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COMMENT

Sex, drugs and animal parts: will Viagra save threatened species?

Many species of plants and animals are used in traditional Chinese medicine (TCM) to treat impotence (typically erectile dysfunction [ED]; Bensky & Gamble 1993). Some of these taxa are overharvested for their medicinal uses and are now threatened. Efforts to conserve many of these taxa have failed because the market forces driving their commercial collection or poaching remain in place. Shortly after Viagra appeared on the market in 1998, we suggested that Viagra has the potential to eliminate demand for animal sexual potency products (von Hippel & von Hippel 1998). We suggested that the East Asian market in animal potency products could soon fall victim to Viagra's success because Viagra is less expensive than many of these animal products (Viagra costs US$ 8–10 per pill in the countries in which it is legalized) and Viagra's effectiveness is demonstrated (Giuliano *et al.* 1997; Morales *et al.* 1998; Sadovsky *et al.* 2001) rather than hoped for.

The first goal of this comment is to examine systematically which animal taxa of conservation concern are collected for TCM treatments for ED. We focus only on TCM treatments for ED, rather than TCM treatments for other ailments that also involve threatened species, because Viagra represents a unique potential replacement for the TCM treatments for ED. That is, with the introduction of Viagra there is suddenly a widely available and highly effective Western medicine for treating a widespread problem (Aytac *et al.* 1999) that was previously largely untreatable. As a consequence of Viagra's efficacy and popularity, certain species may soon enjoy a significant improvement in their conservation status. For this reason, the second goal of the current comment is to assess the potential of Viagra to reduce demand for certain taxa of conservation concern.

We predict that Viagra has the potential to reduce demand for animal products for which the treatment of ED is a primary use and that the potential will be greatest for animal products that are expensive relative to Viagra. According to these criteria the following taxa include species of conservation concern that have the potential of benefiting from Viagra: sea cucumbers, pipefishes, sea horses, geckos, green turtles, deer and pinnipeds (Table 1). Although ED treatments represent only a small sector of TCM and use of threatened species in TCM, they are disproportionately important because of the prevalence of ED, the lack of alternative and effective treatments (prior to Viagra), and the amount of money men are willing to pay to treat ED (for example, note the extraordinary sales of Viagra; Sadovsky *et al.* 2001).

Is there any evidence that the availability of Viagra is having an impact on trade in animal potency products?

Reliable trade data for many threatened species may be impossible to obtain because the illegality of the trade forces it underground. Although time will tell whether populations of affected species recover following the widespread use of Viagra, the most accurate way to immediately assess the impact of Viagra on the market for natural potency products is to compare trade statistics for legally traded species before and after Viagra entered the market. Viagra was approved by the US Food and Drug Administration on 27 March 1998 (Utiger 1998) and was launched by Pfizer in May 1998 (Pfizer Inc., unpublished data 1998). Case studies can be found in the trade of reindeer antler velvet from Alaska and harp seal and hooded seal genitalia from Canada because their trade is legal and records are available.

Reindeer (Rangifer tarandus)

Sales of antler velvet from Alaskan reindeer were first recorded in 1972 and records have been kept since, with the exception of the years 1978–1981 (Fig. 1). Although Figure 1 reveals that sales have been volatile, by far the biggest one-year decline in sales occurred from 1997 to 1998. This reduction of 72% is coincident with Viagra's entry into the market, and is 3.6 times larger than the mean

