

# Feeding dragons in Komodo National Park: a tourism tool with conservation complications

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## Abstract

Large carnivores are key visitor attractions in protected areas, but are difficult to see. Thus, supplementary feeding is sometimes used to attract them to viewing sites. Such intervention is contentious but its effects have rarely been examined. This paper analyses a case study of supplementary feeding in Komodo National Park, Indonesia. Using data from daily and annual Komodo dragon censuses, feeding records and financial accounts, the effects of feeding and its cessation on dragon numbers, tourist viewing opportunities and local community benefits were examined. Regular feeding caused dragon numbers to increase at the feeding site, but not year-round. Cessation of feeding caused numbers to decline again to natural levels. However, tourists were less likely to see dragons at the feeding site after cessation, and local community revenues declined with the loss of a market for goats. Solutions lie in finding less intrusive means for tourists to view dragons, and enabling local people to become involved in tourism through training, recruitment and the development of alternative markets.

## INTRODUCTION

Tourism is a significant feature of protected area conservation (IUCN/UNEP/WWF, 1980; McNeely & Miller, 1984; McNeely, 1993). This is particularly so where visitor attractions include charismatic megafauna such as the mountain gorillas of Bwindi, the giant tortoises of Galapagos, the tigers of Royal Chitwan and the multitudinous assemblage of large mammals in savanna parks throughout sub-Saharan Africa (Goodwin & Leader-Williams, 2000).

Protected area tourism has long been promoted as an ecologically benign means of generating revenues at both national and local scales (Runte, 1987; MacKenzie, 1988). It is viewed as a mechanism for offsetting the operating costs of protected areas and providing benefits to surrounding local communities, which may have borne the greatest opportunity costs of protection (Boo, 1992; Giannecchini, 1993; Goodwin, 1996; Goodwin *et al.*, 1998; Walpole, Goodwin & Ward, 2001). Tourism can be a mechanism for conservation by enabling wildlife to demonstrate tangible value simply by its existence as a visitor spectacle.

Managing tourism in protected areas, however, requires trade-offs. To ensure a continuing stream of visitors and hence a continuing source of revenue for parks and the surrounding communities, protected area man-

agers must provide opportunities for visitors to observe the attractions that have brought them there. Establishing roads, footpaths or viewing stations is common practice. In some cases artificial means may be used to attract animals to places where they may be easily observed, such as the use of boreholes to provide drinking water (Potts, Goodwin & Walpole, 1996). Equally, wildlife may be provided with food as a means of attracting them to a particular location (McDougal, 1980). This is a popular practice for viewing large predators. Animals such as lions, cheetahs, leopards and tigers are amongst the most popular and sought-after visitor attractions in protected areas (Gakahu, 1992; Goodwin & Leader-Williams, 2000). However, by their generally elusive nature and relatively low population densities they are often the most difficult animals to observe. As a result, supplementary feeding has been used to facilitate predator viewing, including that of bears in Yellowstone National Park, tigers in Royal Chitwan National Park and Komodo dragons in Komodo National Park, at designated viewing areas.

The use of artificial means to attract or concentrate wildlife in areas that are accessible to the public has its drawbacks. Pumping water to artificially increase herbivore density can result in altered and degraded habitats (Goodwin *et al.*, 1998), whilst feeding carnivores could result in increased intraspecific aggression, nutritional dependency on the source of food, or a danger of habituated animals attacking humans in search of food (McDougal, 1980; Tyack, 1996). Furthermore, using

artificial methods conflicts with the perceived role of protected areas in the maintenance of populations and habitats in a significantly unaltered state, and may be regarded as unpalatable or unnatural by some visitors.

Intervention such as that described, to ensure that visitors observe the animals they seek, is a contentious issue. However, little published evidence exists describing the problem or solutions to it. Here the issue of supplementary feeding of Komodo dragons in Indonesia is examined. Regular feeding was carried out until 1994. The benefits and costs are assessed, both of feeding and its subsequent cessation, from the perspectives of (1) the animals, (2) the visitors and (3) the local community. Based on these findings, a number of recommendations are suggested for more sustainable tourism management that are of relevance to protected area tourism elsewhere.

