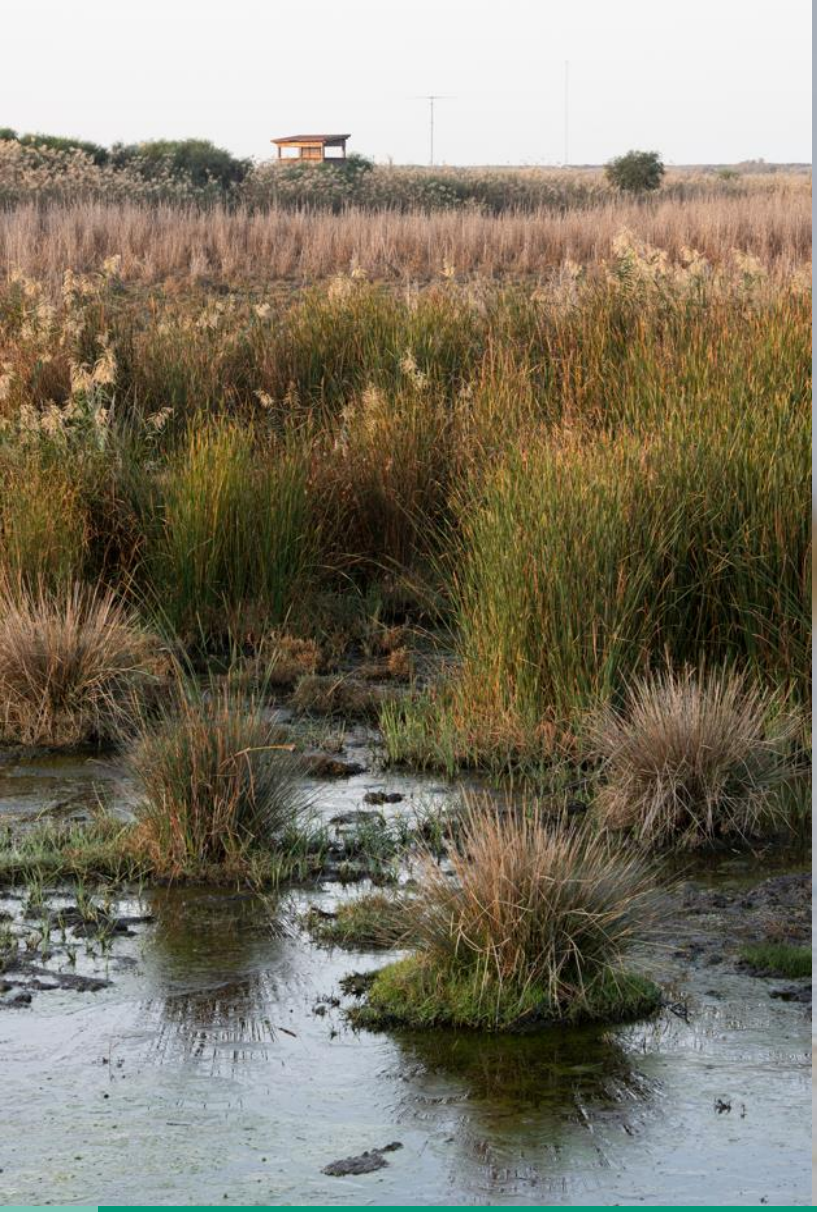

A Review of the **Hydrology** & **Ecology** of the **Akrotiri Peninsula** wetlands **Planning for the future**

December 2024

BirdLife Cyprus

Preface

Akrotiri Peninsula is one of the most important marine and terrestrial biodiversity hotspots in Cyprus, due to a unique combination of factors, including its location, geomorphology and diverse hydrological conditions. It is the largest natural aquatic system in Cyprus, centered around a seasonal Salt Lake, which is one of the few major salt lakes within the eastern Mediterranean in semi-natural condition, that includes a wide range of saline and freshwater influences. It hosts a mosaic of different habitats, from coastal sand dunes to Mediterranean forests of junipers and from saltmarshes to grazing marshes and reedbeds, supporting a significant number of rare, vulnerable or endangered species of plants and animals. It also supports a high number of internationally important migratory birds, providing them with a significant resting, breeding and feeding habitat.

Though most of the Peninsula has protected site status through Sovereign Base Area (SBA) Orders (making it the equivalent of an EU Natura 2000 site), Akrotiri is an area that includes military installations, local villages and at the same time there is intense recreational use of the area and high touristic and residential development. Balancing all these with the need for protection of the important habitats and associated species, is a key challenge.

The aim of this report is to present a review of the current knowledge on the hydrology and ecology of the Akrotiri Peninsula wetlands, including pressures and threats, as well as key trends and based on that, to provide clear recommendations for future management of this high ecological value wetland system.

The need for this review and management recommendations becomes even more crucial, given the recent changes in the area that seem to be affecting the hydrological balance and the overall ecosystem functioning.

This report is part of a two-year project (2023 – 2024) by BirdLife Cyprus, funded by John Ellerman Foundation (UK).

Graham White, previously Head of Ecology at RSPB, served as the scientific coordinator and editor of this report. Marc Illa, Ornithologist and Wetland Ecologist, with expertise in Mediterranean wetlands, contributed on the ecological requirements of key bird species and species-oriented management measures. For the hydrological aspects of this report, valuable input and expertise were provided by I.A.CO Environmental and Water Consultants Ltd team, notably Marios Mouskoundis, Elena Nicolaou and Ayis Iacovides, who have worked extensively in various aspects of the Akrotiri Peninsula hydrology. Finally, BirdLife Cyprus team, Phoebe Vayanou, Christina Ieronymidou and Melpo Apostolidou coordinated the project and edited the final report, drawing on their extensive knowledge and experience with many aspects of the Akrotiri Peninsula.

Special Dedication

It is with great sadness that Martin Hellicar, BirdLife Cyprus Director, who initiated this process, and supported throughout, was not here for the final delivery.

Acknowledgments

We would like to express our sincere gratitude to those who contributed to the successful completion of this report. Special appreciation is given to the team of the Sovereign Base Area Administration – Environment Department and especially to Margarita Hadjistylli, Pantelis Charilaou, Alexia Perdiou and Varnavas Michael for providing time for fruitful discussions and valuable comments on this report, ensuring as well that the proposed management recommendations and measures are realistic and in line with their management vision. Additionally, special thanks are owned to Athina Papatheodoulou, Biologist with extensive experience in Akrotiri wetlands, who kindly reviewed parts of the ecological chapters of this report. Finally, we would like to thank Kelly Martinou from the Joint Services Health Unit, British Forces Cyprus for her input and experience on mosquitoes sustainable management.

Reference

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Contents

1. Introduction

Akrotiri Peninsula, in Limassol District, is the southernmost tip of Cyprus, but also the southernmost part of Europe. It is distinguished for its unique natural beauty and its rich history. It hosts the largest complex of natural wetlands on the island and is arguably the most important area for birds in Cyprus, in terms of both diversity and abundance, hosting bird populations that are important on a national and pan-European scale.

The area is characterized by a wide range of saline and freshwater influences, supporting a mosaic of habitats, from coastal sand dunes and Mediterranean juniper forests to saltmarshes, grazing marshes, and reedbeds. It serves as a vital stopover for numerous migratory birds of international importance, offering a significant resting, breeding, and feeding site. These include thousands of wintering Greater Flamingos, migrating raptors in autumn (mainly buzzard, harrier and falcon species), as well as important breeding species on a European level, such as Kentish and Spur-winged Plovers. The dramatic Episkopi cliffs on the Peninsula's western edge host important numbers of breeding Eleonora's Falcon and also one of only two remaining Griffon Vulture colonies on Cyprus.

In addition to its importance for birds, Akrotiri Peninsula is very rich in flora -incl. Red Book species- and other fauna species, such as both Green and Loggerhead Sea Turtles.









Akrotiri Peninsula is recognized and designated for its biodiversity importance. The largest area of Akrotiri Peninsula is located within the boundaries of the UK Sovereign Base Area (SBA) of Akrotiri, and together with Dhekelia (at northeast of Larnaca), are those parts of Cyprus that remained under British jurisdiction, following the end of British colonial rule and the declaration of the independent Republic of Cyprus in 1960.

Sovereign Base Area Administration ordinances designated it as an equivalent to a Special Protection Area (Natura 2000 site for birds) - SPA and a Special Area of Conservation - SAC (Natura 2000 site for habitats, flora and fauna other than birds) in 2010 and 2015, respectively[1]. The site is of a special European interest because it presents 29 natural habitat types (with 11 listed in Annex 1 of the European Commission Habitats Directive). It supports more than 300 species of birds (with 45 included on Annex 1 of the EU Birds Directive), and more than 800 species of plants, with 18 endemic species, such as the Cyprus Bee Orchid *Ophrys kotschyi* as well as a rich herpetofauna, invertebrate and fish fauna.

Akrotiri Peninsula has also been identified as an Important Bird and Biodiversity Area (IBA), in accordance with BirdLife International criteria. Additionally, the wetlands of the Peninsula are designated as a RAMSAR Wetland of International Importance.

The key sites within the Peninsula are shown in the map below.

Map 1-1: Location of key wetland sites within the Akrotiri Peninsula

1 The UK Sovereign Bases (SBAs) in Cyprus are not part of the EU, but SBA law mirrors that of the Republic of Cyprus (RoC), which is an EU Member State. As the RoC has transposed the EU Birds and Habitats Directives into National law, and the SBA Administration (SBAA) has mirrored these transposing laws through relevant ordinances, the equivalent of SPAs and SACs are designated within the SBAs under SBA orders.

The obligation for the management and protection of the area is statutory, deriving from the Protection and Management of Nature and Wildlife Ordinance 2007 and the Game and Wild Birds Ordinance 2008. The requirement under this legislation is to protect biodiversity, through the conservation of natural habitats, flora and fauna by maintaining or restoring their favourable conservation status. Sovereign Base Areas Administration - Environment Department (SBAA ED) is the authority responsible for the implementation of these Ordinances.

Though enjoying legal protection, the reality on the ground is that Akrotiri Peninsula is facing many human-induced pressures. The area includes military installations, local villages and at the same time there is intense recreational use -especially on the beaches- and mushrooming building development -both within the SBAs (Non-Military Development as of 2022) and outside-, with Europe's biggest casino, an under-construction 18-hole golf course and villa developments just outside of the northern boundary of the SBA (north of the Salt Lake). These result in changes in the ecosystem functioning, and most importantly the Akrotiri Peninsula wetlands are facing changes in their hydrological function. These are mainly caused by recent building development and shifts in water management practices (de-watering projects as part of developments, use of tertiary treated sewage water for irrigation purposes, stormwater management systems, reduction of groundwater abstraction), changes in land-use (land sealing and widespread cessation of citrus growing, leading to much reduced groundwater abstraction for irrigation), but also increasingly by climate change.

This report, by bringing relevant and extensive expertise both locally and internationally, aims to:

- **Review existing information in terms of ecology and hydrology of the wetland complex as a whole, but also for the individual sites within the Peninsula: main Salt Lake, Lady's Mile Beach and Pools, Zakaki Marsh (Lake Makria), Akrotiri Marsh, seasonal wetlands at Merras area (gravel pits) and artificial Bishop's Pool - all of which are interconnected to a greater or lesser extent.**
- **Review current pressures and threats, as well as trends in hydrology, climate change and populations of key species.**
- **Propose a clear plan for sustainable management of the area.**

2. Ecology and hydrology of the Akrotiri Peninsula wetlands

2.1 Ecology

This section describes key ecological features of the Akrotiri Peninsula, including hydrogeological history and formations, habitats, flora and fauna species, giving an emphasis on bird biodiversity.

The ecological characteristics of the key individual sub-sites of the Akrotiri Peninsula are also discussed, which are: Akrotiri Salt Lake, Lady's Mile Beach and Pools, Zakaki Marsh (or Lake Makria), Akrotiri Marsh (or Fasouri Marsh), Merras area (or gravel pits) and Bishop's Pool.

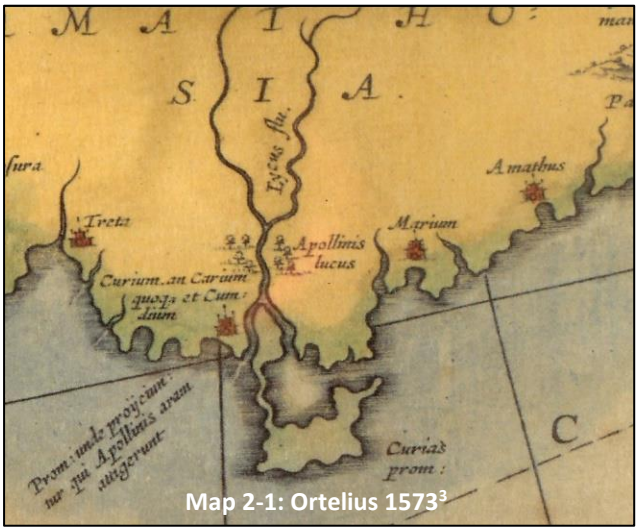
2.1.1 Akrotiri Peninsula Overview

A unique combination of factors led to Akrotiri Peninsula's distinct characteristics as the largest natural aquatic system in Cyprus and one of the most important biodiversity hotspots in Cyprus, including its location and geomorphology, diverse hydrology and the semi-natural condition of its habitats.

Hydrogeology

The underlying geology of the Peninsula consists of two formations, Pakhna (Miocene) and Athalassa (Pliocene), with calcareous sandstones, grits and conglomerates, and gypsum beds, chalk and chalk marls. These are mostly covered by sedimentary, alluvial materials[2].

Akrotiri Peninsula, was once a small island, which joined the mainland of Cyprus through sedimentation from the Kouris and Garyllis Rivers on the west and east side, respectively, in a double tombolo process, combined with land uplift and sea retreat. The western side of the islet joined with the mainland earlier than the eastern one. Maps -such as Ortelius 1573 (Map 2.1)- show the eastern side still open to the sea and the Kouris River with two distributaries, the eastern one of which its flows used to discharge into what is today the Salt Lake. This eastern branch eventually was blocked through sedimentation, but also a local tectonic fault may have played some role in the shift of the river outlet to the sea.



Map 2-1: Ortelius 1573[3]

The wetlands on the northern boundaries of the Salt Lake, from Zakaki Marsh to the east up to the Akrotiri Marsh on the west, are the remnants of an extensive marshy area, which -prior to 1950- was drained to control mosquitos and reclaimed for agricultural purposes. This was achieved by opening surface water passages

[2] *Ramsar Information Sheet: UK32001, Produced by JNCC: Version 3.0, 13/06/2008*

towards the lake and creating a forest, mainly consisting of eucalyptus, acacias and reeds in order to maintain the groundwater at relatively low levels, while simultaneously using artificial abstraction for irrigation purposes[3].

The Akrotiri Peninsula is composed of two distinct, but hydrologically connected areas[2]:

a) The first and largest area is the Salt Lake and sand flats situated in the center of the Peninsula. Over the past three centuries, this former lagoon has been isolated from the sea and a number of saltmarsh vegetation communities now surround the lake. A non-native Eucalyptus forest borders the northern side of the lake and is an important raptor roosting area (mostly for passage raptors on autumn migration).

b) The second distinct area, surrounding the Salt Lake from west, north and east is made up of a matrix of freshwater habitat types, including grazing marshes, reedbeds, low scrub vegetation and shallow lakes.

The wetland areas of the Peninsula are split as follows[2]:

- Shrub dominated wetlands 44.8%
- Saline/brackish lakes – seasonal 33.3%
- Freshwater marshes and pools 7.8%
- Sand/shingle shores and dunes 4.2%
- Saltmarshes 4.1%
- Canals and drainage channels 0.1%
- Other 5.7%

Habitats

Akrotiri Peninsula importance lies on its habitat mosaic characteristics, which include coastal scrubs, saltmarshes, dunes, phrygana, meadows, Mediterranean forests of junipers, eucalyptus forests, agricultural areas, grazing marshes, reedbeds and impressive coastal cliffs. The shores on the west side of the Peninsula are exposed to prevailing westerly winds and waves and exhibit the ecological characteristics of exposed and semi-exposed shores, comprising mainly of shingle beaches. The south coast of the Peninsula is mostly rocky with high cliffs and partially submerged sea caves, and the eastern coast is sandy. The main wetland habitats around the Salt Lake include communities of conservation importance, such as the Mediterranean salt meadows and the Mediterranean halophilous scrubs. The main forest north of the Salt Lake is primarily composed of planted non-native species, mainly acacia and eucalyptus.

The marine area of Akrotiri Peninsula is of equal importance, as it is one of the most pristine and valuable marine areas, not only in Cyprus, but within the Mediterranean Sea. Research studies of Akrotiri marine environment indicate the diversity of its coastal and marine habitats, ranging from seagrass beds to sand dunes, sea cliffs and rocky reefs to remote submerged sea caves. Akrotiri supports healthy meadows of the endemic seagrass *Posidonia oceanica*. In the area we can also find *Cymodocea nodosa* seagrasses and shallow reefs covered with canopy forming *Cystoseira* species, coralligenous communities and sponges. The submerged sea caves at Akrotiri cliffs provide one of the last remaining breeding refuges of the endangered Mediterranean

[3] *I..A.CO Environmental & Water Consultants Ltd. (2023) Overview of the Water Balance and Operation of the Akrotiri Salt Lake.*

monk seal (*Monachus monachus*) on the island and coastal habitats include nesting beaches of the endangered Green turtle and Loggerhead turtle.

Overall, 29 natural habitats have been recorded at Akrotiri.

1110 Sandbanks slightly covered by the sea all the time: This habitat is characterised by sublittoral sandbanks, permanently submerged. The main species is *Cymodocea nodosa*. These sandbanks stretch along the sandy beaches of Akrotiri at depths between 0 and 10 metres.

1120 Posidonia beds: This habitat is characterised by the presence of the marine seagrass *Posidonia oceanica* which is endemic to the Mediterranean. It is a key ecosystem supporting a vast and wide diversity of species including algae, mollusks, crustaceans, polychaeta, sponges, echinoderms, fish as well as marine reptiles like green turtles. The Posidonia beds occur around most of the Akrotiri Peninsula, except the north-western part.

1150 Lagoons: Lagoons are expanses of shallow coastal salt water. The main plants are *Ruppia maritima* and Chara spp. This habitat includes the Salt Lake and the surrounding depressions. Unicellular algae are also present in the Salt Lake.

1170 Reefs: Reefs are rocky marine habitats or biological concretions that rise from the seabed, they are very variable in form and in the communities that they support. Reefs at Akrotiri Peninsula are found in the south.

1210 Annual vegetation of drift lines (*Cakiletea maritamae*): This habitat is characterized by vegetation formed by annual plants growing on gravel or sand enriched by decomposing organic matter such as seaweed. The main plants are: *Cakile maritima*, *Salsola kali*, *Medicago litoralis*, *Euphorbia peplis*, *Lotus alophilus*, *Matthiola tricuspidata*. This habitat stretches along the sandy and gravelly drift lines of the coasts of the Peninsula.

1220 Perennial vegetation of stony banks with *Taraxacum*: The main plants are: *Taraxacum aphrogenes* (endemic to Cyprus), *Centaurea aegialophila*, *Limonium sinuatum*, *Malcolmia nana*, *Matthiola tricuspitata*, *Medicago marina*. This habitat is present along the western coast of the Peninsula.

1240 Vegetated Sea cliffs of the Mediterranean coasts with endemic *Limonium spp*: The main plants are: *Crithmum maritimum, Limonium echioides, Limonium sinuatum, Limonium virgatum, Cichorium spinosum, Convolvulus oleifolius, Echium angustifolium, Euphorbia cassia subsp. cassia, Silene sedoides*. Behind this zone there is often a transitional zone with mixed phryganic (*Thymus capitatus*) and aerohalophilic communities. This habitat is found at places along the southern and western coast of the Akrotiri Peninsula.

1310 Salicornia and other annuals colonizing mud and sand (*Thero-salicornietea* and *Saginetea maritimae*): This habitat is characterized by formations composed mostly or predominantly of annuals, in particular Chenopodiaceae of the genus Salicornia or grasses, colonising periodically inundated muds and sands of marine or interior salt marshes. The main plants are *Salicornia europaea, Halopeplis amplexicaulis, Suaeda maritima, Cressa cretica, Frankenia pulverulenta, Hordeum marinum, Parapholis marginata, Sphenopus divaricatus, Spergularia marina*. This habitat is found at the margins of the Salt Lake and lagoons at the northeastern part of Akrotiri.

1410 Mediterranean salt meadows (*Juncetea maritimi – Juncetalia* maritimi): This habitat includes saltmarshes in the Mediterranean basin dominated by Juncus (rushes) especially *Juncus maritimus* (sea rush) tolerant of saline soils. The main plants are*: Juncus maritimus, Juncus accutus, Juncus articulatus, Juncus heldreichianus, Juncus hybridus, Juncus littoralis, Juncus rigidus, Juncus subulatus, Aeluropus lagopoides, Agropyron elongatum, Bolboschoenus maritimus, Carex distans, Carex divisa, Carex extensa, Centaurium pulchellum, Centaurium tenuiflorum, Crypsis factorovskyi, Hordeum marinum, Imperata cylindrica, Limonium mucronulatum, Linum maritimum, Parapholis marginata, Plantago maritima subsp. crassifolia, Saccharum ravennae, Schoenoplectus littoralis, Schoenus nigricans, Scirpoides holoschoenus, Triglochin bulbosa*.

1420 Mediterranean halophilous scrubs (*Arthrocnemetalia fruticosi*): This scrubby, halophilous (i.e. salt-tolerant) vegetation develops in the uppermost levels of saltmarshes, often where there is a transition from saltmarsh to dunes, or in some cases where dunes overlie shingle. The main plants are: *Arthrocnemum macrostachyum, Salicornia fruticosa, Salicornia perennis, Halimione portulacoides, Halocnemum strobilaceum, Inula crithmoides, Spergularia marina, Suaeda vera, Limonium mucronulatum*. Within this habitat a community of low fixed sand dunes, dominated by *Arthrocnemum macrostachyum* occurs. This habitat is present at the salt marshes and meadows around the lake.

2110 Embryonic shifting dunes: Embryonic shifting dune vegetation exists in a highly dynamic state and is dependent on the continued operation of physical processes at the dune or beach interface. It is representing the first stages of dune construction, constituted by ripples, or raised sand surfaces at the top of the beach. The main plants are: *Otanthus maritimus, Agropyron junceum, Cyperus capitatus, Eryngium maritimum, Medicago marina, Pancratium maritimum* and *Sporobolus virginicus*.

2120 Shifting dunes along the shoreline (white dunes): This habitat encompasses most of the vegetation of unstable dunes where there is active sand movement. These dunes occupy: (i) part of Episkopi bay with special characteristic that the dominant fixing species is *Zygophyllum album*, while the other species are *Medicago marina, Asparagus stipularis, Sporobolus virginicus, Centaurea aegialophila*; (ii) part of Limassol bay where at some places the characteristic is that the dominant fixing species are *Saccharum ravennae* and *Imperata cylindrica*, while other species are *Medicago marina, Pancratium maritimum, Zygophyllum album, Agropyron junceum, Lotus cytisoides, Asparagus stipularis, Centaurea aegialophila* and *Eryngium maritimum*.

2190 Humid dune slacks: Humid dune slacks represent the wetland component of dune systems, appearing as flat valleys in the dunes and are closely associated with high water tables with low nutrient levels. Dune slacks are low-lying areas within dune systems that are seasonally flooded and have low nutrient levels. The main species are: *Plantago maritima* subsp*. crassifolia*, *Juncus spp*., *Saccharum ravennae*. Humid dune slacks occupy small patches of the dune system at Limassol Bay within the Bishop's Farm area.

2230 *Malcolmietalia* dune grasslands: This habitat is formed by vegetation dominated by annual pioneer species of dry depressions in dune systems. The main species are: *Malcolmia nana, Pseudorlaya pumila, Silene colorata, Valantia hispida*. This habitat occupies patches of the dune system at Limassol Bay.

2240 *Brachypodietalia* dune grasslands with annuals: Open, dry perennial dune grasslands. These grasslands, host many therophytes-annual plants which survive the unfavourable season as seeds. This habitat occupies patches of the dune systems within habitat types 2250 and 2260. The main species are: *Trachynia distachya, Aegilops bicornis, Brassica tournefortii, Hedysarum spinosissimum, Silene colorata, Vulpia membranacea, Tuberaria guttata, Parapholis marginata* and *Silene discolor*.

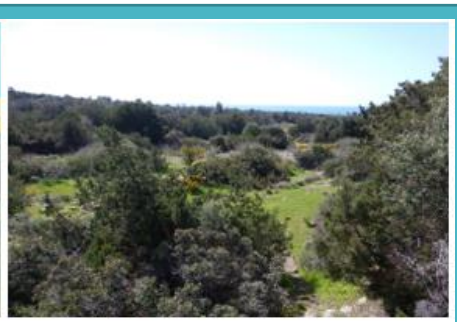
2260 Dune sclerophyllous scrubs: Within this habitat type three plant communities are recognized: a) *Thymus capitatus, Teucrium micropodioides, Helianthemum stipulatum, Cistus spp., Echium angustifolium, Fumana thymifolia*, which occurs near salt marshes b) *Pistacia lentiscus, Asparagus stipularis, Rhamnus oleoides subsp. graecus, Helianthemum stipulatum*, which occurs near salt marshes with special characteristic that the dominating species is *Pistacia lentiscus* c) On flat encrusted sand along the western coast a distinct community occurs with: *Thymelaea hirsuta, Lycium sweinfurthii, Noaea mucronata, Phagnalon rupestre, Echium angustifolium*. This community deviates from the typical ones of the habitat and merits further investigation and special treatment.

3140 Hard oligo-mesotrophic waters with benthic vegetation of Chara formations: This habitat is characterized by lakes and pools with waters rich in dissolved bases (pH often 6-7) or with mostly blue to greenish, very clear, waters that are usually poor in nutrients. The bottom of these unpolluted water bodies is covered with charophytes, *Chara sp.* and *Nitella sp*., algal carpets. This habitat type is found in few places at Akrotiri Marsh.

5210 *Juniperus phoenicea* arborescent matorral: Mediterranean and sub-Mediterranean evergreen sclerophyllous scrub organized around arborescent junipers and specifically *Juniperus phoenicea*. The main plants are: *Juniperus phoenicea, Ceratonia siliqua, Cistus spp., Myrtus communis, Olea europaea, Pistacia lentiscus, Prasium majus, Rhamnus oleoides subsp. graecus, Thymus capitatus, Thymelaea hirsuta*.

5420 *Cisto-Micromerietea* phrygana: Low, thorny formations of hemispherical shrubs of the coastal thermo-Mediterranean zone. The main plants are: *Sarcopoterium spinosum, Thymus capitatus, Cistus spp., Convolvulus oleifolius, Fumana spp., Helianthemum obtusifolium, Helianthemum spp., Helichrysum conglobatum, Lithodora hispidula subsp. Versicolor, Micromenia spp., Noaea mucronata, Onosma fruticosa, Phagnalon rupestre, Teucrium spp*. The following formations are included in this habitat type: a) *Sarcopoterium spinosum* phrygana, b) *Thymus capitatus* phrygana, c) the rare *Thymelaea hirsuta* phrygana. Of special interest are the degraded and dwarf phrygana dominated by *Schoenus nigricans* that form distinct communities within this habitat at several areas of the site.