Table 1 Animal taxa of conservation concern that are collected for TCM treatments for ED. [1]Two species extinct, one extinct in the wild, one critically endangered, three endangered, seven vulnerable, seven lower risk, and international trade in five species regulated by CITES Appendix II. [2]Mediterranean subpopulation critically endangered, international trade prohibited by CITES Appendix I. [3]Green sea turtles are not in the TCM pharmacopoeia for the treatment of ED, but their eggs are used for this purpose as a folk medicine. [4]One species extinct, eight species or subspecies critically endangered, 15 species or subspecies endangered, eight species or subspecies vulnerable, 12 species or subspecies lower risk, international trade prohibited in 12 species and one genus by CITES Appendix I and regulated in two species by CITES Appendix II. [5]One species extinct, one subspecies extinct, one species critically endangered, four species or subspecies endangered, nine species or subspecies vulnerable, one species lower risk, international trade prohibited in one species and one genus by CITES Appendix I and regulated in one species and one genus by CITES Appendix II. [6]One subspecies extinct, 11 subspecies critically endangered, three subspecies endangered, one subspecies vulnerable, two subspecies lower risk, international trade regulated in one subspecies by CITES Appendix II and prohibited in all other species and subspecies by CITES Appendix I. [7]Although rhino horn has a long tradition in TCM of treating many ailments such as fever, it is not used as a direct treatment for ED except by a fringe element in East Asian traditional medicine. The male sex organs are used to treat ED in Laos, Thailand and India and genital tonic pills are available in China, but the use of rhino parts to treat ED is minimal. [8]Three of the eight subspecies extinct, all five remaining are critically endangered or endangered, international trade prohibited by CITES Appendix I. [9]Tigers have a long history of use in the TCM pharmacopoeia for the treatment of a variety of ailments, but ED is not one of them. The male sex organs are, however, sometimes used to treat ED as a folk remedy, for example in the form of tiger penis soup or wine.

Taxon	*Conservation status*	*Part used*	*ED treatment a primary use?*	*More expensive than Viagra?*	*Viagra has potential?*	*References*
Sea cucumbers	10–20 species vulnerable to overexploitation	body	yes	some species	yes	Bensky & Gamble 1993; Jenkins & Mulliken 1999
Pipefishes	1 species critically endangered, 5 vulnerable	body	yes	some species	yes	Bensky & Gamble 1993; IUCN [World Conservation Union] 2000
Sea horses	1 species endangered, 30 vulnerable	body	yes	some species	yes	Bensky & Gamble 1993; Vincent 1996; IUCN 2000
Geckos	many species threatened[1]	body	yes	some species	yes	Bensky & Gamble 1993; CITES 2000; IUCN 2000
Green turtles, *Chelonia mydas*	endangered[2]	eggs[3]	yes	yes	yes	Danguilan-Vitug 1998; CITES 2000; IUCN 2000
Deer	many species threatened[4]	male sex organs, antler velvet	yes	no	yes	Bensky & Gamble 1993; Gaski & Johnson 1994; CITES 2000; IUCN 2000
Pinnipeds	many species threatened[5]	male sex organs	yes	yes (prior to Viagra)	yes	Bensky & Gamble 1993; RT and Associates 1994; Malik *et al*. 1997; Southey 1997; CITES 2000; IUCN 2000
Rhinoceroses	many species threatened[6]	male sex organs, horn[7]	no	yes	no	Bensky & Gamble 1993; WWF [Worldwide Fund for Nature] 1996; CITES 2000; IUCN 2000; K. Baragona, personal communication
Tigers *Panthera tigris*	endangered[8]	male sex organs[9]	no	yes	no	Malik *et al.* 1997; Martin 1998; WWF 1998; CITES 2000; IUCN 2000

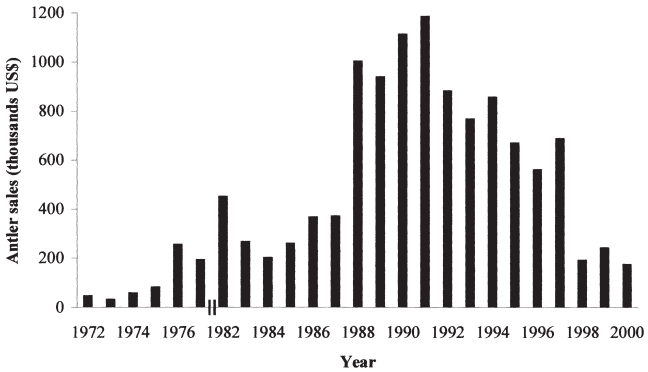

Figure 1 Alaskan reindeer antler sales (thousands US$). Note that the antler sales figures are for reindeer by-products excluding meat, but that virtually all of these by-product sales are of velvet. Data are unavailable from 1978 to 1981. Source: Alaska Agricultural Statistics Service (2001).

