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Trade of live wild birds: potentials, principles and practices of sustainable use

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Each year millions of birds are captured alive and removed from the wild in developing countries in Latin America, Africa and Asia. If they survive, the birds either become pets in local homes, are transported to regional markets where they are sold for the same purpose, or are exported to developed countries where they are sold to pet owners or to aviculturists who breed birds as a hobby or as a business. Birds have made colourful and loved companion animals for centuries, and trade provides legal income for local peoples in a few nations.

The national and international trade in live birds has a somewhat different character than most other uses of wild populations discussed in this book. First, birds must be kept alive after harvest from the wild to have any value, but mortality in captivity is often high (Carter & Currey, 1987; Iñigo & Ramos, 1991). Secondly, some species can be bred in captivity by aviculturists, and this could decrease the economic value of and need for birds harvested from the wild. Thirdly, there is a 'collector mentality' and secrecy about breeding techniques in captivity that pervades aviculture and has hindered it from becoming a self-sufficient enterprise (Clubb, 1992; Derrickson & Snyder, 1992). This results in continued dependence by aviculturists on import of wild stock and creates a self-sustaining market.

There are many different actors involved in the trade of wild birds, each with vested interests. Multitudes of local extractors in developing countries remove birds from the wild and sell them to dozens of middle men, who, in turn, sell them to a handful of international importers that supply a large pet industry and aviculturists in developed countries with common or rare species. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), which has been signed by 150 nations, regulates trade of species that are, or may soon become, endangered by listing them in one of the treaty's appendices (see below) and monitoring their legal trade. Each of these groups has vested interests that favour trade, including CITES, which was founded to track and regulate trade. In contrast, animal welfare groups and many conservation organisations in the countries of origin of the birds typically want an immediate stop to all bird trade. Finding themselves caught between these forces are governments, international conservation organisations and zoological parks. Only a few countries receive significant economic benefits from bird trade (Thomsen *et al.*, 1992). International conservation groups, such as the World Conservation Union (IUCN) and Worldwide Fund for Nature, have encouraged sustainable use of natural products as an approach to control trade, but have also supported decreased quotas and in some cases a moratorium on trade. Likewise, zoos have both supported trade in order to obtain birds for exhibit at reasonable prices and have discouraged it by participating in programmes to reduce the importation of wild birds. Thus the sociopolitical landscape of trade is complex, with many organisations each attempting to lobby for their own vested interests or conservation ethic.

In this chapter I review how the live trade in wild birds is implemented and examine whether it can become a sustainable enterprise. I begin by summarising the magnitude and effects of the bird trade. I then examine whether there is biological potential to sustainably harvest parrots, the group of birds most impacted on, given the current state of knowledge. Next I review what principles should guide the international trade of birds. Finally, I present evidence that suggests that trade, as currently practised, seems unlikely to conserve the species that it uses and the habitats on which they depend.

MAGNITUDE AND EFFECTS OF THE TRADE IN LIVE BIRDS

Captive breeding is the major source of individuals in trade for only a relatively few bird species: budgerigars *Melopsittacus undulatus*, cockatiels *Nymphicus hollandicus*, canaries *Serinus canaria*, zebra and Bengalese finches *Amandava subflava* and *Lonchura domestica*, most *Agapornis* lovebirds, several species of cockatoos *Cacatua*, and a number of Australian finches (e.g. *Chloebia gouldiae*, *Poephila cincta*, *Poephila acuticauda*). For most other birds, the majority of individuals in trade have come directly from wild sources, either trapped as free-flying adults or taken as nestlings.

Estimates of the annual numbers of birds extracted for international trade have ranged from 2 to 5 million individuals in the 1980s to 7.5 million birds during the peak of trade in the 1970s (Inskipp & Gamell, 1979; Thomsen *et al.*, 1992). Unfortunately, there is no monitoring system in place that can yield accurate numbers. Export and import permits for traded birds listed on CITES Appendices I (species threatened with extinction) and II (species that may become threatened if trade is not regulated) must be obtained from countries of both origin and destination, respectively. Export permits are also required for birds on Appendix III, which lists only species protected within the borders of a single nation. I analysed the numbers of birds recorded on CITES permits based on data from the World Conservation Monitoring Centre for the most recent period with complete records, 1991 to 1996.

The total number of birds reported to CITES that were traded among countries from 1991 to 1996 was 4 809 870 individuals (annual mean of 801 645 birds) of 519 species. Finches of the families Passeridae and Fringillidae comprised 70% of the trade (3 372 655 individuals of 70 species) and were exported primarily from Africa (mostly by Senegal and Tanzania, but also by Cameroon, Madagascar and Zaire), Asia (mostly by Vietnam and Malaysia) and Oceania (mostly by Indonesia and Singapore). Parrots (Psittacidae) accounted for 25% of the volume (1 215 020 individuals) and half the species (259). The greatest numbers of parrots came from Latin American countries (mostly Guyana, Surinam and Argentina, but also Nicaragua, Peru and Uruguay), and fewer were shipped from Africa. The remaining 5% of international trade was composed of 36 families and 190 species. Although finches comprise the greatest number of individuals in the trade, parrots account for the greatest monetary share of the commerce (Thomsen *et al.*, 1992).

