

Birds of the Alcatrazes archipelago and surrounding waters, São Paulo, southeastern Brazil

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ABSTRACT: Alcatrazes island and surrounding islets, 35 km from the mainland in southeastern Brazil, are a young archipelago created by rising sea levels around 7,000 years BP. The main island covers 135 ha and is the only to harbour forest, the four islets showing exposed rock, grasses and sedges. A total of 82 species, of which six breeding seabirds, has been recorded in the archipelago. Another 11 seabirds were documented in the waters surrounding the islands. Alcatrazes holds the largest Magnificent Frigatebird, *Fregata magnificens*, colony in the southern Atlantic, as well as the threatened Brazilian population of Royal Terns, *Thalasseus maximus*. The landbird community is impoverished, with few resident species but a large number of seasonal visitors, including Atlantic forest species and intertropical and southern migrants.

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INTRODUCTION

The coast of the State of São Paulo, southeastern Brazil, includes 106 islands isolated from the mainland by distances from a few meters to 38 km (Ângelo 1989). These are scattered over a broad coastal shelf mostly 10–40 m deep that was dry land between 123,000 and 7,000 years BP; the sea level was as much as 110 m below the standard level at 17,000 years BP (Suguio *et al.* 1988).

The shelf started to be flooded by rising sea levels around 7,000 years BP, with several transgressions and regressions relative to the standard sea level in the past several thousand years not exceeding 3–5 meters (Suguio *et al.* 1985). By isolating and changing the exposed area of the islands and of the neighbouring coastal plain, these variations played an important role in shaping the regional fauna (Olmos 1996), including the evolution of insular endemics.

Alcatrazes is one of the most isolated coastal islands in southeastern Brazil. It was occupied by native people at least on a periodical basis before the arrival of European settlers with so far unknown impacts on the native fauna (Gibran *et al.* 2012) and was subject to commercial guano harvesting in the mid-20th century, but has never been occupied for extended periods since pre-colonial times despite attempts to set up a manned lighthouse (Gibran *et al.* 2012). Nevertheless, target practice by the Brazilian Navy, now moved to the neighbouring Sapata islet, has damaged the forest in part of the island (Mercadante 2005; Gibran *et al.* 2012).

Scientific expeditions have visited Alcatrazes starting in the 1910's; in October 1920 a collecting expedition from the now Museu de Zoologia da Universidade de São Paulo (MZUSP) produced a list of 39 species, of which 17 were deemed resident (Luederwaldt and Fonseca 1922). The island has been visited several times by ornithologists since then, but while its breeding seabirds are well-

known (Olmos *et al.* 1996, Campos *et al.* 2004), most of the information on land birds and pelagic visitors is available only in the grey literature.

Here we update and comment the list of bird species known from the Alcatrazes archipelago, some of the coastal islands of São Paulo located farther from the mainland and its surrounding waters.

MATERIALS AND METHODS

Study site

Alcatrazes and its satellite islets and stacks are 35 km from the coast of São Paulo around 24°06'03" S, 45°41'25" W (Figure 1). Besides the main island, covering 135 ha,

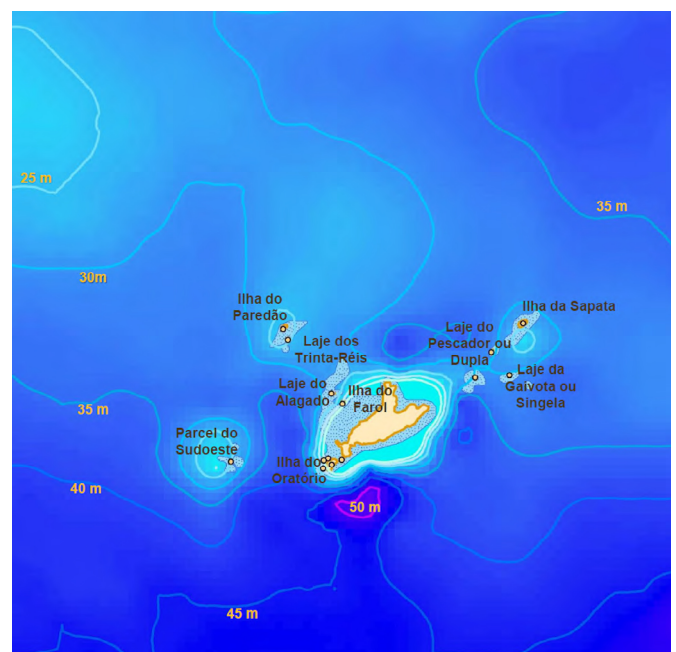


FIGURE 1. General map of Alcatrazes Archipelago. Credit: ICMBio / ESEC Tupinambás



FIGURE 2. View of the main island of the archipelago. Photo: Elsie Rotenberg

there are four islets (Sapata, Paredão, Porto and Oratório or Sul) and five stacks. Two shoals (Parcel de Nordeste and Parcel de Sudeste), with their tops only a few meters deep but plunging to *ca.* 40 m, complete the archipelago (Ângelo 1989). Part of these islets and the shoals are protected by the Tupinambás Ecological Station. Depths around the Alcatrazes archipelago range between the 20–40 m isobaths.

The main island (Figure 2) and adjacent waters are granted access by the Brazilian Navy only under special permit, which gives them a degree of protection despite the damage caused by fires associated with the target practice.

A detailed description of Alcatrazes island is available in Pompéia *et al.* (1993). The main island is roughly y-shaped, the mostly forested bay of Saco do Funil sitting at the fork. Elevations along the main ridges range from about 40 m around Saco do Funil to 266 m at Pico da Boa Vista. The island lacks beaches and the terrain is very steep, especially along the windward south-southeastern face, where towering rocky walls plunge into depths that quickly reach 40 m. Soils are shallow, formed over talus and at places composed mostly of humus and guano.

Most slopes on the higher areas of the island are 60–70 degrees and are made of exposed granitic rock where bromeliads (*Tillandsia* spp., *Vriesea* spp. and *Canistrum* cf. *lindenii*), cacti (*Cereus fernambucensis*, *Coleocephalocereus fluminensis*), orchids (*Oncidium fimbriatum*, *Cattleya tigrina*, *Epidendrum* spp., etc) and the endemic *Begonia venosa* and *B. larorum* (Begoniaceae), *Sinningia insularis* (Gesneriaceae) and *Anthurium alcatrazense* (Araceae) grow.

