



# **Department of Defense Legacy Resource Management Program**

PROJECT NUMBER (13-641)

## **Herpetofauna Biodiversity On Marine Corps Installations**

**Christopher Petersen, Robert E. Lovich, and Sarah Stallings**

Final Report  
September, 2014

THIS PAGE INTENTIONALLY LEFT BLANK

# HERPETOFAUNA BIODIVERSITY ON MARINE CORPS INSTALLATIONS



CHRISTOPHER PETERSEN, ROBERT LOVICH, AND SARAH STALLINGS



Photo Credit:

Eastern Spadefoot Toad (*Scaphiopus holbrookii*): Justin Sweitzer

Mohave Desert Tortoise (*Gopherus agassizii*): Tim Burr

Timber Rattlesnake (*Crotalus horridus*): Chris Petersen

# Abstract

The United States Marine Corps occupies more than two million acres within the United States. To date, no comprehensive inventory of the amphibian and reptile (herpetofauna) diversity has been conducted on Marine Corps lands. This study analyzed data from 17 Marine Corps installations within seven states of the continental United States. The area of Marine Corps land covered in this analysis was approximately 2.2 million acres.

The Marine Corps installations evaluated in this report support a total of 234 species (177 confirmed species and 57 potential species). Snakes are the most abundant herpetofauna species type. Marine Corps Base Camp Lejeune has the greatest number of confirmed herpetofauna species (80 species).

Nine species of reptiles and amphibians confirmed on Marine Corps installations are federally listed as endangered or threatened by the U.S. Fish and Wildlife Service. There are fourteen species of amphibians and reptiles confirmed on Marine Corps installations in states where they are listed as state endangered or threatened. The greatest numbers of federally- and state-listed species types on Marine Corps lands are turtles.

Six non-native amphibian and reptile species are confirmed on Marine Corps installations. The American Bullfrog (*Lithobates catesbeianus*) is the most common invasive herpetofauna species on Marine Corps lands. Marine Corps Base Camp Pendleton has the most non-native herpetofauna species.

Every Marine Corps installation has at least one species of venomous snake except for Marine Corps Mountain Warfare Training Center (MCMWTC) Bridgeport and Marine Corps Air Station (MCAS) Yuma (main base). Marine Corps Base Camp Lejeune has a greater number of confirmed venomous snakes (six) than any other Marine Corps installation. The Eastern Diamond-backed Rattlesnake (*Crotalus adamanteus*) is present at more Marine Corps installations than any other venomous snake species.

The data presented in this report and the resulting herpetofauna species lists for the Marine Corps sites evaluated are provided to identify data gaps and quantify herpetofauna diversity on these lands.

# CONTENTS

<b>Chapter 1—Introduction.....</b>	<b>1-1</b>
1.1 Amphibians and Reptiles .....	1-1
1.2 Natural Resources Management and Endangered Species Act Compliance on Military Lands .....	1-1
1.3 Management of Herpetofauna on Military Lands .....	1-2
1.4 Purpose.....	1-2
<b>Chapter 2—Methods .....</b>	<b>2-1</b>
2.1 Developing the National and Regional Herpetofauna Inventory .....	2-1
<b>Chapter 3—Data Analysis.....</b>	<b>3-1</b>
3.1 Determination of Occurrence on Each Installation.....	3-1
3.2 Federal, State, and NatureServe Status .....	3-1
3.3 Non-native Species .....	3-3
3.4 Venomous Species .....	3-3
<b>Chapter 4—Results.....</b>	<b>4-1</b>
4.1 Marine Corps installations .....	4-1
4.2 Confirmed and Potential Species .....	4-3
4.3 Federal, State, and NatureServe Status .....	4-7
<b>Chapter 5—Summary and Conclusions .....</b>	<b>5-1</b>
5.1 Herpetofauna Biodiversity on Marine Corps Installations.....	5-1
5.2 General Recommendations for Marine Corps Installations .....	5-1
<b>Chapter 6—Acknowledgements .....</b>	<b>6-1</b>
<b>List of Acronyms and Abbreviations .....</b>	<b>LOAA-1</b>
<b>Literature Cited .....</b>	<b>REF-1</b>

## TABLE OF FIGURES

Figure 4-1. Marine Corps Installations Included in the Herpetofauna Inventory .....	4-5
Figure 4-2. Confirmed and Potential Herpetofauna Species on Marine Corps Installations .....	4-7
Figure 4-3. American Alligator (Photo by Paul Block).....	4-8
Figure 4-4. Eastern Diamond-Backed Rattlesnake (Photo by Carmen Lombardo).....	4-8
Figure 4-5. Timber Rattlesnake (Photo by Tammy Conkle).....	4-9

Figure 4-6. Flat-Tailed Horned Lizard (Photo by Robert E. Lovich) .....4-10

Figure 4-7. Eastern Indigo Snake (Photo by J. D. Wilson).....4-10

Figure 4-8. Sierra Nevada Yellow-Legged Frog (Photo by Gary Nafis).....4-11

Figure 4-9. American Bullfrog (Photo by Chris Petersen) .....4-19

Figure 4-10. Red-Eared Slider (Picture by Paul Block).....4-19

Figure 4-11. Eastern Spiny Softshell .....4-21

Figure 4-12. Sidwinder (Photo by Greg Watson) .....4-22

Figure 4-13. Copperhead Snake (Photo by Seth Berry).....4-22

## **LIST OF TABLES**

Table 1. Natureserve Conservation Status Rank Definitions .....3-3

Table 2. Marine Corps Installations Included in the 2014 Herpetofauna Inventory Analysis .....4-2

Table 3. Species Type and Occurance on Marine Corps Installations (2014) .....4-3

Table 4. Conservation Status Summary (2014) .....4-13

Table 6. Venomous Snake Species Confirmed and Potential on Marine Corps Installations (2014) .....4-23

Table 5. Non-Native Species Confirmed and Potential to Marine Corps Installations (2014) .....4-20

Table 7. Comparison of Marine Corps Herpetofauna Biodiversity to Regional Biodiversity (2014) .....4-25

# CHAPTER 1

## Introduction

### 1.1 AMPHIBIANS AND REPTILES

Amphibians and reptiles (herpetofauna) account for a considerable portion of contemporary biodiversity and approximately 17,153 species have been described (AmphibiaWeb, 2012; Uetz, 1995a).

Approximately one new species of reptile or amphibian is discovered by the scientific community every week. Herpetofauna are found in nearly every habitat, occur on every continent except Antarctica (AmphibiaWeb, 2011; Vitt & Caldwell, 2008), and are both ecologically and culturally significant around the globe. Amphibians and reptiles are essential components of the ecosystems they inhabit, maintaining the ecological integrity of their habitats as both predators and prey, often surpassing other vertebrate groups in terms of species abundance or diversity (Ernst & Lovich, 2009; Semlitsch, 2003; Stuart et al., 2008; Klemens, 2000; Vitt & Caldwell, 2008) and serving as indicators of environmental health (Ernst & Lovich, 2009; Hayes et al., 2006; Hayes et al., 2002; Johnson et al., 2007; Pounds et al., 2006).

Herpetofauna are excellent indicator species, meaning populations will start to show signs of distress quickly when their ecosystem is under pressure. This sensitivity to environmental changes has contributed to relatively high extinction rates in herpetofauna. Recent extinction rates of amphibians may be more than 200 times that of historical background rates (McCallum, 2007). There are at least 6 major causes of recent herpetofauna declines and extinctions: habitat loss; land conversion; collection for commercial trade; introduction of exotic species that prey on, compete with, and parasitize native amphibians; environmental contaminants; climate change; and infectious disease (Collins, 2010; Collins and Crump, 2009; Marks, 2006; Ribeiro et al., 2009).

Management of herpetofauna is necessary not only to protect those species, but also to protect all of the inter-related species in the food web and the ecological benefits of herpetofauna. Managing habitats for herpetofauna can have positive impacts on the entire ecosystem, including human health.

### 1.2 NATURAL RESOURCES MANAGEMENT AND ENDANGERED SPECIES ACT COMPLIANCE ON MILITARY LANDS

The Department of Defense (DoD) manages approximately 28 million acres of land and water, much of which provides food and shelter for the diversity of native flora and fauna (Stein et al., 2008). The primary tool for implementation of natural resource management at Marine Corps installations is an Integrated Natural Resource Management Plan (INRMP). The Marine Corps, with the assistance from the U.S. Fish and Wildlife Service (USFWS) and the respective state conservation agencies, is responsible under the Sikes Act (16 U.S.C. 670a-670f, as amended) for carrying out programs and implementing management strategies to conserve and protect biological resources on its lands.

