

Naval Station Rota Reptile and Amphibian Survey



September 2010



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Appendix A: Potential Reptile and Amphibian Species of NS Rota, Spain

Appendix B: Area Profile Maps of Reptiles and Amphibians of NAVSTA Rota

Appendix C: Pictures of Encountered Reptiles and Amphibians of NAVSTA Rota

Appendix D: Interim Field Reports

Introduction

This report summarizes the results of a herpetofauna (reptile and amphibian) survey at Naval Station Rota (NAVSTA Rota), Spain conducted during June and October 2008, March 2009 and July 2010. The main objective of this investigation was to develop an inventory of herpetofauna, including their base-wide distribution and habitat use. Data from these surveys was used to supplement information in the 2010 Cultural/Natural Resources Management User's Guide and can also be used for environmental planning, natural resource management and conservation. Prior to this survey, only cursory field work had been conducted on the station for herpetofauna with the exception of the common chameleon (*Chamaleo chamaeleon*). A comprehensive population count and habitat assessment for the common chameleon was conducted in September 2001.

Study Site

NAVSTA Rota is located in the western section of the Province of Cadiz at the northern end of the Bay of Cadiz. The base encompasses 5,963 acres and contains an airfield, port area, weapons storage area, golf course, agricultural area and housing area. The major vegetation communities of NAVSTA Rota are pine woods, scrub-brush, wetlands and beach dunes. NAVSTA Rota supports approximately 38 acres of wetlands and includes the Salado River, a manmade agricultural pond and a few smaller areas of wetlands (many of which are ephemeral) scattered throughout the installation.

The climate of NAVSTA Rota is heavily influenced by the ocean and generally consists of hot and dry summers and wet, mild winters. Mean monthly temperatures in July and August are on average in the high 70's whereas mean monthly temperatures in December and January are in the low 50's. The majority of rainfall occurs from October through February with the maximum average precipitation occurring in November. The average annual rainfall is 25.5 inches (62.8 cm).



Material and Methods

Prior to the field work, a list of expected species was compiled to establish field methodologies and field survey strategies based on species specific habitat preferences. Based on this literature search, it was possible that 36 species of herpetofauna could be present at NAVSTA Rota (Appendix A).

Field work was conducted by Chris Petersen, Paul Block, David James and Christopher Chilton of Naval Facilities Engineering Command Atlantic. Erin Adams and Sean Sweeney of NAVSTA Rota Public Works Department also significantly contributed to this investigation. Field work took place June 2-5, 2008, October 10-14, 2008, March 25-29, 2009 and July 11-16, 2010. The timing of the field work was designed to target species active in the summer, fall and spring seasons. Interim field reports for the first three field surveys are in Appendix D. This report summarizes all four field surveys. The number of hours that field work was conducted for this investigation was estimated to be 300 hours.

Field Survey Techniques

In general, reptiles and amphibians can be difficult to census due to their secretive nature and influences of temperature, precipitation and season on activity patterns. Therefore, several sampling techniques were used to perform these surveys.

Random Opportunistic Sampling was the primary method used to conduct the field work. This survey method involved searching selected habitats and microhabitats when the probability of encounter is high (appropriate weather and season for the target species). At NAVSTA Rota, this technique was conducted by walking in selected scrub-brush, pine woods, wetland and coastal habitats searching those habitats for animals within their microhabitats. Particular attention was taken to search under plywood boards and other discarded materials since these items are known to provide temporary cover for herpetofauna.

A second technique used during this survey included diurnal and nocturnal road cruising. This technique involved driving/walking roads looking for individuals moving across or resting on roadways. In addition, animals killed on roadways could sometimes be identified and provided useful information on the presence or absence of a species in a particular habitat.



Stripeless Tree Frog

A third technique used during this survey was listening for species-specific vocalizations of breeding frogs and toads. This protocol was conducted by a chance hearing of a species during the daytime and searching for frog choruses as night by listening for vocalizations.

The final technique used for this survey was using a dipnet to sample aquatic microhabitats. Dipnetting was performed randomly within the majority of the aquatic habitats encountered.

Most animals were captured by hand, net or hook and no animals were harmed in the process. A Global Positioning System (GPS) was used to record the location of captured animals and individuals were identified to species using *Reptiles and Amphibians of Britain and Europe* (Nicholas Arnold and Denys Overden, 2004). Snout-vent length and tail length were recorded for captured snakes and lizards using a flexible tape measure. A digital photograph was recorded of each captured species prior to their release. Animals seen or heard in the field but not captured and could be identified to species were included in the results.