6420 Mediterranean tall-herb and rush meadows (*Molinio-Holoscoenion*): This habitat is characterized by humid grasslands formed by tall grasses and rushes, often associated with coastal dunes. The main species are: *Panicum repens, Baldellia ranunculoides, Teucrium scordium subsp. scorpioides, Centaurea calcitrapa subsp. angusticeps, Cyperaceae spp., Juncus spp., Lotus corniculatus, Lythrum junceum, Mentha aquatica, Ononis spinosa, Pulicaria dysenderica subsp. uliginosa, Ranunculus peltatus, Saccharum ravennae, Schoenus nigricans, Scirpoides holoschoenus* and *Euphorbia pubescens*. These occur at Fassouri marsh.

8330 Submerged or partially submerged sea caves: This habitat includes submerged sea caves and partially submerged caves which are only exposed to the sea at high tide. Caves vary in size, from only a few metres to more extensive systems. This habitat is also found along the southern coast of the Peninsula between Cape Gata and Cape Zevgari.

92DO Thermo-Mediterranean riparian galleries (Nerio-Tamariceteae): This habitat is characterized by tamarisk, oleander, and chaste tree galleries and other similar low ligneous formations. Usually found at permanent or temporary streams and wetlands. The main plants are: *Tamarix tetragyna*, *Asparagus stipularis*. This habitat is found mainly at the north and north-western part of Akrotiri.

9320 *Olea* and *Ceratonia* forest: Thermo-Mediterranean woodland dominated by arborescent *Olea europaea ssp. sylvestris, Ceratonia siliqua, Pistacia lentiscus, Myrtus communis.*

9540 Mediterranean forests with endemic Mesogean pines: These are found at some parts of the site with main plants: *Pinus brutia, Pistacia lentiscus, Cistus spp., Juniperus phoenicea, Lithodora hispidula subsp. versicolor, Myrtus communis, Pistacia terebinthus, Rhamnus oleoides subsp. graecus, Thymus capitatus*.

CY02 Reed beds and sedges: This habitat is characterized by reedbed and sedge communities (northern and north-western parts of the site) of the class *Phragmito Magnocaricetea*. This habitat is important as it provides habitat to many birds. The main plants are: *Phragmites australis, Imperata cylindrica, Calystegia sepium, Cladium mariscus, Saccharum ravennae, Juncus spp. and Scirpus maritimus.* This habitat can be found around Makria lake.

CY05 Sand beaches: This habitat type can be found on the front line of sandy coasts, devoid of vegetation or with sparse vegetation of drift line communities. Sand beaches provide important turtle nesting grounds.

Sandflats: This habitat is characterized by sandy areas with seasonal inundation with sparse or no vegetation. It is an important habitat to small waders during seasons when the water levels are higher within the Salt Lake. It also plays a significant contribution to the formation of thermals during drier periods. Sandflats form an area connecting the Salt Lake to the sea on a seasonal basis.

Other habitats

To the north of the Salt Lake there are citrus farms and eucalyptus plantations. Many of the citrus farms are now being abandoned for development reasons (pl. refer to section 2.3). The eucalyptus plantations along the northern side of the Salt Lake were originally planted during early 20th century in an attempt to drain wetland habitat as a measure to limit malaria.

Plants







The Akrotiri Peninsula is one of the most important botanical hotspots in Cyprus. It has been estimated that more than 800 indigenous plant taxa occur on the Peninsula, including many important species, out of around 2000 in the whole of Cyprus. Its floristic importance can be attributed to a large extent to the diversity of habitats it supports ranging from saline, brackish and freshwater habitats, to dunes, grasslands, phrygana, maquis and forest vegetation.

It has an outstanding ecological and biodiversity value and supports an appreciable number of important plant taxa. The species *Crepis pusilla* and *Ophrys kotschyi*, which are present in the Peninsula, are included in Annex II of the Directive 92/43/EEC. Moreover, several threatened species, which are included in the Red Data Book of the Flora of Cyprus (Tsintides et. al., 2007), are hosted in the Peninsula. Some of them are endemic to Cyprus (*Ophrys kotschyi, Serapias aphroditae, Silene microsperma subsp. cypria, Taraxacum aphrogenes*) while the presence of some of them is restricted to Akrotiri Peninsula (*Ipomoea sagittata, Helianthemum kahiricum, Convolvulus lineatus, Linum maritimum*). A few of the species are noted below.

- *Euphorbia hirsuta* is a critically endangered species which the only location with a recently confirmed established population is the Akrotiri Marsh.
- *Helianthemum kahiricum*, is a critically endangered species, added to the flora of Cyprus very recently (Hadjikyriakou, G.N. 2017) and was only described from Akrotiri Peninsula.
- *Ipomoea sagittata*, is an endangered species, which is only known population is in Akrotiri Marsh.
- *Convolvulus lineatus* and *Linum maritimum* are vulnerable flora species only described from Akrotiri Peninsula.
- *Mentha aquatica*, is a critically endangered species, whose best-established population in Cyprus is in Akrotiri Marsh.
- *Schoenoplectus tabernaemontani*, is an endangered species, whose best-established population in Cyprus is in Akrotiri Marsh.
- A number of red list species are hosted in the Peninsula, among which, worth noting are the critically endangered parasitic plant *Cistanche phelypaea*, the endangered species *Ifloga spicata, Ipomoea imperati, Silene microsperma* subsp*. cypria* and the vulnerable species *Achilea maritima, Aegilops bicornis, Cladium mariscus, Coronilla repanda, Crypsis factorovskyi, Erodium crassifolium, Eryngium campestre, Herniaria hemistemon, Isolepis cernua, Juncus littoralis, Juncus maritimus, Lotus cytisoides, Ophrys kotschyi, Phyla nodiflora, Serapias aphroditae, Taraxacum aphrogenes, Triplachne nitens, Urtica membranacea.*

Mammals

Six mammal species of the area (**Monk Seal** *Monachus monachus*, **Egyptian Fruit-bat** *Rousettus aegyptiacus*, **Common Bentwing Bat** *Miniopterus schreibersii*, **Lesser and Greater Horseshoe Bats** *Rhinolophus hipposideros* and *R. ferrumequinum*, and **Bottlenose Dolphin** *Tursiops truncatus*) are listed as requiring protection and management through SAC designation, with Monk Seal listed as a priority species and critically endangered by IUCN[4].

The sea caves at Akrotiri cliffs are one of the few remaining breeding areas in Cyprus for the Mediterranean Monk Seal and also host one important roost of the Egyptian Fruit-bat. Common Bentwing Bats have been recorded at two cave roosts within RAF Station Akrotiri.

Fish

The **Mediterranean Killifish** *Aphanius fasciatus* is a key listed species, requiring protection and management through SAC designation. It was found mainly at Zakaki Marsh, but uses most of the wetland system up to Akrotiri Marsh. Akrotiri is one of the few areas hosting this species in Cyprus. The Mediterranean Killifish is endemic to the Mediterranean and is distributed in all countries of this sea with the exception of the Iberian Peninsula. The gravel pits are of high significance as refuges for Killifish, since they maintain brackish-to-saline water throughout the year, even in periods of drought.

Reptiles

A total of 20 species of reptile are listed as important on the Peninsula, two are endemic. Three reptile species (**Loggerhead Turtle** *Caretta caretta*, **Green Turtle** *Chelonia mydas* and the **Cyprus Whip-snake** *Coluber cypriensis*) are listed as requiring protection and management through SAC designation[4]. These three species along with **Schreiber's Fringe-fingered Lizard** *Acanthodactylus schreiberi* are listed as Endangered by IUCN. The two turtle species and the lizard have significant populations at Akrotiri, whereas the Whip-snake may not be occurring at all.

The Schreiber's Fringe-fingered Lizard is common at Akrotiri. Its preferred habitat is made of coastal dunes or light soil close to the dunes. It can also be found in newly created cultivated areas with sandy soil. It is an endangered species found only in Cyprus, Israel, Lebanon and Turkey.

[4] *Akrotiri Peninsula Environmental Management Plan, 2012*

Breeding populations of two species of sea turtles, the Loggerhead (*Caretta caretta*) and the Green Turtle (*Chelonia mydas*), use the turtle nesting beaches at Akrotiri. Nests at Akrotiri beaches have been increasing steadily and in the last eight seasons have ranged from 80 to 195 in 2024, the highest number ever recorded. The turtles are also using the sea around Akrotiri Peninsula for mating and for foraging.

Amphibians

There are three amphibian species on the Peninsula: **Mediterranean Tree Frog** *Hyla savignyi*, **Green Toad** *Bufo viridis* and **Marsh Frog** *Rana ridibunda*[4]. The Mediterranean Tree Frog plays an important role in the ecology of Akrotiri wetlands. Large numbers of the Tree Frog breed at Akrotiri Marsh and in the winter migrate and/or hibernate in the surrounding areas, particularly to the north of the marsh. They are a significant part of the food chain representing an important food source for a number of important wetland birds. Although this species is found in many other locations in Cyprus, Akrotiri Marsh is the most important breeding area on island.

Invertebrates

Amongst the many key invertebrates, one of the most important for the Salt Lake is ***Phallocryptus (Branchinella) spinosus***, a small shrimp-like crustacean, widely distributed in most brackish wetlands of the Mediterranean basin countries. It is a halophilic species typical of brackish continental waters of Europe and North Africa. In Cyprus it can be found at Akrotiri wetlands, as well as in Larnaca Salt Lake, where it plays an important ecological role in the food chain. Flamingos, Shelduck, Avocet, Glossy Ibis and other bird species take advantage of the winter abundance of *Phallocryptus spinosus*, by foraging intensively in the Salt Lake. This species is highly adapted to and dependent on the water cycle of the Salt Lake. It can persist through prolonged dry periods as it forms resistant cysts that can await suitable conditions to hatch.

18 species of butterflies have been recorded so far in the Akrotiri Peninsula, four of which are endemic species and subspecies. The open forest area and the semi-natural areas hold high butterfly species richness. Common butterfly species one can observe in the area are *Vanessa cardui, Hipparchia cypriensis, Papilio machaon, Pieris brassicae, Polyommatus icarus, Lycaena phlaeas, Maniola cypricola, Leptotes pirithous.*

There are far more moth species at the Peninsula, since 82 moth species have been recorded in the area. At the Eucalyptus Forest one can observe the most moth species. Common moth species in the area include *Lasiocampa terreni, Micropterix cypriensis, Macroglossum stellatarum, Ocnogyna loewii, Catarhoe hortulanaria.*

Out of the 37 dragonfly and damselfly species we have in Cyprus, in Akrotiri one can observe 20 different species. Strong correlation has been observed between winter rainfall levels in the area and dragonfly abundance. Some interesting sites for dragonfly and damselfly watching are Zakaki Marsh, Akrotiri Marsh, Akrotiri Gravel Pits and Bishop's Pool. Akrotiri Orchid Walk, near Akrotiri Environmental Education Center, is possibly the most important site in Europe for *Lestes macrostigma* (Dark Spreadwing). Other common odonatan species of the area include *Sympetrum fonscolombii, Crocothemis erythraea, Orthetrum sabina, Trithemis annulata, Anax parthenope, Ischnura elegans.*

Finally, Akrotiri Marsh is important for grasshoppers' species, such as the Large Cone-head *Ruspolia nitidula* (Akrotiri Marsh is one of the few sites in Cyprus where it occurs), the Cyprian Long-winged Cone-head *Conocephalus fuscus cyprius*, the Marsh-cricket *Pteronemobius heydenii* (Akrotiri marsh is one of the most important sites for this species in Cyprus and sustains good numbers) and the Lamenting Grasshopper *Eyprepocnemis plorans* which is actually only known to be present at the Akrotiri Marsh.

Birds

One of the most important, diverse and species-abundant areas of the island is the Akrotiri Peninsula, where more than 300 bird species are recorded here so far. Birds use the area for breeding, wintering and migration, including to roost, rest and feed. Two major groups of birds use the Akrotiri area: raptors and waterbirds. Raptors concentrate at the Peninsula primarily during their southward migration, because of its natural bottleneck feature and its lifting thermal currents, which create the ideal conditions to fly offshore. The abundance and diversity of wetlands (freshwater, saltwater, coastal areas) offer appropriate conditions for hosting different species of waterbirds. Cranes migrating south will use open areas, especially the Salt Lake to roost and rest overnight. These birds, as well as most raptor and other soaring species, will take advantage of the warm rising thermals created by the Salt Lake and its surroundings.

In the present document, the key species are separated between **strict migrants**, **wintering visitors** and **breeding species**, yet some might fall into more than one category.

Migrant Species:

The total number of observed species in Akrotiri Peninsula goes up to 343 (up to autumn 2024), from which the vast majority are migratory (passing only) and wintering species. Cyprus has a total of 409 species sighted (as of December 2021), so more than 80% of the species seen in the country have been recorded at least once at the Peninsula. Akrotiri, as the southernmost part of Cyprus, is located in the Eastern Mediterranean Flyway and is a significant stopover site for large numbers of birds in both spring and autumn migration. Among the most notable species, there are important concentrations of raptors [e.g. Red-footed Falcon *Falco vespertinus* (Kassinis & Charalambidou 2021), waterfowl, waders, and a highlight of an important passage and stopover for the westernmost populations of Demoiselle Crane *Anthropoides virgo*.

Winter Visitors:

Among the several species recorded during winter, the Greater Flamingo *Phoenicopterus roseus* is the most remarkable one, in terms of the wintering population size and the status of the species. Yet the species is observed year-round and a few breeding attempts have been recorded. The main period of appearance of the species is winter, when the area becomes a key site for the species subpopulation in the Eastern Mediterranean. Additionally, the Common Shelduck *Tadorna tadorna* was noted in relevant concentrations in the past (as wintering and spring migrant mostly).

Large numbers of shorebirds such as Little Stint *Calidris minuta*, Dunlin *Calidris alpina*, Ruff *Calidris pugnax*, Kentish Plover *Charadrius alexandrinus* and Greater Sandplover *Charadrius leschenaultii*, as well as wildfowl, such as Common Teal *Anas crecca*, Mallard *Anas platyrhynchos*, Northern Shoveler *Spatula clypeata*, Eurasian Coot *Fulica atra* use the Peninsula on migration or as wintering habitat. On migration they are found along the muddy edges of reservoirs, sewage farms, river banks, seasonal pools as well as coastal mudflats and seashores. Threats include habitat degradation by diminishing rainfall and disturbance by humans. All fresh and salt water wetlands/pools will be used by these species in the area as well as the eastern and western coasts of the Peninsula.

Breeding Species:

Akrotiri Peninsula supports important breeding populations of key bird species. It is one of the five most important areas in Cyprus for breeding populations of Black-winged Stilt *Himantopus himantopus*, Kentish Plover *Charadrius alexandrinus*, Spur-winged Lapwing *Vanellus spinosus*, and Ferruginous Duck *Aythya nyroca*, which are all considered priority species within the EU. These species have quite specific breeding areas within the Peninsula, which depend on the condition of the wetlands, particularly the availability of standing water.

Moreover, Little Egret *Egretta garzetta* and Squacco Heron *Ardeola ralloides* are two species that have been recorded to breed at least once and have the potential to become regular breeders. One possible breeding species is Little Bittern *Ixobrychus minutus* and a species that has potential to breed in the future is Glossy Ibis *Plegadis falcinellus*.

Key Species accounts/ Ecological Characteristics:

Below is a summary of the ecological characteristics of the key bird species in Akrotiri:

Black-winged Stilt *Himantopus himantopus*	
Population	Widely distributed in Southern Europe, both in coastal (along almost the entire Mediterranean coast, including N Africa) and in inland areas (Keller et al. 2020). Overall, the species seems to be increasing mostly due to population increase in the northern end of the distribution, but some declines have been noted, for instance in Turkey (Keller et al. 2020). The European population is largely migratory (overwintering in sub-Saharan Africa), but in Turkey and N Africa the species is thought to behave more like a resident (Billerman et al. 2024). In Cyprus, the species occurs as a passage migrant and migrant breeder, with an estimated 2-55 pairs in Akrotiri (Hellicar et al., 2014). Following wet winters, up to 70 pairs have been noted (Tye et al. 2012). Small numbers have begun to overwinter, though mostly recorded outside the Peninsula. 
Nesting	Nests usually on the ground, in open areas with a bit of vegetation surrounded by shallow water. The incubation takes about 22-25 days and the chicks are nidifugous, fledging at 28-32 days (Cramp 1983). Usually the nests are found in loose colonies. The species breeds in spring, but some late clutches might occur also during summer.
Diet	Predominantly aquatic insects and other invertebrates, which are taken while walking and by dipping the bill underwater (Cramp 1983). Other prey as plant material (mostly seeds) or small vertebrates (amphibians, fish) are reported, but far less common. The species seems to be quite adaptable and generalist in that regard.
Habitat Requirements	Though quite adaptable, the species requires shallow waters (ideally <20 cm) (Keller et al. 2020) for foraging and nesting. Sites with important hydrological changes might be

	problematic, especially if there are possibilities of drainage during the breeding season, or floodings that drastically increase the water level.
Predation & disturbance	Very sensitive to predators during the nesting season, as the eggs and chicks are easily accessed by mammals (foxes, feral dogs and feral cats) and also birds (gulls and corvids) (Pigniczki et al. 2019). Human disturbance seems less relevant, yet it could also negatively affect breeding and foraging.
Threats & conservation actions	• The management of water levels is very important in order to maintain good foraging areas and, most importantly, suitable nesting areas that maintain relatively constant water level throughout the season (as large water level changes might drown or expose the nests). • In grazed areas, high densities of herbivores might disturb nests by crushing eggs. • Predation might be a very important factor for maintenance of a sustainable breeding population over the long term.

Kentish Plover *Charadrius alexandrinus*	
Population	 Widely distributed along the coasts of the Mediterranean and also inland around the Black and Caspian Seas, but locally it can be a rather scarce species. Although the overall European population is considered stable or slightly decreasing, some clear declines have been noted locally, and further study is needed to understand population trends better (for instance, a decline has been noted for the Turkish population) (Keller et al. 2020). The European Red List of Birds (BirdLife International, 2021) lists the species as *Decreasing,* though not severely enough to trigger a change in IUCN Red List status. In Cyprus, the species is a locally common breeding resident, as well as a passage migrant and winter visitor in variable numbers. The population in Cyprus is estimated at 30-160 pairs during the period 2007-2018, as per Article 12 of the EU Birds Directive (2009/147/EC). The breeding population appears to have declined in recent years.
Nesting	Nests directly on the ground, in open areas with good visibility, and preferably with very low and scattered vegetation (even absent) (Gómez-Serrano & López-López 2014). Incubation takes place for 24-27 days, and the nidifugous chicks fledge at 27-31 days (Cramp 1983). The species, present year-round, shows a rather long nesting season, with first clutches found from mid-March to late clutches found in early July (Tye et al. 2012).
Habitat Requirements	Typically, they are found in coastal habitats, mostly in dune habitats but also on sandy banks near estuaries and river deltas, always sites with low vegetation and close to water. They might occur also inland, especially in salt lakes or similar water bodies where there is very low vegetation. Since the southernmost populations are mostly resident, the amount of food has been noted as very important for the presence of the species.
Diet	Mostly crustaceans, annellida and molluscs, but also a wide range of insects (Cramp 1983). Other prey as plant material (mostly seeds) or small vertebrates (amphibians, fish) are reported, but far less common. The species seems to be quite adaptable and generalist in its diet.
Predation & disturbance	The species is heavily affected both by predation (by foxes, feral dogs, feral cats, corvids…) on their nests but also by human development that induces habitat destruction or disturbance (mostly related to activities on beaches) (Montalvo & Figuerola 2006; Galasso et al. 2022).

Threats & conservation actions	• Creation of artificial "dredge" islands has been shown to be successful for the establishment of breeding pairs (Scarton et al. 2012). • Predator control and access management has been proved as a successful conservation measure in many sites, along with fencing, regulating or banning human activities or sources of disturbance (touristic activities, vehicle access, presence of dogs, etc) (Cimiotti & Hötker 2013, Galasso et al. 2022).

Ferruginous Duck *Aythya nyroca*	
Population	 The Ferruginous Duck *Aythya nyroca* is restricted to fresh-water wetlands with adequate marginal vegetation. The species underwent severe declines in Europe during the 1980s and 1990s, resulting in the species being classified as globally threatened on the IUCN Red List. The species is currently classified as Near Threatened. The main breeding areas in Europe are in Central and Eastern Europe, with much fewer pairs in Greece and Turkey (Keller et al. 2020). In Cyprus, the species has been observed to over summer regularly and breeding was confirmed for first time in 2005 and confirmed annually since 2015. The northernmost populations are migratory (Billerman et al. 2024), and thus migrants and wintering individuals are likely to be regular in Cyprus, when they will mix with the resident population. At Akrotiri, the species is considered established as a breeder, with an estimate of 1-5 pairs (2010-2012) (Hellicar et al. 2014). Bishop's Pool, Zakaki and Akrotiri Marshes are the two main breeding sites, but the invasion of open pools by Common Reed is a threat. At Zakaki, this is due to fresh storm water being diverted into the previously brackish marsh and facilitating the spread of reed.
Nesting	The main breeding season is during spring and early summer, the incubation takes 25-27 days, and fledging period is about 55-60 days (Cramp 1977). The nests are generally placed on floating islands, usually well covered by vegetation (Loucif et al. 2021).
Habitat Requirements	Shallow and well-vegetated wetlands, with emerging vegetation (important for cover) and a combination of floating vegetation structures (important breeding sites), and presence of shallow mudflats (Petkov 2012).
Diet	Largely based on plant materials, mostly plants and seeds from plants growing underwater in shallow lakes, which are taken on surface, submerging the head or diving (Cramp 1977). Invertebrates, mostly *Chironomid* larvae, might be an important complement for their diet (Petkov 2012).
Predation & disturbance	There are no reports of major disturbances reported on the species, yet its secretive breeding behaviour (as well as its endangered status) might be related to a notable sensitivity. Small populations might be particularly sensitive for instance to human disturbance, such as fishing activities, poaching and holidaymakers (Petkov 2003). Additionally, cattle could also cause some disturbance in small sites with restricted suitable habitat, which could be either direct disturbance or important habitat alterations.

Threats & conservation actions	• The species has been noted to react positively and quickly to habitat restoration and conservation measures, as well as it has benefited from reintroduction programmes in some countries (Keller et al. 2020). • Habitat-wise, the loss of macrophytes (mostly due to changing water levels and water quality and turbidity) is an important threat for habitat quality.

Spur-winged Lapwing *Vanellus spinosus*	
Population	 In Europe, the species breeds in Greece, Cyprus and Turkey, with estimates of 60, 60 and 1000 breeding pairs respectively (Keller et al. 2020). The species is also present in some areas in the Middle East and the Nile Delta (as well as in sub-Saharan Africa), and it behaves as resident, except for the birds in Greece, Cyprus and Turkey, which are migratory (Billerman et al. 2024). In Cyprus, the species was first documented as a breeder in 1988, and since, the number of pairs has increased significantly (Charalambidou et al. 2012). Such increase seems to be aligned with an increase in the Middle East (e.g. Ramadan-Jaradi & Bara 2009). Apart from the local breeding population of the island, Spur-winged Plovers use Cyprus as a flyway regularly in spring in small numbers from mid-March to mid-April. At Akrotiri its breeding sites are associated with fresh standing water and like the Ferruginous Duck it uses Zakaki and Akrotiri Marshes. The breeding population at Akrotiri has increased in recent years due to beneficial management.
Nesting	Nests on the ground, in the open, usually near water. The incubation period lasts 22-24 days, and the nidifugous chicks fledge after seven weeks (Cramp 1983). The breeding season is mostly concentrated in spring and early summer. The species can also nest in cultivated areas and other open habitats, but the best quality (measured in some studies through egg volume) is found in meadows (Özkan 2023).
Habitat Requirements	The Spur-winged Lapwing prefers open marshy places by lakes, lagoons, rivers, deltas, sewage ponds, fish ponds, preferably with shallow water, where to find food and nesting areas. The species can also be found in sand banks or barren areas near water-bodies, and also in cultivated areas. The main challenge/limitation is predation (see below).
Diet	A diversity of arthropods (mostly insects), but also other invertebrates, such as molluscs, worms, etc. Occasionally frogs or tadpoles, as well as fish, or plant items, all picked from the ground by sight (Cramp 1983). Therefore, the diet is not very specialised.
Predation & disturbance	Ground predators might have important effects on the species, such as foxes, feral dogs and feral cats (Charalambidou et al. 2012), but also corvids, and the effects of predation might be enhanced if human disturbance is also high (Özkan 2023).
Threats & conservation actions	• Maintenance of meadows with low vegetation and shallow water can ensure the availability of the most suitable habitat. • Predator control at suitable nesting sites might be useful. A proper assessment of predators should be undertaken in order to find the best measure.

The coastal area of the Peninsula, especially the southern part, which is characterized by coastal cliffs, is also used by three important breeding species: the European Shag *Phalacrocorax aristotelis*, Peregrine Falcon *Falco peregrinus* and Eleonora's Falcon *Falco eleonorae*. The first two are resident in the area, whereas the Eleonora's Falcon is a breeding visitor.



The Peninsula is notably important **for non-breeding species**, many of which are using it for wintering or staging during migration, and thermalling to efficiently gain extra lift before flying offshore. Herons and egrets move through in large numbers. Amongst the raptors, European Honey-buzzard *Pernis apivorus*, Red-footed Falcon *Falco vespertinus*, Western Marsh-harrier *Circus aeruginosus*, Pallid Harrier *Circus macrourus* and Saker Falcon *Falco cherrug* are key migrants.

Key migrant/ wintering species include the following:

Greater Flamingo *Phoenicopterus roseus*	
Population	 The Greater Flamingo is a highly mobile species, with a European population that is regarded as a single metapopulation for the entire Mediterranean and NW Africa (Geraci et al. 2012, Keller et al. 2020). This population can be divided into Western and Eastern Mediterranean, with the latter hosting the most important colonies in Turkey (Tuz Lake and Gediz Delta), with scattered breeding records in other sites in Turkey and Greece. The Turkish population is the most important in the Eastern Mediterranean, and it might be the origin for most of the individuals sighted in Cyprus (Balkiz et al. 2015), yet also some birds could come from the Iranian population. A handful of breeding attempts have been documented in Cyprus (at least in six occasions at Akrotiri), but it has never been proved successful (in 2019 35 nests were recorded, and in 2020 about 200 nests were found in Akrotiri with massive nest failure). Nonetheless, the numbers of Flamingos observed in Cyprus, and particularly notably in Akrotiri, are significant. Since the species is very mobile, these secondary sites (outside the main breeding areas) are equally important for the population dynamics of the species (Johnson & Cézilly 2007).
Nesting	Rather flexible breeding period, depending on the conditions (Cramp 1977), yet it is mostly concentrated in spring. Nonetheless, autumn-early winter breeding attempts have been noted elsewhere in the Mediterranean. Only fully adult birds are involved in breeding, and they form rather dense colonies typically in sandy or muddy islands (to avoid predators as much as possible, see later) in their regular feeding lakes. The incubation takes about 30 days, and the fledging takes between 70 and 100 days (Cramp 1977). A few days after hatching, the chicks of the entire colony flock together and stay in dense aggregations that are guarded by a few adults until they start flying.