The United States (U.S.) Marine Corps occupies approximately 2.4 million acres within the United States. The Marine Corps and other DoD Services strive to provide the most realistic training and testing environments for troops in order to maintain military readiness. The Marine Corps also controls entry to portions of its installations as a matter of national security and public safety. As a result, much of the Marine Corps land provides some of the best remaining natural habitat for America's native species, including amphibians and reptiles. In some cases, DoD lands are some of the only large tracts of habitat

left in an area for native species (Benton et al., 2008) making those prime locations for herpetofauna conservation and management. In fact, American military lands harbor some of the greatest concentrations of endangered and threatened habitats and species in the United States (Stein et al. 2008).

As a federal agency, the Marine Corps must comply with the ESA to protect and conserve listed species. The Marine Corps is in a unique position to secondarily promote and conserve biodiversity while still carrying out its primary mission of training and preparing troops.

### **1.3 MANAGEMENT OF HERPETOFAUNA ON MILITARY LANDS**

The Marine Corps takes an ecosystem-based approach to natural resources management. While policies do not specifically address herpetofauna on Marine Corps lands, this management approach and the projects and practices implemented through INRMPs benefit these species both directly and indirectly. In addition, the Marine Corps has subject matter experts in the fields of wildlife biology and herpetology that conduct inventories; perform research and monitoring; and develop outreach, training, and management plans to meet military mission goals while promoting stewardship and conservation for amphibians and reptiles.

The Department of Defense Partners in Reptile and Amphibian Conservation (DoD PARC) was formed in 2009 with the mission of sustaining amphibian and reptile populations and habitats through proactive environmental stewardship, conservation, outreach, and partnerships. DoD PARC is a network of experts and professionals within the DoD dedicated to providing a “framework for the effective management of amphibians and reptiles by the military services and their installations” (<http://www.dodnaturalresources.net/DoD-PARC.html>). DoD PARC has become a leading organization to assist the military Services with their herpetofauna management and conservation by providing education and guidance and by developing partnerships in support of the military mission.

### **1.4 PURPOSE**

The purpose of this study was to conduct an analysis of herpetofauna inventories on Marine Corps installations in the continental United States that have significant natural resources. This included species with conservation needs (federally-, state-, and NatureServe-listed species), nonnative species, and venomous species on a national scale. In addition, study data will facilitate data sharing between Marine Corps installations, regions, and state and federal partners and help foster effective, cooperative conservation initiatives and partnerships.

## CHAPTER 2

# Methods

### 2.1 DEVELOPING THE NATIONAL AND REGIONAL HERPETOFAUNA INVENTORY

Multiple sources were used to compile and update the Marine Corps installation herpetofauna species lists used for this study. The following protocol was followed to develop and refine the species lists:

1. A preliminary list of reptile and amphibian species was developed using the Herpetological Database, a Microsoft Access database that produces a county-level species list using data from Herpnet2 (<http://herpnet.org/>, reptile occurrences), and the National Amphibian Atlas ([http://armi.usgs.gov/national\\_amphibian\\_atlas.php](http://armi.usgs.gov/national_amphibian_atlas.php), amphibian occurrences) for each installation that has an INRMP. All lists were reviewed by DoD PARC.
2. The preliminary species list was then sent to a state wildlife agency biologist/herpetologist or a regional expert to verify that the species on the list could potentially occur on the installation based upon the known species distribution within the state.
3. The draft species list was then compared to the existing installation INRMP species list (if available) and installation species herpetological surveys or species inventories to identify those species that have been confirmed on the installation.
4. The pre-final list was sent to each installation's natural resource manager for review and validation before becoming final.

This process was followed for each of the Marine Corps installations within the continental United States having enough significant natural resources to require an INRMP. In some cases, a major Marine Corps installation has one or several geographically-distinct parcels under its command. These parcels, if included in the INRMP, were considered separately in this analysis and a herpetofauna list was developed for each. Once installation-level lists were complete, they were compiled into a Microsoft Excel spreadsheet and analyzed together.

The lists were updated to reflect the most recent federal, state, and NatureServe statuses as of April 2014. Additional information, such as if a particular species is not native, was obtained from a spreadsheet managed by PARC (Nanjappa & Conrad, 2014).

Subspecies designation was used, if known, during the development of the herpetofauna species lists for each of the Marine Corps installations. However, because one goal of this analysis was to investigate species diversity on all Marine Corps installations, the analysis was conducted on the species level. Subspecies level is only used in this report if the subspecies has a conservation status designation (federal or state) that differs from the full species level. Scientific and common nomenclature was standardized abiding by the Standard English and Scientific Names Committee standards ([http://www.ssarherps.org/pages/comm\\_names/Index.php](http://www.ssarherps.org/pages/comm_names/Index.php)) (Crother, 2012).

THIS PAGE IS INTENTIONALLY BLANK.

# CHAPTER 3

## Data Analysis

Upon completion of the individual Marine Corps installation herpetofauna species lists, data were analyzed based on species occurrence (number of confirmed or potential species [unconfirmed species]); federal, state, and NatureServe status; and occurrence of non-native and venomous species. In addition, the Marine Corps herpetofauna biodiversity was compared to that of all amphibian and reptile species found within the continental United States.

### 3.1 DETERMINATION OF OCCURRENCE ON EACH INSTALLATION

Species are considered confirmed present on an installation when there is literature present endorsing that the species occurs on the installation. Literature is often in the form of site-specific survey data or a report produced by a professional herpetologist or contractor, a museum voucher, or data presented in the installation's INRMP. Personal observations from a reliable source, such as an installation natural resource manager or field biologist, are also accepted in some cases following a review of the supporting information. Citations are provided in the herpetofauna lists for every confirmed species.

Species are considered potential when the installation property is within the circumscribed natural or introduced range of that species and the species has been documented in the same county as a particular military installation, but a specimen has not been confirmed within the boundaries of the installation. Thus a potential species is unconfirmed on an installation.

### 3.2 FEDERAL, STATE, AND NATURESERVE STATUS

#### 3.2.1 Federal Status

Federally-protected species were determined by reviewing the USFWS Website (<http://www.fws.gov/endangered/species/index.html>), lists, and publications.

Species listed under the ESA are assigned to one of four categories. In order of increasing imperilment, these categories are:

1. Candidate species—Species for which the USFWS or the National Oceanic and Atmospheric Administration (NOAA) Fisheries has sufficient information on file regarding biological vulnerability and threats to support a proposal to list as endangered or threatened, but listing is precluded due to lack of funds or other listing actions of higher priority. Candidate species should be considered to be in line for future listing as either threatened or endangered.
2. Threatened species—A species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Collection, harassment, hunting, or killing of a threatened species or its parts, even if accidental, is prohibited under the ESA.
3. Endangered species—A species that is in danger of extinction throughout all or a significant portion of its range (Endangered Species Glossary-Midwest Region, 2013). Collection,

harassment, hunting, or killing of an endangered species or its parts, even if accidental, is prohibited under the ESA.

4. Petitioned species/Under review—Species that are currently under review by the USFWS and data is being collected to make an informed decision regarding listing. For the purposes of this study, a species was considered under review when the species did not have a federal status rank, but may warrant future consideration.

### **3.2.2 State Status**

State-listed threatened and endangered species were determined and recorded for each Marine Corps installation. These data were obtained using a spreadsheet updated by PARC annually and verified by state biologists who reviewed the lists for each Marine Corps installation (Nanjappa & Conrad, 2014).

Marine Corps documentation states that “each installation shall survey and take other appropriate actions to document the presence of state or territory rare and endangered species” (MCO P5090.2A, Environmental Compliance and Protection Manual). As a result, the Marine Corps strives to conserve or manage state-listed species on its lands and work closely with the respective states to avoid negative impacts to these species to help prevent their decline.

### **3.2.3 NatureServe Status**

NatureServe is an international, non-profit conservation organization that collects information on species and ecosystems, and develops conservation tools and services to help meet local, national, and global conservation needs (NatureServe Network, 2013). The DoD uses NatureServe species rankings as a tool to identify species on their lands that may be in need of conservation or of special management practices.

The NatureServe ranking of a species is important to installation natural resource managers providing them an understanding of the conservation status of a particular species on a global scale. This information is useful when determining if a species is at risk of becoming listed as endangered or threatened at the state or federal level. This ranking is also useful when planning for future surveys and when developing long-term conservation strategies.

NatureServe assigns a conservation status rank to species by scoring the species in ten categories, weighting the scores and combining them into an overall numeric score, which is then converted into a calculated rank. The conservation status is based on three factors: rarity, threats, and trends (Faber-Langendoen et al., 2012). NatureServe assigns rounded global status ranked on a scale of G5 to G1, with G5 standing for secure and G1 standing for critically imperiled (table 1). This scale best reflects the global condition of a species without qualifiers or ranges (NatureServe Explorer, 2013). Species with a rank of G1–G3 are considered species at risk and are identified in this report.