It is estimated that approximately 278 acres (113 hectares) were surveyed during the four field periods (Figure 1). Many of the survey locations were sampled multiple times during the field visits and included the major habitat types of NAVSTA Rota (western arroyo, pine woods, coastal and scrub-brush). Surveys were also conducted around permanent and ephemeral water bodies such as the agricultural pond, golf course ponds, ditches and streams.



Chris Petersen with Montpellier Snake



Natterjack Toad

Vegetation Community Mapping

A March 2007 IKONOS satellite image was used to map the dominant vegetation communities at NAVSTA Rota. The imagery was a four band (blue, green, red and near infrared) dataset with a pixel resolution of 0.8 meters. ENVI software was used to classify the imagery into wetlands, stone pine, eucalyptus, bridal broom (retama)

and scrub-brush habitat community classes using a near infrared composite image. Environmental Systems Research Institute (ESRI) software (ArcGIS) was used to compare the location of captured or observed herpetofauna with the vegetation mapping results to investigate the habitat association of each species.

Results

Field biologists captured or observed 24 species (290 individuals) of herpetofauna during the four survey periods (Table 1). Approximately 67% of the species identified by the literature search were observed or captured during this investigation. The greatest number of species observed (19) was during the March 2009 survey period. This was likely the result in the overlap of activity of both spring breeding amphibians and emergence of reptiles from hibernation during this time of year. Twelve species were observed during both the October and June 2008 surveys. The July 2010 survey resulted in the observation of 17 species. It was surprising to us that the second greatest number of species observed was during the time of year when daily high temperatures in Rota are regularly in the 90's and rainfall is typically near zero. An unusual rain event that occurred in July (prior to our field work) may have increased the likelihood of finding herpetofauna active since many of the wetlands contained water.

Amphibians



Iberian Water Frog

Frog and toad species represented 21% of the total species observations (Figure 2). Natterjack toads (*Bufo calamita*) and Iberian water frogs (*Rana perezi*) were the most common species encountered. Stripeless tree frogs (*Hyla meridionalis*) were also common around two of the golf course ponds.



Southern Marbled Newt

Salamander species represented the smallest percent of amphibian observations (8%) and only two species (sharp-ribbed newt [*Pleurodeles waltii*] and the marbled newt [*Triturus pygmaeus*]) were observed during the investigation. Both of these species were observed during the July 2010 field survey under logs along the edge of one of the golf course ponds.

