



## The Invaders – Volume 5, Issue 2 Fall 2020

### In This Issue

Injurious Wildlife – Look what you’re missing!.....1

Invasive Species Management in the South Florida Parks and Preserve.....3

ISWG at TWS Annual Meeting.....sidebar 3

Submitting an Article to The Invader.....sidebar 4

Student Spotlight: Kiersten Youngquist, Murray State University.....6

Global Invasives Update: Towards a Sustainable Management Strategy for a Key Invasive Species in the Federation of St. Kitts and Nevis: The Green Monkey (*Chlorocebus sabaeus*).....7

### About TWS Invasive Species Working Group

The Invasive Species Working Group (ISWG) is composed of scientists engaged in invasive species research and management. The goals of the ISWG are to:

### Injurious Wildlife – Look what you’re missing!

Susan D. Jewell, BS, MS, CWB  
U.S. Fish and Wildlife Service

Imagine the United States without the stone moroko or the dioch or the brushtail possum. We need not imagine, because those devastating invasive species are not here in the United States and likely never will be. That is due to the U.S. Fish and Wildlife Service (USFWS) using information to predict their level of risk and prohibiting their importation as injurious wildlife species before they could become invasive.

The stone moroko is considered Europe’s most invasive fish. The dioch (or quelea) is known as Africa’s feathered locust—the most numerous wild bird in the world. And the brushtail possum is the Australian mammal that multiplied up to 70 million individuals after its introduction to New Zealand. These 3 species are among the more than 300 mammals, birds, fishes, reptiles, mollusks, and crustaceans currently listed as injurious because of their ability to establish, spread, and cause harm (invasive traits). The authority to list species as injurious through the Federal rulemaking process is given to the USFWS (part of the Department of the Interior) by Congress under a 120-year-old statute, commonly called the Lacey Act.

The Lacey Act was passed in 1900 and was the first broad national conservation law in the country. Two major wildlife problems were happening at the end of the 19<sup>th</sup> century that caught the attention of Congressman John Lacey of Iowa, who wanted to resolve both. One concerned protecting native wildlife and the other concerned stopping foreign wildlife from becoming invasive. The former problem was that rampant hunting was driving native

1. Facilitate communication and the exchange of information among members of The Wildlife Society interested in invasive species management.
2. Enhance knowledge and technical capabilities of wildlife professionals in the area of invasive species management.
3. Increase public awareness and understanding of invasive species management issues and decision-making processes.

#### Membership

To renew your ISWG membership for only \$5/year, log in to the TWS member portal and click Membership. <https://wildlife.secure.force.com/customlogin>

#### Connect with TWS ISWG

Website:  
[www.wildlife.org/iswg](http://www.wildlife.org/iswg)

Facebook:  
[TWS Invasive Species Working Group](#)

Email:  
[tws.iswg@gmail.com](mailto:tws.iswg@gmail.com)

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Rob "Goose" Gosnell  
State Director for Wildlife  
Services

species, such as the passenger pigeon and the Carolina parakeet, toward extinction. But States passed laws to protect their own species, and the laws were rendered useless when violators left the State. If you have heard of the Lacey Act, it is most likely this provision that lays out the prohibitions and penalties for interstate wildlife and plant trafficking of native species.

The other issue, and the subject of this article, was that people were importing wild mammals and birds from around the world, sometimes for intentional release. Well-known examples are the European starling, the English sparrow, and the mongoose. These species and others were damaging crops and competing with or preying on native species. This prompted Congressman Lacey to include a provision in the legislation to prohibit the importation of wild mammals and birds that could become "injurious" in the United States.

Thus, some species designated as injurious in 1900 have remained listed for 120 years! However, much has changed with amendments to the injurious provisions, which are now part of the statute 18 U.S.C. 42. Since the last major amendment in 1960, USFWS can use the rulemaking process to add wild mammals, wild birds, fishes, amphibians, reptiles, mollusks, and crustaceans if they are injurious to the human beings, the interests of agriculture, horticulture, forestry, or to wildlife or the wildlife resources of the United States. We now use predictive modeling to prioritize which species to evaluate for listing. You may have heard of the more infamous injurious species, such as the Burmese python in South Florida, the northern snakehead in eastern U.S. waterbodies, three species of Asian carps in the Mississippi River Basin, and the widespread zebra mussel. These species and 13 others were listed after they became invasive in the United States, and these are the species that make the news. The ones not newsworthy are those we listed preemptively—the stone moroko, the dioch, and the brushtail possum, and more than 280 other species. In fact, 94% of the species listed as injurious because of their invasive traits were listed before they established in the United States, and none have established since then. This demonstrates the power of the foresighted 120-year-old law that allows listing at any stage of invasion, including species that have never been imported.

