THREATS AND CONSERVATION STATUS OF COMMON AND ROSEATE TERNS *STERNA HIRUNDO/S. DOUGALLII* IN THE AZORES: A CASE STUDY FOR TERCEIRA ISLAND

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ABSTRACT

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The Azores Archipelago holds the second most important population of Roseate Terns in the North Atlantic. However, the size of the population has been decreasing. In this study, we used remote-sensing cameras and visits to the main colonies of Common Terns *Sterna hirundo* and Roseate Terns *S. dougallii* on Terceira Island to identify the causes of breeding failure. Nest depredation by introduced mammals, particularly rats and cats, was the main cause of breeding failure, leading, in some cases, to the complete destruction of the colony. Additional threats included nest disturbance by humans and dogs, which caused the destruction of some nests. Measures aimed at mitigating depredation were tested but in the case of rodents, control plans proved difficult to achieve. This is probably because rodents are widespread in the Azores, they are not limited by food resources, and/or trapping methods are ineffective.

Key words: seabirds, North Atlantic, Macaronesia, camera traps, depredation, introduced mammals, control actions

INTRODUCTION

The introduction of non-native mammals is the main cause of population declines and extinctions for native seabirds on islands worldwide (Courchamp *et al.* 2003, Doherty *et al.* 2016), including Macaronesia (Clarke 2006). The Azores Islands are the last breeding stronghold for terns *Sterna* spp. in Macaronesia. On Madeira and the Canary Islands, the populations of Common *S. hirundo* and Roseate terns *S. dougallii* have been reduced to relict populations, but the Azores still hold large populations of both species (Clarke 2006). This could be because the Azores have been less exposed to touristic activity and because terns are spread over many colonies on the nine islands of the archipelago (Fig. 1).

The Azores are especially important for Roseate Terns since they hold ~30% of the European population (2679 pairs bred in the 27 European Union (EU) member states in 2019; Piec & Dunn 2021). This species is considered of European Conservation Concern (SPEC 3) and is listed in Annex 1 of the Directive on the Conservation of Wild Birds (EPCEU 2010). In the Azores, both species often occur in mixed colonies and breed mostly on rocky islets with sedimentary plateaus, sea stacks, and cliffs (Ramos & del Nevo 1995). Roseate Terns regularly nest at 19–27 locations, though they are known to have nested at least once at 52 locations. The bulk of the population breeds at five main colonies, situated on Flores, Graciosa, and Terceira islands (Institute of Marine Research (IMAR)-Azores, unpubl. data). Common Terns are much more widely dispersed, nesting in 90 locations at least once between 1989 and 2017 (IMAR-Azores unpubl. data).

Several on-land factors are known to contribute to tern breeding failure in the Azores, including habitat destruction, human disturbance, and uncontrolled human access to the colonies for recreational uses. However, depredation of adults, eggs, and/or chicks is probably the main threat, particularly depredation by introduced mammals. Since colonization by the Portuguese in the late 15th century, several species of mammalian predators have been accidentally or intentionally introduced to the Azores, which has led to the disappearance or decline of seabird populations (Frutuoso 1561, Monteiro *et al.* 1996). Depredation by rats *Rattus* spp., house mice *Mus musculus*, and feral cats *Felis catus* is probably the major cause of breeding failure for Roseate and Common terns in the Azores (Monteiro *et al.* 1996, Neves *et al.* 2011). Other introduced mammal predators include mustelids (ferrets *Mustela putorius furo* and least weasels *Mustela nivalis*) and European hedgehogs *Erinaceus europaeus* (Monteiro *et al.* 1996, Neves *et al.* 2011), although these species probably have a minor impact on tern populations. Rabbits *Oryctolagus cuniculus* can also negatively impact seabirds by overgrazing, which can result in the loss of vegetation cover and may accelerate soil erosion (Bell *et al.* 1997, Monteiro 2000, Courchamp *et al.* 2003). Additionally, the presence of rodents and rabbits near the colonies can attract local predators, such as cats, increasing the rate of nest predation (Courchamp *et al.* 2003). Known indigenous avian predators include the Yellow-legged Gull *Larus michahellis atlantis* (Monteiro *et al.* 1996) and the Ruddy Turnstone *Arenaria interpres* (Bried & Neves 2015), as well as raptors such as the Common Buzzard *Buteo buteo rothschildi* (Monteiro *et al.* 1996). Other potential