Figure 1. NAVSTA Rota Survey Locations

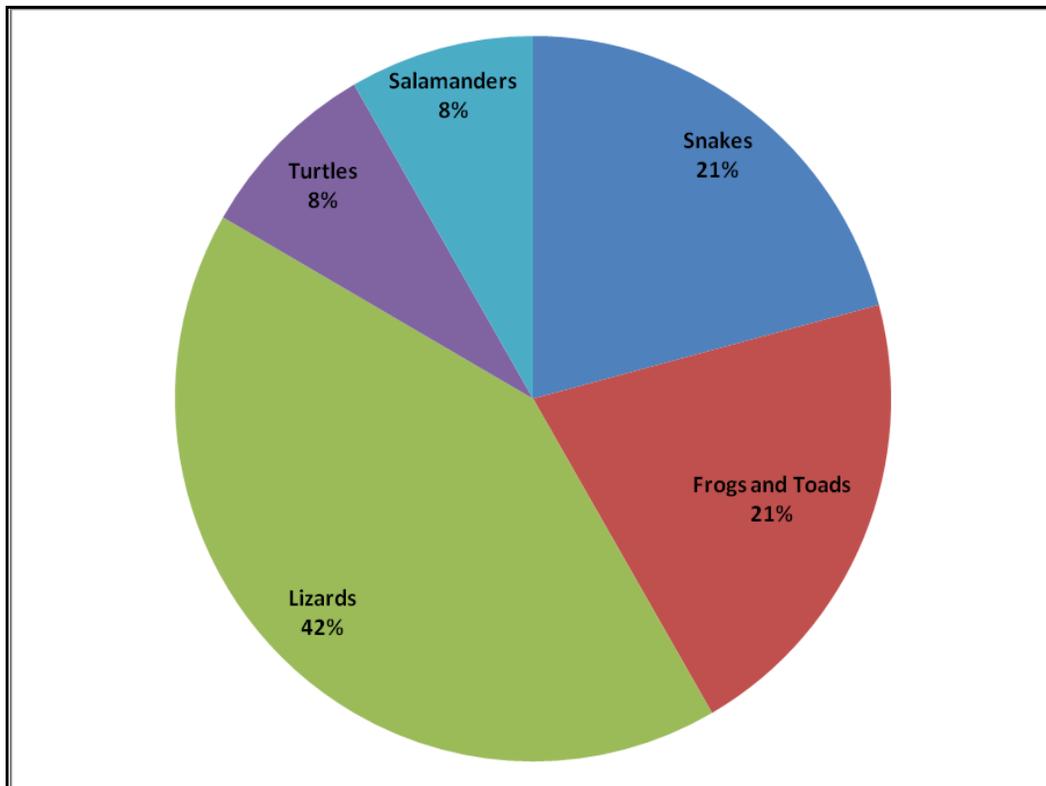


Table 1. Species Observed During Field Surveys

Species	Common Name	Number of Individuals	June 2008	October 2008	March 2009	July 2010
Amphibians						
Frogs and Toads						
<i>Rana perezi</i>	Iberian Water Frog	>60	x	x	x	x
<i>Bufo calamita</i>	Natterjack	22		x	x	
<i>Pelobates cultripes</i>	Western Spadefoot	1			x	
<i>Hyla meridionalis</i>	Stripeless Tree Frog	19			x	x
<i>Discoglossus jeanneae</i>	East Iberian Painted Frog	1				x
Salamanders						
<i>Pleurodeles waltii</i>	Sharp-ribbed Newt	5			x	x
<i>Triturus pygmaeus</i>	Southern Marbled Newt	2				x
Reptiles						
Turtles						
<i>Mauremys leprosa</i>	Spanish Terrapin	>40	x	x	x	x
<i>Trachemys scripta elegans</i>	Red-eared Slider	9	x	x		x
Lizards						
<i>Chamaleo chamaeleon</i>	Common Chameleon	17	x	x	x	x
<i>Tarentola mauritanica</i>	Moorish Gecko	>31	x	x	x	x
<i>Acanthodactylus erythrurus</i>	Spiny-footed Lizard	>33	x	x	x	x
<i>Hemidactylus erythrurus</i>	Turkish Gecko	2		x		
<i>Psammodromus algirus</i>	Large Psammodromus	4	x		x	
<i>Psammodromus hispanicus</i>	Spanish Psammodromus	2				x
<i>Blanus cinereus</i>	Iberian Worm Lizard	5		x	x	x
<i>Lacerta lepida</i>	Ocellated Lizard	6	x		x	x
<i>Chalcides bedriagai</i>	Bedriaga's Skink	6	x		x	x
<i>Podacris hispanica</i>	Iberian Wall Lizard	2		x	x	

Snakes						
<i>Elaphe scalaris</i>	Ladder Snake	13	x	x	x	x
<i>Natrix maura</i>	Viperine Snake	4	x	x	x	
<i>Malpolon monspessulanus</i>	Montpellier Snake	2	x		x	
<i>Coluber hippocrepis</i>	Horseshoe Whip Snake	2			x	x
<i>Macroprotodon cucullatus</i>	False Smooth Snake	2			x	x
Total	24	290	12	12	19	17

Figure 2. Percent of Reptile and Amphibian Species Observed



Reptiles

Turtle species were the smallest percent of reptile observations (8.0%) and were represented by two species (Spanish terrapin [*Mauremys leproda*] and red-eared slider [*Trachemys scripta*]). Lizard species were the greatest number of species observed (42%) and the greatest number of individuals encountered.

Moorish geckos (*Tarentola mauritanica*) and spiny-footed lizards (*Acanthodactylus erythrurus*) were commonly encountered throughout the installation. Snake species represented approximately 21% of the

total number of species observed during the sampling periods. The most frequently encountered snake species was the ladder snake (*Elaphe scalaris*, 13 individuals) and both juvenile and adult individuals were captured. Pictures of reptile and amphibian species encountered are in Appendix C.



