Abalone poaching, methamphetamine use, criminal activity in South Africa and the associated implications for resource management

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Abstract

The illegal exploitation of abalone in South Africa has been escalating since the early 1990s. The South African government issued a ban on all wild abalone fishing in South Africa, effective 1 February 2008. This study explores the relationship between abalone poaching, use of the methamphetamine drug, criminal activity in the coastal communities of South Africa, and the associated implications for the management of the abalone resource. The study formulates a model which is used to identify and appraise the likely effects of various policy instruments in curbing abalone poaching. Like many other studies, this paper also suggests increases in anti-poaching enforcement and fines as one way to curb illegal harvesting. However, the paper also argues for more measures to curb illegal abalone harvesting in the South African context. The paper puts forward the role of drugs, general corruption, the prevalence of bribery, and the high-value of the abalone as possible explanations as to why poaching has continued unabated. Two suggestions of dealing with abalone poaching are exterminating the demand side through targeted enforcement, and ceding the resource to the local coastal communities. However, local communities would need to be empowered to deal with interest groups with access to instruments of violence. Complimentary measures to bring back community patriotism will also be needed given the tattered social fabric of the local coastal communities.

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1. Introduction

In a bid to counter illegal harvesting of South Africa's fisheries resources, the fisheries authority has significantly increased investment in fisheries compliance over the past decade – with a view to increasing both law enforcement capacity and activities (Hauck and Kroese 2006). Despite this increase in enforcement, however, illegal harvesting of abalone (*Haliotis Midae*) has continued unabated – ultimately resulting in the closure of the fishery in 2008 (Raemaekers and Britz 2009). In this paper, we analyse why increased enforcement efforts have failed to curb illegal abalone harvesting by considering additional factors driving the illegal exploitation of abalone.

The abalone fishery is extremely difficult to manage amid the high value of the resource, the presence of highly organised poaching syndicates, increased predation of sea urchins by West Coast rock lobster and the redistribution of access rights following South Africa's transition to democracy (Hauck and Kroese 2006; Hauck and Sweijd 1999; Raemaekers and Britz 2009; Steinberg 2005). Amid increased levels of poaching, the Department of Environmental Affairs and Tourism (DEAT) attempted to reduce the legal fishing effort by closing the recreational fishery in 2003, progressively reducing the total allowable catch (TAC) and ultimately closing the commercial fishery in 2008 (Raemaekers and Britz 2009).

The 1994 "abalone war", which entailed violent confrontations between poachers, police, community members and commercial divers, has evolved into a highly organised illegal transnational trading scheme involving Chinese organised crime syndicates (Hauck and Kroese 2006). Steinberg (2005) denotes this rapid growth in illicit abalone trading in the 1990s to a number of factors: rand weakness against the US dollar provided significant incentive to ramp up the export of high value dollar denominated commodities; the established presence of a Chinese organised crime network in South Africa, with established illicit trade routes between East Asia and South Africa, who bartered drugs for abalone[2]; South Africa's difficulty in executing efficient border control; and finally, increased levels of tolerance towards poaching by previously disadvantaged coastal communities frustrated by the perceived low transformation of the countries fisheries.

The link between abalone and drug usage is well documented. Steinberg (2005) describes how in the mid-1990s, players from the Western Cape's gang-based drug trade moved to abalone-rich fishing communities, taking control of large shares of the abalone market: During this time, large quantities of the chemical precursors for the Cape Flats then drug of choice – methaqualone – were being smuggled into South Africa from East Asia. It was clear by the late 1990s that methaqualone was being bartered for abalone – and had been for some time (Steinberg 2005). Abalone's involvement in

[2] Bartering facilitates the trade of a high value, dollar denominated commodity such as abalone, which is exported, for high value commodities such as drugs, which are imported (Steinberg 2005).