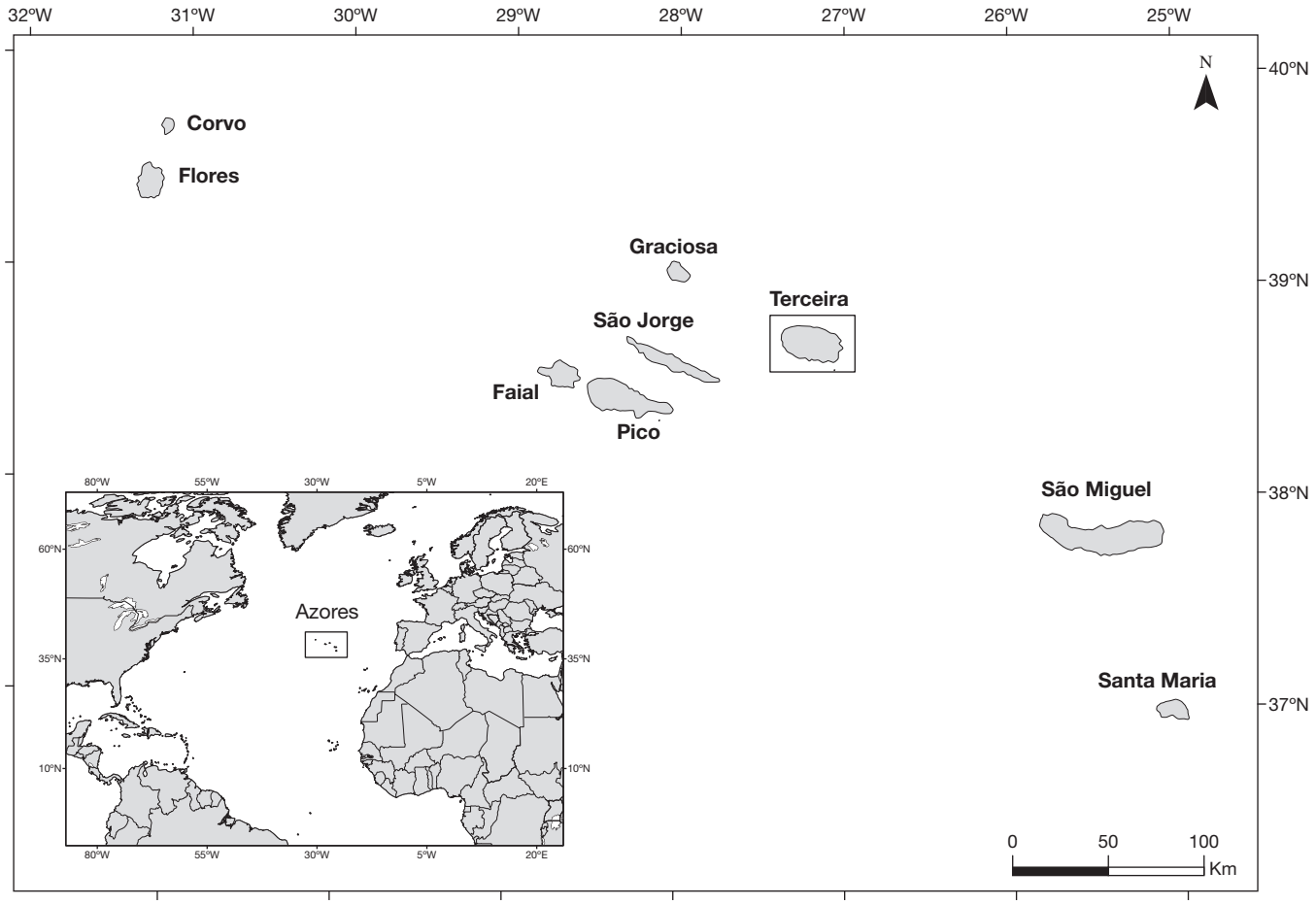

Fig. 1. Location of the study area, Terceira Island (Azores).

avian predators are Little Egrets *Egretta garzetta* and Western Cattle Egrets *Bubulcus ibis*. Neves *et al.* (2011) reported that depredation by Common Starlings *Sturnus vulgaris* ("European Starlings" in the reference) was the main factor responsible for Roseate Tern breeding failure at a colony on Vila Islet (Santa Maria Island) in some years. Yellow-legged Gulls were suspected of destroying 80 nests (mostly Roseate Tern nests but some belonging to Common Terns as well) at Ponta das Contendas on Terceira Island within a two-week period in 2016. This prompted gull nest removal and subsequent recovery of the tern colony (Terceira Natural Park unpubl. data). Other threats to terns include loss of nesting sites (e.g., eruption of the Capelinhos volcano, landslides, etc.), extreme weather events, and trapping at the wintering grounds.

