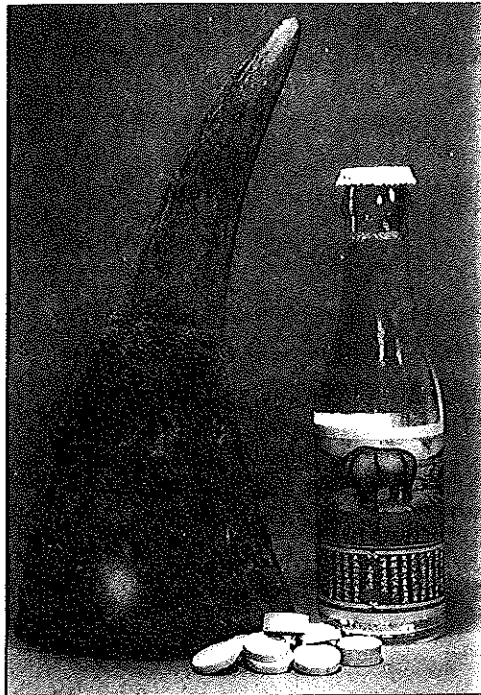
RESEARCH FOR THE REVIEW

Most of the available information on the rhino horn trade has been gathered as a result of the pioneering work of E.B. Martin and his colleagues since 1979, and their results have been presented in numerous articles and several books. During the course of this review all the articles and books in the reference list were read, the files of the World Conservation Monitoring Centre and TRAFFIC were examined, and the rather qualitative information on volumes and prices of rhino horn in world trade were collated. Many of the articles in the reference list re-circulate the same information but in a slightly different form. This approach has presumably been adopted to canvas support amongst different audiences for attempts to halt the trade in rhino horn, but it means that many of the articles read have not been quoted in the body of this report.

The available data that have been compiled for this report are all shown in terms of volume in kg and price in US\$/kg, not corrected for inflation. Some price data has been corrected for inflation where indicated in various Figures, with a base of 100% in 1980 (as was done for the Japan data set shown in Leader-Williams *et al.* 1990). Where the terms wholesale and retail price appear, Martin's definitions for his own work have been followed. Namely, **wholesale price** is that paid by dealers and large pharmacy shops and **retail price** is that charged to the consumer. Volumes of horn can be converted to approximate numbers of rhino supplying that horn using the following mean weights: black rhino: 2.88kg; white rhino: 4.00kg; Indian rhino: 0.72kg; Javan rhino: 0.68kg; Sumatran rhino: 0.27kg (Martin 1983e), making the assumption that horn weights have not changed over time.

THE USES AND HISTORY OF THE TRADE IN RHINO HORN

WWF / J Malinowicz



The use of rhino horn in traditional medicines is widespread and continuing in the Far East.

The rhino horn trade has a long history. One of the earliest records of use of rhino horn as a medicine was by the Chinese during 200 B.C.-200 A.D. (Martin and Martin 1982; But *et al.* 1990). During the Ming and Ching dynasties, the Chinese carved rhino horns into beautiful cups, plates, bowls and figurines. Rhino horn drinking vessels had the added advantage of being able to detect alkaloid poisons, in an age when such poisons were a major means of treachery. However, westerners long believed that rhino horn was used primarily as an aphrodisiac, but this myth was exploded in the early 1980s (Parker and Martin 1979; Martin and Martin 1982). Some rhino horn is indeed consumed as an aphrodisiac, but this is limited to use by the Gujaratis in India. Rhino horn has had two far more important uses in terms of volume traded in recent times. First, horn and other rhino products such as blood, skin and urine, are an important constituent in traditional

medicines and potions used to reduce fevers, headaches and other illnesses in the Far East. Such medicines are used primarily by the Chinese, but also by Burmese, Thais and Nepalis. In contrast, the Japanese and Koreans also learned to use rhino horn in medicines through early cultural links with the Chinese, but do not use other rhino products. Rhino horn is generally sold in the Far East in one of two forms: first as "raw" horn by traditional pharmacists who make up the medicine for individual customers from horns held in their shops, and second as a constituent in manufactured medicines. An important point is that "Fire" (Asian) horn is believed more efficacious than "Water" (African) horn and that Asian horn is considerably more expensive (Nowell *et al.* 1992). Thus both African and Asian rhino horn is used widely throughout the Far East both by indigenous people but particularly by the resident Chinese communities found in most Far Eastern countries (Martin 1983d). In addition, confiscations in Los Angeles, San Francisco and Brussels attest to the use of rhino horn by Chinese communities in Western countries. Second, Yemenis have used African rhino horn since at least the eighth century to make handles for traditional daggers (*jambias*). Daggers are important status symbols in the cultural life of Yemeni men. In contrast to other materials used for dagger handles such as water buffalo *Bubalus bubalis* horn, rhino horn handles improve in appearance and lustre with age. Therefore, it is the quality of rhino horn that interests the makers of daggers rather than any fascination with rhinos per se (Varisco 1987, 1989a, 1989b).

WWF / Hermann Jungius

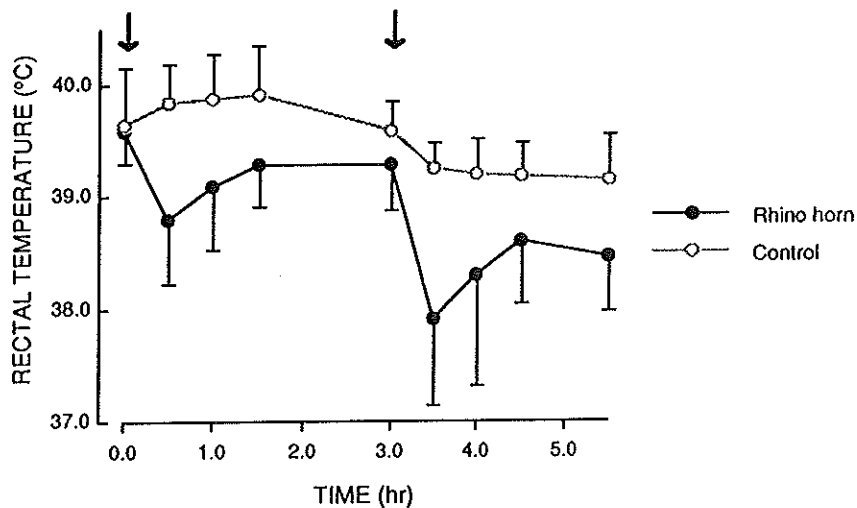


Traditional daggers or *jambias* are produced with rhino horn handles in Yemen.

The beauty of carved rhino horn, whether as cups or dagger handles, cannot be disputed. The pharmacological efficacy of rhino horn as an aphrodisiac can, as with all other types of aphrodisiac, only be guessed at. However, its psychological value may well be all important and has some basis both in the shape of rhino horns and in the long courtship and staying power of copulating rhinoceroses, which take upwards of one hour from intromission to

ejaculation (Goddard 1966; Laurie 1982). An early study suggested, too, that rhino horn had no pharmacological efficacy as an anti-pyretic, using doses of 100-300mg kg⁻¹ administered orally in rats (Hoffmann-La Roche *in litt.* 1980), and that its use must therefore rest on traditional belief. However, a more recent study shows that African rhino horn has an anti-pyretic effect at much higher doses of 4,000-20,000mg kg⁻¹ administered intra-peritoneally, also in rats (Figure 1). The latter represents a dose some one hundred times higher than would be taken by a human, and experimental protocols between the studies differed, not only with respect to the route of administration, but also with respect to the experimental means used to induce the initial pyrexia (But *et al.* 1990). However, the recent study shows that traditional Chinese beliefs may have some pharmacological basis, but this conclusion needs further substantiation (But *et al.* 1990). In addition, a study of the supposed difference in the efficacy of African and Asian horn would be well-merited.

Figure 1: The anti-pyretic effect of two intra-peritoneal injections (marked with arrows) of rhino horn at doses of 2.5g/ml in rats (after But *et al.* 1990).



Whatever the situation with pharmacology versus traditional beliefs, trade in rhino horn has occurred along well established routes for centuries. An early record of rhino horn leaving Azania (ancient East Africa), together with ivory and tortoise-shell, for southern Arabia dates from 50 A.D. (Sutton 1990). However, historical and contemporary information on actual volumes and prices of rhino horn in world trade are generally lacking. To illustrate this point, the five living species of rhinos formerly ranged in historic times in at least 44 countries, some 29 in Africa and 15 in Asia. Rhino horn used to be imported into at least 40 different countries from East Africa alone (Parker and Martin 1979), ranging through North and South America, Europe, the Middle and Far East. Until the mid-1970s, when CITES entered into force, there were no legislative barriers to trade between nations. Yet there are only long series of data over time for three producing and four consuming nations, with additional less complete or anecdotal data from a few other countries.

LEGAL EXPORTS FROM PRODUCING NATIONS

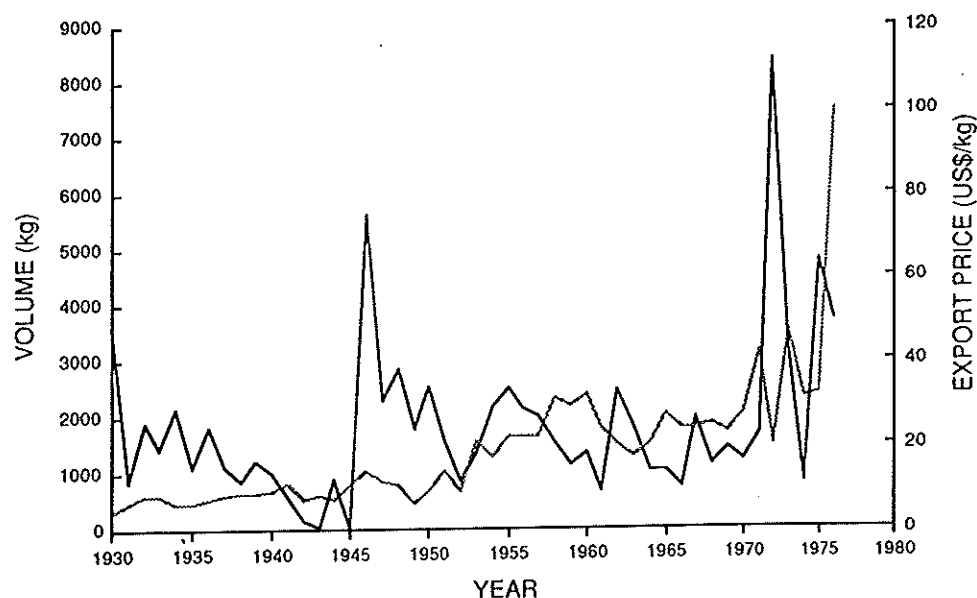
Africa

There is little evidence of domestic consumption of rhino horn produced in Africa (see Martin and Ryan 1990), yet there are only runs of export data in terms of volume and price for three countries, and one short run of data on volumes for a fourth country.

East Africa

The longest time series of data on exports in terms of volume and price of rhino horn derives from the three East African countries of Kenya, Uganda and Tanganyika (later Tanzania after independence in 1964). The declared exports of rhino horn from East Africa were compiled from customs statistics from 1926-1976, three years before Kenya became a party to CITES in 1979 (Parker and Martin 1979). For most years from 1929-1976 there are data on volumes and prices declared to have been exported from each country. The relationship between the average price and the total volume of rhino horn sold from the East African auction rooms is shown in Figure 2. Declared exports from East Africa averaged 1,600kg/year (or the death of 555 black rhinos/year) during the 1930s, dropped to 500kg/year (174 rhinos/year) during World War II, rose to 2,500kg/year (or 868 rhinos/year) immediately after the war, dropped to 1,800kg/year and 1,300kg/year (625 and 451 rhinos/year) during the 1950s and 1960s, before rising to 3,400kg/year (1,180 rhinos/year) in the 1970s. During this period average prices increased steadily until the early 1970s when they showed a more rapid increase (Figure 2; Table 1).