the Western Cape illicit economy was multi-fold: Chinese organised crime bartered cheaply attained chemical precursors for valuable abalone; Western Cape drug dealers bartered cheaply acquired abalone for high value drugs; poachers exchanged abalone for drugs for resale or, alternatively, for their own consumption (Steinberg 2005). Chinese organised crime still remains entangled in the Cape Flats drug market amid the rise in popularity of another recreational drug which is colloquially named *tik* – crystal methamphetamine (Steinberg 2005). Hauck (2000) argues that the illegal exploitation of abalone has evolved into an organised illicit industry controlled by street-gangs at the shore and transnational syndicates who provide the channels through which to export abalone to the Far East.[3]

The presence of these street-gangs and international syndicates has not only increased pressure on the resource, but has compounded the complexity of resource management (Hauck, 2000). The instrumental (rationalist) approach to compliance assumes that fishers base their decision to comply with regulation on economic gains, the probability of detection and the severity of punishment; in this context, the role of law enforcement and deterrence in facilitating compliance is widely recognized (Hauck, 2009). However, while the response of Marine and Coastal Management (MCM) to rising levels of poaching has largely been to strengthen law enforcement (Hauck and Kroese 2006), traditional management measures have proved relatively ineffective in the case of the abalone fishery (Raemaekers and Britz 2009). Hauck and Kroese (2006) document the authorities approach to strengthening law enforcement in the late 1990s: a specialised unit was established to focus on marine offenses and shoreline patrolling increased; formal and informal partnerships were established with other government departments for conducting joint investigations, reflecting the increasingly organised nature of illicit abalone trading; an Environmental Court was established in 2003 primarily to try abalone cases; MCM instituted measures to minimise corruption such as increasing the salaries of fishery control officers and setting up a telephone hotline. In addition to these initiatives, the authorities also attempted to decrease fishing effort by systematically reducing the TAC: the TAC was

[3] The international trade in abalone is primarily driven by Asia. In some East Asian countries, abalone meat is considered a delicacy (Burgener, 2005). In addition to being considered an aphrodisiac, some Asian countries consider abalone to have the esoteric properties of delaying senility and increasing fertility (Hauck and Sweijd, 1999). The main importers of abalone are Hong Kong, China, Japan, Malaysia, South Korea, Philippines, Singapore and Taiwan – with Hong Kong being the largest importer (Allen et al. 2006). Allen et al. (2006) use trade statistics from the Hong Kong Government's Census and Statistics Department to provide a breakdown of the countries of origin of preserved abalones imported into Hong Kong between 1998 and 2002. South Africa and Mozambique's contributions are 19% and 11%, respectively. The category "others" which consists of 9 countries, the majority of which are African countries: Madagascar, Mauritius, Mozambique, Namibia, Senegal, Swaziland, Zambia and Zimbabwe, is estimated to contribute 12%. The authors note that, given that abalone is not endemic to these countries with the exception of Namibia, it is likely that the abalone was poached in South Africa, smuggled into other African countries and re-exported to Hong Kong. The authors' estimate that South Africa is contributing around 40% of Hong Kong's preserved abalone imports. Steinberg (2005) confirms that, while it is not possible to quantify the amount of abalone being smuggled across the country's borders, it is suspected that the majority of abalone is smuggled across uncontrolled and commercial land borders and on unlogged air flights. Once the abalone has crossed over into neighbouring states – where there is no law against the transportation or shipment of abalone without a permit, it is exported from sea and air ports.

reduced from 500 t in 1999/00 to 75 t towards the end of 2007 (Tarr 2003). However, despite these initiatives, abalone poaching remained widespread. By 2007, nearly the entire abalone catch of over 2000 t was estimated to be caught illegally (Raemaekers and Britz 2009).

As increased law enforcement has failed to curb illegal behaviour in the abalone fishery, alternate explanations for illegal behaviour must be explored. In this context, we develop a dynamic model of abalone poaching to assess why increased enforcement has failed to achieve compliance in the abalone fishery. Drawing on the work of Becker (1968), Ehrlich (1973), Messer (2000) and Abbott (2008), we fomulate a South African specific model consisting of two agents: the conservation agency (Marine and Coastal Management) which is responsible for protecting the abalone resource through enforcement activites; and the poacher who divides his time between legitimate employment and illegal abalone harvesting.