For more information from USFWS on injurious wildlife, see <https://www.fws.gov/injuriouswildlife/>. For the history of injurious wildlife, see [A century of injurious wildlife listing under the Lacey Act: a history](#)



The stone moroko, considered Europe's most invasive fish, was preemptively prohibited from importation into the United States by listing in 2016. Photo credit Seotaro (Wikimedia Commons)

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**Invasive Species Working Group  
Meeting at TWS Annual  
Meeting**

The Invasive Species Working Group met virtually at the TWS Annual Meeting in September 2020. We discussed on-going initiatives of the working group, including:

- Efforts by the ISWG Board to update the TWS Position Statement on Feral & Free-Ranging Domestic Cats
- Updates to our charter to clarify removal procedures of inactive board members
- Reactivation of ISWG social media presence (check us out on [Facebook!](#))
- Revival of the The Invaders, the ISWG newsletter, which is now published biennially



The Burmese python, invasive in the Everglades, was listed after establishment but served as a model for preemptively listing seven additional large constrictor snakes that were not established. Photo credit Susan Jewell (USFWS)

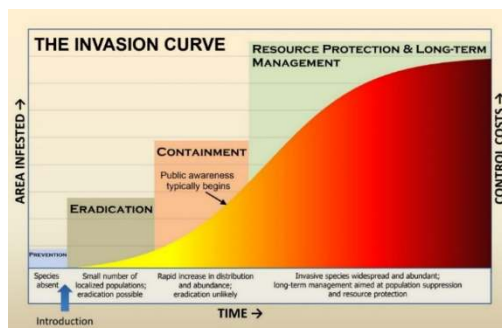
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## Invasive Species Management in the South Florida Parks and Preserve

Jenny Ketterlin  
National Park Service

When most people think of the Florida Everglades and invasive species, the Burmese python (*Python molurus bivittatus*) is probably the first thing that comes to mind. These impressive predators have become a poster child for invasive wildlife and command significant media attention. While Burmese pythons receive a lot of outside attention, they are not the only invasive species Everglades National Park and the other National Park Service (NPS) lands in South Florida are managing. Everglades, Dry Tortugas, and Biscayne National Parks and Big Cypress National Preserve make up almost 2.5 million acres in South Florida and are collectively known as the South Florida Parks and Preserve (SOFL). Like most natural areas, we also have our share of invasive plants—some covering tens of thousands of acres—and we also have other invasive animals, both aquatic and terrestrial.

As one of the invasive species biologists for Everglades National Park (ENP), I assist other park biologists with management activities for a variety of species, with a focus on invasive reptiles. Different species are managed with different objectives depending on their level of infestation and subsequent location on the invasion curve, shown below. Species which are newly detected within an area, like the Peters’s rock agama (*Agama picticauda*) are targeted for local eradication. Species like the Burmese python and the invasive tree, melaleuca (*Melaleuca quinquenervia*), are in the long-term management phase of the curve, and management is focused on population suppression to protect the high priority resources they threaten.



The invasion curve shows the stages of invasive species management from prevention of a species that has yet to arrive to long-term management after the species has become more widespread. It demonstrates how management costs increase the more established a species becomes and how management objectives shift.

The Wildlife Society leadership announced in December 2020 that next year's conference will again be held virtually. TWS ISWG will again host a virtual member's meetings to discuss our 2021 projects. We hope to see you all there!