These figures greatly underestimate the numbers of birds extracted from the wild for the pet trade. They exclude mortality that takes place during capture, while confined by trappers, when transported within the country of origin, and while confined by the exporter before birds are granted CITES permits. Iñigo & Ramos (1991) estimated that 60% of the birds extracted from the wild may perish before export for international markets. Furthermore, the demand for pet birds within many Latin American and Asian countries may be as large or larger than the international market, although little is known about the size of internal markets. To the best of my knowledge, no systematic surveys have been published that estimate the number of pet birds in any exporting country, although even the casual traveller notices that many families have avian pets. In addition, China does not report avian export levels, which may be large (Thomsen *et al.*, 1992; Yiming & Dianmo, 1999). Finally, export statistics track only the legal trade and therefore do not take into account the sizeable number of birds that are smuggled into international commerce. No firm estimates can be given for the size of illegal trade in birds, but it appears to be a profitable business because smuggled birds are thought to follow the same routes as illegal drugs.

Table 9.1. Comparison of levels of diversity, trade and threat in parrots (Psittacidae) and finches (Passeridae and Fringillidae). Endangered and threatened species are those listed by IUCN as critically endangered, endangered or vulnerable

Comparison	Parrots	Finches
No. of species	358	1379
No. of endangered and threatened species	103	90
% endangered and threatened species	28.7	6.5
% endangered and threatened species affected by trade	47.5	13.3
No. of species traded 1991–96	259	70
% endangered and threatened species traded 1991–96	12.7	1.4

Thus, on the basis of pre-export mortality, sizeable internal markets in many countries, missing data and a lucrative black market, it seems reasonable to conclude that the number of birds removed from the wild is probably two to four times the number reported to CITES. This would suggest that 1 600 000 to 3 200 000 birds have been harvested annually from wild populations for the live bird industry in the 1990s.

The impact of trade has not been equal for all traded species. Despite the large numbers of finches traded, principal problems from the trade of birds have been seen with parrots (Table 9.1). Nearly 29% of the world's parrot species are listed by IUCN as threatened with extinction (Critical, Endangered or Vulnerable categories), making this one the most threatened families of birds (Collar *et al.*, 1994). This is five times the rate of threat to finches (Table 9.1). Nearly half of the threatened parrot species are affected by trade compared with only 13% of threatened finches. Surprisingly, one of every eight threatened parrot species recently appeared in the legal international trade, whereas trade of threatened species was negligible for finches (Table 9.1). Examples of parrots now critically threatened by trade include the Spix's macaw *Cyanopsitta spixii*, the hyacinth macaw *Anodorhynchus hyacinthinus*, and the red-crowned Amazon *Amazona viridigenalis*. Most parrots are threatened by a combination of trade and habitat destruction (Beissinger & Bucher, 1992a; Collar & Juniper, 1992). Nevertheless, trade may often be as threatening to most parrots as habitat destruction because many parrots are habitat generalists. Flexible habitat use by parrots is exemplified by the large number of species that have been introduced, as a result of the pet trade, and have become established in urban habitats around the world (Wiley *et al.*, 1992).

Life history differences among species are often responsible for differential vulnerability to exploitation (Reynolds *et al.*, Chapter 7; Purvis,