Common Chameleon

Area Profiles

To coincide with that of the 2010 Cultural/Natural Resources Management User's Guide, the results of the herpetofauna investigation are discussed by the major Areas of the installation (Appendix B, Table 2). For a detailed explanation of each base Area, please refer to User's Guide

Core/Industrial Area



Ocellated Lizard

Two amphibian species (Iberian water frog and natterjack toad) and four reptile species (Moorish gecko, ocellated lizard [*Lacerta lepida*], spiny-footed lizard, viperine snake [*Natrix natrix*]) were recorded in the Core/Industrial Area. The three locations within this Area that herpetofauna were observed were associated with a stone pine vegetation community. The observed species were generally seen on the edges or in

Table 2. Species vs. NAVSTA Rota Areas

	Core/Industrial	Golf Course	Airfield/Flight Line	Western Arroyo	Agricultural	Weapons	Camp Mitchell/Picnic	Salado River	Port Area	Community Housing	Fuel Farm	Coastal
AMPHIBIANS												
Frogs and Toads												
Iberian Water Frog	X	X	X	X	X	X				X		
Natterjack	X			X		X	X		X			
Western Spadefoot				X	X							
Stripeless Tree Frog		X										
East Iberian Painted Frog						X						
Salamanders												
Sharp-ribbed Newt		X		X								
Southern Marbled Newt		X										
REPTILES												
Turtles												
Spanish Terrapin		X	X	X	X	X						
Red-eared slider		X				X						
Lizards												
Common Chameleon				X					X		X	X
Turkish Gecko									X			
Moorish Gecko	X			X			X	X				X
Spiny-footed Lizard	X						X				X	X
Large Psammmodromus				X				X				
Iberian Worm Lizard			X	X	X				X			
Ocellated Lizard	X			X		X						X
Bedriaga's skink		X		X							X	X
Iberian Wall lizard								X				
Spanish Psammmodromus						X						
Snakes												
Ladder Snake		X		X	X	X		X	X			
Viperine Snake	X	X			X							
Montpellier Snake				X				X				X
Horseshoe Whip Snake								X				
False Smooth Snake				X				X				
Total	6	9	3	14	6	8	3	7	5	1	3	6

clearings within the pine community rather than in the interior of the forest. The majority of the species were located under cover objects such as plywood boards, tin and other discarded materials.

Golf Course Area

Amphibian species captured or observed in the Golf Course Area included two species of frogs (Iberian water frog and stripeless tree frog [*Hyla meridionalis*]) and two species of salamanders (sharp-ribbed newt [*Pleurodeles waltii*] and southern marbled newt [*Triturus pygmaeus*]). These species were all associated with ponds located next to the main gate of the installation. Stripeless tree frogs were observed in PVC pipes placed in the ground that defined the “out of bounds” area on the golf course. Iberian water frogs and stripeless tree frogs were heard vocalizing during a night survey at two golf course ponds on March 25, 2009. Both species of newts were observed under cut limbs/trunks of eucalyptus trees along the edge of one of the ponds during the July 2010 survey. Turtles (Spanish terrapins and red-eared sliders) were observed in one pond located to the east of the main gate. Two snake species (ladder and viperine) and one lizard (Bedriaga’s skink [*Chalcides bedriagai*]) were also observed in or near the ponds.

Airfield/Flightline Area



Iberian Worm Lizard

Herpetofauna observed in this Area were within two streams channels that drain water from the southwestern side of the airfield. One of the stream channels was recently re-routed and was devoid of vegetation along a section of its bank (March 2009). The streams contained flowing water during the March 2009 and July 2010 survey. Species observed included the Iberian water frog and Spanish terrapin. An Iberian worm lizard [*Blanus cinereus*] was located under a plywood board along a stream edge.

Western Arroyo Area

The Western Arroyo Area is located along the western side of NAVSTA Rota. This Area contained the highest species diversity than any other Area of the base. Water resources in this Area are limited to one drainage system and several seasonally flooded depressions. The majority of the species observed were reptiles (ladder snake, false smooth snake [*Macroprotodon cucullatus*], Montpellier snake [*Malpolon monspessulanus*], Bedriaga’s skink, common chameleon, Moorish gecko, ocellated lizard, Iberian worm lizard, large psammomorphus [*Psammomorphus algirus*] and Spanish

terrapien). Chameleons were only seen in the southern section of this Area (west of Reflections Club) within broom thicket (*Retama monsperma*) habitat.

Three amphibian species were also observed in the Western Arroyo Area (western spadefoot [*Pelobates cultripes*], sharp-ribbed newt and natterjack toad). An adult western spadefoot was located on the perimeter road and tadpoles of this species were found in a water filled depression between the landfill and perimeter road. Also observed at this site was a sharp-ribbed newt metamorph which was captured with a dipnet (March 2009).

