



# The Amphibians and Reptiles of Naval Station Guantanamo Bay, Cuba: An Updated Checklist and Notes on Conservation Status and Occurrence

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**Abstract.**—Naval Station Guantanamo Bay, a U.S. Navy base established in 1903 and located in southeastern Cuba, contains a rich herpetofauna. However, the last species list for this locality was published over 20 years ago. Since then, taxonomic adjustments, new range maps for some species, and new species discoveries on the base necessitate an updated and complete species list. Within the boundaries of the Naval Station, six species of amphibians (all anurans) and 39 species of reptiles (one amphisbaenid, 24 lizards, eight snakes, one semi-aquatic freshwater turtle, one crocodylian, and four sea turtles) have been documented. Nearly 30% of these species are of conservation concern, classified as near threatened or worse by the IUCN and/or the Cuban Red Book of Vertebrates. The base actively protects two iconic species, *Cyclura nubila* (Cuban Iguana) and *Chilabothrus angulifer* (Cuban Boa), as well as nesting sea turtles, and contains the second known population of the rare *Leiocephalus onaneyi* (Guantanamo Striped Curlytail). *Crocodylus acutus* may be extirpated from the base but the history of this species in eastern Cuba contains inconsistencies. The United States Navy is legally obligated to protect the fauna and flora contained within the base’s boundaries with special attention to listed species.

“ZOOGEOGRAPHERS: *please note that in the West Indies the period of discovery – even of significant discovery – is not quite ended.*” – R.V. Lando and E.E. Williams (1969)

Naval Station Guantanamo Bay (NSGB) is an approximately 117 km<sup>2</sup> (land and water) United States Navy base located in southeastern Cuba. It has a long history as a site for productive organismal biological research on a variety of taxa, including amphibians and reptiles. Notably, the base is the type locality for *Eleutherodactylus etheridgei* (Schwartz 1958), *Sphaerodactylus ruibali* (Grant 1959b), *Cubatyplops perimychnus* (Thomas and Hedges 2007), and the subspecies *Sphaerodactylus nigropunctatus strategus* (Thomas and Schwartz 1966). The base also provided the paratype for *Leiocephalus carinatus aquarius* (Schwartz and Ogren 1956) and *Tarentola crombiei* (Díaz and Hedges 2008). Additionally, NSGB is one of the few localities in Cuba with four species of *Leiocephalus*, whereas most others have three or fewer (Garrido 1973a).

Amphibian and reptilian diversity at NSGB has been documented three times with two surveys (Lando and Williams 1969; Roca and Sedaghatkish 1999) and a third

paper based on the knowledge of researchers with extended experience at the base (Lemm and Alberts 2000).

Each successive publication reported more species from the base; Lando and Williams (1969) listed 26 species (4 anurans and 22 reptiles), the Rapid Ecological Assessment (REA; Roca and Sedaghatkish 1999) recorded five anurans and 26 reptiles (plus indirectly two sea turtles), and Lemm and Alberts (2000) listed 33 species (5 anurans, and 28 reptiles). Other records that include NSGB are available in Rodríguez Schettino et al. (2013) for reptiles and Rivalta González et al. (2014) for amphibians. More recent records are scattered throughout the literature (Sanger et al. 2012; Bakkegard et al. 2020; Velasco et al. 2020) and in museum collections. Citizen-scientists living at NSGB are also contributing via iNaturalist. They hold an advantage over U.S.-based scientists in that they are continually present on base for months to years, increasing the probability of encountering something new. Since previous references are dated, new species have been found, and several have undergone significant taxonomic changes, an updated list is needed. Provided herein is a comprehensive list, notes on the occurrence (or absence)

of certain taxa, and the conservation status of the amphibians and non-avian reptiles (hereafter reptiles) historically known from or presently found at Naval Station Guantanamo Bay, Cuba.

### Methods

I conducted a literature review, starting with the earlier published lists by Lando and Williams (1969), Roca and Sedaghatkish (1999), and Lemm and Alberts (2000). These publications are usually the first found when researching the herpetofauna of NSGB. For more amphibian records, I reviewed Rivalta González et al. (2014) and for reptiles, Rodríguez Schettino et al. (2013). Both reference the scientific literature, cite museum records, and include unpublished records held by the authors from their own observations and personal communications. Other searches included GBIF for amphibians (GBIF 2021a) and reptiles (GBIF 2021b), VertNet (periodically reviewed through September 2022), iNaturalist (last searched on 7 Sept 2022), and HerpMapper (last searched 23 July 2022) for unpublished records. I searched and asked for images of crocodiles on two Facebook pages: “GTMO” and “GTMO Wildlife And Outdoor Adventures” (last search 19 September 2022). I also examined the following museum specimens: MCZ (Museum of Comparative Zoology) R-69444, MPM (Milwaukee Public Museum) 22498, UMMZ (University of Michigan Museum of Zoology) 173483, USNM (Smithsonian Institution, National Museum of Natural History) 59154, 59155, 192811, 286816, 315898–315912, 335779–335782, 335787, 335788, and 335815.

To trace taxonomic name changes and synonymies, I used Amphibian Species of the World (Frost 2021) and The Reptile Database (Uetz et al. 2021). Caribherp (Hedges 2021) provided useful range maps. I also drew upon my own experiences at NSGB (Bakkegard et al. 2020 plus 14 days in May 2022). Some museum records, especially those associated with older specimens, did not always provide detailed localities, instead listing Guantánamo or Oriente Province. For those, I researched the collector using the literature for clues as to their collection localities. The IUCN Red List status was from the International Union for Conservation of Nature and Natural Resources (IUCN 2022), whereas Cuba uses the Red Book of Vertebrates of Cuba (González Alonso et al. 2012), hereafter the Cuban Red Book. Abbreviations for museum records are per Leviton et al. (1985) with the addition of AHAP-D (Alabama Herp Atlas Project-Digital).

