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CHECKLIST OF EXOTIC SPECIES IN THE PHILIPPINE PET TRADE, I. AMPHIBIANS

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ABSTRACT- Trading exotic amphibians is a cause for concern due to its possible negative effects. A checklist of exotic amphibians in the Philippine pet trade was compiled based on surveys conducted between 2008 and 2013. Thirty five exotic species were documented, including the African Clawed Frog (*Xenopus laevis*), a widely available species in the trade and a known vector of the chytrid fungus. Strict trade restriction and monitoring of *X. laevis* is recommended.

Keywords: *amphibian, exotic pet trade, chytrid fungus, Philippines*

INTRODUCTION

The international exotic amphibian pet trade is a cause for concern due to its possible negative effects to the ecosystem, human health, and economy. Exotic amphibians may become invasive when accidentally or intentionally released into a new environment and became established. Invasive species may cause the loss of biodiversity and introduce diseases (Diesmos et al., 2006; Crowl et al., 2008) such as chytridiomycosis, an emerging infectious disease caused by amphibian chytrid fungus (*Batrachochytrium dendrobatidis*). This disease is being linked to dramatic decline of amphibian populations in Central, North, and South America, Australia, and Europe. The spread of the disease was attributed to the international amphibian trade of the African Clawed Frog (*Xenopus laevis*), a known vector of the chytrid fungus (Weldon et al., 2004; Solis et al., 2009; Vredenburg et al., 2013).

In the Philippines, chytridiomycosis was first detected in 2008, Seven frog species namely *Hylarana grandocula*, *H. similis*, *Limnonectes macrocephalus*, *L. magnus*, *L. woodworthi*, *Occidozyga laevis*, and *Sanguirana luzonensis* are infected with the fungus (Diesmos et al., 2012). The disease vector remains unknown since three alien invasive frog species (*Hoplobatrachus rugulosus*, *Hylarana erythraea*, and *Rhinella marina*) tested negative thus far for the fungus (Diesmos et al., 2012). There is no study yet on exotic amphibians in the Philippine food and pet markets (V. Vredenburg, personal communication, July 2013).

The trading of exotic species is regulated by international and national laws. The Philippines is a Party to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) since 1981. The Biodiversity Management Bureau (formerly Protected Areas and Wildlife Bureau) of the Department of Environment and Natural Resources (BMB-DENR) is mandated as the CITES management authority. Under Republic Act No. 9147, also known as the Wildlife Resources Conservation and Protection Act of 2001 or simply the Wildlife Act, importation of exotic amphibian species is allowed upon securing appropriate import and CITES permits from the BMB-DENR. Individuals who acquire exotic pets locally through legal traders must register and obtain certificates of wildlife registration from the BMB-DENR to keep exotic pets legally.

While existing laws and regulations are in place for importation and trade of exotic pets, the quantity and kind of amphibian species imported to the Philippines were largely not documented. Most specimens were illegally brought to the country. This study aims to establish baseline data on exotic amphibians in the Philippine pet trade, and thus contribute to the understanding of wildlife trade in the Philippines.

Figure 1. *Xenopus laevis*, albino morph

METHODS

Between June 2008 and June 2013, surveys were done in selected pet shops in Metro Manila, Cebu, and Davao. Advertisements posted by traders in local trading and social networking websites, and importers' price lists were also documented. Interviews were conducted with shop personnel and amphibian enthusiasts to determine sources of specimens and shipping methods used. Pet centers were visited, unannounced and without set interval between visits, at least three times a year in Metro Manila, two times in Cebu City (Manalili Street), and three times in Davao City during the five-year study period.

A total of 235 pet shops in Metro Manila, Cebu, and Davao were surveyed. In Metro Manila and Cebu City, many pet shops are clustered in pet centers such as Cartimar Pet Center in Pasay City, Arranque Market in Manila City, Tiendesitas Complex in Pasig City, and along Manalili Street in Cebu. In contrast, three pet shops surveyed in Davao City are situated apart from each other (Table 1). For specimens displayed in plain view, data such as date observed, quantity, price, and name of the shop were recorded.

Photographs were also taken when permitted by shop personnel or private enthusiasts. Legal importations of CITES amphibian species from 2008 to 2012 were also reviewed (See Appendix- list).