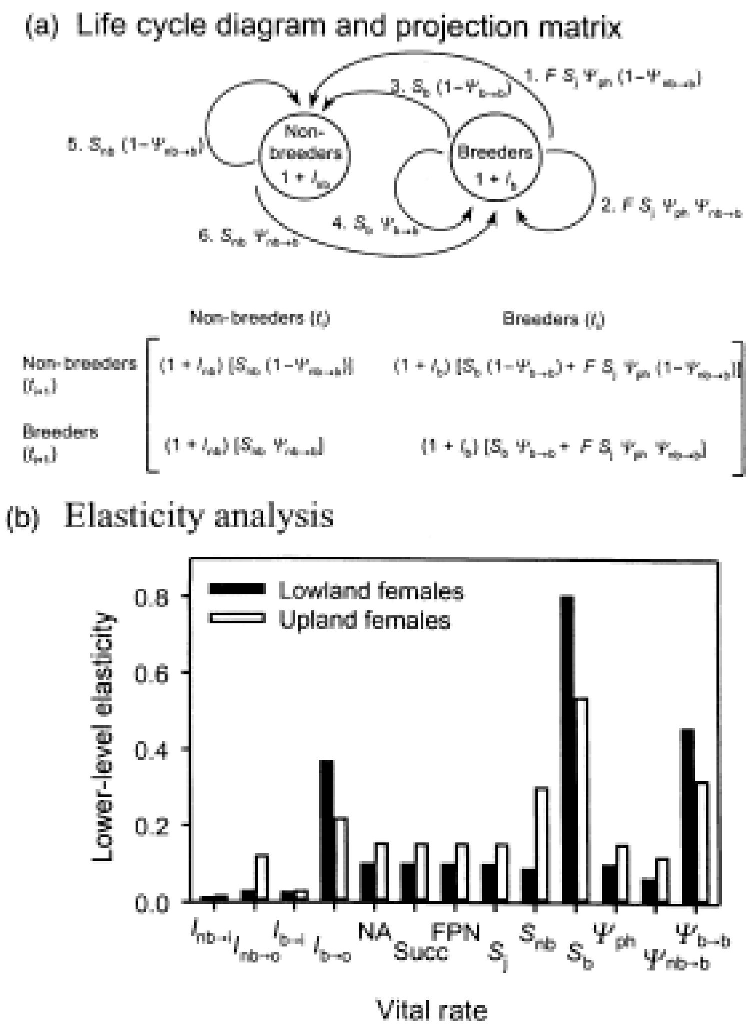

Figure 9.1. (a) Life cycle and (b) elasticity analyses of B. K. Sandercock & S. R. Beissinger (unpublished data, 2001) for the green-rumped parrotlet *Forpus passerinus* at Hato Masaguaral, Guarico, Venezuela. The life cycle diagram and the corresponding projection matrix were structured with breeder and non-breeder nodes to account for the high proportion of non-breeding males (50%) and females (20%) in the two populations (lowland and upland) that were studied (Sandercock *et al.*, 2000). Arcs 1 and 2 describe fecundity of breeders (F), weighted by the subsequent survival of fledglings produced (S_j), juvenile site fidelity (Ψ_{ph}) measured as the probability that a surviving juvenile remained in its natal population or dispersed to the other study population, and the probability that juveniles become breeders ($\Psi_{nb\to b}$) or non-breeders ($1-\Psi_{nb\to b}$) by the next prebreeding census. Fecundity was calculated as the product of the percentage of nests that fledged at least one young (SUCC), the number of young fledged per successful nest (FPN), and the number of nesting attempts per year (NA). Arcs 3 and 4 parallel arcs 1 and 2, but are transition rates of adults, consisting of survival rates of breeders (S_b) and their likelihood of remaining a breeder ($\Psi_{b\to b}$) or becoming a non-breeder ($1-\Psi_{b\to b}$). Finally, arcs 5 and 6 are life history pathways of non-breeders, and are composed of survival of adult non-breeders (S_{nb}) and their breeding status in the following year. Per capita immigration rates were incorporated into the breeder (I_b) and non-breeder (I_{nb}) nodes separately for juveniles moving from one population to another from within the study area (i) and for those entering from outside the study populations (o).

Table 9.2. Comparison of the typical life history traits of parrots (Psittacidae) and finches (Passeridae and Fringillidae)

Life history trait	Parrots	Finches
Clutch size	Small	Large
No. of broods	Single	Multiple
Nest type	Cavity	Open cup or hanging
Age of first breeding	Delayed	Rapid
Adult survivorship rate	High	Intermediate
Primary habitat required	Forest	Grasslands

Chapter 8) and may explain why parrots are more susceptible to overharvesting than finches (Table 9.2). Annual fecundity of parrots is much less than finches by virtue of a smaller clutch size and fewer broods per year. Although parrots can use a variety of altered habitats for foraging, they typically nest in tree cavities, which are often in short supply. This may limit opportunities for nesting and result in large proportions of non-breeding males and females in parrot populations (Beissinger, 1996; Sandercock *et al.*, 2000). A large non-breeder population could create a surplus for harvesting, but may also result in a low rate of population growth. Finches usually make open cup or hanging nests, and do not require specialised structures for nesting. Furthermore, medium- and large-sized parrots may not reach an age of first breeding until two to five years of age, whereas finches usually mature within a year. Finally, most parrots are long-lived compared with finches.

Elasticity analyses of matrix population models (for a review, see Kokko *et al.*, Chapter 14) have shown that small changes in adult mortality rates have large effects on the rate of population change for long-lived species, such as most parrots, compared with small changes in reproductive success (Sæther & Bakke, 2000). B. K. Sandercock & S. R. Beissinger (unpublished data) present an example (Figure 9.1) for a small, highly fecund parrot whose demography has been intensively studied (Beissinger & Waltman, 1991; Waltman & Beissinger, 1992; Stoleson & Beissinger, 1997a; Sandercock *et al.*, 2000). Despite the fact this species lays an average clutch size of seven eggs and can nest more than once a year, which are unusual traits compared with most parrots (Table 9.2), adult survivorship was by far the most elastic matrix parameter (i.e. small changes in this parameter had the greatest impact on population change). The probability of remaining a breeder was the next most important variable. Adult survival is likely to be even more important for larger parrots and macaws that lay fewer eggs and have higher survival rates than green-rumped Parrotlets *Forpus passerinus* (Sæther & Bakke, 2000).