Table 1. Naturereserve Conservation Status Rank Definitions

<b>G1</b>	Critically Imperiled—At very high risk of extinction or elimination due to very restricted range, very few populations or occurrences, very steep declines, very severe threats, or other factors.
<b>G2</b>	Imperiled—At high risk of extinction or elimination due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.
<b>G3</b>	Vulnerable—At moderate risk of extinction or elimination due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors.
<b>G4</b>	Apparently Secure—At fairly low risk of extinction or elimination due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors.
<b>G5</b>	Secure—At very low risk of extinction or elimination due to a very extensive range, abundant populations or occurrences, and little to no concern from declines or threats.

### 3.3 NON-NATIVE SPECIES

A species is considered non-native in this analysis when it occurs, or potentially occurs, on an installation in a state where it is not native. The non-native designations used are from data maintained by members of the PARC organization and are updated annually (Nanjappa & Conrad, 2014). Many species that are non-native become pests or invasive species because they cause harm or unbalance the native ecosystems.

### 3.4 VENOMOUS SPECIES

Venomous snakes in the United States include Rattlesnakes (*Crotalus spp.* and *Sistrurus spp.*), Cottonmouths (*Agkistrodon piscivorus spp.*), Copperheads (*Agkistrodon contortrix spp.*), and Coralsnakes (*Micrurus spp.* and *Micruroides spp.*). There are also two species of venomous lizards in the United States, the Gila Monster (*Heloderma suspectum*) and the Beaded Lizard (*Heloderma horridum*).

Venomous snakes were included in this analysis due to the potential risk of negative human-wildlife interactions. Marine Corps installations with confirmed venomous species should educate their military and civilian members of the potential dangers of these animals. This is particularly true for military personnel that conduct training in natural environments where venomous snakes are present. Likewise, amphibians of many species have toxic skin secretions to avoid predation. Interaction with any amphibian or reptile should be discouraged to avoid undue and costly consequences.

THIS PAGE IS INTENTIONALLY BLANK.

# Chapter 4

## Results

### 4.1 MARINE CORPS INSTALLATIONS

Seventeen Marine Corps installations were included in the inventory of herpetofauna (table 2). The installations are located in the states of Arizona, California, Florida, Georgia, North Carolina, South Carolina, and Virginia and are predominately located in the southeastern and southwestern United States (Figure 4-1). The total acreage of the installations evaluated was approximately 2.2 million acres.

Table 2. Marine Corps Installations Included in the 2014 Herpetofauna Inventory Analysis

<b>Installation Name</b>	<b>County</b>	<b>State</b>	<b>Acres*</b>
Marine Corps Air Station Yuma	Yuma	Arizona	6,316
Marine Corps Air Station Yuma–Barry M. Goldwater Range West	Yuma	Arizona	692,815
Chocolate Mountain Aerial Gunnery Range	Imperial, Riverside	California	456,849
MCAGCC Twentynine Palms	San Bernardino	California	598,178
Marine Corps Logistics Base Barstow	San Bernardino	California	5,405
Marine Corps Air Station Camp Pendleton	San Diego	California	488
Marine Corps Base Camp Pendleton	San Diego	California	125,146
Marine Corps Air Station Miramar	San Diego	California	23,065
Marine Corps Mountain Warfare Training Center Bridgeport	Mono	California	62,884
Marine Corps Support Facility Blount Island	Duval	Florida	686
Marine Corps Logistics Base Albany	Dougherty	Georgia	3,326
Townsend Bombing Range	McIntosh County	Georgia	5,200
Marine Corps Air Station Cherry Point	Craven	North Carolina	11,600
Marine Corps Base Camp Lejeune	Onslow	North Carolina	142,852
Marine Corps Air Station Beaufort	Beaufort	South Carolina	7,200
Marine Corps Recruit Depot Parris Island	Beaufort	South Carolina	8,047
Marine Corps Base Quantico	Fauquier, Prince William, Stafford	Virginia	58,995
<b>TOTAL</b>			<b>2,209,052 acres</b>
*Acres recorded from those reported in the INRMPS			

## 4.2 CONFIRMED AND POTENTIAL SPECIES

Analysis of the herpetofauna inventory data from all 17 Marine Corps installations showed 177 species (76 percent) are confirmed present and an additional 57 species (24 percent) have the potential to be present (table 3). There are 66 confirmed amphibian species and 111 confirmed reptile species on the Marine Corps installations evaluated in this report. Of the species types, snakes have the greatest number of confirmed species (54 species) and the largest number of potential species (18 species).

Table 3. Species Type and Occurance on Marine Corps Installations (2014)

Species Type	Number of Species Confirmed	Number of Species Potential	Confirmed and Potential	Percent Confirmed	Percent Potential
Frogs and Toads	37	13	50	74%	26%
Salamanders	29	11	40	73%	27%
Lizards	35	11	46	76%	24%
Snakes	54	18	72	75%	25%
Turtles	21	4	25	84%	16%
Crocodiles/ Alligators	1	0	1	100%	0
<b>Total</b>	<b>177</b>	<b>57</b>	<b>234</b>	<b>76%</b>	<b>24%</b>

Comparison of the confirmed reptiles and amphibian species on each of the Marine Corps installations has revealed that Marine Corps Base (MCB) Camp Lejeune has the greatest number of confirmed species (80 species; Figure 4-2). Marine Corps Mountain Warfare Training Center Bridgeport has the least number of confirmed species (one species). Marine Corps Air Station Beaufort would have the greatest herpetofauna biodiversity if all of the species listed as potential were confirmed (108 species).

THIS PAGE IS INTENTIONALLY BLANK.



Figure 4-1. Marine Corps Installations Included in the Herpetofauna Inventory

THIS PAGE INTENTIONALLY LEFT BLANK

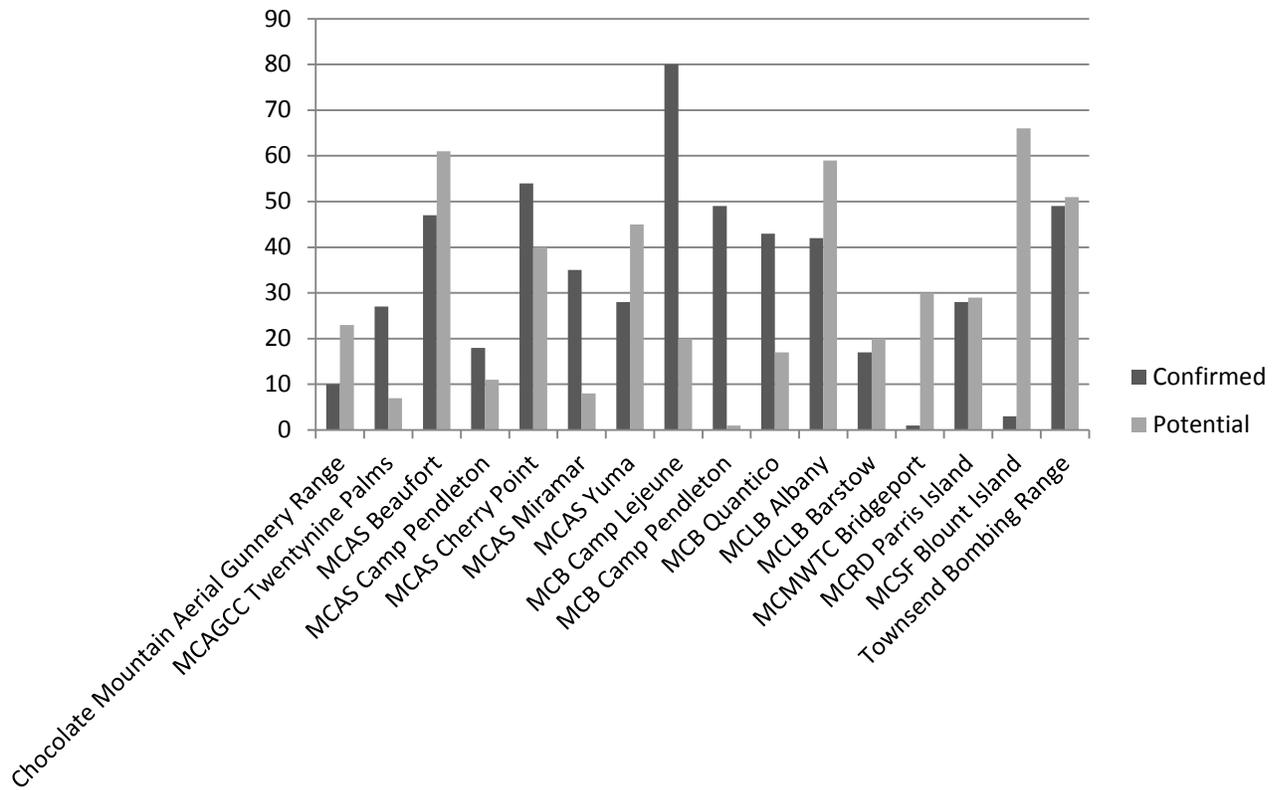


Figure 4-2. Confirmed and Potential Herpetofauna Species on Marine Corps Installations

### 4.3 FEDERAL, STATE, AND NATURESERVE STATUS

#### 4.3.1 Confirmed Species—Federally Endangered, Threatened, Candidate, Under Review

Nine species of reptiles and amphibians confirmed on Marine Corps installations are federally listed as endangered or threatened by the USFWS (table 4). Of the species types, five species are turtles, two are frogs, one is a salamander, and one is an alligator. The American Alligator (*Alligator mississippiensis*) was delisted in 1987. However this species is still listed under the ESA as Similarity of Appearance (Threatened) due to their close resemblance to crocodiles. The American Alligator is the most common federally-listed species on Marine Corps installations and is confirmed present on seven installations.