### Submitting an Article to The Invaders

Our goal with The Invaders is to share interesting stories and recent findings in invasive species ecology, research, and management. If you have a story you would like to share, please email The Invaders editor Jane Anderson at [jane.anderson@tamuk.edu](mailto:jane.anderson@tamuk.edu)

### Reference Links

The Wildlife Society Homepage:  
<https://wildlife.org/>

TWS Annual Conference:  
<https://wildlife.org/network/conferences-network/>

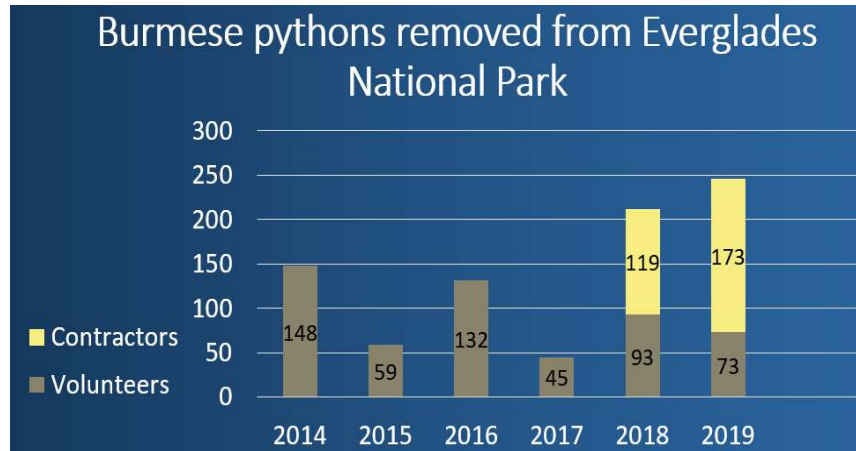
TWS Working Groups:  
<https://wildlife.org/network/tws-local/working-groups/>

Join TWS  
<https://wildlife.org/join/>



The Peters's rock agama is widespread in developed areas just outside of Everglades National Park but has not yet become established in the park. For this reason, management actions focus on eradication within ENP. Male (left) and female (right) Peters's rock agamas. Photo credits: Patrick Ellsworth (top left), Wolfgang Wuster (bottom left) and Trent Adamson (right)

Managing invasive species in over 1.5 million acres of ENP, that can be quite remote, poses many challenges in. One such challenge is the immense workload. Fortunately, teamwork within SOFL, and the valued assistance from outside resources, help manage the invasive species program. I work with staff in Big Cypress National Preserve and Biscayne National Park to manage a group of over 60 citizen scientist volunteers that help us remove Burmese pythons and other invasive herpetofauna and collect important data on these species. Another successful strategy has been utilizing private contractors. Private contractors have long been used for treating non-native plants. Since the inclusion of private contractors in 2018, we are seeing increases in python removals on NPS lands.



When species become as widespread and abundant as the Burmese python, land managers may also benefit from the development of management plans to help prioritize efforts and coordinate with other managers. I am currently part of an effort to develop the first Florida Python Control Plan with a diverse team of 12 federal, state, and local agencies, two tribes, and one non-governmental organization that manage land, primarily in South Florida. This plan will not only help to strengthen and make more effective efforts to manage Burmese pythons in Florida, but could also serve as a model for other invasive wildlife species that are widespread in Florida like the Argentine black and white tegu (*Salvator merianae*) or some of the many exotic fish species.

The Argentine black and white tegu is a large lizard that is also a priority species for management for SOFL. The population was found mostly outside of NPS until recently. ENP partners with the BioCorps internship program at the University of Florida to trap tegus during their active months (February

through October) using live traps or box traps baited with eggs. Through this combined effort, we've found that our trapping program has removed record numbers of tegus in the past two years and this year we found evidence of reproduction within ENP. If these trends continue, tegus may transition to long-term management.