### Results and Discussion

*Species count and conservation status.*—Six species of amphibians (all anurans) and 39 species of reptiles (one amphisbaenid, 24 lizards, eight snakes, one semi-aquatic freshwater turtle, one crocodylian, and four sea turtles) (Table 1) have been

recorded within the boundaries of NSGB (Fig. 1). More conspicuous species are observed in all three of the historical studies, whereas cryptic taxa are less consistently listed. Per IUCN, 31 species (70.5%) were classified as being of Least Concern (LC), one (2.3%) was listed as Near Threatened (NT), 6 (13.6%) as Vulnerable (VU), four (9.1%) as Endangered (EN), two (4.5%) as Critically Endangered (CR), and one has not been evaluated. According to the Cuban Red Book (González Alonso et al. 2012), which only includes species that are NT or worse, NSGB had 13 listed species: two (4.4%) NT, four (8.9%) VU, three (6.7%) EN, and four (8.9%) CR. Three species (two geckos and one snake) were introduced. Three accounts (two with photographs) of an American Crocodile (*Crocodylus acutus*) on the base were found via Facebook.

By IUCN standards, 29% of species require protection, including 100% of sea turtle species and 50% of amphibians. By Cuban Red Book standards, 28% of base species are listed as NT or worse. The United States Department of Defense (DoD) requires that species listed by either the host nation or the United States must be “monitored and managed for their protection and long-term sustainability” with the caveat that this results in “no net loss of installation capabilities and capacity to train, test, or perform other mission-essential functions” (DoD 2020). So, while many look to the IUCN for the status of a species, DoD does not, although the United States is an IUCN member. However, companies contracted by the Navy to do environmental assessments (e.g., Arecas-Mallea 2010; Resolution Consultants 2016) do report IUCN Red List status. The lists DoD uses are those of the host nation, in this case, the Cuban Red Book, or those listed by the United States Fish and Wildlife Service (USFWS). The USFWS lists (Foreign Species and U.S. species) include *Crocodylus acutus*, *Cyclura nubila*, *Dermochelys coriacea*, and *Eretmochelys imbricata*. *Caretta caretta* and *Chelonia mydas* are listed but exclude the Caribbean or southeastern United States populations. However, all four species of sea turtles are listed by Cuba and thus must be protected by the U.S. Navy.

One protected species that needs urgent attention is *Crocodylus acutus*. This species should still be present but might have been extirpated. Gundlach (1880) reported seeing it at Guantánamo Bay and Barbour and Ramsden (1919) first recorded it on the base. They wrote that it was “formerly common about the mouth of the Guantanamo River and the smaller streams which enter that bay, but like so many of the larger water birds they are, since the establishment of the Naval Station, very rare as they afford a too tempting a target to the more or less irresponsible ‘sportsmen’.” Murphy (1953) reported that “Crocodiles are sometimes sighted in the river and in the mangrove labyrinths of the upper Bay, but they are undoubtedly not so common now as in the days when they gave the town of Caimanera its name.” To clarify, Cubans

**Table 1.** The amphibians and reptiles at Naval Station Guantanamo Bay, Cuba, currently or historically. O indicates the authors observed the species or examined specimens, P indicates presumed present but not observed, and N indicates not observed or not listed by LW (Lando and Williams 1969), REA (Rapid Ecological Assessment; Roca and Sedaghatkish 1999), and LA (Lemm and Alberts 2000). The Cuban Red Book (González Alonso et al. 2012) only lists species that are classified as near threatened (NT) or worse. Conservation status codes from best to worst are LC (least concern), NT (near threatened), VU (vulnerable), EN (endangered), and CR (critically endangered) (IUCN, 2022). Note that a conservation status is for that species range wide and not just Cuba. A dash (—) indicates no data. Two common names are provided for ease of use by non-specialists, the first one used by iNaturalist followed by that proposed by Hedges et al. (2019). Notes: Listed as <sup>1</sup>yellow dewlapped *Anolis homolechis*, <sup>2</sup>*Anolis argillaceus*, <sup>3</sup>*Anolis equestris*, <sup>4</sup>*Sphaerodactylus decoratus strategus*, <sup>5</sup>*Arrhyton landoi*, <sup>6</sup>*Typhlops biminienis*; \*Lando unknowingly collected an individual between 1959 and 1962 (Díaz and Hedges 2008) but identified it as *Tarentola americana*.

Species	LW/REA/LA	Cuban Red Book	IUCN Red List (year last assessed)	IUCN population trend
<b>Amphibia: Anura: Bufonidae</b>				
<i>Peltophryne empusa</i> Cope 1862 Cuban Small-eared Toad/Cuban Small-eared Toad	N/O/O	—	VU (2004)	decreasing
<i>Peltophryne peltoccephala</i> (Tschudi 1838) Eastern Giant Toad/Eastern Cuba Giant Toad	O/O/O	—	LC (2008)	stable
<i>Peltophryne taladai</i> (Schwartz 1960) Cuban Spotted Toad/Cuban Spotted Toad	N/N/N	—	VU (2004)	decreasing
<b>Amphibia: Anura: Eleutherodactylidae</b>				
<i>Eleutherodactylus atkinsi</i> Dunn 1925 Cuban Groin-spot Frog/Cuban Groin-spotted Frog	O/O/O	—	LC (2004)	stable
<i>Eleutherodactylus etheridgei</i> Schwartz 1958 Etheridge's Robber Frog/Oriente Coastal Frog	O/O/O	VU	EN (2008)	stable
<b>Amphibia: Anura: Hylidae</b>				
<i>Osteopilus septentrionalis</i> (Duméril & Bibron 1841) Cuban Tree Frog/Cuban Treefrog	O/O/O	—	LC (2019)	increasing
<b>Reptilia: Squamata (amphisbaenians): Amphisbaenidae</b>				
<i>Amphisbaena cubana</i> Gundlach & Peters 1879 Cuban Worm Lizard/Cuban Brown Wormlizard	O/P/P	—	LC (2016)	unknown
<b>Reptilia: Squamata (lizards): Dactyloidae</b>				
<i>Anolis angusticeps</i> Hallowell 1856 Cuban Twig Anole/Cuban Twig Anole	N/N/N	—	LC (2016)	stable
<i>Anolis argenteolus</i> Cope 1861 Guantanamo Anole/Cuban Trunk Anole	N/O/O	—	LC (2016)	stable
<i>Anolis homolechis</i> Cope 1864 Habana Anole/Cuban White-fanned Anole	O/O/O	—	LC (2016)	stable
<i>Anolis jubar</i> Schwartz 1968 Cubitas Anole/Cuban Coast Anole	N/O <sup>1</sup> /O <sup>1</sup>	—	LC (2016)	stable
<i>Anolis litoralis</i> Garrido 1975 Oriente Pallid Anole/Oriente Pallid Anole	O <sup>2</sup> /P <sup>2</sup> /P <sup>2</sup>	—	LC (2016)	stable
<i>Anolis ophiolepis</i> Cope 1861	O/P/P	—	LC (2016)	unknown