Figure 4-3. American Alligator (Photo by Paul Block)

Marine Corps Base Camp Pendleton has the greatest number of federally-listed herpetofauna species confirmed on its installation (five species). Marine Corps Air Station Yuma (main base), MCAS Miramar, and MCB Quantico do not have any confirmed federally-listed species.



Four species currently under review (the Eastern Diamond-backed Rattlesnake [*Crotalus adamanteus*], the Gopher Frog [*Lithobates capito*], the Southern Hog-nosed Snake [*Heterodon simus*], and the Western Pond Turtle [*Actinemys marmorata*]) and one candidate species (the eastern population of the Gopher Tortoise [*Gopherus polyphemus*]) are confirmed on seven Marine Corps installations. Marine Corps Base Camp Lejeune has the greatest number of confirmed herpetofauna species under review on its installation (three species).

Figure 4-4. Eastern Diamond-Backed Rattlesnake (Photo by Carmen Lombardo)

#### 4.3.2 Potential Species—Federally Endangered, Threatened, Candidate, Under Review

Two federally-endangered species (Kemp's Ridley Sea Turtle [*Lepidochelys kempii*] and the Hawksbill Sea Turtle [*Eretmochelys imbricate*]) and two federally-threatened species (Eastern Indigo Snake [*Drymarchon couperi*] and the Yosemite Toad [*Anaxyrus canorus*]) have the potential to occur on Marine

Corps installations (table 4). In addition, the Western Pond Turtle (*Actinemys marmorata*) is currently under review by the USFWS and has the potential to occur at three Marine Corps installations in California. Lastly, the Striped Newt (*Notophthalmus perstriatus*) is a candidate species and has the potential to occur at Marine Corps Logistics Base (MCLB) Albany and Townsend Bombing Range. Future surveys may confirm the presence of these species.

### 4.3.3 State Status

#### 4.3.3.1 Confirmed Species—State Threatened or Endangered

There are fourteen species of amphibians and reptiles confirmed on Marine Corps installations in states where they are listed as state endangered or threatened (table 4). Of the species types, six are turtles, three are snakes, two are frog/toads, and there is one salamander, one lizard and one alligator. Marine Corps Base Camp Lejeune has the greatest number of state-listed threatened and endangered herpetofauna species (8 species).

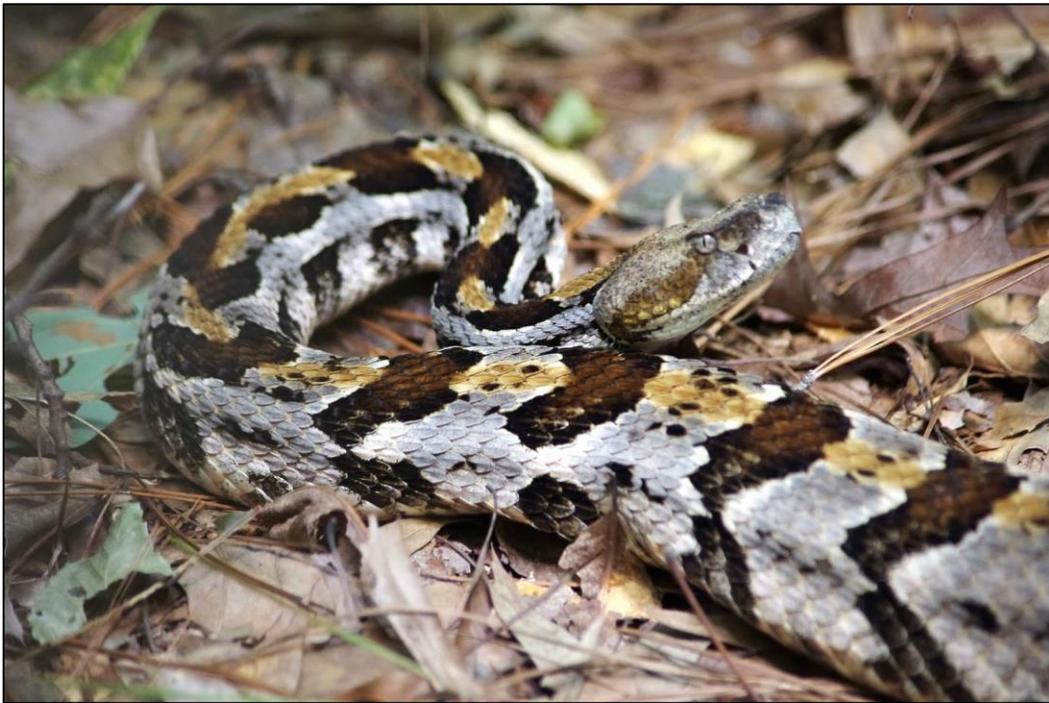


Figure 4-5. Timber Rattlesnake (Photo by Tammy Conkle)



Figure 4-6. Flat-Tailed Horned Lizard (Photo by Robert E. Lovich)

#### 4.3.3.2 Potential Species—State Threatened or Endangered

There are four species of amphibians and reptiles with the potential to occur on Marine Corps installations in states where they are listed as state-endangered or threatened. Of the species types, two are sea turtles (Kemp's Ridley Sea Turtle [*Lepidochelys kempii*], Hawksbill Sea Turtle [*Eretmochelys imbricate*]) one is a snake (Eastern Indigo Snake [*Drymarchon couperi*]), and one is a salamander (Striped Newt [*Notophthalmus perstriatus*]). All of the state-listed species with potential to occur on Marine Corps installations are located on the east coast of the United States.



Figure 4-7. Eastern Indigo Snake (Photo by J. D. Wilson)

#### 4.3.4 NatureServe Status

##### 4.3.4.1 Confirmed Species—Species at Risk

Seventeen species of reptiles and amphibians confirmed on Marine Corps installations have a NatureServe status of G1–G3—six lizards, five turtles, four frogs, one salamander, and one snake. Only one species has a status of G1–Critically Imperiled (Sierra Nevada Yellow-Legged Frog [*Rana sierra*]) which is confirmed on MCMWTC Bridgeport. Marine Corps Base Camp Pendleton has the greatest number of NatureServe species with a status of G1–G3 (seven species).



Figure 4-8. Sierra Nevada Yellow-Legged Frog (Photo by Gary Nafis)

##### 4.3.4.2 Potential Species—Species at Risk

There are 10 species with a NatureServe status of G1–G3 that have the potential to occur on Marine Corps installations. Of the 10 species, 1 has a NatureServe Status of G1–Critically Imperiled (Kemp’s Ridley Sea Turtle [*Lepidochelys kempii*] which has the potential to occur at MCAS Beaufort, Marine Corps Support Facility (MCSF) Blount Island, and MCB Camp Lejeune.

THIS PAGE INTENTIONALLY LEFT BLANK

Table 4. Conservation Status Summary (2014) (Sheet 1 of 5)