Alcatrazes island has some forest cover, the outer islets showing only grasses, sedges and herbs, or exposed rock. The dominant arboreal species is the palm *Syagrus romanzoffiana*, forming a “palm forest” with associated species such as *Guapira opposita* (Nyctaginaceae), several species of Myrtaceae (*Eugenia* spp., *Myrcia ovata*, *Psidium cattleyanum*), figs *Ficus* spp. and other less common trees. A dense understory is evident in many areas. Higher up the slopes, especially at Saco do Funil, palms may be less dominant and there are patches of forest similar to the one on slopes at the mainland with *Myrsine guianensis* (Myrsinaceae), *Ficus enormis* (Moraceae), *Trichilia* cf. *elegans* (Meliaceae) and several Myrtaceae.

In places, the forest understory is dominated by a

dense growth of the bamboo-like *Eremitis parviflora* (Poaceae), an uncommon species elsewhere. Bushes of *Schinus terebinthifolius* (Anacardiaceae) are recolonizing formerly burnt areas at Saco do Funil, but grassy patches, sometimes dominated by invasive species such as *Melinis minutiflora* and *Imperata brasiliensis*, remain both there and in areas of shallow soil. There is no permanent water course in the main island, only a few springs and damp seepage areas. When it rains some water may flow along drainage areas such as at Saco do Funil.

A colony of Magnificent Frigatebirds *Fregata magnificens* settled an area dominated by the low tree *Guapira opposita* (Nyctaginaceae) and the liana *Capparis declinata* (Capparaceae) on the northwest (mainland-facing) side of the island. The low, tangled vegetation seems to be the result of damage caused by the birds.

The waters around Alcatrazes are under the influence of the warm, high salinity but nutrient-poor Brazil Current, with the subsurface penetration of the cool, nutrient-rich Central Atlantic Water increasing productivity during the early summer, and occasional winter northward extensions of the Falklands Current over the shelf bringing both nutrient-rich waters and southern marine species (Rossi-Wongtschowski and Madureira. 2006; Pires-Vanin 2008).

Alcatrazes island has high biological interest, harbouring (so far) three endemic vertebrates, two frogs (*Scinax alcatraz* and *Cyclorhamphus faustoi*; Lutz 1973, Brasileiro *et al.* 2007) and one pit viper (*Bothrops alcatraz*, Marques *et al.* 2002). Local populations of the frog *Adenomera marmorata*, the amphisbaenian *Amphisbaena hoguei* and of the snakes *Micrurus corallinus* and *Siphlophis pulcher* require further study on their taxonomic and conservation status. The fact that the island became isolated only in the last 9,000–7,000 years makes it a natural experiment on evolutionary rates and speciation (Marques *et al.* 2002; Graziotin *et al.* 2006).

Data Collection

Bird surveys in Alcatrazes were carried out as part of biological inventories linked to a long-running campaign aiming to transform the islands and surrounding waters into a national park. These were executed with the permission of the Brazilian Navy and the Brazilian agency in charge of protected areas (ICMbio).

Here we include birds seen or otherwise recorded in

Alcatrazes island and neighbouring islets and stacks, and seabirds recorded in a rough 23 km radius around the islands. This radius was considered adequate to allow the inclusion of pelagic species using the area. Seabirds were recorded during several boating trips in the area between 2012 and 2013, some during the Expedições de Avistagem em Alcatrazes programme established by the yacht clubs of Ilhabela and Barra do Una together with ICMBio. This is a citizen-science programme aimed at getting a better understanding of local marine mammal populations.

We also include previously published information (Luederwaldt and Fonseca 1922; Campos *et al.* 2007) in order to collate a comprehensive list. Nomenclature and taxonomic sequence follow CBRO (2011).

Visits to survey land birds in Alcatrazes Island were made in 31 October–02 November 1992, 10–12 December 1992, 15–16 April 1993, 24 and 28 April 1993, 15–17 April 1994, 27–28 October 2011, 02 September 2012, 16 November 2012 and 05–06 September 2013. In every visit a campsite at Portinho, on the mainland-facing side of the island, was used as a base and trails running from there to other parts of the island, including the higher areas, were walked in search of birds. Records were made *ad libitum* in order to compile a species list, natural history notes being taken as seen fit.

Work on seabirds nesting on the main island and the islets was carried out by Juliana Yuri Saviolli over five years and nine expeditions: 05 and 06 December 2008, 07 April 2009, 21 December 2010, 05–06 October 2011, 25–26 October 2011 and 16 November 2012, and during surveys to gather data for ESEC Tupinambás' management plan, still in progress. Seabird numbers were assessed from direct counts at the colonies (Campos *et al.* 2004). Frigatebirds were captured for banding and collection of biological material during these trips. Also, censuses of seabirds of the islands, islets, slabs and other emerged parts of the Alcatrazes archipelago were made from boats.

Photographic records are available in Wikiaves (<http://www.wikiaves.com.br>) and indicated along the text with the initials WA followed by the access number in that database (for example, WA1075293). Using this record as an example for the others in this paper, it can be retrieved on-line by typing <http://www.wikiaves.com/1075293>.

RESULTS AND DISCUSSION

A total of 82 bird species, of which 64 landbirds and six breeding seabirds, has been recorded in Alcatrazes island and neighbouring islets and stacks. Another 11 marine species (penguins, albatrosses, petrels and skuas) were documented in the waters surrounding the islands (Table 1).

These numbers compare with 63 species, of which 51 are landbirds, reported from Queimada Grande, a 43 ha island some 34 km off the coast of southern São Paulo which was studied more systematically (Montanhini 2010; A. Macarrão in prep).

As expected, Alcatrazes has an impoverished community compared to the mainland, and a large proportion of the recorded species among the land birds seem to be visitors common in the mainland which failed to settle (*see below*), but these provide insights on the dispersal and colonising ability of different groups.