Figure 2: The volume (solid line) and price (dashed line) of East Africa's declared exports from 1929-1976 (data from Parker and Martin 1979).



This data set, acquired from one consistent source, can be combined with some more anecdotal information for earlier years (Table 2). This suggests that far larger volumes of horn were traded from East Africa during 1840-1900 (Martin and Martin 1982). From these figures, it was estimated that East Africa as a whole may have traded 11,000kg/year from 1849-1895. This represents the death of around 170,000 black rhinos over this period (Martin and Martin 1982), assuming there has not been a marked decline in horn weight. Even if mean horn weight was higher than the present 2.88kg (Martin 1983e), say 4kg, this would still represent the death of around 100,000 black rhinos.

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Table 1: Declared volume (kg) and average price (US\$/kg) of exports from East Africa (Kenya, Uganda and Tanganyika/Tanzania before/after 1964) during 1949-1976 to countries of destination (data from Parker and Martin 1979).

YEAR	Hong Kong	Aden/ S Yemen	Zanzibar	China	USA	UK	Japan	Others	Total volume	Average price
1949	1,067		508		152	51			1,778	6
1950	965		1,423		102	51			2,540	9
1951	1,372		203						1,575	14
1952	508		356						864	19
1953	965		203		51	102		51	1,372	21
1954	1,422	51	508		51	152			2,184	17
1955	1,361		862		91	91		91	2,496	22
1956	1,134	45	544		182	227			2,132	22
1957	227	363	953		272	182			1,997	22
1958	182	136	726		408	91			1,543	31
1959	45		817		227	45			1,134	29
1960	91	45	907		181	136			1,360	32
1961	136	136	45		182	181			680	24
1962	1,588	771			45	46			2,450	20
1963	1,270	136	46		227	136			1,815	17
1964	259	604			88	45		36	1,032	19
1965	178	682			58	70		35	1,023	27
1966	331	196			78	48	38	43	734	24
1967	1,068	668			50	24	142	3	1,955	24
1968	101	342		465	56	5	9	151	1,129	25
1969	994	396			35			20	1,445	23
1970	249	829			12	3	113	4	1,210	27
1971	187	882		364	16		231	4	1,684	42
1972	2,718			4,554	33		1,068	16	8,389	20
1973	846			2,125	25			216	3,212	47
1974	676			111	20			31	838	31
1975	3,912	779						92	4,783	32
1976		1,946						1,393	3,339	100
Total	23,852	9,007	8,101	7,619	2,642	1,686	1,601	2,186	56,694	

THE WORLD TRADE IN RHINO HORN: A REVIEW

Table 2: Historical estimates of rhino horn exports from East Africa, shown as estimated quantities either in kg for individual years or as kg/year over a run of years, and price in US\$/kg (from Martin and Martin 1982).

Year	Place and activity	Quantity	Price
1840s	Mafia and Bagomoyo received	c. 5,500-8,000kg/year	
1863/64	Zanzibar imported	c. 6,350kg	0.63
1867/68	Zanzibar imported	c. 9,700kg	0.73
1873	Zanzibar imported	c.12,700kg	0.79
1870s	Mombasa exported	c. 1,590kg/year	0.94
1893	Tanganyika exported	c. 7,000kg	1.10
1894	Tanganyika exported	c. 9,000kg	1.10
1895	Tanganyika exported	c.13,400kg	1.10
1914	East African exports		3.15
1926	East African exports		11.69
1929	East African exports		22.68

The statistics from 1949-1976 include the countries to which the horn from East Africa was declared to have been exported (Table 1). In the 1950s most horn from East Africa went to Hong Kong and the then independent Zanzibar, both of which acted as entrepôts for trade to the Far East. In the 1960s an increasing proportion of horn was taken by Aden/South Yemen, and in the late 1960s and 1970s Hong Kong, South Yemen and China all took relatively even shares of East Africa's declared horn (Figure 3a).

Figure 3: The countries of (a) destination and (b) origin of East Africa's declared rhino horn exports from 1947-76 (data from Parker and Martin 1979).

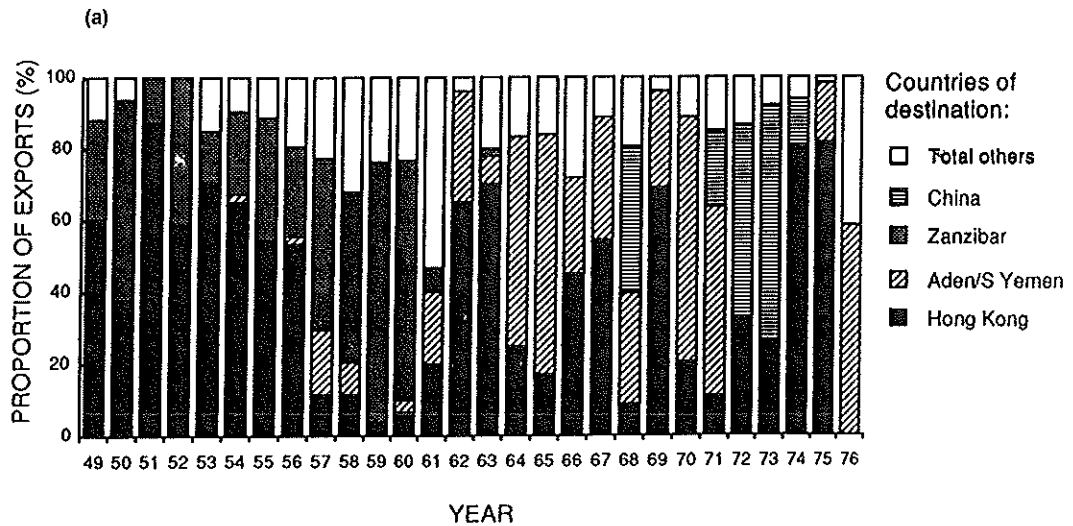
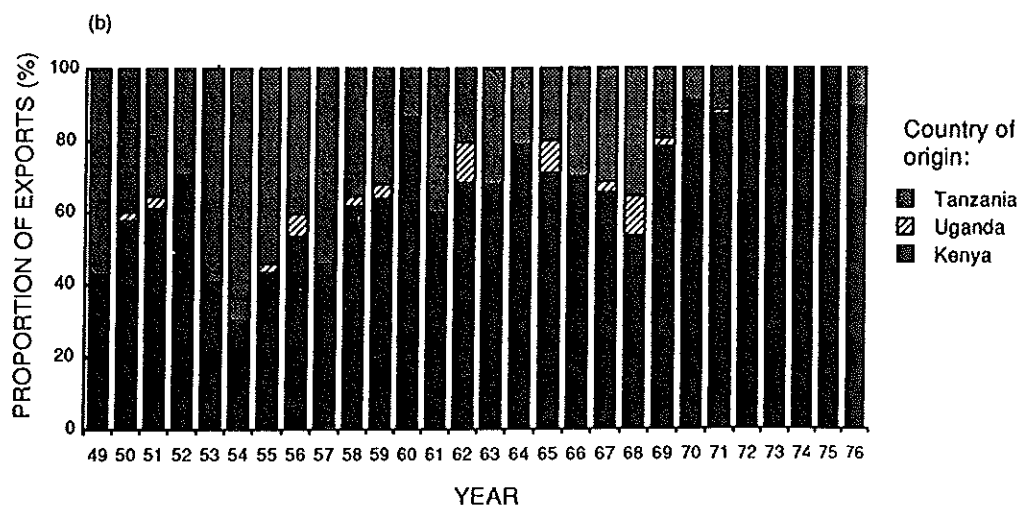


Figure 3 continued



The rest of Africa

Data on exports from other African countries are largely anecdotal and fragmentary (Martin 1983d). The only other time series is for South Africa, but is for volumes only (see Table 8c), and this is discussed in another context below.

Asia

In contrast to African producers, many of the producing nations in Asia use horn for domestic consumption and export it. There are, however, even fewer runs of data from Asia than from Africa. From 1919-1927, 344kg of horn was exported from Sumatra to Singapore and China, and from 1912-1922, 210kg of Sumatran horn was exported from Borneo. For this period, the trade from these two states averaged 90kg (or the deaths of 350 Sumatran rhinos)/year (Martin 1983d).

The only time series comparing volumes and prices is from the horns recovered from Indian rhinos dying in Assamese reserves. Between 1965 and 1979 this horn was put up for tender legally (but probably exported illegally). The auctioning of horn ceased from 1979/80 and onwards due to pressure from conservationists, and the recovered horn was instead stockpiled (Martin and Ryan 1990). The quantities available for tender fell from 1965 to a low in 1972 but then increased again (Table 3). The average price increased steadily until a rapid price increase in 1979, and this increase is clear even when average prices are corrected for inflation. This rise mirrors events in Africa, but the wholesale value of Indian rhino horn is considerably higher (Figure 4a).

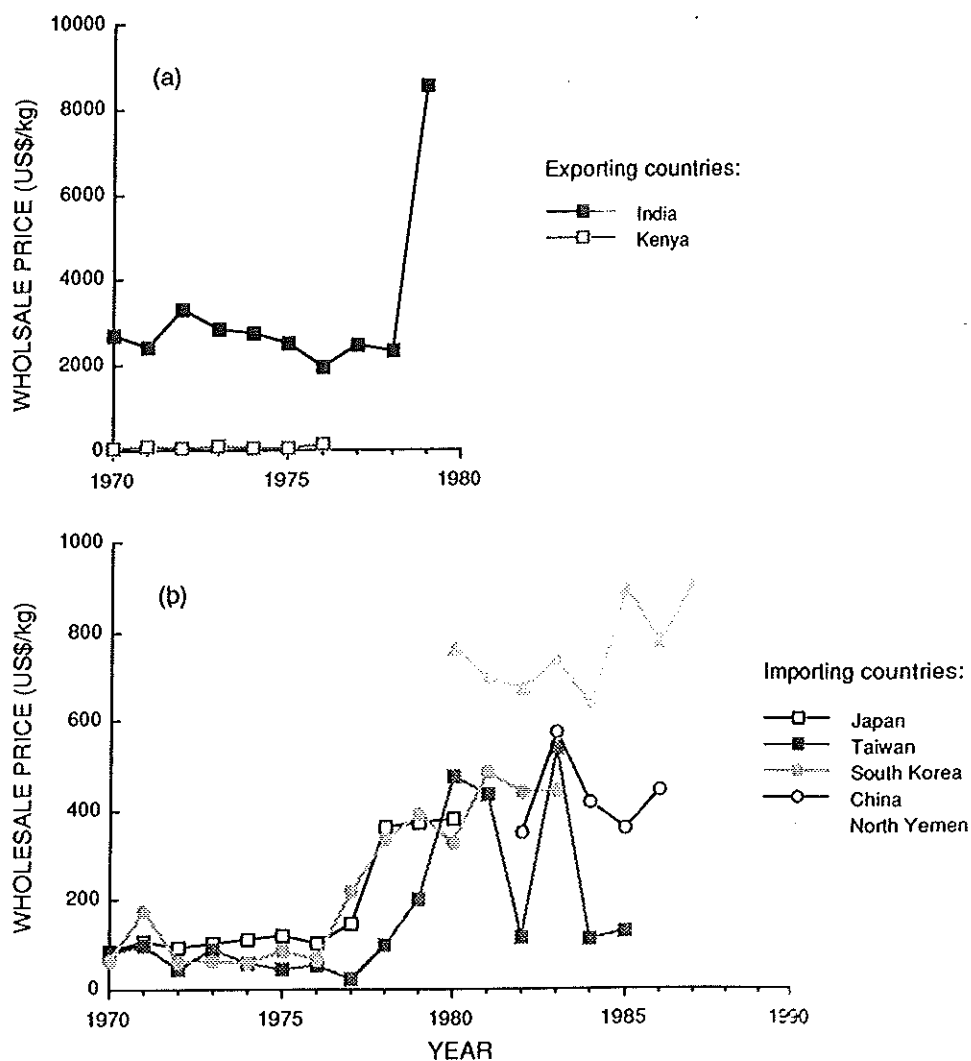
The appearance of Asian countries such as India as major exporters to other Asian countries (see below in Tables 4-6) occurs in large part because they acted as entrepôts for African horn (Martin 1983d).