### SITE PROFILE

Komodo National Park (KNP) ( $119^{\circ}30'$  E,  $8^{\circ}35'$  S) is located in the Lesser Sunda Islands of Indonesia, in the province of East Nusa Tenggara. Lying in the Sape straits between Flores and Sumbawa, KNP comprises the two substantial islands of Komodo and Rinca, the three smaller islands of Padar, Gili Dasami and Gili Motang, together with dozens of small offshore islets. The straits between the main islands and all waters within 1000 m

of shore are also contained within the boundary of the park (Fig. 1). The total area of KNP is 1730 km<sup>2</sup>, of which 35% is terrestrial and 65% is marine (Sumardja, 1981; Robinson & Bari, 1982; Walpole, 1997).

KNP is best known for the Komodo monitor (*Varanus komodoensis*) known locally as 'ora' and colloquially termed 'Komodo dragon'. Discovered in 1910, its total population is not more than 3000 individuals, with a very limited distribution. It is found only on the islands of Komodo, Rinca, Gili Motang and Gili Dasami and in certain coastal regions of western and northern Flores. The species is probably extinct on Padar, where it was last seen in 1975 (Lilley, 1995). It is the largest living lizard, with males generally weighing up to 70 kg and sometimes exceeding 3 m in length (Auffenberg, 1981). The Komodo dragon is listed by IUCN as vulnerable (IUCN, 1996).

Three village enclaves remain within KNP, two on Rinca and one on Komodo. These villages were not relocated out of KNP upon its establishment in 1980, but were allowed to remain as enclaves on the islands, with utilization rights over marine areas in KNP but no rights other than access over terrestrial areas outside the enclaves. Approximately 1800 people live in these village enclaves. Only those on Komodo Island come into contact with tourists (Hitchcock, 1993; Walpole, 1997).

Visitors have travelled to the islands since the discovery of the Komodo dragon, which remains the prin-

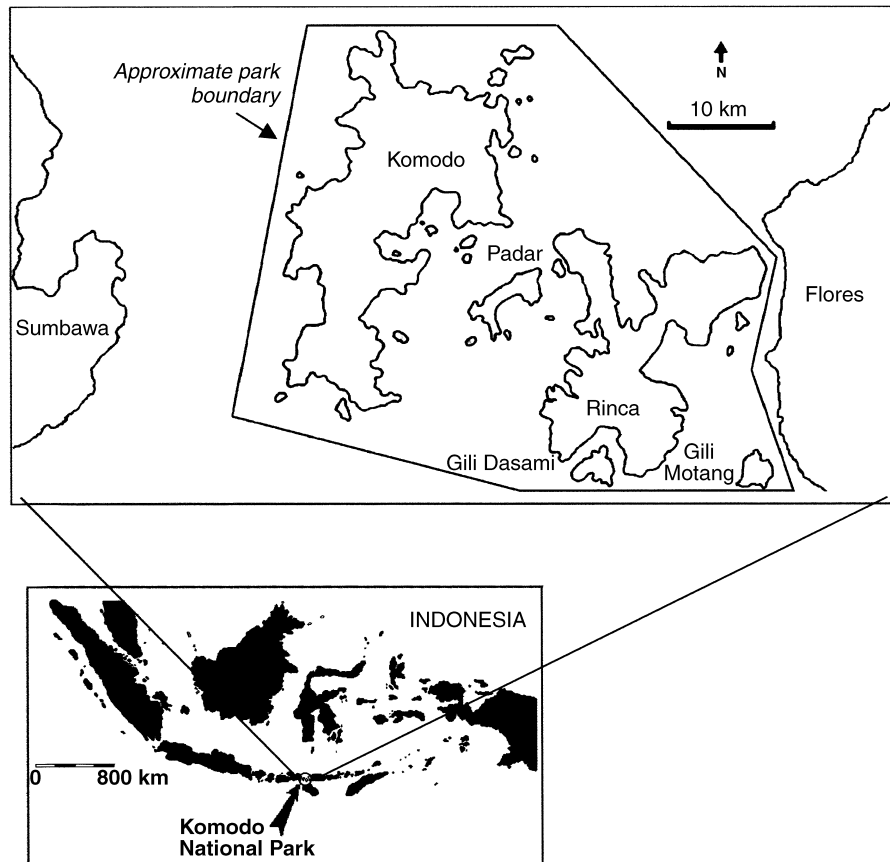


Fig. 1. Komodo National Park, Indonesia.

principal attraction. Prior to the establishment of KNP, visitors were mainly staff members of museums or zoological gardens sent to collect dragon specimens and natural history data. Tourism has grown steadily since KNP was formally established in 1980. In the 1995/96 financial year there were almost 30 000 arrivals, of which 93% were foreign visitors principally from Holland, Germany, England, North America and Australia. Almost 80% were day-trippers who each spent 2-3 h in the park to view and photograph dragons (Walpole, 1997).