Alcatrazes lacks forest-dependent birds known to be sensitive to habitat fragmentation and isolation, such as *Thamnophilidae*, *Furnaridae*, *Dendrocolaptidae*, *Grallariidae*, *Rhinocryptidae*, *Formicariidae*, *Pipridae* and many tyrant flycatchers. The 135 ha island offers limited habitat to support viable populations of those species, while the 35 km of open water are a formidable barrier. Nevertheless, some forest species do cross to the island. Aside from strong-flying tanagers and thrushes, records of *Piaya cayana*, *Basileuterus culicivorus* and *Mionectes rufiventris* (and the open-habitat *Guira guira*) are surprising, suggesting an unsuspected ability to cross open water or, maybe, being ship assisted.

Resident and Migratory Species

A group of species seems to be largely resident in the island, including the abundant *Coereba flaveola* and *Troglodytes musculus*, by far the commonest land birds, and *Aramides cajanea*, *Leptotila rufaxilla*, *Coragyps atratus*, *Rupornis magnirostris*, *Milvago chimachima*, *Amazilia fimbriata*, *Thraupis sayaca*, etc. Montanhini (2010) and Macarrão (in prep) found *Guira guira*, *Leptotila rufaxilla*, *Coereba flaveola* and *Troglodytes musculus* to be resident at Queimada Grande, other land birds being regarded as visitors.

As is common in coastal islands, a large proportion of the Alcatrazes avifauna is made up of visitor and other species just passing through. Herons, cormorants, shorebirds and land birds such as swifts and most tyrant flycatchers have little trouble reaching the islands. Many seem transient, although it is possible that Oystercatchers *Haematopus palliatus*, a shore species, have bred on the main island.

Visitors from the mainland include some intratropical and altitudinal migrants such as tyrant flycatchers and thrushes (Alves 2007). Some, like *Sporophila caerulea* and *Volatinia jacarina*, may be attracted by the grass of the formerly burnt patches at Saco do Funil (now mostly overrun by bushes). Common fruiting trees such as *Myrsine guianensis* and *Schinus terebinthifolius* attract migrants like thrushes and flycatchers as well as resident tanagers and grosbeaks. Species seen feeding on the latter (all in April) include *Elaenia flavogaster*, *Turdus amaurochalinus*, *Thlypopsis sordida*, *Ramphocelus bresilius* and *Cyanoloxia brissonii*.

Thrushes, especially *T. flavipes* and *T. amaurochalinus*, are known to undertake long migrations in South America, with both altitudinal movements and southern populations moving to the Atlantic Forest during the winter (Aleixo and Galetti 1997; Sick 1997; Olmos and Silva e Silva 2001; Alves 2007; Capllonch *et al.* 2008). Four species (*T. flavipes*, *T. amaurochalinus*, *T. leucomelas* and *T. albicollis*) were recorded feeding on the fruits of *Alibertia* aff. *myrciifolia* K. Schum, Rubiaceae family, in September (when *T. rufiventris* was heard) together with *Procnias nudicollis*, *Elaenia flavogaster*, *Tangara preciosa*, *T. sayaca*, *Tachyphonus coronatus*, *Coereba flaveola* and *Saltator similis*. The seasonal abundance of fruit in a relatively predator-free environment may encourage the birds to cross to the island in multiple occasions once they have discovered the spot by accident or social learning, especially among migrants.

TABLE 1. Birds recorded in the Alcatrazes archipelago and surrounding waters. Nomenclature and taxonomic sequence follow CBRO (2014). Source: 1, Luederwaldt and Fonseca 1922; 2, Olmos *et al.* 1995; 3, Campos *et al.* 2007; 4, this paper. *Specimen housed in the Museu de Zoologia da Universidade de São Paulo — MZUSP, numbers indicate photographic vouchers in Wikiaves.

Status:		
RB Resident breeders		PM Passage migrants; trans-equatorial migrant seabirds recorded in the area mostly while on migration; some may forage in waters around the islands.
WB Winter-spring breeders		
R Apparent residents, breeding not confirmed		
B Breeding recorded, ? indicates resident status uncertain		IM Intratropical and altitudinal migrants; includes landbirds with southern populations moving north to coastal São Paulo during the winter and those moving between the coastal plain and the hinterland on a seasonal basis.
Ac Accidental species not regular in coastal São Paulo state.		
V Visitors, most are common in the nearby mainland.		
SM Southern migrants; seabirds breeding in Patagonia and south Atlantic islands present in the region mostly during the winter.		? Status uncertain
NM Nearctic migrants; migratory landbirds from North America.		

FAMILY/Common Name	SCIENTIFIC NAME	SOURCE	MONTH	STATUS
Spheniscidae				
Magellanic Penguin	<i>Spheniscus magellanicus</i> (Forster, 1781)	4 WA1077502	06,09,10	SM
Diomedidae				
Royal Albatross	<i>Diomedea epomophora</i> (Lesson, 1825)	2*	?	Ac
Atlantic Yellow-nosed Albatross	<i>Thalassarche chlororhynchos</i> (Gmelin, 1789)	4 WA1077501	04,06,10	SM
Black-browed Albatross	<i>Thalassarche melanophris</i> (Temminck, 1828)	4 WA1077500	06	SM
Procellariidae				
Southern Giant-Petrel	<i>Macronectes giganteus</i> (Gmelin, 1789)	4 WA1079106	07	SM
Sooty Shearwater	<i>Puffinus griseus</i> (Gmelin, 1789)	4	04	PM
Greater Shearwater	<i>Puffinus gravis</i> (O'Reilly, 1818)	4 WA1077498	04,06,10	PM
Manx Shearwater	<i>Puffinus puffinus</i> (Brünnich, 1764)	4 WA1079147	04,11	PM
Cory's Shearwater	<i>Calonectris borealis</i> (Cory, 1881)	2*	04	PM
Hydrobatidae				
Wilson's Storm-Petrel	<i>Oceanites oceanicus</i> (Kuhl, 1820)	1,4 WA768969	04,10	PM
Fregatidae				
Magnificent Frigatebird	<i>Fregata magnificens</i> Mathews, 1914	1*,2,3,4 WA1077499	04,09,10,11,12	RB
Sulidae				
Brown Booby	<i>Sula leucogaster</i> (Boddaert, 1783)	1*,2,3,4 WA1077528	04,09,10,11,12	RB
Phalacrocoracidae				
Neotropic Cormorant	<i>Phalacrocorax brasilianus</i> (Gmelin, 1789)	4	12	V
Ardeidae				
Cattle Egret	<i>Bubulcus ibis</i> (Linnaeus, 1758)	4	04,10	V
Cocoi Heron	<i>Ardea cocoi</i> Linnaeus, 1766	4 WA1079102	09,11	V
Snowy Egret	<i>Egretta thula</i> (Molina, 1782)	4	01,04	V
Cathartidae				
Turkey Vulture	<i>Cathartes aura</i> (Linnaeus, 1758)	4	12	B
Black Vulture	<i>Coragyps atratus</i> (Bechstein, 1793)	1,4	04,09,10,11,12	RB
Accipitridae				
Roadside Hawk	<i>Rupornis magnirostris</i> (Gmelin, 1788)	1*,4 WA1081404	04,09,10,11	R
Falconidae				
Southern Caracara	<i>Caracara plancus</i> (Miller, 1777)	4	09,10	V
Yellow-headed Caracara	<i>Milvago chimachima</i> (Vieillot, 1816)	1*,4	04,09,10,11	R
Orange-breasted Falcon	<i>Falco deiroleucus</i> Temminck, 1825	4	04,12	Ac
Aplomado Falcon	<i>Falco femoralis</i> Temminck, 1822	4	03	V
Peregrine Falcon	<i>Falco peregrinus</i> Tunstall, 1771	4	01,11	NM
Rallidae				
Gray-necked Wood-Rail	<i>Aramides cajanea</i> (Statius Muller, 1776)	1*,4	04,09,10,11,12	RB
Russet-crowned Crake	<i>Laterallus viridis</i> (Statius Muller, 1776)	4	11,12	V?