Habitat Requirements	Due to the limited ability for swimming and its adaptation with very long legged, the species prefers shallow water bodies (ideally 10-60 cm; Scarton 2017), rather vegetation free, and generally salty or brackish (important for the development of their main food). Notably, a good foraging area in winter might be relevant for the next breeding season, as females start using winter resources to produce the eggs, as well as local resources from the nesting site later on (Rendón-Martos 2015). The impact of disturbance (either human or by predators) is huge (see below), and might overrun the habitat quality *per se*.
Diet	The species is highly specialized for filter-feeding, with an especially adapted bill that filtrates particles between 500 and 6000 µm, mostly crustaceans, insects, other invertebrates (Rendón-Martos 2015) but also algae, seeds and eventually small fish (Cramp 1977, Rendón et al. 2023). Nonetheless, it has been shown flamingos get a major energetic gain eating water column crustaceans rather than benthic invertebrates (as Chironomid larvae), thus highlighting the importance of such in their diet (Deville et al. 2013). At Akrotiri, the main crustacean available at the Salt Lake is *Phallocryptus (Branchinella) spinosus,* which is reported to tolerate a salinity level of 25-56‰ (Mura 1987).
Predation & disturbance	Flamingos are probably one of the species most sensitive to disturbance, particularly during the breeding period. As they breed on the ground in rather dense colonies, a single disturbance (a mammalian predator passing by or several human disturbances as visits, low airplanes, among others) could cause massive breeding failure of the entire colony. Outside the breeding season, though they continue to favour quiet places, they could adapt to some levels of human disturbance (e.g. presence of people, aircraft passing over, etc.) if they occur regularly and they are not identified as a threat. Nonetheless, disturbance is always a threat for the species, as it can also modify their behaviour and foraging areas (Scarton, 2017).
Threats & conservation actions	• Lead poisoning has been identified as an important threat for the species (e.g. Rendón et al. 2023). Proper monitoring of the presence of lead, and corresponding mitigation actions, could be interesting. There is no evidence that it might be a problem at Akrotiri at the moment. • The species is also quite sensitive to collision, mostly with electric or other cables and antennae. A notable set of structures is found in Akrotiri; thus, it can be of importance for the flamingo population in terms of direct mortality or as a barrier preventing local movements. A review by Tye (2013) compiles the information known from the structures at Akrotiri and proposed some relevant mitigation solutions. • Changes in salinity are among the most important abiotic factors that can influence directly prey availability, and thus, flamingo populations (Annetin et al. 2012). Thus, it is crucial to have good monitoring in order to prevent major changes on the system. The specific requirements of the main prey, *Phallocryptus (Branchinella) spinosus*, are hardly described in the literature, and only some information is found at Mura (1987).

Common Shelduck *Tadorna tadorna*	
Population	 The species is mostly found in winter and during spring migration at the site, with concentrations of up to several hundreds of birds (and maximum of 1200, Hellicar et al. 2014). The monthly surveys carried out by BirdLife Cyprus show a high variability in the number of wintering and spring migrants recorded each year, but the concentrations that were once detected are certainly much rarer during the last years, which seems to indicate some change, yet the population trend is still uncertain. In Europe, the species has increased importantly in distribution range and population size, also at the SE population around the Black Sea, which might be the main source of the individuals observed in Cyprus (Keller et al. 2020; Flint & Richardson 2024). Nonetheless, the species seems to be less common nowadays at Akrotiri, and that might reflect either a local change (less attractive for Shelducks) or a change of migration of the species. Indeed, Common Shelducks have a rather complex movement pattern, which a marked period of moult-migration, which means that they perform specific movements to important moulting sites, that also have an effect on the final wintering area (Cimiotti et al. 2023).
Habitat requirements and local patterns	Common Shelducks forage mostly on benthic invertebrates, wading in shallow water or wet mud (Cramp 1977). During winter they are mostly found in intertidal areas (or salt lakes), where higher biomass of benthic food can be found, especially in relation to warmer temperatures (Cimiotti et al. 2023). Local changes on habitat might alter the amount of food and the occurrence of the species (Meininger & Snoek 1992), but more research should be done in the area in order to see if a local effect might be the main reason for the apparent population change. At the Akrotiri Peninsula, the species is mostly observed at the Salt Lake, but also at the Lady's Mile Pools, and in much smaller numbers at the Merras area. As mentioned earlier, the complex movements of the species might have also altered the occurrence of the species south to Cyprus, and thus is reflected in local counts. In that regard, moulting sites from the likely source of the birds in the area (the SE European population) might have been slightly changed due to habitat loss or human disturbance (Meininger & Snoek 1992, Meng et al. 2020).

Little Bittern *Ixobrychus minutus*	
Population	 Widely distributed worldwide, Little Bitterns are found in most of Europe occupying different types of wetlands, mostly with good reedbed coverage (or mixed with other marsh plants) (Keller et al. 2020). The species is also mostly migratory (to Sahelian Africa), migrating on a wide front. There are no clear data on the species trends in Europe, yet a decline was reported during the late 1990s, and a slight apparent increase afterwards (Keller et al. 2020). The species is an occasional breeder in Cyprus, with breeding confirmed at Akrotiri Marsh in 2004 and recorded as potentially breeding at the site in several years since. The species remains quite secretive during the breeding period, making it a tricky species to monitor.

Habitat requirements and local patterns	A reedbed specialist, found mostly in *Phragmites* but also on *Typha* sp. coverage, and eventually on areas with more bushes (Keller et al. 2020). Its diet includes a variety of invertebrates and small vertebrates that finds inside or at the edge of the reedbeds (Cramp 1977). The species is a common passage migrant in Cyprus, but the regular oversummering individuals at good habitat areas (large reedbeds) suggests that the species might or could be established as a breeder.

Little Egret *Egretta garzetta*	
Population	Widely distributed worldwide, in Europe it has shown a notable increase in distributional range to the north-west, but also towards the east. In contrast, the population numbers seem to be in decline (Keller et al. 2020). Global warming has been listed as one of the main reasons behind the distribution changes. In Cyprus, the species is listed as a common passage migrant and occasional breeder, with a recent apparent increase of wintering and breeding individuals. 
Habitat requirements and local patterns	Prefers shallow lakes, pools and lagoons, but also rivers or streams, from the coast to inland areas, and usually nests in trees or bushes (generally in heronries). The diet is formed mostly by small fish and amphibians, but also insect larvae, crustaceans, and other invertebrates or small vertebrates (Cramp 1977). The increase of individuals observed at Akrotiri Peninsula might also reflect an increase in breeding individuals, or at least secure the establishment of the species in the area during the whole year. That might be particularly significant, given the aforementioned population declines reported on a European level.

Squacco Heron *Ardeola ralloides*	
Population	The species is found in wetlands around the Mediterranean, the Black Sea and the Caspian Sea (mostly along the Danube and the N part of the Black Sea), and the population remains mostly stable yet with slight increases on the west and slight declines on the east (Keller et al. 2020). One of the factors that directly benefits the species is the increase of rice cultivation in some areas, while wetland destruction is one of the main reasons for declines. The species migrates to Africa, and the conditions on the wintering grounds might be another limiting factor for the European population (Fasola & Alieri 1992). 
Habitat requirements and local patterns	Prefers shallow lakes, pools and lagoons, usually with a good coverage of helophytic vegetation. In that regard, rice fields are a very suitable habitat for the species, but this habitat type is lacking in Cyprus. For nesting, it usually joins interspecific heronries in trees or bushes, but might also nets in reedbeds (Cramp 1977). The diet is formed mostly by prey smaller than 10 cm, such as small fish, amphibians, crustaceans and several other invertebrates captured in or close to the water (Cramp 1977). The species has been recorded to breed at least once and have the potential to become regular breeder.

Glossy Ibis *Plegadis falcinellus*	
Population	The Glossy Ibis is a widely distributed species around the globe, and in Europe it has an increasing trend in population and distribution range (Keller et al. 2020). The increase has been increasing in rate during the last decades, particularly in SW and SE Europe, mostly Greece and Bulgaria, though in Turkey the population is reported to be declining (Rodríguez 2019, Keller et al. 2020). In Cyprus, the species has been reported as a recent coloniser at the eastern part of the island, and the increase of oversummering individuals at Akrotiri might also result in its establishment as a breeding species locally. 
Habitat requirements and local patterns	Forages on several invertebrates, usually in the water in shallow wetlands, but also sometimes on land near water (Cramp 1977). They forming colonies, sometimes associated to herons, heronries in trees or bushes to nests in the middle of reedbeds (Rodriguez 2019). The increase in oversummering individuals, together with the presence of suitable habitat, could result in a new breeding species for the area in the coming years.

Demoiselle Crane *Anthropoides virgo*	
Population	The Demoiselle Crane is well distributed in Central Asia, from the N Black Sea (Ukraine and SW Russia) to NE China, with an isolated population in E Turkey, and winters mostly in India and E Sub-Saharan Africa (in the latter, only birds from the western population) (Billermann et al. 2024). 
Importance of the migration site	The westernmost populations, which migrate to Africa, are the ones that migrate over Cyprus regularly. Such populations are declining (Billermann et al. 2024), and thus, important migration stopover sites are particularly relevant. Akrotiri is a regular site for the migration of the species. The number of birds recorded in the area is variable, and the autumn passage (late August – early September) is much more regular than the spring passage. Flint & Richardson (2024) give a mean (2010-2021) island-wide autumn total of birds see by day (so excluding night-time passage) of c. 530. Also, they state "The decline matches the long-term decline in the distribution and size of the population in S Ukraine, which now numbers just 200-250 pairs with a post-breeding total, including juveniles, immature and non-breeding adults, of c.2000 birds". Thus, the observed passage across Cyprus, and with a local importance of Akrotiri, might be indicative for the entire westernmost population.

2.1.2 Individual Sites within the Akrotiri Peninsula

Akrotiri Salt Lake

Akrotiri Salt Lake has an area of around 10km^2 and is located at an altitude where the deepest part of the lake is at around -2.5m below mean sea level. The lake was formerly connected with the sea, with the wetlands on the northern boundaries, from Zakaki Marsh in the east to Akrotiri Marsh in the west, remnants of an extensive marshy area that was drained to control mosquitos, and reclaimed for agricultural purposes by opening surface water channels towards the lake. A plantation mainly consisting of Eucalyptus was planted in order to maintain the groundwater at relatively low levels.

The term 'Salt Lake' is technically incorrect, as this is a term which mostly refers to salt lakes in dry, inland, closed watersheds. The characteristics of Akrotiri, such as its proximity and interaction with the sea, the dynamic sedimentary processes, the freshwater inflows and salinity gradients observed, and the historical background of interconnection to the sea and alluvial depositions mostly from the Kouris and Garyllis rivers, reveals the transitional character of the wetland as a coastal lagoon. It has been declared as a coastal lagoon under the EU Habitats Directive. However, common usage has it as Akrotiri Salt Lake.

The Fairy Shrimp *Phallocryptus (Branchinella) spinosus* forms a key part of the Salt Lake ecosystem, starting from the nutrient cycle (e.g. carcasses and faecal material) sustaining the primary production, and its contribution in the food chain by grazing phytoplankton and as prey for waterfowl, aquatic insects and possibly fish. It is poorly adapted to fend off predation from fish or aquatic insect larvae, particularly when the salinity is not high. The Killifish *Aphanius fasciatus* is already present in the aquatic environments around the Salt Lake and occasionally can be observed in the main body of the lake. The Killifish is an active predator of aquatic invertebrates, has a high tolerance to salinity variations from fresh to hyper saline water and is suspected to be resistant to drought.

The main input of water to the Salt Lake is from direct rainfall, and at a lesser extent from groundwater seepage from Akrotiri Aquifer through the eucalyptus forest at the north of the Lake, inflows from Zakaki and Akrotiri Marsh, as well as small quantities from surface runoff from Akrotiri Village. Outflows from the Lake are attributed only to the losses by evaporation. These are presented in more detail in section 2.2.

Lady's Mile Beach and Pools

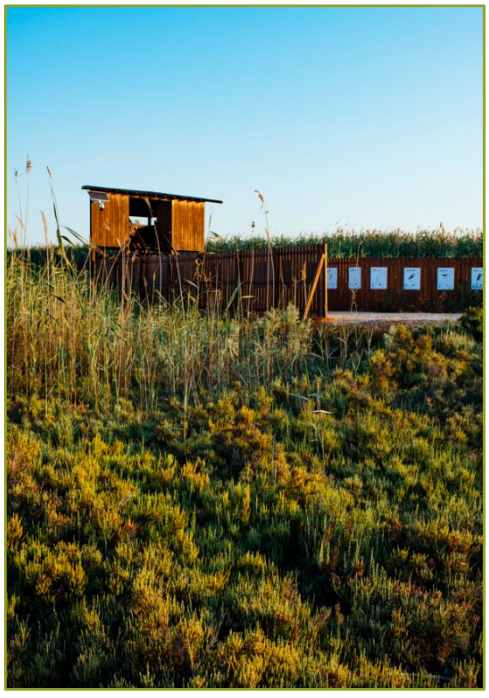
This is an area of sandy beach, sandflats, coastal dunes, salt lagoons and mud flats on either side of the dirt road that heads south along the eastern side of the Salt Lake. The lagoons are natural depressions that seasonally fill from natural inundation as water levels rise. The low sandy dunes can break during storms and provide irregular saline inflows into the shallow pools and to the adjacent Salt Lake. Lady's Mile was open in the middle ages, functioning as a lagoonal spit. Sand spit development on the east side of Akrotiri gradually closed off the opening to the sea, thereby closing the lagoon. The area continues to change as tourist development spreads and brings a range of threats to the habitats.

The dunes support a number of specific plant communities and include scarce plants such as Cottonweed. Lady's Mile Pools is one of the most important breeding sites for Kentish Plover across Cyprus and are usually present all year. Large flocks of gulls are present in the winter, mainly Black-headed but also Armenian, Caspian, and Yellow-legged as well as *fuscus* and *heuglini* races of Lesser Black-backed Gull. Greater flamingo can feed here, and when the water levels are right in the spring, feeding migrant waders such as Curlew Sandpiper, Ruff, Little Stint, Little Ringed Plover, Temminck's Stint and Black-winged stilt occur. Wheatears feed in the sand dunes when on migration, and shrikes, pipits and larks use the bushes inland from the salt flats.

Sea turtles nest on the shorelines, but during the last years there have been many failed nesting attempts, due to recreational pressures on Lady's Mile beach.

Zakaki Marsh (or Lake Makria)

Zakaki Marsh is a small marshy area located west of Limassol port, and to the north-east of the Salt Lake. It is a remnant of a once much larger wetland that was dominated by salt marshes. A formerly brackish-saline waterbody dominates the marsh area. The area was noted for breeding Ferruginous Duck and Black-winged Stilt, but also supports large numbers of migrant and wintering birds. It was particularly important for a population of the Killifish *Aphanius fasciatus*. A total of 17 species of dragonfly were recorded in 2017, but the spread of reeds during the last couple of decades is contributing in the declining of the above species in the marsh.



The lake has an extent of 15.500 m^2 at top water level, but currently has little or no open water due to overgrowth of Common Reed. The marsh was formerly completely open with brackish pools, but in the last 20 years there has been a significant increase in reed growth, now covering the entire site with most of the open water covered. Whilst the surrounding areas still support brackish habitats, and Black-winged Stilts still breed, the lake itself now supports Reed and Moustached Warblers, crakes and roosting Night Herons.

Recent management, primarily reed cutting has maintained some open areas in front of a raised birdwatching hide. However, the vigour of the reed means that the open areas remain only until the next growing season as the reed recovers (i.e. couple of months after clearing). A more intensive removal of reed rhizome and pool deepening would be needed for a longer-term change.

The major change in the ecology of the lake from open brackish to reed-dominated freshwater, came about primarily after the construction of stormwater drainage systems (between 2003-2008) that discharge into the lake, but also, due to additional groundwater (freshwater) inflows into the lake, as irrigated citrus groves to the north of the lake are replaced with urban development. The shift in the basic hydrology of the marsh/lake from saline to freshwater, with increased levels of nutrients, has promoted the growth of reed and resulted in the deterioration of designated SPA habitat and probably the loss of the Killifish. The increased inflow of fresh water with more nutrients, favours the increase and the dominance of reeds. Reeds, however, also play a role in water purification and filtering that is important in improving the quality of the water flowing into the Akrotiri Salt Lake.

In the frame of the Darwin DPLUS141 project (2021-2024)[5] actions took place aiming to understand the hydrological regime of the marsh, both quantitative and qualitative and according to that and the ecological needs of the site, to propose management solutions. This was achieved by a) a comprehensive hydrological study that identified the hydrological regime of Zakaki Marsh, b) ecological assessment and proposal of management options with habitat restoration as a target, with the needs of target species as a key indicator, and with key stakeholders' engagement throughout the process. These resulted in an agreed plan of action, ready to be implemented. At the same time, annual reed clearances took place and monthly bird counts have taken place to monitor the priority species and other birds using the wetland.

Based on the hydrological study of the lake, the stormwater inflow into the Makria Lake is more than 95% of the total annual inflow of the lake, with a water quality that is related to an urban environment, and ~3% of the total annual inflow is attributed to the direct rainfall and less than 1% is attributed to the groundwater seepage. Furthermore, the Makria Lake can retain less than 5% of the volume of water that inflows to it, as the remaining volume of water is overflowing towards the Akrotiri Salt Lake. The estimated amount that overflows towards the Akrotiri Salt Lake is about 500,000 to 800,000 m^3 per year.

The agreed project recommendations for habitat management aim to create small habitats within the marsh that are a) suitable for key species (i.e. swallow and deeper pools, excavation of reed rhizomes), b) more sustainable in terms of maintenance and c) at the same time maintain reeds that filter the water that ends up in Akrotiri main Salt Lake and d) improve the birdwatching experience. This entails:

- Mechanical uprooting of reeds will take place in the area in front of the existing bird hide which is expected to reduce reed reappearance for ~2-3 years. This area will be ~45 m long and ~25 m wide. The roots of the reeds reach about half a meter below the ground.
- Additionally, a deeper lake will be excavated in the edge of the above area, with a depth of 3 m and a diameter of ~20 m. Excavating a deeper pool ~3 m that has proven that prevents the reappearance of reeds for more than 5 years.

[5] *BirdLife Cyprus, Terra Cypria, SBAA ED, RSPB (2021-2024) DPLUS141 «Habitat Restoration and Wise Use for Akrotiri and Cape Pyla».*

Akrotiri Marsh (or Fasouri Marsh)

Akrotiri Marsh is the only remaining lowland wet grassland in Cyprus, covering an area of ~150 hectares (1.5 km^2). It is dominated by a large reedbed and surrounding wet meadows and it is an important breeding site for birds, resting and wintering site for migratory birds and also important for its flora, hosting rare and threatened plant species

It supports significant endangered plant species included in the Red Data Book of the Flora of Cyprus. Some of these are: Soft stem bulrush *Schoenoplectus tabernaemontani*, Water mint *Mentha aquatica*, Hairy Spurge *Euphorbia hirsuta*, Saltmarsh morning glory *Ipomoea sagittata*.

A total of 76 bird Species of European Conservation Concern (SPECs) and 64 bird species/subspecies listed in Annex I of the EU Birds Directive, (34 species are both SPEC and Annex I species) have been recorded at the site. Black-winged Stilt, Spur-winged Lapwing and Ferruginous Duck (4-5 pairs) breed at Akrotiri Marsh. Ferruginous Duck is a very rare breeding bird in Cyprus with Akrotiri Marsh being amongst the best breeding sites. Other important breeding birds are Black Francolin *Francolinus francolinus* (3-4 pairs) and Little Bittern *Ixobrychus minutus* (six recorded in survey in 2015). Also, of note are the Common Reed-warbler *Acrocephalus scirpaceus* and the (Black-headed) Western Yellow Wagtail *Motacilla flava feldegg* which breed only at a few sites in Cyprus. In addition, a further 60 Annex I species and 68 SPEC species visit during migration and there are a further 87 non-Annex I species that visit in spring autumn or winter and 76 non-SPECs (of which 23 are on Annex I, so 53 non-SPEC non-Annex I). In total, about 200 species have been recorded. A total of 16 species of dragonfly recorded, including Black Percher *Diplocodes lefebvrii*, one of the few locations for this species.

The whole of Akrotiri Marsh is Crown Forest land, which is subject to Akrotiri villagers' rights to exploit natural resources. Traditionally, the site had been used by the locals of the nearby Akrotiri village for grazing by the Cyprus cattle breed and for collection of raw material for basketry. In the last couple of decades, changes in nearby land uses resulted in changes in the hydrological regime of the site. Additionally, on-site grazing had been in decline and in combination with hydrological changes, led to the rapid over-expansion of reeds, resulting in biodiversity degradation on site. From 2015 to 2017, the Darwin Plus project "Akrotiri Marsh Restoration: a flagship wetland in the Cyprus SBAs"[6] took place in order to enhance the biodiversity richness of the wetland, by restoring Akrotiri Marsh to a mosaic of habitats, similar to the state it was in some decades ago.





[6] *BirdLife Cyprus, Akrotiri Environmental Education Centre, Royal Society for the Protection of Birds (2015-2017). DPLUS034 Project: Akrotiri Marsh Restoration: a flagship wetland in the Cyprus SBAs*

Additionally, from 2021 to 2024, in the framework of the Darwin Plus 141 project "Habitat Restoration & Wise Use for Akrotiri & Cape Pyla"[5], actions took place to promote the economic viability of conservation grazing, conserve important plant species and increase public awareness.

In the frame of the above two Darwin Plus projects (2015 – 2023) the following **restoration, conservation and awareness raising actions** took place:

- Grazing as the main long-term conservation tool

Grazing had been a traditional activity at Akrotiri Marsh, with the site grazed by Cyprus cattle, a traditional breed that gets subsidised for its preservation. Livestock grazing is an effective and sustainable tool for reed management. Cattle can limit reed expansion by grazing and can damage the reed's rhizome by trampling. Before 2015, those who still had grazing animals on site were very few and cattle were tethered. To maximize cattle grazing effectiveness, the Darwin Plus project (2015-2017) built cattle sheds with feeding and water stations and funded locals to purchase cattle. Additionally, the site was fenced to allow free-range grazing and control visitor access to reduce disturbance. A marketing plan for the wildlife-friendly Akrotiri Marsh beef was elaborated (under Darwin Plus project, 2021-2024) to further contribute to the economic viability of graziers.

- Restoration works

Additionally, through mechanical reed cutting and creation of pools (during 2015-2017), suitable habitat was created for key bird species, such as Ferruginous Duck. At the same time, key drainage channels were restored and water level control structures were installed to facilitate water management of the site. However, these structures have been vandalised and no longer exist on site.

- In situ and ex situ conservation of rare plants

Through systematic vegetation surveys (2021 to 2024), rare plant species are identified and monitored. Suitable areas were fenced for planting target plant species, promoting managed grazing and supporting and enhancing existing plant population. At the same time, seeds were collected and stored in the Agricultural Research Institute National Seed Bank and also used for growing and planting in situ and ex situ.

- Awareness Raising

Birdwatching hides were constructed and information signs and road signs were placed at key points.

Public awareness events and actions, such as workshops, festivals, a dedicated website for visitors, etc. were organised and set up to promote this unique wetland as a wildlife friendly destination.

- Basketry

One of the oldest handicrafts, whose practice has been fading away in the last decades due to non-profitability, was promoted through funding training lessons. The plants that make up the raw material for basketry are confined mainly to Akrotiri Marsh and the need for raw material contributes to its conservation.



All the above resulted in:

Creation of a mosaic of habitats & biodiversity increase

- The support for conservation grazing resulted in an increase in the number of native Cyprus cattle grazing on site --> 2015: 28 cattle, 2017: 87 cattle and 2022: 145 cattle
- A total area of 0.38 ha (38 000 m^2) of reed was cleared due to a combination of reed cutting and cattle grazing, resulting in an increase in grazing area from 13 ha at the start of the Darwin Plus project (2015) to 18 ha at the end of the project (2017).
- The following years, the grazing area further increased to 27 ha (2023) due to cattle grazing clearing the dense reeds, creating open spaces and promoting habitat diversity.
- The number of wader species using the site has increased noticeably, including an increase in Spur-winged Lapwings, a key local species.

Plant conservation

- Through targeted conservation actions, the population of rare plant species within the marsh increased within the range of 25-50%, depending on the species.
- More than 7000 seeds of rare plant species in the marsh were deposited in a seed bank.
- Ex-situ conservation sites have been planted with the targeted rare plants to further promote their conservation.

Public Awareness

- Akrotiri Marsh is increasingly recognized and perceived by the public as a unique and important wetland, where visitors come from Cyprus and abroad to birdwatch, admire the landscape and experience one of the few areas in Cyprus where cattle graze freely.
- The Akrotiri Spring Festival was launched in 2023 for the first time with great success, attracting hundreds of visitors, aimed to become an annual event.

The **remaining challenges** for the site are:

- Need for an updated and agreed management scheme for the area - On 2023, the SBAA Environment Department initiated the procedure to formulate Akrotiri Marsh Management Committee with clear roles and responsibilities by inviting all stakeholders to discuss the management needs and the involvement of the different stakeholders. This is a very positive step towards sustainable management of the marsh.
- Ongoing management - More support for ongoing management actions, such as water management, adaptive grazing regime according to conservation targets, ongoing monitoring, maintenance of existing infrastructures.
- Further needs for conservation, restoration and management actions - Important plant species conservation, maintenance of open pools/ lakes for birds, etc.
- Further needs for promotion and upgrade of the site for ecotourism purposes

The Marsh is fed by rain water from a catchment of mainly agricultural land to its north and west. It is also hydraulically connected to the Akrotiri aquifer. The Marsh drains southward towards Akrotiri Salt Lake.

Merras area (or Gravel Pits)

Merras area - to the west of the main Salt Lake, south and west of Akrotiri Marsh - contain salt flats, shingle coast, sand dunes, small pools and scrub. Backed by a cobble barrier beach this is a large area dominated by salt marshes, salt steppe, and several pools. In winter, the marshes are usually flooded. Flooding occurs due to rainwater run-off and especially from seawater surges during storms.

About a dozen very small and three large gravel pit pools, created by past quarrying in the area now form permanent saline lagoons. Three of these (known as Ai Yorkis Pond, Navagio Pond and Paraga Pond) are >2 metres deep and are of high significance as refuges for Killifish, since they maintain brackish-to-saline water throughout the year and act as refugia, even in periods of drought.

As with other areas, these wetlands can support large numbers of migrant birds in peak passage periods, from waders around the pools to migrant passerines in the bushes and low scrub. Typical plants in the lagoons include Beaked Tasselweed and various stoneworts.

Bishop's Pool

Located next to Agios Nicolaos of Cats Monastery and set amongst plantations, Bishop's Pool is a man-made reservoir constructed for irrigation purposes and has a capacity of around 150,000 m^3. It is supplied with water from Limassol via the Yermasoyia – Polemidhia Irrigation Project, and takes surplus treated effluent from the Akrotiri sewage treatment works. Water is pumped from the reservoir to the plantations within the adjacent farmland. However, in recent years, less water has been pumped due to supply of tertiary treated water for irrigation through a governmental pipe and direct irrigation from boreholes. This has resulted in increasing nutrient levels within Bishop's Pool and signs of eutrophication during the summer months.