Like many carnivores, Komodo dragons are difficult to observe in the wild. They do not come regularly to water, and basking sites are predominantly inaccessible to casual visitors. As a result, goats were used as bait to attract dragons, following on from scientific studies that had used bait to facilitate behavioural observations (Auffenberg, 1981). A feeding site for tourists was established in the early 1980s at a clearing above a dry stream bed, an easy 2 km walk from the visitor centre and jetty where visitors arrive and depart the island. Groups of up to 30 visitors were taken by a guide to an enclosure at the feeding site. Goats were slaughtered and tied to a tree outside the viewing enclosure to attract wild dragons, which could then be observed feeding. As visitor numbers rose, so the frequency of feeding increased, with several goats being provided during twice-weekly sessions in the early 1990s.

Concern over the potentially negative impacts of feeding on the dragons, particularly habituation and health problems, led to a cessation of feeding in August 1994. Currently tourists are still taken to the viewing enclosure at the ex-feeding site, where a residual group of dragons remains.

## METHODS

### Impact on dragon numbers at a viewing site

The staff of KNP established two procedures for monitoring the Komodo dragon population; a daily count of dragon group size at the feeding/viewing site, and an annual population census on both Komodo and Rinca. Daily dragon counts from 1990-1996 were compiled into monthly averages to examine the effect of supplementary feeding and its cessation on group size at the feeding site. Annual censuses were conducted by KNP staff each October from 1993-1995. In each census, a dead goat was secured at several permanent plots (47 on Komodo, 29 on Rinca), and an observer placed nearby. The number of dragons visiting the bait over a 24 h period was recorded. The annual means of the data from 1993-1995 were compared with the October mean daily count at the viewing site, and with data on mean group size at carrion from Auffenberg (1981).

### Impact on dragon viewing opportunities

In order to identify whether a change in the quality of viewing took place after the cessation of supplementary feeding, the percentage was calculated of days per month

when no dragons were seen at the viewing site, from April 1990 to August 1996. Similarly, the percentage was calculated of days when only one dragon was encountered at the site. These two occurrences represent situations of decreased viewing quality since in the first no dragons are seen at the viewing site, and in the second no opportunity for viewing intraspecific behavioural interactions is facilitated.

### Impact on local benefits from tourism

The islanders of KNP have very few opportunities to benefit from tourism (Walpole & Goodwin, 2000). Opportunities are limited to providing visitor services (transport, guiding), and the sale of produce (carved dragon handicrafts and goats). The cessation of feeding removed a market for goats, and therefore represents an opportunity cost for local residents.

