



Alien terrestrial vertebrates of Hong Kong: species richness, taxonomic composition and introduction pathways

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Abstract Invasive alien vertebrates have multiple negative impacts on biodiversity and impact human well-being and the economy. Hong Kong has been a major international shipping and trading hub for centuries. With less than a quarter of Hong Kong's land developed, its subtropical landscapes host rich native biodiversity. However, Hong Kong is also at high risk of biotic invasions that can threaten its native species and ecosystems. Limited systematic, published data on alien species in Hong Kong impedes our ability to understand introduction sources, pathways and patterns, which is needed to prevent future introductions and tackle the potential impacts of invasive species. We aimed to address this gap by creating and analyzing the first database of alien terrestrial vertebrates in

Hong Kong. Overall, we recorded 213 alien terrestrial vertebrate species, including 155 bird, 37 reptile, 15 mammal and six amphibian species, of which 49 are established and seven are invasive. Most of these alien vertebrate species (92%) were affiliated with the pet trade derived from captivity and were released or escaped to the wild. Cultural and religious practices had a major role in shaping the alien species composition in Hong Kong. Other introduction sources include biocontrol, agriculture or horticulture, hitchhiking on traded plants and on freight. This study provides a baseline for further monitoring, management and control of introduced alien species in Hong Kong.

Keywords Alien species · Hong Kong · Introduction pathways · Invasive species · Pet trade · Vertebrates

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Introduction

Invasive alien species have been a key driver of species declines globally (Blackburn et al. 2019), and have impacted the economy, public health, and society directly and indirectly (Adelino et al. 2021; Bando et al. 2023; Crystal-Ornelas and Lockwood 2020). Invasive alien species cause high and rising economic losses (Diagne et al. 2021; Turbelin et al. 2023). Asia had an estimated loss of USD \$432 billion from introduced species, with India and China having the highest costs (Liu et al. 2021). In China alone, invasive

alien species directly led to costs of an estimated USD \$2.40 billion and indirectly USD \$12.1 billion already in the year 2000 (Xu et al. 2006), with further increases since.

Species introductions can potentially be facilitated by wildlife trade, including the pet trade (García-Díaz et al. 2017; Smith et al. 2009). For example, 85% of 140 alien reptiles and amphibians in Florida, USA have been suggested to have originated from the pet trade (Krysko et al. 2011). Commercially traded species also often tend to be more invasive compared to untraded species. For example, while 1.7% of all ant species are recognized as invasive, the proportion increases to 10.9% among those that are traded (Gip-pet and Bertelsmeier 2021).

Several introduction pathways have been recorded for alien vertebrate species (El-Shafie 2020; Harrower et al. 2017; Saul et al. 2017), including their direct importation as a commodity, introduction through a transport vector, and natural spread from a neighboring region where the species has been introduced previously (Hulme et al. 2008). These three mechanisms are not mutually exclusive (Hulme et al. 2008), and where they co-occur, the risk of invasion for such species may be higher. For example, the Hong Kong Special Administrative Region of China (Hong Kong) is a global trading hub that is also directly connected to mainland China, greatly increasing the risk of alien species introductions.

Hong Kong's geographical location, its long trade history, free trade policy and other factors have led to its status as a major global trade hub (ADMCF 2018). Hong Kong is located on the southern coast of China and has a subtropical climate. While densely populated, only approximately 24% of Hong Kong's land is developed partly due to its steep terrain (CEDE 2015) (Fig. 1a). The remaining less modified landscapes hold subtropical forests with rich native biodiversity, including ~3300 species of native plants, 55 native terrestrial mammals, over 560 native bird species and 115 species of native herpetofauna (Fig. 1b, c). However, some of Hong Kong's unpopulated areas are also disturbed, which may favor the invasion of alien species (Meyer et al. 2021; Peh 2010). Hong Kong has four main regions that are highly interconnected, including Hong Kong Island, Lantau Island, Kowloon and the New Territories. Kowloon is connected to the New Territories, which is connected to mainland China. Since 2018, Lantau Island has been

connected to Macau via the Hong Kong-Zhuhai-Macao Bridge, a 55 km-long bridge. Hong Kong is now recognized as one of the world's largest international trading hubs for a variety of goods, including live animals (ADMCF 2018; Hatten et al. 2020). At least 24 million individual live terrestrial alien animals were imported to Hong Kong annually between 2007 and 2016 alone, of which around 4 million were imported for the pet trade (ADMCF 2018).