Species	Federal Status	State Status where Confirmed or Potential	NatureServe Status	Confirmed Location/s	Potential Location/s
<b>Leatherback Sea Turtle</b> <i>(Dermochelys coriacea)</i>	Endangered	Endangered–GA, NC, SC, VA	G2–Imperiled	<ul style="list-style-type: none"> <li>• MCB Camp Lejeune</li> <li>• MCB Camp Pendleton</li> </ul>	<ul style="list-style-type: none"> <li>• MCAS Beaufort</li> <li>• MCSF Blount Island</li> </ul>
<b>Arroyo Toad</b> <i>(Anaxyrus californicus)</i>	Endangered		G2–Imperiled	<ul style="list-style-type: none"> <li>• MCAS Camp Pendleton</li> <li>• MCB Camp Pendleton</li> </ul>	
<b>Sierra Nevada Yellow-legged Frog</b> <i>(Rana sierra)</i>	Endangered	Threatened–CA	G1–Critically Imperiled	<ul style="list-style-type: none"> <li>• MCMWTC Bridgeport</li> </ul>	
<b>Kemp’s Ridley Sea Turtle</b> <i>(Lepidochelys kempii)</i>	Endangered	Endangered–NC, SC	G1–Critically Imperiled		<ul style="list-style-type: none"> <li>• MCAS Beaufort</li> <li>• MCSF Blount Island</li> <li>• MCB Camp Lejeune</li> </ul>
<b>Hawksbill Sea Turtle</b> <i>(Eretmochelys imbricata)</i>	Endangered	Endangered–NC, SC	G3–Vulnerable		<ul style="list-style-type: none"> <li>• MCAS Beaufort</li> <li>• MCSF Blount Island</li> <li>• MCB Camp Lejeune</li> </ul>
<b>Green Sea Turtle</b> <i>(Chelonia mydas)</i>	Threatened	Threatened–GA, NC, SC	G3–Vulnerable	<ul style="list-style-type: none"> <li>• MCB Camp Lejeune</li> <li>• MCB Camp Pendleton</li> </ul>	<ul style="list-style-type: none"> <li>• MCAS Beaufort</li> <li>• MCSF Blount Island</li> </ul>
<b>Olive Ridley Sea Turtle</b> <i>(Lepidochelys olivacea)</i>	Threatened		G3–Vulnerable	<ul style="list-style-type: none"> <li>• MCB Camp Pendleton</li> </ul>	
<b>Loggerhead Sea Turtle</b> <i>(Caretta caretta)</i>	Threatened	Endangered–GA Threatened–NC, SC	G3–Vulnerable	<ul style="list-style-type: none"> <li>• MCB Camp Lejeune</li> <li>• MCB Camp Pendleton</li> </ul>	<ul style="list-style-type: none"> <li>• MCAS Beaufort</li> <li>• MCSF Blount Island</li> </ul>
<b>Frosted Flatwoods Salamander</b> <i>(Ambystoma cingulatum)</i>	Threatened	Endangered–SC Threatened–GA	G2–Imperiled	<ul style="list-style-type: none"> <li>• Townsend Bombing Range</li> </ul>	<ul style="list-style-type: none"> <li>• MCAS Beaufort</li> </ul>

Table 4. Conservation Status Summary (2014) (Sheet 2 of 5)

<p><b>American Alligator</b> <i>(Alligator mississippiensis)</i></p>	<p>Similarity of Appearance (Threatened)</p>	<p>Threatened–NC, SC</p>	<p>G5–Secure</p>	<ul style="list-style-type: none"> <li>• MCLB Albany</li> <li>• MCAS Beaufort</li> <li>• MCSF Blount Island</li> <li>• MCB Camp Lejeune</li> <li>• MCAS Cherry Point</li> <li>• MCRD Parris Island</li> <li>• Townsend Bombing Range</li> </ul>	
<p><b>Desert Tortoise</b> <i>(Gopherus agassizii)</i></p>	<p>Threatened</p>	<p>Threatened–CA State Protected - AZ</p>	<p>G4–Apparently Secure</p>	<ul style="list-style-type: none"> <li>• MCAGCC Twentynine Palms</li> <li>• Chocolate Mountain Aerial Gunnery Range</li> <li>• MCLB Barstow</li> </ul>	
<p><b>Gopher Tortoise</b> <i>(Gopherus polyphemus)</i></p>	<p>AL, MS, LA– Federally Threatened Elsewhere– Candidate</p>	<p>Endangered–SC Threatened–FL, GA</p>	<p>G3–Vulnerable</p>	<ul style="list-style-type: none"> <li>• MCLB Albany</li> <li>• MCSF Blount Island</li> </ul>	<ul style="list-style-type: none"> <li>• MCAS Beaufort</li> <li>• Townsend Bombing Range</li> </ul>
<p><b>Eastern Indigo Snake</b> <i>(Drymarchon couperi)</i></p>	<p>Threatened</p>	<p>Threatened–GA</p>	<p>G3–Vulnerable</p>		<ul style="list-style-type: none"> <li>• Townsend Bombing Range</li> </ul>
<p><b>Yosemite Toad</b> <i>(Anaxyrus canorus)</i></p>	<p>Threatened</p>		<p>G2–Imperiled</p>		<ul style="list-style-type: none"> <li>• MCMWTC Bridgeport</li> </ul>
<p><b>Eastern Diamond-backed Rattlesnake</b> <i>(Crotalus adamanteus)</i></p>	<p>Under Review</p>	<p>Endangered–NC</p>	<p>G4–Apparently Secure</p>	<ul style="list-style-type: none"> <li>• MCAS Beaufort</li> <li>• MCLB Albany</li> <li>• MCB Camp Lejeune</li> <li>• MCRD Parris Island</li> <li>• MCSF Blount Island</li> <li>• Townsend Bombing Range</li> </ul>	<ul style="list-style-type: none"> <li>• MCAS Cherry Point</li> </ul>

Table 4. Conservation Status Summary (2014) (Sheet 3 of 5)

<b>Gopher Frog</b> <i>(Lithobates capito)</i>	Under Review	Endangered–SC Threatened–NC, FL	G3–Vulnerable	<ul style="list-style-type: none"> <li>• MCB Camp Lejeune</li> </ul>	<ul style="list-style-type: none"> <li>• MCAS Beaufort</li> <li>• MCLB Albany</li> <li>• Townsend Bombing Range</li> </ul>
<b>Southern Hog-nosed Snake</b> <i>(Heterodon simus)</i>	Under Review	Threatened–GA, SC	G2–Imperiled	<ul style="list-style-type: none"> <li>• MCB Camp Lejeune</li> </ul>	<ul style="list-style-type: none"> <li>• MCAS Beaufort</li> <li>• MCAS Cherry Point</li> <li>• MCLB Albany</li> </ul>
<b>Western Pond Turtle</b> <i>(Actinemys marmorata)</i>	Under Review		G3–Vulnerable	<ul style="list-style-type: none"> <li>• MCB Camp Pendleton</li> </ul>	<ul style="list-style-type: none"> <li>• MCAS Camp Pendleton</li> <li>• MCAS Miramar</li> <li>• MCLB Barstow</li> </ul>
<b>Striped Newt</b> <i>(Notophthalmus perstriatus)</i>	Candidate	Threatened–GA	G2–Imperiled		<ul style="list-style-type: none"> <li>• MCLB Albany</li> <li>• Townsend Bombing Range</li> </ul>
<b>Timber Rattlesnake</b> <i>(Crotalus horridus)</i>		Endangered–VA	G4–Apparently Secure	<ul style="list-style-type: none"> <li>• MCAS Beaufort</li> <li>• MCB Camp Lejeune</li> <li>• MCB Quantico</li> <li>• Townsend Bombing Range</li> </ul>	<ul style="list-style-type: none"> <li>• MCAS Cherry Point</li> <li>• MCLB Albany</li> </ul>
<b>Harlequin Coralsnake</b> <i>(Micrurus fulvius)</i>		Endangered–NC	G5–Secure	<ul style="list-style-type: none"> <li>• MCB Camp Lejeune</li> </ul>	<ul style="list-style-type: none"> <li>• MCAS Beaufort</li> <li>• MCLB Albany</li> <li>• MCRD Parris Island</li> <li>• MCSF Blount Island</li> <li>• Townsend Bombing Range</li> </ul>
<b>Eastern Tiger Salamander</b> <i>(Ambystoma tigrinum tigrinum)</i>		Threatened–NC	G5–Secure	<ul style="list-style-type: none"> <li>• MCLB Albany</li> </ul>	<ul style="list-style-type: none"> <li>• MCAS Cherry Point</li> <li>• MCB Camp Lejeune</li> <li>• MCAS Beaufort</li> <li>• Townsend Bombing Range</li> </ul>

Table 4. Conservation Status Summary (2014) (Sheet 4 of 5)

<b>Spotted Turtle</b> <i>(Clemmys guttata)</i>		Threatened–SC	G5–Secure	<ul style="list-style-type: none"> <li>• MCAS Beaufort</li> <li>• MCB Camp Lejeune</li> <li>• MCB Quantico</li> </ul>	<ul style="list-style-type: none"> <li>• MCLB Albany</li> <li>• MCAS Cherry Point</li> <li>• Townsend Bombing Range</li> </ul>
<b>Flat-tailed Horned Lizard</b> <i>(Phrynosoma [Anota] mcallii)</i>		State Protected–AZ	G3–Vulnerable	<ul style="list-style-type: none"> <li>• MCAS Yuma–BMGR</li> </ul>	MCAS Yuma–main base
<b>Southern California Legless Lizard</b> <i>(Anniella stebbinsi)</i>			G3–Vulnerable	<ul style="list-style-type: none"> <li>• MCB Camp Pendleton</li> <li>• MCAS Miramar</li> </ul>	
<b>Blainville's Horned Lizard</b> <i>(Phrynosoma [Anota] blainvilleii)</i>			G3–Vulnerable	<ul style="list-style-type: none"> <li>• MCB Camp Pendleton</li> <li>• MCAS Miramar</li> </ul>	
<b>Goode's Horned Lizard</b> <i>(Phrynosoma [Doliosaurus] goodei)</i>			G3–Vulnerable	<ul style="list-style-type: none"> <li>• MCAS Yuma–BMGR</li> </ul>	
<b>Western Spadefoot</b> <i>(Spea hammondii)</i>			G3–Vulnerable	<ul style="list-style-type: none"> <li>• MCB Camp Pendleton</li> <li>• MCAS Camp Pendleton</li> <li>• MCAS Miramar</li> </ul>	
<b>Yuma Fringe-toed Lizard</b> <i>(Uma rufopunctata)</i>			G3–Vulnerable	<ul style="list-style-type: none"> <li>• MCAS Yuma–BMGR</li> </ul>	<ul style="list-style-type: none"> <li>• MCAS Yuma–main base</li> </ul>
<b>Mohave Fringe-toed Lizard</b> <i>(Uma scoparia)</i>			G3–Vulnerable	<ul style="list-style-type: none"> <li>• MCAGCC Twentynine Palms</li> <li>• MCLB Barstow</li> </ul>	
<b>Mount Lyell Salamander</b> <i>(Hydromantes platycephalus)</i>			G3–Vulnerable		<ul style="list-style-type: none"> <li>• MCMWTC Bridgeport</li> </ul>

