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A preliminary herpetological survey of the Vilanculos Coastal Wildlife Sanctuary on the San Sebastian Peninsula, Vilankulo, Mozambique

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Abstract. This paper reports on and discusses the findings of a herpetofaunal survey of the San Sebastian Peninsula, Vilankulo, Mozambique. A total of 39 reptile and 20 amphibian species were recorded including new records for Mozambique, range extensions and taxa previously considered endemic to the Bazaruto Archipelago.

Keywords. Herpetofauna, San Sebastian Peninsula, Vilankulo, Mozambique.

Introduction

The herpetofauna of Mozambique is still relatively poorly known, especially when compared to the rest of southern Africa. The most recent accounts are those of Broadley (1966a, 1983), Poynton & Broadley (1985a, b, 1987, 1988) and Channing 2001. In addition, it appears that some early records have been overlooked in museum collections. Apart from these, most recent records often emanate from scant, sporadic or opportunistic collecting (Downs & Wirminghaus 1990). As a result there is a void in our knowledge, which also complicates the interpretation of species' distributions and even the taxonomic status of some species. Broadley (1990, 1992) contributed extensively towards our knowledge of the herpetofauna occurring on the Bazaruto archipelago, including descriptions of three new species and three new subspecies, all of which were believed to be endemic to the archipelago. These endemics were considered surprising, owing to the view that the islands' period of isolation from the mainland was too short to allow speciation to occur. These islands form a northward extension of the San Sebastian Peninsula.

A survey of the herpetofauna of the San Sebastian Peninsula was undertaken as part of a larger study of the vegetation and fauna to assess the conservation importance of the area.

The Study Site

The San Sebastian Peninsula lies south-east of the town of Vilankulo, forming the mainland extension of the Bazaruto Archipelago which includes Margaruque, Benguera, Bazaruto and Santa Carolina islands (Fig. 1). The Vilanculos Coastal Wildlife Sanctuary (VCWS) lies along the peninsula between 22.0833 and 22.3500° S, and 35.4005° and 35.5505° E, comprising a land surface area of approximately 22 000 ha (Fig. 1). The area forms part of Mozambique known as the Gazaland Plain, formed from fine Kalahari sand washed down by the upper Zambezi - Limpopo river drainage system prior to the Plio-Pleistocene down-warping of the margins of the subcontinent (King 1967, Moore 1999, Moore & Larkin 2001).

The Peninsula is comprised of undulating sandy dunes rising from sea level to 96 m a.s.l (Tinley 1985). These dunes fall off steeply to the sea and bay in the north and west, but are interspersed by low lying areas formed by salt marshes and mangroves as well as narrow former beach terraces along the east and northwest. These terraces vary in width, reaching 300 – 500 m along the estuary and perhaps narrower in the north. Numerous

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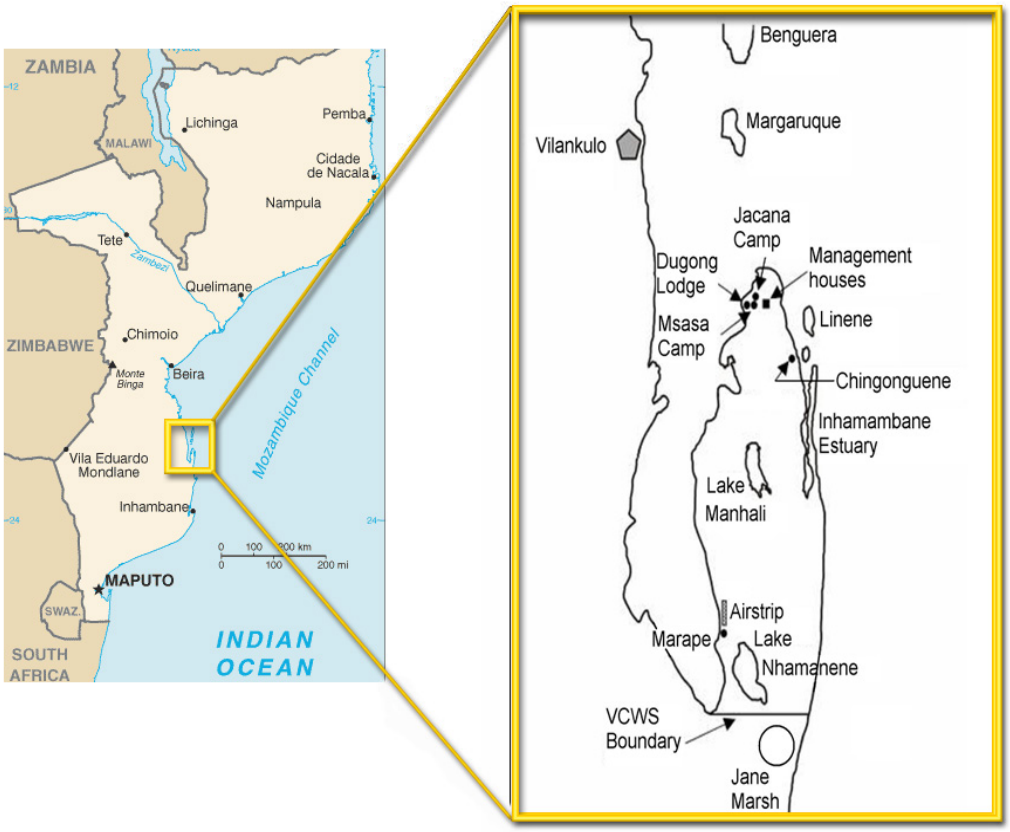

Figure 1. The location of the San Sebastian Peninsula and the Vilanculos Coastal Wildlife Sanctuary, Mozambique.

pans and lakes occur along the peninsula, mostly grouped together in the northern half. These water bodies all lie at sea level or close to it but vary in size and permanence, the largest being up to 1000 ha in extent (van der Walt, pers. comm.). Extensive freshwater swamps or marshes occur along the eastern and south western sides of the sanctuary. Along the eastern side of the peninsula lies the Inhamambane estuary between the mainland and a sand spit. The latter extends out from the mainland, forming a long narrow promontory, most of which is vegetated although the vegetation peters out towards the northern tip, where bare sand and mobile dunes occur.