Pet keeping is deeply rooted in the culture of Hong Kong's community, contributing to the high demand and large volume of importation of live animals. For example, keeping live birds for their beauty and their song has been a popular leisure activity in Hong Kong since at least the 1920s (HKHM 2014). Some pet stores and markets still specialize in selling live caged birds (HKHM 2014). Traded animals can enter the wild through intentional releases and as escapees from captivity. Some are released into the wild as part of traditional practices of setting animals free (e.g., Buddhist or Taoist and other traditions) for good karma (Du et al. 2024; Shiu and Stokes 2008).

Information about invasive alien species is crucial for future conservation and management plans that aim to mitigate their impact (Roy et al. 2023). However, there are currently key gaps for Hong Kong, with only limited and dispersed information in the literature about its alien vertebrates. Historical ecological data on alien vertebrates is also scarce. One of the few published sources are the historical records of birds that date back to 1860 (Swinhoe 1861).

Knowledge gaps persist regarding introduced species composition, introduction patterns and pathways of alien terrestrial vertebrates in Hong Kong. In this study, we aimed to create the first comprehensive database of alien terrestrial vertebrates recorded in Hong Kong to address this gap. We examined taxonomic, spatial, and temporal patterns of Hong Kong's terrestrial alien vertebrate species introductions. We included mammals, birds, reptiles, and amphibians as these have more complete and verifiable records in Hong Kong compared with other groups.

Materials and methods

We defined alien species following the International Union for Conservation of Nature, hereby IUCN (IUCN 2022) as: "an animal, plant or other organism

that is introduced by humans, either intentionally or accidentally, into places outside its natural range". We recorded all alien terrestrial vertebrate species that were introduced to Hong Kong, either intentionally or accidentally, irrespective of whether they currently have established permanent populations (i.e., including casual species).

We carried out a literature search using peer-reviewed articles, grey literature, and existing databases using both Google Scholar search engine and Google search in Incognito mode. We used a combination of keywords including "invasive species", "invasion", "introduced species", "alien species", "exotic species", "non-native species", with our target taxonomic groups including "amphibians", "mammals", "reptiles", and "birds". We also searched iNaturalist for records of non-native species using the explore feature with the location filter "Hong Kong". We used filters such as "Introduced", "Research Grade" and taxonomical filters to locate only records of alien vertebrate species verified by other naturalists (Campbell et al. 2023). Additionally, we verified the species identification for all observations by examining diagnostic morphological characteristics from images provided by the users (Campbell et al. 2023; Koo et al. 2022).

When available, we used the source for each record to extract information on the species' year of its introduction, pathway, establishment status, and invasiveness. We classified the species introduction pathways following the Convention on Biological Diversity (CBD) categories, applying both the CBD broader categories and subcategories (Harrower et al. 2017), which were initially introduced by Hulme et al. (2008). The pathway categories included "release in nature", "escape from confinement", "transport-contaminant", "transport-stowaway", "corridor", and "unaided". For records that were only reported on iNaturalist, we used in our database the earliest verified observation of the species as the date of introduction. When data provided by iNaturalist was different from data reported in peer-reviewed journals or other verified databases, we used data from the latter verified published sources. For each alien species recorded, we then collated data on its IUCN Red List status and the species' native geographic distribution from IUCN Red List of Threatened Species (IUCN 2022). We excluded hybrid species which were not assessed by IUCN. For described species not assessed

in the IUCN Red List, information on native origin was obtained using peer-reviewed literature and/or other verified databases, as specified in Supplementary Table 1.

Results

Alien species richness and taxonomic composition

We recorded 213 alien terrestrial vertebrates in Hong Kong, including 155 bird species (from 43 families and 10 orders), 37 reptile species (from five families and three orders), 15 mammal species (from seven families and five orders), and six amphibian species (from four families and one order). Of the total number of alien species, at least 24 bird species, 13 mammals, nine reptiles, and two amphibian species have established self-sustaining populations, and seven species are invasive (Supplementary Table 1).