Agricultural Area

With the exception of the agricultural lake, the Agricultural Area is generally devoid of reptile and amphibian species due to the absence of suitable habitat. The perimeter of the lake was surveyed during each of the four field survey periods. Only reptile species were observed at the lake (ladder snake, viperine snake and Spanish terrapien). It is possible that amphibian species inhabit the agricultural lake and were not observed during this investigation. However, the frequent use of the lake by a variety of bird species (cattle egrets, ducks) and the presence of fish could limit amphibian population levels. Amphibians species (western spadefoot tadpoles, Iberian water frog) were observed in two flooded depressions located east of the lake approximately 175 meters. These depressions contained water during the October 2008 and March 2009 survey periods. The site was completely dry during the July 2010 survey.

Weapons Area



The Weapons Area was surveyed during the October 2008 and July 2010 survey periods. A spring fed depression in the Weapons Area contained Iberian water frogs, Spanish terrapiens and red-eared sliders. During the July 2010 survey, Sean Sweeney captured an East Iberian painted frog on the west side of the spring under a board. This was the only location where this species has been observed on NAVSTA Rota.

Under cover objects near the administration building, natterjack toads and a ladder snake were captured. Both an adult and juvenile ladder snakes were observed under a single piece of plywood located next to a parking lot east of the administration area.

In the northwest side of the Weapons Area (between the agricultural field and the olive grove) an ocellated lizard, dead latter snake and two Spanish Psammmodromus were observed.

Camp Mitchell/Picnic Area

Herpetofauna observed within the Camp Mitchell/Picnic Area were the Moorish gecko, spiny-footed lizard and natterjack toad. The three species were located in a sandy clearing within the stone pine habitat adjacent to an ephemeral stream. No amphibian or reptile species were observed within the pine forest habitat of this Area.

Salado River Area



Horseshoe Whip Snake

Four snake species (Montpellier, ladder snake, false-smooth, horseshoe whip [*Coluber hippocrepis*]) and three lizard species (Moorish gecko, large psammmodromus and Iberian wall lizard [*Podacris hispanica*]) were identified at the abandoned skeet range within the Salado River Area. The concrete walls at the skeet range provide excellent basking, foraging and cover habitat for these animals. A Montpellier snake was found exposed, basking, along a concrete wall. This snake was injured and had multiple lacerations on its body, possibly the result of a predator attack or getting run over by a car. Two horseshoe whip snakes were found under concrete slabs that had broken off from the wall.

The scrub habitat north of the skeet range provides an abundance of cover habitat for herpetofauna. In fact, this area was difficult to survey due to the density of the vegetation, (mostly Lentisk Tree (*Pistacia lentiscus*)). During the March 2009 investigation, multiple isolated pools of water were surveyed adjacent to the Salado River. No amphibian species were recorded using these pools. It is possible that the water in and adjacent to the Salado River is too salty for amphibians to inhabit. A man-made pond within the interior of the Salado River Area may provide amphibians breeding habitat. This site was dry when discovered during the July 2010 survey.

Port Area

Three lizard species (common chameleon, Iberian worm lizard, Turkish gecko [*Hemidactylus turcicus*]), one toad species (natterjack toad) and one snake species (ladder snake) were recorded within the coastal pine habitat of the Port Area. These animals were

observed along the abandoned railroad track south of Flor Road and north of the beach. This was the only location on NAVSTA Rota where the Turkish gecko was located. All animals, with the exception of the chameleon, were located under cover objects such as cut tree branches and plywood boards. The chameleon was observed moving on the sand away from the beach to a broom thicket.

Community/Housing Area

The Iberian water frog was the only species observed in the Community/Housing Area during the four survey periods. Numerous individuals of this species were observed in the drainage ditch north of the school during the October 2008 survey period. The presence of metamorphs suggests that this is a breeding site for the species. Ocellated lizards, Bedriaga's skinks and a single report of a Lataste's viper (*Vipera latasti*) have also been reported in the housing areas by NAVSTA Rota Public Works Department personnel but were not confirmed during this investigation.

Fuel Farm Area

The Fuel Farm Area was surveyed during the October 2008 and July 2010 field investigations. The common chameleon, spiny-footed lizard and Bedriaga's skink were recorded in this Area. The broom thicket habitat and sandy soil in this Area was ideal for the chameleon. Four individuals were observed on a remnant sand dune in the eastern section of the area.