The regional climate is referable to Koppen's type (Aw) or equatorial dry season type (Tinley 1985). The area is warm and humid although distinctly seasonal, with a pronounced dry season during the winter months of June - August although some orographic rain does fall. Rainfall ranges from 600-800 mm per annum, while humidity may be exceptionally high at certain times. The prevailing winds appear to be south-easterly and dunes along the east coast lie along a south-easterly plane alternating with crests and hollows. These dunes form part of an extensive but narrow dune field extending from Richard's Bay in South Africa's KwaZulu-Natal province to Bazaruto (Tinley 1985). The barrier dunes along the coast exhibit blowouts where the vegetation has been unable to prevent wind erosion.

The Peninsula and associated VCWS lies within the Flora Zambesiaca floral region (Wild & Grandvaux Barbosa 1968), with the dominant vegetation type being *Brachystegia spiciformis* and *Julbernadia globiflora* (Miombo) woodland on Sul do Save sands. The Miombo woodland varies in canopy density, and can be classified as either closed-canopy or open-canopy interspersed by a field layer of grasses, depending on the quality of the underlying soils. Scattered bushclumps are also present, as are thickets in varying stages of decline as a result of slash-and-burn agriculture and the incidence of fire. Remnant dune forests and scrub are found in the north-west and along the estuary in the east, mostly between the sea and the Miombo woodland. Tall thicket and forest are present in dune troughs south of the estuary,

while dense scrub dominates along the dune crests and slopes in the east. Extensive mangroves communities occur around the peninsula, particularly along low-lying areas which flush with sea water at high-tide, while tidal salt marshes are also present along the coast. Both annual and perennial pans and marshes are present, with vegetation ranging from rooted hydrophytes to a grass/sedge community in drier parts bordered by *Phoenix reclinata* thickets. A number of abandoned subsistence agriculture fields are also present, most showing varying degrees of recovery following slash-and-burn agricultural practices. The soils are leached deep regic sands covered by a layer of leaf litter in the forested areas and sparse grass in the open savanna areas.

Materials and Methods

The VCWS was first visited by one of us (NHGJ) from 13 June to 2 July 2002, with a follow-up visit conducted from 26 August – 13 September 2002. The area was traversed by vehicle, including night drives, but mostly on foot. Initially reptiles seen or deduced as being present were recorded in a pocket note book. During the second field trip, two series of pitfall traps 100 m in length, were erected in Miombo woodland, one extending out from a freshwater pan.

The limited number of roads and tracks hampered the accessibility of the area, especially in the eastern and southern sections, and portions of the VCWS could therefore not be surveyed.

Incidental records were compiled by EWP, who was resident in the VCWS from October 2002 - April 2003, as well as by DWP, who visited the VCWS opportunistically from October 2002 - April 2003. Additional incidental observations were made by reserve staff including Dave Smart (DS), Jenny Newenham (JN) and Ryan Pietersen.

Holes that were dug for the construction of the boundary fences acted as effective pit-fall traps, and were opportunistically checked. French drains that were constructed at the housing complexes also served as efficient pit-fall traps prior to them being covered, and these were routinely examined during the summer months. The clearing of vegetation and digging of foundations during construction also yielded some interesting fossorial reptile species.

Specimens that were collected have been deposited in the Northern Flagship Institute (Transvaal Museum), Pretoria, South Africa and acquisition numbers incorporated in the following account.

Systematic Account

Chelonia

Testudinidae

Kinixys belliana belliana Gray 1831

A woodland and coastal forest species which has been recorded from the vicinity of Msasa camp (DS), Chingonguene village in the east, and near the airstrip.

Cheloniidae

Chelonia mydas (Linnaeus) 1758

Probably the most common marine turtle in seas around the Peninsula. The species is herbivorous feeding mostly on algae and "sea grasses" which occur abundantly in the area. This species is known to be eaten by the local fishermen as carapaces and skeletal remains have been found around human habitation in the Sanctuary. The species has also been recorded from the Bazaruto Archipelago (Broadley 1990, 1992).

Lepidochelys olivacea (Escholtz) 1829

Three adult individuals found trapped in a fisherman's net that had been washed up onto the sand spit were cut free and released. These represent the first record of the species from the Bazaruto Archipelago.

Pelomedusidae

Pelusios subniger subniger (Lacepede) 1788

The tracks of terrapins crossing the road between two pans close to Jacana camp are likely to belong to this species, which has also been recorded from the Bazaruto National Park (Broadley 1992).

Squamata

Serpentes

Leptotyphlopidae

Leptotyphlopidae incognitus Broadley & Watson 1976

Individuals were captured at Msasa camp as well as around the management houses. One of the Msasa individuals was found sheltering under the bark of an Msasa *Brachystegia spiciformis* ca 1.5m above the ground. This species has also been recorded from Benguera Island (Broadley 1992).

Pythonidae

Python natalensis A. Smith 1840

A large snake which has been recorded from the northern part of the reserve. It appears to inhabit areas around pans, with spoor being seen of snakes entering and emerging from the water. Individuals were also seen in Msasa camp and at the workshop (TM85490). Has also been recorded from the Bazaruto Archipelago (Broadley 1990).