Birds accounted for 72.2% (155 species) of all alien species recorded. Among the 10 orders of Aves, passerines (Passeriformes) were the largest, with 109 species, followed by parrots (Psittaciformes; 25 species), and doves and pigeons (Columbiformes; five species). Among the 43 bird families, laughingthrushes (Leiothrichidae) had the highest species richness (18 species), followed by starlings and mynas (Sturnidae; 12 species), parrots (Psittacidae; 11 species), estrildid finches (Estrildidae; nine species) and old-world flycatchers (Muscicapidae; nine species). Of the introduced birds, 110 species have at least part of their native distribution range in Asia, 18 in Africa, 11 in Australia, 11 in Europe, and eight in America (Supplementary Table 1).

The 37 alien species of Reptilia belong to three orders, and account for 17.8% of the alien species in Hong Kong. Among these, turtles and tortoises (Testudines; 30 species) prevailed, followed by squamates (Squamata; five species) and crocodiles (Crocodilia; two species). Among the five families of alien reptiles, turtles (Geoemydidae) had the highest species richness, accounting for all 30 species from the order Testudines. Among the 32 alien reptile species with known native ranges, 22 species originated from other areas of Asia, eight originated from America, three from Australia, and one was from Africa (Supplementary Table 1).

Alien mammals accounted for 7.2% of all introduced vertebrates, and included 15 species belonging to five orders. Alien rodents (Rodentia) were the most species-rich mammalian order (eight species), followed by artiodactyls (Artiodactyla), carnivores (Carnivora) and primates, each with two species, and lagomorphs (Lagomorpha) with one species. Among the seven families with alien species, murids (Muridae) had seven species, which comprised most recorded rodents. Thirteen species were native to Asia, the domestic rabbit (*Oryctolagus cuniculus*) was native to Europe and the domestic cat (*Felis catus*) was native to Asia or Africa (Supplementary Table 1).

Amphibians accounted for 2.9% (six species) of all alien species recorded; all belonged to the amphibian order Anura and were represented by four families. Fork-tongued frogs (Dicroglossidae) were represented by three species, and rain frogs (Eleutherodactylidae), pipid frogs (Pipidae) and tree frogs (Hylidae), each had one species. Three species of alien amphibians were native to Asia, two to America and one to Africa (Supplementary Table 1).

Introduction sources and pathways

We found that the main intentional introduction pathways of alien species in Hong Kong included the release of pets, introduction for horticulture, agriculture, or biocontrol agents. Unintentional introduction pathways, included hitchhiking on plants or freight like cargo ships (AFCD 2022). Two-hundred-and-three species were introduced intentionally, one unintentionally, and nine species had unknown introduction pathways. Of the 204 species with information on pathways available, 96% (196 species) were introduced via escaping confinement, four species were released for biocontrol and horticulture, two arrived by hitchhiking on habitat material, and one arrived by hitchhiking on freight (Supplementary Table 1).

All alien bird species in Hong Kong were derived from captivity, aside of the house crow (*Corvus splendens*), which was introduced through hitchhiking on transport ships. Most alien herpetofauna were also derived from captivity. Among the 43 species of alien herpetofauna, 37 had pet trade origins, including the 30 freshwater turtle species (Supplementary Table 1). Hong Kong's alien mammals were introduced via mixed pathways. Four species escaped from confinement, and four were released to assist

farming or as biocontrol agents. Most rodents were associated with human-modified habitats and had an unconfirmed origin, with the exception of the tree squirrels (*Callosciurus erythraeus*), which were introduced as escaped or abandoned pets. The long-tailed macaque (*Macaca fascicularis*), rhesus macaque (*Macaca mulatta*) monkeys and their hybrids were introduced to consume alkaloid-rich fruits that were contaminating reservoir water (Peaker 2018; Wong, Ni 2000). Two bovid species, the domestic ox (*Bos taurus*) and domestic water buffalo (*Bubalus bubalis*), were introduced to assist with agriculture (Barbato et al. 2020). Dogs (*Canis lupus familiaris*) and cats, two common domesticated pet species (*Felis catus*), were likely introduced via multiple complex pathways due to their strong associations with humans.

IUCN status of the alien species in Hong Kong

Of all alien vertebrate species introduced to Hong Kong, 11 species (5.2%) were listed by IUCN's Red List as Critically Endangered globally in their native range, 16 species (7.5%) were Endangered, eight species (3.38%) were Near Threatened, five species (2.3%) were Vulnerable, 164 species (77%) were listed as Least Concern in the IUCN Red List, and five species (2.3%) were not evaluated (IUCN 2025). The remaining five species (2.9%) were unassessed hybrids. Herpetofauna have higher proportions of threatened species relative to birds, mammals, and amphibians (Fig. 1).

