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# Ritual Releasing of Wild Animals Threatens Island Ecology

Govindasamy Agoramoorthy · Minna J. Hsu

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## Introduction

Human beings have served as both accidental and deliberate dispersal agents of various species of fauna and flora for millennia, but, nonnative species of plants and animals are now appearing in new areas at a greater rate than ever before and often to the detriment of native species. In several countries people also practice various types of religious and spiritual freeing of wild animals, although very little is known of the extent of these practices and their impact on the natural environment. In this paper, we discuss how the ritual freeing of wildlife promotes an invasion of nonnative species, that is threatening the fragile island environment of Taiwan.

The term alien species refers to a species transported or established outside its native range by the activities of humans, whether intentionally or not. This definition does not imply that human-mediated dispersal of species is inherently unnatural, but it recognizes that the rate at which humans are homogenizing the world's diverse biota is occurring at a scale previously absent in Earth's evolutionary history (Williamson, 1996). For example, it has been estimated that the rate of new species establishment in the Hawaiian Islands was approximately one new species every 35,000 years prior to human arrival; it is now on the order of 20–30 species/year, which is a million-fold rate increase.

Under the Convention on Biological Diversity (2002), invasive alien species means an alien species whose

introduction and/or spread threatens biological diversity. It refers to a species, subspecies, or lower taxon introduced outside its natural past or present distribution; it includes any part—gametes, seeds, eggs, or propagules—of such species that might survive and subsequently reproduce. These organisms are sometimes called exotic, nonnative or nonindigenous species.

## Materials and Methods

We conducted a survey between 2 February and 28 November 2004 to record sightings of alien bird species in Taiwan. We surveyed different habitats such as forest, agricultural areas, villages, towns, and cities. Direct observation using binoculars (Leica 10×40) was carried out to record bird sightings after randomly searching the survey areas during mornings (06:30–10:30) and evenings (15:30 to 18:30) using roads, trails, and footpaths. We used a car in urban areas while forest areas were surveyed on foot. After sighting an alien bird species, data on the number, group structure (if found in groups), age-class, breeding status, and behavioral activities were recorded using all-occurrences sampling method (Lehner, 1996). Data on the religious sites, such as temples and their role in providing services to devotees to release wildlife into Taiwan's wilderness areas were pooled from Environment and Animal Society of Taiwan (2004).

## Results and Discussion

### A Small Island Exposed to Invasive Species

Ninety-three percent of the total population in Taiwan, adhere to one of the two major traditional religions:

G. Agoramoorthy  
Department of Pharmacy, Tajen University,  
Yanpu, Pingtung 907, Taiwan

M. J. Hsu (✉)  
Department of Biological Sciences,  
National Sun Yat-sen University,  
Kaohsiung 804, Taiwan  
e-mail: hsumin@mail.nsysu.edu.tw

Buddhism and Taoism, which stress the importance of good deeds during a person's life and decree that releasing animals back to nature is one of the ways to garner good karma. In recent years, the large numbers of wildlife that have been released into Taiwan's wilderness areas by Buddhist and Taoist believers have alarmed even animal rights organizations. People in Taiwan are estimated to spend about USD 6 million a year to set free 200 million wild animals for religious reasons, including insects, fishes, birds, reptiles, and mammals.

A total of 2,007 temples and religious institutions were surveyed and 483 (24.1%) of them provided animal releasing services, mainly in outdoor areas (Table I). Only four temples released animals within their premises (Table I). The Eastern part of Taiwan and other offshore islands released a lower percentage (13–18%) of animals compared to the rest of Taiwan (24–25%). Since there is a huge market for the ritual animal release trade, various species of birds, fishes, snakes, frogs, turtles, and even insects and monkeys are being captured from the wild by hunters or purchased from local pet markets to be released around the island's rivers, mountains, forests, lakes, and reservoirs.

#### Taiwan's Unique Natural History and Diversity

Taiwan lies on the Tropic of Cancer and is separated from the mainland China by a narrow strait, at one point only 130 km wide. It covers an area of 36,000 km<sup>2</sup> and has a population of about 23 million people. The landscape is dominated by rugged mountains with a remarkable diversity of fauna and flora. The island rose from the sea floor of the Asian continental shelf approximately four million years ago.

More than a century ago, naturalist Alfred Russell Wallace was impressed with the ecological beauty of Taiwan and wrote, "...among recent continental islands there is probably none that surpasses in interest and instructiveness the Chinese island named by the Portuguese, Formosa" (Wallace, 1880). Taiwan is a biological microcosm and one can travel from a mountain peak in

central Taiwan to a coral reef in the south in just a single day. Taiwan harbors about 4,000 species of vascular plants, 61 species of mammals, 400 species of birds, 92 species of reptiles, 30 species of amphibians, 140 species of freshwater fish, and an estimated 50,000 insect species including 400 species of butterflies (Hsu and Agoramorthy, 1997). Six national parks, 18 nature reserves and 24 protected areas have been designated to safeguard fauna and flora—the protected area covers 440,290 ha, which is 12.2% of the total land area.