Atractaspididae

Atractaspis bibronii A. Smith1849

An uncommon burrowing snake, three individuals were observed in the vicinity of Msasa camp, two of which were examined. Both of these snakes agreed with specimens from the Bazaruto archipelago in having the lateral two scale rows and ventrum white (Broadley 1992). Subjectively, these individuals appeared to be more slender than individuals encountered in the eastern parts of South Africa. Both of the VCWS individuals had a midbody scale count of 17 scales, as opposed to the normal 21 – 23 rows encountered across most of this species' range (Branch 1998) or 19 midbody scale rows present in specimens from the Bazaruto archipelago and adjacent mainland (Broadley 1990, 1992). This seems therefore abnormal although scale counts of the ventrals (213) and subcaudals (22) appear typical for the species.

Amblyodipsas microphthalma microphthalma (Bianconi) 1850

This rare burrowing snake was unearthed in the north of the reserve during excavations. It has also been found on Bazaruto Island (Broadley 1990, 1992).

Xenocalamus bicolor lineatus Roux 1907

One specimen (TM85119) was unearthed during the digging of foundations for the new office complex in the north of the reserve. Another individual was found crossing the road between Msasa camp and Dugong Lodge at night, while a further individual was captured near the management houses. A melanistic individual (mbs 17, ventrals 234, subcaudals 31, anal divided, SVL 545 mm, TL 598 mm), was found in the vicinity of Msasa camp. This uncommon fossorial snake was also recorded by Broadley (1992) from Bazaruto Island.

Lamprophiidae

Lamprophis capensis (Dumeril & Bibron) 1854

Recorded in the sanctuary near the airstrip and at Msasa camp. Also found in the vicinity of Jane marsh. This species is likely to occur throughout the Peninsula but appears to be uncommon.

Psammophiidae

Psammophis mossambicus Peters 1882

Individuals were commonly seen in Miombo woodland in and around Msasa camp.

Colubridae

Philothamnus semivariegatus (A. Smith) 1840

A common snake in Miombo woodland, often recorded around Msasa camp and on Linene Island. Has also been recorded from the Bazaruto National Park (Broadley 1990, 1992; Downs & Wirminghaus 1990).

Philothamnus hoplogaster Guenther 1863

A common and widespread snake in the sanctuary, usually occurring close to water. It has not been recorded from the Bazaruto Archipelago, the closest recorded locality being approximately 150 km to the north (Broadley 1983).

Philothamnus natalensis natalensis (A. Smith) 1848

A single individual was recorded from near Jane marsh but the species appears to be uncommon. Broadley (1990, 1992) recorded the species from Bazaruto Island.

Crotaphopeltis hotamboeia (Laurenti) 1768

Recorded from Miombo woodland in the vicinity of Jane marsh and in Msasa camp. Has also been recorded from Bazaruto Island (Broadley 1990, 1992).

Dispholidus typus typus (A. Smith) 1829

An individual was seen at Dugong Lodge, while a large male was recorded crossing the road near Marape. This species has also been recorded from Bazaruto Island (Broadley 1990).

Thelotornis mossambicanus Bocage 1895

Frequently recorded from Msasa camp and environs. Has also been recorded from the Bazaruto National Park (Broadley 1990, 1992).

Elapidae

Aspidelaps scutatus fulafula (Bianconi) 1849

An uncommon and very unusual snake with a large nasal shield which the snake uses to burrow into the sand. Has been recorded from the sanctuary (DS) and from the vicinity of Vilankulo (Broadley 1983), but not from the islands of the Bazaruto Archipelago.

Naja annulifera Peters 1854

A large snake recorded from the sanctuary in Miombo woodland (JN), but it appears to be uncommon, this being the only record. Broadley (1995, Fig. 5) records the species from the area.

Naja melanoleuca Hallowell 1857

A relatively common snake on the peninsula having been recorded from dune thicket, mangroves and

Miombo woodland throughout the northern and central portions of the sanctuary. A large individual (2.4m TL) that was seen crossing the road near Msasa camp at dusk had just eaten a juvenile *Varanus niloticus*. Although most of the individuals encountered displayed the normal colouration, three individuals all approximately 1,4 m TL were dirty yellow in colour with dark speckling, thus resembling the speckled-phase of the Cape cobra *Naja nivea.* The size and lepidosis of one of these is as follows:
SVL 1400 mm, TL 1690 mm, 19 mbs, ventrals 208, subcaudals 71, anal scale entire.
The species has also been recorded as occurring on Bazaruto Island (Broadley 1990, 1992).

Naja mossambica Peters 1854

Has been recorded from the sanctuary (DS) but appears to be rare. Broadley (1983, Map 72) recorded the species from the vicinity of Vilankulo.

Dendroaspis polylepis (Guenther) 1858

Recorded from the southern part of the Peninsula in less settled areas, as well as south of the sanctuary in closed canopy Miombo woodland.

Amphisbaenia

Amphisbaenidae

Zygaspis violacea (Peters) 1854

A rare amphisbaenian on the Peninsula and appears to be confined to bushclumps in Miombo woodland and dune thicket, occurring in sandy soil under leaf litter (TM85046, TM85249). It has also been recorded from the island of Margaruque in the Bazaruto Archipelago. Initially described as *Zygaspis longicauda* (Broadley 1990), the lepidosis was subsequently found to coincide with the range displayed by *Z. violacea* (Broadley & Broadley 1997).
Size and lepidosis: TM85046 SVL 156.0 mm, T 49,4 mm (24% of TL), TL 205,4 mm. Dorsals19-21; ventrals 16-17 per midbody annulus; caudals 65; autotomy at 7; last 10 subcaudals white; precloacal pores 4. Shed its tail on capture. TM85249 SVL 177.0 mm, T 51 mm (22,4% of TL), TL 228,0 mm; mbd 5,7 mm. Dorsals19-22; ventrals 18-19 scales per midbody annulus; caudals 61, autotomy at 7; precloacal pores 4.