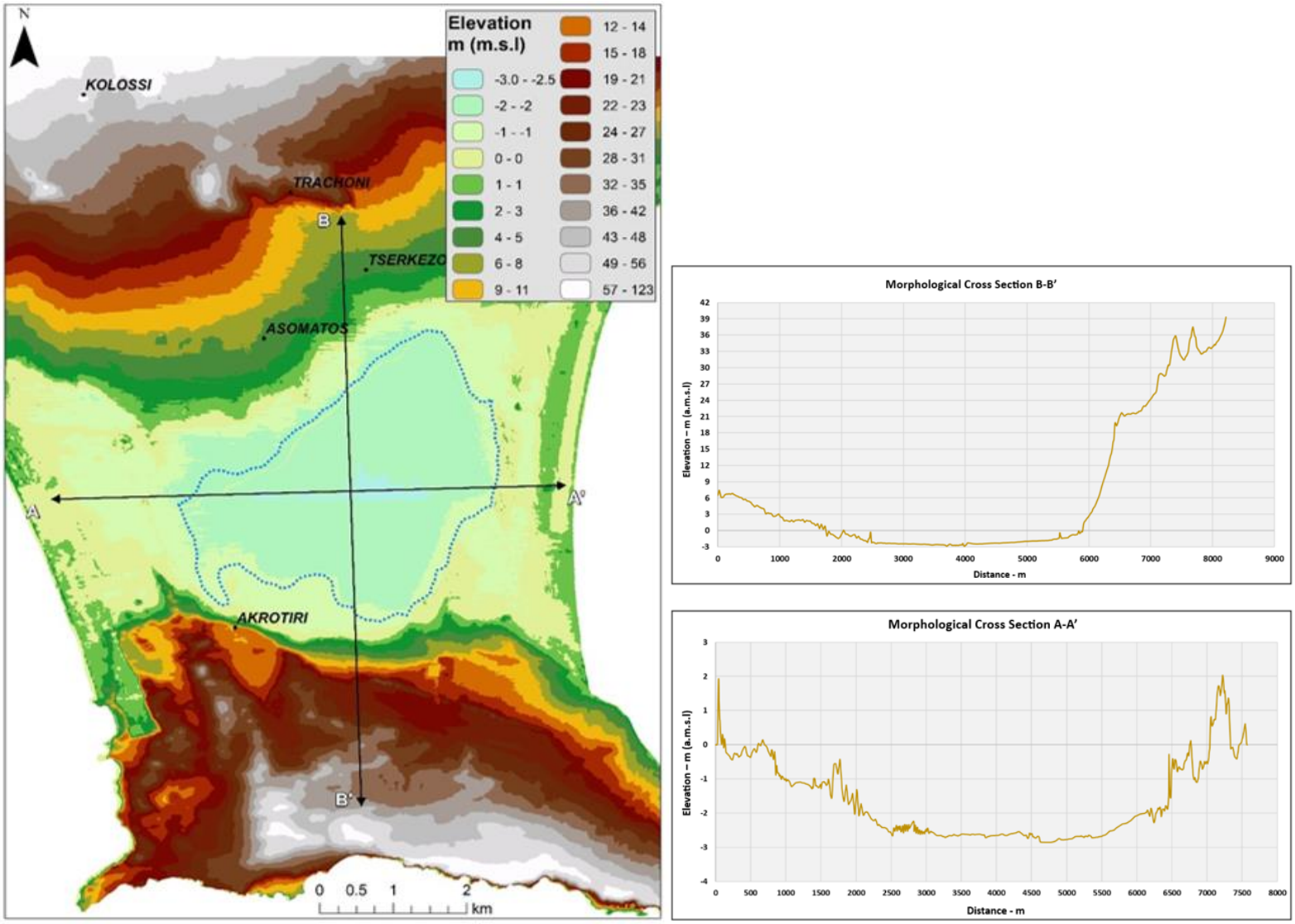
The tree-lined pool, with areas of emergent aquatic vegetation, is an important refuge for waterbirds, notably Ferruginous Duck, and migrants. Issues with botulism, a toxic poisoning caused by growth of a harmful bacterium, have been recorded in the past, notably in 2017 and 2023, and may be increasing as nutrient levels rise.

2.2 Hydrology

For the purposes of this project, I.A.CO Environmental and Water Consultants Ltd prepared an overview of the water balance and operation of the Akrotiri Salt Lake[7], taking into consideration available relevant hydrological studies and reports that have been elaborated for the area during the last years. This section on hydrology is based on this report overview.

2.2.1 Topography

Akrotiri Salt Lake, with an area of 10km^2, is located at an altitude below the average sea level with the deepest part of the bottom at -2.5m m.s.l. Map 2.2 is a morphological map of the Lake with topographical sections.



Map 2.2: Morphological Map of the wider area of the Lake with topographical sections from west to east (AA') and from north to south (BB')[7]

[7] *I.A.CO Environmental and Water Consultants Ltd (2023). Overview of the Water Balance and Operation of the Akrotiri Salt Lake.*

2.2.2 Changing hydrological conditions

The hydrological conditions of the aquifer have undergone significant changes in recent years due to the changing water resource management strategies and policies, such as:

- The construction of the Kouris dam in 1988 of 115Mm^3 capacity, effectively blocking the main recharge of the Akrotiri aquifer.
- The complete cessation, due to the Kouris dam, of water diversions for irrigation purposes, on the basis of water rights from Kouris river.
- The import of tertiary treated sewage water in 1999 for irrigation purposes in the wider area, replacing groundwater extraction from local boreholes.
- Recent plans for residential developments in the area of the "Tserkez Tsiflik" and abandoning cultivation of the same area which has reduced groundwater abstraction along the northern boundary of the Lake.

For more detail, please refer to section 2.4.1 – Trends in Hydrology.

2.2.3 Inflow Sources to the Lake

Map 2.3 shows the catchment areas of all inflows to the Salt Lake, which are the following:

- **Direct rainfall to the Lake**

The estimated extent of the Lake area, including a small catchment around the Akrotiri village in the southwest of the Lake, is of the order of 10km^2. All the rainfall falling on this area ends up directly or as runoff to the Lake and it is abstracted solely by evaporation.

- **Inflows from Akrotiri Marsh (or Fasouri Marsh) at the NW of the Lake**

The aquifer to the northwest of the Lake, discharges significant quantities to the Lake through the Akrotiri marsh, which has an area of about 1,3km^2, most of which is covered by water in winter and the rest is covered by reed beds and a typical wetland and grassland vegetation. This discharge is coming from surface runoff from a catchment area of agricultural land of 3,2km^2 and through groundwater seepage which is controlled by the hydraulic gradient at the time. At high water-table “rising or welling up”, water appears. All these quantities are subjected to evaporation before discharge to the Lake.

- **Inflows from Akrotiri aquifer through Eucalyptus forest at the N of the Lake**

The aquifer to the north of the Lake discharges significant quantities to the Lake through the eucalypt forest along its northern boundary. This discharge through the subsurface, is controlled by the groundwater hydraulic gradient at the time. The “rising or welling up” water discharges to the Lake through the surface. The Forest, along the northern boundary of the Lake, was created in the period of 1940-50 to lower the water-table and keep the area dry to fight malaria.

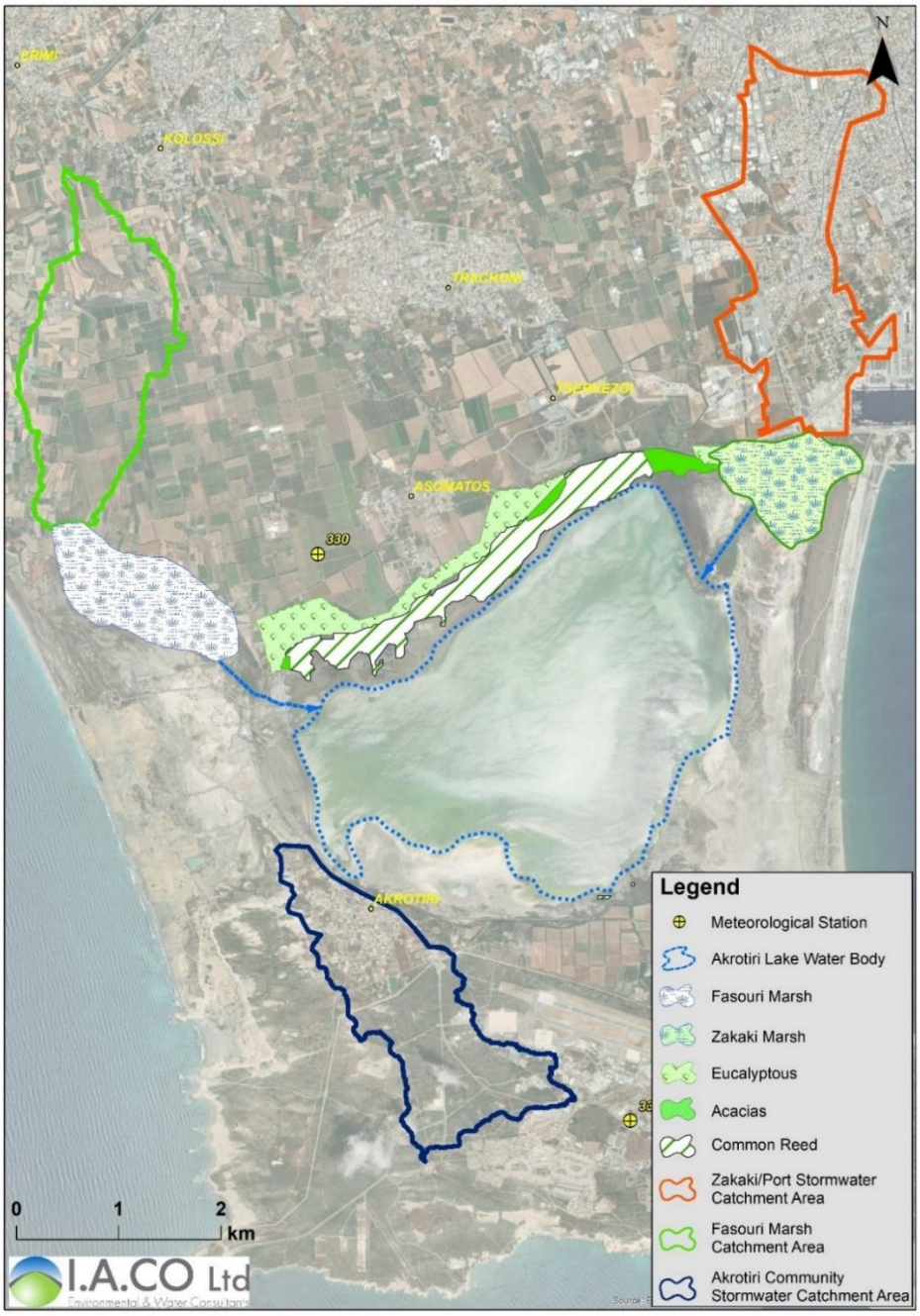
- **Surface runoff from the “Zakaki Marsh” (or Lake Makria) at the NE of the Lake**

The average surface runoff from a 3.8km^2 urban development catchment area is estimated at ~0,6 Mm^3 annually for a mean monthly rainfall condition. The runoff quantities of this catchment area discharge into the Zakaki Marsh (Lake Makria). When the water level in the Makria Lake reaches the elevation of +0,38m (a.m.s.l), and water still inflows into it, then water overflows towards the Akrotiri Salt Lake through an open manmade channel. It is noted that the hydrological regime of the Zakaki Marsh has been changed over the year, mainly

after the construction of a stormwater drainage system (between 2003-2008) that discharges into the Lake. At the present conditions, the stormwater inflow into the Zakaki Marsh is more than 95% of the total annual inflow, with a water quality that is affected by the urban environment. Furthermore, the Makria Lake can retain less than 5% of the volume of water that inflows to it, as the remaining volume of water is overflowing towards the Akrotiri Salt Lake

- **Surface runoff to the Lake from the Akrotiri Village catchment**

Surface runoff from the catchment area (2,7km^2) around the Akrotiri village at the South West of the Lake discharges to the Lake through some 18 outlet hydraulic structures of the stormwater network under the main road of the area.



Map 2.3: Hydrological and hydrogeological regime of the Akrotiri Lake's wider area[7]

2.2.4 Water Balance of the Akrotiri Lake

The estimation of the quantities of the water balance of the Salt Lake is of great importance, because this determines the various volumes of water and their origin and entry to the Lake. The water balance is of particular significance in the evaluation of water quality (salinity, fertilizers, chemicals and other elements such as nitrates, heavy metals, etc.) and their effect on the ecology of the lake.

For these reasons, special importance has been given for the best possible calculation of the balance as this has not been addressed to this extent before, and the new land use developments in the region make this highly necessary.

Outflows from the Lake are attributed only to the losses by evaporation.

On Table 2.1 the overall water balance is presented. Diagram 2.1 presents the percentage of inflow sources contributing to the Salt Lake.

Out of the **mean annual inflow of water to the Lake**, which approximately is of the order of **~7.1Mm^3**,

- → the rainfall falling directly on the Lake area is the 59% or 4.1 Mm^3.
- → the eucalyptus forest at the north of the Lake contributes23% or 1.6 Mm^3.
- → the Zakaki and the Port areas through Zakaki Marsh contribute 8% or 0.6 Mm^3.
- → the Akrotiri Marsh at the NW of the Lake contribute 7%, or 0.51 Mm^3.
- → a small quantity of surface flow originates from surface runoff from Akrotiri Village of ~3% or 0.21 Mm^3.

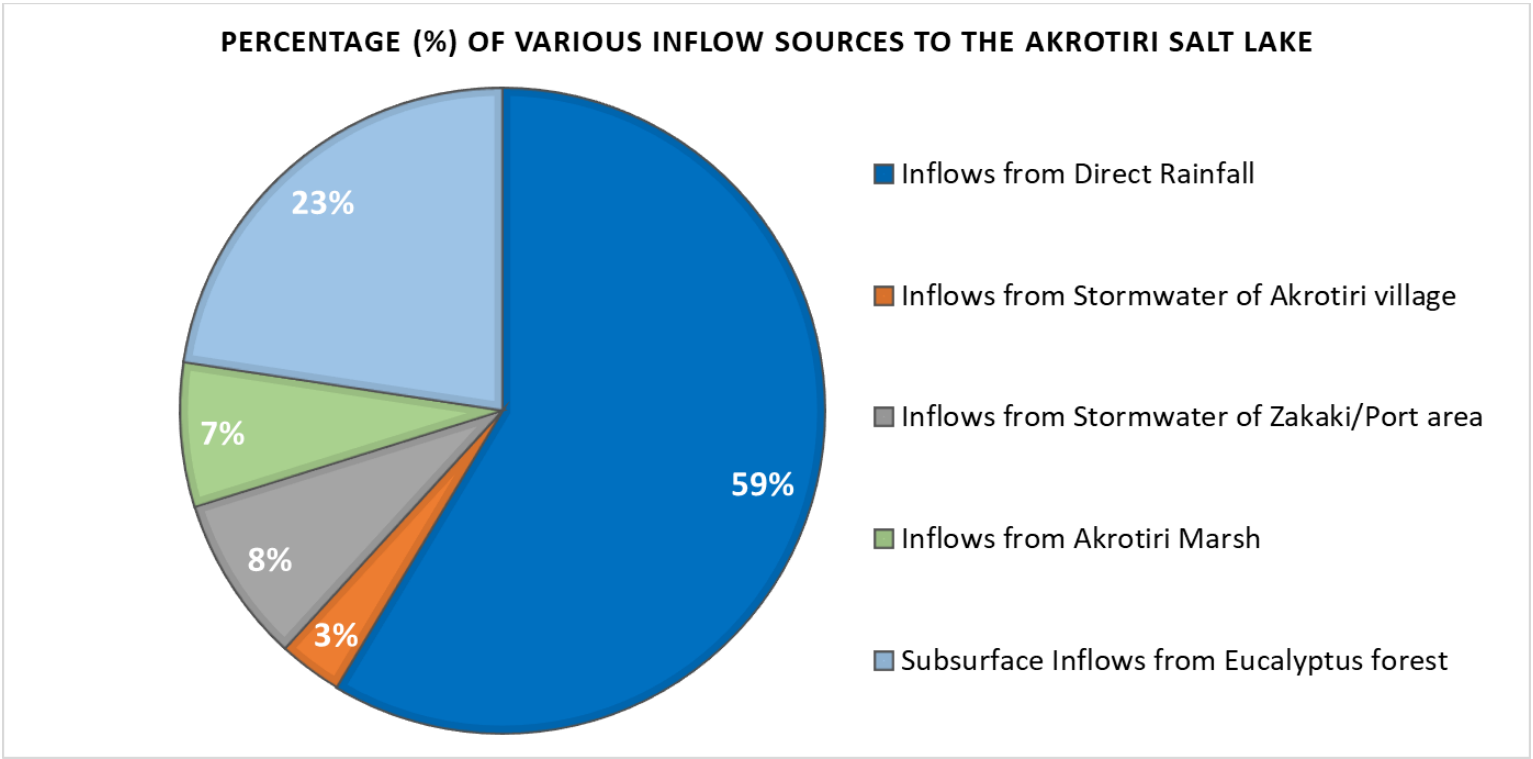


Diagram 2.1: Percentage ratio of inflow sources and volume of water in Lake[7]

Table 2.1: The Akrotiri Salt Lake water balance on the basis of monthly data on the basis of the period 1988-2013[7]

Month	MEAN RAINFALL M.S.330 (mm)	INFLOWS TO THE LAKE BEFORE EVAPORATION (m^3)						EVALUATION OF EVAPORATION (m^3)			AFTER EVAPORATION LOSS (m^3)			MEAN LAKE WATER LEVEL PERIOD 1988-2013 (m-a.s.l)
		DIRECT FROM RAINFALL	SURFACE FLOWS AKROTIRI VILLAGE CATCHMENT	SURFACE FLOWS ZAKAKI & PORT CATCHMENT	FROM AKROTIRI LIVADHI WETLAND	NET FLOW FROM /ZAKAKI	ACCUMULATED VOLUME OF FLOWS	WATER-LEVEL ELEVATION OF ACCUMULATED VOLUME AS PER CURVE (m-m.s.l)	SURFACE AREA ON THE BASIS OF WATER-LEVEL AS PER CURVE (m^2)	LOSSES DUE TO EVAPORATION	VOLUME OF WATER IN LAKE AFTER EVAPORATION (m^3)	WATER LEVEL ELEVATION OF TOTAL VOLUME AS PER CURVE (m-m.s.l)	SURFACE AREA BASED ON WATER LEVEL ELEVATION AS PER CURVE (m^2)	
Oct	21.9	219000	11826	31536	0	0	262362	-2.47	1837244	184533	77829	-2.55	1014127	**-2.4**
Nov	64.3	643000	34722	92592	0	0	848143	-2.26	3978842	257829	590314	-2.35	3129242	**-2.4**
Dec	103.5	1035000	55890	149040	5040	0	1835284	-2.04	6144240	274279	1561005	-2.09	5680309	**-2.1**
Jan	91.6	916000	49464	131904	0	0	2658373	-1.92	7155559	319424	2338949	-1.96	6815836	**-1.8**
Feb	69.8	698000	37692	100512	85104	210000	3470257	-1.82	7838633	395067	3075190	-1.87	7531484	**-1.8**
Mar	35.6	356000	19224	51264	180288	570000	4251966	-1.74	8356061	616677	3635289	-1.80	7956462	**-1.8**
Apr	19.1	191000	10314	27504	242268	820000	4926375	-1.66	8734252	911856	4014519	-1.76	8208972	**-1.8**
May	5.8	58000	3132	8352	0	0	4084003	-1.75	8252826	1151269	2932734	-1.88	7410037	**-2.0**
Jun	0.3	3000	162	432	0	0	2936328	-1.88	7413183	1187592	1748736	-2.06	6006696	**-2.1**
Jul	0	0	0	0	0	0	1748736	-2.06	6006696	1027866	720870	-2.30	3577352	**-2.3**
Aug	0	0	0	0	0	0	720870	-2.30	3577352	578887	141983	-2.52	1306908	**-2.3**
Sep	3.4	34000	1836	4896	0	0	182715	-2.50	1489326	198378	0	-2.58	651443	**-2.4**
	TOTAL	**4,153,000**	**224,262**	**598,032**	**512,700**	**1,600,000**				**7,103,657**				

In Diagram 2.2 the monthly volumes of water stored in the Lake after the losses by evaporation are presented.

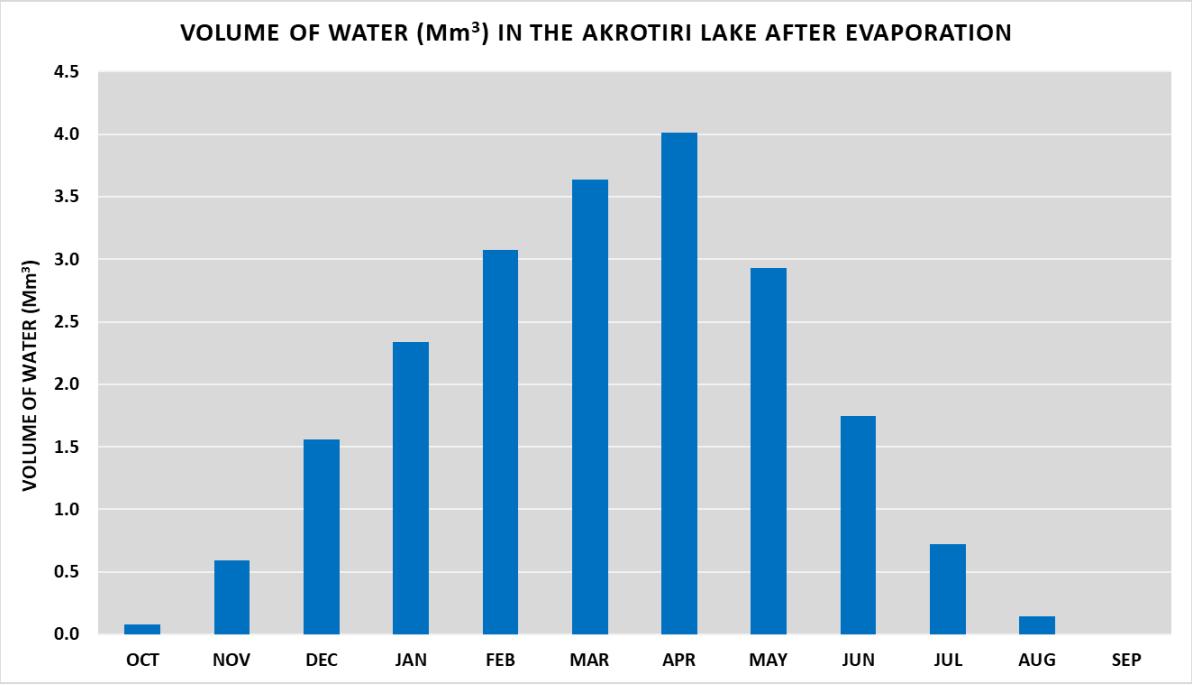


Diagram 2.2: Monthly lake volume fluctuation after losses by evaporation[7]

Diagram 2.3 shows the degree of matching of the simulated mean monthly water level in the Lake resulting from the evaluated sources and quantities of inflow after evaporation to the mean monthly water levels observed over the period of 1988-2013.

The matching agreement is considered particularly good which means that the estimated water inflow quantities and outflow (losses) are of the correct magnitude.

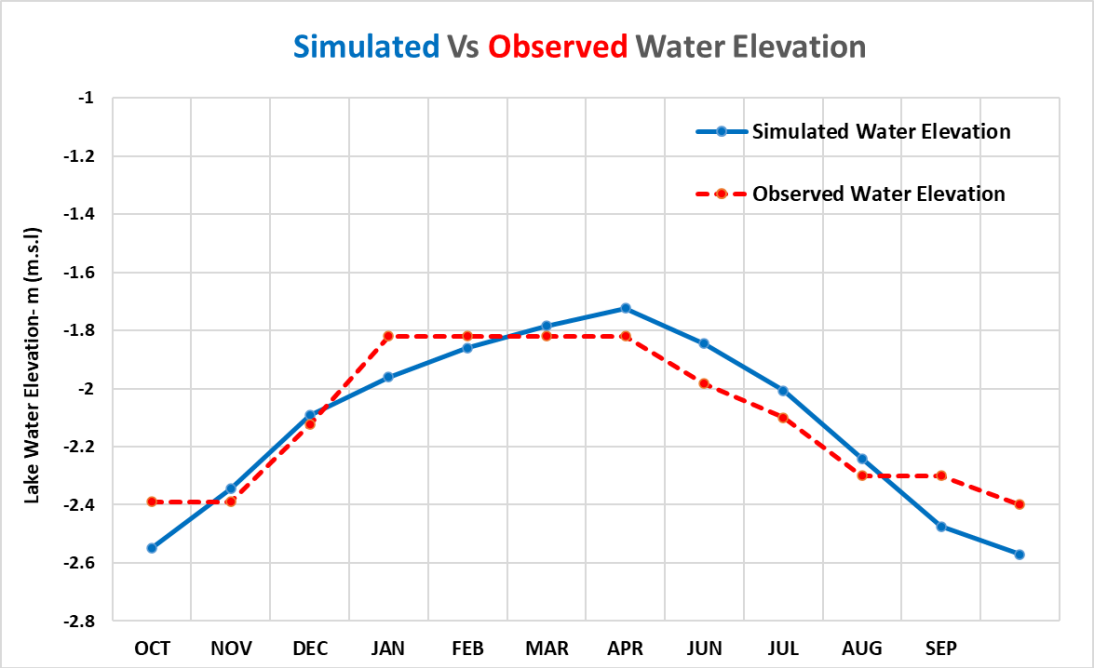
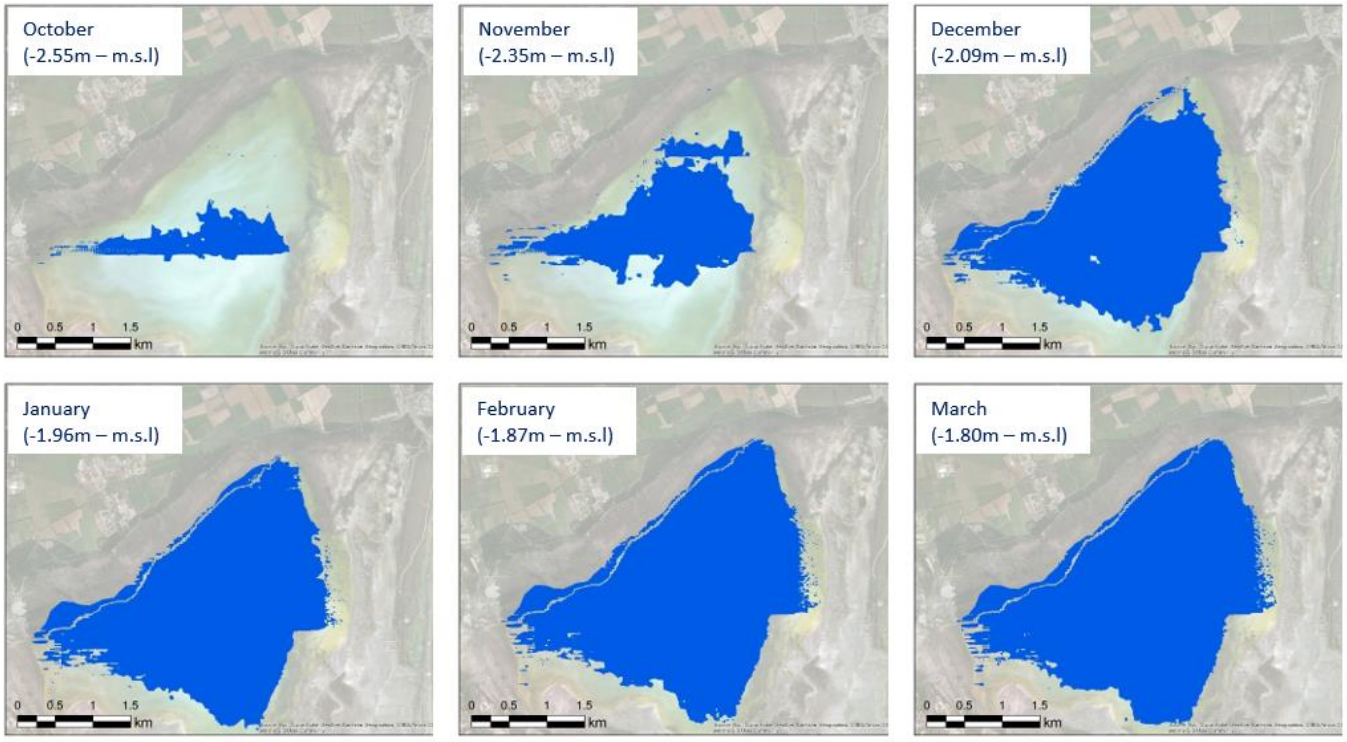


Diagram 2.3: Comparison of the simulated mean monthly water level elevation of the Lake resulting from the water balance evaluation with the mean monthly values observed over the period of 1988 - 2013[7]

Diagram 2.4 shows the monthly inundated surface area under mean conditions as computed in the framework of the mean annual water balance of the Lake for all months of the year.