The major innovation of this model is that it allows us to explore the relationship between abalone poaching, the use of methamphetamine (in other words inelastic drug use) and police corruption. The inclusion of these additional factors enables us to provide an explanation for continued abalone poaching in the face of increased law enforcement effort.

The paper proceeds as follows: The model is outlined in Section 2 while Section 3 derives the relevant policy implications. Finally, Section 4 concludes.

2. The Model

Emphasising the similarity between the traditional household choice problem and the decision to commit an offense, the literature on the economics of crime applies choice theory to the study of illicit activities (Block and Heineke 1975). In his seminal article, Becker (1968) assumes that, an individual will commit a crime (offence) if the expected utility from committing that crime is greater than the utility obtained from devoting his or her time and resources to alternative activities. As noted by Becker (1968): "Some persons become 'criminals'... not because their basic motivations differ from that of other persons, but because their benefits and costs differ" (Becker 1968 in Block and Heinke 1975: 314).

Ehrlich (1973) formulates a more comprehensive model by incorporating the costs and gains from licit and illicit activities (as opposed to the cost of punishment alone). In this way, "it links formally the theory of participation in illegitimate activities with the general theory of occupational choices by presenting the offender's decision problem as one of an optimal allocation of resources under uncertainty to competing activities both inside and outside the market sector, rather than as a choice between mutually exclusive activities" (Ehrlich, 1973: 522).

Thus, a model of choice between legal and illegal activities can be formulated within the framework of the usual economic theory of choice under uncertainty. This paper draws on Messer (2000) and Abbott (2008) in formulating a South African specific model portraying two agents namely the conservation agency which is responsible for protecting the abalone resource and the poacher who has to make decisions about allocating his labour to legitimate employment or illegal abalone harvesting. The poacher's motive in illegally harvesting the abalone is to supply it to the lucrative black market (Hauck and Sweijd 1999). A major innovation of the current model above the previous ones is that it also looks at the interactions between abalone poaching and use of demand inelastic drugs, and the role of corruption and bribery in abalone poaching.

The conservation agency is tasked with the preservation of the abalone resource. Let x be the stock of the abalone that is still in the water. The existence value of the resource is a function of its stock i.e. $T(x)$. There is a lucrative market for harvested abalone. The existence of such a market motivates illegal harvesting (poaching) of the resource by people external to the conservation agency. To counter such illegal harvest, the conservation agency invests in anti-poaching enforcement e.[4] Anti-poaching enforcement comes at a cost of $f(e)$. Even though the conservation agency does not proactively participate in the market for the harvested abalone he supplies it with confiscated poachers' loots to defray costs.

We assume that the conservation agency selects an optimal level of anti-poaching enforcement e in order to maximise the present value of net benefits from the resource. In any given period, the net benefits from the resource are made up of the existence value of the resource $T(x)$, the anti-poaching enforcement costs $f(e)$, revenues from any fines imposed on apprehended illegal harvesters F, and the proceeds from sale of confiscated illegal harvests C.[5] Thus, the objective of the conservation agency can be concisely written as,

$$\underset{e}{Max} \int_0^{\infty} T(x) - f(e) + \pi(e,\omega)(1-\theta)[F+C]e^{-rt}dt$$

where π denotes the probability with which illegal harvesters will be apprehended. It is assumed here that the likelihood of apprehending illegal harvesters is increased by anti-poaching enforcement and reduced by the presence of corruption amongst enforcement officers. We assume the existence of a

[4] Anti-poaching enforcement aims to reduce illegal abalone harvesting and increase the likelihood of confiscating harvested abalone (and apprehending the culprits involved). Ideally the size of anti-poaching enforcement should depend on the size of the resource and the extent of the threat of the illegal harvesting on the resource.