Five-striped Grass Anole/Five-striped Grass Anole					
<i>Anolis porcatus</i> Gray 1840	O/O/O	—	LC (2016)	stable	
Cuban Green Anole/Cuban Green Anole					
<i>Anolis sagrei</i> Cocteau in Duméril & Bibron 1837	O/P/O?	—	LC (2015)	stable	
Brown Anole/Cuban Brown Anole					
<i>Anolis smallwoodi</i> Schwartz 1964	O <sup>3</sup> /O/O	—	NT (2016)	unknown	
Smallwood's Anole/Green-blotched Giant Anole					
<b>Reptilia: Squamata (lizards): Gekkonidae</b>					
<i>Hemidactylus frenatus</i> Duméril & Bibron 1836	N/N/N	—	LC (2019)	stable	
Asian House Gecko/Common House Gecko					
<i>Hemidactylus mabouia</i> (Moreau de Jonnés 1818)	O/O/O	—	LC (2019)	stable	
Tropical House Gecko/Tropical House Gecko					
<b>Reptilia: Squamata (lizards): Iguanidae</b>					
<i>Cyclura nubila</i> (Gray 1831)	O/O/O	VU	VU (1996)	unspecified	
Cuban Ground Iguana/Cuban Iguana					
<b>Reptilia: Squamata (lizards): Leiocephalidae</b>					
<i>Leiocephalus carinatus</i> Gray 1827	O/O/O	—	LC (2015)	stable	
Northern Curly-tailed Lizard/Saw-scaled Curlytail					
<i>Leiocephalus macropus</i> Cope 1862	O/O/O	—	LC (2016)	stable	
Monte Verde Curlytail Lizard/Cuban Side-blotched Curlytail					
<i>Leiocephalus onaneyi</i> Garrido 1973	N/N/N	CR	CR (2016)	unknown	
Sierra Curlytail Lizard/Guantanamo Striped Curlytail					
<i>Leiocephalus raviceps</i> Cope 1862	O/O/O	—	LC (2016)	stable	
Mountain Curlytail Lizard/Pallid Curlytail					
<b>Reptilia: Squamata (lizards): Phyllodactylidae</b>					
<i>Tarentola americana</i> (Gray 1831)	O/O/O	—	LC (2016)	unknown	
American Wall Gecko/American Wall Gecko					
<i>Tarentola crombiei</i> Díaz & Hedges 2008	N*/N/N	VU	LC (2016)	stable	
Crombie's Wall Gecko/Oriente Tuberculate Gecko					
<b>Reptilia: Squamata (lizards): Sphaerodactylidae</b>					
<i>Gonatodes albogularis</i> (Duméril & Bibron 1836)	N/P/P	—	LC (2013)	stable	
Yellow-headed Gecko/White-throated Clawed Gecko					
<i>Sphaerodactylus nigropunctatus</i> Gray 1845	O <sup>4</sup> /N/N	—	LC (2016)	stable	
Black-spotted Least Gecko/Three-banded Geckolet					
<i>Sphaerodactylus notatus</i> (Baird 1858)	O/P/O	—	LC (2016)	stable	
Reef Gecko/Brown-speckled Geckolet					
<i>Sphaerodactylus ruibali</i> Grant 1959	O/P/O	EN	EN (2016)	unknown	
Ruibal's Least Gecko/Guantanamo Bay Geckolet					
<i>Sphaerodactylus torrei</i> Barbour 1914	N/P/O	—	EN (2016)	stable	
Cuban Broad-banded Sphaero/Cuban Broad-banded Geckolet					

**Reptilia: Squamata (lizards): Teiidae**

<i>Pholidoscelis auberi</i> (Cocteau in Cocteau & Bibron 1838–1843)	O/O/O	—	LC (2016)	stable
Auber's Ameiva/Cuban Groundlizard				

**Reptilia: Squamata (snakes): Boidae**

<i>Chilabothrus angulifer</i> (Bibron 1840)	O/O/O	NT	LC (2016)	stable
Cuban Tree Boa/Cuban Boa				

**Reptilia: Squamata (snakes): Dipsadidae**

<i>Arrhyton redimitum</i> (Cope 1862)	O <sup>5</sup> /P <sup>5</sup> /O <sup>5</sup>	—	LC (2016)	unknown
Oriente Brown-capped Racerlet/Oriente Brown-capped Racerlet				

<i>Arrhyton taeniatum</i> Günther 1858	N/O/P	—	LC (2016)	unknown
Günther's Island Racer/Broad-striped Racerlet				

<i>Cubophis cantherigerus</i> (Bibron 1843)	O/O/O	—	LC (2016)	stable
Cuban Racer/Cuban Racer				

**Reptilia: Squamata (snakes): Tropidophiidae**

<i>Tropidophis melanurus</i> Schlegel 1837	O/O/O	—	LC (2016)	stable
Cuban Dwarf Boa/Giant Trope				

**Reptilia: Squamata (snakes): Typhlopidae**

<i>Cubatyphlops perimychnus</i> (Thomas & Hedges 2007)	O <sup>6</sup> /P <sup>6</sup> /O <sup>6</sup>	CR	LC (2016)	unknown
Guantanamo Bay Blindsnake/Guantanamo Bay Blindsnake				

<i>Indotyphlops (Virgotyphlops) braminus</i> (Daudin 1803)	N/N/N	—	LC (2018)	increasing
Brahminy Blindsnake/Brahminy Blindsnake				

<i>Typhlops cf. lumbricalis</i> (Linnaeus 1758)	N/N/N	—	LC (2016)	stable
Earthworm Blind Snake/Cuban Brown Blindsnake				