Table 4. Conservation Status Summary (2014) (Sheet 5 of 5)

<p><b>Neuse River Waterdog</b> <i>(Necturus lewisi)</i></p>			G3–Vulnerable		<ul style="list-style-type: none"> <li>• MCAS Cherry Point</li> </ul>
<p><b>Island Glass Lizard</b> <i>(Ophisaurus compressus)</i></p>			G3–Vulnerable		<ul style="list-style-type: none"> <li>• MCAS Beaufort</li> <li>• MCRD Parris Island</li> <li>• MCSF Blount Island</li> <li>• Townsend Bombing Range</li> </ul>
<p><b>Mimic Glass Lizard</b> <i>(Ophisaurus mimicus)</i></p>			G3–Vulnerable		<ul style="list-style-type: none"> <li>• MCAS Beaufort</li> <li>• MCAS Cherry Point</li> <li>• MCB Camp Lejeune</li> <li>• MCLB Albany</li> <li>• Townsend Bombing Range</li> </ul>

THIS PAGE INTENTIONALLY LEFT BLANK

#### 4.3.5 Non-native Species

Six non-native amphibian and reptile species are confirmed on Marine Corps installations (table 5). Four of the species (the Spiny Softshell Turtle [*Apalone spinifera*], the Snapping Turtle [*Chelydra serpentina*], the Red-Eared Slider [*Trachemys scripta elegans*], and the American Bullfrog [*Lithobates catesbeianus*]) are native to the United States, but have been transported outside their natural range. The African Clawed Frog (*Xenopus laevis*) and the Mediterranean Gecko (*Hemidactylus turcicus*) are not native to the United States and are confirmed on MCAS Miramar and MCLB Albany respectively. Marine Corps Base Camp Pendleton has the most non-native herpetofauna species (four species).



Figure 4-9. American Bullfrog (Photo by Chris Petersen)



Seven additional non-native species have the potential to be present at Marine Corps installations. Three of these species (the Indo-pacific Gecko [*Hemidactylus garnotti*], the Greenhouse Frog [*Eleutherodactylus planirostris*], and the Cuban Treefrog [*Osteopilus septentrionalis*]) are not native to the United States. The remaining species are native to the United States, but have been transported outside their natural range.

Figure 4-10. Red-Eared Slider (Picture by Paul Block)

Table 5. Non-Native Species Confirmed and Potential to Marine Corps Installations (2014)

Species	Confirmed Location/s	Potential Location/s
<b>Spiny Softshell</b> ( <i>Apalone spinifera</i> )	<ul style="list-style-type: none"> <li>• MCB Camp Pendleton</li> </ul>	<ul style="list-style-type: none"> <li>• MCAS Yuma (BMGR West)</li> </ul>
<b>Snapping Turtle</b> ( <i>Chelydra serpentina</i> )	<ul style="list-style-type: none"> <li>• MCB Camp Pendleton</li> </ul>	
<b>Red-eared Slider</b> ( <i>Trachemys scripta elegans</i> )	<ul style="list-style-type: none"> <li>• MCAS Miramar</li> <li>• MCB Camp Pendleton</li> </ul>	<ul style="list-style-type: none"> <li>• MCAS Camp Pendleton</li> <li>• MCB Quantico</li> </ul>
<b>American Bullfrog</b> ( <i>Lithobates catesbeianus</i> )	<ul style="list-style-type: none"> <li>• MCAS Miramar</li> <li>• MCB Camp Pendleton</li> <li>• MCLB Barstow</li> </ul>	<ul style="list-style-type: none"> <li>• MCAGCC Twentynine Palms</li> <li>• MCAS Camp Pendleton</li> <li>• MCAS Yuma (BMGR West)</li> </ul>
<b>African Clawed Frog</b> ( <i>Xenopus laevis</i> )	<ul style="list-style-type: none"> <li>• MCAS Miramar</li> </ul>	
<b>Mediterranean Gecko</b> ( <i>Hemidactylus turcicus</i> )	<ul style="list-style-type: none"> <li>• MCLB Albany</li> </ul>	<ul style="list-style-type: none"> <li>• Chocolate Mountain Aerial Gunnery Range</li> <li>• MCAS Yuma (BMGR West)</li> <li>• MCAS Yuma (main base)</li> <li>• MCLB Barstow</li> <li>• MCSF Blount Island</li> <li>• Townsend Bombing Range</li> </ul>
<b>Indo-pacific Gecko</b> ( <i>Hemidactylus garnotti</i> )		<ul style="list-style-type: none"> <li>• MCSF Blount Island</li> </ul>
<b>Greenhouse Frog</b> ( <i>Eleutherodactylus planirostris</i> )		<ul style="list-style-type: none"> <li>• MCAS Beaufort</li> <li>• MCLB Albany</li> <li>• MCSF Blount Island</li> <li>• Townsend Bombing Range</li> </ul>
<b>Cuban Treefrog</b> ( <i>Osteopilus septentrionalis</i> )		<ul style="list-style-type: none"> <li>• MCAS Beaufort</li> <li>• MCSF Blount Island</li> </ul>
<b>Northern Leopard Frog</b> ( <i>Lithobates pipiens</i> )		<ul style="list-style-type: none"> <li>• MCMWTC Bridgeport</li> </ul>
<b>Rio Grande Leopard Frog</b> ( <i>Lithobates berlandieri</i> )		<ul style="list-style-type: none"> <li>• Chocolate Mountain Aerial Gunnery Range</li> <li>• MCAS Yuma (BMGR West)</li> </ul>
<b>Texas Horned Lizard</b> ( <i>Phrynosoma cornutum</i> )		<ul style="list-style-type: none"> <li>• MCSF Blount Island</li> </ul>
<b>Western Painted Turtle</b> ( <i>Chrysemys picta belli</i> )		<ul style="list-style-type: none"> <li>• MCAS Miramar</li> <li>• MCB Camp Pendleton</li> </ul>



Figure 4-11. Eastern Spiny Softshell

#### 4.3.6 Venomous Species

Thirteen species of venomous snakes are confirmed on Marine Corps installations within the United States (two species in the genus *Agkistrodon* [Copperhead and Cottonmouth], one species in the genus *Micrurus* [Coralsnake], nine species in the genus *Crotalus*, and one in the genus *Sistrurus* [rattlesnakes]). In addition, there is the potential for an additional species (Sonoran Coralsnake [*Micruroides euryxanthus*]) at MCAS Yuma-main base and Barry M. Goldwater Range (BMGR West) (table 6).

Every Marine Corps installation has at least one species of venomous snake except for MCMWTC Bridgeport and MCAS Yuma (main base). However, there is the potential for the Great Basin Rattlesnake (*Crotalus oreganus lutosus*) to be present at MCMWTC Bridgeport and for the Western Diamond-backed Rattlesnake (*Crotalus atrox*), the Sidewinder (*Crotalus cerastes*), the Mojave Rattlesnake (*Crotalus scutulatus*), and the Sonoran Coralsnake (*Micruroides euryxanthus*) to be present at MCAS Yuma (main base). Marine Corps Base Camp Lejeune has the greatest number of confirmed venomous snakes (six) as compared to any other Marine Corps installation.

The Eastern Diamond-backed Rattlesnake (*Crotalus adamanteus*) is present at more Marine Corps installations (six) than any other venomous snake species. The Harlequin Coralsnake (*Micrurus fulvius*) is only present at MCB Camp Lejeune and the Black-tailed Rattlesnake (*Crotalus molossus*) is only present at MCAS Yuma BMGR West (table 6).