Coastal Area

This Area was surveyed during all four survey periods. Five lizard species (common chameleon, spiny-footed lizard, Moorish gecko, Bedriaga's skink and ocellated lizard) and one snake species (Montpellier snake) were observed during the surveys. The broom thicket habitat along the beach was



Road Killed Montpellier Snake with Chameleon

ideal for chameleons, and more individuals were observed in the Coastal Area than any other. While conducting an archeological investigation in September 2008, researchers found a dead Montpellier snake on the perimeter road through the Coastal Area. The

specimen was particularly notable because it contained the remains of a chameleon that the snake had recently eaten.

Landfill Area

Due to the lack of habitat diversity at the landfill site, no surveys were conducted in the Landfill Area.

Vegetation Community Mapping

The vegetation community/species mapping resulted in 38 acres (15.4 ha) of permanent and ephemeral wetlands on NAVSTA Rota (Figure 3). The largest wetland was the agricultural lake (3.6 ac, 1.5 ha). Stone pine community occupied 575 acres (233 ha) and the largest stands were located primarily in the Camp Mitchell and Western Arroyo Areas of the base. Fifty seven acres (23 ha) of Eucalyptus trees were mapped on the base. The majority of the trees were scattered throughout the Golf Course Area; however, the Western Arroyo, Weapons and Fuel Farm Areas contained eucalyptus stands of approximately 5 acres (2 ha) each. During the July 2010 field survey it was observed that many of the eucalyptus trees on the golf course were cut down and replaced with native tree species. Scrub-shrub community (excluding those areas of planted stone pine) were mapped on 581 acres (235 ha) of NAVSTA Rota. The Western Arroyo and Salado River Areas contained the majority of this community type. Lastly, retama thickets were mapped on 32 acres (13 ha) of the base. The two largest thickets were mapped west of the Reflections Club in the Western Arroyo Area and in the Golf Course Area.

Herpetofauna Community Associations

The greatest observations of herpetofauna species (13) were associated with the wetland community followed by that of the scrub-brush community (12 species). Ten species of herpetofauna were associated with the stone pine community and seven species in retama thickets (Table 3). There were no species observations within stands of eucalyptus trees. It is possible that herpetofauna use this habitat, however, this dense and shaded environment is likely not preferred by many reptiles and amphibians. Fourteen of the 24 species were associated with one vegetation community type whereas ten of the species were observed in more than one community.

Frogs, toads, salamanders and turtles were strongly associated with the wetland community. Natterjack toads and Iberian water frogs were the only amphibians observed in more than one vegetation community. Lizards and snakes were mostly associated with pine, scrub-brush and retama communities. Moorish geckos, spiny-footed lizards, Iberian worm lizards, ocellated lizards, Bedriaga's skinks, ladder snakes, viperine snake and the Montpellier snakes were observed in two or more vegetation communities.