Monopeltis sphenorhynchus sphenorhynchus Peters 1879.

An individual was unearthed while digging the foundations for the new office complex in the north of the reserve. This species has also been recorded from Bazaruto Island (Broadley 1992).

Sauria

Scincidae

Typhlosaurus aurantiacus bazarutoensis Broadley 1990

An uncommon, fossorial legless skink found under leaf litter and rotting logs in bushclumps in Miombo woodland and dune thickets. Broadley (1990) described two subspecies, *T. a. bazarutoensis* and *T. a. carolinensis,* endemic to the islands of the Bazaruto Archipelago. Material from the peninsula is referable to *T. a. bazarutoensis*, TM85118, TM85252, TM85253 being uniform golden in colour and with similar lepidosis except for TM85254 which resembles the nominate form in the lack of fusion of the head shields. TM 85254 is also interesting in that it has got six dark longitudinal stripes, while all other material from the VCWS and Bazaruto archipelago are usually plain pinkish golden yellow in colour with darker infusions restricted to the head. However, one specimen examined by Broadley (1990) had seven dark stripes on the tail and remnants of two dark dorsal stripes.

Size and lepidosis: TM85252: SVL 108,8 mm; T 23,2 mm; TL 132,0 mm. Ventrals 153; subcaudals 35; LL 3; 7 scales bordering mental. Fusion of head shields include posterior subocular and postocular on left side; lower temporal reduced in size; posterior supraciliary fused with ocular on left and right sides. Colour: Golden.
TM85253: SVL 142,0 mm; T 26,0 mm; TL 168,0 mm. This individual has the largest SVL recorded for the subspecies. Ventrals148; subcaudals 33; LL 3; 7 scales bordering mental. Fusion of head shields includes the lower temporal and 3rd UL as well as the ocular-postocular on the left side. Colour: Golden.

TM85254: SVL 122,0 mm; T 25,2 mm; TL 147,2 mm. Ventrals 151; Subcaudals 34; LL 3; 7 scales bordering mental. No fusion of head shields resembling the nominate race. Colour: Golden yellow with 6 longitudinal stripes; dorsals distinct, laterals a series of interrupted spots; nine dark stripes along tail, six dorsal and lateral and three ventral.

Scelotes insularis Broadley 1990

A small burrowing skink only recorded from dune scrub and thicket in the north. Originally described from Bazaruto Island, it was previously thought to be endemic to the islands of the Bazaruto archipelago

(Broadley 1990, 1994, Branch 1998). These records extend the distribution of this species to the mainland. TM85250, TM85251.

Size and lepidosis: TM 85250: SVL 53,36 mm; T 26,64 mm; TL 80,0 mm. Mbs 18; ventrals 89; subcaudals 76. Supranasals in narrow contact behind rostral. TM85251: SVL 61,0 mm; T 61,0 mm; TL 122,0 mm. Mbs 18; ventrals 86; subcaudals 64 (tail tip regenerated); supranasals in narrow contact behind rostral.

Lygosoma lanceolatum Broadley 1990

A rare burrowing skink described from the islands of the Bazaruto Archipelago (Broadley 1990). In the sanctuary this skink has only been recorded from dune thicket at the northern end of the peninsula. TM85256. Size and lepidosis: TM85256: SVL 71,0 mm; T 79,0 mm; TL 150,0 mm. Mbs 26; ventrals 60; subcaudals 54; UL 6/7, 4-5 largest. Enlarged ear scales 3.

Lygosoma sundevallii (A. Smith) 1849

A widely distributed burrowing skink recorded from Miombo woodland within the sanctuary. This represents a new distribution record for the species which was believed to be separated from the coast by *Lygosoma afrum* (Peters). TM85117, TM85255.

Trachylepis depressa (Peters) 1854

Recorded from the coastal dunes flanking the estuary where it inhabits areas of dune scrub. Also recorded from the areas surrounding Msasa camp and the management houses. Has been recorded from the Bazaruto National Park (Broadley 1990, 1992).

Trachylepis varia (Peters) 1867

The most common skink in the sanctuary, this species mainly occurs in Miombo woodland where it is often found foraging around the bases of trees and dead wood on the ground. Broadley (1990, 1992) also recorded the species from the Bazaruto National Park.

Trachylepis striata (Peters) 1844

This skink has been recorded from Msasa camp, the management houses and environs, as well as dune thickets at the northern end of the peninsula. Broadley (1990) and Downs & Wirminghaus (1990) recorded the species from Santa Carolina Island but the former was of the opinion that these had been accidentally imported from the mainland with freight.

Panaspis wahlbergii (A. Smith) 1849

A small terrestrial skink usually seen foraging among leaf litter, it was recorded from open Miombo woodland near Jacana camp. Has also been recorded from the islands of Bazaruto and Benguera (Broadley 1990, 1992). The ventral breeding colour in males from the peninsula differed from that recorded for the islands, being typically pinkish orange throughout, whereas the island specimens were white under the throat and chest (Broadley 1990).

Lacertidae

Ichnotropis capensis (A. Smith) 1838

A terrestrial lizard, that has been recorded throughout the Peninsula in open Miombo woodland. This record extends the distribution of the species 175 km north of the nearest record along the coast at Inhambane. It appears that this species occurs in two discrete populations, one along the coast of Kwazulu-Natal and southern Mozambique, with the main population extending from the northern Cape, Northwest and Limpopo Provinces in South Africa to Botswana, Zimbabwe, eastern Namibia and Angola.

Ichnotropis squamulosa Peters 1854

Individuals were seen in the northern sections of the sanctuary in open Miombo woodland. This record extends the distribution of this species along the coast 200 km south of Beira and 400 km north of Maputo. TM85497.