POTENTIAL FOR SUSTAINABLE HARVESTING OF PARROTS

To harvest populations of wild animals sustainably, the rate of harvest (h) must not exceed the rate of productivity of the population at a particular size (N), which, in the simplest models of harvesting, is the difference between per capita birth (b) and death (d) rates (Caughley, 1977; Getz & Haight, 1989; Ludwig, Chapter 2) such that

$$(b - d)N - hN > 0. \qquad (9.1)$$

The harvest rate should be set well below this level due to the effects of environmental stochasticity (Lande *et al.*, 1995; Engen *et al.*, 1997; Lande *et al.*, Chapter 4). If harvesting is mainly of adults or is equally implemented among age classes, the theory of maximum sustainable yield suggests that reducing population size to approximately one-half of carrying capacity (K) would maximise productivity (Figure 9.2a), depending on the shape of density dependence (Sutherland & Gill, Chapter 12). In the case of bird trade, sustainable yields would need to be set for each country, because that is how CITES sets export quotas.

To set harvest or export levels that are sustainable at large spatial scales for birds or other terrestrial wildlife, six areas of biological knowledge are needed (Beissinger & Bucher, 1992a):

1 *Population size and range*: Population trends must be detected, ideally by estimating population densities for different habitat types or land uses so that the effects of habitat change can be evaluated.
2 *Habitat requirements and movement*: Understanding habitat requirements, diet and ranging patterns is important for assessing the effects of landscape change on population viability. Different habitats may be needed for breeding and feeding, for different stages of development and for the non-breeding season.
3 *Resilience to human disturbance and habitat changes*: Species differ in how

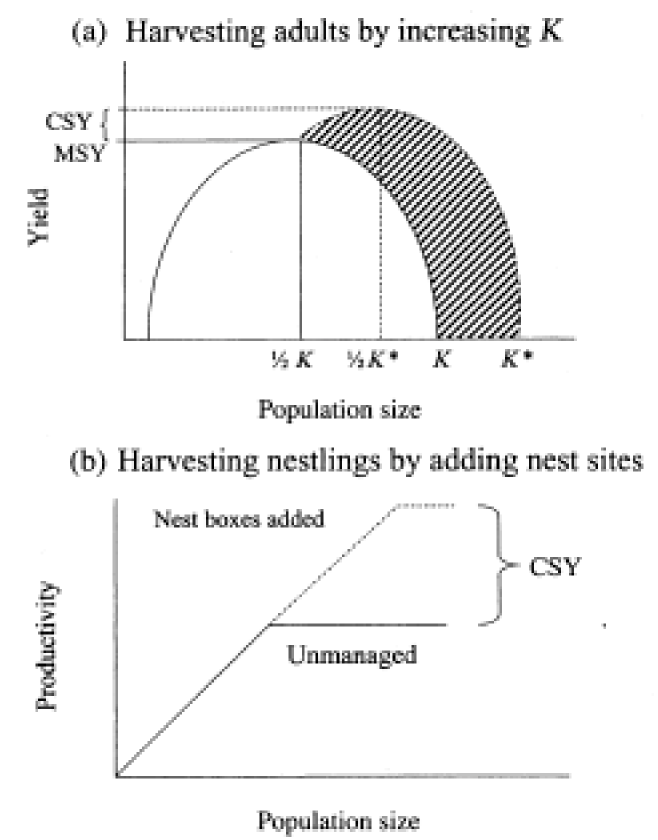

Figure 9.2. Two examples of the Conservative Sustainable Yield Model (Beissinger & Bucher, 1992a,b). (a) Comparison of harvesting of adults under the maximum sustainable yield model (MSY) and the conservative sustainable yield model (CSY), where the carrying capacity is increased to K^* by management actions. Yield is maximised at half carrying capacity for both MSY (K) and CSY (K^*). The harvest is large for MSY but only the increment between MSY and CSY is harvested under the Conservative Sustainable Harvest Model. (b) Effect of adding nest sites on the productivity and yield of nestlings from a parrot population under the Conservative Sustainable Yield Model. The unmanaged population has a large proportion of non-breeders due to nest site limitations. Productivity increases when nest boxes are added, as pairs that were unable to nest owing to lack of cavities begin to nest. The difference in productivity between the managed and unmanaged populations would be available to harvest as the CSY.

they respond to direct and indirect effects of human activities. Direct impacts of harvesting, such as abandonment of nests due to human visitation, may be easier to minimise than indirect effects that result from land use changes, such as regional shifts from grazing to agriculture.

4 *Estimates of demographic rates*: Harvesting potential is directly related to age- or stage-specific natality and mortality rates. For long-lived organisms, field studies may require 5–10 years to develop accurate estimates of these rates and longer to properly estimate their variances for use in population models (Beissinger & Westphal, 1998).

5 *Key factors that regulate populations*: Demographic factors that greatly affect population dynamics can be determined by correlation analyses using several annual life tables based on average estimates of vital rates (Varley & Gradwell, 1960) and by a variety of techniques for analysing sensitivity (Caswell, 1989).

6 *Effects of environmental variation*: Considering only averages for vital rates may lead to inaccurate estimates of harvest rates because annual variation in weather and natural catastrophes can strongly affect productivity and survivorship (e.g. Beissinger, 1986; Bayliss, 1989).