**Reptilia: Testudines: Cheloniidae**

<i>Caretta caretta</i> (Linnaeus 1758)	N/N/N	EN	VU (2015)	decreasing
Loggerhead Sea Turtle/Loggerhead Seaturtle				

<i>Chelonia mydas</i> (Linnaeus 1758)	N/N/O	EN	EN (2004)	decreasing
Green Sea Turtle/Green Seaturtle				

<i>Dermochelys coriacea</i> (Vandelli 1761)	N/N/N	CR	VU (2013)	decreasing
Leatherback Sea Turtle/Leatherback Seaturtle				

<i>Eretmochelys imbricata</i> (Linnaeus 1766)	N/N/O	CR	CR (2008)	decreasing
Atlantic Hawksbill Sea Turtle/Hawksbill Seaturtle				

**Reptilia: Testudines: Emydidae**

<i>Trachemys decussata</i> (Gray 1831)	N/N/N	NT	—	—
Cuban Slider/Cuban Slider				

**Reptilia: Crocodylia: Crocodylidae**

<i>Crocodylus acutus</i> (Cuvier 1807)	N/P/P	VU	VU (2020)	increasing
American Crocodile/American Crocodile				



used “caiman” as a common name for *Crocodylus acutus* (American Crocodile) while using “cocodrilo” for the Cuban

Crocodile, *Crocodylus rhombifer* (Gundlach 1880; Barbour and Ramsden 1919). To further confuse things, true caimans



Fig. 1. Upper map indicates the location of Naval Station Guantanamo Bay (yellow), on the southeastern coast of Cuba. The lower map is of Naval Station Guantanamo Bay. Base boundaries are indicated by the yellow line. The easternmost boundary is 8 km in length.

(*Caiman crocodilus*) were introduced into Cuba in 1959 (Sampedro Marín and Rodríguez Schettino 2003). King et al. (1982), citing Barbour and Ramsden (1919), stated that by 1919, naval base personnel had eliminated *Crocodylus acutus* from the rivers and estuaries around the bay but provided no other information. Roca and Sedaghatkish (1999) listed it as present based on reports from base residents, and Lemm and Alberts (2000) reported a recent “number of sightings” in the Guantánamo River. They also noted not seeing a crocodile despite spending many hours cruising the river. However, while its presence on the base, currently or historically, was considered common knowledge, I could not find photographic vouchers or museum specimens for *Crocodylus acutus* at NSGB until I made inquiries via Facebook. From the GTMO Facebook page, J. Sligh provided two photographs of a crocodile taken on the base in 1971 (now vouchered as AHAP-D 3821). A posting on the GTMO Wildlife And Outdoor Adventures Facebook page by P.J. Tolson on 3 August 2020 had an image of a base newsletter dated 15 September 1977 with two photographs of a crocodile in the Guantánamo River. An A. Sweeney reported seeing crocodiles in the river after heavy rains while he performed harbor patrol duties from 1992 to 1995. More recently, two experienced naturalists stationed at NSGB from 2015 to 2022, reported never seeing a crocodile (T. Fidler and W. Fidler, pers. comm.), although the habitat most appropriate for this species on base is not easily accessed by civilians. I have taken a boat up and down the accessible section of the Guantánamo River at least 10 times from 2015 to 2022 and have never seen a crocodile, but river transits were allowed only during daylight hours when crocodiles are difficult to detect. Thus, *Crocodylus acutus* was historically present at NSGB but, if still present, is rare. Other records on the distribution of this species include two localities in the Guantánamo Province over the last century (Varona 1985), whereas Soberón (2000) and Rodríguez Schettino et al. (2013) did not show the species present anywhere in Guantánamo Province. Further complicating matters pertaining to the species, *Crocodylus acutus* is most likely a species complex with Cuban populations showing some of the greatest genetic differentiation (Milián-García et al. 2018a; Rossi et al. 2020). So, while listed in this paper as *Crocodylus acutus*, future research might determine that Cuban populations are a distinct species (Milián-García et al. 2018b). However, until an appropriate and thorough survey for *Crocodylus acutus* on and around NSGB is completed, I do not recommend that *Crocodylus rhombifer* be introduced as proposed by Roman (2019). Except for the river, minimal freshwater habitat is present on the base.

**Additions.**—Known species that had not been previously recorded on the base (Fig. 2) included *Peltophryne taladai* (GBIF ID 2549991204/iNaturalist 37327150) discovered 20 November 2019 by W. Fidler (with a second iNatural-

ist entry in November 2021 by jonwoods), *Anolis angusticeps* collected in 2010 (MCZ:Herp: R-189885–8) and used in Sanger et al. (2012), *Hemidactylus frenatus* (MCZ:Herp: R-189911–21), *Leiocephalus onaneyi* (Bakkegard et al. 2020), *Indotyphlops braminus* (GBIF ID 2397176546/iNaturalist 10513611) documented on 30 March 2017, and *Trachemys decussata* (GBIF ID 2397710784, iNaturalist 9299645) photographed 5 November 2017, both by W. Fidler.

I also added four species of sea turtles based on multiple lines of evidence. The rapid ecological assessment (REA) (Roca and Sedaghatkish 1999) suggested that *Caretta caretta*, *Chelonia mydas*, *Dermochelys coriacea*, and *Eretmochelys imbricata* be target species for conservation but did not include them in their species list; however, Lemm and Alberts (2000) listed *Chelonia mydas* and *Eretmochelys imbricata* as the two most common species of sea turtle present. *Dermochelys coriacea*, *Eretmochelys imbricata*, and *Chelonia mydas* were known nesters on the beaches of NSGB (Alberts 2003; Santos et al. 2006) and *Dermochelys coriacea* were seen swimming in the bay near Hicacal beach (Alberts 2003), and *Caretta caretta* was sighted in the bay, in the waters off the leeward side runway and also at “the slot,” a diving area near Cable Beach (Alberts et al. 2001). Divers regularly see *Eretmochelys imbricata* swimming in the bay (R.A. White, pers. comm.) and iNaturalist has documented recent (since 2010) observations of *Eretmochelys imbricata* and *Chelonia mydas*.