Specimens were identified to species level by examining their distinguishing morphological characters or by comparing photographs posted by sellers with published photographs and identification keys from literature (e.g. Conant and Collins, 1991; Henkel and Schmidt, 2000). Observed specimens that could not be identified conclusively to genus level were omitted from the list. Scientific nomenclature follows AmphibiaWeb (2013).

Table 1. Location and number of shops surveyed

LOCATION	NUMBER OF SHOPS SURVEYED
Cartimar Pet Center	126
Arranque Market	58
Tiendesitas Complex	30
Quezon City	3
Manila City	5
Cebu City	10
Davao City	3

RESULTS AND DISCUSSION

Thirty five exotic amphibian species representing 13 families and 25 genera were documented (Table 2). Several species remain undocumented since specimens that cannot be conclusively identified were omitted from the list. In 2012, five morphologically distinct small frogs (snout-vent length = 15−25 mm) of African origin, tentatively identified as members of family Hyperoliidae, were observed in the trade. Since the family Hyperoliidae contains 223 species in 18 genera and many taxa are naturally polymorphic (Schioltz, 1999; AmphibiaWeb, 2013), it was impossible to identify the frogs in the trade based on visual encounter and/or photographs. Furthermore, some traders were more discreet in

their trading activities. They advertised the complete list of available species to their previous buyers only. The natural distribution of documented exotic amphibians in the Philippine pet trade is in, Africa, America, Asia, Australia, and Madagascar (Figure 2).

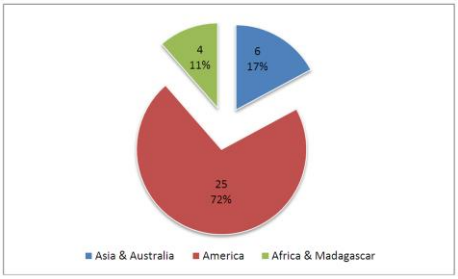

Figure 2. Natural distribution of exotic amphibians in the Philippine pet trade

Figure 3. *Kaloula pulchra*

Figure 4. *Hylarana erythraea*

Figure 5. *Rhinella marina*

Figure 6. *Hoplobatrachus rugulosus*

Invasive Species

Four invasive frog species were present in the Philippine pet trade namely, Marine Toad (*R. marina*), Chinese Edible Frog (*H. rugulosus*), Asiatic Painted Frog (*Kaloula pulchra*), and Green Paddy Frog (*H. erythraea*). *Rhinella marina* was intentionally introduced as a biological control against agricultural pests in 1930s, *Lithobates catesbeianus* and *H. rugulosus* were commercially farmed for the food market, and *H. erythraea* introduction pathway is not certain. *K. pulchra* is the only species, of the five known invasive frog species in the Philippines , suspected to have been introduced through the pet trade (Diesmos et al., 2006). Due to its drab coloration and burrowing habit, this species generated only a negligible interest in the Philippine pet trade. The availability of the *K. pulchra* was documented twice during the study period. Interviews with two traders revealed that *K. pulchra* were all collected locally. The rapid

spreading of *K. pulchra* in numerous localities in Luzon (Diesmos et al., 2006; Brown et al., 2012, 2013), Palawan (Fidenci, 2009), Mindanao (Sy, 2013), Cebu (Sy et al., in press), and other islands such as Marinduque and Mindoro (Sy, unpub. data) supports its accidental introduction to agricultural and horticultural products as a more plausible cause for the spread, as hyphothesized by Diesmos and Brown (2011).

The most commonly encountered exotic amphibian species during the study was *X. laevis*. In February 2013, two importers/wholesalers and 15 pet shops within Metro Manila had the albino form of *X. laevis* for sale. The quantity on display per shop ranged from 20 to >200 frogs. Majority of the pet shops with exotic amphibians only had *X. laevis* and/or Chinese Fire-bellied Newt (*Cynops orientalis)*. The relative widespread availability of *X. laevis* may be attributed to its high profit margin, low retail price, high turnover rate, and easy rearing requirement. Most amphibian pets need to consume live aquatic worms (*Tubifex* sp.), fruitflies (*Drosophilia* sp.), or crickets (G*ryllus* sp.), which may not always be readily available. *X. laevis* can thrive on dry fish food diet alone. Due to its low price and widespread availability, *X. laevis* might eventually become an invasive species in the Philippines. That is, when the novelty of keeping exotic frogs diminishes and unwanted specimens are accidentally or intentionally released into local waterways.