Figure 3. Vegetation Mapping

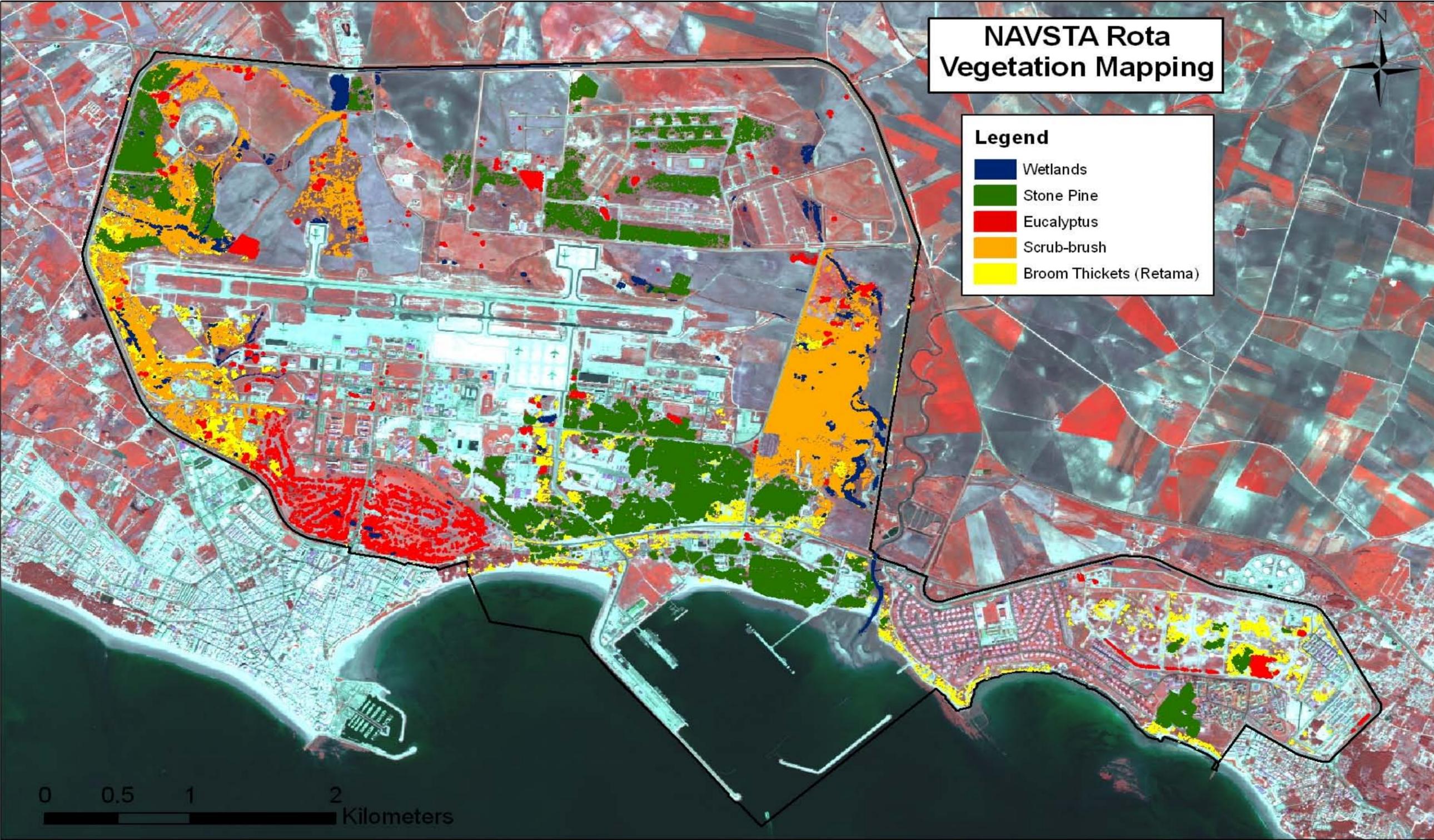


Table 3. Species Observations vs. Vegetation Community Type

	Wetlands	Stone Pine	Eucalyptus	Scrub-brush	Retama
AMPHIBIANS					
Frogs and Toads					
Iberian Water Frog	X	X			
Natterjack	X	X		X	X
Western Spadefoot	X				
Stripeless Tree Frog	X				
East Iberian Painted Frog	X				
Salamanders					
Sharp-ribbed Newt	X				
Southern Marbled Newt	X				
REPTILES					
Turtles					
Spanish Terrapin	X				
Red-eared slider	X				
Lizards					
Common Chameleon					X
Turkish Gecko		X			
Moorish Gecko		X		X	X
Spiny-footed Lizard		X			X
Large Psammmodromus				X	
Spanish Psammmodromus				X	
Iberian Worm Lizard	X	X		X	
Ocellated Lizard				X	X
Bedriaga's skink		X		X	X
Iberian Wall lizard				X	
Snakes					
Ladder Snake	X	X		X	
Viperine Snake	X	X			
Montpellier Snake		X		X	X
Horseshoe Whip Snake				X	
False Smooth Snake				X	
Total	13	10	0	12	7

Summary

The habitats of NAVSTA Rota provide a home to a diversity of reptiles and amphibians. A total of 24 species of herpetofauna were observed during the four survey periods. Observations of amphibians were associated with wetland habitats, with the exception of natterjack toads and Iberian water frogs. The Iberian water frog and natterjack toad were the two amphibian species most encountered on NAVSTA Rota. These two species were also found in the most Areas of the installation. Western spadefoots and the east Iberian painted frog were the least common amphibian species. Based on a literature review, additional amphibian species that could possibly be present on NAVSTA Rota include two salamander species and five frog and toad species.