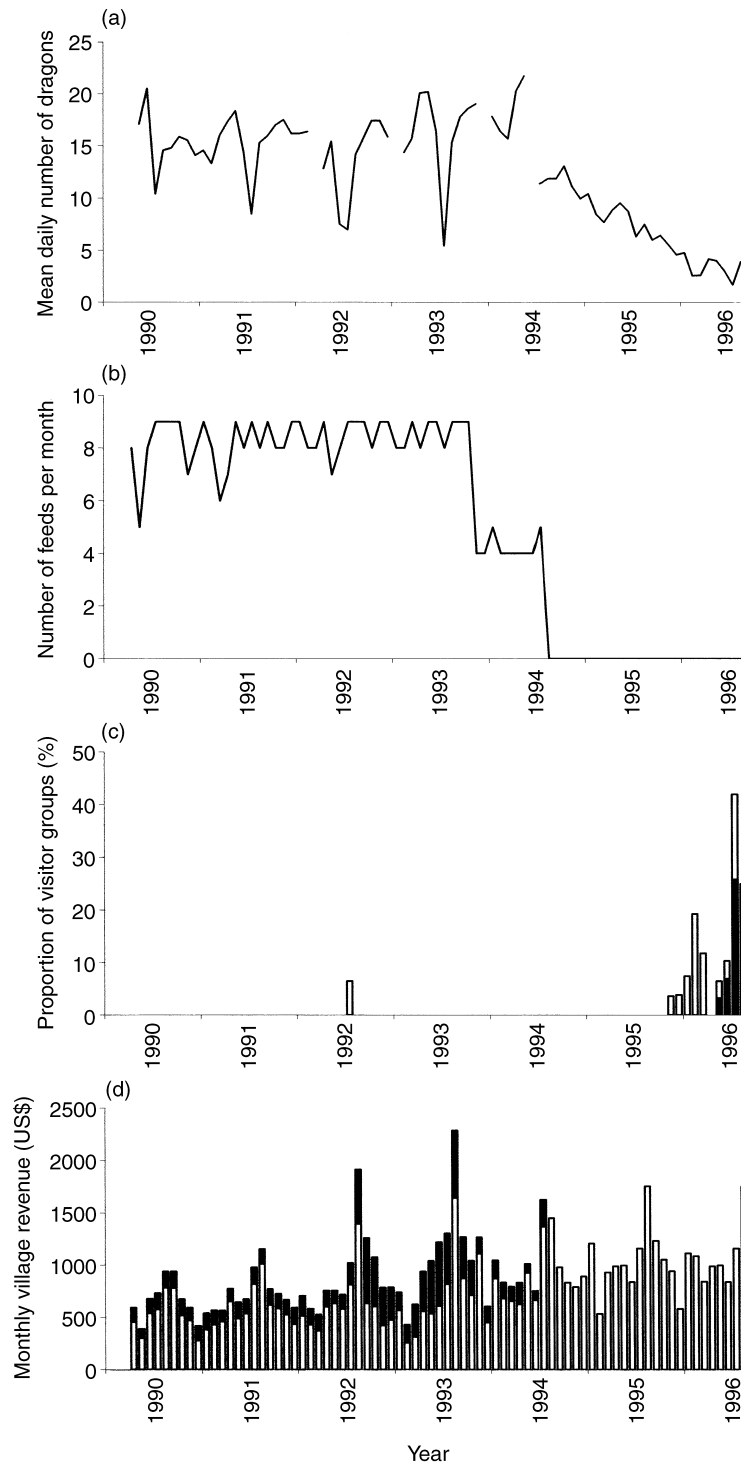
Detailed monthly accounts of the local financial benefits of tourism from transport, guiding and the sale of carvings were available for 1995/1996. These were used together with monthly visitor arrival data to estimate revenues from these sources for previous years. In addition, park records of supplementary feeding were used to estimate the revenue accruing to the villagers from goat sales during previous years. From these figures an estimate of the local opportunity costs of cessation were made.

Where conversions to US\$ have been made, the annual end-of-period exchange rates published by the International Monetary Fund (IMF) have been used. Figures have been adjusted to a 1995/1996 US\$ equivalent to take account of inflation, using IMF real effective exchange rate indices based on relative wholesale prices. The 1995 end-of-period exchange rate was US\$1 = Rp2308 (IMF, 1997).

## RESULTS

The average daily number of dragons each month at the feeding site shows two principal patterns (Fig. 2(a)). First, during the period of supplementary feeding, there was a marked seasonal pattern. A high concentration of individuals at the site for most of the year gave way to a trough each July. Secondly, and more significantly, upon the cessation of feeding (Fig. 2(b)), numbers steadily declined to below the level of the seasonal troughs witnessed during the period of feeding (Fig. 2(a)).