Given the vulnerability of tern species, especially the Roseate Tern, special conservation measures are needed to protect their habitats and to ensure their survival and reproductive success (Piec & Dunn 2021). To achieve this, it is critical to understand which factors limit breeding success. Thus, the aim of this study was to provide information about Common and Roseate tern populations and colony characteristics, as well as an assessment of depredation threats in the Azores Archipelago, using Terceira Island as a case study. Additionally, we provide information about the identity of nest predators and the effectiveness of predator control actions.

METHODS

Study site

The Azores Archipelago (37–40°N, 025–031°W), which consists of nine main islands and many small islets, is in the eastern North Atlantic, about 1400 km from mainland Portugal (Fig. 1). The islands are divided into three groups: Eastern (São Miguel and Santa Maria), Central (Faial, Pico, Graciosa, São Jorge, and Terceira) and Western (Corvo and Flores). Terceira Island (38.7°N, 027.2°W) is the third largest (~400 km^2) and has a maximum elevation of 1023 m. It has held important populations of Roseate Terns over the years, reaching 45% of the Azorean breeding population in 2000 (Amaral *et al.* 2010).

Study colonies

Ponta das Contendas

Ponta das Contendas is situated at the southeastern tip of Terceira Island and includes an eroded peninsula and two small islets of 2.2 ha (0.022 km^2) in size. It is an important nesting site for both Roseate and Common terns. It is included in the Special Protection Area of Ponta das Contendas – Ilha Terceira PTZPE0031 (EU Birds Directive 2009/147/EC) and is classified as an Important Bird Area (PT067) by BirdLife International

(2018). It is also included in the Habitats or Species Management Protected Area of Ponta das Contendas (TER06) and Marine Resources Management Protected Area of Ponta das Contendas (TER16; Regional Legislative Decree DLR nº. 11/2011/A; Regional Legislative Decree DLR nº 15/2012/A).

Included in the Ponta das Contendas colony is Feno Islet (1.6 ha), which emerged from the eroded peninsula and is separated from the main island by a channel ~2 m wide. The edges of the islet are rocky and low, and there is a plateau rising to 14 m above sea level (asl) that covers about a quarter of the islet. This plateau and its slopes, being the preferred breeding habitat of the Roseate Terns at this colony, are covered with low halophytic vegetation. Roseate and Common terns also nest on the lower rocky areas that are sparsely covered with clumps of fescue *Festuca petraea*. South of Feno Islet, a small rocky islet (0.6 ha) rises 3 m asl. While used by terns, it provides a low-quality habitat with few opportunities for successful breeding. Small rocky depressions caused by wave-spray erosion are used as nest sites, but they tend to become readily filled with water during inclement weather (sea surge, spray, heavy rainfall), resulting in the loss of eggs and young chicks.

Ponta da Serreta

Ponta da Serreta is a peninsula located on the northeastern coast of Terceira Island that is categorized as Habitats or Species Management Protected Area of Planalto Central e Costas Nordeste (TER11; Regional Legislative Decree DLR nº. 11/2011/A; Regional Legislative Decree DLR nº 15/2012/A). Its total area is 0.21 km^2 and the peninsula is mainly covered by a mixed forest of exotic and native tree species. Common Tern colonies are located on inaccessible cliffs and on the accessible rocky coast. Currently the colony on the rocky coast is abandoned, probably due to human and animal disturbance.

Quatro Ribeiras

Quatro Ribeiras is located on the northern coast of Terceira Island. It is classified as Habitats or Species Management Protected Area of Costa das Quatro Ribeiras (TER10 & TER11; Regional Legislative Decree DLR nº. 11/2011/A; Regional Legislative Decree DLR nº 15/2012/A), Special Area of Conservation PTTER0018 "Costa das Quatro Ribeiras" (EU Habitats Directive; CEC 1992). This colony is formed by cliffs enclosing small bays that are inaccessible to humans. It holds several colonies of Common Terns, but Roseate Terns were also detected during some years.