Spanish terrapins, Moorish geckos and spiny-footed lizards were the three reptile species most frequently observed at NAVSTA Rota. The majority of the other reptile species were found in relatively low numbers. Based on a literature review, additional reptile species reported for southern Spain included one turtle species, one lizard species and three snakes. It is likely that a few of these species are present at NAVSTA Rota and were not encountered during this investigation. In particular, there is suitable habitat for the Lataste's Viper in the Coastal and Salado River Areas and there has been an unconfirmed report of this species by NAVSTA Rota Environmental Public Works personnel.

The installation Area with the greatest species diversity was the Western Arroyo Area (14 species, Table 2). The installation Area with the second greatest species diversity was the Golf Course Area. The Western Arroyo Area is the largest (500 acres) naturally vegetated and generally undisturbed Area of NAVSTA Rota. Its habitat structure and vegetation diversity make it the most important Area for herpetofauna on the installation.

Whereas the herpetofauna species encountered in the Western Arroyo Area were widely distributed across the site, species in the Golf Course Area were concentrated at artificial ponds. These ponds provide breeding habitats for amphibians and feeding sites for reptiles. The observations of the non-native red-eared slider in the Golf Course Area and Weapons Area are notable. This species likely colonized these areas as a result of people releasing their pet turtles into the ponds.

The Weapons Area had the third highest species diversity. The spring fed wetland in that Area provides a continuous supply of water to herpetofauna and is likely an important breeding site for amphibians.

Chameleons were confirmed in Western Arroyo, Port, Coastal and Fuel Farm Areas of NAVSTA Rota. The most individuals were located in the Coastal Area. These results are consistent with those reported in the *Distribution, Habitat and Conservation of the Common Chameleon at Naval Station Rota (September 2001)* study. No new confirmed chameleon locations were identified during this investigation. All sites where chameleons were encountered were dominated by broom thickets and individuals were typically three

to four feet off the ground on outer branches. The most chameleons were found in the Coastal Area during the four survey periods.

Conservation and Management Recommendations

1. It is recommended that NAVSTA Rota environmental staff continue to survey for and document any herpetofauna species encountered on the base. Data to be collected include species name, location observed/captured and date. NAVFAC Atlantic can assist with species identifications.
2. It is recommended that cut branches and trucks from the eucalyptus trees on the golf course be placed around the golf course ponds. This will provide instant habitat for a variety of species.
3. Feral cats can be a major predator of reptiles and amphibians. While conducting field work at NAVSTA Rota numerous feral cats were observed. It is recommended that these animals be captured and removed. NAVFAC Atlantic can assist with the development of a cat removal program.
4. Providing NAVSTA Rota workers and residences with reptile and amphibian educational opportunities and materials (for example programs and brochures) may discourage the killing of them due to fear, hatred and ignorance.
5. Inform base residents that exotic reptile and amphibian pets should not be released under any circumstances. Released individuals compete with native herpetofauna for resources such as food and hibernation sites. In addition, there is the potential for exotic species to introduce diseases to native species.
6. The non-native red-eared slider turtle is an invasive species that was observed in ponds of the Golf Course Area and Weapons Area. It is recommended that these individuals are trapped and removed.
7. The invasive giant reed (*Arundo donax*) was observed growing in several Areas of NAVSTA Rota. This plant forms dense monocultures that prevent native vegetation from growing. A reduction in native plant diversity could negatively impact herpetofauna by reducing habitat availability. It is recommended that an invasive plant control program be initiated to prevent the further introduction and spread of invasive plants.
8. Commercial trade of native species could be a threat to base herpetofauna populations. Prohibit base workers and residences from collecting and removing herpetofauna from NAVSTA Rota. Encourage base Security to support this effort.
9. It is recommended that around any wetland sites (such as the golf course ponds and agricultural lake) that herbicides, pesticides and fertilizers are used, a buffer of at least 100 feet be used to minimize the impact of chemicals beyond the target area. The buffer will act as a barrier in which the vegetation will take up the unwanted chemicals and also act as cover for herpetofauna.
10. Follow existing Best Management Practices to control sediment and erosion associated with construction activities, especially around wetlands.
11. Identify all the permanent and seasonally flooded wetlands on NAVSTA and protect these locations.

12. Allow dead, fallen trees and woody debris to remain on the ground in the stone pine habitats. These will provide important foraging, shelter and basking sites for reptiles and amphibians.

Acknowledgements

We would like to acknowledge NAVSTA Rota Public Works Department for all their support on this study. In particular, we would like to thank Mrs. Erin Adams and Mr. Sean Sweeney for their planning, coordination and field assistance during this investigation. Their enthusiasm and support of this project was a major contributor to its success.