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Table 3: The volume and price (in kg and US\$/kg) of horn recovered from dead Indian rhinos and put up for tender in Assam. Some of the horn was defective, but for consistency the price of sound horn only is shown (data from Martin 1983d).

Year	Volume	Price	Year	Volume	Price
1965	29.34	931	1973	17.03	1,650
1966	22.04	1,161	1974	31.60	1,750
1967	14.39	1,104	1975	16.13	1,760
1968	Nil		1976	18.06	1,454
1969	12.72	1,269	1977	30.04	1,950
1970	10.44	1,333	1978	45.33	1,957
1971	21.90	1,269	1979	39.49	7,800
1972	7.10	1,800			

Figure 4: The wholesale price of rhino horn, corrected for inflation, from two exporting countries and five importing countries, showing (a) prices of African and Asian horn and (b) of African horn only (data from Tables 1, 3, 4, 5, 6, 7, 12).



IMPORTS TO CONSUMING AND ENTREPOT NATIONS

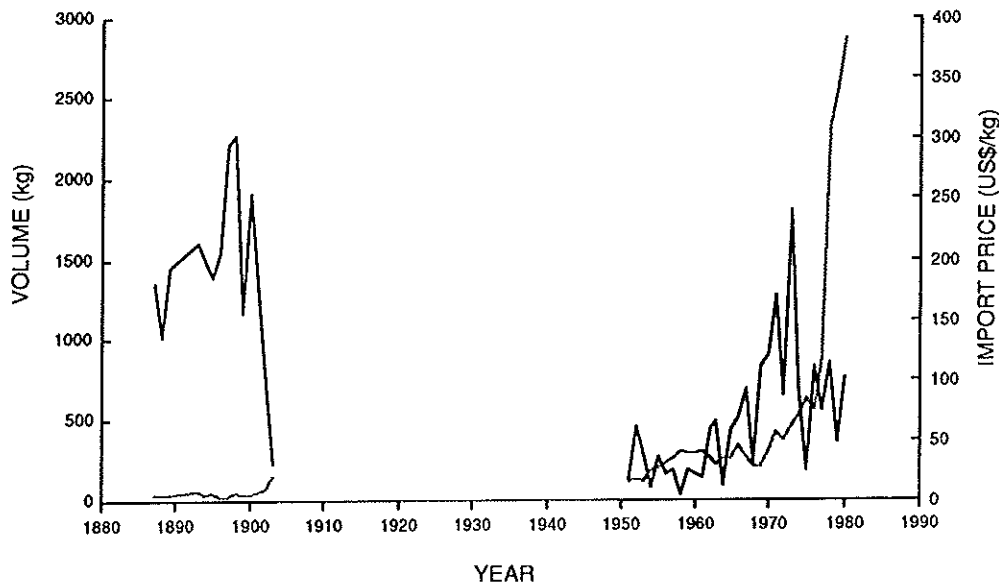
Far East

Rhino horn has been traded and consumed in the Far East for centuries, yet there are only reasonable time series of declared imports to three consuming countries.

Japan

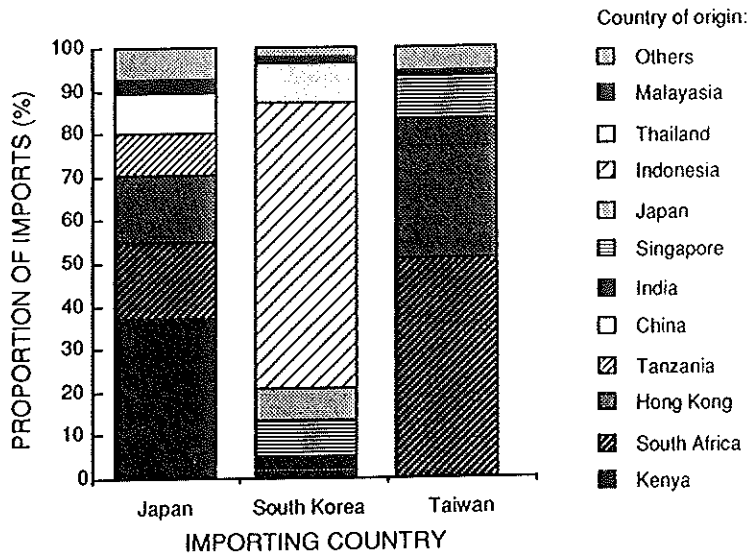
Japan has the longest series of data on horn volumes and prices covering 1882-1903 and 1951-1980 (Figure 5). The volume of imports to Japan was high (1,283kg/year) during 1882-1889 and rose higher still (1,697kg/year) during 1893-1900. Between 1882 and 1887, most horn was imported from Siam (Thailand) and East Indies (Indonesia), from Sumatran and Javan rhinos. The level of imports during this period represents the deaths of around 2,000 rhinos/year depending on the mix of horn from the two species. In 1888, the Japanese turned both to Indian traders who supplied them, not with Indian horn which was then used for domestic consumption, but with East African horn, and to the Chinese. African horn continued to be exported into Japan between 1904 and 1940 when World War II interrupted supplies, but no records were kept.

Figure 5: The volume (solid line) and price (dashed line) of Japan's declared imports from 1882-1903 and 1951-1980 (data from Martin 1983d).



After the War, Japan declared the greatest volume of horn imports of the three Far Eastern nations with statistics, at an average of 488kg/year during 1951-1980. From 1951-1959 imports were low (196kg/year) but increased in the 1960s (404kg/year) and 1970s (806kg/year). The price of horn climbed steadily from the nineteenth century to the 1970s and then increased rapidly (Figure 5). Thus, the relationship between volume and price for Japan shows similarities to the export data from East Africa (c.f. Tables 1, 2, 4; Figures 2, 5). The declared countries of origin of the horn imported to Japan have also been recorded from 1951-1980 (Table 4). Kenya (37%), South Africa (18%), Hong Kong (18%) and Tanganyika/Tanzania (10%) provided the bulk of Japan's declared imports (Figure 6).

Figure 6: The declared origin of rhino horn imported to three Far Eastern consuming nations (data from Tables 4, 5, 6).



Taiwan

A shorter series of declared imports are available for Taiwan from 1968-1985 (Table 5). Over this period, declared imports were similar to Japan's at an average of 476kg/year. The average price of horn remained steady until the late 1970s, increased rapidly between 1978 and 1982, but then dropped, rose and dropped from 1983-1985 (Table 5). The early part of Taiwan's data set has two problems. First, from 1968-1971 horn volumes included some antelope horn (Martin 1980b). Second, from 1968-1978, the declared countries of origin of 67% of the horn were not specified, but the major source during this period was Hong Kong (51%). Sources of origin were better specified during 1979-1985, when most of Taiwan's declared horn came from South Africa (51%), Hong Kong (32%) and Singapore (10%) (Figure 6).

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Table 4: Declared volume (kg) and average price (US\$/kg) of imports to Japan during 1951-1980 from countries of origin (*Tanganyika/Tanzania before/after 1964) (data from Martin 1983d; Martin and Barzdo 1984).

YEAR	Kenya	South Africa	Hong Kong	Tanganyika*	Tanzania*	China	India	Others	Total volume	Average price
1951		80				36			116	16
1952		137	58			112		150	457	17
1953		83	18			174			275	15
1954		48				30			78	25
1955	48		56			157		5	266	27
1956	48					120			168	31
1957	18	18				120		30	186	34
1958	30			6					36	41
1959	25		50	18		51	20	18	182	39
1960	61					94	5		160	39
1961	10					132	2		144	40
1962	160	25	20			75	151	15	446	34
1963	92	215		69		6	112		494	29
1964		10	79				8		97	35
1965	38	39	68	10		53	62	160	430	34
1966	91	43	49	146		75		115	519	45
1967	59		162		261	20	86	100	688	36
1968	9	25	106		49			50	239	28
1969	295	11	274		85			160	825	28
1970	203	37	353		262	10		28	893	41
1971	447	121	197		414		31	60	1,270	56
1972	588	15	45						648	50
1973	1,016	462	265					49	1,792	60
1974	409	164	27		84				684	70
1975	143	22	16						181	84
1976	704	64	55						823	75
1977	304	25	229					3	561	116
1978	367	350	120					16	853	308
1979	234	68						55	357	341
1980	7	587	15			106		48	763	383
Total	5,406	2,649	2,262	249	1,155	1,371	477	1,062	14,631	

Table 5: Declared volume (kg) and average price (US\$/kg) of imports to Taiwan during 1966-1985 from countries of origin (data from Martin 1980b; Martin and Barzdo 1984; Anon. 1985).

YEAR	South Africa	Hong Kong	Singapore	Japan	Indonesia	Others	Total volume	Average price
1966		326				48	374	35
1967		226				268	494	27
1968		1,077		10		394	1,481	20
1969		242				119	361	38
1970		122		4		85	211	39
1971		119				11	130	50
1972		216				725	941	24
1973		153		3		189	344	51
1974						1,600	1,600	37
1975						1,098	1,098	32
1976						681	681	40
1977		200				24	224	17
1978	166	84	12			643	905	82
1979	11	170				38	219	184
1980	55			2			57	477
1981	47						47	476
1982	71				4		75	136
1983	117						117	654
1984		50	70				120	142
1985	43						43	168
Total	510	2,984	82	19	4	5,923	9,522	

South Korea

The third series of declared imports is for South Korea and spans 1970-1983 (Table 6). Declared imports were the lowest of the Far East nations at 204kg/year and remained fairly constant during this period, but import prices rose rapidly in the 1970s. Most horn imported to South Korea was declared to have come from Indonesia (67%), with lesser amounts from Thailand (9%), Singapore (9%) and Japan (7%) (Figure 6). However, this appears unlikely because Indonesian dealers did not re-export their African horn, and it seems likely that most of South Korea's horn came from Hong Kong (Martin 1983d).

Table 6: Declared volume (kg) and average price (US\$/kg) of imports to South Korea during 1970-1983 from countries of origin (data from Martin 1983d; Martin and Barzdo 1984; Anon. 1985).