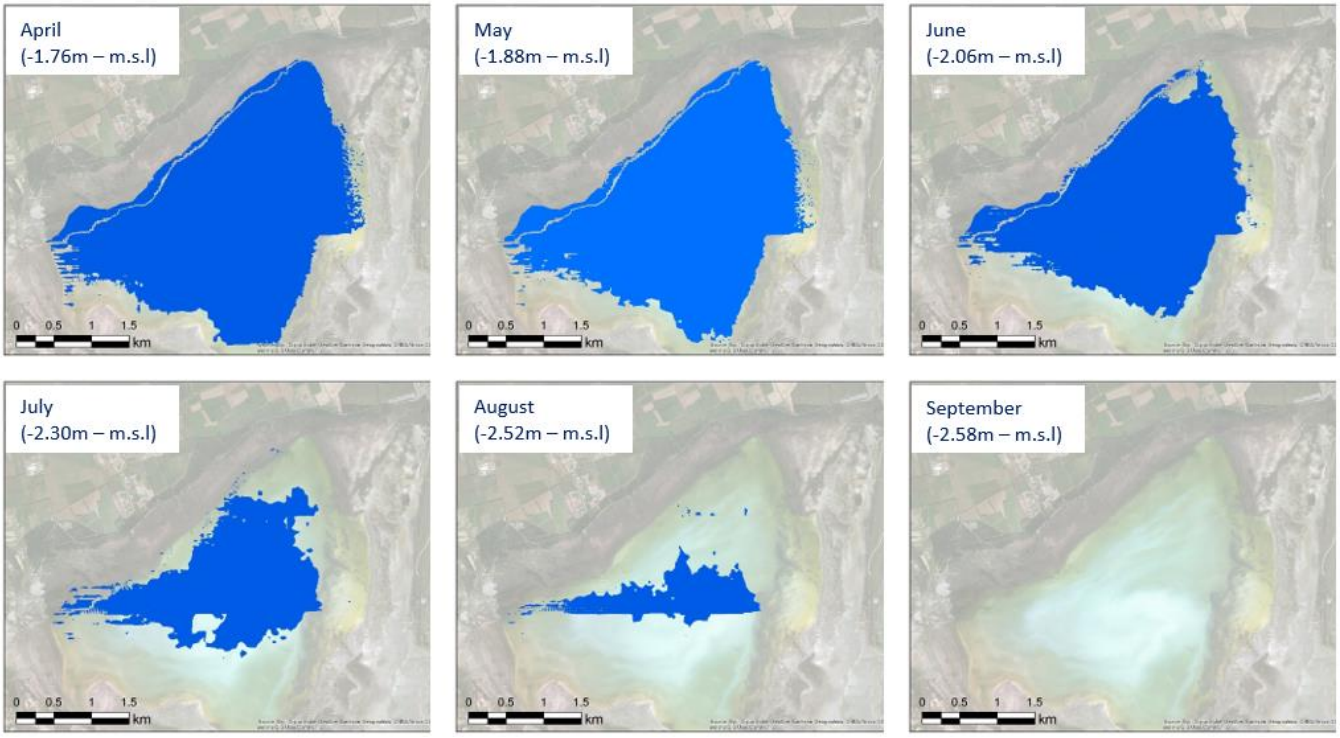


Diagram 2.4: Mean monthly water level configuration of the water surface area of the Akrotiri Salt Lake on the basis of the results of the water balance[7]

2.3 Pressures & Threats

The habitats and species on the Akrotiri Peninsula are adapted to very narrow sets of conditions and are sensitive to a wide range of threats. The following are the most significant.

Development pressure

The continuing development of land to the north of the Salt Lake, expanding from Limassol is a major change the last decade. The key known developments are various building projects to the north of the Salt Lake -at a distance of around 400m- from the north boundary of the Lake, including the Casino Resort, the golf course and villas, and various apartment buildings. These largely replace old citrus plantations, and as well as direct loss of habitat, present real issues with drainage and stormwater run-off and urban source pollutants.

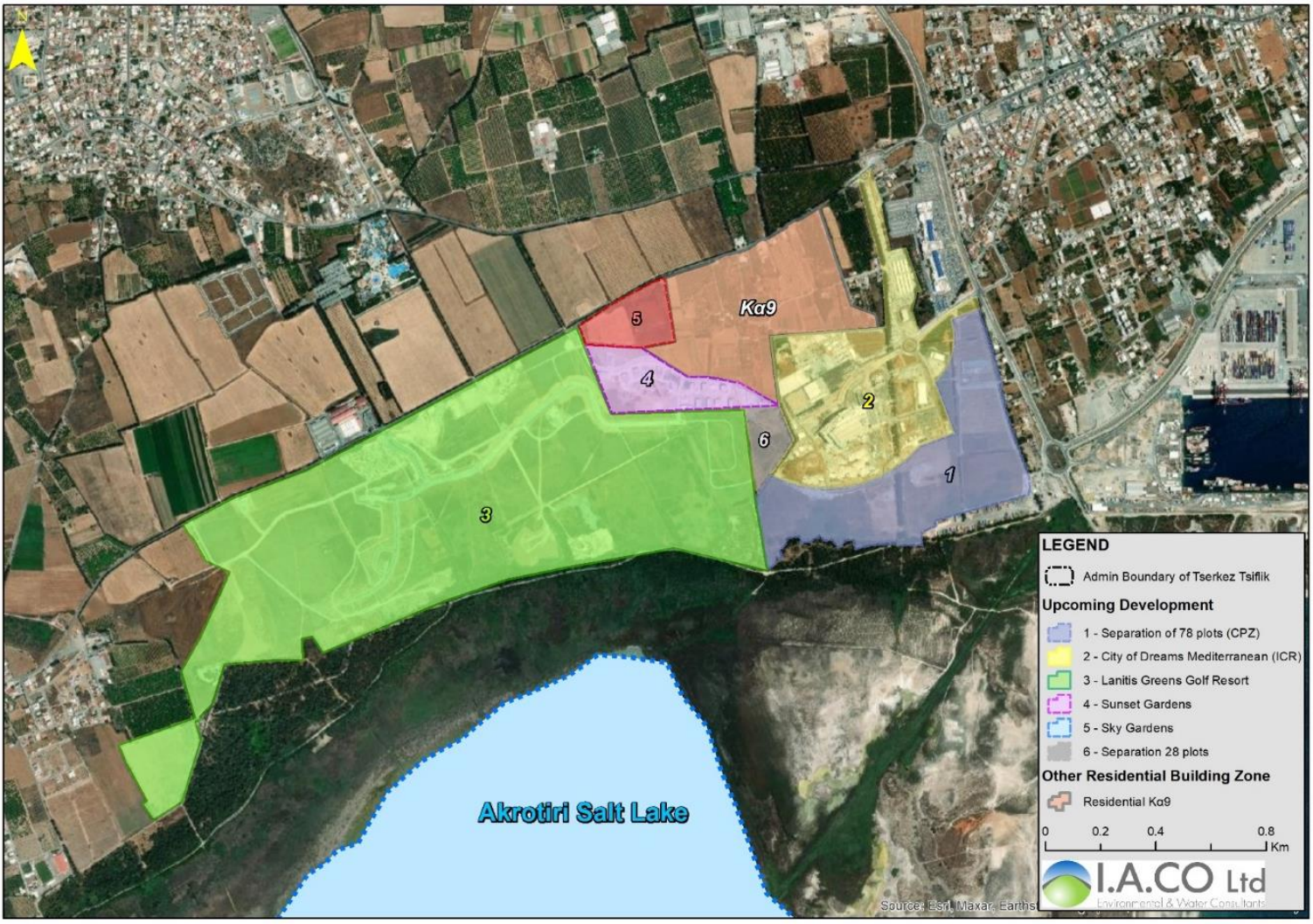
The various developments to the north of the Salt Lake, that are already developed or anticipated to be constructed in the next few years are presented in the following Map 2.4.

Completed developments:

- **The City of Dreams Mediterranean Casino**: An integrated resort including casino, hotel with 500 luxury rooms, restaurants, spa, pool complex, waterpark, etc.
- **Sunset Gardens Developments**: 310 apartments distributed in buildings up to four floors. The development also includes outdoor areas and additional communal facilities.
- **My Mall Limassol**: A commercial shopping facility fully constructed since 2009.

Developments under construction:

- **Lanitis Greens Golf Resort**: A golf course (18 holes), Club House, restaurant, shop, parking areas, pedestrian/ bicycle designated pavement/roads and residential units (500 villas and 250 apartments, at 1st phase) and a water storage facility.
- **78 Plots Zakaki Demarcation** and new road network: An area of 204,650 m^2, includes a road network (including all sidewalks, and the bicycle path and parking areas and green spaces of approximately 50,330 m^2).
- **Sky Gardens**: Two residential towers and 10 Villas**.**
- **Brightbuild Properties Ltd**: Residential development (3 buildings with 6 floors).
- **Walton Tower**: Proposed development that involves the construction of a tower for business (offices) and commercial purposes. The building will be 7 floors, 31 m high and will be consisted of 12 offices and 4 shops.
- **Residential Building Planning zone (Κα9):** Anticipated to be developed by dwellings.



Map 2.4: Various developments to the north of the Salt Lake (within the Tserkez Tsiflik boundaries) that are constructed or are anticipated to be constructed in the next few years

In addition, there are approved plans for a large solar park at Bishop's Pool – phase A (12 MW) is constructed and operational and phase B (8 MW) is pending.

Additionally, the master plan for Lady's Mile area/ road is under design and consultation phase, which aims to regulate the access, as well as re-construct the 6km road along Lady's Mile existing road, with associated infrastructure.

Alteration of the hydrological regime of the wetlands

Linked to the continuing development described above, there are significant hydrological changes in the area and as most of the habitats at Akrotiri are directly or indirectly associated with the wetlands, the ecosystem of the area is particularly sensitive to these changes. These changes relate to both the water quantity and quality, and in the last few years the changes of water regime for the wetlands is the major hydrological threat to the local ecosystem.

The construction of the Kouris Dam, the import of tertiary treated sewage water, the residential/ touristic developments in the area north of the Salt Lake, the inflow of stormwater and the abandoning of citrus tree cultivation with associated reduced groundwater abstraction; all these have been resulting in significant alteration of the ecosystem, affecting almost all the individual wetlands. Examples of visible impacts are: a) the rapid increase and takeover of reeds in e.g. Zakaki Marsh (Picture 2.1) and Akrotiri Marsh, as well as in other areas, b) the water retaining in the main Salt Lake during the summer months, mainly due to dewatering activities that are occurring in the wider area, which was not the case in the past years, c) eutrophication signs due to high nutrients (N,P) in the aquifer, as well as direct discharges in certain areas of the Salt Lake (north east), etc.

Picture 2.1: Zakaki Marsh in 2003 (left) and 2024 (right), where reed takeover is visible

Increasing tourism and unmanaged access

Increasing tourism and associated developments and recreational use are a major threat to the habitats, especially along Lady's Mile Beach, which includes restaurant facilities that keep expanding their footprint (parking spaces, beach occupation). In addition, unmanaged access, especially by vehicles, causes direct and indirect damage to habitats and species, especially in some areas western of Lady's mile road, as well as uncontrolled vehicle access in Merras area. The flat landscape and large number of roads and dirt tracks (many

of the latter illegal) offers innumerable access points, especially to off road vehicles and some parts have become very popular for either organized events or driving on an individual basis. This results in disturbance of key species, trampling, habitat fragmentation and loss.

Picture 2.2: Lady's mile beach (left) & view of illegal dirt roads (right) in Lady's mile/ Zakaki area

In the context of recent projects in the area (funded by Darwin Plus and MAVA) (2021-2024), a number of access management measures/ actions took and will take place in the Lady's mile area and eucalyptus forest area. These include installation of surveillance cameras, gate bars, barriers, creation of soil embankments, placement of rocks to designate parking and prevent access, rubbish collection, installation of information signs, etc. All these actions restricted vehicle access to sensitive habitats and were also combined with the designation of walking trails.

Introduction of invasive alien species

Introduction of invasive alien species is one of the main threats to the habitats at Akrotiri. The biggest threat is represented by *Acacia saligna*, which was introduced in Cyprus in the past century and has been spreading rapidly, especially in areas affected by fire or mechanical disturbance. This is a small, dense, spreading Acacia tree, growing up to eight metres tall.

Eucalyptus is also a problem, increasing the risk of fire in Mediterranean regions.

Climate change

A changing climate will have a worsening impact on many of the other threats listed, as for example, hydrological changes, fires, natural succession, and most notably, the basic environmental conditions each habitat type requires. More detail is provided in section 2.4.2.

Collision within antennae fields

The numerous antennae within and around the Merras area and Akrotiri Marsh area are a major collision threat for large migrating birds, such as Demoiselle Crane, Greater Flamingo and various raptors. A comprehensive

report by Tye (2013) summarises previous reports on this issue and collates key recommendations, which amongst others include removal of disused antenna structures, redesign and progressively replacement of antenna structures, so as to minimise the height of structures, increase the visibility of all cables and the night-time visibility of structures, replacement of all red aircraft warning lights on all antenna structures by flashing white warning lights, etc.

Fire

Fire is one of the main causes of habitat change/degradation in Cyprus, but it can also have beneficial results as it can be used as a management tool in certain circumstances.

However, in recent years, climate change has increased the risk of fire, particularly in habitats with planted species such as Eucalyptus or Acacia. Recent fire incidents in Akrotiri concentrate mainly in at Akrotiri Marsh, Eucalyptus Forest and Zakaki.

Predation

Predation can be an important issue for turtle nests and for ground nesting birds. Predators include feral cats, Red Fox, rats, crows and Ghost Crabs.

Pollution

The habitats at Akrotiri are very sensitive to pollution, especially the ones associated with the wetlands and the sea. The potential sources of pollution in the area include stormwater drainage system, pollutants from the urban development, aquifer and Salt Lake sewage contamination, runoffs from gardens and golf irrigation with tertiary treated water, agriculture, oil slicks, fuel and oil depots and fish farming. Increased nutrient levels in storm water flows are a key issue.

Natural succession of habitats

Natural succession of habitats can threaten the early succession species and bring changes that are often slow to notice. Loss of shallow open pools can be especially damaging for invertebrates, such as dragonflies.

The above pressures and threats result in direct habitat loss and degradation and in species conservation status deterioration, which are the main impacts in Cyprus coastal areas, including the Akrotiri Peninsula, due to mainly the pressure for development, as well as unmanaged visitation patterns in coastal areas.

2.4 Trends

2.4.1 Hydrological & Hydrogeological Trends

The hydrogeological conditions of the aquifer have undergone significant changes in recent years due to the changing water resource management strategies and policies, as well as changing climatic conditions. These human interventions have changed the sequence of natural processes taking place in the ecosystem over many years. The key events and trends are as follows:

- The construction of the Kouris dam in 1988 of 115Mm^3 capacity, effectively blocking the main recharge of the Akrotiri aquifer and the complete cessation, due to the dam, of water diversions for irrigation purposes.
- The import of tertiary treated sewage water from 1999 for irrigation purposes in the wider area, replacing groundwater abstraction from local boreholes.
- The more recent reduction in cultivation, notably citrus plantations, to the north of the lake, and numerous development projects in the area, has resulted in reduced water abstraction along the northern boundary of the lake.
- The construction of a stormwater drainage system (between 2003-2008) that discharges into Zakaki Marsh.
- Runoff from various developments to the north of the Salt Lake.
- Dewatering works during the construction of various developments and infrastructures, whose derived water ends up in the Akrotiri Salt Lake.
- The replenishment of aquifer with tertiary treated water near M1
- Climate change (as summarised below).

These have led to significant changes in the behavior of the groundwater level, and as a result to the outflow of groundwater and rising water to the Akrotiri meadow and the forest along the northern border of the Lake ending to the Lake itself.

Diagram 2.5 shows the effects of the above management actions that need to be considered carefully both for the aquifer itself as well as in connection to the water balance of the Salt Lake.

The construction of Kouris dam and cessation of diversions resulted to the reduction of recharge. At the same time, over abstraction of groundwater for citrus mainly cultivations, resulted in the drawdown of groundwater levels and sea-intrusion at the Kouris Delta. These conditions resulted to a reduced subsurface and surface runoff to the Lake.

In later years, the introduction of tertiary treated effluent for irrigation to the area associated with a mandatory, or otherwise, decrease of groundwater exploitation, as well as the abandoning of cultivation of large areas in favor of residential and other similar developments, resulted to an increased trend of the groundwater levels. This fact is anticipated to increase the groundwater seepage to the lake through the eucalyptus forest. The groundwater level rise trend for 1999-2018 is of the order of 50mm/y ranging from 19mm in the aquifer in the north-east of Lake (Zakaki area), to 40mm in the under-construction Golf Resort area and 70mm/y in the northern area, in Asomatos.

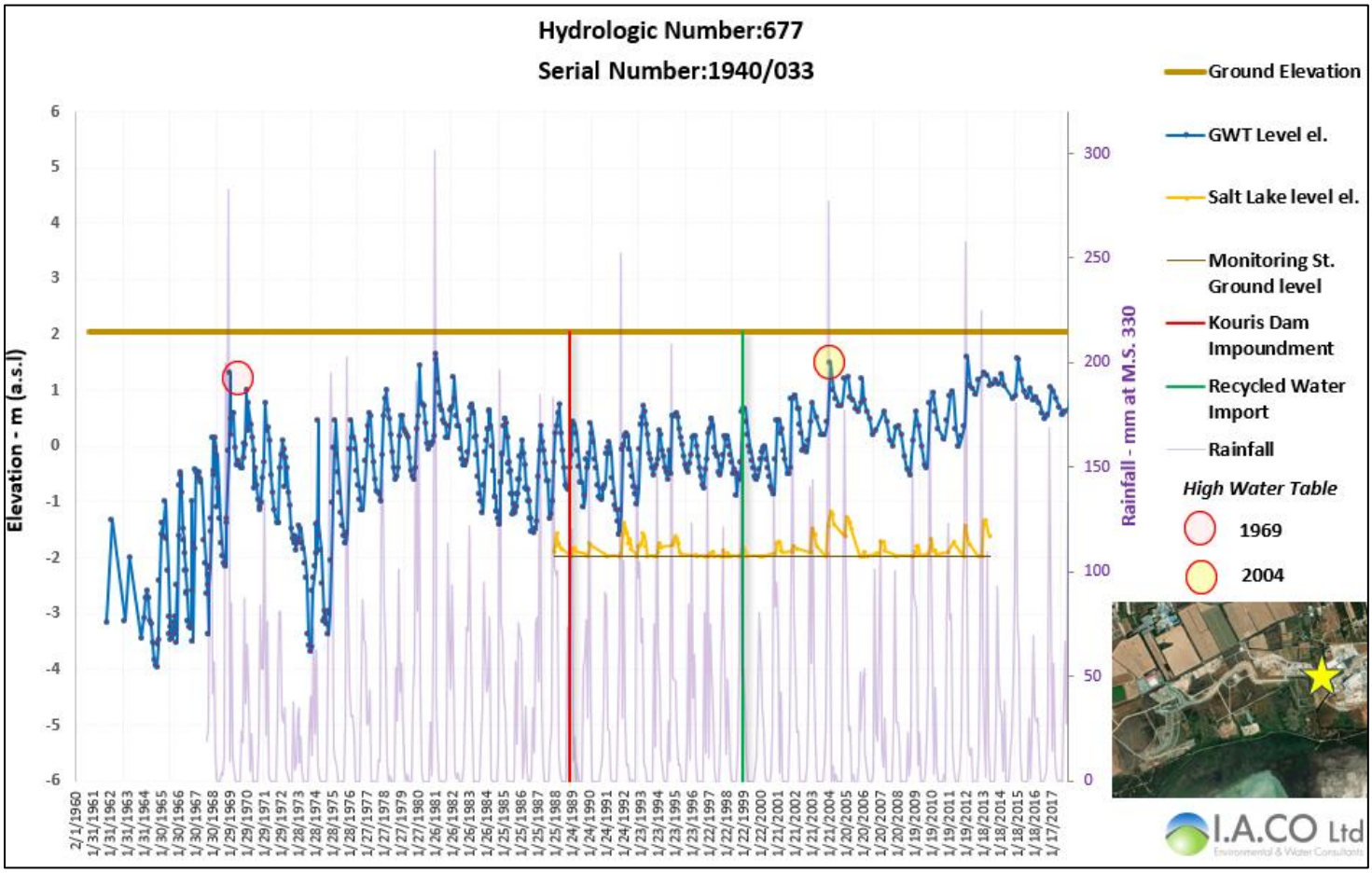


Diagram 2.5: Groundwater level fluctuation of borehole of Hydro. No.: 677 at the north-east of the Lake as it evolved from the different management stages: a) before (1960-89) and after (1989-1999) the Kouris dam, and b) after the introduction of tertiary treated water for irrigation (1999) and abandoning cultivation in certain areas.

2.4.2 Climate Change Trends

Future climatic change in both temperature and rainfall is another significant factor in the overall ecology and hydrology of the habitats of the Akrotiri Peninsula. Changing temperature patterns may impact on the habitats and the key species within the area. Rainfall and storm flows constitute the main source of water in the Akrotiri wetlands. Reduced annual average rainfall, as well changes to rainfall patterns such as rainfall frequency and intensity may produce complex changes to groundwater and surface water flows, as well as the volume of water that is derived from direct rainfall which is the main source of the lake's water (see diagram 2.1).

This section looks at evidence for future temperature and rainfall changes and then looks at potential adaptation measures for the key habitats.

In Giannakopoulos *et al* (2010), *Precipitation and temperature regime over Cyprus as a result of global climate change,* climatic changes in temperature and rainfall, and extreme events (number of hot days, number of warm nights, drought length) were examined. The results are presented in the table below.

Table 2.2: Future projected temperature and rainfall changes due to climate change (from Giannakopoulos et al 2010)

	1961-1990	2021-2050	2071-2100
Average annual temperature (daily maximum)	24	+1.3-1.6°C	+3.5-4.3°C
Average annual temperature (daily minimum)	15	+1.5°C	+4.0°C
Average winter temperature (daily maximum)	15	+1.4°C	+3.6°C
Average winter temperature (daily minimum)	8	+1.3-1.4°C	+3.3°C
Average summer temperature (daily maximum)	34	+1.9°C	+5.0°C
Average summer temperature (daily minimum)	22	+1.8°C	+4.2°C
No of days exceeding 35°C	60	+25	+60
No of nights exceeding 20°C	75	+45	+90
Rainfall total		-6-18%	-20-35%
Rainfall in winter		-25%	-40%
Rainfall in autumn		+35%	-20%
Periods of rainfall below 1mm		+15 days	+15-30 days

In summary, the projections show the potential impact of future climate change on Cyprus in two 30-year periods. Both projections predict warming temperatures. The warming, depending on the season, is in the range of 1.3 - 1.9 °C for 2021– 2050 and 3.6 – 5.0 °C for 2071–2100. For the minimum average temperature, the simulations indicate an increase of about 1.5 °C for 2021–2050 and 4 °C for 2071–2100. The seasonal variability varies between 1.3 °C in winter and 1.9 °C in summer for the 2021–2050 simulation, whereas for the 2071–2100 simulation is in the range of 3.3 °C (winter) to 4.3 C (summer).

Finally, the projections indicate a decrease in rainfall. The sharpest decrease is evident seasonally for the 2071–2100 simulation (decrease in winter accompanied with decrease in autumn), whereas for the 2021–2050 simulation, rainfall shows a decrease in winter, but an increase in autumn. Both simulations indicate an increase in the dry period with precipitation below 1 mm of about 15 days for 2021–2050 and of about 15 days to 1 month for 2071–2100.

More projections are outlined in Zittis *et al.* (2022), *Climate change and weather extremes in the Eastern Mediterranean and Middle East*. This detailed paper summaries various climate projections and demonstrates that over the past 50 years and especially during recent decades, the eastern Mediterranean has warmed significantly faster than the European average. The observed recent temperature increase of about 0.45°C per decade is projected to continue, although strong global greenhouse gas emission reductions could moderate this trend. In addition to projected changes in mean climate conditions, the probability of extreme weather events with potentially disruptive societal impacts are highlighted. These include the strongly increasing severity and duration of heatwaves, droughts and dust storms, as well as torrential rain events that can trigger flash floods. Projections for Cyprus also highlight that the number of consecutive dry days is expected to increase by up to 20–40 additional days per year, with the dry period of the year projected to expand by one to two months by 2100.

Sea level rise is also highlighted, a potentially significant factor for the Akrotiri peninsula. For the period 1993–2018, the Mediterranean Sea level was shown to have risen at a rate of 2.8 ± 0.1 mm per year, consistent with the rise in global sea levels (3.1 ± 0.4 mm). Based on estimations from regional climate models, the rise in the Mediterranean Sea level is expected to be close to that of the global mean sea level. The average sea level in the

Mediterranean is variously predicted to increase by between 20–90 cm by 2100, compared to the end of the twentieth century.

So, whilst it is difficult to be precise about climate in the future, the general trends are clear and we should expect the following:

- A decline in total annual rainfall, but more seasonal variability and intensity.
- Increased average temperatures with extended drought periods and night temperatures. Critically, some projections show the eastern Mediterranean warming up to two times faster than the global average.
- A rise in sea levels, increasing coastal erosion.
- Species distributions moving within their ideal climate 'envelope'.