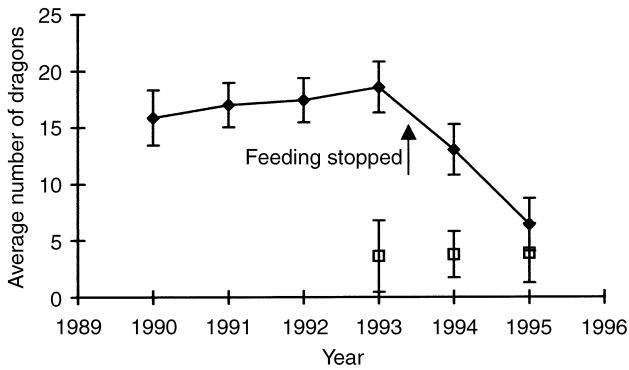
Comparison of the average dragon numbers at the annual October census with the average daily numbers at the viewing site each October (Fig. 3) revealed that (1) in the years when supplementary feeding occurred at the viewing site, a significantly higher number of dragons were seen at any one time at the site than were seen over 24 h at the annual October survey sites, and (2) after the cessation of feeding, the number of dragons seen at the viewing site fell to within one standard deviation of the average number seen at the annual census sites. Auffenberg (1981) found that on average less than four individuals were seen together at a carcass, whilst over the period of a day a mean total of seven dragons visited



**Fig. 2.** Monthly data on supplementary feeding of dragons, 1990–1996. (a) Mean daily dragon numbers each month, (b) number of feeding days each month, (c) percentage of visitor groups seeing one (□) or zero (■) dragons at the viewing site, (d) monthly revenue to the local community from goat sales (■) and other sources (□).

a carcass. The maximum number recorded visiting a carcass was 17 (Auffenberg, 1981). The regular observation of 15–20 dragons at the viewing site at any one time during supplementary feeding was considerably greater both than the densities observed before (Auffenberg, 1981), and after (Fig. 3) the period of supplementary feeding.

After the cessation of supplementary feeding, when dragon numbers at the viewing site declined, the possibility of visitors seeing only one or even no dragons at the site increased markedly (Fig. 2(c)). In July 1996 almost 30% of visitor groups saw no dragons at the viewing site.



**Fig. 3.** Average daily dragon numbers at the viewing site each October (●) compared with mean census site (□) figures, 1990–1995 (including standard deviations).

In 1995/1996, an estimated US\$1.1 million was spent by visitors to KNP in the local economy surrounding KNP (Walpole & Goodwin, 2000). Of this, only 1% (c.US\$12 600) accrued to the inhabitants of the park. There were two principal sources of revenue from tourism for Komodo island villagers in 1995/1996; the sale of wooden dragon carvings (US\$5600) and a shuttle boat service transporting visitors from the government ferry to shore and back (US\$6100). A small amount also accrued from tourism-associated labour within KNP (US\$900). The cessation of supplementary feeding removed a market for goats valued at US\$2–5000 per annum (Fig. 2(d)). As a result, the local community has lost up to one-third of its potential revenue from tourism.

## DISCUSSION

Supplementary feeding of dragons increased the group size at the viewing site. Dragons scavenge over wide areas and can travel up to 8 km to carrion, and their foraging patterns lead them to return to specific sites that can be expected to produce food (Auffenberg, 1981). It is likely that individuals from a wide area converged on the feeding site and remained in the vicinity when food was readily available. Given that sub-adults and some non-dominant adult males are transient nomads rather than habitual residents (Auffenberg, 1981), supplementary feeding may have significantly altered the dispersal pattern of these individuals, and thus their interactions with other individuals and their habitat. However, there were troughs in the number of dragons each July, suggesting a period of temporary dispersal during this time. This could be related to mating behaviour (Auffenberg, 1981). These troughs and the decrease in number after the cessation of supplementary feeding suggest that the measured effects of feeding were short term and reversible.

The increase in dragon numbers was to a level generally not found naturally, however, and may have resulted in longer term, unmeasured ecological, behavioural and physiological changes. The risk of such effects persuaded the management of KNP to discon-

tinue supplementary feeding. Subsequent to this cessation, the number of dragons observed at the viewing site declined. The decline continued to a level at which KNP management could not guarantee that visitors would see dragons at the viewing site. The divergence between the activity (walking to a viewing site), expectation (seeing 'wild' dragons at the viewing site) and experience (increased likelihood of not seeing dragons there) is likely to translate into a decreased satisfaction amongst some visitors. This in turn may subsequently affect visitor arrivals and revenue as visitors spread word of their experiences.