TABLE 1. Continued.

FAMILY/COMMON NAME	SCIENTIFIC NAME	SOURCE	MONTH	STATUS
Haematopodidae				
American Oystercatcher	<i>Haematopus palliatus</i> Temminck, 1820	4	12	V
Scolopacidae				
Spotted Sandpiper	<i>Actitis macularius</i> (Linnaeus, 1766)	1*	10	PM
Ruddy Turnstone	<i>Arenaria interpres</i> (Linnaeus, 1758)	4	10	PM
Sanderling	<i>Calidris alba</i> (Pallas, 1764)	4	10	PM
White-rumped Sandpiper	<i>Calidris fuscicollis</i> (Vieillot, 1819)	1*	10	PM
Stercoraridae				
Parasitic Jaeger	<i>Stercorarius parasiticus</i> (Linnaeus, 1758)	4 WA928741	04	PM
Laridae				
Kelp Gull	<i>Larus dominicanus</i> Lichtenstein, 1823	1,2,3,4 WA1077542	04,09,10,11,12	R
Sternidae				
Yellow-billed Tern	<i>Sternula superciliaris</i> (Vieillot, 1819)	1	10	?
South American Tern	<i>Sterna hirundinacea</i> Lesson, 1831	2,3,4	04 to 10	WB
Cabot's Tern	<i>Thalasseus acuflavidus</i> (Cabot, 1847)	2,3,4	04 to 10	WB
Royal Tern	<i>Thalasseus maximus</i> (Boddaert, 1783)	2,3,4	06 to 12	WB
Columbidae				
Ruddy Ground-Dove	<i>Columbina talpacoti</i> (Temminck, 1811)	1,4	04,10	V
White-tipped Dove	<i>Leptotila verreauxi</i> (Bonaparte, 1855)	4	04,09,10	R
Gray-fronted Dove	<i>Leptotila rufaxilla</i> (Richard & Bernard, 1792)	1*,4 WA1075312	04, 10	V?
Cuculidae				
Squirrel Cuckoo	<i>Piaya cayana</i> (Linnaeus, 1766)	4	04,09,10	R
Smooth-billed Ani	<i>Crotophaga ani</i> (Linnaeus, 1758)	1,4	04,11,12	R
Guira Cuckoo	<i>Guira guira</i> (Gmelin, 1788)	1*,4	04,09,10,11	R
Caprimulgidae				
Little Nightjar	<i>Hydropsalis parvula</i> (Gould, 1837)	1*	10	V
Apodidae				
Gray-rumped Swift	<i>Chaetura cinereiventris</i> (Sclater, 1862)	4	11	V
Trochilidae				
White-tailed Goldenthrout	<i>Polytmus guainumbi</i> (Pallas, 1764)	4	04, 11	Ac
Glittering-throated Emerald	<i>Amazilia fimbriata</i> (Gmelin, 1788)	1*,4	04,10,11,12	R
Alcedinidae				
Ringed Kingfisher	<i>Megaceryle torquata</i> (Linnaeus, 1766)	4	04	V
Amazon Kingfisher	<i>Chloroceryle amazona</i> (Latham, 1790)	4	04,10	R?
Cotingidae				
Bare-throated Bellbird	<i>Procnias nudicollis</i> (Vieillot, 1817)	4 WA1075268	09	IM
Rhynchocyclidae				
Gray-hooded Flycatcher	<i>Mionectes rufiventris</i> (Cabanis, 1846)	4 WA1081408	09	?
Tyrannidae				
Cliff Flycatcher	<i>Hirundinea ferruginea</i> (Gmelin, 1788)	4	04,11	R
Southern Beardless-Tyrannulet	<i>Camptostoma obsoletum</i> (Temminck, 1824)	4	09,10	V
Yellow-bellied Elaenia	<i>Elaenia flavogaster</i> (Thunberg, 1822)	1*,4	04,09,10,11	IM
Olivaceous Elaenia	<i>Elaenia mesoleuca</i> (Deppe, 1830)	1*,4	10	IM
Short-crested Flycatcher	<i>Myiarchus ferox</i> (Gmelin, 1789)	1*,4 WA1080527	04,09,10,11	R
Sirystes	<i>Sirystes sibilator</i> (Vieillot, 1818)	4	11	IM
Great Kiskadee	<i>Pitangus sulphuratus</i> (Linnaeus, 1766)	1*,4	04,09,10,11	R
Streaked Flycatcher	<i>Myiodynastes maculatus</i> (Statius Muller, 1776)	4	11	IM
Boat-billed Flycatcher	<i>Megarynchus pitangua</i> (Linnaeus, 1766)	1*,4	10	V
Social Flycatcher	<i>Myiozetetes similis</i> (Spix, 1825)	4	04,11	V
Tropical Kingbird	<i>Tyrannus melancholicus</i> (Vieillot, 1819)	1,4	04,11	IM
Fork-tailed Flycatcher	<i>Tyrannus savana</i> (Vieillot, 1808)	4	04	IM
Vermilion Flycatcher	<i>Pyrocephalus rubinus</i> (Boddaert, 1783)	1*	10	IM
Euler's Flycatcher	<i>Lathrotriccus euleri</i> (Cabanis, 1868)	4	10,11,11	IM

TABLE 1. Continued.