#### Recent Extermination of Fauna Due to Human Disturbance

Over the last few decades, the tiny island has evolved from agricultural backwater to global technological giant, leading to environmental disasters such as dangerously polluted rivers (Agoramorthy and Hsu, 2000). Due to population growth, habitat destruction, hunting, and demand for animal body parts in traditional Chinese medicine, several species of wildlife are threatened. Some animals have already become extinct in the wild due to these pressures. For example, the only mega bat, the Formosan flying fox, *Pteropus dasymallus formosus*, previously abundant on Taiwan's Green Island, became extinct in the 1990s due to hunting, deforestation, and habitat alteration (Hsu, 1997). The largest cat, the clouded leopard *Neofelis nebulosa brachyurus*, has not been sighted for two decades and is presumed extinct. These elusive cats were trapped for their beautiful skin. The Formosan black bear, *Selenarctos thibetanus formosanus*, has seldom been seen in the wild since there is a great demand for their body parts in the traditional Chinese medicine market. The sika deer, *Cervus Nippon taiouanus*, once roamed in the thousands along the coastal plains in Taiwan until the 1960s. Large-scale hunting of sika deer started during the Dutch colonial period between 1624 and 1661, and continued until the Japanese occupation between 1895 and 1945. These elegant deer became extinct in the wild during the late 1960s due to intensive hunting and the destruction of their natural habitat for agricultural expansion (Hsu and Agoramorthy, 1997).

**Table I** Religious Places and their Role in Releasing Animals into the Wild in Taiwan

| Region | Practice release of animals |                 |                         |            | No release of animals |            |
|--------|-----------------------------|-----------------|-------------------------|------------|-----------------------|------------|
|        | Sample size                 | Outdoor release | Within property release | Percentage | Sample size           | Percentage |
| North  | 752                         | 187             | 0                       | 24.87      | 565                   | 75.13      |
| Center | 499                         | 123             | 2                       | 25.05      | 374                   | 74.95      |
| South  | 597                         | 142             | 1                       | 23.95      | 454                   | 76.05      |
| East   | 136                         | 25              | 0                       | 18.38      | 111                   | 81.62      |
| Island | 23                          | 2               | 1                       | 13.04      | 20                    | 86.96      |
| Total  | 2,007                       | 479             | 4                       | 24.07      | 1,524                 | 75.93      |

Source: Data pooled from Environment and Animal Society of Taiwan (2004)

## Silent Invasion of Alien Species and Threats to Fragile Nature

There is no perfect science to predict which introduced species will become invasive or when they will become invasive. However, there are a few broadly defined characteristics that are likely to give an organism an advantage, including a rapid growth rate, strong dispersal capabilities, large reproductive output, and broad tolerance for such variable environmental conditions as moisture, temperature, and acidity. Parties to the Convention on Biological Diversity and other international bodies have recognized the urgent need for risk analysis frameworks that will better enable prevention and management of this problem (McNeely *et al.*, 2001).

In Taiwan, the exotic mouth-breeder fish, *Tilapia* spp., sucker-mouth catfish, *Hypostomus punctatus*, and the reared slider, *Trachemys scripta*, have already infested ecosystems such as the natural rivers, lakes, and ponds throughout the island. Out of the total 75 species of exotic birds that we recorded during this study, ten species were seen to breed successfully in the wild, while eight other species have well-established breeding populations throughout the island (Table II). Taiwan's natural forest areas have already been invaded by over 200 exotic plants of which 90 commonly seen exotic plants have displaced plant species endemic to Taiwan.

These cases clearly indicate that the alien species invasion is indeed beyond control in Taiwan and will undoubtedly lead to further extinctions of endemic species, hybridism, and irreversible alteration of the genetic makeup

of biological communities in Taiwan. There is currently a lack of long-term monitoring and research data and it is therefore crucial to conduct longitudinal research and monitoring to evaluate the situation so that timely and appropriate mitigation measures can be taken. Although Taiwan enacted a wildlife conservation law in 1989, the enforcement of the provisions to crack down on the smuggling of exotic wildlife has been weak. Furthermore there is no policy to ban the practice of ritual release of animals, which at present is unregulated and unmonitored, and is certainly leading to invasions of nonnative species, which may be catastrophic to the ecological food chain if management measures are not taken immediately.