YEAR	Indonesia	Thailand	Singapore	Japan	India	Malaysia	Hong Kong	Kenya	Others	Total volume	Average price
1970				1			2			3	30
1971			50	2						52	91
1972			197	31					20	248	34
1973	214			9	30					253	37
1974	97	81		6			30			214	38
1975	200			12						212	58
1976	204	65		8						277	49
1977	207	66		15	19					307	172
1978	51									51	284
1979	208	40			20	30			20	318	355
1980	93	4		89		21			10	217	326
1981	127						5		10	142	530
1982	200			28				35		263	516
1983	300									300	537
Total	1,901	256	247	201	69	51	37	35	60	2,857	

Middle East

It is probable that the wish to own a *jambia* is not restricted to Yemeni men, and indeed *jambias* are found in at least Saudi Arabia (Martin 1990b). However, Yemen appears the major user of rhino horn and it is only from there that information on the rhino horn trade exists. Because rhino horn improves in appearance with age, it is the preferred material for dagger handles.

Yemen

Yemen used to comprise two countries. Aden or South Yemen was under British control from 1839-1967 and imported rhino horn from East Africa that appears under the East African export statistics (Table 1). Increasing volumes were recorded as leaving for Aden: 51kg (7kg/year) from 1949-1955; 725kg (120kg/year) from 1956-61, 3,795kg (474kg/year) from 1962-69 and 4,436kg (634kg/year) from 1970-1976 (Table 1, Figure 3a). From 1967-1990 South Yemen was a communist state and import of luxury goods such as rhino horn has been discouraged. North Yemen, by contrast, remained isolated until it underwent a long civil war between 1962-1969. North Yemen then replaced South Yemen as the major consumer of rhino horn, so it can be assumed that South Yemen acted as an entrepôt for its northern neighbour in East Africa's customs statistics from 1969-1976. During 1969-1977, official statistics show that North Yemen imported at least 22,645kg (3,235kg/year) of horn (Table 7a), and it was believed most horn imported to North Yemen at this stage was from East Africa.

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Table 7a: Total declared imports and estimates of the total volume of horn entering North Yemen (since 1990 the Republic of Yemen), the purchases of and wholesale price paid by the main merchant in Sanaa (all in kg or US\$/kg)(after Martin 1984a, 1985b, 1987; Vigne and Martin 1987a, b, 1991b).

Declared imports		Estimated imports		Merchant's purchases		
Year	Volume	Year	Volume	Volume	Price	Events
1969-70	233					
1970-71	131	1970	c.3,000	c.3,000		
1971-72	1,445	1971	"	"		
1972-73	2,139	1972	"	"		
1973-74	3,544	1973	"	"		
1974-75	Nil	1974	"	"		
1075-76	8,310	1975	"	"		
1976-77	6,843	1976	"	"		
		1977	"	"		
		1978	"	"		
		1979	c.1,675	"		
		1980	"	1,050	764	
		1981	"	1,320	764	
		1982	"	1,585	786	Imports banned
		1983	"	1,120	891	
		1984	"	1,058	796	Reduced smuggling
		1985	c.1,000	475	1,159	
		1986	c. 500	100	1,032	
		1987				Further restrictions
		1990	c. 120		1,360	Further restrictions
Total	22,645		43,000	36,708		

Table 7b: Change in the rate of manufacturing dagger handles from rhino horn by the main merchant in Sanaa.

Year	No daggers/year	Rhino horn handles	
		No/year	%
1970s	6,000	6,000	100
1986	24,000	2,400	10

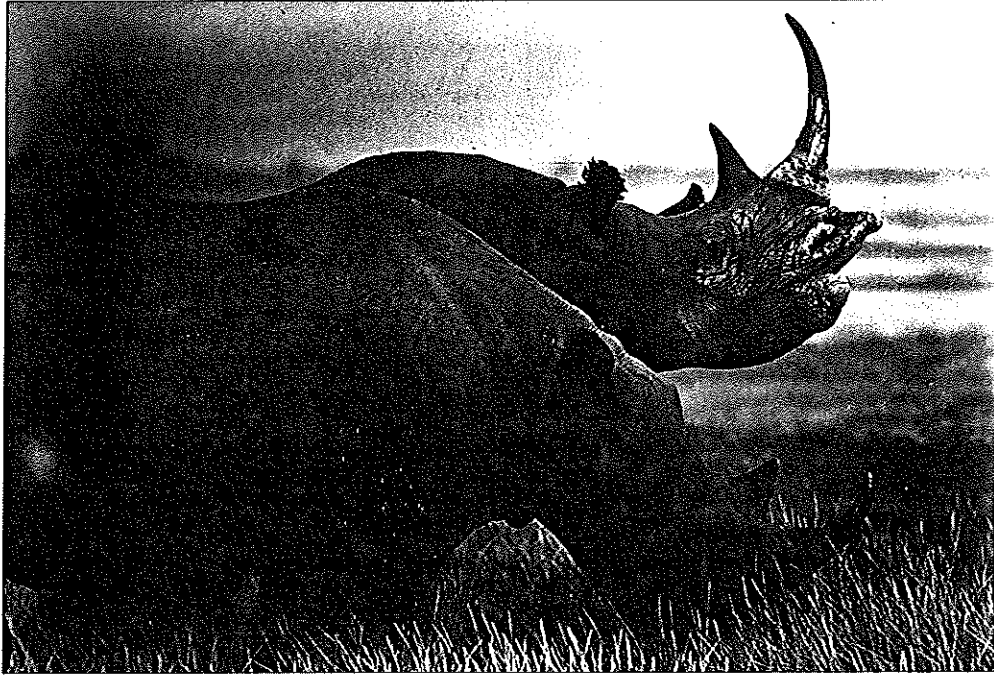
Table 7c: Price of horn shavings in Sanaa for export (in US\$/kg).

Year	Price
1985	139
1986	227
1987	253
1990	340

The declared statistics cease well before North Yemen first banned imports in 1982. However, the main rhino horn trader in Sanaa, the capital of North Yemen, kept records of the volumes and wholesale prices of horn that he bought spanning the end of the period when horn could be imported legally and the start of the supposed import ban (Table 7a). Both his colleagues and the main trader claimed that he monopolised two thirds to four fifths of Yemen's trade (Martin 1987). The trader's records are exact from 1980-1986 and estimated from the 1970s to 1980. With an approximate total import of 36,000kg from 1970-1986, and multiplying up from the trader's claimed rate of monopolisation, the volume of the horn trade was estimated for North Yemen from 1970-1986 by Martin (1987), as shown in Table 7a. However, it was also claimed that there was considerable smuggling of horn (and most other consumer goods) into North Yemen in order to

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avoid import tax, to the approximate tune of 70% of total imports (Martin 1985b). As it was only after 1983 that more rigorous customs checks were instituted to save the country large amounts of revenue (Martin 1985b), the estimated volumes for North Yemen most probably only represent minimum values. Even so, the Yemeni trader's claimed total volume of 36,000kg of horn represents the death of a minimum of 12,750 black rhinos.



WWF / Mark Boulton / ICCE

The black rhinos have been subject to the worst decline experienced by any land mammal in recent time. The main reason: poaching for their horns.

COMPARISONS BETWEEN EXPORT AND IMPORT STATISTICS**Under-reporting in Declared Statistics**

Large mis-matches are evident between the declared statistics of exporting and importing nations (Tables 8a, b, c). If the assumption that South Yemen acted as entrepôt for its northern neighbour in East Africa's customs statistics from 1969-1976 is correct, then there is an almost five-fold difference between the declared exports from East Africa to South Yemen and the declared imports to North Yemen (Table 8a).

Similarly, the declared exports from Kenya and Tanzania during 1955-1980 are between four and 12 times lower than the declared imports to Japan over the same period (Table 8b). Furthermore, the proportion of horn that Tanzania contributed to East Africa's declared statistics dropped significantly after independence in 1964 (Figure 2b), but this was clearly not due to a lack of rhinos to supply the horn. Instead, it appears that in the declining economy of an extreme socialist state, entrepreneurs were illegally converting increasing quantities of horn into hard currency (Parker and Martin 1979). Furthermore, the official exports from South Africa during 1966-1978 are lower than the minimum total imports to the three consuming and entrepôt countries of Japan, Taiwan and Hong Kong, even though the data for Taiwan and Hong Kong (South Africa's two most important consumers: see Figure 6) are missing from almost the entire run of data (Table 8c). One further example comes from an entrepôt for a single year. In 1978, South Korea declared that it had exported 28kg of horn to Japan, which itself recorded 133kg of imports from South Korea (Song and Milliken 1989).

Table 8a: Mis-match between declared exports of horn from East Africa to South Yemen and declared minimum imports to North Yemen during 1969-1977, all in kg (data from Parker and Martin 1979). The data for North Yemen represent a minimum because the lack of imports in 1974-1975, which is probably due to lack of recording rather than to lack of imports (Varisco 1987).

Year	Volume	Years	Volume
1969	396	1969-1970	233
1970	829	1970-1971	131
1971	882	1971-1972	1,445
1972		1972-1973	2,139
1973		1973-1974	3,544
1974		1974-1975	Nil
1975	779	1975-1976	8,310
1976	1,946	1976-1977	6,843
Total	4,832		22,645

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Table 8b: Mis-match between declared exports of horn from East Africa and declared imports from Japan, all in kg (data from Parker and Martin 1979; Martin 1983d).

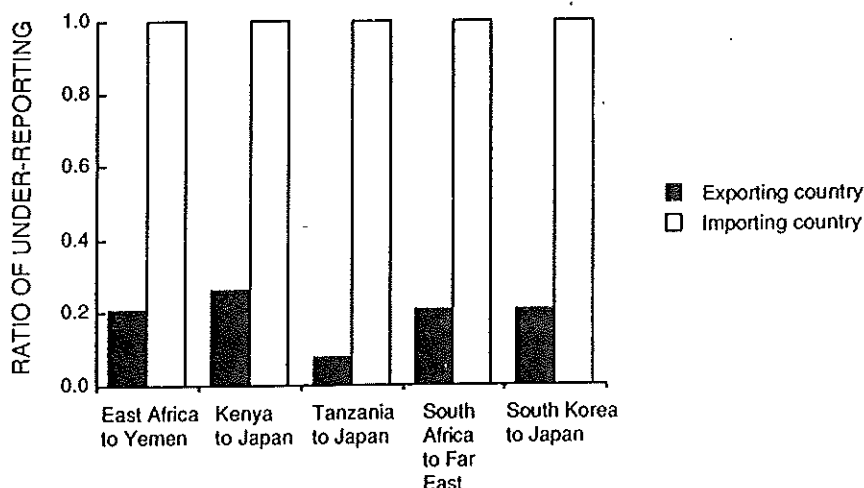
Year	Kenyan exports to Japan	Japanese imports from Kenya	Tanganyikan/ Tanzanian exports to Japan	Japanese imports from Tanganyika/ Tanzania
1955		48		
1956		48		
1957		18		
1958		30		
1959		25		18
1960		61		
1961		10		
1962		160		
1963		92		69
1964				
1965		38		10
1966	11	91	27	146
1967	142	59		261
1968	9	9		
1969		295		85
1970	67	203	46	262
1971	128	447	91	414
1972	1,062	558	6	
1973		1,016		
1974		409		84
1975		143		
1976		704		
1977		304		
1978		367		
1979		234		
1980		7		
Total	1,419	5,376	107	1,349

Table 8c: Mis-match between the official exports of horn from South Africa and the declared imports to various countries from South Africa (data from Martin 1983d).