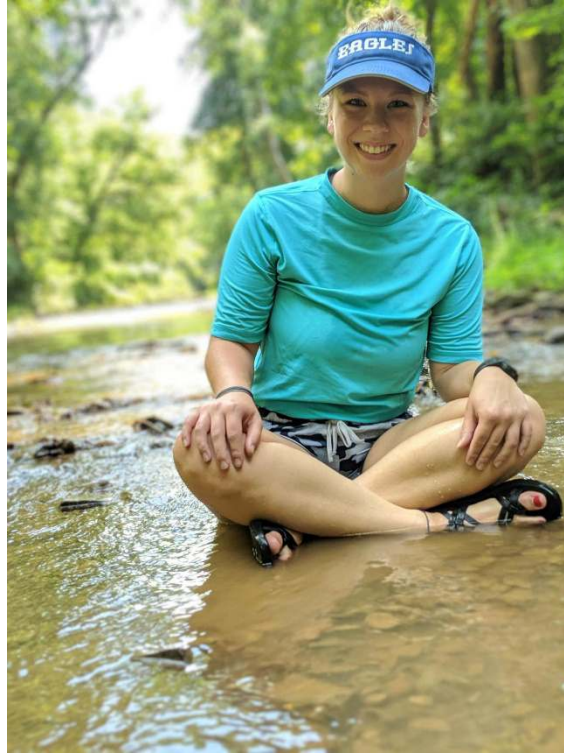
Tegus trapped by ENP interns. Photos by Ryan Baer (left) and Meghan Connelly (right), University of Florida

Despite the challenges, invasive species management can be a rewarding field that is always providing opportunities to learn something new and ways to achieve new accomplishments. It is a dynamic and stimulating field that is likely to continue to grow in importance in natural areas management. Because invasive species know no boundaries, forming partnerships with neighboring land managers and cooperative organizations helps to advance knowledge and increase efficiencies as well as provide an additional professional community in which to work. The TWS Invasive Species Working group is a community that serves to promote the field, the students and professionals working within it.

For more information on invasive plants and animals in Everglades National Park, see: <https://www.nps.gov/ever/learn/nature/nonnativespecies.htm>

## Student Spotlight: Kiersten Youngquist, Murray State University

My name is Kiersten Youngquist and I recently defended my M.S. Thesis, which I completed in the lab of Dr. Andrea Darracq at Murray State University. As a part of my thesis, I conducted a mesocosm experiment in summer 2019 to assess the effects of Asian clams (*Corbicula fluminea*) on the health of native mussels and biofilms. Asian clams are an invasive species found throughout the United States that can reach densities of greater than 1000 individuals/m<sup>2</sup>. Though studies have hypothesized Asian clams may play a role in native mussel declines and could have ecosystem level effects within aquatic systems, few studies have quantified these effects. Thus, my objectives were to assess the influence of Asian clams on adult, native mussel health and biofilm production.



My experiment consisted of exposing 8 base mussels of two native species, *Plectomerus dombeyanus* and *Amblema plicata*, to varying densities of Asian clams (0 [control], 10 [low], 100 [medium], or 1000 [high] individuals/m<sup>2</sup>) or comparable densities of native mussels for 8 weeks within flow-through chambers we built at Hancock Biological Station in Murray, KY. To measure effects on native mussel health, I took a small tissue sample from each base mussel at the end of week 8 and quantified glycogen content. I also placed 3 ceramic tiles into each mesocosm and removed one every 2 weeks beginning in week 3 to quantify biofilm production in weeks 3, 5, and 7. *P. dombeyanus* mussels were not affected by density or Asian clams and *A. plicata* mussels were not affected by Asian clams. However, the glycogen content of *A. plicata* was 14, 32, and 34 % lower than the control at medium, high, and low densities regardless of species (Asian clams or native mussels added), respectively.



While I found no direct effect of Asian clams on the glycogen content of native mussels, some species, like *A. plicata*, may be negatively affected by Asian clams because Asian clams can reach high densities in the systems they invade. In weeks 3 and 5, there was no effect of Asian clams or density on biofilms. However, after 7 weeks biofilm production was 3 times greater in the native mussel treatment compared to the control. Conversely, biofilm production within the Asian clam treatment did not differ from the control. Biofilms play an important role in nutrient cycling within aquatic ecosystems and my results indicate Asian clams influence biofilm production, which could ultimately lead to ecosystem-level effects.