Predator identification

To identify nest predators, automatic remote-sensing cameras (Moultrie 880i, Bushnell Trophy Cam HD) were deployed at Ponta das Contendas, Ponta da Serreta, and Quatro Ribeiras during the breeding season (May to September) for five consecutive years (2015–2019). At each nest, a single camera was mounted on a wooden stake placed 50–150 cm from the nest (Table 1). Cameras remained active for seven consecutive days. Each camera was then moved to another nest to maximize the spatial coverage in each colony (Hervías *et al.* 2013). Cameras were programmed to take photos every 30 seconds and were set with high sensitivity of the infrared sensor to increase the detection of small species. Cameras recorded the date and time for each event, along with the number of eggs, chicks, and adults present in the nests during the installation and upon the recovery of the cameras.

Additionally, during May 2017, three artificial nests were deployed at Ponta das Contendas. Each was provided with four chicken eggs and monitored with two camera traps for 14 days. Cameras were checked every seven days.

Predator control

Based on the mammalian and avian predator species detected, several unstandardized predator control campaigns were conducted to minimize their impact. These actions were implemented at only the accessible tern colonies, namely Ponta das Contendas, Ponta da Serreta, and Quatro Ribeiras.

Ponta das Contendas

Two predator species were controlled, namely Yellow-legged Gulls and black rats *R. rattus*. Between 1984 and 2004, the gull population increased by almost 60% in the Azores (Neves *et al.* 2006a) and spread its nesting locations. One of the new breeding sites was Ponta das Contendas, where one pair bred in 2003, increasing to 14 pairs in 2015. In 2015, egg removal was initiated and carried out annually thereafter. The objective was to discourage gulls from nesting by continuously destroying their eggs and nests. Rat control has been conducted since 2006, but due to proximity to the shore, rats re-invade the islets every few years. Ten rat bait stations were placed permanently on the coastline and five were placed on the islets. They were filled with baits containing the second-generation anticoagulants bromadiolone or difenacoum. Bait stations were checked every two weeks

TABLE 1
Number of Roseate (R) *Sterna dougallii* and Common (C) *S. hirundo* tern nests monitored by cameras and colony size for three colonies on Terceira Island, Azores, 2015–2019

	2015		2016		2017		2018		2019	
Colony	**Monitored nests**	**Colony size**	**Monitored nests**	**Colony size**	**Monitored nests**	**Colony size**	**Monitored nests**	**Colony size**	**Monitored nests**	**Colony size**
Ponta das Contendas	-	12 R 56 C	8	75 R 48 C	6	133 R 133 C	4	139 R 256 C	2	151 R 260 C
Ponta da Serreta	3	31 C	20	31 C	-	5 C	-	No terns	-	No terns
Quatro Ribeiras	3	86 C	-	No terns	-	No terns	-	No terns	-	No terns

and replenished when needed. In 2019, three GoodNature A24 pneumatic kill traps and five Tomahawk live-box traps were deployed on the islets in addition to the bait stations. However, both methods proved ineffective for capturing rats.

Ponta da Serreta

Rat control was initiated at this location in May 2016, when 22 stations baited with bromadiolone were placed throughout the colony. The bait stations were checked and replenished every two weeks. Additionally, during the 2016 nesting season, when depredation of tern chicks by a feral cat was recorded by the Bushnell cameras, we deployed three Tomahawk live-box traps baited with sardines and canned cat food. The traps were checked daily until the cat was captured at the end of the nesting season.

Quatro Ribeiras

In 2015, we deployed ten Tomahawk live-box traps baited with sardines and canned cat food for five consecutive days (06–10 July), in an attempt to remove a feral cat detected during colony monitoring. The traps were checked daily, but the cat was not captured.

RESULTS

Tern colonies on Terceira Island

Twenty-one colonies of Common Terns and three colonies of Roseate Terns were identified on Terceira Island (three on islets and 18 on the main island; see Fig. 2). Ponta das Contendas was the most important colony for both species. All Roseate Tern colonies and most Common Tern colonies on Terceira Island, as well as some foraging areas within a few hundred meters of the colonies were situated within the Special Protection Areas.

Predator identification

Our sampling effort included 322 camera-trap days, involving 46 nests on Terceira Island between 2015 and 2019 (Table 2). We detected four predator species responsible for nesting failure (Fig. 3). Cats and black rats were observed depredating eggs and chicks; Yellow-legged Gulls were observed depredating eggs; and dogs *Canis familiaris* were observed (for the first time in the Azores) disturbing nests, which led to nest abandonment (Table 2). These species caused significant impacts in the colonies, sometimes leading to colony abandonment.