FAMILY/COMMON NAME	SCIENTIFIC NAME	SOURCE	MONTH	STATUS
Olive-sided Flycatcher	<i>Contopus cooperi</i> (Nuttall, 1831)	4	11	NM
Velvety Black-Tyrant	<i>Knipolegus nigerrimus</i> (Vieillot, 1818)	1*,4	04,10	IM
Vireonidae				
Rufous-browed Peppershrike	<i>Cyclarhis gujanensis</i> (Gmelin, 1789)	1*,4	04,09,10	IM
Hirundinidae				
Blue-and-white Swallow	<i>Pygochelidon cyanoleuca</i> (Vieillot, 1817)	4	04,11	IM
Grey-breasted Martin	<i>Progne chalybea</i> (Gmelin, 1789)	4	04	IM
Troglodytidae				
Southern House-Wren	<i>Troglodytes musculus</i> (Naumann, 1823)	1*,4 WA1080532	04,09,10,11,12	R
Turdidae				
Yellow-legged Thrush	<i>Turdus flavipes</i> (Vieillot, 1818)	4 WA1081409	09	IM
Pale-breasted Thrush	<i>Turdus leucomelas</i> (Vieillot, 1818)	4	09	IM
Rufous-bellied Thrush	<i>Turdus rufiventris</i> (Vieillot, 1818)	4	04,09	IM
Creamy-bellied Thrush	<i>Turdus amaurochalinus</i> (Cabanis, 1850)	1*,4	04,09,10	IM
White-necked Thrush	<i>Turdus albicollis</i> (Vieillot, 1818)	4 WA1075295	04,09	IM
Passerellidae				
Rufous-collared Sparrow	<i>Zonotrichia capensis</i> (Statius Muller, 1776)	1*,4 WA1077562	04,09,10,11	R
Parulidae				
Golden-crowned Warbler	<i>Basileuterus culicivorus</i> (Deppe, 1830)	4	10	?
Masked Yellowthroat	<i>Geothlypis aequinoctialis</i> (Gmelin, 1789)	1*,4	10,11	?
Thraupidae				
Bananaquit	<i>Coereba flaveola</i> (Linnaeus, 1758)	1*,4	04,09,10,11,12	R
Green-winged Saltator	<i>Saltator similis</i> (d'Orbigny & Lafresnaye, 1837)	1*,4 WA1075294	04,09,10,11,12	R
Orange-headed Tanager	<i>Thlypopsis sordida</i> (d'Orbigny & Lafresnaye, 1837)	1*,4 WA1080530	04,09,10	R
Ruby-crowned Tanager	<i>Tachyphonus coronatus</i> (Vieillot, 1822)	1*,4 WA1077563	04,09,10,11	R
Brazilian Tanager	<i>Ramphocelus bresilius</i> (Linnaeus, 1766)	4	04,09,10	R
Sayaca Tanager	<i>Tangara sayaca</i> (Linnaeus, 1766)	1*,4 WA1075296	04,09,10,11	R
Palm Tanager	<i>Tangara palmarum</i> (Wied, 1823)	4	04,10	R
Chestnut-backed Tanager	<i>Tangara preciosa</i> (Cabanis, 1850)	4 WA1075293	09	IM
Guira Tanager	<i>Hemithraupis guira</i> (Linnaeus, 1766)	4 WA1075292	09	V
Saffron Finch	<i>Sicalis flaveola</i> (Linnaeus, 1766)	1*,4	10,11,12	?
Blue-black Grassquit	<i>Volatinia jacarina</i> (Linnaeus, 1766)	4	11	IM
Double-collared Seedeater	<i>Sporophila caeruleascens</i> (Vieillot, 1823)	1*,4	10,11	IM
Cardinalidae				
Ultramarine Grosbeak	<i>Cyanoloxia brissonii</i> (Lichtenstein, 1823)	1*,4	04,09,10,11	R
Passeridae				
House Sparrow	<i>Passer domesticus</i> (Linnaeus, 1758)	4	10	?

Breeding Seabirds

Breeding seabirds found year-round include Brown Boobies, *Sula leucogaster*, with an estimated 3,000 birds (Campos et al. 2004), and Magnificent Frigatebirds, *Fregata magnificens* (Figure 3). At ca. 6,000 birds, the frigatebird population at Alcatrazes is the largest breeding concentration in the southern Atlantic, with a remarkable increase since the 1920's associated with better protection from disturbance since the Navy closed access to the island and more food became available from trawlers operating in the region (Olmos et al. 1995; Campos et al. 2004).

In October 2011 about 7,000 individuals and 2,500 nests of *Fregata magnificens* were estimated to be on the main island of Alcatrazes (Figure 4). The field trip censuses revealed about 3,000 individuals of *Sula leucogaster* (Figure 5) and 1,000 individuals of *Larus dominicanus*, distributed and nesting on the islets and the main island.

Three species of terns occur in the archipelago. *Sterna hirundinacea* has nested on the main island and also on nearby Sapata (or Amigos) and Tartaruga islets, while *Thalasseus maximus* has nested at Sapata and Paredão (or Trinta Réis) islets (Campos et al. 2004). While frigatebirds and boobies have active nests throughout the year (with a peak between May and October, when trawlers are active in the area), terns are autumn to spring breeders. *Sterna hirundinacea* and *T. acufavidus* start breeding in April, the breeding season lasting to late August-early September, while *T. maximus* starts breeding in June, the last birds leaving the colonies in early December and the peak being

August–October (Campos et al. 2004).