Figure 7. *Cynops orientalis*

Figure 8. *Ambystoma mexicanum*, albino morph

Figure 9. *Ceratophrys cranwelli*

Review of CITES trade database showed that 228 live exotic amphibians representing 17 species were legally imported from the United States and the Netherlands from 2008 to 2012 (Table 3). Popular or common exotic amphibian species were mostly, if not all, imported or collected in the wild without proper permits. During this study, around 4,000 individuals of the five most traded exotic amphibian species were documented (Table 4). Live specimens were typically imported from China, Hong Kong, Taiwan and Thailand. They are shipped by air cargo together with legally-imported ornamental freshwater fishes.

Access to Internet

Easy and inexpensive access to the Internet and decreasing cost of mobile devices with Internet capabilities were instrumental in the

Table 3. Legally-imported CITES appendix-listed exotic amphibians from 2008 to 2012

YEAR IMPORTED	SPECIES	QUANTITY	SOURCE COUNTRY
2008	*Agalychnis callidryas*	16	United States
2012	*Adelphobates galactonotus*	16	Netherlands
2012	*Ameerega bassleri*	6	Netherlands
2012	*Dendrobates auratus*	14	Netherlands
2012	*Dendrobates leucomelas*	25	Netherlands
2012	*Dendrobates tinctorius*	46	Netherlands
2012	*Epipedobates tricolor*	36	Netherlands
2012	*Oophaga pumilio*	15	Netherlands
2012	*Phyllobates bicolor*	6	Netherlands
2012	*Phyllobates terribilis*	10	Netherlands
2012	*Ranitomeya fantastica*	14	Netherlands
2012	*Ranitomeya imitator*	4	Netherlands
2012	*Ranitomeya lamasi*	4	Netherlands
2012	*Ranitomeya reticulata*	4	Netherlands
2012	*Ranitomeya vanzolinii*	4	Netherlands
2012	*Ranitomeya ventrimaculata*	2	Netherlands
2012	*Mantella aurantiaca*	6	Netherlands

Table 4. Five most traded exotic amphibian species in the Philippine Pet Trade

Species	Quantity Observed
Xenopus laevis	>2,000
Rhinella marina	>1,000
Cynops orientalis	>500
Bombina orientalis	>200
Ceratophrys spp.	>100

dramatic increase of trading activities for exotic species in the past few years. Importers can easily locate international suppliers by conducting Internet searches. With minimal effort and cost, a seller can then post advertisement of available specimens in various local websites and instantaneously reach numerous potential buyers throughout the country. For instance, Facebook, an immensely popular social networking website today, hosts no less than 30 local exotic pet groups which are active in trading activities. Importers, enthusiasts and resellers used mainly local trading and social networking websites to advertise and directly link with end buyers for higher-valued species (> PHP 3,000 each/ > USD 66.67 each).

Figure 10. *Ceratophrys ornata*

Figure 11. *Litoria caerulea*

Figure 12. *Pyxicephalus adspersus*

Utilization

Exotic amphibians were utilized primarily as pets, but also as dissection specimens in biology classes (*R. marina*) and as food items for carnivorous pets (*H. rugulosus* and *H. erythraea*).

Price Range

Price per specimen ranged from PHP 5 (USD 0.11) for a juvenile *H.rugulosus* to PHP 7,300 (USD 162) for a Dendrobatid frog (Table 5). Relatively hard to acquire species such as Dendrobatid, Tomato Frog, and Mantella commanded premium prices. In contrast, the price of *Bombina orientalis* dropped from PHP 750 (USD 16.67) each in 2009 to PHP 120 (USD 2.67) in 2013 due to increased supply. *Xenopus laevis* and *C. orientalis* were the top most commonly observed exotic amphibians, which retailed for as low as PHP 30 (USD 0.67) and PHP 45 (USD 1.00) each, respectively.

Table 5. Price range of exotic amphibians in the Philippine pet trade

Natural Distribution	Price in Philippine Peso (PHP)
Africa and Madagascar	30 – 6,500
America	2,000 – 7,300
Asia and Australia	45 – 3,000
AIS in the Philippines	5 - 100

CONCLUSION

When individuals become more creative in their illicit exotic pet trading activities, the Philippine wildlife authority has to be more proactive in addressing the issue, especially the potential harmful effects of exotic species when they escape confinement and become established in a new environment. *Xenopus laevis* in the Philippine pet trade is a potential candidate as invasive species and vector of the chytrid fungus. Thus, its trade and shipping within the country should be strictly regulated and monitored. Coordination and cooperation among various governmental agencies need to be strengthened to combat illegal wildlife trade effectively and to prevent or mitigate the introduction of exotic species and emerging diseases in the country.