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## **Global Invasives Update**

### **Towards a Sustainable Management Strategy for a Key Invasive Species in the Federation of St. Kitts and Nevis: the Green Monkey (*Chlorocebus sabaesus*)**

Kerry M. Dore, Ph.D.  
Research Associate, Baylor University &  
National Coordinator, Invasive Alien Species Initiative, Federation of St. Kitts

The Federation of St. Kitts and Nevis is one of seven countries participating in the sub-regional project: "Preventing COSTS of Invasive Alien Species (IAS) in Barbados and the OECS Countries," implemented by the United Nations Environment Programme (UNEP), funded by the Global Environment Facility (GEF), and executed by the Centre for Agriculture and Bioscience International (CABI). Also participating in this program are Barbados, Antigua and Barbuda, St. Lucia, St. Vincent, Grenada, and Dominica. Regional initiatives include biosecurity assessments conducted at the airports and seaports, a marine risk assessment (currently being drafted for the region), and a regional phone app and ID IAS risk (under development). Three core countries, St. Kitts and Nevis, Barbados, and Antigua and Barbuda, will develop a National Invasive Species Strategy and Action Plan and

have additional funding to investigate the invasive species deemed most problematic to the nation. St. Kitts and Nevis picked the green monkey (*Chlorocebus sabaeus*).

Green monkeys arrived in St. Kitts and Nevis (as well as Barbados) as a byproduct of the slave trade between West Africa and the Caribbean. The date of their first arrival is unknown. It may have occurred as early as the 1560s, when three slaving trips were made from the Guinea Coast to the West Indies, but it is more likely that the animals made their journey on one of the many boats that were active participants in the Caribbean slave trade by 1600. By the late 1600s, the animals were well established on all three islands. They were officially declared a vermin in Barbados in 1682, and a bounty was offered for each monkey killed. The earliest known report of the monkeys in St Kitts and Nevis is provided by Father Labat, a French priest who visited St Kitts in 1700. Labat reported that there was a well-established population of “wild monkeys roaming the island” and that they had escaped from the homes of French settlers during a local war between the English and French. This suggests that the animals had been pets of the French plantation owners and that the French were responsible for their presence on the island.



Green monkey consuming a tree fern in St. Kitts  
Photo Credit: K. Dore

Dr. Kerry M. Dore (National Project Coordinator and research consultant), in collaboration with the National Project Steering Committee, is coordinating the ongoing research on the green monkeys. Work is currently underway to assess the monkeys' impact on agriculture, biodiversity, tourism, and households. For the agriculture component, Dr. Dore is monitoring monkey crop losses on a randomly selected subset of farmers (N=65) that were studied in 2010-2011 as part of her doctoral research. In addition, she has recently begun monitoring monkey crop losses on a randomly selected 1/3 of farms and backyard gardens in Nevis. Household economic surveys will be conducted with each of these farmers and gardeners to better assess the economic toll these animals play on the agricultural sector.

For the biodiversity component, the IAS team used camera traps to study monkeys' consumption of native plants over about an 8-month period and obtained many videos of their consumption of key plants (e.g. bromeliads, heliconias, cacti, and tree ferns). A nest predation study is also underway. Four times over 2020-2021, quail eggs in faux nests will be placed every 100m along the Mt. Liamuiga and Nevis Peak trails. Nests will be randomly placed either to the right or left of the 100m markers and at ground level or 2-3m high. In the first trial, conducted in September-October 2020, all of the depredated eggs were consumed by two other invasive species: rats and mongoose. Work over the rest of the year will determine if there are seasonal impacts on nest predation. The IAS team in St. Kitts and Nevis will also be collecting monkey feces and planting it to investigate monkeys' seed dispersal of both native and invasive plants.

Research plans for the tourism and households component are still being finalized. For the households work, the IAS team is collaborating with Ross University School of Veterinary Medicine to assess monkeys' potential transmission of viruses, bacteria, and parasites to humans, as the interconnections between these two species in the villages has steadily increased since the closure of the sugar industry in 2005.

The data resulting from this research will be fed into a Cost-Benefit Analysis being conducted in collaboration with economists Dr. Pike Stahlmann-Brown and Dr. Adam Daigenault. The end product of our work will be a data-



driven, sustainable monkey management strategy, to be submitted to the St. Kitts and Nevis government in approximately August 2022.

The work in St. Kitts and Nevis has received international press coverage:

<https://www.bbc.com/news/world-latin-america-49125580>

<https://www.unenvironment.org/news-and-stories/story/caribbean-wrestles-mischievous-invaders-monkeys>



Edited by Jane Anderson, Ph.D.

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*ISWG is a working group of The Wildlife Society that promotes the control, mitigation, and prevention of invasive species' introduction to improve natural resources for wildlife.*

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