Temporal patterns of alien species introductions

When comparing changes in the temporal trends of introductions over different periods, we found that the peak period for all groups of terrestrial vertebrate introductions to Hong Kong was between 1961 and 1990 (Fig. 2). Birds and mammals showed a consistent increase in introductions between 1900 and 1990, and after reaching a peak, declined from 1991 to 2020. For herpetofauna, the first verified introduction record was in 1990, with a steady increase from 1991 to 2020 (Fig. 2). Nonetheless, the exact introduction year of most alien species in Hong Kong remains underreported and is difficult to accurately record. Information on the first records was only available for 47 species (22.6% of the total alien fauna).

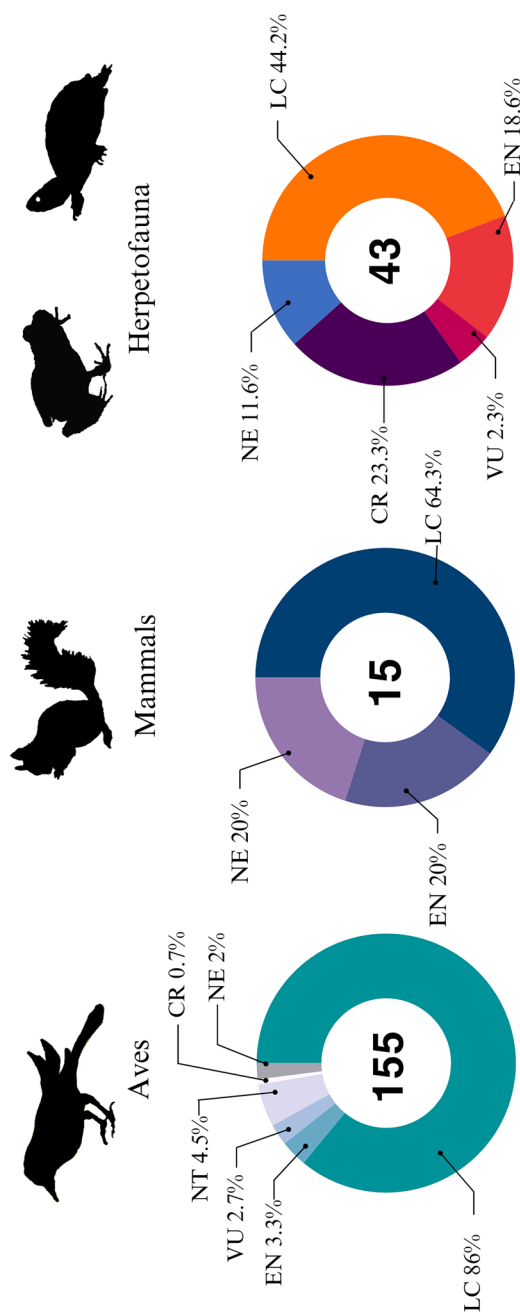
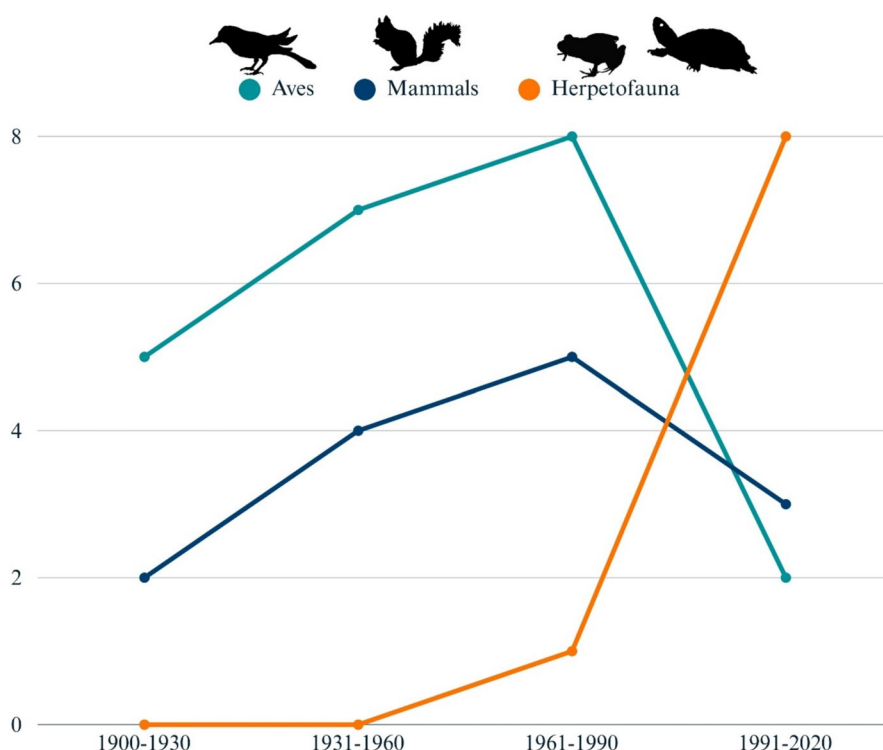