Year	South African official exports	Japanese declared imports	Taiwan declared imports	Hong Kong imports	Minimum total imports
1966	605	43	NA	NA	
1967			NA	NA	
1968		25	NA	NA	
1969		11	NA	NA	
1970		37	NA	NA	
1971		121	NA	NA	
1972		15	NA	NA	
1973	389	462	NA	NA	
1974	304	164	NA	NA	
1975		22	NA	NA	
1976	126	64	NA	NA	
1977		25	NA	NA	
1978	177	350	166	345	
Total	1,601	1,339	166	345	1,850

Therefore, even when rhino horn could be traded legally, it appears that there was a flourishing illegal trade. The difference of around four to 12 times between the trade figures of exporting and importing nations (Figure 7) would appear to be due primarily to the latter recording illegal exports from producing nations. The size of the difference between exporting nations may not be a fully accurate estimate of the size of the illegal trade. On the one hand, it may be an overestimate, at least in the case of Japan. Studies of the ivory trade show that some Kenyan ivory re-exported from Hong Kong to Japan appeared in the Japanese statistics under Kenya, but in the Kenya statistics under Hong Kong (Milliken 1989), and the same may be true for rhino horn. On the other hand, the difference may be an underestimate for it takes no account of the under-reporting by the importing country. This cannot be easily quantified because there are no other sets of figures for comparison. However, smuggling into importing countries was believed to be considerable even when the horn trade was legal, in order to avoid import taxes, for example into South Korea and Yemen (Martin 1983d, 1985d).

Figure 7: The extent of under-declaring of exports relative to declarations of imports from the same country, for a range of years (East Africa) and the single year of 1978 (South Africa, South Korea).



Usefulness of Trade Statistics

Despite their various shortcomings, the legal and declared trade statistics make several points. For example, comparisons between African and Asian trade and exports (Tables 1, 3) show that there were considerable differences in volumes and prices produced legally by the two continents in the 1970s. The volume of legal trade was much higher from East Africa than from India, but the average price of Asian horn at source was much higher (Figure 4a). As will be shown when discussing the illegal trade, this difference also translates through to retail prices charged in pharmacies (see later in Table 11). The price of African and Asian rhino horn differs for two main reasons, first, because there are far fewer Asian rhinos and, second, because Asian horn is considered much more effective as a medicine (Martin 1980b; Martin and Martin 1982; Nowell *et al.* 1992).

The legal trade statistics also show that a sharp increase in the price of horn was seen in all producing and consuming countries in the late 1970s (Tables 1, 3, 4, 5, 6, 7a). This difference still holds when prices are corrected for inflation (summarised in Figure 4b for countries consuming African rhino horn). This price rise has been attributed to two main factors (Martin 1980b; Martin and Martin 1982). First, many Yemeni workers migrated to Gulf States with oilfields after the end of the civil war in North Yemen in 1969 and, with high wages, were able to afford *jambias*.

Second, new buyers, mainly Africans, entered the markets in the now independent African countries and broke the monopoly of Indian traders. The price rise was not due to reduced supplies because an increasing amount of horn entered the market in the 1970s (Figures 2, 5). A third possible factor has not been considered (Martin and Martin 1982), namely that the formulation of CITES and the placing of horn from all species of rhino on Appendix I by 1977 meant that continued trade would be illegal, thereby causing the price of horn to rise.

Finally, with the move into the era of illegal trade, the declared trade statistics are useful, ironically, in showing the ineffectiveness of CITES and other bans in controlling the trade in rhino horn. Several producing countries had their own bans in place before CITES. For example, India abolished rhino hunting in Bengal and Assam in 1910, Indonesia's rhino populations have been protected nominally since 1931, Malaysia's have been protected since 1955, whilst Thailand's have been protected since 1960. Thus exports made by these four countries since the dates of their bans and that appear in the declared imports of other countries (Tables 4-6) were already illegal. Even after many producing and entrepôt countries became a party to CITES, they still continued to export rhino horn that appeared in the legal imports of consuming countries until they in turn became a party to CITES (Table 10). South Africa was a major offender with its illegal exports to Japan and Taiwan, as was Hong Kong with its exports to Japan, Taiwan and South Korea (Martin and Martin 1989; Vigne and Martin 1989a). Even though Indonesia appears a major offender with its exports to South Korea, it seems to appear incorrectly as a guise for Hong Kong, further swelling the volume of Hong Kong's illegal traffic (Martin 1983d; Song and Milliken 1990). Obviously these figures represent minimum levels of contravention of CITES because they exclude horn not declared by the importing nation. However, these figures show clearly the ineffectiveness of CITES and other bans in controlling the supply of horn by producer and entrepôt nations, as will be discussed further below.

HOW MUCH HORN HAS COME ONTO INTERNATIONAL MARKETS?

Incompleteness of Trade Statistics

The good quality of data on volumes of ivory in world trade has recently enabled a model to be formulated that matches changes in ivory volumes to changes in elephant numbers (Milner-Gulland and Mace 1991). One of the aims of this review was to determine if the data on volumes of rhino horn would permit a similar model for rhinos. Unfortunately, the available statistics for trade in rhino horn are very incomplete, even when the horn trade was legal, for two main reasons. One reason has been discussed already, namely the under-representation of trade in declared statistics (Figure 7). The other reason is that the statistics for rhino horn cover only a short period and very few producing or consuming countries (Tables 1, 3, 4, 5, 6, 7a, 12). It is therefore not even possible to sum the total declared world trade in rhino horn for any single year.

Attempts to Match Horn Volumes Traded and Changes in Rhino Numbers

Despite the incompleteness of trade statistics, an attempt has been made to quantify the total volume of horn traded during the 1970s. Using annual average volumes from declared statistics for Yemen, Taiwan, Japan and South Korea, it was estimated that a minimum of around 8,000kg/year of rhino horn was traded during the 1970s (Martin 1980b: Table 9). Because this was mainly supplied by black rhinos, this volume represented the deaths of around 2,800 rhinos/year during this period. A crude attempt was made to match this assumed loss to the actual loss in rhino numbers, which from the African Elephant and Rhino Specialist Group (AERSG) best estimates, was calculated to have been 2,660 rhinos/year during the same period (Martin 1980b). The volume of trade in the 1980s was estimated to have dropped to 3,000kg/year, based on the loss of Yemen from the marketplace (Table 7a) and from estimates of change in rhino numbers (Martin 1983d).

Table 9: Minimum estimates of rhino horn imports into main consumer countries, taking into account declared volumes per year during 1971-1977 (North Yemen) and during 1972-1978 (Japan, Taiwan and South Korea) and educated guesses for other countries (taken from Martin 1980b). The figures in brackets are re-calculated by the author on the basis of the same data used by Martin. The figures can be verified in Tables 4-7.

Country	Volume (kg/yr)		Approx. volume
North Yemen	2,972	(2,828)	} 3,000
Taiwan	943	(827)	
Japan	792		} 2,000
South Korea	223		
China:			
Chippings from North Yemen	750	(407)	} 1,750
Other imports	1,000		
Others	1,000		} 1,000
Total			7,750

Table 10: Minimum levels of contravention of CITES regulations by producer and entrepôt nations exporting rhino horn, as shown by declared imports of consumer countries, all in kg (data from Tables 4, 5 and 6).

Producer/entrepôt	Enforcement of CITES	Japan until 1980	S Korea until 1983	Taiwan until 1983
South Africa	1975	1,094	—	344
India	1976	—	49	—
Hong Kong	1976	364	5	170
Malaysia	1978	—	51	—
Kenya	1979	7	35	—
Indonesia	1979	—	720	4
Japan	1980	NA	28	—
China	1981	NA	—	—

The volumes of horn on world markets were then questioned and believed to have been great underestimates (Western 1989). It was argued that the earlier analysis (Martin 1980b), using only losses of rhinos between censuses, had taken no account of recruitment and the subsequent loss of these additional rhinos. Using corrections for the proportion of rhinos believed poached (90%, based on evidence from Amboseli, Kenya in Western 1982) and for the loss of orphan calves (20%) that would contribute nothing to the horn trade, it was estimated that only 45-51% of the horn actually going on to international markets was picked up in trade surveys, and that this shortfall went undetected (Western 1989). Given that China declared that it alone imported 2,124kg/year of African rhino horn during 1982-1986 (see later in Table 12) and that other importing countries, especially South Korea and Yemen, were known to under-report the volumes they imported (Martin 1983d, 1985b), this argument appears to have some basis (Western 1989). It was also recognised that the best estimates of rhino numbers produced by AERSG are also likely to be under-estimates, and could cause an even greater disparity between detected and undetected horn volumes (Western 1989).

The criticism that much trade went undetected was subsequently refuted (Martin and Ryan 1990). It was acknowledged that recruitment needed to be taken into account, but the two studies then differed on the proportion of horn that would reach international markets. While one side estimated that 90% of deaths were due to poaching (Western 1989), the other side believed that only 50% of adult deaths arose from poaching and that only 14% of horn was recovered from natural deaths (Martin and Ryan 1990). Corrections were also made for the amount of horn that would never have reached international markets because (a) rhinos were shot on license in various countries until 1979, (b) recovered and confiscated horns were being stockpiled (see later in Table 13), (c) storage of stockpiles was inefficient and resulted in damage to horns, and (d) a small amount of domestic use within Africa (see Martin and Ryan 1990). After making these assumptions and corrections, it was estimated that volumes of 8,000kg/year in the 1970s and 3,000kg/year in the 1980s left little horn unaccounted for (Martin and Ryan 1990).

Some of the corrections have merits, especially with regard to the proportion of horn recovered from natural deaths. However, the basis for their major assumption that only 50% of rhino deaths arose from poaching was not explained (Martin and Ryan 1990), when carcass ratios from major populations such as Luangwa Valley, Zambia that were heavily exploited in the 1980s were in fact around 70% (Leader-Williams 1988; Leader-Williams *et al.* 1990). In addition, only minimum values of traded volumes can be estimated both because horn volumes are under-reported and because rhino numbers are under-counted to unknown extents. Furthermore, estimates of horn volumes made from population estimates lack independence. It seems likely, therefore, that the

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actual volumes of horn that have entered the trade will remain open to speculation, and that a model of horn volumes against rhino numbers could not be approached with the same degree of confidence as a model of ivory volumes against elephant numbers (Milner-Gulland and Mace 1991).

MONITORING THE ILLEGAL TRADE

Producing and Entrepôt Nations

Reductions in rhino numbers and distribution, especially of black rhinos, provide evidence of continued trade in rhino horn in producing countries. However, apart from evidence cited above (Table 10), horn volumes have been impossible to monitor in producing and entrepôt nations.

Consuming Nations in the Far East

Since import statistics in consumer nations of the Far East ceased to be recorded, the illegal trade in horn has been monitored largely through the continuing work of E.B. Martin and his colleagues, who have conducted interviews with pharmacists since 1979. These interviews have provided a short time series on the availability of rhino horn products for sale and their price in Far Eastern consumer nations. These data have at least two major drawbacks. First, the general problem of whether changes in the proportion of shops stocking horn (an index of 'consumer' demand) and in its retail price can be equated to changes in demand in terms of volume. Second, the specific problem of the reliability of interviews conducted openly by a westerner accompanied by an interpreter as compared with undercover interviews by nationals without a westerner present. The reliability of the former approach has been questioned recently for South Korea (Song and Milliken 1989, 1990). As a Korean, Song pretended to be buying medicines for a sick relative, and their survey showed that more pharmacies were selling horn and at a higher price in 1988, in contrast to a 1986 survey which suggested that South Korea's 1984 import ban had been successful in reducing consumer demand because fewer pharmacies were stocking horn and its retail price had dropped (Martin 1986c). Furthermore, a recent survey in Taiwan was conducted by local college students (Nowell *et al.* 1992) and its results followed the same pattern as the Korean survey. While these increases may reflect a real difference between years, methodological differences cannot be discounted. Despite these reservations, most data that are available to monitor the illegal trade in consumer nations over time come from E.B. Martin's interviews (Table 11). A profile of each consumer nation now follows, and at this stage all data on prices remain uncorrected for inflation.