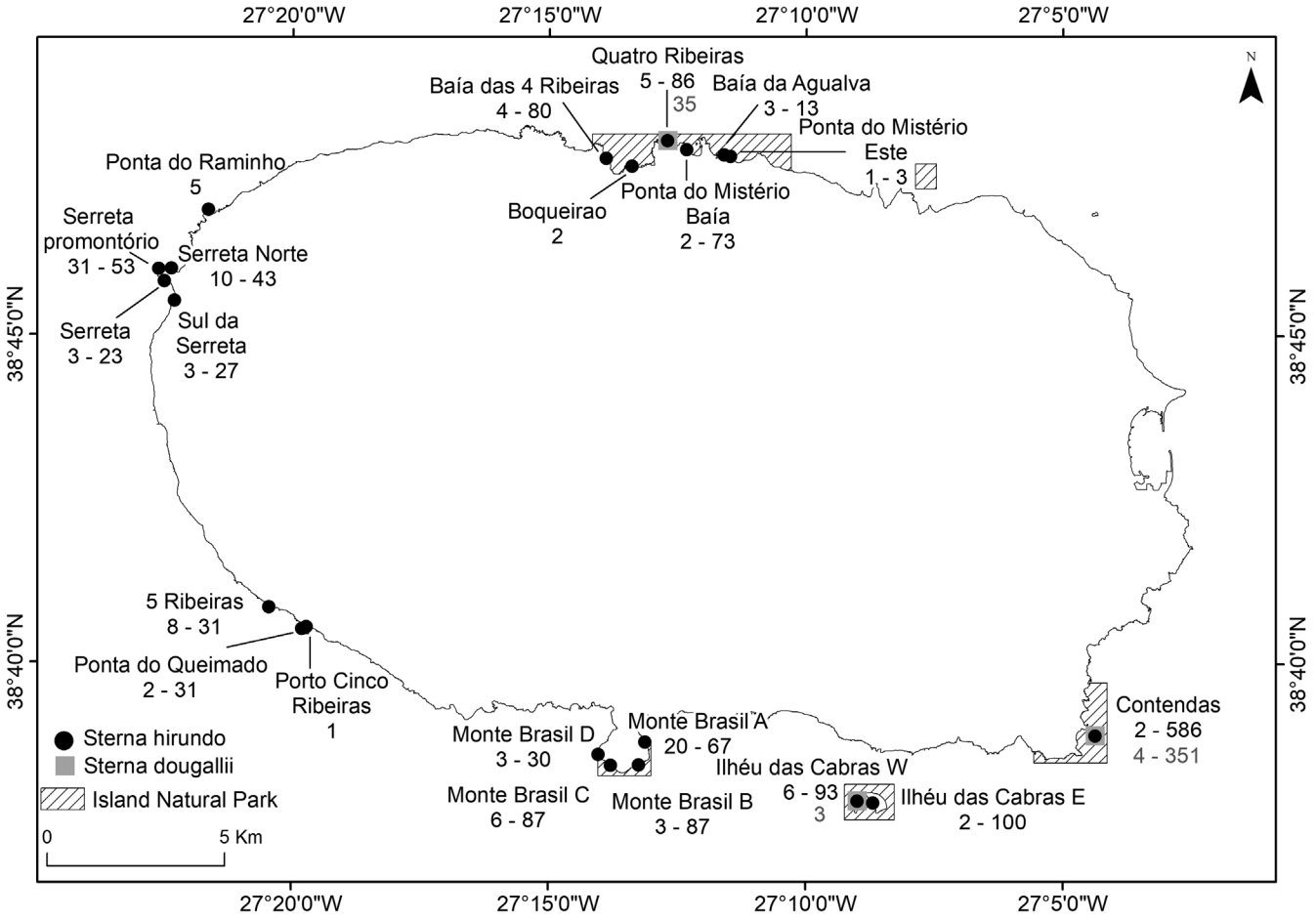

Fig. 2. Location of the colonies (i.e., assemblies of contiguous nests) of Common *Sterna hirundo* and Roseate *S. dougallii* terns on Terceira Island, with an indication of the maximum and minimum number of breeding pairs at each colony during 1989–2019. Protected marine areas included in the Terceira Natural Park are marked with oblique lines.

