CHAPTER 1: HUNTING AS A THREAT

This brief introductory chapter will provide a context for the thesis as a whole, reviewing the evidence that hunting is a serious conservation issue, and offering the two tenets on which subsequent theoretical work is based, that densities of exploited populations are commonly low and uneven. the structure of the thesis is outlines at the end of the chapter.

1.1 Background

The history of conservation is intimately bound to hunting. The founders of the modern conservation movement have been characterised as the 'penitent butchers' (Fitter and Scott 1978), but long before their time privileged hunting elites sought to protect populations of game species, more often motivated by the appeal of exclusivity rather than absolution. Many of the earliest national parks or conservation areas protected for the public good grew out of hunting reserves, and therefore inherited a philosophy of large game management, principal to which was the suppression of poaching. The revolution in conservation philosophy and practice during the last quarter of the 20th focussed on biodiversity (e.g. Wilson 1998) and the rights of local communities, however (e.g. Wells *et al.* 1992). In this taxonomically and socially more inclusive environment it became politically incorrect to focus on the protection of a few large species at the cost of local consumptive use. Anti-poaching enforcement efforts did not of course stop, but they ceased to be prioritised or actively promoted by major international donors.

In recent years there has been renewed interest in hunting as a conservation threat, centring around an appreciation of the severity of the 'bushmeat' crisis of the Central and West African rainforests (Bakarr *et al.* 2001). A Bushmeat Crisis Task Force has been established, the problem is firmly on the agenda of organisations such as Conservation International, IUCN and UNEP, and even recent World Bank and GEF publications have had the temerity to call for greater investment in anti-poaching measures (e.g. Ntiamoa-Baidu 1997; Bennett and Robinson 2001; DFID 2002; Mainka and Trivedi 2002; Boyle 2003).

1.1.1 Anecdotal historical evidence

Within the historical record, there is abundant evidence of the capacity of hunting to decimate and eventually exterminate wildlife populations. Hunting has been a primary factor in many recorded extinctions, including some of the most celebrated cases such as the Dodo, the Passenger Pigeon and the Thylacine. For many commercially important species, such as whales and a host of species within the North American fur industry, successive population collapses in the face of over-harvesting, necessitating new exploitation from ever more distant regions, have been carefully documented

(Ponting 1991). Archaeological work in New Zealand and Hawaii has shown that extinction through over-exploitation was not the preserve of European colonists (Ponting 1991), and there is a strongly argued case that the loss of the vast majority of the Pleistocene megafauna was largely or exclusively the result of human hunting pressure, most noticeably following the arrival of humans in the Americas (Martin 1967). The ability of newcomers to extirpate naive prey, typically on islands of limited size, is undisputed, but does not necessarily imply that such events are particularly relevant to the modern world.

1.1.2 Systematic comparative evidence

Many of the species on the current IUCN Red Data List, including 34% of threatened mammals (IUCN 2000) and 88% of threatened Galliformes (McGowan 2002) have exploitation listed as a threat, but this is a subjective designation and does not provide an assessment of the relative importance of hunting in comparison to other listed threats.

Two lines of objective evidence, the strong taxonomic bias in recorded extinctions (Gaston and Blackburn 1997; Russell *et al.* 1998) and nested patterns of extinction on islands (Bolger *et al.* 1991; McDonald & Brown 1992; McKinney 1997; Hager 1998), suggest that there is regularity in the extinction process, however, and have encouraged comparative studies aimed at their elucidation. Studies of actual extirpations have concerned local extinctions of species on islands or effective islands formed by remnant habitat fragments or protected areas. These have mainly documented disappearances of small, short-lived species within timescales of a few years (e.g. Simberloff and Gotelli 1984; Laurance 1991), but some have looked at local extinctions of large vertebrates on land bridge or habitat islands formed since the end of the last ice age (e.g. McDonald and Brown 1992; Foufopoulos and Ives 1999). More recently, since Mace and Lande (1991) first sought to provide objective threat criteria for the production of IUCN Red Data Lists, red-list categories have been used as a metric of extinction risk in a number of comparative studies (e.g. Bennett and Owens 1997; Mace and Kershaw 1997; Purvis *et al.* 2000).