Nucras caesicaudata Broadley 1972

A rare species recorded from Miombo woodland near Jacana camp. This record represents a range extension of 350 km for this species from the northeastern Limpopo Province and southeastern Zimbabwe to the coast.

Varanidae

Varanusa. a. albigularis (Daudin) 1802

Recorded from the northern portion of the sanctuary, as well as near the airstrip. Also recorded from the Bazaruto National Park (Broadley 1990).

Varanus niloticus (Linnaeus) 1762

Widespread and common around wetlands in Miombo woodland. Five individuals were seen at one of the smaller pans close to Msasa camp, while the larger pans supported many more individuals. It is preyed upon by *Naja melanoleuca.*

Agamidae

Agama armata Peters 1854

Widespread throughout the Sanctuary, having been

recorded in dune scrub, Miombo woodland and dune thicket. These records extend the distribution of this species to the coast.

Chamaeleonidae

Chamaeleo dilepis Leach 1819

This chameleon has been recorded on the peninsula (DS) and has also been found on Benguera Island (Broadley 1990, 1992).

Gekkonidae

Hemidactylus mabouia Moreau de Jonnes 1818

A relatively common gecko, being recorded from Msasa camp and the management houses. This species was also found to frequent large *Balanites*, *Ficus* and *Adansonia digitata* trees, sometimes together with *H. platycephalus*. Has also been recorded from the Bazaruto National Park (Broadley 1990, 1992).

Hemidactylus platycephalus Peters 1854

A large gecko recorded from the eastern side of the peninsula and "Baobab valley" where individuals were found under a loose piece of bark on a *Balanites* tree and on the boles of large *Ficus* and *Adansonia digitata* trees. Has also been recorded from the Bazaruto National Park, where it appeared to be extending its range (Broadley 1990, 1992). TM85264, TM85265.

Lygodactylus capensis capensis (A. Smith) 1849

A common dwarf gecko found on tree trunks and dead wood throughout the sanctuary. Has also been recorded from the Bazaruto National Park (Broadley 1990, 1992).

Crocodylia

Crocodylidae

Crocodylus niloticus Laurenti 1768

Appears to be rare in the sanctuary with only two confirmed sightings from a pan in the vicinity of Jacana camp, one of which was subsequently seen at Msasa camp and the other in a pan adjacent to the workshop pan. It is likely that this species is less common at present than in the past owing to continued human persecution in the area. Has also been recorded inhabiting freshwater pans and lakes on Bazaruto and Benguera Islands (Broadley 1990).

Amphibia

Anura

Bufonidae

Amietophrynus garmani (Meek) 1897

The most common toad on the peninsula, often observed feeding on insects attracted to lights in the evenings at Msasa camp. They were heard calling extensively during June around pans at Jacana camp. The males from the sanctuary do not exhibit the distinct markings normally associated with this species. A vertebral stripe is also frequently present, thus differing from typical material. TM85268. The species has not been recorded from the Bazaruto Archipelago and Broadley (1990) remarks on the apparent absence of toads in general.

Amietophrynus gutturalis (Power) 1927

Less common than the previous species in the sanctuary, it has been recorded calling during September in the vicinity of Jane marsh, while also being found around Msasa camp and around the management houses.

Hyperoliidae

Afrixalus fornasini (Bianconi) 1849

Recorded from Jacana camp, in the showers and on vegetation at Msasa camp and around the management houses in the north of the reserve. This record extends the distribution of this species northwards along the coast. TM85262.

Hyperolius argus Peters 1854

Commonly seen around Msasa camp at night, as well as in riparian vegetation at Jacana camp.

Hyperolius marmoratus marmoratus Rapp 1842

Individuals exhibiting a dorsal colour pattern typical of this subspecies were recorded by JN from Jacana camp. An uncommon reed frog on the Peninsula, individuals were also captured around the houses in the north of the reserve. It appears as though the Sanctuary lies on a contact zone between *Hyperolius m. marmoratus* and *Hyperolius m. taeniatus*. Some hybridization of colour patterns was seen (TM85113). This is a new record for Mozambique and a range extension of 700 km.

Hyperolius marmoratus taeniatus Peters 1854

The most common reed frog, occurring around most pans and wetlands in the Sanctuary. Brown males, presumably belonging to this subspecies, were also collected at the management houses (TM85114 & TM85115). Also recorded from the Bazaruto National

Park (Broadley 1990, 1992; Downs & Wirminghaus 1990). TM85272.

Hyperolius pusillus (Cope) 1862

Recorded from dune scrub along the estuary, as well as in the vicinity of Msasa camp and the management houses. Has also been recorded from Bazaruto Island (Downs & Wirminghaus 1990). TM85263.

Hyperolius tuberilinguis Smith 1849

A common reed frog recorded from pans and marshes around Msasa and Jacana camps and in the vicinity of Jane marsh calling from vegetation in the water. Also recorded from Bazaruto National Park (Broadley 1990, 1992). TM85259, TM85260, TM85261.

Kassina maculata (Duméril) 1853

A common kassina around vegetated pans, usually heard calling from emergent vegetation in the middle of the pan. Also often found in dry cisterns around houses. Large tadpoles were captured in gill nets during September. Has not been recorded from the Bazaruto Archipelago and this record extends the distribution of this species further north along the coast from that recorded by Channing (2001). TM85269, TM85270, TM85271

Kassina senegalensis **(**Duméril & Bibron) 1841

Individuals were heard calling from pans in the vicinity of Msasa camp, with a single individual being captured in a dry cistern at the management houses in the northern section of the sanctuary. This species has also been recorded from the Bazaruto National Park (Broadley 1990, 1992).