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Table 11: Consumer demand for rhino horn in some major cities of eastern Asia, as measured by the number of traditional pharmacies stocking horn and by the average retail price. All data were collected by E.B. Martin apart from those marked with *† (from Martin and Vigne 1987b; Martin 1989a, b; *Song and Milliken 1990; Martin and Martin 1991; Milliken *et al.* 1991; † Nowell *et al.* 1992).

Country	City	Year	Selling %	Horn (N)	Retail price		Restrictions
					African	Asian	
Hong Kong		1976					CITES
		1979	73	15	11,103		Imports banned
		1982	46	50	15,700		
		1985	41	80	14,282		
		1986					Exports banned
		1987	32	60	20,751		
	1990	5	65	16,240			
China	Guangzhou	1981					CITES
		1985	17	12	18,722		
		1987	15	13	16,304		
Taiwan	Taipei	1979	100	9	1,596	17,090	
		1985	76	34	1,532	23,929	Imports/exports banned
		1988	73	60	4,660	40,558	
		1989					Internal trade banned
		1990	51	79	4,221	54,000	
	1991†	71	167	8,148	62,455		
	Kaohsiung	1985	90	20	2,007	21,365	
1988		87	15	3,347	42,880		
1990		50	14	3,737	40,404		
1991†		84	197	5,107	42,495		
Singapore		1979	53	15	11,615		
		1983	35	46	11,804		
		1986	39	33	14,464		Imports/exports banned
		1987					CITES
		1988	23	43	17,327		
Japan	Tokyo	1980	44	18	1,620		CITES
		1986	17	29	3,417		
	Osaka	1980	90	10	2,230		CITES
		1982	60	5	2,516		
		1986	76	41	3,771		
S Korea	Seoul	1980	63	30	1,436		
		1982	62	76	1,797		
		1983					Medicines banned
		1986	51	108	1,771		Imports banned
		1988*	86	59	4,410		
Peninsula Malaysia	Kuala Lumpur	1978					CITES
		1981	58	26	19,801		
		1983	21	29	17,280		
		1986	10	41	11,636		
		1988	4	45	23,810		
Sabah Malaysia	Kota Kinabalu	1986	11	18		14,697	
		1988	10	21	4,070	20,350	
Brunei		1978				20,851	Sumatran trade banned
	1982	40	5	6,895			
	1987	14	7	3,797			
	1988	12	8	6,614			
Macau		1979	78	9	4,127		
		1982	64	14	7,797		
		1986	80	20	8,644		CITES
		1987	65	22	8,407		
		1988					Internal trade banned
		1990	7	28	15,285		
Thailand	Bangkok	1972					Trade banned
		1979	52	23	3,654		
		1983					CITES
		1986	34	44		11,629	
		1988	33	52		13,111	
		Hat Yai	1988	50	4		20,910

India

Domestic consumption of rhino horn as an aphrodisiac by Gujaratis seems largely to have ceased, and few pharmacies stock horn. This may be for two reasons. First, rhino horn imports from Africa were banned in 1972, causing the price of horn to rise beyond the means of most Indians (Vigne and Martin 1987c). Second, it has paid to export all the available Indian rhino horn to more lucrative markets, and the high prices commanded for Asian rhino horn in Taiwan (Table 11) are probably responsible for the poaching of at least 489 Indian rhinos during 1979-1989 (Martin *et al.* 1987; Vigne and Martin 1991a).

Hong Kong

Customs statistics show that Hong Kong took 42% of East Africa's declared exports from 1949-1976 (Table 1). Hong Kong became a party to CITES under the United Kingdom's ratification in 1976, but a short run of import statistics showed that Hong Kong imported 445kg of horn on license between June 1978 and February 1979 (Martin 1983d). Ivory traders, however, requested the government to take direct action against the trade and the first step in this process was the registration of existing stocks in 1978-1979, and the banning of all imports of horn in February 1979. Only existing stocks, totalling 696 kg of horn, were eligible for re-export (Milliken 1991). This continued 'legal' trade made it easier for illegal trade to continue and, in April 1986, Hong Kong agreed to stop exports of old stocks (Martin and Martin 1987). Internal trade continued after 1979 but fewer pharmacies stocked horn products in 1987. However, the retail price of horn doubled between 1979 and 1987 (Table 11). Internal trade in rhino horn was banned in August 1988, and a ban on the import, export and local sale of medicines claiming to contain rhinoceros ingredients was enacted in May 1989 (Milliken 1991; Milliken *et al.* 1991). Hong Kong therefore provides a successful model of the steps necessary to bring many aspects of the trade in rhino horn under control, and recent surveys show that very few pharmacies now stock horn (Table 11). However, the extent to which these measures have succeeded in controlling Hong Kong's role as an entrepôt remains uncertain. For example, 1,000kg of horn was said to have been purchased by Hong Kong businessmen in 1987/88 for export to China (Martin and Martin 1991), and exports from Hong Kong to Taiwan continue (Milliken *et al.* 1991). Given Hong Kong's traditional role as go-between for trade with Taiwan and China, and Taiwan's lack of trade links with Africa, apart from South Africa, Hong Kong may still remain an important deal-making centre for trade in rhino horn.

China

Customs statistics show that China directly imported 13% of East Africa's declared exports from 1949-76 (Table 1), and no doubt imported more via entrepôts. China became a party to CITES in 1981, and some domestic use of rhino horn also continues (Table 11). However, even though China has banned the use of rhino horn in new medicinal products, it has continued to be the major manufacturer of medicines containing rhino horn for re-export, and uses 600-700kg of horn annually (Martin 1990a). Intriguingly, as it was then a party to CITES, a short run of statistics was collected by ITRG, which showed that China imported 10621kg of African horn and 433kg of Asian horn during 1982 to 1986 (Table 12). The origin of this horn was not declared, but it was believed mainly to be from North Yemen (in the form of chips left over from carving dagger handles), Hong Kong, Macau and Taiwan, with smaller quantities smuggled in from Singapore and Thailand (Martin 1990a). In 1988, stocks of horn in China were registered and this produced a total of 9,874kg in the various medicine corporations, but excluded stocks in retail medicine shops, museums and private ownership. At current rates of use, this should provide sufficient stocks to last 15 years, but even valuable carved rhino horn antiques are now being stored up for pulverisation and inclusion in medicines (Martin 1990a).

Table 12: Rhino horn imports to China during 1982-1986, shown as volumes (kg), total price (US\$ $\times 10^4$) and average price (US\$/kg)(data from WCMC and TRAFFIC files).

Year	Rhino horn (African)			Rhino horn (Asian)		
	Volume	Total price	Price/kg	Volume	Total Price	Price/kg
1982	6,651	274	412	54.5	65	11,927
1983	517	36	696	76	101	13,289
1984	705	37	525	92	108	11,739
1985	2,274	106	466	149	171	11,476
1986	474	28	591	61	101	16,557

Taiwan

Taiwan was a major importer of horn from 1979-1985, and was supplied mainly by South Africa, Hong Kong and Singapore (Table 5). Taiwan cannot become a party to CITES because it is not recognised by the United Nations. However, Taiwan banned imports and exports of horn in 1985 but internal trade continued, itself to be the subject of a further ban in June 1989. The effect of these bans had apparently been to reduce those stocking horn products from 100% of pharmacies in 1979 to 50% in 1990. However, the retail price of African horn tripled from 1979-1988, but fell by 10% between 1988 and 1990. The retail price of Asian horn has also tripled but continued to rise between 1979 and 1990 (Table 11). Evidence suggests that most African horn during this period continued to originate from South Africa and its supplying countries, while supplies of Asian horn continue to come in from Hong Kong, Indonesia and India. Taiwan is also believed to be stockpiling horn and acting as an entrepôt since Macau and Singapore imposed, and apparently successfully enforced, bans on imports and exports of horn in 1985 and 1986, respectively (Martin and Vigne, 1986; Vigne and Martin, 1989a). A legally mandated registration of rhino horn was completed in November 1990, supposedly covering all importers, wholesalers, retailers and private owners, and produced a total stock of 1,465kg from 410 registrants. However, a survey in 1991 showed that a total of 1,800 pharmacies throughout Taiwan stocked horn and suggested current stockpiles of at least 3,712kg and possibly as high as 8,943kg (Nowell *et al.* 1992).

Singapore

Singapore took only a negligible fraction of East Africa's declared horn exports during 1949-1976 (Parker and Martin 1979). During the late 1970s and early 1980s, however, Singapore replaced Hong Kong as a major entrepôt, especially of horn from Sumatran rhinos in Sabah and Indian rhinos in Assam (Martin and Martin 1987; Martin 1989a). It took considerable pressure for Singapore to ban imports and exports of rhino horn in 1986 (Anon. 1986c) and in 1987 Singapore became a party to CITES. An 'undercover' survey conducted on behalf of CITES by local university students in 1985 showed that only 7% of 30 pharmacies examined sold horn (Sheeline 1987), but this survey is believed unreliable and is not included in Table 11. Instead, the proportion of pharmacies stocking rhino horn has declined from 53% in 1979 to 23% in 1988, while the retail price of African horn has increased from US\$ 11,615 to 17,327/kg over the same period (Table 11). In 1991, ten horns were seized in a consignment from Indonesia, and were believed to be from Javan or Sumatran rhinos (TRAFFIC International *in litt.* 1992).

Japan

Before its accession to CITES in 1980, Japan imported large volumes of horn (Table 4). Pre-CITES stocks of horn remain legal, but pharmacists are being encouraged to use substitutes such as saiga. Fewer pharmacies now stock horn in two major cities, but the retail price of horn doubled between 1980 and 1986. There has been no recent survey of the extent of present sales of either raw horn or manufactured medicines in Japan.

South Korea

Customs statistics show that South Korea was a major importer of horn during 1970-1983, and suggested it was mainly supplied by Indonesia, Thailand, Singapore and Japan. However, it was estimated that actual imports were twice those declared due to high customs taxes which encourage smuggling (Martin 1983d) and that imports came mainly from Hong Kong (Martin and Barzdo, 1984; Sheeline 1987). The use of rhino horn in medicines was banned in 1983 and the import of horn was banned totally in 1986, but South Korea is not yet a party to CITES. By 1986, smuggling of horn was believed to have dwindled (Martin 1986c), fewer pharmacies were stocking horn and its retail price appeared to have fallen (Table 11). In contrast, a survey in 1988 showed that many more pharmacies were stocking horn products and that retail prices had more than doubled (Song and Milliken 1989, 1990). South Korea therefore remains a major consumer of rhino horn, but further surveys and/or registration of horn stocks are badly needed to determine the extent of South Korea's use in relation to China and Taiwan, and to investigate North Korea as a possible market.

Malaysia

The number of shops in Peninsula Malaysia stocking rhino horn products are few and declining, and prices too have not risen dramatically (Table 11). Rhino products are not in great domestic demand and little smuggling is believed to occur (Martin 1989a). However, a recent seizure from a medicine shop in the state of Penang included 13 rhino horns, 34 rhino hoofs and seven kg of rhino skins, all believed to be from Sumatran rhinos (R. Samsudin *in litt.* to TRAFFIC International 1992).

Sabah

The Chinese community in Tawau export Sumatran rhino horn from Sabah and Kalimantan to Singapore, and some pharmacies stock Sumatran rhino horn (Table 11).