[5] The values of F and C will be characterised fully once we have explored the behaviour of the illegal harvesters and their interaction with anti-poaching enforcement.

general corruption index ω which assigns higher values for more corruption. Thus, π is a function of e and ω.

Apprehension in this context refers to the poacher being subdued by the anti-poaching enforcement officers. Given the presence of corruption in general and the payment of bribes[6] in particular, the anti-poaching enforcement officers will take one of two courses of action once they have apprehended the poacher: make a formal arrest or accept a bribe. It is assumed that bribery will take place with a probability of θ. Thus, on the one hand, if the poacher is formally arrested then his loot will be confiscated and he will be fined. The poacher's total financial cost of the fine F will be paid with a probability of $(1-\theta)$. The poacher's total expected revenue loss from the confiscated loot C will also be made with probability $(1-\theta)$. By symmetry, the conservation agency will receive revenues from fines F, and proceeds from sale of confiscated illegal harvests C with probability $\pi(e,\omega)(1-\theta)$.

In maximising net benefits, the conservation agency will need to take the abalone stock dynamics into account. The dynamics of the stock of abalone that is still in the water is governed by (i) its natural growth g which is assumed to depend on the stock size, and (ii) the illegal harvest h which depends on the size of the stock of abalone, the amount of effort directed towards abalone poaching, other livelihood pressures whose resolution requires the use of harvested abalone, and the effectiveness of anti-poaching enforcement. Thus,

$$\dot{x} = g - h$$

In order to know h, there is a need to fully characterise the amount of effort directed towards abalone poaching and the other livelihood pressures whose resolution requires the use of harvested abalone. This can be done by exploring the behaviour of the illegal harvesters. The local illegal abalone industry consists of divers, middlemen and processors. The divers who are usually from the local coastal communities do the actual harvesting. The middlemen who are usually gang operatives buy and collect the poached abalone from the divers then sell and deliver it to the processors. The processors who are usually Chinese entities buy and dry the abalone from the middlemen then transport and sell it to markets in external places such as Hong Kong, China and Taiwan.

The local illegal abalone market consists of the demand and supply sides. One plausible way of demarcating the two sides would be to draw a line between those involved in the pre-processing

[6] It is assumed that corruption is a broad class which encompasses bribery. Some of the corrupt practices which do not involve bribes would be turning a blind eye on friends and relatives who are involved in illegal activities.

stages on one side and those involved in the processing and beyond on the other side. Thus, the category consisting of the divers and middlemen would constitute the supply side while the processors would represent the ultimate demand side of the abalone market. We therefore define the actors on the supply side as the poacher for purposes of our model.

The middlemen position in the abalone trade has been dominated by gangs who seek to generate easy income to oil their activities. One of the needs of the gangs in carrying out their activities is drugs. Thus dealing in illegal abalone helps gangs to generate financial resources to secure drugs usually for own consumption but also for sale to others. Drugs can be addictive and are therefore generally assumed to have inelastic demand. Thus, if a significant section of the abalone market supply side consumes drugs and finances its demand for drugs through illegally harvested abalone then demand for drugs $D(q)$ will be one of the factors affecting the abalone poaching function. Thus, the use of drugs can be characterised as a livelihood pressure whose resolution requires the use of harvested abalone. For example, when the price of drugs q goes up poachers will not reduce their demand for drugs as drugs are highly price inelastic. Instead, poachers will harvest more abalone to assure themselves of almost the same quantity of drugs. Thus, even though increases in anti-poaching enforcement should reduce the illegal harvest levels, if they coincide with rising drug prices then they will be rendered ineffective.

The major way through which the poacher will affect the abalone resource is by selecting the amount of effort to put into abalone poaching. The abalone poacher is assumed to have an initial income endowment of y_0. He can use his labour to generate additional income by allocating it to either poaching or legitimate employment or both. Thus, the poacher derives his income from the proceeds of sale of the poached harvest and from a wage w at the legitimate employment. The fraction of time spent poaching is given by τ.