Figure 4-12. Sidewinder (Photo by Greg Watson)



Figure 4-13. Copperhead Snake (Photo by Seth Berry)

Table 6. Venomous Snake Species Confirmed and Potential on Marine Corps Installations (2014) (Sheet 1 of 2)

Species	Confirmed Location/s	Potential Location/s
<b>Copperhead</b> ( <i>Agkistrodon contortrix</i> )	<ul style="list-style-type: none"> <li>• MCAS Beaufort</li> <li>• MCB Camp Lejeune</li> <li>• MCAS Cherry Point</li> <li>• MCB Quantico</li> </ul>	<ul style="list-style-type: none"> <li>• MCLB Albany</li> <li>• Townsend Bombing Range</li> </ul>
<b>Cottonmouth</b> ( <i>Agkistrodon piscivorus</i> )	<ul style="list-style-type: none"> <li>• MCAS Beaufort</li> <li>• MCLB Albany</li> <li>• Townsend Bombing Range</li> <li>• MCAS Cherry Point</li> <li>• MCB Camp Lejeune</li> </ul>	<ul style="list-style-type: none"> <li>• MCSF Blount Island</li> </ul>
<b>Eastern Diamond-backed Rattlesnake</b> ( <i>Crotalus adamanteus</i> )	<ul style="list-style-type: none"> <li>• MCAS Beaufort</li> <li>• MCLB Albany</li> <li>• MCB Camp Lejeune</li> <li>• MCRD Parris Island</li> <li>• MCSF Blount Island</li> <li>• Townsend Bombing Range</li> </ul>	<ul style="list-style-type: none"> <li>• MCAS Cherry Point</li> </ul>
<b>Western Diamond-backed Rattlesnake</b> ( <i>Crotalus atrox</i> )	<ul style="list-style-type: none"> <li>• Chocolate Mountain Aerial Gunnery Range</li> <li>• MCAS Yuma (BMGR West)</li> </ul>	<ul style="list-style-type: none"> <li>• MCAS Yuma (main base)</li> </ul>
<b>Sidewinder</b> ( <i>Crotalus cerastes</i> )	<ul style="list-style-type: none"> <li>• Chocolate Mountain Aerial Gunnery Range</li> <li>• MCAGCC Twentynine Palms</li> <li>• MCAS Yuma (BMGR West)</li> <li>• MCLB Barstow</li> </ul>	<ul style="list-style-type: none"> <li>• MCAS Yuma (main base)</li> </ul>
<b>Timber Rattlesnake</b> ( <i>Crotalus horridus</i> )	<ul style="list-style-type: none"> <li>• MCAS Beaufort</li> <li>• MCB Camp Lejeune</li> <li>• MCB Quantico</li> <li>• Townsend Bombing Range</li> </ul>	<ul style="list-style-type: none"> <li>• MCAS Cherry Point</li> <li>• MCLB Albany</li> </ul>
<b>Speckled Rattlesnake</b> ( <i>Crotalus mitchellii</i> )	<ul style="list-style-type: none"> <li>• MCAGCC Twentynine Palms</li> <li>• MCAS Miramar</li> <li>• MCAS Yuma (BMGR West)</li> <li>• MCB Camp Pendleton</li> <li>• MCAS Camp Pendleton</li> </ul>	<ul style="list-style-type: none"> <li>• Chocolate Mountain Aerial Gunnery Range</li> <li>• MCLB Barstow</li> </ul>
<b>Black-tailed Rattlesnake</b> ( <i>Crotalus molossus</i> )	<ul style="list-style-type: none"> <li>• MCAS Yuma (BMGR West)</li> </ul>	

Table 6. Venomous Snake Species Confirmed and Potential on Marine Corps Installations (2014) (Sheet 2 of 2)

<b>Western Rattlesnake</b> ( <i>Crotalus oreganus</i> )	<ul style="list-style-type: none"> <li>• MCAS Camp Pendleton</li> <li>• MCAS Miramar</li> <li>• MCB Camp Pendleton</li> </ul>	<ul style="list-style-type: none"> <li>• MCMWTC Bridgeport</li> </ul>
<b>Red Diamond Rattlesnake</b> ( <i>Crotalus ruber</i> )	<ul style="list-style-type: none"> <li>• MCAS Miramar</li> <li>• MCB Camp Pendleton</li> </ul>	<ul style="list-style-type: none"> <li>• MCAS Camp Pendleton</li> </ul>
<b>Mohave Rattlesnake</b> ( <i>Crotalus scutulatus</i> )	<ul style="list-style-type: none"> <li>• MCAGCC Twentynine Palms</li> <li>• MCAS Yuma (BMGR West)</li> <li>• MCLB Barstow</li> </ul>	<ul style="list-style-type: none"> <li>• MCAS Yuma (main base)</li> </ul>
<b>Pygmy Rattlesnake</b> ( <i>Sistrurus miliarius</i> )	<ul style="list-style-type: none"> <li>• MCAS Cherry Point</li> <li>• MCB Camp Lejeune</li> <li>• Townsend Bombing Range</li> </ul>	<ul style="list-style-type: none"> <li>• MCAS Beaufort</li> <li>• MCLB Albany</li> <li>• MCSF Blount Island</li> </ul>
<b>Sonoran Coralsnake</b> ( <i>Micruroides euryxanthus</i> )		<ul style="list-style-type: none"> <li>• MCAS Yuma (main base)</li> <li>• MCAS Yuma (BMGR West)</li> </ul>
<b>Harlequin Coralsnake</b> ( <i>Micrurus fulvius</i> )	<ul style="list-style-type: none"> <li>• MCB Camp Lejeune</li> </ul>	<ul style="list-style-type: none"> <li>• MCAS Beaufort</li> <li>• MCLB Albany</li> <li>• MCRD Parris Island</li> <li>• MCSF Blount Island</li> <li>• Townsend Bombing Range</li> </ul>

**4.3.7 Comparison of Herpetofauna Biodiversity on Marine Corps Installations to Regional Biodiversity**

The seventeen Marine Corps installations evaluated in this report have 52 percent of the total biodiversity of herpetofauna (confirmed and potential) of all species documented in the states of Arizona, California, Florida, Georgia, North Carolina, South Carolina, and Virginia (table 7). Of the species types, Marine Corps sites have the greatest percentage of frogs and toads on their lands (68 percent) in comparison to all species within the seven states, whereas salamanders represented the smallest percentage (31 percent). Lizard, snake, alligator, and turtle biodiversity on Marine Corps installations was 47 percent or greater in comparison to all species within the seven states that were evaluated.

Table 7. Comparison of Marine Corps Herpetofauna Biodiversity to Regional Biodiversity (2014)

<b>Species Type</b>	<b>Number of Confirmed and Potential Herpetofauna Species on Marine Corps Lands</b>	<b>Number of Herpetofauna Species Within the Same States as Marine Corps Installations</b>	<b>Percent of Marine Corps Herpetofauna Biodiversity to Regional Biodiversity</b>
<b>Frogs and Toads</b>	50	74	68%
<b>Salamanders</b>	40	128	31%
<b>Lizards</b>	46	99	47%
<b>Snakes</b>	72	111	65%
<b>Turtles</b>	25	39	64%
<b>Crocodiles/Alligators</b>	1	2	50%
<b>Total</b>	<b>234</b>	<b>453</b>	<b>52%</b>

THIS PAGE IS INTENTIONALLY BLANK.

## CHAPTER 5

# Summary and Conclusions

### 5.1 HERPETOFAUNA BIODIVERSITY ON MARINE CORPS INSTALLATIONS

The seventeen Marine Corps installations evaluated in this report support a total of 234 species (177 confirmed species and 57 potential species [table 3]). Snakes are the most abundant species type. Marine Corps Base Camp Lejeune has the greatest number of confirmed herpetofauna species (80 species).

Nine species of reptiles and amphibians confirmed on Marine Corps installations are federally listed as endangered or threatened by the USFWS (table 4). There are fourteen species of amphibians and reptiles confirmed on Marine Corps installations in states where they are listed as state endangered or threatened. The greatest numbers of federally- and state-listed species types on Marine Corps lands are turtles. Marine Corps Base Camp Pendleton has the greatest number of federally-listed herpetofauna species confirmed on its installations (five species).

Six non-native amphibian and reptile species are confirmed on Marine Corps installations (table 5). The American Bullfrog (*Lithobates catesbeianus*) is the most common invasive herpetofauna species on Marine Corps lands. Marine Corps Base Camp Pendleton has the most non-native herpetofauna species (four species).

Thirteen species of venomous snakes are confirmed on Marine Corps installations within the United States (table 6). Every Marine Corps installation has at least one species of venomous snake except for MCMWTC Bridgeport and MCAS Yuma (main base). Marine Corps Base Camp Lejeune has the greatest number of confirmed venomous snakes (six) on any Marine Corps installation. The Eastern Diamond-backed Rattlesnake (*Crotalus adamanteus*) is present at more Marine Corps installations than any other venomous snake species.

Marine Corps lands support 52 percent of the total biodiversity of herpetofauna (confirmed and potential) of all amphibian and reptile species documented in the states of Arizona, California, Florida, Georgia, North Carolina, South Carolina, and Virginia (table 7).