TABLE 2
Tern predators detected from camera-trap monitoring campaigns conducted on Terceira Island, 2015–2019

Year	Colony	Nº of cameras	Sampling effort (CTD)[a]	Species	Impact recorded
2015	Quatro Ribeiras	3	21	*Felis catus*	Egg depredation
2015	Ponta da Serreta	3	21	*Rattus rattus*	Egg depredation
2016	Ponta da Serreta	20	140	*Felis catus*	Egg depredation
				Canis familiaris	Disturbance, nest abandonment
2016	Ponta das Contendas	8	56	Not identified[b]	Egg depredation
2017	Ponta das Contendas	6	42	*Larus michahellis atlantis*	Egg depredation
2018	Ponta das Contendas	4	28	*Rattus rattus*	Egg depredation
				Larus michahellis atlantis	Egg depredation
2019	Ponta das Contendas	2	14	*Rattus rattus*	Egg and chick depredation

[a] CTD = camera-trap days
[b] Camera traps ran out of batteries or snapshots were not fast enough to catch the depredation event.

At Ponta das Contendas, at least 80 nests unmonitored by cameras were depredated in 2016 and 2017. During the artificial nest experiment in 2017, Yellow-legged Gulls were observed depredating the chicken eggs. During 2018 and 2019, rats were observed depredating tern eggs and chicks. During 2016–2019 camera traps registered the presence of many Common Starlings, but our camera-trap data revealed no evidence that starlings affect breeding terns. Rock Doves *Columba livia* were detected by several cameras, but no significant negative impacts were observed, apart from competition for the artificial nesting boxes.

At Ponta da Serreta, the lower number of breeding pairs counted in 2017 was caused by nest depredation by rats and cats during 2015 and 2016, as well as disturbance by dogs and humans (engaged in fishing and tourism). Colony size decreased from 31 to five breeding pairs (Table 1). No breeding attempt by terns has been registered since 2018 (Table 1).

At Quatro Ribeiras, the impact of a single cat led to the almost total abandonment of the colony in 2015. The terns did not return in the following years.

No other rodent species (e.g., house mice, Norway rat *R. norvegicus*) were detected on tern colonies, nor were European hedgehogs, least weasels, or ferrets.

Predator control

The control actions reduced the number of gull pairs attempting to nest at Ponta das Contendas. In 2015, 14 pairs attempted to nest; this was reduced to one pair in 2020. Over the same period, the number of terns nesting in the colony increased slightly, as did the number of terns using artificial wooden nest boxes (two boxes out of 45 occupied in 2016; six boxes out of 45 occupied in 2019). Since 2010, the Ponta das Contendas colony has been free of terrestrial predators but in 2018, rodenticide routinely deployed in early spring was consumed. Rodenticide stations were replenished, but no further signs of consumption were registered. However, camera traps showed that at least one black rat survived the rodent control action and remained present on the islet.

The rat control actions on Ponta das Contendas in 2019 were largely ineffective: the rats that remained on the islets did not consume the rodenticide and the digital counters on the GoodNature traps did not reveal rat captures. Tomahawk live-box traps were also ineffective, because most of the bait was removed from the boxes by gulls. One cat was successfully removed from Ponta da Serreta in 2016 using Tomahawk live-box traps, but the same action conducted at the Common Tern colony at Quatro Ribeiras in 2015 was not successful.

Fig. 3. Camera captures of tern nest predators: (A) a Yellow-legged Gull *Larus michahellis atlantis* preying on artificial nest at Ponta das Contendas, (B) a black rat preying on a tern egg at Ponta das Contendas, and (C) a feral cat and two tern chicks (marked by arrow) at Quatro Ribeiras.

DISCUSSION

Cats and rodents are the most widespread non-native mammals on oceanic islands, and their impacts on native seabirds (mainly through opportunistic depredation) have been largely reported (e.g., Jones *et al.* 2008, Dumont *et al.* 2010; Jeschke & Genovesi 2011, Bonnaud *et al.* 2012). Other mammal species are also problematic, including rabbits (Brodier *et al.* 2011, Chapuis *et al.* 2011), hedgehogs (Burger & Gochfeld 1994), dogs (Tomkins 1985, Towns *et al.* 2011), and mustelids (Burger & Gochfeld 1994, Cuthbert & Davis 2002). Consistent with that pattern, most nest failures in Azorean terns seem to be because of depredation by introduced mammals, particularly rats and cats, as our study noted. Other authors have also reported depredation by these species in the archipelago and consider them to be a major threat on the main islands (del Nevo *et al.* 1993, Monteiro *et al.* 1996), where they are widespread (e.g., Mathias *et al.* 1998); their numbers are particularly high in coastal areas due to proximity to urban areas (Mathias *et al.* 1998, Lamelas-López *et al.* 2016). The recent arrival of at least one black rat at Ponta das Contendas in 2018 was responsible for recurrent depredation during the following years. Actions aimed at removing this individual from the islet proved unsuccessful. However, in some other cases, mammals (rats and rabbits) have been successfully eradicated (Bried *et al.* 2009, Amaral *et al.* 2010).