Fig. 1 Total number of alien birds, mammals and herpetofauna that were assessed by IUCN in Hong Kong, and their proportions of IUCN Red List status. CR=Critically Endangered, EN=Endangered, VU = Vulnerable, NT=Near Threatened, LC=Least Concern, NE=Not Evaluated, EX=Extinct

Fig. 2 The total number of species of birds, mammals and herpetofauna species introduced into Hong Kong (y-axis) in the periods between 1900–1930, 1931–1960, 1961–1990 and 1991–2020



Discussion

This study provides a baseline that can help advance our understanding of the species composition and introduction pathways of alien terrestrial vertebrates in Hong Kong, which has been a major international trading hub for centuries. By synthesizing extensive primary and grey literature sources, existing databases and citizen science data, we compiled and analyzed the first comprehensive database of alien birds, mammals, reptiles, and amphibians in Hong Kong. This work can help inform conservation decisions, guide the development of alien species management strategies, and establish a robust baseline for future investigations into the risks posed by alien species. We hope it will encourage further surveys, monitoring, and data collection for alien species in terrestrial, freshwater, coastal and marine ecosystems across Hong Kong.

Birds, the dominant class (72%) of all alien vertebrates introduced into Hong Kong, coincide with the high diversity of avian species being traded. This trend is also observed in Taiwan (Su et al. 2016), where birds are also publicly available for sale in local pet markets. Bird stores in Hong Kong

congregate on what locals call the “bird street”, where customers purchase many different bird species for their traits, such as attractive plumage and varying songs (HKHM 2014). By 1982, over 400 bird species had already been recorded as being traded in Hong Kong (Melville 1982). High demand for diverse bird traits may have led to the high diversity of traded species, and thereby, more birds could potentially be released or managed to the wild (Su et al. 2016). This is supported by our dataset, showing that 149 out of 150 alien birds in Hong Kong were derived from captivity and are part of the pet market (Supplementary Table 1). Similar trends can be observed for the alien herpetofauna of Hong Kong. For example, studies on alien freshwater turtles of Hong Kong suggest that the pet trade at least partly contributes to the high diversity of alien turtles in Hong Kong, and indeed all of the alien species were found in local pet markets (Sung and Fong 2018; Sung et al. 2021).

Many of the introduced birds, reptiles and amphibians in Hong Kong likely escaped from confinement through ‘mercy release’ (Lee et al. 2022; Sung et al. 2021), a traditional practice also known as prayer animal release (e.g., Buddhist, Taoist practices and others), which involves releasing captive animals into

the wild for good karma (Shiu and Stokes 2008). This practice has been popular for centuries across different parts of Asia, such as China, Thailand and Cambodia (HKHM 2014; Liu et al. 2012; Su et al. 2016). Mercy release usually involves large numbers of individual animals of many species released together at a single event (Shiu and Stokes 2008; Su et al. 2016). These released animals are often derived from captivity as pets or as food (Lee et al. 2022; Su et al. 2016). Mercy release could be an important contributing factor to the establishment of captive animals in the wild (Du et al. 2024), since a large number of individuals of one or more species are released in each event, which has been occurring repeatedly over time (Liu et al. 2012; Su et al. 2016). The consistent release of alien species into the wild increases the likelihood of alien species establishing populations, which significantly increases the risks of biological invasions (Du et al. 2024; Su et al. 2016).