Brunei

Although Brunei only joined CITES in 1990, export of Sumatran horn was banned in 1978. However, Brunei still imports some Sumatran horn from Singapore, and some horn is used in pharmacies (Table 11). Fears that it could become an entrepôt for African horn have not been realised (Martin 1989b).

Macau

Rhino horn has been imported to Macau for many years to supply Chinese pharmacies. However, in 1984 and 1985 traders found Macau to be a convenient entrepôt after other Asian countries had banned the trade in horn. Around 500kg of horn in several shipments were seized or declared en route to Hong Kong in 1984 and 1985 (Martin and Vigne 1987b). Even though supposedly a party to CITES since 1981 when Portugal joined, the Macau government officially agreed to conform to CITES only in 1986. Most pharmacies continued to sell horn and the retail price of horn doubled between 1979 and 1987 (Table 11). A ban on internal trade was announced in March 1988 (Anon. 1989a), and appears to have been very successful in greatly reducing the proportion of pharmacies stocking horn in 1990 (Table 11).

Thailand

Trade in Thailand seems largely to be in Asian rhino horn (Table 11). Even though Thailand instituted a trade ban in 1972 and became a party to CITES in 1983, internal consumption of horn continues and threatens Sumatran rhino populations in neighbouring countries (Martin 1989a).

Consuming and Entrepôt Nations in the Middle East

The illegal trade in the Middle East has been monitored by interviews with horn carvers in North Yemen (Martin 1987; Vigne and Martin 1987a, 1991b).

North Yemen

When North Yemen's economy was booming as a result of migrant workers bringing home big salaries from the Saudi oilfields in the 1970s, only rhino horn dagger handles were made (Table 7b). As black rhinos in Africa became depleted, and when it was realised that well organised trade routes were established from East Africa, Zambia and Central African Republic via Burundi, Somalia, Sudan, Djibouti and United Arab Emirates to Yemen, pressure was put on Yemen by conservationists to control their trade. North Yemen has not become a party to CITES but instead banned the import of rhino horn in 1982. The ban was not strictly enforced and horn continued to be imported, but at reduced volumes. The main trader reduced his purchases of horn from over 1,000kg annually during 1980-1984 to 475kg in 1985 to 100kg in 1986 (Table 7a). However, this reduction in trade may have been due also to the downturn in the North Yemen economy. While the total production of daggers had increased in North Yemen, far more were being made with other cheaper materials such as water buffalo horn and fewer were being made with rhino horn (Table 7b). Further pressure to impose bans and curtail the rhino horn trade (including on its export of horn chippings left over from making dagger handles: Table 7c), was put on North Yemen by conservationists and diplomats in 1987. In May 1990, North and South Yemen united to form the Republic of Yemen. The total volume of rhino horn now reaching Yemen appears to have become greatly reduced, to perhaps 120kg annually (Vigne and Martin 1991b: Table 7a).

United Arab Emirates

The trade route to Yemen has been known to involve various Gulf States, and this was dramatically confirmed by the recent burning of around 2,000kg of rhino horn in Dubai in 1992 (TRAFFIC International *in litt.* 1992: see Table 13 below). The exact origin of this horn is not known, nor its relationship to the reduced demand in Yemen. The role of Gulf States as entrepôts needs further investigation.

TRADE BANS AND THE CONSUMPTION OF RHINO HORN

Has CITES Affected the Consumption of Rhino Horn?

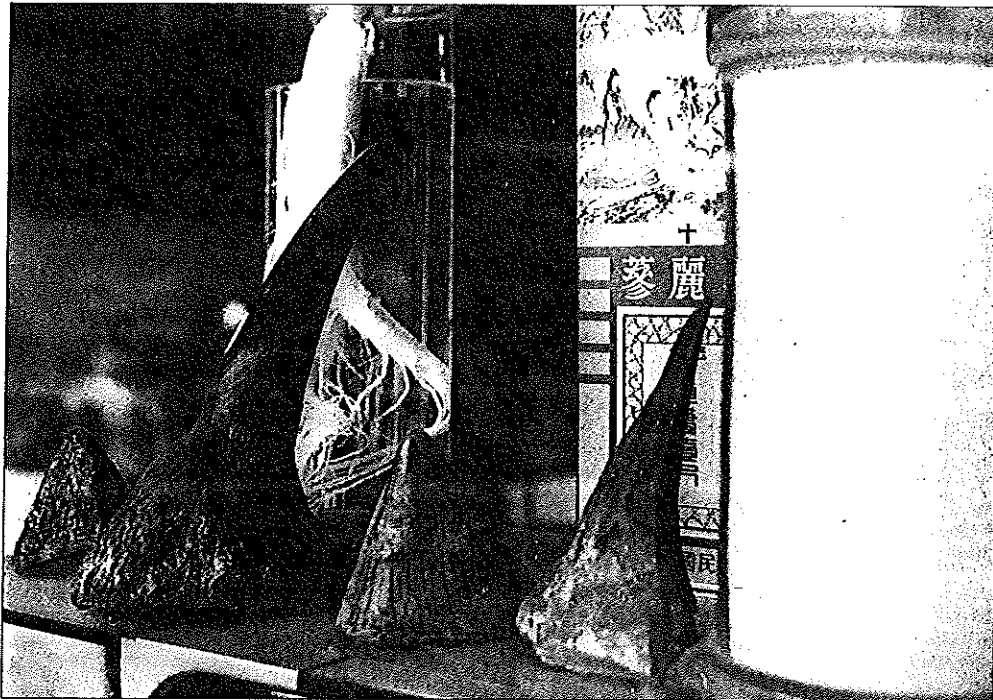
Since 1977, CITES has prohibited commercial international trade in all rhinoceros parts, derivatives or products. However, actual demand for horn, as evidenced by continued loss of rhinos in the wild, is a function both of the degree to which speculators are stockpiling horn and consumers are using horn. Control of domestic possession and sale of rhino parts and products is beyond the specific mandate of CITES and still remains unregulated in most consuming nations in Asia. Since the 1980s, therefore, the main approach by conservationists wishing to halt the serious declines seen in unprotected populations of endangered rhinos has been to attempt to halt the trade and encourage the use of substitutes within individual consuming nations. This option was seen as a more cost-effective approach than providing protection for rhinos throughout their range (e.g. Martin 1980b, 1987, 1988b; Cumming and Jackson 1984; Western 1987; WWF 1991).

It has been argued from survey data collected on the rhino horn trade that demand for rhino horn has decreased (Martin and Martin 1987), and that the battle to control the trade is being gradually won, using the following reasoning. First, only three tonnes/year of horn came onto world markets from 1980-1985 (see above), in contrast to the eight tonnes/year during the 1970s (Table 9). Second, even with this reduced supply, wholesale prices have remained the same since 1979, and retail prices actually fell from 1980 to 1986 in several cities (Table 11). Third, had the demand for horn remained constant, the prices would have soared because less horn was available (Martin and Martin 1987). Demand was believed to have fallen due to acceptance of substitutes such as water buffalo and saiga antelope *Saiga tatarica* horn in traditional medicines (indeed recent findings suggest that substitutes like water buffalo horn are as efficacious as anti-pyretics in traditional medicines (But *et al.* 1990)). Yet results from South Korea and Taiwan caution against accepting results from such surveys as evidence of reduced demand (Song and Milliken 1990; Nowell *et al.* 1992). By the mid-1980s there was evidence of reduced consumption only in Japan, India and North Yemen. In the case of Japan, this appeared due to the voluntary acceptance of substitutes (Martin 1983d) but, as noted above, the use of rhino horn medicines by the Japanese was learned from the Chinese and may not be as firmly ingrained a traditional belief. In the case of India, it was because it is more economically viable to export horns to lucrative markets (Martin 1983d; Martin *et al.* 1987). In the Yemen the reduced use of rhino horn can be attributed to the fact that substitutes and synthetic materials of suitable quality are acceptable for dagger handles, especially in times of economic stringency, in contrast to medicines (Vigne and Martin 1991b). This makes the point quite clearly that it is easier to halt the trade in animal products in luxury than in consumer goods.

Since the earlier optimism that demand for horn was slowing, the retail prices of horn have again risen in the data collected from 1988 and onwards (Table 11). A further look at the survey data on the illegal trade in rhino horn is merited because the retail prices charged in pharmacies (Table 11) have not previously been corrected for inflation, and have therefore not reflected real prices. It is unfortunate that only average retail prices are available for correction, rather than the full range of prices, because the few data points give little chance for statistically significant trends in changes of price to be detected. That aside, such correction appears to provide a slightly clearer picture of the success of efforts of a sample of consuming nations to control their trade in rhino horn (Figure 8). In Hong Kong, a significantly and consistently lower proportion of pharmacies have stocked rhino horn during 1979-90 and the real average retail price of rhino horn has shown no trend of increase, and possibly even decreased (Figure 8). By contrast, in South Korea (1980-1988) and Taiwan (1979-1991) the proportion of pharmacies stocking horn varied significantly but showed no consistent decline, and in Singapore (1979-1988) there was no significant change in the proportion of pharmacies stocking horn. However, even with the limited price data, there was a

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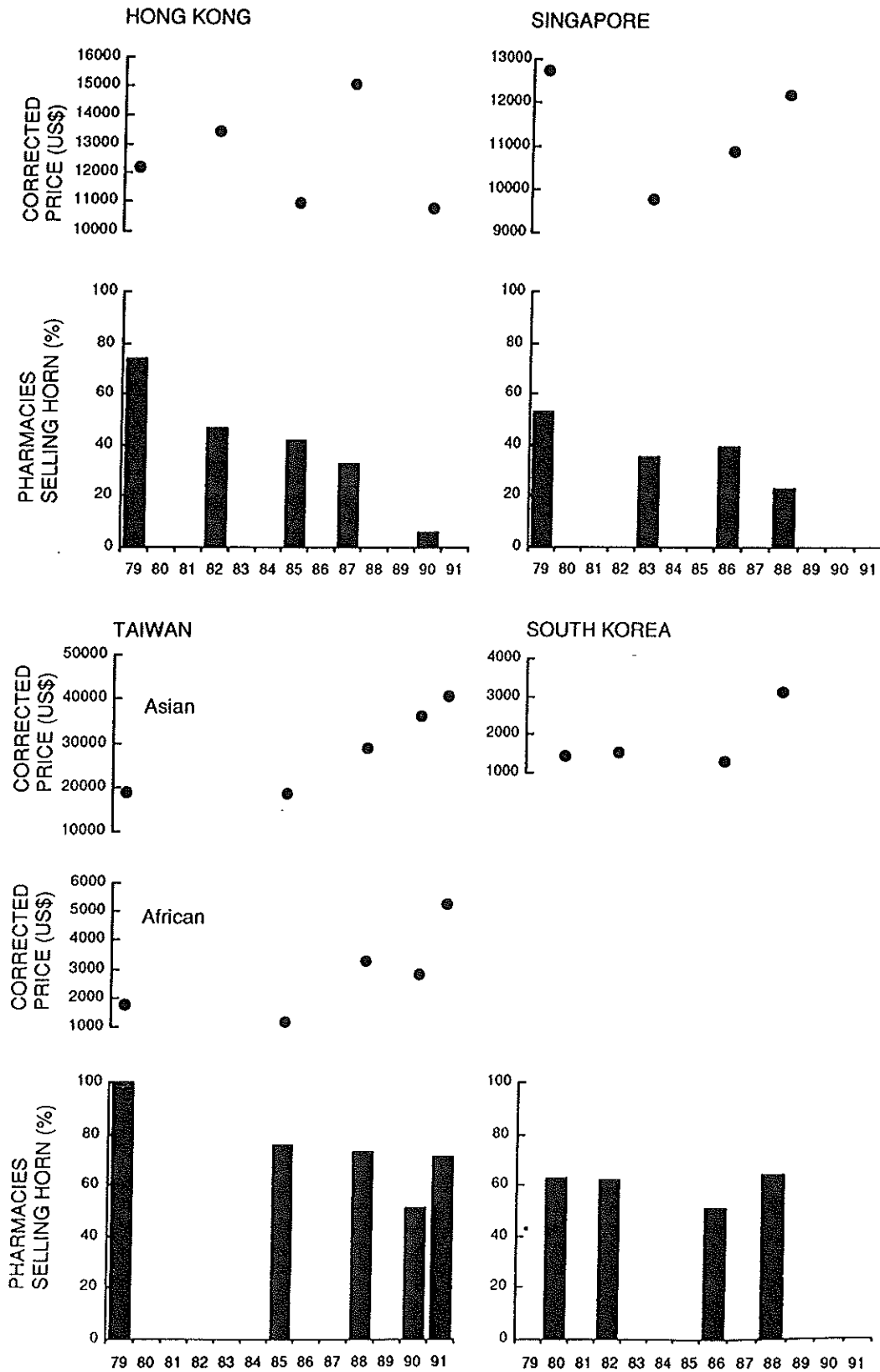
close to significant increase in the real price of Asian rhino horn in Taiwan and weaker trends of increase in the real price of African rhino horn in South Korea, Taiwan and Singapore (Figure 8). The even fewer data for Thailand (1976-1986) more resemble the situation in South Korea, Taiwan and Singapore. In contrast, the data for Kuala Lumpur, Malaysia (1981-1988) and Brunei (1982-1988) more closely resemble the Hong Kong situation, where prices may have even fallen. The situation in Macau (1979-1990) is somewhat equivocal because a lower proportion of pharmacies stock rhino horn, but the real price of horn has tended to increase. The two or fewer data points for China, Japan and much of Malaysia do not permit any reasonable conclusions.