On October 2011, only five specimens of *Sterna hirundinacea* were resting on the Brazilian Navy poles in front of Saco do Funil. As expected for winter nesting species, no nesting records were made for *Sterna hirundinacea* and *Thalasseus maximus* in the archipelago at this time, and only some remains of abandoned nests and eggs of *Thalasseus acufavidus* were found on top of Oratório islet.

Terns can move breeding sites from one year to another, an adaptation to available food supplies and predator and parasite pressure (Efe et al. 2000). Mass abandonment of breeding areas can happen very often for no apparent reason, but is usually related to strong pressure from natural predators, human interference and alteration or loss of habitat (for example Erwin et al. 1981). In this study, the main factor for the mass abandonment of *Thalasseus acufavidus* nests on Oratório islet was the competition and predatory pressure of *Larus dominicanus*, since about 100 adults and 50 nests of this species were recorded on the same island. In the same year there were records of breeding terns at Itaçucé island and at the waterway terminal of Petrobras TASS, in São Sebastião, about 40 km away from Alcatrazes (Juliana Saviolli, personal observation).

Of the five species nesting in Alcatrazes, only *Thalasseus maximus* has a “Vulnerable” status on the Brazilian list of threatened species. *Thalasseus acufavidus*, *Sterna hirundinacea*, *Larus dominicanus*, *Sula leucogaster* and *Fregata magnificens* are non-threatened species according to the national list and the international red list of threatened species (IUCN—Redlist). Nevertheless, Efe et al. (2011) propose the actual status of *Thalasseus acufavidus* nationally be modified to “Vulnerable” or “Endangered”, since most of its breeding population is confined to a few islets off the coast of Espírito Santo, where it nests on a few small islands. Shorelines are susceptible to human disturbance and historically its colonies have suffered intense egg collection; the species is losing breeding areas in different parts of the Brazilian coast. Like *Thalasseus acufavidus*, the other species and colonies of terns are also historically subject to severe human impacts, so detailed studies evaluating the actual status of *Sterna hirundinacea* can provide important data for the species' conservation.

Although *Larus dominicanus*, *Sula leucogaster* and *Fregata magnificens* enjoy a better conservation status,



FIGURES 3–4: Magnificent Frigatebird, *Fregata magnificens*. 3, Magnificent Frigatebird, *Fregata magnificens*, with nestling. Photo: Edélcio Muscat. 4, Countless *F. magnificens* flying over the island on a foggy morning. Photo: Fabio Olmos.



FIGURE 5: Young Brown Booby, *Sula leucogaster*. Photo: Edélcio Muscat.

their colonies also suffer from severe weather, interaction with fisheries, direct human interference and marine pollution, among other factors which can cause severe fluctuations in populations.

Alcatrazes is the largest seabird breeding site in southeastern Brazil and the second largest in the country. Conserving the islands is vital for those species' survival. Rigorous and effective protection of these nesting areas and expansion of periodic detailed studies of the reproductive species are necessary for the understanding of biological and ecological aspects and to guide actions for the conservation of species and island environments.

Notes on selected species

Magellanic Penguin *Spheniscus magellanicus*—On 30 June 2012 at least 15 penguins were seen foraging over the Parcel de Sudeste together with several dozen Brown Boobies *Sula leucogaster*. The penguins apparently pushed small fish to the surface, making them accessible to the boobies. Two Great Shearwaters *Puffinus gravis* (Figure 6) were seen in the same spot after the boobies departed leaving the penguins on their own. Four live penguins, and a few dead ones, were seen on the way to and back from the islands on 5 and 6 September 2013. Magellanic Penguins are common winter visitors to the coast of São Paulo, sometimes with hundreds of individuals recorded (Olmos et al. 1995).

Royal Albatross *Diomedea epomophora*—One adult collected in 1933 “off Alcatrazes island” is the single report of this species for northern São Paulo (Dénes et al. 2007).

Atlantic Yellow-nosed Albatross *Thalassarche chlororhynchus* and Black-browed Albatross *T. melanophris*—On 30 June 2012 five *T. chlororhynchus* (including one juvenile) and two *T. melanophris* were resting on the water around 23°57'46" S, 45°39'04" W, close to an anchored trawler (Figures 7 and 8). At least four *T. chlororhynchus*

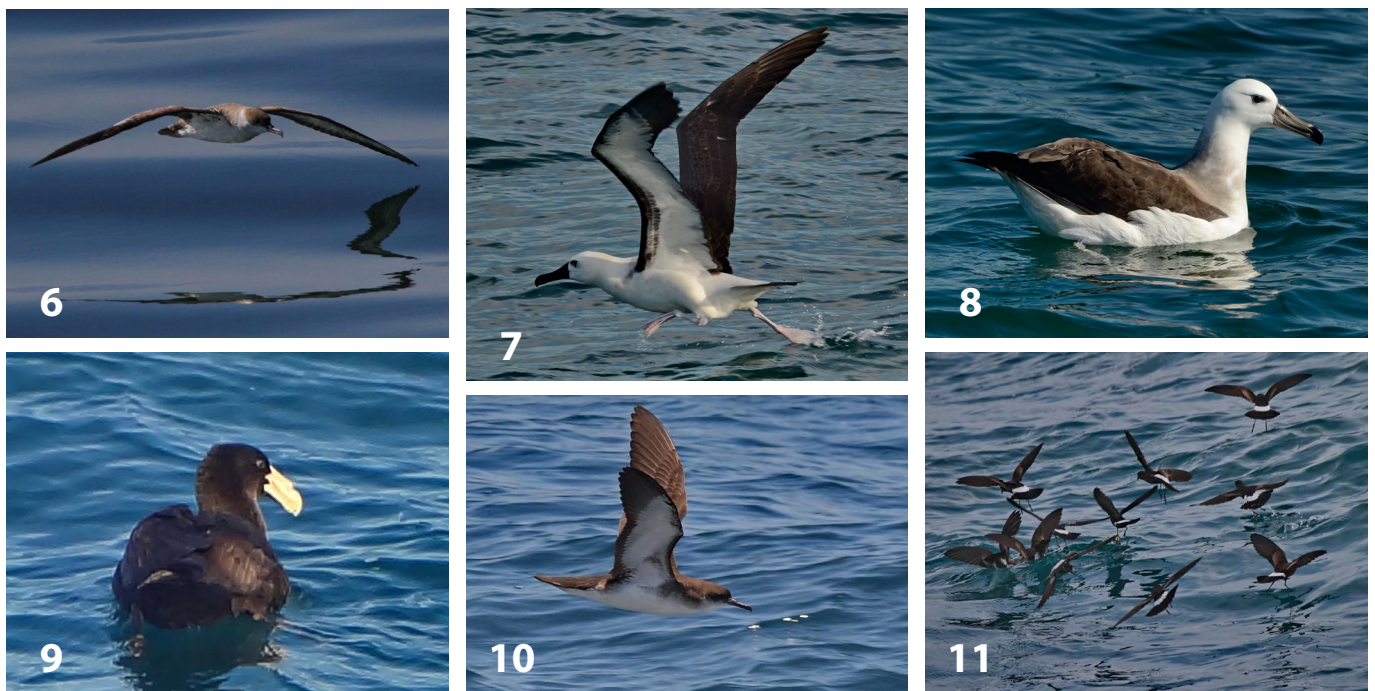
were also noted while navigating between Alcatrazes and the south coast of São Sebastião (Ilhabela island) on 06 October 2012; a lone adult at 24°17'10" S, 45°37'52" W, or 23 km southeast off Alcatrazes, on 06 April 2013; and another lone adult at 23°56' S, 45°31' W on 05 September 2013.