Alien mammals in Hong Kong with known introduction pathways either escaped from confinement as pets or were intentionally released to agricultural lands to assist with other human activities. While rodents were the largest group of alien mammals in Hong Kong, there is little information available on most mammalian introduction pathways. They may have potentially been introduced through freight or other transport connections, similar to the introduction pathway of alien rodents in other areas, especially on islands (Khlyap, Warshavsky 2010).

Alien species have successfully established populations in urban and natural areas of Hong Kong, and some of these populations have known impacts on native biodiversity and ecosystems (Lee et al. 2022, 2016). However, comprehensive studies on their overall impacts are lacking and warrant further studies. Existing case studies, such as those on the Critically Endangered yellow crested cockatoo (*Cacatua sulphurea*), and the greenhouse frog (*E. planirostris*), have raised concerns about their potential impacts on native and endemic species (Lee et al. 2016; Wang 2020). Besides the direct impacts of alien species, such as predation and competition (Doherty et al. 2016; Pyšek et al. 2020), some species hybridize with native species, including threatened species, leading to irreversible genetic changes to the native species (Sung et al. 2021). A notable example is the alien lineage of a native frog species, the Chinese bull frog

(*Hoplobatrachus chinensis*), where individuals originated from Thailand and mainland China pose risks of competition and hybridization with native *H. chinensis* in Hong Kong (Lee et al. 2022). We urge further research on the impacts of hybridization between threatened native species and alien species.

Overall, our new database shows that the pet trade is a major pathway for the introduction of alien vertebrates into Hong Kong. This is supported by the high numbers of live animals imported to Hong Kong for the exotic pet trade (Inglis et al. 2022). Similar patterns were observed in alien freshwater fishes in Hong Kong, where the majority of alien fishes entered Hong Kong via the aquarium trade (Chan et al. 2023). Despite clear connections between invasive species and the pet trade (Lockwood et al. 2019), the knowledge gaps and legislation loopholes related to the pet trade are still poorly known (Inglis et al. 2022).

Hong Kong currently has no specific regulations that relate to mercy releases of alien species despite the high risk of these introductions contributing to biological invasions (Du et al. 2024; Lee et al. 2022). In contrast, Singapore implemented strict legislation to control mercy release in 2005, including fines (Tan 2006; Wong 2006), resulting in a drop of release cases from 44 cases in 2004 to seven cases in 2005 (Tan 2006; Wong 2006). In Hong Kong, the high level of connectivity with neighboring regions could reduce the effectiveness of a similar regulation on mercy release to control species introductions, because alien species from neighboring regions can still be transported into Hong Kong. Such regulation may also raise ethical concerns due to the religious and cultural importance of mercy release traditions (Thạch 2024) and should thus be done carefully and in close consultation and engagement of the local community. More attention should be directed towards developing alternative approaches that balance effectiveness with cultural and religious values. For example, collaboration between religious and cultural organizations and environmental groups to organize planned and managed releases of threatened or other native species as part of a conservation reintroduction effort could offer a sustainable alternative, potentially better aligning with conservation efforts, such as species reintroduction projects (Awoyemi et al. 2016). Hong Kong should move to consider the overall impacts of mercy release and develop appropriate strategies that support conservation targets.

Other introduction pathways, such as unintentional introductions through hitchhiking on live traded plants and by freight should also be closely monitored. As one of the busiest trade hubs in the world (ACI 2023; Lawler et al. 2021), Hong Kong processes large amounts of diverse imports through the Hong Kong Port, which in 2022 alone handled over 17 million TEU (twenty-foot equivalent unit) of containers and connected to over 460 destinations worldwide weekly (HKMPB 2023). It is important to further investigate the role of ports and land bridges in introducing invasive species to both Hong Kong and mainland China. With high connectivity to mainland China, Hong Kong could be a “stepping stone” for invasive species into mainland China and Macau (Lu et al. 2018).

Biosecurity regulations and effective enforcement of management strategies are being used in some countries to prevent further introductions of alien species (Pyšek et al. 2020). In Japan, the Invasive Alien Species Act is an example of a legal framework that aims to restrict the raising, planting, storing, carrying, or importation of recognized invasive species (Goka et al. 2013; Mito 2006). A similar framework can be accompanied by improving monitoring of the wildlife trade, for example better documentation of live imports, exports, and re-exports of all live animals (Fragoso, Ferriss 2008; Gerson et al. 2008).