WWF / Michele D'Apraz

The sale of rhino horn medicines is widespread in Taiwan. The horns are "shaved" (see horn on right) and mixed with a large number of other natural ingredients, according to ancient recipes.

Figure 8: Change in numbers of pharmacies selling rhino horn and in retail price, corrected for inflation, of African horn (except where indicated), in four Far Eastern countries (data from Table 11).



Demand, in terms of stocking frequency and real price, for horn has declined, as far as the analysis of these limited data permit, in only Hong Kong, Peninsula Malaysia and Brunei (plus North Yemen and India for reasons discussed above). In the remaining points of sale surveyed over the past decade or so, there is suggestive evidence that demand, in terms of real price has increased. Thus it appears clear that CITES, other national bans and most other efforts may have succeeded in slowing, but not in halting, the rhino horn trade for medicines in the Far East. Control of domestic possession and sale of rhino parts and products, however, is beyond the specific mandate of CITES and still remains unregulated in most consuming nations in Asia. The regulatory model developed in Hong Kong has involved successive steps, of acquiring the broad legal scope to deal with all rhinoceros commodities, of registration of stocks and issuance of possession licences, of import and export/re-export bans, of total bans on domestic trade and of instituting penalties for offenders (Milliken 1991). This regulatory model is being adopted in Taiwan and could be promoted as the way forward in other flourishing markets like South Korea and Thailand. However, after two decades of unsustainable exploitation of the black rhino and its local extinction in many of Africa's protected areas, it is being increasingly questioned whether the policy of attempting to halt the trade in rhino horn, followed for the last 15 years or so, should be reversed. Therefore, proposals were made to the March 1992 meeting of the Conference of the Parties to CITES in Kyoto, Japan to transfer the rhino populations of Zimbabwe (black and white rhinos) and South Africa (white rhinos) to Appendix II, thus providing for a limited legal trade in rhino horn.

Towards a Legalised Trade in Rhino Horn?

Several arguments are made in favour of a legalised horn trade. The first and most important is that rhinos do not have to be killed to produce a harvest of horn, even though poachers certainly kill rhinos. Horns continue to grow throughout life to counteract wear on their tips, although growth rates are slower in older animals (Mentis 1972; Pienaar *et al.* 1992). Horns that have been lost in fights or removed regrow, but in a slightly deformed shape (Bigalke 1945; Ritchie 1963). Rhino horns can be cut off without discomfort as they comprise compressed hair and are not enervated (Ryder 1962), though it will usually be necessary to restrain the rhino by immobilisation. The second argument is that considerable quantities of confiscated and found horn are now building up in warehouses (Table 13), and future dehorning operations of rhinos will produce increasing quantities of horn that would otherwise be added to these stockpiles. Dehorning as means of protecting rhinos has been discussed since the 1950s, but was first attempted in 1989 in Namibia (Leader-Williams 1989). It is now being carried out as a routine measure on all translocated rhinos in Zimbabwe. The third main argument is the economic consideration that selling such a valuable product legally would produce a much greater income per unit area of wildlife land for re-investment in rhino conservation than many alternatives available to state and private land-owners (Anderson 1983; 't Sas-Rolfe 1990a, 1990b).

Table 13: Stockpiles of rhino horn (all in kg) held by six producer nations, including three parks authorities in South Africa, and two consuming nations (data from different sources).

Country/Authority	Year	Volume	Action	Source
Kenya	1987	247		Martin & Ryan (1990)
	1990	350	Burnt	Anon. (1990b)
Tanzania	1987	31		Martin & Ryan (1990)
Zambia	1985	55		"
Zimbabwe	1987	750		"
Natal Parks Board	1987	1,692		"
	1990	1,900		Armstrong (1990)
National Parks Board	1987	100		Martin & Ryan (1990)
Bophutaswana	1981	35	Burnt	"
Namibia	1987	173		"
Assam	1984	236		Martin <i>et al</i> (1987)
China	1989	9,874	Medicines	Martin (1990a)
Taiwan	1990	3,712-	Medicines	Nowell <i>et al.</i> (1992)
		8,943		
Dubai (UAE)	1992	2,000	Burnt	TRAFFIC in litt. (1992)

Many of these arguments will founder on the philosophy, whether rational or not, of individual conservationists, range states and other parties to CITES. In the recent debate on whether African elephants should be transferred to Appendix I of CITES, the African continent became polarised between a group of southern African countries that favoured sustainable trade in ivory versus the rest of Africa that saw rampant and illegal over-exploitation and wished for a total ban on trade. Most parties to CITES sided with the majority of the range states and the majority of Africa's elephant populations, and voted for a ban and its continuance in 1989 and 1992. In one sense, therefore, a discussion on the possible opening of a legal rhino horn trade could not be started at a more inopportune time, given that the majority of world opinion is in favour of international trade bans as the method for saving Africa's endangered pachyderms. However, the situation with respect to rhinos differs markedly from that of elephants for two reasons. First, the southern countries now possess most of Africa's rhinos (Cumming *et al.* 1990), and therefore the southern countries' views on how they see best to conserve their rhinos merit wider attention than they were granted in the ivory debate. Second, if the ivory trade ban is indeed working, this is most probably because of a voluntary reduction in demand by users of a luxury commodity in response to the publicity surrounding the plight of elephants and the "ivory ban", rather than the ban per se. In contrast, Chinese users of traditional medicines appear unwilling to cease including rhino horn in their potions (Nowell *et al.* 1992), even though substitutes like water buffalo horn are as effective pharmacologically (But *et al.* 1990). Therefore the much longer-standing trade bans for rhino horn have been ineffective because they appear not to have caused a voluntary reduction in demand.

Aside from the philosophical arguments, what evidence is there to suggest that a legalised trade could benefit rhino conservation? Theoretical economic models suggest that the sales of confiscated and harvested horn will alter the supply curve and depress the equilibrium price (see Bergstrom 1990). Assuming that the number of animals killed by poachers is an increasing function of the price of horn (which it is in part, see Milner-Gulland and Leader-Williams 1992), then legal sales should be a preferred option to destroying or stockpiling confiscated material, or not harvesting horn (Bergstrom 1990). Clearly more empirical work is needed on the relationship between commodity prices and demand under legal and illegal trade regimes, but these theoretical models on the economics of crime and confiscation point the way forward. More empirical models

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show that it would be profitable to dehorn secure populations of rhinos on private land, but suggest it would be necessary to dehorn rhinos for their protection very regularly to make poaching unprofitable on state land (Milner-Gulland *et al.* 1992). Further work is also necessary here, but these models again point the way forward. Whatever, the economic arguments, however, any proposals to re-open a legal trade in rhino horn must be translated into successful policies.

The South African proposal for transferring its white rhino population to Appendix II notes that the transfer of one species to a different appendix should not lead to a reduction in controls for other species. It is for this reason that proposals to open up trade in African rhino horn need further consideration. At this stage it would appear that there is insufficient knowledge of the following:

- a) the dynamics of the trade in African and Asian rhino horn and the extent to which the trades may differ. To date it is known that "Fire" (Asian) horn is more efficacious than "Water" (African) horn and that Asian horn is considerably more expensive (Nowell *et al.* 1992). However, until we know more about the differences and similarities in the trade in the two types of horn, it cannot be said with certainty that a southern African trade would not have serious repercussions for the highly endangered Javan and Sumatran rhinos. The situation with Indian rhino horn also merits investigation, for it is building up into stockpiles (Table 13) while rhinos in Assam are being poached by such new methods as electrocution (Vigne and Martin 1991a).
- b) the volumes of horn traded and demanded by world markets. There are educated guesses of the approximate volumes of horn traded over the past two decades which have been justified on various grounds and disputed on others (see above). This parameter needs better estimation in order to assess the potential supply available from aspiring producers and its effect upon present price structures and demand for illegal horn. The recent study in Taiwan breaks new ground in having counted the total number of pharmacy shops and estimated the number of medicinal outlets in a particular country (Nowell *et al.* 1992). With a large sample of shops having been surveyed also for stocking horn, this has enabled an estimate to be made of the total stocks of horn held in the country (Table 13). Further unpublished work by Nowell and her colleagues has shown that a sample of pharmacists and doctors prescribe and sell on average around 45g of rhino horn annually. When multiplied by the total number of pharmacies and clinics selling horn (Nowell *et al.* 1992), this suggests the consumption of a total of 486kg annually. Hopefully Nowell's approach can be extended to provide an estimate of annual demand in other consuming nations.
- c) the likelihood that the trade will continue in its present form for the foreseeable future. The argument has been made that the trade in horn is traditional and will continue. However, there are no published data on the age structure of users of traditional medicines, and whether younger people, now more subjected to western ideas and conservation appeals, are coming on stream as consumers of traditional medicines or turning to aspirins.
- d) the role of stockpiling in influencing illegal demand for rhinos in the wild, and the role that legalising a trade in rhino horn might have on reducing speculation and demand for rhino horn. Investigations of demand have centred mainly on quantifying trends in consumption. Economic studies of the role of stockpiling on influencing volumes demand, using case studies for other commodities, would seem a good starting point for examining whether or not a legalised trade in rhino horn would reduce the demand side that is driven by speculators.

In summary, the question of whether or not a legalised trade in rhino horn should be re-opened is a complex issue, and this review has not provided the answer, one way or another. However, it is hoped that the review will provide the basis for a rational debate on the issue before the next Conference of the Parties to CITES, and that it highlights areas where further research is needed. If it achieves this aim, then this review will have served its purpose.

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