Species such as *Peltophryne taladai*, *Leiocephalus onaneyi*, and *Trachemys decussata* are rare and/or cryptic, as evidenced by their recent discovery; *Hemidactylus frenatus* (discussed below) and *Indotyphlops braminus* appear to have been recently introduced (non-native plants are occasionally sold at the Navy Exchange, thus a potential route onto the base), and *Crocodylus acutus* might also be rare regionally or extirpated from the base. No clear explanation exists as to why *Anolis angusticeps* was not noted until 2010. It might have been overlooked as seven other species of small to medium-sized anoles are present. Schwartz and Thomas (1968) specifically stated that it was cryptic and not often encountered in the field. *Trachemys decussata* was first documented in 2017 via iNaturalist. Little suitable habitat for this species exists on the base, but enough to support at least 11 that were moved due to a construction project to a more favorable location on the base over two days in July 2022 (R.A. White, pers. comm.). These individuals are also recorded on iNaturalist. Other records exist for this turtle from Guantánamo Province (Rodríguez Schettino et al., 2013) and the species has a nearly island-wide distribution (Rhodin et al. 2017).

**Simple taxonomic updates.**—Several taxa on the previous lists or in older literature have undergone simple taxonomic changes: *Bufo peltacephalus* is now *Peltophryne peltacephala* (Frost et al. 2006), *Hyla septentrionalis* is now *Osteopilus septentrionalis* (Trueb and Tyler 1974), *Alsophis cantherigerus* to





**Fig. 2.** Recently detected herpetofauna at Naval Station Guantanamo Bay, Cuba: Cuban Spotted Toad (*Peltophryne taladai*), Brahminy Blindsnake (*Indotyphlops braminus*), Cuban Slider (*Trachemys decussata*), Guantamo Striped Curlytail (*Leiocephalus onaneyi*), Cuban Twig Anole (*Anolis angusticeps*), and Common House Gecko (*Hemidactylus frenatus*). Photographs by W. Fidler (top left, top right, third row), R.A. White (second row left), and the author (second row right, bottom).



*Cubophis cantherigerus* (Hedges et al. 2009), *Ameiva auberi* to *Pholidoscelis auberi* (Goicoechea et al. 2016), *Cyclura macleayi* to *Cyclura nubila* (Schwartz and Carey 1977), and *Epicrates angulifer* to *Chilabothrus angulifer* (Reynolds et al. 2013). Others were synonymized or redescribed as subspecies: *Eleutherodactylus estradai* as a synonym of *Eleutherodactylus atkinsi* (Frost 2021), *Anolis equestris palardis* to *Anolis smallwoodi* (Schwartz and Garrido 1972), *Sphaerodactylus decoratus strageus* as a synonym of *Sphaerodactylus nigropunctatus* (Schwartz and Garrido 1985), and *Arrhyton landoi* as a synonym of *Arrhyton redimitum* (Hedges et al. 2009).

**Complex taxonomic updates.**—Taxa present but masquerading as other species included *Anolis jubar*, previously a subspecies of *Anolis homolechis* (Schwartz 1968; Garrido 1973b), *Anolis litoralis*, which was split out of the *Anolis argillaceus* complex (Navarro Pacheco et al. 2001; Poe et al. 2017), *Tarentola crombiei*, once thought to be young *Tarentola americana* (Díaz and Hedges 2008), and *Cubatyplops perimychnus*, a new species described when the *Typhlops biminiensis* group was re-analyzed (Thomas and Hedges 2007). Some of these species have complex histories, an extensive record in the literature, or museum specimens that needed re-examination. Detailed accounts are provided below in order as listed in Table 1.

Ruibal and Williams (1961) noted variation in dewlap color (white, yellow, gray) across the range of *Anolis homolechis*. Schwartz (1968) re-examined the *Anolis homolechis* complex and erected a subspecies, *Anolis homolechis jubar* (but limited its range to Camagüey Province), assigned some specimens collected on base to *Anolis homolechis homolechis*, but also indicated that others from the base were of uncertain status. Lando and Williams (1969) listed *Anolis homolechis* as present, and noted the variation in dewlap color, but were unable to assign any to subspecies. Garrido (1973b) elevated *Anolis h. jubar* to full species, *Anolis jubar* to describe lizards

with a light yellow, yellow, or orange dewlaps, whereas that of *Anolis homolechis* is white (Fig. 3). Porter et al. (1989) constructed karyotypes from *Anolis homolechis* collected at NSGB and found those karyotypes matched *Anolis homolechis* from elsewhere (Gorman and Atkins 1968). Roca and Sedaghatkish (1999) and Lemm and Alberts (2000) accounted for both species by noting that some *Anolis homolechis* had white or gray dewlaps (*Anolis homolechis*) whereas others had yellow or yellow-blotched dewlaps (*Anolis jubar*).

What was known as *Anolis argillaceus* at NSGB is now *Anolis litoralis* (Fig. 4), a member of the *Anolis argillaceus* species complex (Navarro Pacheco et al. 2001; Poe et al. 2017). Lando and Williams (1969) identified an anole (MCZ:Herp: R-67382) as *Anolis argillaceus*. Peters (1970) described *Anolis argillaceus centralis* from two specimens, neither of which were collected in Guantánamo Province. Garrido (1975) elevated *Anolis centralis* to full species with two subspecies, *Anolis centralis centralis* and *Anolis centralis litoralis*. No specimens from NSGB were included in his study, but based on correspondence with E.E. Williams amended to the end of this paper, he ascribed NSGB specimens to *Anolis centralis* ssp. One specimen (USNM 286816) identified as *Anolis centralis* was collected from NSGB in 1987 and used as the voucher for a phylogeny of anoles by Burnell and Hedges (1990). This specimen is listed in the USNM catalog as *Anolis litoralis*. Garrido (1988) noted that the distribution of *Anolis argillaceus*, *Anolis centralis centralis*, and *Anolis centralis litoralis* needed better definition and questioned whether variations in populations from several areas, one of which was Guantánamo, represented simple variation or constituted geographical races. Rodríguez Schettino (1999) listed *Anolis centralis litoralis* as present at NSGB, referencing Lando and Williams (1969). In 2001, *Anolis centralis litoralis* was elevated to *Anolis litoralis* (Navarro Pacheco et al. 2001), and these specimens from NSGB (MCZ:Herp: R-10709, 67382,



**Fig. 3.** Cuban White-fanned Anole (*Anolis homolechis*) (left) and Cuban Coast Anole (*Anolis jubar*) (right) from Naval Station Guantanamo Bay, Cuba. Photographs by the author.