Efforts to set sustainable harvest rates for parrots and finches are greatly handicapped by a lack of good biological information for nearly all species. Although much information exists on the behaviour of parrots in captivity, they have typically proved to be difficult to study in the wild. Parrots may be noisy but they often inhabit the canopies of forests, making them hard to observe or census. Furthermore, nearly all species nest in cavities high in trees, which likewise are difficult to find and study. Most species are not plumage or size dimorphic, so the sexes cannot be readily distinguished. Because of their strong bills and hourglass-shaped legs, it has been difficult to develop adequate marking systems for banding parrots that do not result in injury to the birds (Meyers, 1995). Likewise only recently have neck-mounted radio transmitters been developed for parrots that allow detailed studies of movement to be made. This advance is important because many parrots fly long distances (> 25 km) across landscapes on a daily basis, making it difficult to determine movements and habitat requirements without telemetry. Thus few quantitative data are available on parrot demography (survival rates, longevity, recruitment, age of first breeding, annual productivity), annual population variation, diet and how it varies annually, habitat requirements, ranging behaviour, immigration and emigration, and social structure for parrots. Exceptions include the outstanding long-term studies of *Amazona vittata* on Puerto Rico (Snyder *et al.*, 1987; Meyers *et al.*, 1996), my on-going work with *Forpus passerinus* in the llanos of Venezuela (Beissinger & Waltman, 1991; Waltman & Beissinger, 1992; Stoleson & Beissinger, 1997a; Sandercock *et al.*, 2000), *Myiopsitta monachus* in Argentina (Bucher *et al.*, 1991; Navarro *et al.*, 1992, 1995; Martin & Bucher, 1993) and work done in Australia and New Zealand (Merton *et al.*, 1984; Rowley, 1990; Moorhouse *et al.*, 1999). The demography and population biology of traded finches appear to be equally poorly studied. Therefore it is not currently possible to set scientifically determined harvest quotas for any species of parrot or, for that matter, any species of bird currently traded.

Beissinger & Bucher (1992a,b) proposed a simple model for sustainable harvesting that could be used in the absence of detailed information discussed above, which is needed to set precise quotas. The Conservative Sustainable Harvest Model (Figure 9.2) suggested that if it can be demonstrated that a local population is stable or increasing ($(b-d)N \geq 0$), then any increase in the rate of population growth from increased productivity (b^*), decreased mortality (d^*) or increased carrying capacity (K^*) due to management programmes (mN) would lead to an increase in overall population size ($mN = (b^* - b)N$ and/or $mN = (d - d^*)N$), which could be harvested ($mN = hN$). Population trends and demography would need to be documented prior to the start of management programmes, and then compared with the increased rate of population growth or productivity produced from management activities. Once management begins, excess individuals produced by management could be harvested, and in theory should result in the maintenance of the population at preharvest levels. This is a cautious approach to resource use because it allows only extraction of excess produced by investments to improve the size of the population.

To apply the Conservative Sustainable Harvest Model, we must first determine which age classes should be harvested. Nestlings are the best age class for harvest in parrots (Beissinger & Bucher, 1992a,b). They adapt more easily to captivity, can be tamed and trained to talk, and their harvest has less of an impact on population dynamics than harvest of adults as discussed above. Harvesting nestlings also means that maximising sustainable harvests (hN) would not necessarily require reducing population size to one-half carrying capacity, the traditional approach to maximise sustainable yield (Ludwig, Chapter 2); instead, yields of nestlings are maximised by maximising productivity (bN) or the number of successfully nesting pairs, which would probably be accomplished by maintaining populations near carrying capacity (see also Lande *et al.*, Chapter 4). Density dependence seems unlikely to impact on the harvest of parrot nestlings in the manner in which it impacts on the harvest of adults because: (1) excess nestlings are removed before they have fledged, and (2) productivity can be increased without increasing population size by increasing the likelihood of becoming a breeder ($\Psi_{nb \to b}$ in Figure 9.1). Thus the juvenile survival rate of young that do fledge seems unlikely to be affected by an increase in population size or probability of becoming a breeder.

Productivity could be increased by management actions that increase the number of breeding pairs, percentage of nests fledging young or number of young fledged per nest. Methods to increase productivity include adding nest boxes to increase the number of nesting pairs, protecting nest sites from predators, supplementing food supplies, decreasing hatching asynchrony and deliberate multiple clutching (Beissinger & Bucher, 1992a,b). Adding nest sites is probably the easiest way to increase productivity for species that accept them, and determining the change in the number of breeding pairs should be straightforward (Figure 9.2b). Another easy and conservative way to harvest parrots and macaws would be to take advantage of the fact that most species exhibit hatching asynchrony, which leads to brood reduction of the last-hatched young (Stoleson & Beissinger, 1997b). Chicks that would normally die from brood reduction could be removed from the nest shortly after hatching, with little or no effect on population size.

Thus, if it is implemented properly and conservatively, sustainable harvesting may have potential advantages for conservationists, aviculturists, the pet industry, and local peoples. In theory, conservationists could gain by having healthy populations of wild parrots near carrying capacity, and by transmitting economic value to habitats to help to conserve them in their natural states. Aviculturists could obtain new genetic stock for their breeding programmes from birds harvested sustainably. The pet industry would have a steady but small inflow of legally imported birds already conditioned to captivity. Finally, if designed properly, the profits from these programmes could be directed to the local people in need of ways to support themselves and the economy of nations that are trying to develop.