Table 2.3: Summary of the key changes in water availability impacting on the Akrotiri wetlands

Increases in water availability	Declines in water availability
Introduction of treated effluent for irrigation, combined with reduced groundwater abstraction for citrus plantations has led to an increase in groundwater level and subsequent flow to the Salt Lake	Due to the Kouris dam, reduction in re-charge, lowering of groundwater and increase of sea-intrusion to the Kouris delta. Reduced groundwater and surface flow from Akrotiri Marsh to the Salt Lake.
Discharge of storm water from Limassol areas into Zakaki Marsh.	
Climate predictions – no increases in water availability.	Climate predictions – reduction in rainfall of 6-18% predicted over the coming 30 years. In addition, rising temperatures of 1.3-1.9^{o}C over the same period, will increase rates of evapo-transpiration.
Predicted increase in sea levels may increase sea overflows and erosion.	
Summary result: The trend in groundwater levels for 1999-2018 is an average increase of 50mm per year, ranging from 19mm in the aquifer in the north-east of Lake (Zakaki area), to 40mm in the golf course development area, and to 70mm per year in the northern area, in Asomatos, coinciding with increased irrigation. However, over the next 30-year period, climate change may result in a reduction of rainfall of 6-18%, increased temperatures and rising sea levels.	

A range of **adaptation measures** and relevant actions can be considered. The following table sets out actions that may be targeted towards coastal and wetland habitats. They are focused on three key areas: **resistance** (buffer or protect from change, increase refugia), **resilience** (return to normal conditions after climate disturbance) and **transition** (actively predict and promote change).

The headline points are as follows:

- Manage pollutant loads to minimise impact on natural nutrient status.
- Restore and maintain natural hydrological regimes – good dynamic management.
- Management to maintain structural and species diversity in vegetation type. Maintain early successional habitats, reedbeds and wet grasslands in good condition.

- Good biosecurity to slow the spread of invasive non-native species.
- Predict increasing and colonising species and implement beneficial management.

Table 2.4: Potential climate change adaptation measures

	Resistance – buffer or protect from change, increase refugia	**Resilience** – return to normal conditions after disturbance	**Transition** – actively predict and promote change
	Identify, maintain or create refugia. Increase buffering from extremes	**Reduce risk and impact of climate disturbances**	**Facilitate change through species transition. Create stepping stones and create habitat in predicted locations**
Wetlands	* Maintain full range of successional states & diversity of habitat structure * Maintain value of wet grassland and reedbed through appropriate management regimes to adapt to varying conditions * Ensure flexibility in grazing regimes to adapt to varying conditions * Maintain ditch and pool networks to accommodate both high & low water levels. *Promote good biosecurity to slow spread of invasive non-native species * Manage pollutants to minimise impact on natural nutrient status * Identify and protect key botanical locations	*Increase size and diversity of wetland * Dynamic management - restore & maintain natural hydrological regimes * Large scale rejuvenation of wetlands/reedbeds * Consider long term water availability, through storage & up to date water control structures	* Restore large, naturally functioning wetlands. * Create habitat for colonising species e.g. large shallow meres, nesting sites for herons etc * Fresh-brackish-saline transitions * Increase trophic cascade – increase grazing options * Transition to more sustainable habitats where appropriate
Coastal, dunes and saltmarsh	* Reduce non-climatic pressures. * Manage recreational pressures. * Identify and protect key assets - wader roosts and key feeding areas, key botanical locations	* Maintain diversity of habitat * Increase fresh-brackish-saline transitions * Identify transitional habitat areas where roll back can occur * Anticipate and develop approaches to managing the landward movement of dune systems, which will require consideration of the impacts on adjacent access routes.	* Managed realignment projects * Ensure options for breeding soft-shore seabirds, passage & wintering waterbirds – create new lagoons
Saline lagoons	* Maintain in best possible condition * Reduce non-climatic pressures * Manage recreational pressures * Manage damaging nutrient and chemical inputs * Identify and protect key assets - wader roosts and key feeding areas	* Increase size of habitat where possible, enlarge functional units	* Anticipate future changes and allow habitat movement or create new habitat

2.4.3 Population Trends of Key Bird Species

With the available monitoring data collected since 2006 (mostly through monthly waterbird counts carried out by BirdLife Cyprus and Game and Fauna Service, but also as part of short specific studies), results for the key bird species are presented in the following section and summarised in Table 2.5.

Table 2.5: Summary of the population trends for several key bird species on the Akrotiri Peninsula, from the results of the monitoring data (2006-2023)*

Species	winter trend	spring trend	summer trend	autumn trend
Common Shelduck *Tadorna tadorna*	Uncertain (apparent decrease)	Uncertain (apparent decrease)	Not Applicable	Not Applicable
Ferruginous Duck *Aythya nyroca*	Strong decrease	Moderate decrease	Moderate decrease	Uncertain
Greater Flamingo *Phoenicopterus roseus*	Strong decrease	Strong increase	Uncertain (apparent increase)	Uncertain
Common Coot *Fulica atra*	Strong decrease	Strong decrease	Strong decrease	Strong decrease
Glossy Ibis *Plegadis falcinellus*	Uncertain (apparent increase)	Strong decrease	Uncertain (apparent increase)	Uncertain
Squacco Heron *Ardeola ralloides*	Not Applicable	Strong decrease	Uncertain (apparent increase)	Uncertain (apparent increase)
Little Egret *Egretta garzetta*	Strong increase	Stable	Uncertain (apparent increase)	Strong increase
Black-winged Stilt *Himantopus himantopus*	Not Applicable	Moderate increase	Uncertain	Moderate increase
Kentish Plover *Charadrius alexandrinus*	Uncertain	Uncertain (apparent increase)	Moderate decrease	Moderate decrease
Spur-winged Lapwing *Vanellus spinosus*	Uncertain (apparent increase)	Moderate increase	Strong increase	Strong increase

* **Strong increase** –an increase of more than 5% per year/ **Moderate increase** –an increase of no more than 5% per year/ **Stable –no significant change** (confidence limits 0.95-1.05)/ **Uncertain –no significant change** (confidence limits <0.95 and/or >1.05)/ **Moderate decrease** –a decline of no more than 5% per year/ **Strong decrease** –a decline of more than 5% per year

Common Shelduck *Tadorna tadorna*

The species uses Akrotiri Salt Lake and Lady's Mile Pools in winter and spring, with the largest numbers located at the Salt Lake.

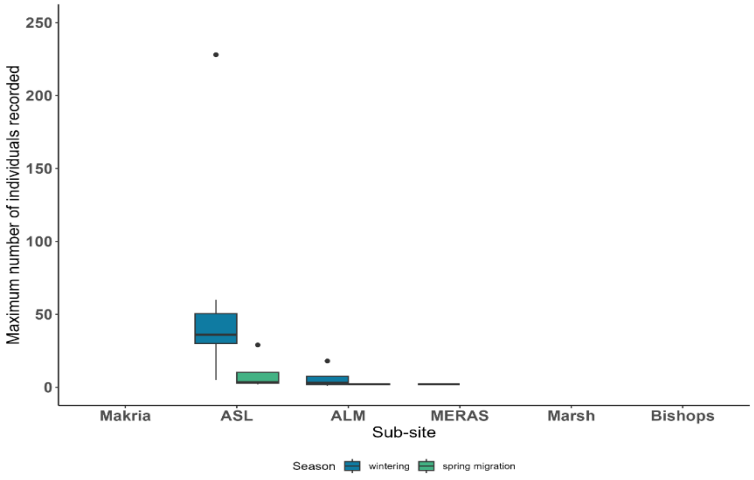


Figure 2.1: Seasonal maximum number of Common Shelduck *Tadorna tadorna* per Akrotiri sub-site during 2017 – 2024.

The population shows an uncertain trend during winter, but with clear indications of decline, and a similar pattern for the spring migration.

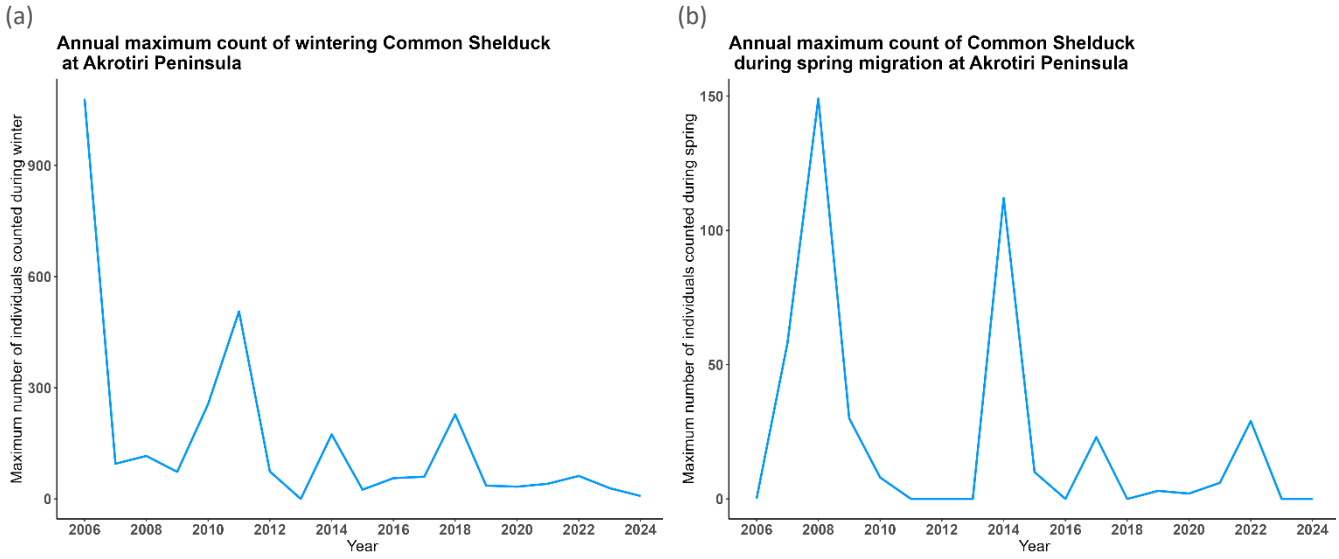


Figure 2.2: Seasonal maximum counts showing trends in Common Shelduck *Tadorna tadorna* numbers at Akrotiri Peninsula since 2006. During the wintering period (a) the population trend is uncertain, but tends to decline. During spring migration (b) the population trend is uncertain, but tends to decline.

Ferruginous Duck *Aythya nyroca*

The species is mostly observed at Bishop's Pool throughout the year, with smaller numbers recorded at Makria Lake and Akrotiri Marsh. The latter sites, with dense reed coverage, present some difficulties for detection of the species, so it is likely that the species is overlooked in these areas.

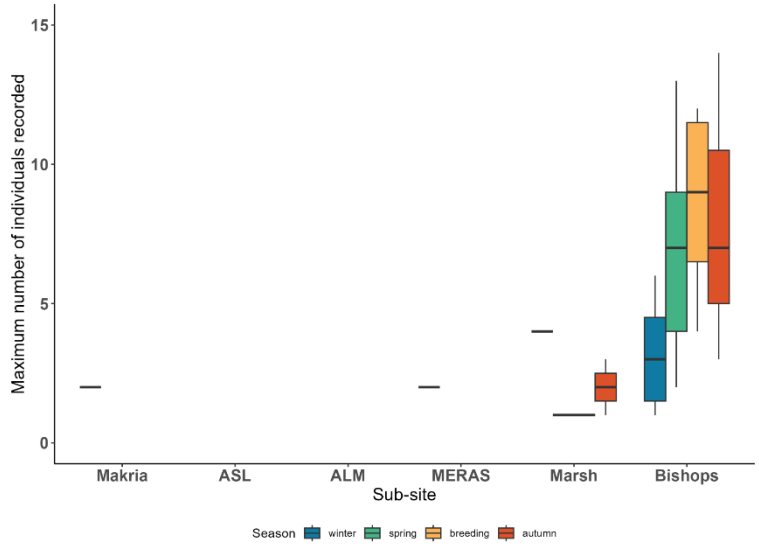


Figure 2.3: Seasonal maximum number of Ferruginous Duck *Aythya nyroca* per Akrotiri sub-site during 2017 – 2024.

The population has decreased clearly in all seasons: in winter (10.7 ± 4% decrease per year; strong decrease ($p<0.05$)), in spring (4.7 ± 3.3% decrease per year; moderate decrease ($p<0.05$)) and in summer (6.7 ± 2.5% decrease per year; moderate decrease ($p<0.01$)), while in autumn the trend is uncertain.

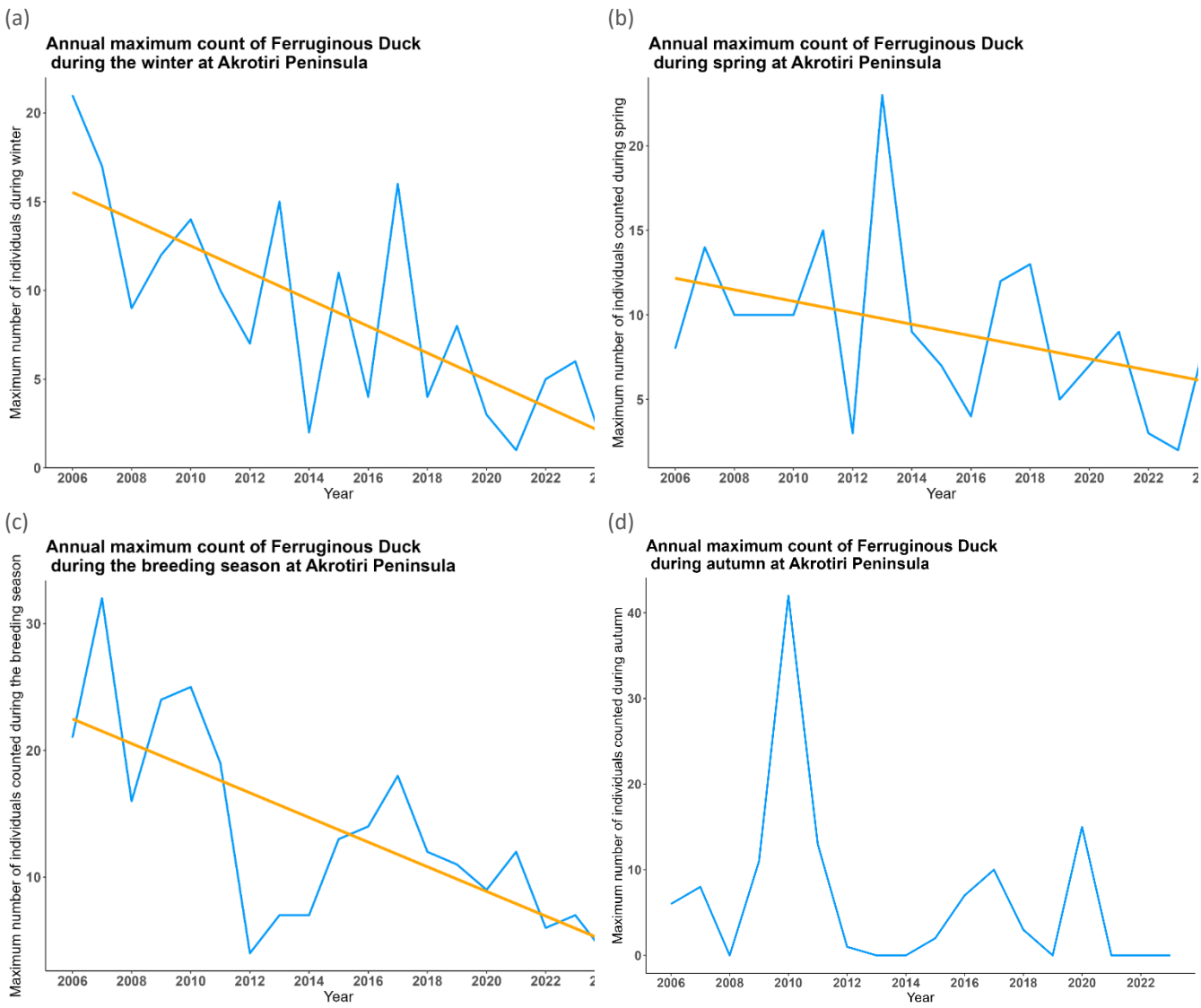


Figure 2.4: Seasonal maximum counts showing trends in Ferruginous Duck *Aythya nyroca* numbers at Akrotiri Peninsula since 2006. During the wintering period (a) the population has shown a strong decrease (10.7 ± 4% decrease per year, p<0.05). During spring migration (b) the population has shown a moderate decrease (4.7 ± 3.3% decrease per year, p<0.05). During the breeding period (c) the population has shown a moderate decrease (6.7 ± 2.5% decrease per year, p<0.01). During autumn migration (d) the population trend is uncertain.

The Ferruginous Duck has been recorded as a breeder from 2005, though the species' secretive behaviour during the breeding period might have hidden some earlier breeding records. The first confirmed nesting of Ferruginous Duck was at Akrotiri Marsh during 2005-2007 with 2-3 nests per year. Breeding was first documentated at Zakaki Marsh during 2009-2010, while in 2011 the species was recorded to have bred at Akrotiri Marsh and Zakaki Marsh, and in 2012 at Akrotiri Marsh. After this, no evidence of confirmed breeding was found, but in 2016 there was confirmation of breeding at Bishop's Pool. In 2017 there was confirmed breeding at Bishop's Pool and Akrotiri Marsh, and in 2019 and 2020 there were family groups in Bishop's Pool reported and also in 2020 at Akrotiri Marsh. The highest summer counts were during the years 2006-2011, and since then the species became much scarcer. The strong expansion of the reedbed at Akrotiri Marsh and Zakaki Marsh could have been related to the observed decline, in terms of expansion of a less suitable habitat, but also more difficult detectability. New technologies, such as drones or acoustic surveys could be used to better assess the population of the species at these sites.

Greater Flamingo *Phoenicopterus roseus*

The species mostly uses Akrotiri Salt Lake throughout the year, but also uses other sites, specifically Lady's Mile Pools and the Merras area, depending on water levels and likely available resources and disturbance levels.

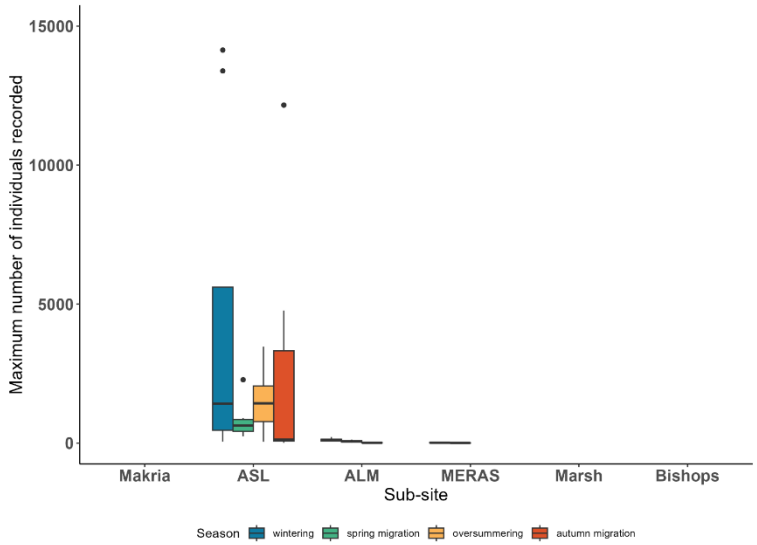
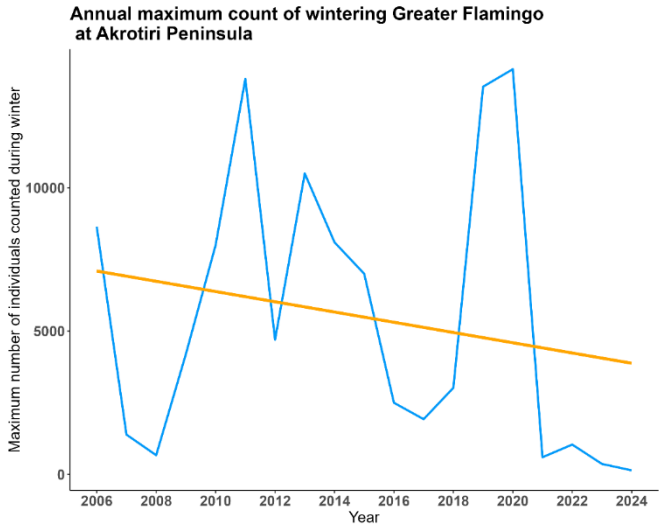


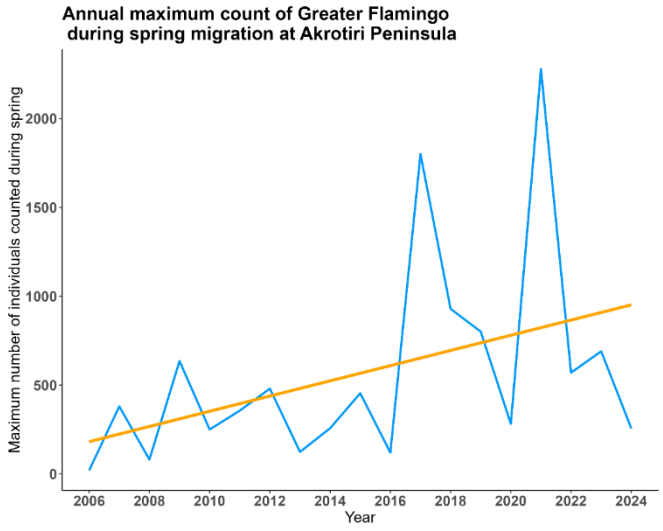
Figure 2.5: Seasonal maximum number of Greater Flamingo *Phoenicopterus roseus* per Akrotiri sub-site during 2017 – 2024.

The population has fluctuated strongly during the wintering period, with a long-term decline evident (9.9 ± 0.3% decrease per year; strong decrease, p<0.01). High counts during the winters of 2019 and 2020 were the result of higher than average rainfall during those years (153% of average rainfall in hydrological year 2018-2019 and 122% of average rainfall in 2019-2020), resulting in good water levels. By contrast, the species has increased in spring migration (11.0 ± 0.9% increase per year; strong increase, p<0.01). Trends during the summer period and autumn migration are uncertain and numbers of Greater Flamingos during these periods are mostly related to the water levels.

(a)



(b)



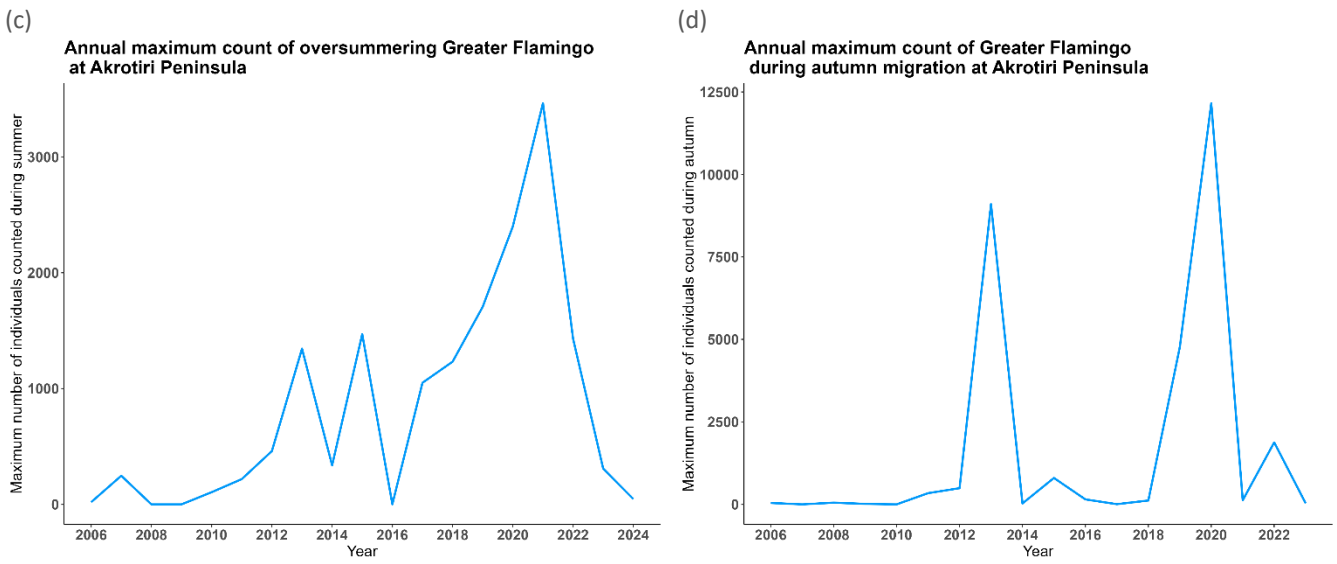


Figure 2.6: Seasonal maximum counts showing trends in Greater Flamingo *Phoenicopterus roseus* numbers at Akrotiri Peninsula since 2006. During the wintering period (a) the population has shown a strong decrease (9.9 ± 0.3% decrease per year, p<0.01). During spring migration (b) the population has shown a strong increase (11.0 ± 0.9% increase per year, p<0.01). During the summer period (c) and autumn migration (d) the population trend is uncertain.

The following table presents information on nesting and breeding attempts of the species. Nesting attempts appear to be related to rainfall and therefore water levels in the Salt Lake. The years when breeding attempts were recorded were preceded by hydrological years of average or higher than average rainfall: 127% of average rainfall during the hydrological year 2011-2012, 106% of average rainfall during 2012-2013, 109% of average rainfall during 2014-2015, 153% during 2018-2019 and 122% during 2019-2020. Despite average rainfall during 2021-2022 and 2022-2023, no nesting attempts were observed during the last two breeding seasons. There is no evidence that any breeding attempts of Greater Flamingo were successful, as no flightless chicks have ever been recorded in Cyprus.

Table 2.6: Summary of breeding attempts by Greater Flamingo *Phoenicopterus roseus* at Akrotiri Peninsula

Year	Nesting information
2012	200 nest mounds, signs of incubation (10 birds)
2013	At least 25 incubating birds
2015	60-100 nest mounds, at least 20 birds sitting
2019	60-80 nest mounds
2020	200 nest mounds

Common Coot *Fulica atra*

Interestingly, the numbers of Common Coot *Fulica atra* reported during the monthly waterbird surveys, show similar patterns. During the breeding period, the species was most abundant between 2006 and 2012, with a significant reduction in counts during the breeding season and also year-round from 2013 onwards. Monitoring data shows that there is a strong population decline (p<0.01) in all seasons (assessed independently), with the following trends on average: in winter the population declined by 12.4 ± 1.2% per year, in spring by 12.1 ± 2.3%, in summer by 13.2 ± 1.6% and in autumn by 14.4 ± 3.1%.