As indicated earlier, the illegal harvest h depends on the size of the stock of abalone x, the amount of effort directed towards abalone poaching which is represented by the fraction of time spent poaching τ, other livelihood pressures such as drug consumption $D(q)$ whose resolution requires the use of harvested abalone, and the effectiveness of anti-poaching enforcement which is represented by the size of the anti-poaching enforcement e. Thus, the poaching function is given by $h(\tau, x, D(q), e)$.

The poached harvest can be sold at a unit price of p. The financial benefit set to be made in the event of a successful sale will be $ph(\tau, x, D(q), e)$. However, given the presence of anti-poaching enforcement, the poacher may be apprehended before selling his loot. As indicated earlier,

apprehension in this context refers to the poacher being subdued by the anti-poaching enforcement officers after which they can take one of two courses of action: make a formal arrest or accept a bribe. On the one hand, if the poacher is formally arrested then his loot $h(\tau, x, D(q), e)$ will be confiscated and he will be fined δ per unit of the confiscated loot. The poacher's total financial cost of the fine F will be $\delta h(\tau, x, D(q), e)$ and will be paid with a probability of $(1-\theta)$. The poacher's total expected revenue loss from the confiscated loot C will be $ph(\tau, x, D(q), e)$, also made with probability $(1-\theta)$. By symmetry, the conservation agency will receive revenues from fines F, and proceeds from sale of confiscated illegal harvests C with probability $\pi(e, \omega)(1-\theta)$. On the other hand, if the anti-poaching enforcement officers accept a bribe then the poacher gets to pay a bribe of B per unit of his loot and keep the loot, $h(\tau, x, D(q), e)$.[7] The total financial cost of the bribe will be $Bh(\tau, x, D(q), e)$ and will be paid with a probability of θ, given apprehension. As pointed out earlier, it is assumed that the poacher is apprehended with probability $\pi(e, \omega)$.

The problem of the poacher is therefore to decide the amount of poaching effort to exert. Since the poacher does not have property rights over the resource he will not take the stock dynamics into account. The poacher's problem can thus be written,

$$\underset{\tau}{Max}\ \pi(e,\omega)[y_0 + w(1-\tau) - [(1-\theta)\delta + \theta B]h(\tau, x, D(q), e)] + (1-\pi(e,\omega))[y_0 + w(1-\tau) + ph(\tau, x, D(q), e)]$$

The first order condition consistent with positive time spent poaching is

$$h_\tau(\tau, x, D(q), e)[(1-\pi(e,\omega))p - \pi(e,\omega)[(1-\theta)\delta + \theta B]] = w$$

from which one can solve for τ^* as a function of $x^*, D(q), p, \pi, \delta, w, \omega, \theta, B$ and e^* if given specific functional forms.[8] The first order condition simply says that labour will be allocated to poaching until the marginal benefit from poaching (i.e. the expected value of the additional harvest $h_\tau(\tau, x, D(q), e)[(1-\pi(e,\omega))p - \pi(e,\omega)[(1-\theta)\delta + \theta B]]$) is equal to the marginal cost of such a labour deployment (i.e. the foregone wage w). The values of x^* and e^* are determined from the conservation agency's problem.

[7] It is expected that B will be less than δ, which is why poachers would be enticed to collaborate with the bribery-seeking officers instead of preferring to be formally arrested. While some may argue that the bribe only needs to be smnaller than $\delta + p$ we argue that p will not feature in this decision as it does not necessarily help with the current cash flow on which bribery is usually supported.

[8] It should be noted that $(1-\pi(e,\omega))p > \pi(e,\omega)[(1-\theta)\delta + \theta B]$ since h_τ and w are positive.