Arthroleptidae

Leptopelis mossambicus Poynton 1985

Heard calling from the vicinity of Jane marsh during September and recorded from Msasa camp during December. Broadley (1990) also recorded the species from Bazaruto Island.

Leptopelis natalensis (Smith) 1849

A metamorphosing tadpole belonging to this species was collected in Jane marsh during September at the same time that the Brown-backed Tree Frog was heard calling. An adult individual was also found near Msasa camp. This represents a substantial northwards range extension of 600 km for this species, and is also the first record for Mozambique. TM85266.

Microhylidae

Phrynomantis bifasciatus (Smith) 1847

Individuals were heard calling from pans in the vicinity of Msasa camp during December and January. Also recorded from Bazaruto National Park (Broadley 1990, 1992).

Pipidae

Xenopus muelleri (Peters) 1844

Has been recorded from pans in the vicinity of Msasa camp and the management houses. Numerous individuals were also found in holes dug to plant fence-line posts in dune scrub vegetation on the crest of a sand dune overlooking Chingonguene village following a rainstorm. This species is likely to be widespread across the Peninsula.

Petropedetidae

Phrynobatrachus acridoides (Cope) 1867

Occurs throughout the peninsula wherever suitable pools of permanent water are found, where it frequents waterside vegetation. Individuals were heard calling during September. TM85116, TM85258, TM85273.

Phrynobatrachus mababiensis FitzSimons 1932

The smallest of the frogs occurring in the sanctuary, it seems to be widespread at suitable waterbodies but is less common than the former species. It has also been found in the Bazaruto National Park (Broadley 1990, 1992). TM85274.

Ptychadenidae

Ptychadena mossambica (Peters) 1854

This frog has been found in marshes along the east and south of the sanctuary, as well as in the vicinity of Msasa camp. It has also been recorded from the Bazaruto National Park (Broadley 1990). TM85257.

Ptychadena oxyrhynchus (Smith) 1849

The species has been recorded from the ecotone between the salt marsh and a fresh water seep below Msasa camp, and was also found in dry cisterns around the management houses. Frogs were heard calling in September and December. TM85267.

Ranidae

Tomopterna krugerensis Passmore & Carruthers 1975

Individuals were found around Msasa camp as well as the management houses. This species has also been

recorded from the Bazaruto National Park (Broadley 1990, 1992).

Tomopterna marmorata (Peters) 1854

A single individual was found in a dry cistern at the management houses. This record represents a large northward range extension for this species along the coast. The nearest records are Maputo in the south, Boror and Magasso in the north and eastern Kruger National Park and south-eastern Zimbabwe in the west.

Discussion

A total of 4 chelonian, 18 snake, 2 amphisbaenian, 18 lizard, 1 crocodile and 20 amphibian taxa have been recorded from the Vilanculos Coastal Wildlife Sanctuary on the San Sebastian Peninsula. Compared with that recorded from the islands (Broadley 1990, 1992) and adjacent mainland there are several omissions and it is likely that many more species can be expected to occur. Table 1 is a comparative list of species recorded from the Peninsula and from the Bazaruto Archipelago (Broadley 1990, 1992).

The distribution and composition of the herpetofauna on the Peninsula, indicates a link with that of the Bazaruto Archipelago, a not unforeseen conclusion. It is believed that these islands were attached to the mainland until as recently as 10 000-90 000 years ago when rising sea levels during the Flandrian Interglacial severed this link (Downs & Wirminghaus 1997; Tinley 1985), although Cooper and Pilkey (2002) place the separation at 148-200 000 years before present and Armitage *et al.* (2006) also maintain that the separation took place 130-250 000 years ago. The period of separation of the islands from the mainland does not, however, explain the difference in species composition between the Peninsula and the Vilankulo mainland.

Broadley (1990) suggested that habitat destruction in the past on the Peninsula resulted in the relict and insular species recorded on the Bazaruto Archipelago. Although areas of dune forest and thicket along the peninsula have been decimated by anthropogenic activities, this has not affected fossorial species to the same extent as perhaps terrestrial and arboreal species. The former still occur along the peninsula, thus indicating that many of the species currently considered to be relict may in fact be an artefact of inadequate sampling. This includes species such as *Typhlosaurus a. bazarutoensis*, *Lygosoma lanceolatum* and *Scelotes insularis*, which were previously believed to be endemic to the islands of the Bazaruto Archipelago, but have since been found to occur on the Peninsula, thus confirming a previous link with the latter. It is perhaps significant that all of the species which are taxonomically distinct are fossorial and likely to be poor swimmers.

This confirms that the Peninsula and the islands were at one stage contiguous but had subsequently been separated from the mainland by rising sea levels, resulting in the speciation currently observed. At a later stage the Peninsula reunited with the mainland and separated from the islands but retained most of the herpetofauna that existed prior to separation. According to Broadley (1990) the separation of the islands Benguerra and Margaruque from Bazaruto took place more recently. This does not explain why *Zygaspis violacea* has only been recorded from Margaruque and not from the other islands. Margaruque is the closest to the Peninsula where the species has also been recorded, which indicates a longer tie with the Peninsula and not Bazaruto. *Z. violacea* has been recorded from Maxixe/ Inhambane south to Maputo and is likely to also occur in the intervening area from San Sebastian to Maxixe.

It is of interest that the lepidosis of one of the *Typhlosaurus aurantiacus* specimens (TM 85254) was similar to that of the nominate form with no reduction in head shields but was striped as in *T. a. fitzsimonsi.* The tail was also striped ventrally in contrast to the white or yellowish-white, occasionally with scattered black dots in the latter. The number of ventrals (151) however could be that of *T. a. fitzsimonsi* or of *T. a. bazarutoensis*. This individual was found together with *T. a. bazarutoensis* under the same log.