On the basis of biological and sociological considerations of sustainable use of wildlife, Beissinger & Bucher (1992b) presented some criteria to judge the applicability of wildlife for sustainable use. It may be easier to implement the sustainable use of wildlife in systems with the following characteristics:

1 *Age classes with a low reproductive value (Fisher 1930) are harvested*: This would allow both productivity and population density to remain high

2 *Products are marketed shortly after harvesting so that long periods (e.g. years) in captivity can be avoided*: This would act to minimise losses and expenses during captive husbandry.
3 *The potential to increase productivity through management is high*: Under such circumstances, sustainable harvests can be larger.
4 *Harvested species only require a small or moderate amount of land that is under the control of one owner*: Usually social species will require less land than territorial species because individuals group closer together and often occur in higher densities (Emmons, 1987). It will be easier to set and enforce harvest limits if one land owner controls the resource rather than many that must split the control.
5 Species that complete their life cycle within the management area will be easier to monitor and manage for sustainability.
6 Species that are fecund and adapted to earlier successional stages will be easier to sustain and be less susceptible to overharvesting than species with low rates of reproduction or requiring mature forests, which are disappearing rapidly.

Sustainable harvesting of parrots fits some of these criteria. Parrots can be harvested as nestlings, and do not have to be kept in captivity for years before being marketed. In the case of some species, parrots are capable of greatly increased productivity through intensive management, and may spend their complete life cycle within a management area. The potential for death in captivity may be the major disadvantage of harvesting parrots compared with other wildlife systems. Also many parrots have a relatively low reproductive potential and may be more susceptible to overharvesting than more fecund species (Bucher, 1992).

In conclusion, the above discussion suggests that there may be good potential to harvest some species of parrots from the wild for trade. In the next section, we move beyond potential to examine whether or not the harvest of wild birds for exportation is desirable.

PRINCIPLES TO GUIDE THE INTERNATIONAL TRADE IN LIVE BIRDS

The issues relating to the governance of the international trade in live birds are complex and transcend biology. Political, social and economic factors each affect the conditions under which trade has been or should be implemented. Little serious thought has been given to the implications of these factors in the international trade of live wildlife, including the role of

In recognition of the pivotal role played by the USA as the largest importer of live birds in the world (Thomsen *et al.*, 1992) and the importance of legislation that was about to be introduced to the US Congress to decrease the importation of birds in 1990, the American Ornithologists' Union (AOU) formed a committee of ornithologists concerned with bird trade issues (Beissinger *et al.*, 1991). The charge of this subcommittee was to review the problems associated with the bird trade and to make recommendations for effective ways of dealing with the detrimental influences of trade on wild bird populations.

If there is to be a trade in live exotic birds for commercial purposes, it is important to state what conditions should be fulfilled. Focusing primarily on the implications for conserving wild bird populations in the country of origin as well as in North America, the committee developed seven principles to provide the basis for guiding an international trade in live birds (Beissinger *et al.*, 1991).

1 *The importation of live exotic birds should be sustainable, and should not pose risks for wild populations of species that are imported*: There is no justification for commercial endeavours that contribute to the extinction in the wild of a species, as discussed earlier for several parrots as the trade is currently practised. Export quotas for most countries need to be lowered drastically. Commercial harvesting of any of the 1183 bird species listed by IUCN as threatened with extinction is likely to increase their chances of extinction and should be prohibited.
2 *The importation of live exotic birds should not pose significant risks of disease transmission to native species, poultry or other birds held for legitimate purposes such as exhibition or scientific study*: Quarantine regulations around the world are, for the most part, unlikely to stop the importation of potentially threatening diseases. For example, all birds imported to the USA are held for 30 days of US Department of Agriculture regulated quarantine and tested only for exotic Newcastle disease (velogenic viscerotropic Newcastle disease, VVND). This period is too brief to allow the detection of other slow acting pathogens, many of which have recently been imported into collections of captive birds and could potentially be transferred to native species (Cooper, 1989; Nilsson, 1990). Difficulties with this one disease alone, which caused a massive loss to the poultry industry in 1972 and has continued to strike periodically since then (Nilsson, 1990), suggests that enormous economic losses may occur if worldwide shipments of birds continue and current quarantine procedures are not changed to require much longer quarantine periods and testing for many more diseases. The massive extinctions of native Hawaiian birds, caused in part by diseases to which many species had no prior exposure, exemplify the potentials of exotic diseases to have tragic consequences (Warner, 1968; Van Riper *et al.*, 1986).
3 *The importation of live exotic birds should not result in significant potentials for the establishment of feral populations*: Uncontrolled experiments in introductions of exotic bird species are already underway around the world as a result of continued international trade. Large numbers of exotic birds establishing themselves, so far mostly in urban environments but perhaps eventually spreading to natural ecosystems, may cause native populations to decline (Wiley *et al.*, 1992).
4 *The importation of live exotic birds should be consistent with national policies concerning the use of native species*: To be ethically consistent, the trade in live exotic birds should be regulated by nations in the same manner that they regulate commercial uses of native wildlife. For example, the USA has prohibited most commercial uses of native wildlife species. Legal forms of utilisation of wild birds, for example sport hunting and falconry, are carefully regulated, require licenses, and require that wild populations of game birds or raptors be managed in a sustainable manner. Exotic birds were largely exempt from US regulations until the passage of the Wild Bird Conservation Act of 1992. So, although it is illegal to market or hold native bird species, except under permit, it is quite legal to practise these same activities with most non-native birds without a permit. This poses unfortunate ethical inconsistencies in the treatment of wildlife species.
5 *The trade of live exotic birds should be governed by regulations that are economically feasible, practically enforceable, simple, and effective. Regulations should not preclude scientific studies of birds in captivity, international recovery efforts, or public exhibitions for educational purposes*: Complicated regulations imply complicated bureaucracies and significant expense, and are susceptible to failure because of underfunding and difficulties in addressing complexities. Simplicity in regulations is an important goal.
6 *Captive breeding of exotic species for aviculture should be self-sustaining (i.e. without requiring the continued importation of wild-caught birds) and be conducted humanely*: The importation of wild birds for commercial aviculture is fuelled in part because it is often less expensive for aviculturists to import adult wild-caught birds and begin production immediately than to wait for years for captive-reared juvenile birds to