The problem is that these studies generally focus on autecological characteristics which make species intrinsically extinction-prone, rather than on extraneous sources of threat. The few exceptions, which relate patterns of species decline to human activities (Kerr and Currie 1995; Channell and Lomolino 2000), do so only in very broad terms, concluding that decline rates are sensitive to metrics of human density or economic activity. Biological characteristics likely to make species vulnerable to hunting pressure include large body size, low reproductive rates, small population sizes, and a host of behavioural factors, such as aggregation and the ability to learn new avoidance behaviours.

In a literature bedevilled by confounded explanatory variables, taxonomic non-independence and selectivity, and even philosophical differences over the appropriate processes to examine, there is

broad, if not unequivocal, support for the importance of these factors in predisposing species to extinction. Studies supporting a role for body size include Pimm *et al.* (1988) (although their results are disputed by Tracy and George (1992), Haila and Hanksi (1993) and Vucetich *et al.* 2000), Bennett and Owens (1997), Purvis *et al.* (2000) for primates, Sullivan *et al.* (2000) and Gaston and Blackburn (1995), and those failing to find a significant role include Foufopoupos and Ives (1999) and Davies *et al.* (2000). Pre-1996 findings are conveniently reviewed by Gaston and Blackburn (1996). For fecundity, Bennett and Owens (1997) find in favour, but Purvis *et al.* (2000) suggest that its importance is limited. Small population size, or in its absence some other metric of rarity, such as range size, endemism or low abundance, is almost always significant (Diamond 1984; Simberloff and Gotelli 1984; Thomas and Mallorie 1985; Happel *et al.* 1987; Pimm *et al.* 1988; Bolger 1991; Thomas 1991; Given and Norton 1993; Mace and Kershaw 1997; Foufopoulos and Ives 1999; Manne *et al.* 1999; Davies *et al.* 2000; Purvis *et al.* 2000 – for primates; Gaston and Blackburn 1996), although the universality of even this result is challenged for carnivores (Purvis *et al.* 2000; Woodroffe & Ginsberg 1998). Unfortunately, low reproductive potential and rarity confer vulnerability to virtually every threat process imaginable, and so imply little about the importance of hunting. There is also a tautology in using red-list categories largely based on rarity as the metric of extinction risk. Whilst body size may not be as widely implicated as conferring sensitivity to other threat processes, it is also highly correlated with fecundity and natural abundance. Behavioural factors have been discussed at length (Reed 1999), but the difficulty of classifying them means that they are rarely included in quantitative studies.

To find clear evidence of the importance of hunting in threatening species with extinction, we need to tease out the effects of different threat processes, i.e. to identify those species which have declined in excess of the rate of loss of their habitat, and for which the introduction of novel competitors, predators or parasites has not been implicated. Whilst this remains to be done systematically, Kerr and Currie (1995) have at least made a start. In a comparative study of 90 countries, they found that the degree of threat to bird and mammal faunas was not closely related to the extent of habitat loss, but the threat status of the mammal fauna closely correlated with the extent of PA coverage, suggesting that the activities occurring within the habitat are more important than its simple presence.

1.1.3 Contemporary field observations

Although widespread quantitative data are largely lacking due to the problems of surveying low density populations in closed habitats, an overwhelming body of conservationists report that observation of large animals and their sign are extremely scarce throughout vast areas of tropical forest, certainly more so than could be explained simply by increased vigilance amongst species affected by hunting (e.g. Redford 1992; Hill *et al.* 1997; Peres 2000a). On a regional level, the situation is perhaps most severe in mainland East and Southeast Asia, where high population densities, new access routes into remaining forest and very high prices for some wildlife products have decimated populations even

where sizeable tracts of habitat remain. The dismal state of Indochina's megafauna, as summarised by Duckworth and Hedges (1998), contrasts with earlier claims that the wildlife spectacle of the Cambodian savannah rivalled those of Africa (Wharton 1957). In Lao, the sighting rate of Common Muntjac by professional wildlife survey biologists averages about 1 per man-month (Duckworth *et al.* 1999). These observations have stimulated research into the hunting practices of forest communities in Asia, Africa and South America, with typically dire conclusions in regard to its sustainability (Wilkie *et al.* 1998; Wilkie and Carpenter 1999; Robinson and Bodmer 1999; Robinson and Bennett 2000b; Peres 2000a; Fa 2000; Noss 2000; Bennett *et al.* 2000; Fimbel *et al.* 2000; Leeuwenberg and Robinson 2000).