Going back to the conservation agency, we assume that the conservation agency selects an optimal level of anti-poaching enforcement e in order to maximise the present value of net benefits from the resource taking the abalone stock dynamics into account. The conservation agency's problem can be comprehensively written as,

$$\underset{e}{Max} \int_0^{\infty} T(x) - f(e) + \pi(e,\omega)(1-\theta)[\delta(h(\tau,x,D(q),e)) + ph(\tau,x,D(q),e)]e^{-rt}dt$$

s.t. $\dot{x} = g(x) - h(\tau,x,D(q),e)$

The Pontryagin's maximum principle consistent with positive anti-poaching enforcement by the conservation agency is given by:

$$f_e(e) = \pi_e(e,\omega)(1-\theta)[\delta + p]h(\tau,x,D(q),e) + [\pi(e,\omega)(1-\theta)(\delta + p) - \lambda]h_e(\tau,x,D(q),e)]$$

$$\dot{\lambda} = r\lambda - T_x(x) - \lambda g_x(x) - [\pi(e,\omega)(1-\theta)(\delta + p) - \lambda]h_x(\tau,x,D(q),e)$$

$$\dot{x} = g(x) - h(\tau,x,D(q),e)$$

from which one can solve for steady-state values of e^* and x^* as functions of $\tau^*, x^*, D(q), p, \pi, \delta, w, \omega, \theta$ and e^* if given specific functional forms. The steady state equilibrium requires that $\dot{x} = 0$ and $\dot{\lambda} = 0$. It should be noted that the value of τ^* is determined from the poacher's problem. Thus, it is clearly evident that one can solve for τ^*, x^* and e^* from the two agents' problems. The first condition simply says that the conservation agency will invest in anti-poaching enforcement until the marginal benefit from it (i.e. the expected additional revenue from fines and sale of confiscated loot after more successful enforcement $\pi_e(e,\omega)(1-\theta)[\delta + p]h(\tau,x,D(q),e)$ and the additional value from the resource that is still in the water rather than harvested after more successful enforcement has reduced the harvest $[\pi(e,\omega)(1-\theta)(\delta + p) - \lambda]h_e(\tau,x,D(q),e)]$) is equal to its marginal cost (i.e. the cost of additional enforcement $f_e(e)$).

3. Policy implications

This section considers the various aspects of the model and draws implications for policy. Many models on poaching are usually quick to suggest increases in anti-poaching enforcement and fines to curb illegal harvesting. The model formulated above also gives the same impression *prima facie* as $d\tau/de < 0$ and $d\tau/d\delta < 0$. However, as we argue below, while these actions constitute a move in a desired direction more measures will be needed to curb illegal abalone harvesting in the South African

context. South African regulation of the abalone industry started off in earnest with the imposition of a quota. However, with a quota the problems of anti-poaching enforcement were compounded as it was difficult to distinguish between legal and illegal harvest. This was the prime motivation for imposing a ban on harvest. We therefore investigate the effect of enhancing enforcement by considering the comparative statics:

$$\frac{d\tau}{de} = \frac{\pi_e[(1-\theta)\delta + \theta B + p]h_\tau - [(1-\pi)p - \pi[(1-\theta)\delta + \theta B]]h_{\tau e}}{[(1-\pi)p - \pi[(1-\theta)\delta + \theta B]]h_{\tau\tau}} < 0$$

$$\frac{d\tau}{d\delta} = \frac{\pi h_\tau}{[(1-\pi)p - \pi[(1-\theta)\delta + \theta B]]h_{\tau\tau}} < 0$$

With increased enforcement there will be, firstly, a reduction in harvest as the poachers are forced to stay out of water and, secondly, an increase in the probability of apprehending the poachers. It would seem therefore that with a ban, enforcement will be enhanced as anyone seen with abalone is deemed to have obtained it illegally and they must necessarily be a poacher. Thus, the ban coupled with enhanced anti-poaching enforcement should ultimately reduce the poaching effort and illegal harvest ceteris paribus.