become mature (Clubb, 1992). Instead of supplementing captive birds with wild imports, private aviculturists must begin to adjust their practices towards the goal of self-sustaining captive populations, including better coordination of studbooks to maintain genetically viable captive gene pools.

7 *Captive breeding of exotic birds as a conservation strategy should be pursued only as a last resort, and only as part of internationally recognised and structured programmes*: The promotion of captive breeding as conservation is sometimes a rationalisation for keeping exotic birds in captivity. Captive breeding for conservation should be fully integrated with preservation and reintroduction efforts, conducted within the native range of the species, and internationally coordinated (Derrickson & Snyder, 1992). The many problems associated with captive breeding argue for using this technique with great discretion (Snyder *et al.*, 1996).

In conclusion, the seven principles discussed above provide a different perspective on trade that is not apparent when considering only the potential for sustainable harvest of birds in the preceding section. While harvest for the trade has the potential to offer certain benefits to exporting countries and aviculturists, there are a variety of reasons discussed above why trade in wild birds might not be desirable or advisable for importing countries. In the following section I examine how the trade actually functions in practice.

BIRD TRADE IN PRACTICE

Two factors work at different spatial scales to affect how the trade of birds is actually practised. First, market forces far from the source of the birds are so strong that it is attractive for local people to poach birds for the trade. In a unique meta-analysis, Wright *et al.* (2001) present data on poaching and mortality rates of 4024 wild nests for 21 species of parrots in 14 Neotropical countries. The average rate of poaching was 30%. Six studies reported no poaching and four studies found > 70% of the nests had had their young robbed. Mortality from poaching was higher than mortality due to natural causes in species that were poached. Poaching was significantly higher in unprotected sites than in protected sites. The rate of poaching was unrelated to the conservation status (i.e. IUCN rank). However, inexpensive species selling for less than $500 on the US retail market had lower poaching rates than those selling above that value. Because the demand far exceeds the capacity for breeders to produce exotic birds, there is great

impetus to poach birds from the wild, where they may be sold as pets or falsely entered into the trade as captive-bred or sustainably harvested individuals.

Secondly, the practice of sustainable harvesting would require a degree of local control over harvests that is difficult and expensive to achieve. Presently no marking system, including closed-ring banding schemes, can reliably distinguish legal from illegally harvested birds, or identify illegally harvested birds that are 'laundered' through harvest programmes. Reliably distinguishing between legally and illegally harvested individuals requires a well-documented pedigree and tissue samples for DNA analyses. Without strong controls, attempts at sustainable harvesting could increase conservation problems rather than solve them. Most countries realise that they are incapable of controlling harvest of live birds and do not permit birds to be harvested from the wild for export or for national pet markets.

The USA recognised that, as the largest single importer of live wild birds (Thomsen *et al.*, 1992), it bore a responsibility for finding a solution to unsustainable use in many exporting countries and to the smuggling of wild birds out of countries that prohibited trade. The Wild Bird Conservation Act (WBCA) of 1992 was enacted to decrease the importation of wild birds for the pet trade. The act prohibits only importation of birds listed on CITES Appendices I and II, unless the birds come from licensed captive breeding facilities or sustainable harvesting programmes. These two appendices include most endangered and threatened species and all parrot species. The Act does not regulate other species and excludes importation of birds used for scientific study and zoological parks, as well as all game birds. The Act was acceptable under the General Agreement on Tariffs and Trade (GATT) that promotes free trade, because species that are prohibited from importation have already been identified by an international treaty (CITES).