Nine specimens of *Atractaspis bibronii* from the Vilankulo mainland, the Peninsula, the Bazaruto Archipelago and one from the Sabi – Lundi River Confluence in south-eastern Zimbabwe exhibit midbody scale rows ranging from 17-19 (Broadley 1966a, 1990, 1992, Jacobsen et al, this paper). This differs substantially from the 21-23 rows recorded elsewhere within its distribution (Branch 1998), although Broadley (1983) mentions that 19 and 25 may be rarely encountered, the latter from Zimbabwe northwards. The former is likely based on the same material from the Vilankulo area (Map 48, Broadley op.cit) as well as the specimen from the Sabi - Lundi River Confluence (Broadley 1966a). Ventral lepidosis seems to overlap with that typical for *Atractaspis bibronii* ranging from 213 – 225, which is at the lower end of that recorded by Branch (1998) of 213 – 256. Broadley (1966a) mentions that the specimen with 19 scale rows from the Sabi – Lundi River Confluence had 225 ventrals, while another individual

Table 1. Comparative lists of the herpetofauna recorded from the San Sebastian Peninsula and the Bazaruto archipelago. SSP: San Sebastian Peninsula; BAZ = Bazaruto Archipelago.

Species	Common Name	SSP	BAZ
Tortoises, Terapins, Turtles			
Kinixys b. belliana	Bell's Hinged Tortoise	x	
Pelusios subniger	Pan Hinged Terrapin	?	x
Caretta caretta	Loggerhead Turtle		x
Eretmochelys imbricata	Hawksbill Turtle		x
Lepidochelys olivacea	Olive Ridley Turtle	x	
Dermochelys coriacea	Leatherback Turtle		x
Chelonia mydas	Green Turtle	x	x
Lizards			
Homopholis wahlbergii	Wahlberg's Velvet Gecko		x
Hemidactylus mabouia	Tropical House Gecko	x	x
Hemidactylus platycephalus	Flat-headed House Gecko	x	x
Lygodactylus capensis	Cape Dwarf Gecko	x	x
Agama armata	Peter's Ground Agama	x	
Chamaeleo dilepis	Common Chameleon	x	x
Scelotes duttoni	Dutton's Dwarf Burrowing Skink		x
Scelotes insularis	Bazaruto Dwarf Burrowing Skink	x	x
Trachylepis depressa	Eastern Coastal Skink	x	x
Trachylepis varia	Variable Skink	x	x
Trachylepis striata	Striped Skink	x	
Lygosoma lanceolatum	Bazaruto Writhing Skink	x	x
Lygosoma sundevallii	Sundevall's Writhing Skink	x	
Panaspis wahlbergii	Wahlberg's Snake-eyed Skink	x	x?
Typhlosaurus aurantiacus bazarutoensis	Golden Blind Legless Skink	x	x
Ichnotropis capensis	Cape Rough-scaled Lizard	x	
Ichnotropis squamulosa	Peter's Rough-scaled Lizard	x	
Nucras caesicaudata	Blue-tailed Sandveld Lizard	x	
Gerrhosaurus major major	Rough-scaled Plated Lizard		x
Gerrhosaurus flavigularis	Yello-throated Plated Lizard		x
Varanus albigularis	Veld Monitor	x	x
Varanus niloticus	Water Monitor	x	x?
Amphisbaenians			
Monopeltis s. sphenorhynchus	Slender Spade-snouted Worm Lizard	x	x
Zygaspis violacea	Violet Round-headed Worm Lizard	x	x
Snakes			
Typhlops fornasinii	Fornasini's Blind Snake		x
Leptotyphlops incognitus	Eastern Thread Snake	x	x
Python natalensis	Southern African Python	x	x
Aparallactus capensis	Cape Centipede Eater		x
Xenocalamus lineatus bicolor	Bicoloured Quill-snouted Snake	x	x
Xenocalamus transvaalensis	Transvaal Quill-snouted Snake		x
Amblyodipsas m. microphthalma	White-lipped Snake	x	x
Atractaspis bibronii	Bibron's Burrowing Asp	x	x
Aspidelaps scutatus fulafula	Shield-nosed Snake	x	
Naja melanoleuca	Forest Cobra	x	x

Table 1. *continued*

Naja annulifera	Snouted Cobra	x	
Naja mossambica	Mozambique Spitting Cobra	x	
Dendroaspis polylepis	Black Mamba	x	
Lamprophis capensis	Brown House Snake	x	
Lycophidion s. semiannule	Eastern Wolf Snake		x
Psammophis orientalis	Mozambique Stripe-bellied Sand Snake		x
Psammophis mossambica	Olive Grass Snake	x	
Prosymna janii	Mozambique Shovel-snout		x
Prosymna stuhlmanii	East African Shovel-snout		x
Philothamnus hoplogaster	Green Water Snake	x	
Philothamnus n. natalensis	Natal Green Snake	x	x
Philothamnus semivariegatus	Spotted Bush Snake	x	x
Crotaphopeltis hotamboeia	Herald Snake	x	x
Dispholidus typus	Boomslang	x	x
Thelotornis mossambicanus	Mozambique Vine Snake	x	x
Dasypeltis m. medici	East African Egg-eater		x
Crocodile			
Crocodylus niloticus	Nile Crocodile	x	x
Amphibia			
Xenopus muelleri	Tropical Platanna	x	
Amietophrynus garmani	Olive Toad	x	
Amietophrynus gutturalis	Gutteral Toad	x	
Phrynomantis b. bifasciatus	Banded Rubber Frog	x	x
Tomopterna krugerensis	Knocking Sand Frog	x	x
Tomopterna marmorata	Russet-backed Sand Frog	x	
Ptychadena oxyrhynchus	Sharp-nosed Grass Frog	x	
Ptychadena mossambica	Broad-banded Grass Frog	x	x
Phrynobatrachus mababiensis	Dwarf Puddle Frog	x	x
Phrynobatrachus acridoides	East African Puddle Frog	x	
Leptopelis mossambica	Brown-backed Tree Frog	x	x
Leptopelis natalensis	Forest Tree Frog	x	
Kassina maculata	Red-legged Kassina	x	
Kassina senegalensis	Bubbling Kassina	x	x
Afrixalus fornasinii	Greater Leaf-folding Frog	x	
Hyperolius argus	Argus Reed Frog	x	
Hyperolius pusillus	Water Lily Frog	x	x
Hyperolius tuberilinguis	Tinker Reed Frog	x	x
Hyperolius m. marmoratus	Painted Reed Frog	x	
Hyperolius marmoratus taeniatus	Painted Reed Frog	x	x