Furthermore, the cessation of supplementary feeding had an opportunity cost for the local community, by reducing their revenue from tourism. Although the principal rationale for KNP is protection of the Komodo dragon and its environment (Blower, van der Zon & Mulyana, 1977), it is important to recognize the value of involving local communities in the benefits that flow from protected areas (McNeely & Miller, 1984; Goodwin, 1996; Walpole *et al.*, in press). The situation that has arisen, of the tourism experience and local benefits both being tied to supplementary feeding, is a product of *laissez-faire* development. Supplementary feeding became the cornerstone of a system that evolved to provide rapid access to dragons for quick-visiting tourists on tight cruise schedules, and which provided an opportunity for the local community to exploit tourism by providing goats for feeding. The cessation of feeding destabilised this system by decreasing viewing quality and local benefits simultaneously. The potential risks include reduced visitation and park revenues, and reduced support for conservation by local communities (Goodwin, 1996).

These problems do not comprise a case for the reintroduction of feeding, but they do suggest the need for alternative, environmentally acceptable strategies to provide quality wildlife viewing alongside additional ways for local people to benefit. Various recommendations can be made.

To facilitate dragon viewing, other means could be found to attract dragons. The park authorities are experimenting with providing piped water to the dry river valley where the viewing site is located in the hope that this will attract dragon prey species such as deer (*Cervus timorensis*) and wild pigs (*Sus scrofa*). This in turn might encourage dragons to remain in the vicinity. An alternative may be to reintroduce sporadic feeding that would encourage dragons to visit the site but would not be predictable or frequent enough for them to become habituated. It might also be possible to establish other less intrusive viewing methods, such as the provision of viewing hides close to nests or natural basking sites. Hides and watchtowers are commonly used for wildlife viewing and bird-watching worldwide, and are simple to construct (Goodwin *et al.*, 1998). Such facilities could only be visited by small groups of visitors and may necessitate longer lengths of stay by visitors, but would decrease visitor impacts and provide more natural viewing opportunities.

It is also recommended that visitors are educated about park policy and the need for less intrusive means to view dragons, as this would help to address any misconceptions that visitors may have about dragon viewing within KNP. Visitor education could be implemented in a variety of ways. Currently there are numerous sign boards within the park, and an audiovisual slide presentation was developed some years ago. Furthermore, each group of visitors receives a short briefing by a ranger before they proceed to the dragon viewing site. Each of these initiatives could be adapted and expanded to fulfill a greater educational role. It would also be beneficial to distribute literature through tour and transport operators so that visitors gain some awareness of park policy prior to their arrival at the park.

There are several ways of increasing the involvement of local communities in tourism and conservation. The main obstacles to local involvement are a lack of skills and a lack of opportunities to exploit the tourism market (Walpole & Goodwin, 2000). These can be addressed by providing relevant training programmes. Already a group of islanders have been trained to manufacture wooden dragon carvings for sale to visitors, and these are being marketed at the visitor centre on Komodo island. Cruise ship and other transport operators could be encouraged to carry such locally produced items on board to increase local access to the tourism market. Similarly, tour operators in Bali and Lombok that sell tours to KNP could serve as a network of more widespread outlets for local handicrafts, to reach an even wider market.

Local people could be given guiding, language and natural history training to allow them to be employed as naturalist guides for KNP visitors. Elsewhere it has been shown that local guides contribute more to visitor awareness and understanding than tour guides accompanying clients from outside the local area (Goodwin *et al.*, 1998). A market for the sale of meat and other fresh produce to the cafeteria at the visitor centre, or to visiting tour boats, could also be established to replace the lost market for goats used in supplementary feeding. Such an initiative for local provision of fresh produce to a hotel operator exists on nearby Lombok (Telfer & Wall, 1996). With additional training and access to capital through micro-credit schemes, local people could establish a guest house and restaurant within their village on Komodo island, so as to exploit the overnight visitor market. Community-based accommodation initiatives are developing in many ecotourism destinations, and in this case a simple adaptation of the 'losmen' or home-stay model common throughout Indonesia would suffice.

This study demonstrates the difficulties and trade-offs encountered when wildlife tourism is based on supplementary feeding. The same difficulties are likely to arise wherever artificial means are used to facilitate tourism in protected areas. The problems are not, however, insurmountable. This study has shown that addressing the concerns regarding supplementary feeding may adversely affect the visitor experience and local benefits in the short term, but these problems can be overcome.

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