Importation of live birds into the USA declined drastically after the WBCA took effect in October 1993 (Figure 9.3). The total numbers of live birds imported into the USA dropped from an average of 150 000–200 000 per year in the 1980s and early 1990s to an average of 3500 birds per year from 1994 to 1997. Annual levels of legal import to the USA of psittacines, which mostly came from New World countries, declined from > 100 000 annually to hundreds of birds. A shift of Latin American parrots to markets in other parts of the world apparently has not occurred, and the total numbers of legally traded parrots has declined radically (Figure 9.3). Finches, on the other hand, were not greatly affected by the change in US laws. Although the number of finches imported into the USA declined

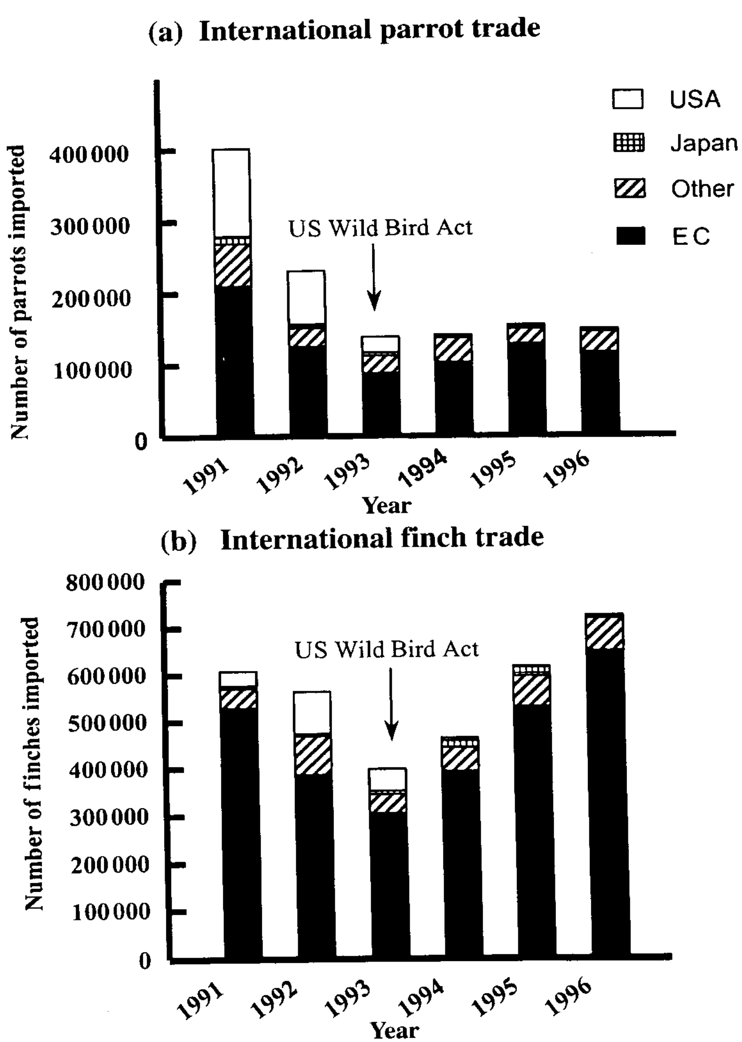

Figure 9.3. The annual numbers of (a) parrots and (b) finches in the international trade based on CITES permits issued from 1991 to 1996 for the USA, Japan, European Community countries, and other countries. The USA enacted the Wild Bird Conservation Act in 1992 and it came into effect in October 1993.

dramatically from around > 50 000 per year to fewer than 3000 per year, the USA represented only a small market for finches compared with countries in the European Community (Figure 9.3). The source of most finches in the international trade is Africa and Asia. Finches appear to have found alternative markets in the European Union that are closer to exporting countries than is the USA. As a result, total trade in finches has remained as high or higher than it was before the WBCA came into effect (Figure 9.3).

There is not yet enough information to determine the effects of the WBCA on wild bird populations. It seems likely that the WBCA will decrease harvesting rates of parrots. Wright *et al.* (2001) found that poaching rates of Neotropical parrots were significantly lower after the enactment of the WBCA. However, no systematic surveys are available to indicate trends of wild populations of parrots or finches to determine whether populations have started to recover.

CONCLUSIONS

The international and national trade in live birds is a multimillion dollar industry that threatens rather than conserves birds. Although there is potential to harvest birds for the pet trade in a sustainable manner, harvest quotas are based on poor science. Furthermore, biological principles suggest that shipping birds around the world is unwise. Finally, poaching is pervasive as the trade is currently practised, and difficult to control. Only if sustainable harvesting can lead to robust bird populations and habitat preservation will giving a market value to birds by trading them achieve a conservation purpose. In the face of pressures from current unsustainable harvesting, most attempts at sustainable harvesting seem likely to fail.

Several changes in CITES are required to recreate a trade that conserves birds and ecosystems. First, to avoid the problem of introducing exotic species and diseases, CITES would have to switch its appendices from long 'dirty lists' of species that are too threatened to harvest to short 'clean lists' of species that are safe to import and whose quotas have been scientifically set at conservative levels. Secondly, international and national regulation of harvest of birds must shift from the use of national quotas to local harvest quotas. National quotas do not tie harvest levels into local conditions and provide no impetus for ecosystem conservation, because they mostly benefit economic interests that lie outside the region and that lack any commitment to sustaining the birds or their habitats. Quotas developed on a site-by-site basis, such as for a particular ranch or management area, would directly connect harvest levels to local population changes and habitat conditions.

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