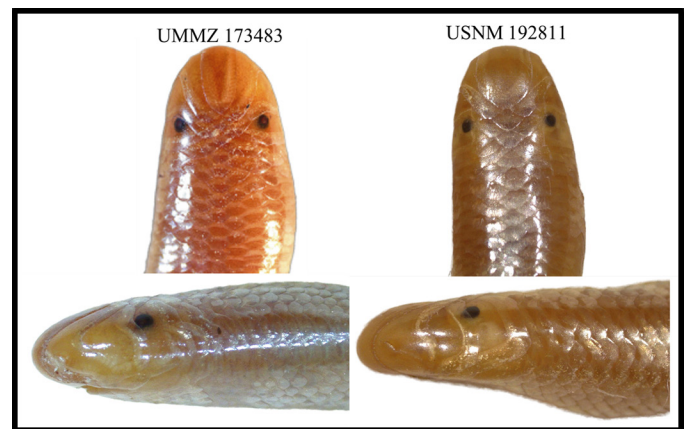
**Fig. 4.** Oriente Pallid Anole (*Anolis litoralis*) from Naval Station Guantanamo Bay, Cuba. Photograph by the author.

69421, 141463, 172058) were ascribed to *Anolis litoralis*, which included the Lando and Williams (1969) specimen. The range of *Anolis centralis* no longer includes Guantánamo Province; however, that of *Anolis argillaceus* does, although not along the southeastern coast (Navarro Pacheco et al. 2001). The two species differ in the shape of the ear opening, either oval with a posterior skin fold (*Anolis litoralis*) or small and circular (*Anolis argillaceus*), and dewlap color, yellow (*Anolis litoralis*) or pale orange (*Anolis argillaceus*) (Batista-Alvarez and Iturriaga 2020).

Two species of blindsnakes at NSGB were well documented, *Cubatyphlops perimychnus* and *Indotyphlops braminus*. What was previously reported as *Typhlops biminienis* (Lando and Williams 1969; Roca and Sedaghatkish 1999; Lemm and Alberts 2000) is now *Cubatyphlops perimychnus* (Thomas and Hedges 2007; Hedges et al. 2014), whose species description included most of the Lando and Williams (1969) specimens. Another specimen not accounted for in the literature is MCZ:Herp R-69444, collected in 1975 and currently cataloged as *Cubatyphlops biminienis*. *Cubatyphlops biminienis* (once *Typhlops biminienis*) is presently limited to the Bahamas (Thomas and Hedges 2007). Upon examination and comparison with a paratype (USNM 192811), MCZ:Herp

R-69444 most closely resembles *Cubatyphlops perimychnus*. A third species, a member of the *Typhlops lumbricalis* group might also present at NSGB (Fig. 5). Upon examination, UMMZ 173483, currently identified as *Typhlops lumbricalis*, was not *Cubatyphlops perimychnus* or *Indotyphlops braminus*, but also does not fully fit the description of *Typhlops lumbricalis* as defined by Domínguez and Díaz Jr. (2011). Thus, it was included in Table 1 as *Typhlops cf. lumbricalis*. MPM 22498 was listed in the catalog as *Typhlops lumbricalis* but, upon examination, appeared to be in the *Typhlops biminienis* group and is most likely *Cubatyphlops perimychnus*, based on the shape of the rostral scale, a preocular that touches labials 2 and 3, and a strap-shaped postocular. However, the status of *Typhlops lumbricalis* and related species in Cuba is still in flux (Domínguez and Díaz Jr. 2011, 2015; Rodríguez Schettino et al. 2013; Hedges et al. 2019). Therefore, UMMZ 173483, MPM 22498, and MCZ:Herp: R-69444 should be examined by those specializing in blindsnakes to confirm identifications.

*Troublesome taxa.*—Several species were reported through a variety of sources as present at NSGB but are not. These included *Cadea blanoides*, *Amphisbaena innocens*, *Anolis alutaceus*, *Caraiba andreae*, *Hemidactylus brookii haitianus*, and two *Sphaerodactylus* that were subsumed into other species. Also, two specimens of *Leiocephalus cubensis* (USNM 59154 and 59155) might have been collected at NSGB but the evidence is insufficient to include them in Table 1. Rodríguez Schettino et al. (2013) indicated that *Cadea blanoides* was present at NSGB. However, the original reference (Hass et al. 2001) indicated that the specimen in question was from Pinar del Rio, Viñales, Cueva de San Jose Miguel. Before that entry is a record for *Amphisbaena cubana*, which was collected at NSGB (and documented via other means). Thus, the record in Rodríguez Schettino et al. (2013) that recorded



**Fig. 5.** Blindsnakes from Naval Station Guantanamo Bay, Cuba: A comparison between UMMZ 173483 (*Typhlops cf. lumbricalis*) and USNM 192811, a paratype of *Cubatyphlops perimychnus* (see text). Note the narrower, strap-shaped rostral in UMMZ 173483 versus a broader rostral with an acuminate posterior edge in USNM 192811. The preocular and postnasal are not the same shape and in UMMZ 173483, the preocular touches labial 3. Photographs by the author.



*Cadea blanoides* at NSGB was most likely a transcription error. Roca and Sedaghatkish (1999) listed *Amphisbaena innocens* as known from the Naval Station but not observed during the REA, noting that “A single specimen in Kansas University deserves further observation.” Lemm and Alberts (2000) stated that they did not see *Amphisbaena innocens* but referenced an unpublished report indicating its presence. A search of the Kansas University (KU) herpetology collection via VertNet in May 2021 revealed a specimen (KU 274464), labeled *Amphisbaena innocens*. A subsequent investigation revealed a cataloging anomaly. KU 274464 was not associated with a physical specimen, instead, the number came from an Albert Schwartz field notebook. KU 268771 was associated with a specimen, an *Amphisbaena cubana*, collected at NSGB. In July 2022, KU 274464 was still listed as *Amphisbaena innocens* in VertNet but in the KU herpetology web portal, it and KU 268771 were both listed as *Amphisbaena cubana* and were linked via a field-tag number AS V 16607. *Amphisbaena innocens* is endemic to Hispaniola and has never been considered a Cuban species (Gans 2005). *Anolis alutaceus* was listed by Rodríguez Schettino et al. (2013) as present at NSGB, referencing a USNM record. A search of the USNM Amphibians and Reptiles Collections and GBIF (2021c) databases failed to show any records for this species associated with NSGB, although this species has been collected in Guantánamo Province. Rodríguez Schettino (1999) did not list this species at NSGB. With no further data, I concluded that this species is not a member of the NSGB herpetofauna.