Mustelids were also considered by some authors as an important threat to Common Terns on the main islands of the Azores (e.g., del Nevo *et al.* 1993), but we did not detect any depredation by these species. Additionally, European hedgehogs were previously thought to depredate tern eggs in the Azores (Monteiro *et al.* 1996), but that was not observed in our study. We suggest that mustelids and hedgehogs currently have a minor impact on tern populations, given that 1) they do not occur on all the islands of Azores (see Table 3 and Borges *et al.* 2010); 2) their spatial distribution is more restricted and their preferred habitats are away from tern colones, mainly in pastures surrounded by mixed woodland (Mathias *et al.* 1998; Lamelas-López *et al.* 2019, 2020); and 3) their abundance is relatively low on Terceira Island and throughout the Azores (Lamelas-López, unpubl. data). For example, the ferret is an uncommon species on most of the main islands of the archipelago where it does occur (Mathias *et al.* 1998).

Other predators that threaten terns or other small seabirds include the native Common Starlings and the introduced Madeira wall lizards *Teira dugesii* (Neves *et al.* 2017). We did not detect depredation by these species, but they are likely to be among the main egg predators on islets, particularly starlings. Also, the native Yellow-legged Gull was probably responsible for the depredation of a significant proportion of nests at Ponta das Contendas in 2016. Although we did not detect depredation by Yellow-legged Gulls during this study, we did collect evidence of depredation from artificial nests deployed in the Ponta das Contendas colony in 2017.

Management implications

Wildlife managers require reliable data to establish suitable management plans and to ensure the breeding success of native seabirds, particularly for vulnerable species such as Roseate Terns. Based on our experience, cameras are among the most cost-effective methods to monitor wildlife (Silveira *et al.* 2003, Lamelas-López & Salgado 2021) and they proved effective in identifying nest predators. However, the main limitation of this method is the large number of false activations caused by the movement of terns in the nests and by wind blowing vegetation. This can be time-consuming to analyze the records (Lamelas-López & Ferrante 2021), and false activations sometimes causes the SD memory card to fill before replacement. Also, the characteristics of the colonies made camera deployment difficult on occasion. In some cases, the cameras had to be installed too close to the nest, causing image over-exposure and burn-out.

In some colonies, such as Praia Islet (the largest tern colony in the Azores, on Graciosa Island) and Vila Islet, artificial nest boxes have been deployed for terns but have rarely been used (Bried & Neves 2015). At Ponta das Contendas, only six boxes out of 45 were occupied in 2019, a low rate of nest box occupation compared to other Roseate Tern colonies (e.g., Great Gull Island in the USA, Coquet Island in the UK, Rockabill Island in Ireland; Piec & Dunn 2021). This is probably due to a combination of factors such has higher availability of suitable habitat and more favorable weather conditions (i.e., less rain and higher temperatures) in the Azores.

Eradication, though usually expensive and logistically complex, is often the preferred method to minimize the negative impact of predators on islands (Brooke *et al.* 2007, Capizzi *et al.* 2010, Bolton *et al.* 2014) and should be based on a cost/benefit balance supported by reliable data. In our study, the control actions were ineffective. The poison stations did not attract rats, probably due to the availability of alternative natural food resources. Live-box traps were effective for removing the feral cat threat at Ponta da Serreta but not at Quatro Ribeiras. Live-box traps were ineffective for capturing rats, mainly due to removal of the bait by gulls and the abundance of alternative food resources in the colonies. Rats also seemed to avoid the traps. In addition, Stokes (2013) stated that live-box traps are not appropriate for multiple species of various sizes (e.g., a rat can escape a cat trap, a cat cannot enter a rat trap); researchers may underestimate the abundance of some species when only one type of trap is used. For these reasons, the installation of different models of live-box traps could increase the number of rats captured in the colonies.