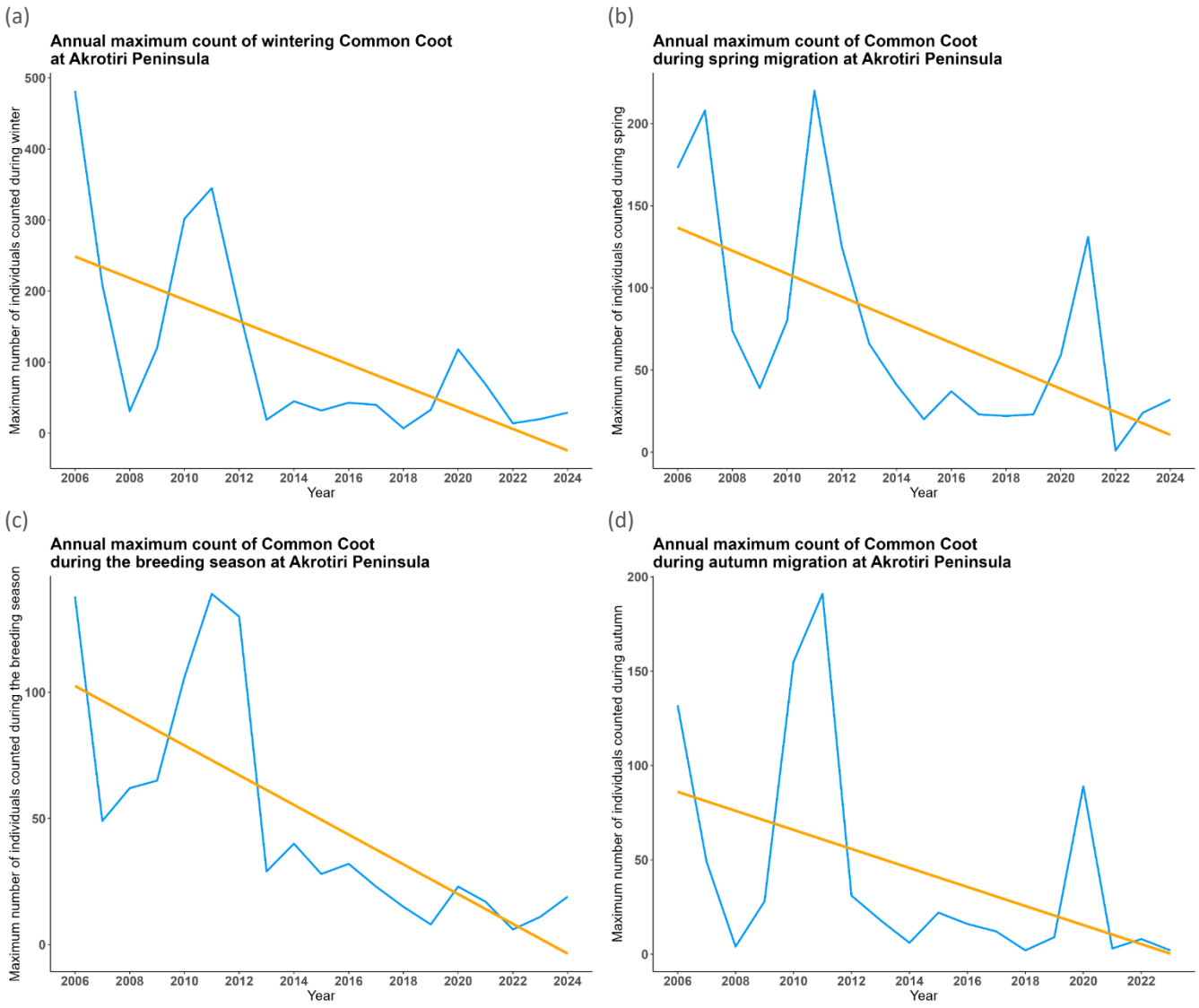


Figure 2.7: Seasonal maximum counts showing trends in Common Coot *Fulica atra* numbers at Akrotiri Peninsula since 2006. During the wintering period (a) the population has shown a strong decrease (12.4 ± 1.2% decrease per year, p<0.01). During spring (b) the population has shown a strong decrease (12.1 ± 2.3% decrease per year, p<0.01). During the breeding period (c) the population has shown a strong decrease (13.2 ± 1.6% decrease per year, p<0.01). During autumn (d) the population trend has shown a strong decrease (14.4 ± 3.1% decrease per year, p<0.01).

Since this species has similar ecological requirements to the Ferruginous Duck, but it is rather more flexible and adaptable to changing environments, these patterns in population trend demonstrate that the deterioration of habitat quality is likely the main factor also driving the decline of Ferruginous Duck in the area.

Demoiselle Crane *Antrhopoides virgo*

From the existing monitoring data, the species is known to use the area as a stopover site during migration, especially during autumn, but targeted monitoring would be useful in order to quantify the exact use of the area, as well as the number of individuals that are passing on migration. As mentioned earlier in the report, Flint & Richardson (2024) give a mean (2010-2021) island-wide autumn total of birds see by day of *c.* 530. Since a good part of the movement occurs at night, it is likely that the proportion of individuals from the western population that passes over the island is underestimated.

Glossy Ibis *Plegadis falcinellus*

The species uses the Akrotiri Marsh throughout the year (with particular importance over summer and winter), and the Salt Lake during the migratory seasons. Zakaki Marsh has a few observations also during summer and autumn, and the Merras area during summer and spring.

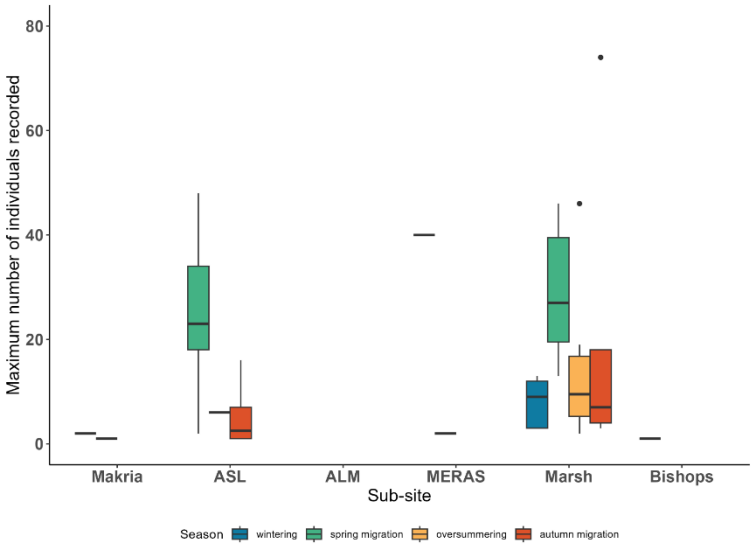


Figure 2.8: Seasonal maximum number of Glossy Ibis *Plegadis falcinellus* per Akrotiri sub-site during 2017 – 2024.

Although the population trend in winter is uncertain, the species seems to be increasingly overwintering in Akrotiri Marsh. In spring, perhaps surprisingly, the species shows a strong decrease trend ($p<0.01$), with an average of 7.7 ± 1.2% decrease per year. The trend is also uncertain for summer and autumn, but it shows signs of increase, particularly since 2019, when the species reached the maximum number of individuals during winter, summer and autumn.

The secretive behaviour of the species during the breeding period, if nesting inside large reedbeds, could mean that breeding attempts of the species in Akrotiri Marsh, the site that concentrates most of the observations, are overlooked.

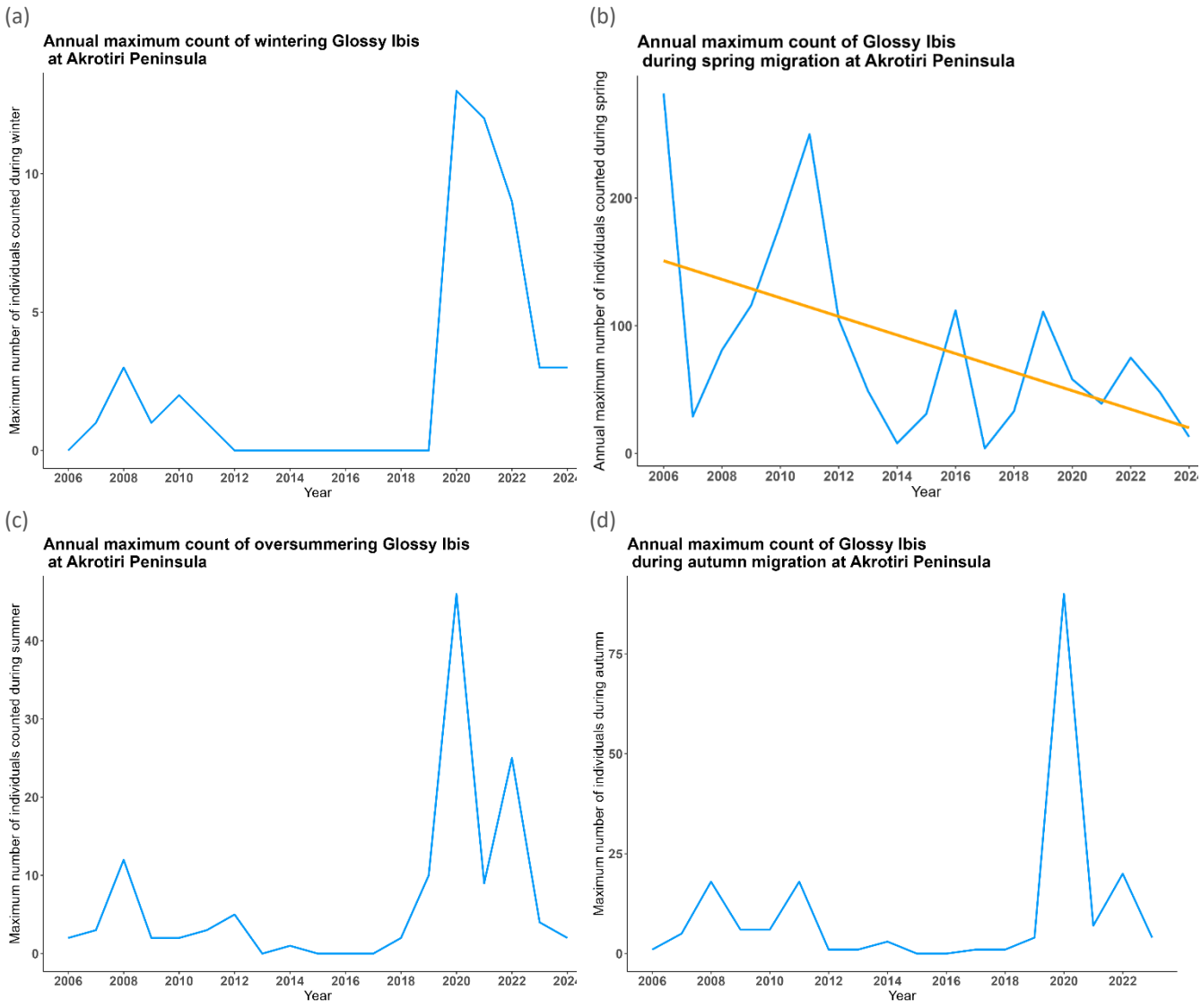


Figure 2.9: Seasonal maximum counts showing trends in Glossy Ibis *Plegadis falcinellus* numbers at Akrotiri Peninsula since 2006. During the wintering period (a) the population trend is uncertain. During spring migration (b) the population trend has shown a strong decrease (7.7 ± 1.2% decrease per year, p<0.01). During the breeding period (c) and autumn migration (d) the population trend is uncertain.

Little Bittern *Ixobrychus minutus*

As a reedbed specialist, Little Bittern is mostly observed at Akrotiri Marsh, Zakaki Marsh and Bishop's Pool. Observations of the species over the summer period are regular, but the secretive behaviour of the species during breeding and the fact that it also occurs as a common passage migrant makes monitoring difficult. Dedicated studies are needed to confirm breeding at the site (mostly by locating flightless juveniles) and to estimate the number of breeding pairs and local requirements / threats.

Squacco Heron *Ardeola ralloides*

From the existing monitoring data, individuals use Akrotiri Marsh almost exclusively in all seasons. Small numbers are occasionally found at Bishop's Pool, Lady's Mile and Akrotiri Salt Lake. The only winter record of the species is in Makria Lake.

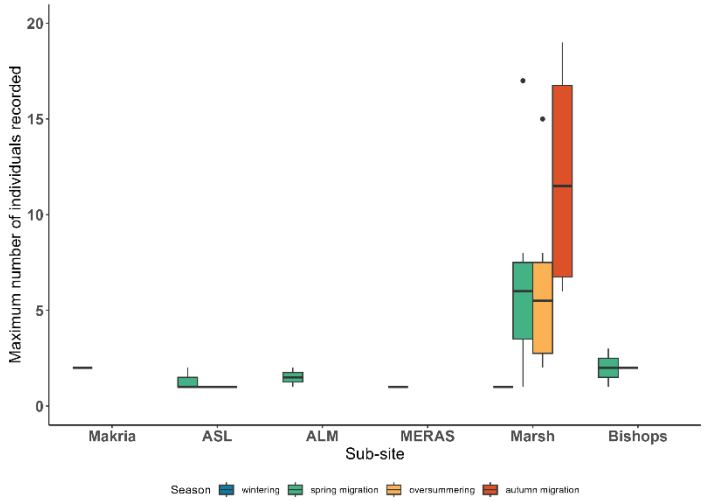


Figure 2.10: Seasonal maximum number of Squacco Heron *Ardeola ralloides* per Akrotiri sub-site during 2017 – 2024.

The population shows a steep decline during spring migration. During the summer and autumn the trends are uncertain, but there are clear indications of an increase. The species has been recorded to breed at Akrotiri Marsh, but the secretive behaviour of the species during the breeding period, nesting inside large reedbeds, could mean that breeding attempts of the species in Akrotiri Marsh, the site that concentrates most of the observations, are overlooked.

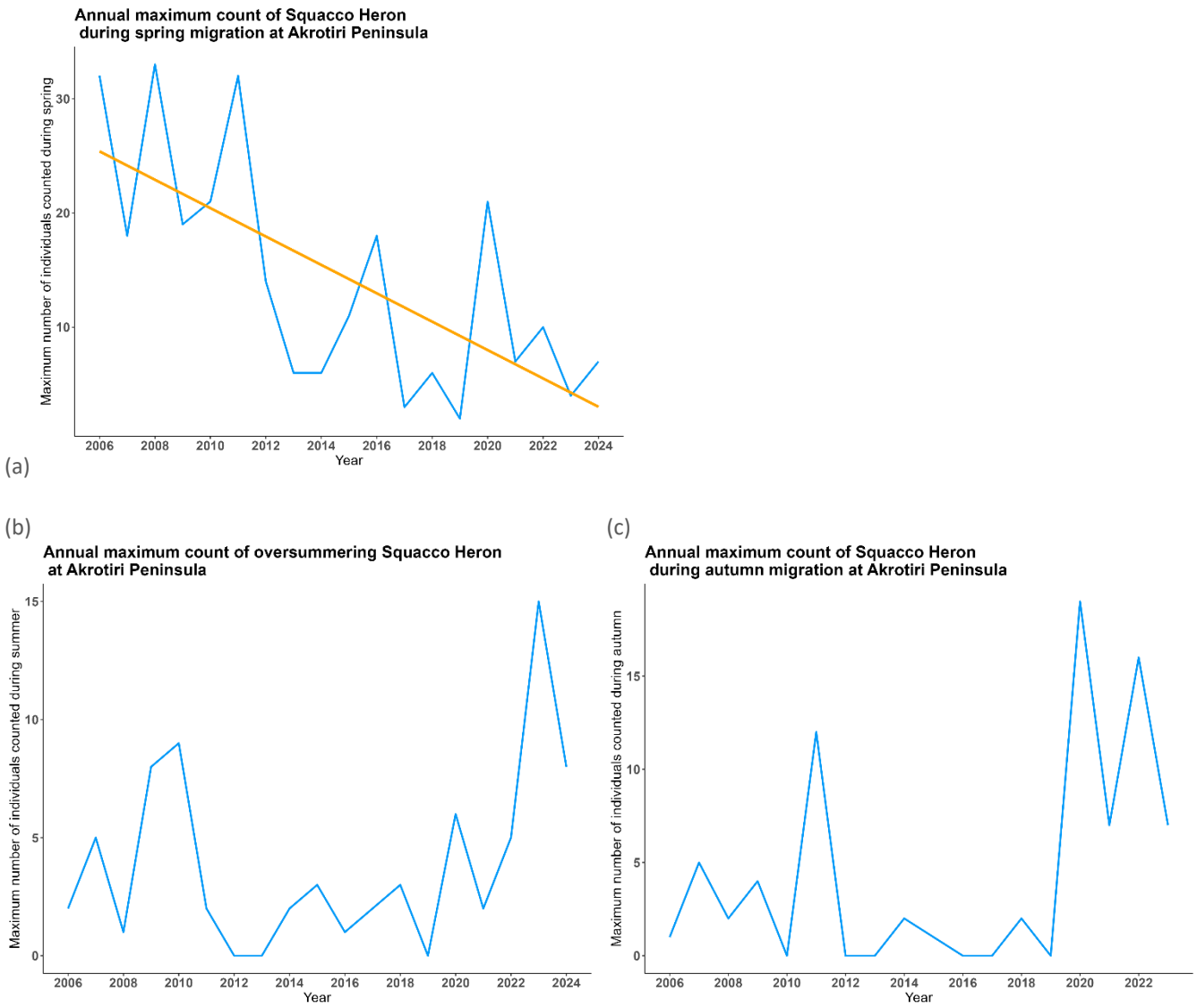


Figure 2.11: Seasonal maximum counts showing trends in Squacco Heron *Ardeola ralloides* numbers at Akrotiri Peninsula since 2006. During the spring migration (a) the population has shown a strong decrease (9.0 ± 2.5% increase per year, p<0.05). During the summer period (b) and the autumn migration (c) the population trend is uncertain.

Little Egret *Egretta garzetta*

The species is found across the Akrotiri Peninsula year-round, with the largest numbers recorded during autumn migration especially at Akrotiri Salt Lake, Lady's Mile Pools and Akrotiri Marsh.

The population shows a strong increase (p<0.05) in winter (18.2 ± 10.8% increase per year), a stable trend during spring migration, an uncertain trend during summer (but likely increasing) and a strong increase (p<0.01) during autumn (13.9 ± 1.5% increase per year).

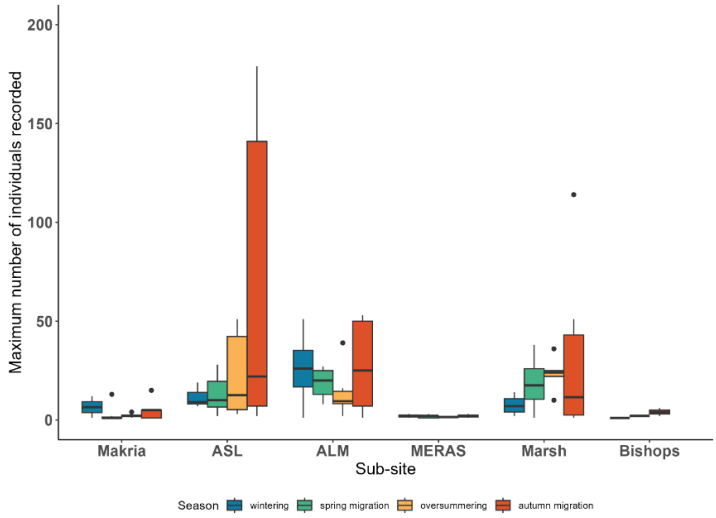


Figure 2.12: Seasonal maximum number of Little Egret *Egretta garzetta* per Akrotiri sub-site during 2017 – 2024.

Figure 2.13: Seasonal maximum counts showing trends in Little Egret *Egretta garzetta* numbers at Akrotiri Peninsula since 2006. During the wintering period (a) the population has shown a strong increase (18.2 ± 10.8% increase per year, p<0.05). During spring migration (b) the population trend is stable, showing no significant increase or decrease. During the breeding period (c) the population trend is uncertain. During autumn migration (d) the population trend has shown a strong increase (13.9 ± 1.5% increase per year, p<0.01).

The species has recently established a breeding colony in nearby Zakaki area since 2020, which is likely to be driving the observed population increases. This site is not under any protection currently, so it is at risk in future, should it not be possible to put conservation measures in place to protect the colony.

Little Egret has also been recorded to breed at Bishop's Pool, while suitable breeding areas exist e.g to the north of Akrotiri Salt Lake, which are difficult to survey, demonstrating that there is potential for the species to further expand in area.

Black-winged Stilt *Himantopus himantopus*

The species mostly uses Akrotiri Salt Lake during the whole year (including nesting), Akrotiri Marsh during migration and breeding, the Merras area mostly for migration (but also some breeding just outside Akrotiri Marsh) and Lady's Mile Pools during migration.

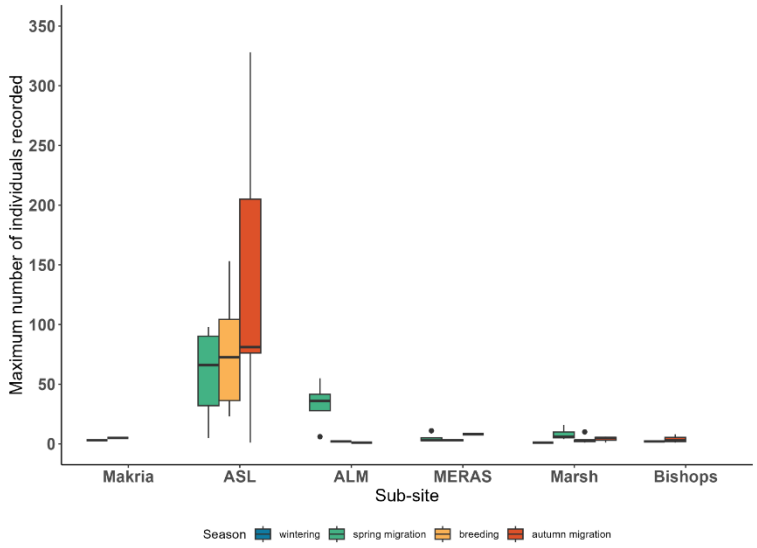


Figure 2.14: Seasonal maximum number of Black-winged Stilt *Himantopus himantopus* per Akrotiri sub-site during 2017 – 2024.

The population seems to be increasing overall, particularly during the migration periods: in spring (6.3 ± 1.4% increase per year; moderate increase, $p<0.01$) and in autumn (8.7 ± 4.7% increase per year; moderate increase, $p<0.05$). During the breeding period, the population trend is uncertain, though it tends to increase, with the highest numbers of individuals recorded during the breeding season in 2020 and 2022.

Figure 2.15: Seasonal maximum counts showing trends in Black-winged Stilt *Himantopus himantopus* numbers at Akrotiri Peninsula since 2006. During the spring migration (a) the population has shown a moderate increase (6.3 ± 1.4% increase per year, p<0.01). During the breeding period (b) the population trend is uncertain. During autumn migration (c) the population trend has shown a moderate increase (8.7 ± 4.7% decrease per year, p<0.05).

It is important to note that the current preferred breeding location for the species at the edge of Akrotiri Marsh is potentially at risk, due to difficulties in management of the land, which is privately owned and outside the common grazing marsh area.

Kentish Plover *Charadrius alexandrinus*

The species uses Akrotiri Salt Lake and Lady's Mile Pools throughout the year, and is recorded in smaller numbers also in the Merras area. Akrotiri Lady's Mile Pools are the preferred site during autumn migration, with the largest number of individuals recorded here during the season. Important numbers are also recorded here during winter and spring migration. The majority of wintering individuals and migrating individuals in spring use Akrotiri Salt Lake, while the breeding sites are found in Akrotiri Salt Lake, Lady's Mile Pools and the Merras area.

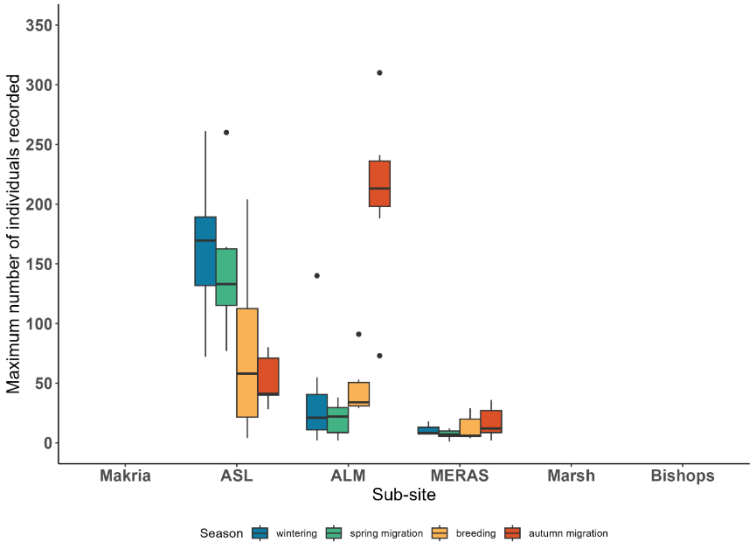


Figure 2.16: Seasonal maximum number Kentish Plover *Charadrius alexandrinus* per Akrotiri sub-site during 2017 – 2024.

The population in winter and spring migration is uncertain, though in the latter season the trend tends to an increase. During the breeding period, on the other hand, the species shows an evident decline (2.9 ± 0.8% decrease per year; moderate decrease, $p<0.01$), with a subsequent decrease in autumn as well (2.3 ± 0.6% decrease per year; moderate decrease, $p<0.01$).

Both summer and autumn declines are likely related, and the fact that the spring numbers seem to increase could indicate the species is not finding suitable breeding areas or that nesting failure is very high at the start of the season. Interestingly, the main decline seemed to occur between 2010 and 2012, and a very slight (yet not significant) population recovery has been observed since.

Figure 2.17: Seasonal maximum counts showing trends in Kentish Plover *Charadrius alexandrinus* numbers at Akrotiri Peninsula since 2006. During the wintering (a) and spring migration periods (b) the population trend is uncertain. During the breeding period (c) the population has shown a moderate decrease (2.9 ± 0.8% decrease per year, p<0.01). During autumn migration (d) the population trend has shown a moderate decrease (2.3 ± 0.6% decrease per year, p<0.01).

Spur-winged Lapwing *Vanellus spinosus*

The species mostly uses the areas at Akrotiri Marsh, but it is also observed in small numbers at the Salt Lake, the Merras area and Lady's Mile Pools. The breeding sites are exclusively located in and just outside Akrotiri Marsh. The species was recorded in small numbers until around 2019-2020, when numbers started increasing at a high rate. The restoration of Akrotiri Marsh was probably the main driver behind the increase of breeding individuals in Akrotiri, thus habitat availability is likely to have been an important limitation.

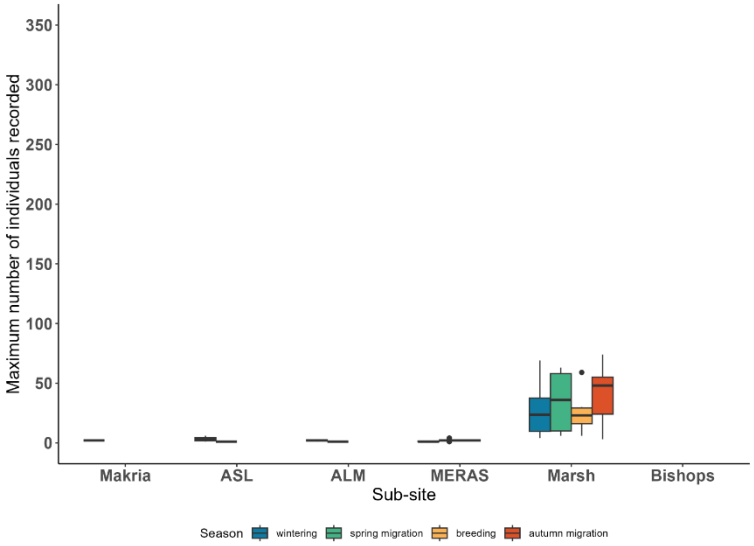


Figure 2.18: Seasonal maximum number Spur-winged Lapwing *Vanellus spinosus* per Akrotiri sub-site during 2017 – 2024.