The confusion around the presence (or absence) of several reptiles is due to one person, Chapman Grant, a mostly self-taught herpetologist, founder of the journal *Herpetologica* and later The Herpetologists' League (Smith 1986). *Caraiba andreae* was listed by Schettino et al. (2013) as present, referencing a USNM record. A search of the USNM database revealed no specimens of this species. However, GBIF records (2021d) show that Chapman Grant collected *Caraiba andreae* (then *Antillophis andreae orientalis*; UIMNH 48121 to 48125) in Oriente Province, of which Guantánamo was once a part. This collection, made in December 1957, could have been at NSGB as Grant was there (Grant 1958). The challenge these specimens pose is that the locality data lack specificity. Oriente was once a province and “Guantanamo” is a label that can be applied to the Naval Base, the city, the bay, or the countryside surrounding any of those areas (Thomas and Schwartz 1966). Furthermore, Thomas (1968) and Schwartz and Garrido (1985) detailed the issues with Grant's localities, indicating that those listed as the Naval Base are not likely to be the Naval Base but instead apply to other localities as much as 16–32 km away. The only literature record I found for this snake indicating a possible connection with NSGB is Barbour and Ramsden (1919) discussing *Leimadophis andreae* (as it was then known). The

referenced specimen, MCZ:Herp: R-11726 (currently cataloged as *Antillophis andreae orientalis*), was not collected on the base. Therefore, with no further specimens or iNaturalist observations, this snake (*Caraiba andreae*) is not likely present at NSGB. Grant also described *Sphaerodactylus spielmani* (Grant 1958) and *Sphaerodactylus alayoi* (Grant 1959a) and gave the type locality as Guantanamo Naval Base. Since then, *Sphaerodactylus spielmani* has been redescribed as a subspecies of *Sphaerodactylus torrei* and *Sphaerodactylus alayoi* is now a subspecies of *Sphaerodactylus nigropunctatus* (Thomas and Schwartz 1966; Schwartz and Garrido 1985) due in part to Grant's questionable recording of his collection sites. The locality of the third species of gecko Grant described from eastern Cuba, *Sphaerodactylus ruibali*, is clearly NSGB (Grant 1959b; Schwartz and Garrido 1985).

House geckos (*Hemidactylus* spp.) also are problematic. GBIF (2022) and VertNet (VertNet 2022) list a specimen of *Hemidactylus brookii haitianus* (UMMZ 173500) collected by P.J. Tolson. Once thought to be found in Cuba (Powell and Maxey 1990), *Hemidactylus brookii* and *Hemidactylus haitianus* are synonyms of *Hemidactylus angulatus*, another species of gecko introduced from West Africa (Weiss and Hedges 2007; Rösler and Glaw 2010; Díaz 2014; Borroto-Páez et al. 2015). Díaz (2014) showed *Hemidactylus angulatus* to be found at other localities in Guantánamo Province and stated that it was the most widely distributed non-native gecko in Cuba. However, it is easily confused with *H. mabouia* (Kluge 1969; Borroto-Páez et al. 2015). I examined UMMZ 173500 from photographs that showed key features (Kluge 1969) and identified it as *Hemidactylus mabouia*. *Hemidactylus frenatus* is well documented at NSGB with specimens, which appear to have been addressed by Powell et al. (2011) and photographs (iNaturalist). Apparently, the latter is a relatively recent introduction to NSGB as the specimens were collected in 2010 and the first iNaturalist photograph was taken in 2017. The literature shows it also has a complex history in Cuba. Henderson and Powell (2009) did not list *Hemidactylus frenatus* as present in the West Indies. Estrada (2012) listed *Hemidactylus frenatus*, *mabouia*, and *turcicus* as present in Cuba. Rodríguez Schettino et al. (2013) listed *Hemidactylus mabouia* and *Hemidactylus turcicus* at NSGB with *Hemidactylus frenatus* not listed as present in Cuba and referenced a USNM specimen for their *Hemidactylus turcicus* record. That specimen (USNM 192632) was originally cataloged as *Hemidactylus turcicus* but has since been reidentified as *Hemidactylus mabouia* (S. Gotti, pers. comm.). Díaz (2014) reviewed the status of *Hemidactylus frenatus*, *mabouia*, and *turcicus* in Cuba and indicated only *Hemidactylus frenatus* and *Hemidactylus mabouia* were present at NSGB. To complicate matters further, *Hemidactylus mercatorius* haplotypes were found at NSGB (USNM 317834–35, collected at NSGB in 1988; D. Mulcahy, pers. comm.). Thus, *Hemidactylus frena-*



*tus* and *Hemidactylus mabouia* apparently are currently present at NSGB, but that conclusion could change depending on a reanalysis of the *Hemidactylus mabouia/mercatorius* complex.

One additional note on geckos, in this case, *Gonatodes albogularis*, is needed. The first account of this species was in the REA (Roca and Sedaghatkish 1999), which stated that it is known but was not observed (without reference to how it was known). Lemm and Alberts (2000) recorded the same story that I had heard about this species, that only a single specimen had ever been found on the base. However, the Kansas University Herpetology Collection (KUH) has eight specimens (KUH 229494–229501), all from the windward side horse corral. Five of these were collected in November 1968 and three more in April 1969. The collector is not listed but the records have Albert Schwartz (AS) field numbers associated with them. However, I know of no other sightings of this species at NSGB, and the horse corral no longer exists (horses were moved off base 1998–1999 and no buildings remain at that site). However, recent sightings (iNaturalist) of the species in Guantánamo Province and the city of Santiago de Cuba exist.