However, when we consider reality in South Africa there is no evidence of reduced illegal harvest since the ban was instituted. The model in this paper offers four possible explanations as to why poaching has seemingly continued unabated despite the ban and the implied enhanced enforcement. It is true that enforcement works through the probability of detection and harvest levels. It is also the case that there are other factors which work through the same variables but in a way that is contrary to the aims of anti-poaching enforcement. These factors, which are also incorporated in the model and which yield the comparative statics given below, are (i) the role of drugs such as methamphetamine, (ii) general corruption in the anti-poaching enforcement system, (iii) the prevalence of bribery in the anti-poaching enforcement system, and (iv) the high value of the abalone products on the market.

$$\frac{d\tau}{dq} = -\frac{h_{\tau D} D_q}{h_\tau} > 0$$

$$\frac{d\tau}{d\omega} = \frac{\pi_\omega[(1-\theta)\delta + \theta B + p]h_\tau}{[(1-\pi)p - \pi[(1-\theta)\delta + \theta B]]h_{\tau\tau}} > 0$$

$$\frac{d\tau}{d\theta} = -\frac{\pi(\delta - B]h_\tau}{[(1-\pi)p - \pi[(1-\theta)\delta + \theta B]]h_{\tau\tau}} > 0$$

$$\frac{d\tau}{dp} = -\frac{(1-\pi)h_\tau}{[(1-\pi)p - \pi[(1-\theta)\delta + \theta B]]h_{\tau\tau}} > 0$$

As pointed out earlier, abalone poaching is entangled with drugs. Abalone is an easy source of income for gang operatives with which to buy drugs which are necessary in the gang activities. There has been a reported increase in the prevalence of drug use in South Africa especially methampthetamine. Such a surge in demand of the drugs result in a rise their prices. Since the quantity demanded of drugs does not respond much when prices rise, the drug users would have to secure additional income to finance the drug price increase. It is believed that the source of this additional finance has been dealing in illegal abalone thereby fueling its poaching despite enforcement efforts. Thus, a fight against abalone poaching will necessarily need to also generally fight drug use especially methamphetamine use which has an intimate relationship with abalone poaching.

Almost all of the illegally harvested abalone in South Africa is exported mainly to Hong Kong and China. The delivery of illegally harvested abalone to local processing houses and ports of its export would be very difficult with alert enforcement efforts given the vast distances involved. It would appear that enforcement is being compromised in some instances thereby aiding the unabated continuation of the illicit abalone trade. There have been reports of police vehicles being used to transport poached abalone in order to escape enforcement while in transit. In some cases top political figures have been implicated in faciliating such abalone movements. The role of this general corruption would then be to reduce the probability of apprehension and thereby fuel poaching effort and resource degradation.

Another specific type of corruption which has been reported to be prevalent in South Africa is bribery. In the presence of bribery possibilities, the investment in enforcement is rendered ineffective. The anti-poaching enforcement officers use paid time to earn additional income from apprehended poachers who they decide should go scot-free after they have paid them bribes. Eventually the poachers internalise the bribes as any other ordinary cost of their harvesting activities. Thus, the prevalence of the use of bribes increases poaching effort and consequently leads to over expoitation of the resource.

Due to the existence of a number of factors detracting from anti-poaching enforcement, the size of anti-poaching enforcement is not necessarily related to effectiveness of enforcement. There might be ways of raising the probability of apprehension without necessarily increasing anti-poaching enforcement. In the presence of corruption, the effectiveness of any level of anti-poaching enforcement will be lower. By turning the system to a corrupt-free one, effectiveness of anti-poaching effort will be enhanced. What mechanisms can one use to get rid of corruption? In a real life situation one would need another enforcement activity – an anticorruption enforcement effort and expense. However, another simple way would be to preach about ethical behaviour to the enforcement officials hoping that they will change their behaviour. Investment in community education about the ecology

and social-economics of the abalone resource might also incite community involvement in enhancing effectiveness of enforcement.