### 5.2 GENERAL RECOMMENDATIONS FOR MARINE CORPS INSTALLATIONS

The following recommendations are suggested to help conserve and manage amphibians and reptiles on Marine Corps lands. These recommendations are applicable to all Marine Corps installations.

1. Herpetofauna inventories are recommended at Marine Corps installations where the number of potential species greatly exceeds that of the confirmed species (Figure 4-2).
2. Maintain the herpetofauna species spreadsheet developed for this report up to date. DoD PARC members can conduct or assist with the task.
3. Conduct general herpetofauna surveys and monitoring every five to seven years to document the presence or absence of species and document general population trends.

4. Monitor for the occurrence of invasive herpetofauna species.
5. Those installations with venomous snakes should educate military and civilian personnel of the potential dangers of these species. Educational posters, pamphlets, and brochures are recommended.

## CHAPTER 6

# Acknowledgements

The authors recognize the following natural resource managers and environmental planners who provided data for this study:

Charles Black (MCAS Miramar)  
John DeLuca (MCB Camp Lejeune)  
Kim Fleming (MCI East)  
Brain Henen (MCAGCC Twentynine Palms)  
Gary Henderson (Townsend Range/MCAS Beaufort)  
John Holloway (MCRD Parris Island)  
Shari Kennedy (MCSF Blount Island)  
Carmen Lombardo (MCAS Cherry Point)  
Kaye London (MCS Camp Pendleton)  
Ryan Orndorff (MC HQ)  
Ron Pearce (CMAGR)  
Julie Robbins (MCLB Albany)  
John Rohm (MCB Quantico)  
Abigail Rosenberg (MCAS Yuma/BMGR)  
Craig Tenbrink (MCB Camp Lejeune)  
Diane Walsh (MCAS Camp Pendleton)

We would also like to thank the following individuals who work for the various state wildlife agencies and universities for their technical review of the Marine Corps installation species lists:

Jeff Bean  
Jeff Hall  
John Jensen  
Joseph Mitchell  
Lin Piest  
Paul Moler  
Laura Patterson  
Tom Jones  
Susan Watson  
Will Dillman

Lastly, we would like to recognize Polly Conrad and Priya Nanjappa from PARC who provided guidance and support throughout this study.

This project was funded through the DoD Legacy Resource Management Program (PN 13-641). We are greatly appreciative of their support to conduct this study.

THIS PAGE IS INTENTIONALLY BLANK.

# List of Acronyms and Abbreviations

<b>BMGR</b>	Barry M. Goldwater Range
<b>DoD</b>	Department of Defense
<b>DoD PARC</b>	Department of Defense Partners in Reptile and Amphibian Conservation
<b>ESA</b>	Endangered Species Act
<b>INRMP</b>	Integrated Natural Resource Management Plan
<b>MCAS</b>	Marine Corps air station
<b>MCAGCC</b>	Marine Corps air ground combat center
<b>MCB</b>	Marine Corps base
<b>MCLB</b>	Marine Corps logistics base
<b>MCMWTC</b>	Marine Corps mountain warfare training center
<b>MCRD</b>	Marine Corps recruit depot
<b>MCSF</b>	Marine Corps support facility
<b>NOAA</b>	National Oceanic and Atmospheric Administration
<b>PARC</b>	Partners in Reptile and Amphibian Conservation
<b>U.S.</b>	United States
<b>U.S.C.</b>	United States Code
<b>USFS</b>	U.S. Forest Service
<b>USFWS</b>	U.S. Fish and Wildlife Service

THIS PAGE INTENTIONALLY LEFT BLANK

# Literature Cited

- AmphibiaWeb. 2011. [www.amphibiaweb.org](http://www.amphibiaweb.org)
- AmphibiaWeb. 2012. <http://amphibiaweb.org/>
- Benton, N. , J. D. Ripley and F. Powledge (Eds.). 2008. *Conserving Biodiversity on Military Lands: A Guide for Natural Resources Managers* . <http://www.dodbiodiversity.org/>
- Collins, J. P. 2010. Amphibian decline and extinction: what we know and what we need to learn. *Diseases of Aquatic Organisms*. 92:93-99. doi: 10.3354/dao02307
- Collins, J. P., and M.L. Crump. 2009. *Extinction in Our Times. Global Amphibian Decline.*: Oxford University Press.
- Crother, B. I., (ed.)2012. Scientific and Standard English Names of Amphibians and Reptiles of North America North of Mexico, with Comments Regarding Confidence in our Understanding. SSAR Herpetological Circular 39:1-92.
- Endangered Species Glossary-Midwest Region.  
2013.<http://www.fws.gov/midwest/endangered/glossary/index.html>
- Ernst, C. H., and J.E. Lovich. 2009. *Turtles of the United States and Canada*: Johns Hopkins University Press.
- Faber-Langendoen, D., J. Nichols, L. Master, K. Snow, A. Tomaino, R. Bittman, and B. Young 2012. NatureServe Conservation Status Assessments: Methodology for Assigning Ranks: Revised ed. Pp. 1-52. Arlington, Virginia: NatureServe.
- Hayes, T. B., P. Case, S. Chui, D. Chung, D., C. Haeffele, K. Hatson, and M. Tsui. 2006. Pesticide mixtures, endocrine disruption, and amphibian declines: Are we underestimating the impact? *Environmental Health Perspectives*, 114:40-50. doi: 10.1289/ehp.8051
- Hayes, T. B., A. Collins, M. Lee, M. Mendoza, N. Noriega, A.A. Stuart, , and A. Vonk. 2002. Hermaphroditic, demasculinized frogs after exposure to the herbicide atrazine at low ecologically relevant doses. *Proceedings of the National Academy of Sciences of the United States of America*, 99(8):5476-5480. doi: 10.1073/pnas.082121499
- Johnson, P. T. J., J.M. Chase, K. Dosch, R.B. Hartson, J.A. Gross, D.J. Larson, and S.R. Carpenter. 2007. Aquatic eutrophication promotes pathogenic infection in amphibians. *Proceedings of the National Academy of Sciences of the United States of America*, 104 40:15781-15786. doi: 10.1073/PNAS.0707763104
- Klemens, M.W (ed.). 2000. *Turtle Conservation*. Washington, DC: Smithsonian Institution Press.
- Marine Corps Order P5090.2A *Environmental Compliance and Protection Manual*

- Marks, R. 2006. Amphibians and Reptiles: Vol. 35. Natural Resources Conservation Service and Wildlife Habitat Council.
- McCallum, M. L. 2007. Amphibian decline or extinction? Current declines dwarf background extinction rate. *Journal of Herpetology*, 41(3):483-491. doi: <http://dx.doi.org/10.1670/0022-1511>
- Nanjappa, P., and P.M. Conrad. 2014. Conservation and Protection Status by Species. In P. Nanjappa & P. M. Conrad (Eds.), *State of the Union: Legal Authority Over the Use of Native Amphibians and Reptiles in the United States* (1.04 ed., pp. 189-225). Washington, DC: Association of Fish & Wildlife Agencies.
- NatureServe Explorer. 2013. <http://explorer.natureserve.org/ranking.htm#global>
- NatureServe Network. 2013. <http://www.natureserve.org/>
- Pounds, A., M.R. Bustamante, L.A. Coloma, J.A. Conuegra, M.P.L. Fogden, P.N. Foster, and B.E. Young. 2006. Widespread amphibian extinctions from epidemic disease driven by global warming. *Nature*. 439:161-167. doi: 10.1038/nature04246
- Ribeiro, R., X. Santos, N. Sillero, M.A. Carretero, and G.A. Llorente. 2009. Biodiversity and land uses at a regional scale: Is agriculture the biggest threat for reptile assemblages? *Acta Oecologica*. 35(2):327-334. doi: <http://dx.doi.org/10.1016/j.actao.2008.12.003>
- Semlitsch, R. D. 2003. Conservation of Pond-Breeding Amphibians. In R. D. Semlitsch (Ed.), *Amphibian Conservation*. Pp. 8-23. Washington, DC: Smithsonian Institution Press.
- Sikes Act, 16 U.S.C. 670a-670f
- Stein, B., C. Scott, and N. Benton. 2008. Federal lands and endangered species: The role of military and other federal lands in sustaining biodiversity. *BioScience*. 58(4):339-347. doi: 10.1641/B580409
- Stuart, S. N., M. Hoffmann, J. S. Chanson, N. A. Cox, R. J. Berridge, P. Ramani, and B. E. Young . 2008. *Threatened Amphibians of the World*. (Eds.). Barcelona, Spain; Gland, Switzerland; Arlington, Virginia: Lynx Edicions; IUCN; Conservation International.
- Uetz, P. (1995a). The Reptile Database. from [www.reptile-database.org](http://www.reptile-database.org)
- Vitt, L. J., J.P. Caldwell. 2008. *Herpetology, Third Edition: An Introductory Biology of Amphibians and Reptiles* (Third ed.): Academic Press.