Temporal trends of alien species introductions into Hong Kong

Trends in bird introduction events are strongly affiliated with avian trade and with the bird pet industry (Su et al. 2016). This is supported by our finding that the vast majority (97%) of the alien birds in Hong Kong originated from captivity (Supplementary Table 1). The timing of major introductory events was aligned with the timing of their popularity in trade. For example, the number of licensed bird traders increased from 135 to 181 from 1976 to 1979, and around 695,000 birds were imported into Hong Kong in 1975 (Melville 1982). These coincide with the peak bird introduction period in our dataset. The decline in bird introduction events between 1991 and 2020 may be attributed to tightened legislation in relation to the pet bird businesses in 1979, where bird

traders were required to submit detailed monthly sale reports (Melville 1982).

The increase in introduction events of herpetofauna from 1961–1990 to recent years (Fig. 2) likely reflects the growing popularity of keeping reptiles and amphibians as pets in Hong Kong (Burghardt 2017; Kraus 2015). The high number of alien freshwater turtle species corresponded with the volume and diversity of individual and species of turtles documented in local pet markets in recent years (Cheung and Dudgeon 2006; Sung and Fong 2018). While amphibian trade in Hong Kong is less well documented, an estimated 18.8 million live frogs were imported between 2015 and 2019, predominantly Chinese bullfrogs, which were introduced for food purposes (Inglis et al. 2022). The diversity of frogs traded in Hong Kong is unknown, although records from the Law Enforcement Management Information System (LEMIS) show that at least 43 alien frog species were exported to the USA from Hong Kong between 2006 and 2010 (Kolby et al. 2014). Currently, only three alien amphibian species have successfully established in Hong Kong. Overall, with the rising popularity of keeping herpetofauna as pets (Hughes et al. 2021), there is potential for further introductions through pet abandonment or release. While legal enforcement to control intentional release of herpetofauna can be effective, public awareness, engagement and education on the adverse impacts of releasing alien pets could play a key role in mitigating this risk.

Most mammal introductions happened before the 1990s when agriculture and farming was more prominent (HKSTEC 2021). The exact introduction dates of bovids, cats and dogs are unknown, but it is known that bovids were introduced long before the 1950s as they were introduced to assist in crop farming (Barbato et al. 2020). The decades between 1961–1990 were found to be the peak introduction period of mammals, mainly due to the introduction of eight species of rodents, seven of which are from the family Muridae. It is possible that these were able to establish at least partly due to the clearing of lowland forests for rice cultivation (Chung and Corlett 2006).

There are currently some regulatory legislation and restrictions in relation to the exotic pet trade in Hong Kong, mainly the Public Health Ordinance (Cap 139) and the Protection of Endangered Species and Plants (Cap. 586). Cap 139 prevents the introduction

of diseases and parasites from pets or animal-related products by quarantine and inspections. Cap. 586 regulates the trade, import, export, re-export, and possession of CITES listed animals. However, Cap. 586 may not be helpful in preventing over-exploitation of some threatened species, as many of these species are not CITES-listed. Currently, trade of non-CITES listed animals does not require permission to provide information on whether they are sourced from the wild or captivity, with the exception for cats and dogs. This is a gap that allows the continued exploitation of threatened, yet non-CITES listed species, as the individuals traded could be sourced from the wild and sold in markets without regulation or monitoring.

Conclusion

Using the new database created in this study, we find that the introduction of alien vertebrates into Hong Kong is closely linked to the wildlife trade, and is often associated with cultural practices, such as mercy release. Importantly, this study not only highlights the significance of multiple introduction pathways, but also the lack of research on the impacts of alien terrestrial vertebrates in Hong Kong. The database provides a foundational baseline for a more in-depth examination of introduction pathways, their historical patterns, and the complex conservation challenges that emerge where wildlife trade and cultural traditions intersect with biodiversity conservation considerations. We highlight the urgent need for building comprehensive management strategies, improved regulatory frameworks, and culturally sensitive solutions to prevent further introductions and to mitigate the ecological impacts of alien vertebrates.

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Author contribution All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by SH. The first draft of the manuscript was written by SH and all authors edited multiple versions of the manuscript. All authors read and approved of the final manuscript.

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Data availability The data collated and used in this study is available for downloading in the Supplementary Information as a table.

Declarations

Conflict of interest The authors declare no competing interests.

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