In parallel to the historical data on the geographical spread of the whaling and fur industries (Ponting 1992), a number of recent studies have noted the strong spatial aspect to patterns of hunting and harvesting of resources exploited by local people in developing countries. Harvesting intensity is found to be much higher, and/or exploited population densities much lower, closer to settlements and major transport routes for hunting in tropical forests (Wilkie 1989; Wilkie and Curran 1991; Peres and Lake 2003; C. Chin pers. comm.), artisanal freshwater fisheries (Petrere 1986), and NTFP harvesting (Nantel *et al.* 1996; Ntamag 1997; Aoworth *et al.* 1998; Abbott and Mace 1999; J. Ghazoul pers. comm.).

1.1.4 Why now?

Massive depletion of wildlife populations is not a new phenomenon, and the pressures which have fomented the current crisis – availability of new hunting technologies, increased access to remote areas, and increased demand for wildlife products due to population growth and urban prosperity – have grown steadily over recent decades. So why has attention suddenly turned to the problem? The answer probably has much to do with the politics of conservation. In the biodiversity era, undue concentration on a taxonomically limited range of species commonly targeted by hunters has not been politically correct. To some extent the new conservation rhetoric outstripped reality and traditional activities continued under the guise of keystone/indicator/flagship/umbrella species concepts – the diversity of terms perhaps reflecting the desperation with which justification was sought. A focus on big and charismatic species has always continued within public fund-raising; even when adverts talk of several species being lost each day, based on extrapolations of the numbers of minute tropical beetles and their denizens, the pictures that accompany the commentary are almost always, and rather disingenuously, of tigers, killer whales, etc. But there has been a genuine shift in attitude, and many amongst the current generation of conservation practitioners were schooled according to the orthodoxy that habitat conservation was the paramount concern; look after the forest and the animals will look after themselves.

Possibly the revival of concern about hunting represents the return swing of the pendulum as this new generation have discovered for themselves that a change in rhetoric has not abolished an old problem.

In cases of large-scale commercial exploitation for international trade, the problem could not be ignored, but it may have taken more bravery to focus on diffuse local hunting as a major conservation concern, and it is noticeable that the first discussion of the 'empty forest' was still couched in holistic, habitat-friendly terms (Redford 1992). Probably the amount of attention currently being shown to the Bushmeat Crisis has much to do with the vaunted position of the African megafauna within the public consciousness, over that of its far more beleaguered Asia counterpart.

Whatever the divination of the specific timing, it does not undermine the validity of the general observations of very low and spatially-structured prey densities. The following sections begin to explore the validity of the inference that these density patterns imply a high risk of extinction.

1.2 Thesis structure and aims

Chapter 2 explores the implications of the two observations of section 1.1.3 – low and spatially uneven densities in harvested populations – for the sustainability of harvesting, shows how considerations of stability lead logically to a bioeconomic approach, and outlines the distinctive features of bioeconomics. Chapter 3 explores the behaviour of a simple generic spatial bioeconomic model, derived from the elementary theoretical models of chapter 2. It demonstrates that an explicit spatial bioecomonic framework can produce a wide range of responses to various factors, and can resolve differences between the results of previous models in which not all assumptions have been formulated explicitly.

In order to test the practical application of the generic bioeconomic model, thereafter referred to as the supply and demand (S&D) model, a case study is developed for the hunting of ibex in the North Tien Shan mountain range along the Kazakh-Kyrgyz border. In the absence of much real data from the system, a complex simulation model is developed as a virtual ecology against which to compare the performance of the S&D model. Chapter 4 provides background to the case study and describes the socio-economic data collected and parameters of later models derived from these. Chapter 5 details the structure of the simulation model, and chapter 6 compares the performance of the S&D model to it under various assumptions regarding the amount of data available for its parameterisation.

Chapter 7 broadens the bioeconomic approach to analyse the cost-effectiveness of different management interventions within a simple quantitative framework. The North Tien Shan case study is again used to provide the basis for a preliminary worked example in the chapter.

Finally, chapter 8 discusses some of the emergent themes of the thesis and potential avenues for future progress.