Both species are mostly winter visitors to the coast of São Paulo, *T. chlororhynchus* being the commonest albatross in this region (Olmos et al. 1995; Olmos 1997). The presence of *T. melanophris* is associated with winter cold fronts (Olmos 1997; Olmos and Bugoni 2006).

Southern Giant Petrel *Macronectes giganteus*—An all blackish juvenile was photographed on 29 July 2013 between the southern tip of São Sebastião island (Ilhabela) and Alcatrazes (Figure 9). Giant Petrels are uncommon winter visitors to São Paulo (Olmos et al. 1995) and most records refer to juveniles.

Manx Shearwater *Puffinus puffinus*—A migrant from the northern hemisphere passing along the coast of São Paulo to and from its wintering grounds off Uruguay and Argentina (Olmos 2002). On 01 November 2012 at least 20 were seen flying south-southwest between Alcatrazes and Ilhabela. The birds were alone, never gathering in flocks, and ignored attempts to attract them with dead fish (Figure 10). On 06 April 2013, 13 *P. puffinus* passed by our boat anchored at 24°17'10" S, 45°37'52" W. The birds flew by alone (once), in pairs (twice), and quartets (twice), one quartet together with three *Calonectris borealis*. A loner of the latter species was also seen.

Greater Shearwater *Puffinus gravis*—On 30 June 2012 one was seen at 23°06'07" S, 45°39'48" W, between Alcatrazes and Montão de Trigo island. Another two birds approached our boat at Parcel do Sudeste on the same day. A lone bird with very worn plumage also landed close to our boat at 24°17'10" S, 45°37'52" W on 06 April 2013. A common species off southeastern and south Brazil



FIGURES 6–11: 6, Greater Shearwater, *Puffinus gravis*, flying low over the water off Alcatrazes. Photo: Fabio Olmos. 7, Yellow-nosed Albatross, *Thalassarche chlororhynchus*, very close to the boat. Photo: Elsie Rotenberg. 8, immature Black-browed Albatross, *Thalassarche melanophris*. Photo: Elsie Rotenberg. 9, Southern Giant Petrel, *Macronectes giganteus*. Photo: Alexandre Costa. 10, Manx Shearwater, *Puffinus puffinus*, lifting off. Photo: Fabio Olmos. 11, Wilson's Storm Petrels, *Oceanites oceanicus*, feeding on scraps left by dolphins. Photo: Fabio Olmos.



FIGURES 12–17. 12, female Peregrine Falcon, *Falco peregrinus*, with a recently killed Snowy Egret, *Egretta thula*, on Alcatrazes Island. Photo: Leandro Saadi. 13, immature male Bare-throated Bellbird, *Procnias nudicollis*. Photo: Edélcio Muscat. 14, Southern House Wren, *Troglodytes musculus*, a common land bird in Alcatrazes. Photo: Edélcio Muscat. 15, White-necked Thrush, *Turdus albicollis*, feeding on *Alibertia* fruit. Photo: Fabio Olmos. 16, Male Chestnut-backed Tanager, *Tangara preciosa*, an unexpected presence in Alcatrazes. Photo: Edélcio Muscat. 17, Guira Tanager, *Hemithraupis guira*. Photo: Fabio Olmos.

(Olmos and Bugoni 2006), where wrecks involving both this species and *Calonectris borealis* are known to occur (Olmos et al. 1995).

Sooty Shearwater *Puffinus griseus* — On 06 April 2013 a lone bird flew by our boat at 24°17'10" S, 45°37'52" W. Together with *P. puffinus*, *P. gravis*, *Oceanites oceanicus* and *Stercorarius* spp., this is a trans-equatorial migrant recorded off São Paulo on passage to and from its wintering grounds.

Wilson's Storm Petrel *Oceanites oceanicus* — A seasonally common species off São Paulo, where it is mostly a passage migrant. Nine seen while sailing between Santos and Alcatrazes on 27 April 1993. On 06 October 2012 about 150 were feeding on fish scraps left by a foraging pod of Rough-toothed Dolphins around 23°52'S, 45°44'W (Olmos et al. 2013) (Figure 11). A lone bird was also seen close to our boat at 24°17'10" S, 45°37'52" W, or 23 km southeast off Alcatrazes, on 06 April 2013.

Parasitic Jaeger *Stercorarius parasiticus* — On 06 April 2013 a total of three small skuas, one identified as a dark-morph *S. parasiticus*, were seen at 24°17'10" S, 45°37'52" W. Another dark-morph in breeding plumage flew low in front of our boat at 24°17'12" S, 45°34'10" W.