*Leiocephalus cubensis* was not listed as present in Guantánamo Province by Rodríguez Schettino (1999) but is listed as present in the province and at NSGB by Rodríguez Schettino et al. (2013), who referenced USNM. Additionally, the range map for *Leiocephalus cubensis* in Schwartz and Henderson (1991) shows a dot at NSGB. Two specimens, USNM 59154 and 59155, were collected in 1917 by J. Henderson and P. Bartsch with a locality of “Guantanamo Bay, beach near Cable House.” Bartsch, then the Smithsonian’s Curator of the Division of Marine Invertebrates, and Henderson, a Regent for the Smithsonian, spent March 1917 exploring the Guantanamo Bay area, mainly working on mollusks, but collecting other taxa as well (Bartsch 1918). During this time, Bartsch also studied the marine shipworms (Teredinidae – well-known destroyers of wood pilings) of Guantanamo Bay (Ruhoff 1973). Whether these lizards were collected at NSGB or somewhere else in the Oriente (as the province was called then) is unclear, as Bartsch and Henderson traveled beyond the base boundaries. Off-base travel was not allowed after 1 January 1959 (Murphy 1953) and remains restricted to the present. Henderson’s field notebook, in which he listed only mollusks (Henderson 1920), shows they visited three areas in eastern Cuba in 1917: Mount Libano (source of the Guaso River), Naval Station Guantanamo Bay, and Caimanera (which also sits on Guantánamo Bay), but Bartsch described at least 18 species of marine and terrestrial mollusks in the Oriente (Ruhoff 1973), indicating travel beyond those areas recorded by Henderson (1920). Only the southern half of Guantánamo Bay is within the boundaries of the Naval Station and the bay has beaches lining its perimeter. However, there was a cable station at NSGB dating from 1887

and located on the cliffs overlooking Fisherman’s Point, a well-known geographic reference (Murphy 1953). Images of this cable station are available online (Burns 2015, 2018, 2019) and the station is referenced in a NAVFAC report (Resolution Consultants 2016). This area, once known as Ocean View Park, is within a developed area of the base and still serves as a park. Thus, these two specimens present an intriguing record. Because the locality data are unclear, an extensive search failed to find these two specimens in anyone’s work, and five species of *Leiocephalus* in sympatry would be unusual, I did not include *Leiocephalus cubensis* in Table 1 — but future researchers should keep an eye out!

### Conclusions

I have herein provided a new baseline for future additions, deletions, or updates to the herpetofauna of NSGB. The number of species known to occur on the base continues to increase and is now up to 45 (6 anurans and 39 reptiles, including sea turtles). One challenge in developing a definitive list of species present at any locality is that taxonomic changes do not always make it into museum records. Small staffs and tens of thousands of specimens mean that unless a pressing need exists or an active research project is ongoing, a specimen may remain identified as it was originally, perhaps from 100 years before. However, these specimens, regardless of how they are identified, are vitally important to understanding far more than just what species were present where and when. Thus, when conducting literature reviews or working through biodiversity and museum databases, one must examine specimens and pay close attention to taxonomic changes and updates to phylogenies, range maps, and/or species descriptions.

A high density of species, especially lizards and sea turtles, highlights the importance of this place for the U.S. Navy to maintain a light footprint and as an ideal place to study ecological and behavioral interactions between sympatric species. It also is an important site for long-term research on *Chilabothrus angulifer*, contains the second known population of *Leiocephalus onaneyi*, one of the rarest lizards in the world, and serves as a nesting site for four species of sea turtles. NSGB has attracted attention not only for its rich and diverse herpetofauna but as a proposed site for a nature preserve, peace park, and research station (Roman and Kraska 2016; Roman 2019). While an intriguing proposal, the base plays an important role in U.S. Caribbean operations, with multiple missions other than the detention operations. However, world events are associated with habitat loss at NSGB. The Cuban Missile Crisis in November 1962 led to alterations of forests and beaches into places that “no longer afford ideal collecting areas” (Lando and Williams 1969) as the base prepared defenses by cutting roads for tanks and building fighting positions. The Haitian migration (Operation Sea Signal,

1994–1996) led to a 95% loss of native cactus forest at Firing Point, negatively affecting *Cyclura nubila* (Alberts 2003), and further clearing occurred to construct facilities to hold the 11 September 2001 terrorist attack detainees. As species such as *Trachemys decussata* and *Leiocephalus onaneyi* have small ranges on the base and the status of others is not well known, new infrastructure needs, whether for temporary or long-term use, should be built over previously disturbed or developed land, rather than on native or near-native habitat.

The Naval Station has opportunities to restore habitat for not just the herpetofauna but other terrestrial species as well. The REA (Roca and Sedaghatkish 1999) found that the greatest biodiversity and the most important habitats for protecting terrestrial species on the base are cactus and thorn scrub and all four forest types (*Croton-Coccothrinax*, *Coccothrinax*, *Phyllostylon*, and *Phyllostylon-cactus*) on the base. The base has a plant nursery (operated mainly by volunteers but under the umbrella of the Naval Facilities Engineering Systems Command [NAVFAC] Environmental Program) that is used to propagate native plants for residential use. The area containing the detention operations could be replanted with native trees and cacti, once that mission is complete. If nothing else, the dirt roads used by security patrols could be replanted with native species to avoid these disturbed areas from becoming overgrown by the widespread non-native grasses already present, thus reducing the intrusion of invasives into the remaining native forest and cactus scrub. The area in and around McCalla Field, deactivated in 1970, and Gas Hill, which is currently grass-covered (should be forest), could also be restored by removing invasives and replanting native species. Restoration will help mitigate the negative effects of climate change. Projections by Velazco-Pérez and Mancina (2019) on lizard distributions in Cuba show that whether under their best or worst-case scenario, climate suitability for some coastal species (e.g., those at Guantánamo) will decline to the point that they could completely disappear as early as 2050 unless they can migrate to the mountains around the Guantánamo Basin. Replanting and restoring the base's native forest will increase canopy cover and could buy some time for species to adapt. Eastern Cuba is a biodiversity hotspot and an area with a high proportion of not just amphibians and reptiles requiring protection, but also birds and mammals (Cox et al. 2022). A concerted effort at habitat restoration on the base will not only protect biodiversity but also demonstrate to the international community that the United States is committed to being a good steward of natural resources.

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