volatility in annual antler sales. However, antler sales were already falling before Viagra entered the marketplace, with a peak in sales occurring in 1991 (Fig. 1), so some of the drop in sales from 1997 to 1998 is probably due to pre-existing market conditions. A comparison with reindeer meat sales is instructive because meat sales also peaked in 1991 and declined thereafter (Alaska Agricultural Statistics Service 2001). Although sales of reindeer meat also dropped from 1997 to 1998, this decline in sales only amounted to a 20% loss, which is only 1.1 times the mean volatility in annual meat sales. The fact that meat sales did not decline as significantly as antler sales from 1997 to 1998 suggests that the decline in antler sales cannot be solely attributed to an overall decrease in the reindeer market.

It is probable that this drop in antler sales is partially due to the collapse of Asian economies that began on 2 July 1997 when the Thai government devalued the baht. However Viagra also appears to be a major contributing factor because: (1) an important sector of the consumer base of velvet is the East Asian community in Western countries such as the USA and Canada, and these countries did not experience economic decline during this time period; (2) Viagra sales were robust in Asia even during the economic collapse, suggesting that sales of products that treat ED are relatively price inelastic, or at least not as vulnerable to economic conditions as are other 'luxury' items; and (3) reindeer antler sales remained low in 1999 and 2000 (Fig. 1) despite the recovery of many Asian economies.

Harp seals (Phoca groenlandica) and hooded seals (Cystophora cristata)

From 1996 to 1998, both harp seals and hooded seals were harvested in Canada at approximately the maximum levels permitted by law, or in excess (Department of Fisheries and Oceans 1999). The total allowable catch of harp seals remained at 275 000 in 1999 and 2000, yet sealers harvested only 244 552 in 1999 and only 91 602 in 2000 due to poor markets (Department of Fisheries and Oceans 2001; Panel on Seal Management 2001*a*). Similarly, the 1999 harvest of 201 hooded seals and the 2000 harvest of 10 hooded seals were well below the total allowable catch of 10 000 (Department of Fisheries and Oceans 2001). The Panel on Seal Management (2001*a*) attributed the 1999–2000 collapse of these markets to reduced prices for pelts, phasing-out of government subsidies on meat, increased use of Viagra instead of seal genitalia, and higher costs for fuel and ammunition. The relative importance of Viagra in this process is unclear, but prices for seal genitalia were down sharply in 1998 (coincident with the introduction of Viagra) and have remained low (Department of Fisheries and Oceans 1999). In 1996 Canadian sealers processed 30 000–50 000 seal penises (Southey 1997). The Department of Fisheries and Oceans (2001) reported that, 'In 1998, due to declining prices – $15 to $20 [Canadian] per unit, compared to $70 to $100 in previous years – only an estimated 20 000 organs were sold to processors . . . There has been virtually no market for seal organs in [1999–2000].' The market for seal pelts and seal oil improved in 2001 (pelt prices rose from Canadian $14 in 2000 to $30–37 in 2001), and as a consequence approximately 210 000 harp seals were harvested in 2001 (Panel on Seal Management 2001*b*).

Other animal taxa that are legal to trade (e.g. many species of pipefishes, sea horses and sea cucumbers), as well as other sources of deer velvet (e.g. elk [*Cervus elaphus*] from the USA and New Zealand) and seal genitalia (e.g. from Greenland, Norway and Russia) should be investigated for the impact of Viagra on their trade. Such data provide a proxy for the impact of Viagra on illegally traded species. Because market forces are driving the overcollection of, and subsequent threat to these species, the elimination of these market forces may prove to be the most effective conservation solution.

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