Orange-breasted Falcon *Falco deiroleucus* — On 11 December 1993 one Peregrine-type falcon was observed perched at the frigatebird nesting colony at Portinho with its back to the observer. It was less robust compared to a Peregrine Falcon female and had dark blackish-grey upper parts. The backlight made observations of details difficult but the edges of the secondaries looked pale and some rufous was perceived on the sides of the neck. Together with the colour of the back these field marks suggest the bird was an Orange-breasted Falcon. What probably was the same bird was briefly seen flying over the frigatebird colony the following day and again on 16 April 1994. Near

Alcatrazes it has been recorded from the south coast of Ilhabela (Olmos 1996). This is an extremely rare species in southeastern Brazil, with, so far, no documented records from São Paulo.

Peregrine Falcon *Falco peregrinus* — On 01 November 1992 one female was seen flying at Alto da Boa Vista, later landing on a palm. On 19 January 2013 another female was recorded while it swooped at and killed a Snowy Egret *Egretta thula* at Saco do Funil (Figure 12).

Peregrines from Greenland are regular summer visitors to coastal São Paulo (and probably Alcatrazes), where they feed on pigeons, smaller birds and fruit bats (Silva e Silva 1997). The observation of one taking such a large prey in Alcatrazes was an unusual event in the wintering grounds of south-east Brazil.

White-tailed Goldthroat *Polytmus guainumbi* — A hummingbird more typical of the savannas and semi-deciduous forests of the hinterland, visiting the coast during summer-spring. *Polytmus guainumbi* has been documented in Ubatuba in late November (Rotenberg 2008).

One *P. guainumbi* was observed visiting the flowers of several bromeliads on the rocky areas at Alto da Boa Vista on 02 November 1992 and again in the same area on 28 April 1993. The abundance of ornithophilic flowers in this habitat (*Vriesea* spp., *Sinningia insularis*) make it attractive to hummingbirds.

Bare-throated Bellbird *Procnias nudicollis* — An immature male (WA1075268) was recorded attending a fruiting *Alibertia* aff. *myrciifolia* K. Schum, Rubiaceae family, on 05 September 2013 (Figure 13). This species is known to disperse widely away from the coastal forests that are its current stronghold during the winter and has been recorded in Queimada Grande in June–July (Montanhini 2010, Macarrão in prep).

Olive-sided Flycatcher *Contopus cooperi* — One seen atop a tree near the campsite from a vantage point on 01 November 1992. Recognised by the robust size, dark olive-brown overall colour and flanks and whitish throat and mid-belly. This long-distance North American migrant has been recorded in the Atlantic Forest of São Paulo and Rio de Janeiro, including areas close to Alcatrazes like Ubatuba, where it may be regular (Willis *et al.* 1993; Sick 1997).

Southern House Wren *Troglodytes musculus* — One of the commonest land birds in Alcatrazes (Figure 14). On 12 December 1992 a nest was found in a hollow about 1 m high in a tree trunk. Upon examination it was found that the two nestlings were being eaten by a large tarantula *Vitalius wacketi*. This is a common to abundant species in the island (although numbers seem to vary considerably along the year) and may be a significant predator of small birds nesting in holes and crevices.

It is worth mentioning that the Alcatrazes wren population has noticeable differences in its song structure compared to birds from the neighbouring mainland, suggesting considerable isolation.

Chestnut-backed Tanager *Tangara preciosa* — One male was observed feeding on the fruit of *Alibertia* aff. *myrciifolia* K. Schum, Rubiaceae family, together with several *Turdus* spp. (Figure 15) on the afternoon of 5 September 2013. A pair was present on the same tree the following morning, the male being photographed (Figure 16).

This species is usually found in the hinterland of southern Brazil from Rio Grande do Sul to southern São Paulo, being replaced along the coast by *T. peruviana* (Sick 1997). The latter is known to migrate north from its breeding areas along the coast from Santa Catarina to southern São Paulo during the austral winter, when it can range widely (Sick 1997; Birdlife International 2012), but the movements of *T. preciosa* are poorly known. Outside the usual range in southern São Paulo, the Wikiaves website has winter (June–August) records from Atibaia (WA183142), Piracaia (WA600904), Piracicaba (WA1004286) and Teodoro Sampaio (WA985375), in the interior of São Paulo state, suggesting a northward winter displacement. Records on the coast seem all to belong to *T. peruviana*.

Guira Tanager *Hemithraupis guira* — *Hemithraupis guira* is an uncommon species in the northern coast of São Paulo, where it is mostly found during the winter (Figure 17).

Conservation

Alcatrazes is a valuable natural experiment on habitat isolation and the ability of land bird species to colonize isolated patches of habitat and establish viable populations. Also, the island offers unique opportunities for evolutionary studies and resident populations of species such as *Aramides cajanea* and *Troglodytes musculus* show morphological (the first; Stotz 1992) and vocal (the latter) differences compared to the mainland.

It is interesting that, despite many opportunities for colonisation, the islands failed to support populations of introduced mammals, especially rats and mice, probably because of a combination of stochastic factors with an abundance of tegu lizards *Salvator merianae* eager to consume the newcomers, so those invasive species are not

a problem so far.

Starting in 1982, the main island was used by the Brazilian Navy for target practice, which caused a significant palm-dominated forest area at Saco do Funil to be replaced by invasive grasses (Gibran *et al.* 2012). Live ordnance was replaced by sand-filled ones in the 1990's after fires in 2004 and the practice has now (2013) been stopped. Areas found covered by grasses in 1993 are now dominated by bird-dispersed bushes and regeneration is progressing.

Alcatrazes holds significant seabird nesting colonies, including the biggest colony of Magnificent Frigatebirds *Fregata magnificens* in the southern Atlantic. Seabird numbers were reported to be much smaller in the early 20th century (Luederwaldt and Fonseca 1922), suggesting that the exclusion of people from the island by the Brazilian Navy and discards available from shrimp trawlers (an industry that began after the Second World War) have favoured those species (Olmos *et al.* 1996). The ban on fishing around the island by the military has also created an “involuntary park” (Olmos 2010) that allowed reef and rock-dwelling fish populations to recover, the present biomass and diversity being the greatest in southeastern Brazil and comparable to long-established protected areas elsewhere in the country (K. Leite pers. com.).

A proposal to transform the islands and adjacent waters into a national park has been lingering in the Brazilian environment ministry since the early 1990's. After a long struggle by environmentalists, the decision made in mid-2013 by the Brazilian Navy to support the creation of the park and its protection may, at last, allow the area to be properly managed.

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