## The Global Nightmare of Invasive Species

Invasions of alien species are one of the most significant drivers of environmental change globally (McNeely *et al.*, 2001). The costs of biological invasion are measured not just in monetary terms, but also in terms of unemployment, damaged goods/equipment, power failures, food and water shortages, environmental degradation, loss of biodiversity, increased rates and severity of natural disasters, disease epidemics, and lost lives (Bright, 1998). In the United States, the invasion of alien species has been ranked second to habitat conversion as a cause of species endangerment and extinction (Wilcove *et al.*, 1998). Even the best protected nature reserves are not immune to the invasion of alien species (O'Dowd *et al.*, 2003). The decimation of native species in Guam by the brown tree snake, *Boiga irregularis*, illustrates the potential for a single invasive

**Table II** List of Alien Bird Species that are Established in the Wild in Taiwan

| Family name       | Common name/Scientific name                             | Breeding Status |
|-------------------|---------------------------------------------------------|-----------------|
| Psittacidae       | Umbrella cockatoo ( <i>Cacatua alba</i> )               | a               |
|                   | Goffin's cockatoo ( <i>Cacatua goffini</i> )            | a               |
|                   | Crested cockatoo ( <i>Cacatua galeria</i> )             | a               |
|                   | Red lorry ( <i>Eos bornea</i> )                         | a               |
|                   | Rainbow lorikeet ( <i>Trichoglossus haematodus</i> )    | a               |
| Threskiornithidae | Sacred ibis ( <i>Threskiornis aethiopicus</i> )         | b               |
| Sturnidae         | Asian glossy starling ( <i>Aplonis panayensis</i> )     | b               |
|                   | White-vented myna ( <i>Acridotheres javanicus</i> )     | b               |
|                   | Common myna ( <i>Acridotheres tristis</i> )             | b               |
|                   | Jungle myna ( <i>Acridotheres fuscus</i> )              | b               |
|                   | Black-collared starling ( <i>Sturnus nigricollis</i> )  | b               |
|                   | Vinous-breasted starling ( <i>Sturnus burmannicus</i> ) | a               |
|                   | Grey-headed myna ( <i>Sturnus malabarius</i> )          | a               |
| Passeridae        | Java sparrow ( <i>Padda oryzivora</i> )                 | a               |
| Estrildinae       | Indian silverbill ( <i>Lonchura malabarica</i> )        | b               |
|                   | Common waxbill ( <i>Estrilda astrild</i> )              | a               |
|                   | Orange-cheeked waxbill ( <i>Estrilda melpoda</i> )      | b               |
| Fringillidae      | Yellow-fronted canary ( <i>Serinus mozambicus</i> )     | a               |

<sup>a</sup> Breeding recorded in the wild

<sup>b</sup> Established and expanding successfully in the wild

species to cause significant and permanent losses to biodiversity in a relatively short time frame.

A recent study estimates that invasion of alien species costs the United States more than USD 100 billion annually (Pimentel *et al.*, 2000). There are, however, remarkably few quantitative studies of the socioeconomic impacts. Losses to agriculture alone worldwide have been estimated at between USD 55 and 248 billion a year, so it is obvious that the impact and management costs of a single invasive species can carry a price tag in the millions. For example, the golden apple snail, *Pomacea canaliculata*, that was introduced from Latin America as a high protein food source during the 1980s, caused losses to rice crops in the Philippines of about USD 1 billion a year (Naylor, 1996). Formosan termites, *Coptotermes formosanus*, introduced from South East Asia, cost an estimated USD 1 billion annually in property damage, repairs, and control measures in the United States (Suszkiw, 1998).

The Caribbean bivalve known as the Santo Domingo false mussel, *Mytilopsis sallei* is found in large numbers along the walls and floors of tidal monsoon canals in various Asian ports including in Taiwan, Japan, Hong Kong, Thailand, Fiji, and India. This bivalve forms mats of several kilometers long in some cases, and is closely related to the notorious Asian zebra mussel, *Dreissena polymorpha*, that has invaded and caused havoc in the waterways of North America (Drake and Bossenbroek, 2005). Statistics indicate imported plants and animals that have proliferated in China cost the country nearly USD 14.5 billion each year. There are currently at least 400 invasive species in mainland China that range from plants to reptiles and micro-organisms—over 100 species may have had substantial impact on the development of agriculture, forestry, animal husbandry, and fisheries.

Alien invasive species certainly pose an imminent threat to Taiwan's delicate island ecology and natural environment. Environmentalists, sociologists, educators, and the general public should be aware of the potential dangers of

silent invasion of alien species in Taiwan. Local and federal government agencies in Taiwan must act quickly to counter the unmonitored ritual release of wildlife by the public, which has been ignored for decades.

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