from the same area with 23 scale rows had 236 ventrals. Subcaudals also fall within the range of the species, from 22-24 at Vilankulo and south-eastern Zimbabwe and 18-28 overall (Branch 1998).

All of the taxa occurring on the Peninsula have adjacent mainland relatives, some of which such as *Lygosoma sundevallii* appear to have colonised the area since the lowering of sea levels. It was expected that *Lygosoma afrum* would have occurred in the area as this species appears to replace *L. sundevallii* along the coast (Broadley 1966b, Branch 1998), but the former was not recorded. Whether this is an isolated relict population or is part of a larger distribution across the Gazaland plain in not known. Other species such as *Agama armata*, *Nucras caesicaudata* and *Tomopterna marmorata* suggest that the latter is likely to be the case.

Also of biogeographic significance is the occurrence of *Leptopelis natalensis* along the peninsula. This species was previously believed to be endemic to KwaZulu Natal and the Eastern Cape Province of South Africa (Channing 2001, Minter et al. 2004, Passmore & Carruthers 1995). More recently the species was recorded from Kosi Bay close to the border with Mozambique (Pietersen, Havemann, Retief & Davies 2008). It appears that this is a relict population being far removed from the closest other distribution record although there is a possibility that the species may

occur in suitable habitat southwards along the coast.

In addition two forms of *Hyperolius marmoratus* were recorded from the Peninsula. *H. m. taeniatus* was the most common occurring together with *H. m. marmoratus* and an occasional intermediate morph. *Hyperolius m. marmoratus* is generally accepted as being confined to the Eastern Cape and KwaZulu-Natal provinces of South Africa (Passmore & Carruthers 1995; Schiotz 1999), while Channing (2001) restricts the distribution of *H. m. marmoratus* to KwaZulu-Natal. It is possible that this may be a relict population, similar to what may be the case for *Leptopelis natalensis*.

The Peninsula has been subjected to considerable anthropogenic impacts in the past, most of which are still present. Agriculture and fire are the most pronounced and mainly responsible for the extensive habitat destruction which has taken place. Together with the collection of construction material and firewood they have substantially impoverished herpetofaunal habitat. The incidence of fire is reducing the remaining areas of dune forest and thickets along the peninsula, to the detriment of the herpetofauna. It is known that during the protracted civil war, people moved away from the mainland to the islands (Downs & Wirminghaus 1990) and perhaps also onto the peninsula to escape from the fighting. This more recent increase in the settlement of the islands compared to the longer and perhaps denser settlement on the Peninsula may account for the presence of some species in the former and their absence or apparent scarcity in the latter. In this respect it is perhaps significant that *Psammophis orientalis* has not yet been found on the Peninsula, despite being regarded as common on Bazaruto Island (Broadley 1990) and has also been recorded along the coast as far south as Inhambane (Broadley 1983). In contrast, *Kassina maculata* was common along the Peninsula, yet has not been recorded from the Bazaruto Archipelago although suitable habitat is present. Toads appear to be absent from the Archipelago (Broadley 1990) but two species have been recorded to date from the Peninsula.

Other factors affecting the abundance and distribution of the herpetofauna include persecution, either for food or out of fear. The Nile crocodile *Crocodylus niloticus* is likely to have occurred here more frequently in the past, but has since been reduced in number having been hunted for food, as well as being a threat to humans and livestock. Other species also persecuted for food, included *Python natalensis* and chelonians. Evidence of the latter includes carapaces and skulls of Green turtles *Chelonia mydas,* along the perimeter of the Peninsula. One of us (EWP) rescued three adult Olive Ridley Turtles from a discarded gill net.

Conclusion

The survey of the herpetofauna of the San Sebastian Peninsula has resulted in numerous range extensions. Taxa formerly considered endemic to the Bazaruto Archipelago have been recorded from the Peninsula, indicating that these areas were formerly contiguous but had separated at some point from the mainland, resulting in the speciation recorded. At a later stage the peninsula reconnected with the mainland but with an apparent gradual separation from the islands.

The presence of an 'aberrant' *Typhlosaurus aurantiacus* in sympatry with *T. a. bazarutoensis* is indicative that the species complex requires a more in depth assessment. Similarly the differences in midbody scale rows of *Atractaspis bibronii* from this area and the Bazaruto Archipelago, compared to populations further west indicate the possibility of an undescribed cryptic species occurring along the coast.

It is also evident that human occupation of the peninsula has had a drastic impact on the herpetofauna, due to habitat destruction and the incidence of fire. What biogeographic inference can be made on the absence of widespread and common species? Is it an artefact of inadequate collecting, or have the species disappeared due to anthropogenic impacts, or were they never there? The present survey was inadequate to cover the extensive area of the peninsula and vehicular access of many parts was limited. Despite this, it compares well with what has been recorded from the Bazaruto Archipelago and has increased our knowledge of the distribution and biogeography of the herpetofauna of this area of coastline.

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