The last factor influencing the dynamics of poaching behaviour is the price of abalone. Given that abalone demand is inelastic due to its association with status in Asia, there is always big money to be made from the abalone business. When this is taken against the background of the alternative sources of income that poachers have access to, there is no doubt that abalone poaching will continue to be lucrative for some time to come if drastic measures are not taken to curb it. The abalone resource is under threat and it needs to be protected.

One option of dealing with abalone poaching would be to exterminate the demand side. Given that gangs act as monopsony by buying abalone from the local divers and monopoly by supplying abalone to the Chinese dealers, if one were to focus enforcement on gangs and the Chinese dealers or at least their actions with regard to abalone activities then one would successfully extinguish the source of income for abalone poachers and remove their incentives to harvest. This is likely to work given that most of the abalone is harvested by the local harvesters for sale rather than for own consumption.

Drastic measures focusing on creating an effective monitoring and enforcement mechanism are also needed. One option of creating an effective monitoring and enforcement mechanism would be to allocate the resource to the local coastal communities for their management. The advantage is that this would also address the previous concern of community alienation from the abalone resource. Under such an arrangement, the government could cede property rights of particular sea beds to the coastal communities, ask them to manage the resource, and let them suffer the consequences of their management actions. Thus all net benefits from the resource will accrue to the coastal communities. Given the need to protect some income generating opportunities for some members such as divers, the coastal communities might elect a number amongst themselves to be appointed as harvesters. These harvesters could pay rents to the rest of the community. If exploitation is not restrained then communities themselves will suffer direct losses over time in terms of reduced rents.

In fact the authorities have once flirted with this idea but not fully. There are obvious challenges which have to be addressed for this co-management arrangement to work. As the model above shows, the poacher group is made up of divers from the local coastal communities and gang operatives. With co-management the property rights will become entrenched in the local coastal communities. This arrangement gives resource monitoring responsibilities to the local coastal communities and paves way for self-monitoring. However, the challenge would be how to handle the gang operatives who are usually external to the local coastal communities. Co-management of the sort suggested above would alienate one powerful interest group: gang operatives. Besides, the members of the coastal communities themselves are not homogenous e.g. some are divers whose livelihood depends on being

in the water while others are not. While divers are not very difficult to manage as they can be allocated a harvesting quota while they pay rent to the broader community, the same arrangement is likely unenforceable with gang operatives who are powerful stakeholders. The gang operatives are readily bent on disregarding any local rules and regulations that may be put in place by the local community because of their access to instruments of violence. They may threaten any members of the community involved in policing or enforcement.

Thus, if co-management is to work it must therefore be assisted by empowering local communities to deal with interest groups wanting to access the resource, some of whom have access to instruments of violence. One way might be for a specialised police force to avail itself for use by the local community to tackle the unforgiving gang operatives as they will fight to the bitter end to get access to the abalone resource. The key role of the coastal communities might be as little as being informants. Complimentary measures to bring back the community gel will also be needed given that the history of illegal abalone fishing left the social fabric of the local coastal communities tattered.

4. Conclusion

The illegal exploitation of abalone in South Africa has been escalating since the early 1990s. The South African government issued a ban on all wild abalone fishing in South Africa, effective 1 February 2008. This study explores the relationship between abalone poaching, use of the methamphetamine drug, criminal activity in the coastal communities of South Africa, and the associated implications for the management of the abalone resource. The study formulates a model which is used to identify and appraise the likely effects of various policy instruments in curbing abalone poaching. Like many other studies, this paper also suggests increases in anti-poaching enforcement and fines as one way to curb illegal harvesting. However, the paper also argues for more measures to curb illegal abalone harvesting in the South African context. The paper puts forward the role of drugs, general corruption, the prevalence of bribery, and the high-value of the abalone as possible explanations as to why poaching has continued unabated. Two suggestions of dealing with abalone poaching are exterminating the demand side through targeted enforcement, and ceding the resource to the local coastal communities. However, local communities would need to be empowered to deal with interest groups with access to instruments of violence. Complimentary measures to bring back the community gel will also be needed given the tattered social fabric of the local coastal communities.

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