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Table 2. Exotic amphibians in the Philippine pet trade

FAMILY	SCIENTIFIC NAME	VERNACULAR NAME	AUTHOR, YEAR	NATURAL DISTRIBUTION
Bombinatoridae	*Bombina orientalis*	Oriental Fire-bellied Toad	(Boulenger, 1890)	Asia
Bufonidae	*Rhinella marina**	Marine Toad	(Linnaeus, 1758)	Central & South America
Ceratophryidae	*Ceratophrys cranwelli*	Cranwell's Horned Frog	Barrio, 1980	South America
	Ceratophrys ornata	Ornate Horned Frog	(Bell, 1843)	South America
	Lepidobatrachus laevis	Budgett's Frog	Budgett, 1899	South America
Dendrobatidae	*Adelphobates galactonotus*	Splash-backed Poison Frog	(Steindachner, 1864)	South America
	Ameerega bassleri	Pleasing Poison Frog	(Melin, 1941)	South America
	Dendrobates auratus	Green & Black Poison Frog	(Girard, 1855)	Central America
	Dendrobates leucomelas	Yellow-headed Poison Frog	Steindachner, 1864	South America
	Dendrobates tinctorius	Dyeing Poison Frog	(Cuvier, 1797)	South America
	Epipedobates tricolor	Phantasmal Poison Frog	(Boulenger, 1899)	South America
	Oophaga pumilio	Strawberry Poison Frog	(Schmidt, 1857)	South America
	Phyllobates bicolor	Black-legged Poison Frog	Dumeril & Bibron, 1841	South America
	Phyllobates terribilis	Golden Poison Frog	Myers, Daly & Malkin, 1978	South America
	Ranitomeya fantastica	Fantastic Poison Frog	(Boulenger, 1884)	South America
	Ranitomeya imitator	Mimic Poison Frog	(Schulte, 1986)	South America
	Ranitomeya lamasi	Pasco Poison Frog	(Morales, 1992)	South America

	Ranitomeya reticulata	Red-backed Poison Frog	(Boulenger, 1884)	South America
	Ranitomeya vanzolinii	Spotted Poison Frog	(Myers, 1982)	South America
	Ranitomeya ventrimaculata	Reticulated Poison Frog	(Shreve, 1935)	South America
Dicroglossidae	*Hoplobatrachus rugulosus**	Chinese Edible Frog	(Wiegmann, 1834)	Asia
Hylidae	*Agalychnis callidryas*	Red-eyed Treefrog	(Cope, 1862)	Central America
	Litoria caerulea	White's Treefrog	(White, 1790)	Asia and Australia
	Phyllomedusa sauvagii	Waxy Monkey Treefrog	Boulenger, 1882	South America
	Trachycephalus resinifictrix	Amazon Milk Frog	(Goeldi, 1907)	South America
Mantellidae	*Mantella aurantiaca*	Golden Mantella	Mocquard, 1900	Madagascar
Microhylidae	*Dyscophus guineti*	Madagascan Tomato Frog	(Grandidier, 1875)	Madagascar
	*Kaloula pulchra**	Asiatic Painted Frog	Gray, 1831	Asia
Pipidae	*Xenopus laevis*	African Clawed Frog	(Daudin, 1802)	Africa
Pyxicephalidae	*Pyxicephalus adspersus*	African Bullfrog	Tschudi, 1838	Africa
Ranidae	*Hylarana erythraea**	Green Paddy Frog	(Schlegel, 1837)	Asia
	Lithobates catesbeianus	American Bullfrog	(Shaw, 1802)	North America
Ambystomatidae	*Ambystoma mexicanum*	Mexican Axolotl	(Shaw & Nodder, 1798)	Central America
	Ambystoma californiense	California Tiger Salamander	Gray, 1853	North America
Salamandridae	*Cynops orientalis*	Chinese Fire-bellied Newt	(David, 1873)	Asia

* Invasive species; specimens in the trade were collected in the Philippines