In the case of eradicating introduced species, it is also necessary to consider that population control could generate unpredictable chain effects on trophic structure of communities, affecting biodiversity and natural ecosystems (Courchamp *et al.* 1999, 2000, 2003; Hervías *et al.* 2013; Ringler *et al.* 2015). Additionally, when the predator species is a native and potentially endemic sub-species (as is the case for the Yellow-legged Gull in the Azores), the control actions can create an ethical conflict (Lamelas-López & Ferrante 2021), especially if it becomes necessary to conduct lethal control. Whenever possible, alternative options to lethal control should be attempted, including egg removal, restricting the access of people to tern colonies to reduce tern disturbance and sensitivity to predators, or limiting the availability of anthropogenic food for the native gulls. Nevertheless, until the population of Yellow-legged Gull returns to more natural levels in the Azores (i.e., pre-1984 populations, before human populations expanded and rubbish dumps became a food source), the lethal control of specific predatory individuals may be necessary for the conservation of Roseate Terns in the Azores, as has been shown in tern colonies in North America (Scopel & Diamond 2017).

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TABLE 3
Potential predators of Common *Sterna hirundo* and Roseate *S. dougallii* terns in the Azores[a]

			Island[b]										
Species	**Order**	**Status**	**COR**	**FLO**	**FAI**	**PIC**	**GRA**	**SJG**	**TER**	**SMG**	**SMR**	**Impact**	**Source**
Mammals													
Erinaceus europaeus	Erinaceomorpha	int			×				×	×	×	Egg depredation	Monteiro *et al.* 1996
Canis familiaris	Carnivora	int	×	×	×	×	×	×	×	×	×	Disturbance, nest abandonment	Camera-trapping
												Egg, chick and adult depredation	Monteiro *et al.* 1996
Felis catus	Carnivora	int	×	×	×	×	×	×	×	×	×	Egg, chick and adult depredation	Camera-trapping
													Monteiro *et al.* 1996; Neves *et al.* 2011
Mustela nivalis	Carnivora	int							×	×		Egg, chick and adult depredation	Monteiro *et al.* 1996; Neves *et al.* 2011
Mustela putorius furo	Carnivora	int		×	×	×		×	×	×	×	Egg, chick and adult depredation	Monteiro *et al.* 1996; Pitta Groz *et al.* 2002; Neves *et al.* 2011
Oryctolagus cuniculus	Lagomorpha	int		×	×	×	×	×	×	×	×	Habitat degradation	Monteiro *et al.* 1996; Bried *et al.* 2009
Mus musculus	Rodentia	int	×	×	×	×	×	×	×	×	×	Egg and chick depredation	Monteiro *et al.* 1996; Neves *et al.* 2011
Rattus spp.	Rodentia	int	×	×	×	×	×	×	×	×	×	Egg depredation	Camera-trapping
												Egg, chick and adult depredation	Monteiro *et al.* 1996; Amaral *et al.* 2010; Neves *et al.* 2011
Reptilia													
Teira dugesii	Squamata	int	×	×	×	×	×	×	×	×	×	Chick depredation	Neves *et al.* 2017
Aves													
Arenaria interpres	Charadriiformes	nat	×	×	×	×	×	×	×	×	×	Egg depredation	Bried & Neves 2015
Larus michahellis atlantis	Charadriiformes	nat	×	×	×	×	×	×	×	×	×	Egg depredation	Camera-trapping (artificial nests)
												Egg, chick and adult depredation	Monteiro *et al.* 1998; Neves *et al.* 2011
Buteo buteo	Accipitriformes	nat			×	×	×	×	×	×	×	Chick and adult depredation	Monteiro *et al.* 1998
Sturnus vulgaris	Passeriformes	nat	×	×	×	×	×	×	×	×	×	Egg depredation	Neves *et al.* 2006b; Neves *et al.* 2011; Neves *et al.* 2015; Bried & Neves 2015
Others													
Humans			×	×	×	×	×	×	×	×	×	Disturbance; nest abandonment; egg destruction	Camera-trapping
												Disturbance; decrease in nesting success; egg destruction	Monteiro *et al.* 1998

[a] The colonization status of potential predators is noted as introduced (int) or native (nat). Information sourced from "camera-trapping" refers to the present study.

[b] Islands where each species occurs: COR - Corvo, FLO - Flores, FAI - Faial, PIC - Pico, GRA - Graciosa, SJG - São Jorge, TER - Terceira, SMG - São Miguel, SMR - Santa Maria

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