The population has increased significantly, following up the colonisation of Cyprus in 1988 (Charalambidou et al. 2012), with a notable increase from 2019 onwards. In winter, the population has increased but low numbers during the winter 2023-2024 have kept the trend uncertain. In spring, the species shows a moderate increase ($p<0.05$) with an average increase of 18.7 ± 14.0% per year. In summer and autumn, the species shows a strong increase ($p<0.01$), with average increases of 14.3 ± 4.2% and 24.2 ± 10.2% per year, respectively.

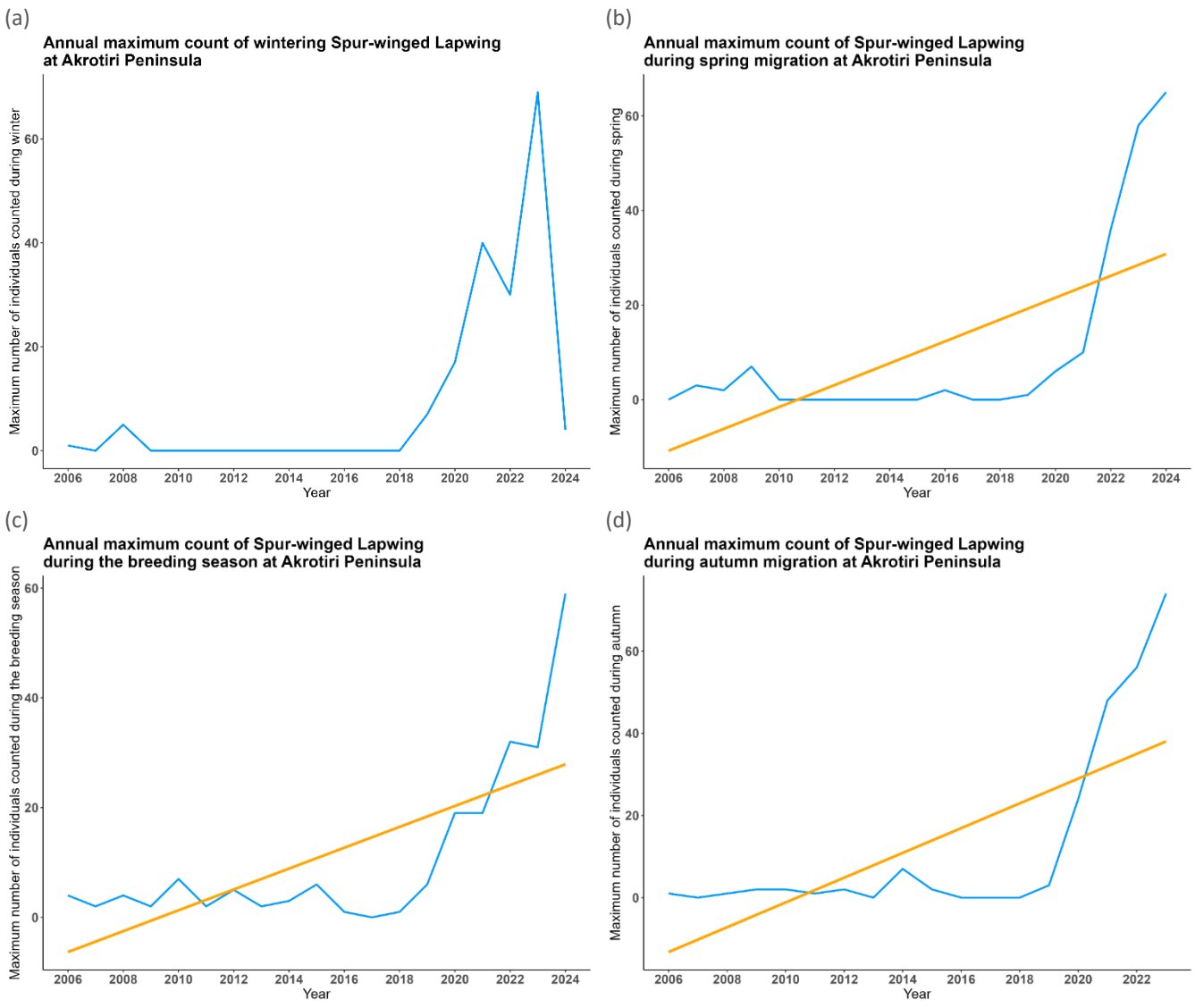


Figure 2.19: Seasonal maximum counts showing trends in Spur-winged Lapwing *Vanellus spinosus* numbers at Akrotiri Peninsula since 2006. During the wintering period (a) the population trend is uncertain. During spring migration (b) the population has shown a moderate increase (18.7 ± 14.0% increase per year, $p<0.05$). During the breeding period (c) the population has shown a strong increase (14.3 ± 4.2% increase per year, $p<0.01$). During autumn migration (d) the population trend has shown a strong increase (24.2 ± 10.2% increase per year, $p<0.01$).

3. Future Management Recommendations

3.1 Vision

The primary objective for the future is to ensure that the habitats and key species of the Akrotiri Peninsula remain in good conservation status, while maintaining a balanced ecosystem that continues to provide essential ecosystem services.

Key identified threats to the area will be addressed through elimination or mitigation. Regular monitoring of species populations and habitat quality will inform appropriate actions as needed, and adaptation to climate change will be ongoing.

Existing development pressures will be managed by collaborating with developers to ensure that the highest environmental standards are met, integrating best practices across all phases—design, construction, and operation. This will be supported by continuous monitoring and legislation enforcement by the responsible authorities. Future development will be aligning with the conservation objectives and needs of the area.

Ultimately, the Akrotiri Peninsula will be renowned for its exceptional wildlife and become an integral part of the region's tourism appeal.

3.2 Management Recommendations

The key objective of this review is to provide a set of clear management recommendations/ measures for the Akrotiri wetlands. These recommendations are aiming to:

1) **monitor all sensitive, important and/ or changing biotic and abiotic conditions** so that there is good knowledge base on how the ecosystem is responding and changing through time
2) **minimise existing pressures and threats**
3) **promote a healthier and more resilient ecosystem** for all habitats and species that it supports

Based on the Vision above, the recommendations for conservation, protection, restoration and management actions at Akrotiri Peninsula are presented in the following paragraphs. These are listed under the following five categories:

1. **Audit**
2. **Protect**
3. **Manage**
4. **Restore**
5. **Create**

For each category, the recommendations/ measures are structured in respective **strategic objectives**, for each of which, information is provided on the **target**, the **issues addressed** and the **area** of implementation.

For each measure the **timeframe** and **priority scale** (high: 1, medium: 2, low: 3) are indicated:

Strategic objective	
Recommendation/Measure	
Target	
Issues addressed	
Area	
Timeframe	
Priority	
Description	

Timeframe
o On-going
o Immediate (1-2 years)
o Medium- term (3-5 years)
o Long-term (5-10 years)
Priority
o High
o Medium
o Low

3.2.1 Audit

Strategic objective	**Habitat and Species Systematic Monitoring**
Recommendation/Measure	**1.1 Six-year habitat audit cycle**
Target	Key habitats in the Akrotiri Peninsula
Issues addressed	- Lack of Knowledge - Effectiveness of management - Habitat loss and degradation
Area	Akrotiri Peninsula (all areas)
Timeframe	Immediate and ongoing
Priority	1
Description	Undertake an audit of the key features of each habitat and their condition, assessing pressures and trends. The last overall habitat mapping in the area has been done in the context of the Management Plan in 2012. An updated habitat mapping needs to be done, including also the assessment of the habitats condition, evaluating pressures and threats. Based on that, identification and prioritization of protection/ management/ conservation and restoration actions will be made for the coming years. Audits will be repeated every six years.

Strategic objective	**Habitat and Species Systematic Monitoring**
Recommendation/Measure	**1.2 Monitoring species population trends**
Target	All key species for the Akrotiri Peninsula
Issues addressed	- Lack of Knowledge - Effectiveness of management - Species conservation status deterioration
Area	Akrotiri Peninsula (all areas)
Timeframe	Immediate and ongoing
Priority	1
Description	The first step is to compile an agreed list of key species to monitor and design and implement a monitoring plan based on species monitoring requirements and information gaps with timescale, frequency, areas and techniques. Monitoring responsibilities need to be assigned also to external collaborators (e.g. Game & Fauna Service, BirdLife Cyprus, Water Development Department, Sewerage Board of Limassol and Amathus, Department of Fisheries and Marine Research, Terra Cypria, other scientists/ bodies) and all monitoring data collected must be gathered in a central database.

Strategic objective	**Habitat and Species Systematic Monitoring**
Recommendation/Measure	**1.3 Monitoring breeding success and productivity of ground-nesting waders**
Target	Black-winged Stilt, Spur-winged Lapwing and Kentish Plover
Issues addressed	- Lack of Knowledge - Effectiveness of management - Species conservation status deterioration - Predation - Increasing tourism and unmanaged access

Area	Akrotiri Peninsula (all areas)
Timeframe	Short term and ongoing
Priority	1
Description	Predation has been identified as one of the main threats to ground-nesting waders. The Akrotiri Peninsula has two abundant predators which are often very problematic for birds: Foxes *Vulpes vulpes* and Feral Cats *Felis catus*. Additionally, stray dogs act as predators in the area in a lesser extent and Hooded crows can act as predators, which are very abundant in the area (especially near Akrotiri Marsh). Detailed monitoring of nest success, chick survival (productivity) and predation pressure needs to take place in order to identify and address further conservation measures.

Strategic objective	**Habitat and Species Systematic Monitoring**
Recommendation/Measure	**1.4 Monitoring of prey abundance in Salt Lake**
Target	Greater Flamingo
Issues addressed	- Alteration of the hydrological regime of the wetlands - Lack of Knowledge - Effectiveness of management - Species conservation status deterioration
Area	Akrotiri Salt Lake
Timeframe	Immediate and ongoing
Priority	1
Description	Studying the hydrological changes at the Akrotiri Salt Lake may reveal changes in water quality and quantity, which might impact the life cycle of the main crustacean *Phallocryptus (Branchinella) spinosus,* the most important element of the food chain and prey for flamingos. Understanding how the species reacts to the changes is crucial to anticipate actions on the hydrology of the site. Monitoring of abundance of *Phallocryptus (Branchinella) spinosus* to be undertaken. This is complimentary to the next measure 1.5 on water quantity and quality monitoring.

Strategic objective	**Abiotic systematic Monitoring** **Understand and quantify hydrological and hydrogeological regime changes**
Recommendation/Measure	**1.5 Systematic monitoring of water quantity and quality in all wetland system**
Target	Hydrological regime changes
Issues addressed	- Alteration of the hydrological regime of the wetlands - Lack of Knowledge - Effectiveness of management - Species conservation status deterioration - Habitat loss and degradation
Area	All Akrotiri Wetlands
Timeframe	Immediate and ongoing
Priority	1
Description	The significant hydrological changes in the area have impacts in the whole ecosystem. It is crucial to understand and quantify these

	changes by designing and implementing an ongoing monitoring program in all the wetland sub-systems that measure water quantity (levels, inflows, outflows) and quality (nutrients, salinity, oxygenation, temperature, pH, specific pollutants) at appropriate frequency and on both surface and groundwaters. On-going monitoring is done by the Water Development Department, but this needs to be reinforced in frequency, sampling points and parameters monitored. Additionally, taking into account the monitoring results from all lake's inflow sources, along with the monitoring of the lake's water level, the lake's water balance should be re-evaluated in conjunction with the aquifer model proposed in measure 1.6 below.

Strategic objective	**Understand and quantify hydrological and hydrogeological regime changes**
Recommendation/Measure	**1.6 Development of the model of the Akrotiri aquifer, considering existing conditions and future trends**
Target	Hydrological regime changes
Issues addressed	- Alteration of the hydrological regime of the wetlands - Lack of Knowledge - Climate Change
Area	Akrotiri Peninsula
Timeframe	Immediate
Priority	1
Description	Development of groundwater model of the Akrotiri aquifer as a management dynamic tool by competent authorities. This refers to a simulation or representation of the aquifer system that is used to understand, analyze, and manage groundwater resources effectively. This model can provide valuable insights into aquifer behavior and assist in making informed decisions about water resource management (e.g. irrigation and recharge of aquifer with recycled water, cessation of borehole use etc). The key points about aquifer model as a management tools are the following: · **Understanding Aquifer Dynamics**: Models help in understanding how water moves through aquifers, including recharge, discharge, and flow patterns. · **Predicting Impacts**: They can predict how different management strategies (e.g., pumping rates, land use changes) affect groundwater levels and quality. · **Water Resource Planning**: Helps in planning for sustainable groundwater use, ensuring that withdrawals do not exceed recharge rates. · **Contamination Risk Assessment**: Models can evaluate the spread of contaminants and assess risks to groundwater quality. · **Drought and Flood Management**: Assists in managing aquifer levels during extreme weather events by simulating various scenarios. · **Regulatory Compliance**: Supports compliance with regulations regarding groundwater use and protection. · **Informed Decision-Making**: Provides data-driven insights that can lead to better management practices.

	• **Stakeholder Engagement**: Helps communicate complex groundwater issues to stakeholders, including the public, policymakers, and industry. In summary, the aquifer model will serve as critical management tool that will help decision makers to understand groundwater system, predict future scenarios and make informed decisions for sustainable water resource management, taking into consideration the impacts to the hydrological regime of the Akrotiri Lake.

Strategic objective	**Habitat and Species Systematic Monitoring** **Abiotic systematic Monitoring**
Recommendation/Measure	**1.7 Development of a centralised monitoring database & Data input of monitoring results (past, present, future)**
Target	All habitats and Species Hydrological regime changes
Issues addressed	- Alteration of the hydrological regime of the wetlands - Lack of Knowledge - Effectiveness of management - Species conservation status deterioration - Habitat loss and degradation
Area	Akrotiri Peninsula
Timeframe	Immediate and ongoing
Priority	1
Description	Monitoring efforts are already taking place for Akrotiri Peninsula by various stakeholders, but monitoring results are not collected in a central database that could allow an integrated interpretation and assessment of monitoring results. It is crucial for all monitoring data collected to be gathered in a central database, in order for the responsible managing body (i.e. SBAA ED) to assess overall results and identify negative trends in populations or habitats or abiotic factors' trends that require addressing through conservation action or appropriate management.

3.2.2 Protect

Strategic objective	**Maintain/ improve conservation status of key indicator species**
Recommendation/Measure	**2.1 Regulation of human access and human activities in key nesting, feeding and roosting areas of Kentish Plover and non-breeding visitors**
Target	Kentish Plover and other key species
Issues addressed	- Disturbance - Predation - Increasing tourism and unmanaged access - Species conservation status deterioration - Habitat degradation and loss
Area	Lady's Mile Pools, Merras area
Timeframe	Short term and ongoing
Priority	1
Description	Human activities (tourists/ visitors, illegal training of hunting dogs, vehicle access) needs to be regulated to avoid direct disturbance to breeding sites and to prevent habitat degradation/loss. This action is particularly needed in sites of Merras Wetland and Lady's Mile. Continuation, as well as maintenance, of the work already undertaken is a priority, together with patrolling.

Strategic objective	**Maintain/ improve conservation status of key indicator species** **Maintain/ improve habitat quality and extent**
Recommendation/Measure	**2.2 Regulation of human access and human activities in turtle nesting and key dune areas**
Target	Dunes habitat, Key flora species, Turtle nesting areas
Issues addressed	- Disturbance - Predation - Increasing tourism and unmanaged access - Species conservation status deterioration - Habitat degradation and loss - Erosion
Area	Lady's Mile beach
Timeframe	Immediate and ongoing
Priority	1
Description	Human activities, which concern tourists/ visitors, dog presence, vehicle access, pedestrian access, restaurant facilities on Lady's mile beach, need to be regulated to avoid direct disturbance to turtle nesting areas and to prevent dune habitat loss. This action is needed along Lady's Mile Beach but also other dune areas like Merras. This can be achieved by access restriction measures (i.e. wooden paths, roped off beach areas, road blocks), patrolling and law enforcement and use of information signs for public awareness. Continuation, as well as maintenance, of the work already undertaken is a priority, together with patrolling.

Strategic objective	**Maintain/ improve conservation status of key indicator species**
Recommendation/Measure	**2.3 Reduction of collision risk with antennae, high infrastructure towers (telecommunication antenna towers) & electrocution risk in medium tension network**
Target	**Migrating birds, esp. soaring birds**
Issues addressed	- Collision with antennae
Area	Akrotiri Marsh, Merras area
Timeframe	Short term
Priority	1
Description	There is need to implement the recommendations made in the report by Tye (2013). Notably, monitoring of the collision impact should be undertaken in order to identify which species are mostly affected and in which locations. Additionally, it is important to minimize the electrocution risk in medium voltage network. There should be an effort to remove disused cables/antennae, redesign new structures, improve visibility of structures with visual cue markers, such as Firefly deflectors and replace red warning lights with white strobe lights.

Strategic objective	**Maintain/ improve conservation status of key indicator species**
Recommendation/Measure	**2.4 Anti-predation measures through fencing or predator control for nesting Kentish Plover, Black-winged Stilt and Spur-winged Lapwing**
Target	Kentish Plover, Black-winged Stilt and Spur-winged Lapwing
Issues addressed	- Predation - Species conservation status deterioration
Area	Lady's Mile Beach, Akrotiri Marsh, Merras area
Timeframe	Long term
Priority	2
Description	If nest success and chick survival (productivity) is low and predation is an issue, based on nesting success monitoring in measure 1.3, this needs to be quantified and identified in detail (ideally using automatic cameras on nests) and measures to prevent predator access should be taken in place, ideally by fencing some areas effectively (either temporarily –during the nesting season- or permanently). Temporary fencing could be done using electric fences and/or smelling deterrents, and permanent fencing by appropriate fences for exclusion or excavation of deep canals (thus, forming small islands).

Strategic objective	**Maintain/ improve conservation status of key indicator species**
Recommendation/Measure	**2.5 Prevent and/or manage fish introductions in all areas, but esp. to key Merras pools with Killifish**
Target	Mediterranean Killifish
Issues addressed	- Predation - Competition - Species conservation status deterioration
Area	All Akrotiri Wetlands, esp. Merras area
Timeframe	Medium term
Priority	1

Description	Unauthorised fish introductions to pools used by Mediterranean Killifish have the potential to increase competition and predation in these key refuges for the Killifish. The pools may need netting to remove existing fish.

Strategic objective	**Maintain/ improve conservation status of key indicator species**
Recommendation/Measure	**2.6 Reduce predation by feral cats by a trap, neuter, shelter/ rehome scheme**
Target	Ground nesting birds
Issues addressed	- Predation - Species conservation status deterioration
Area	Akrotiri Peninsula (all areas)
Timeframe	Medium term
Priority	1
Description	Investigate the potential for a trap, neuter, shelter/ rehome for feral cats on the Peninsula, and implement if possible. Project may involve camera traps, live traps, public consultation, working with existing cat sanctuaries and public awareness. Liaise with similar projects in Europe.

Strategic objective	**Maintain/ improve conservation status of key indicator species** **Maintain/ improve habitat quality and extent**
Recommendation/Measure	**2.7 Monitor, audit and work with stakeholders, local authorities and existing developers in order to minimize any input of pollutants in any of the Akrotiri Wetlands.**
Target	Akrotiri Salt Lake, but also all other Akrotiri Wetlands
Issues addressed	- Development pressure - Alteration of hydrological regime - Pollution
Area	All Akrotiri Wetlands, esp. development areas north of Salt Lake
Timeframe	Immediate and ongoing
Priority	1
Description	It is critical to establish, in collaboration with other stakeholders (Water Development Department, Geological Survey Department, Environment Department etc.), a regular control/ audit/ monitor system of the current developments and their infrastructure in order to ensure that water input to the Salt Lake is of an acceptable quality and will not lead to pollution issues. Regular monitoring of run-off before it enters the protected area is essential.

Strategic objective	**Maintain/ improve habitat quality and extent** **Maintain/ improve conservation status of key indicator species**
Recommendation/Measure	**2.8 Regulation of human access and human activities in the Orchids Walk area**
Target	- Orchids
Issues addressed	- Disturbance - Increasing tourism and unmanaged access - Species conservation status deterioration

	- Habitat degradation and loss
Area	Orchids walk
Timeframe	Short term and ongoing
Priority	1
Description	This is one of the few areas within the SBA where the endemic orchid *Ophrys kotschyi* is found, among other orchid species. Within the area, there is no access control or installed signs on the importance on this site to the endemic orchid, resulting in several orchids and other plants being trampled by walkers or destroyed by uncontrolled car driving. Impacts from trampling needs to be managed by designation of restriction of car access, designation of walking trail and information signs.

Strategic objective	**Maintain/ improve habitat quality and extent** **Maintain/ improve conservation status of key indicator species** **Efficient & effective General Management**
Recommendation/Measure	**2.9 Implementation of Awareness and Education actions**
Target	- Children, Visitors, Tourists, Locals
Issues addressed	- Disturbance - Increasing tourism and unmanaged access - Species conservation status deterioration - Habitat degradation and loss
Area	Akrotiri Peninsula (all areas)
Timeframe	Short term and ongoing
Priority	1
Description	Awareness and education on the values of the area for locals, children, visitors, society overall, etc. are crucial in creating shifts in attitudes and behaviours. Towards this aim, implementation of ongoing of Awareness and Education actions through Akrotiri Environmental and Education Centre and collaboration with NGOs and competent authorities to increase awareness of the value of the area.

3.2.3 Manage

Strategic objective	**Efficient & effective General Management**
Recommendation/Measure	**3.1 Update of Akrotiri Peninsula Management Plan according to the Sovereign Base Areas environmental legislation with a protection status similar to that of the NATURA 2000 sites**
Target	- Efficient management - All Key habitats in the Akrotiri Peninsula - All key species for the Akrotiri Peninsula
Issues addressed	- Effectiveness of management - Habitat loss and degradation - Species conservation status deterioration
Area	Akrotiri Peninsula
Timeframe	Immediate and ongoing
Priority	1
Description	Following the updated habitat mapping and assessment of the habitats condition, the agreed monitoring plan for key species and the gathering of all existing information, the update of Akrotiri Peninsula Management Plan needs to be elaborated, as a high priority. This should include data gaps and a schedule to fill these gaps through monitoring programs, and all necessary conservation, protection and restoration actions, prioritized and within a timeframe of implementation. Additionally, allocation of responsibilities needs to be made between SBAA Environment Department and external collaborators/ stakeholders in the form of agreements of cooperation, in order to result in a realistic implementation of the management plan (e.g. Game & Fauna Service, Birdlife Cyprus, Water Development Department, Department of Fisheries and Marine Research, Terra Cypria, other scientists/ bodies). The management plan should be adaptive and updated based on new information from monitoring/ auditing at least every 6 years following the 6-year habitat auditing cycle.

Strategic objective	**Efficient & effective General Management**
Recommendation/Measure	**3.2 Patrolling and Legislation enforcement**
Target	- Efficient management - All Key habitats in the Akrotiri Peninsula - All key species for the Akrotiri Peninsula
Issues addressed	- Effectiveness of management - Habitat loss and degradation - Species conservation status deterioration - Increasing tourism and unmanaged access - Disturbance - Pollution
Area	Akrotiri Peninsula
Timeframe	Immediate and ongoing
Priority	1

Description	Patrolling and Legislation enforcement in the Akrotiri Peninsula needs to be reinforced, since there are significant pressures in both habitats and species from illegal activities. These concern waste dumping and littering, off-road driving, pollution events, hunting and training of hunting dogs, non-compliance of restaurants and relevant facilities in Lady's mile beach (i.e. umbrellas, sun beds, lighting, noise, parking footprint etc). etc. There must be clear and transparent regulations for the area and law enforcement with aversive fines and procedures, applying a zero-tolerance approach where illegalities are detected

Strategic objective	**Maintain/ improve habitat quality and extent**
Recommendation/Measure	**3.3 Management of key reedbed habitat features**
Target	Reedbed habitat quality
Issues addressed	- Natural succession - Habitat loss and degradation - Species conservation status deterioration
Area	Akrotiri Marsh, Zakaki Marsh
Timeframe	Short term and ongoing
Priority	1
Description	Identify targets for areas of reed/marsh and open water habitat and maintain. Program routine reedbed management, notably clearances of channers, pools, other areas on annual/ 5/ 10-year cycle depending on the location needs.

Strategic objective	**Maintain/ improve habitat quality and extent**
Recommendation/Measure	**3.4 Sustainable grazing in Akrotiri Marsh**
Target	Marsh habitat quality
Issues addressed	- Habitat loss and degradation - Species conservation status deterioration
Area	Akrotiri Marsh
Timeframe	Short term and ongoing
Priority	1
Description	Based on the operation of Akrotiri Marsh Management Committee, implement the recommendations grazing study of the Darwin Plus141 project, ensuring sustainable grazing of the marsh and aiming to achieve a balance between open water, reedbed and grassland for the benefit of key species. Continue working with graziers and stakeholders to deliver a sustainable grazing scheme.

Strategic objective	**Maintain/ improve conservation status of key indicator species**
Recommendation/Measure	**3.5 Improvement of open grazed meadows for the nesting of Black-winged Stilt and Spur-winged Lapwing**
Target	Black-winged Stilt, Spur-winged Lapwing
Issues addressed	- Habitat loss and degradation - Species conservation status deterioration - Disturbance
Area	Akrotiri Marsh

Timeframe	Long term
Priority	3
Description	Most of the breeding pairs of Black-winged Stilt and Spur-winged Lapwing are currently related to the grazing activities at Akrotiri Marsh. Thus, grazing needs to be maintained for the conservation of the species, but it could be improved to avoid overgrazing of some areas and to reduce nest disturbance (of incubating adults or egg trampling). The improvements could be made by including GeoFencing systems or by dividing the grazing area into different areas, with corresponding management of grazing time during the year (for instance, leaving a meadow area without or with very little cattle access during the nesting season).

Strategic objective	**Maintain/ improve conservation status of key indicator species**
Recommendation/Measure	**3.6 Akrotiri Marsh flora conservation & management**
Target	Key flora species included in Cyprus Red Data Book: e.g. Soft stem bulrush *Schoenoplectus tabernaemontani*, Water mint *Mentha aquatica*, Hairy Spurge *Euphorbia hirsuta*, Saltmarsh morning glory *Ipomoea sagittata*.
Issues addressed	- Habitat loss and degradation - Species conservation status deterioration - Disturbance
Area	Akrotiri Marsh
Timeframe	Immediate and Ongoing
Priority	1
Description	Following the Darwin Plus141 project conservation actions, it is important to continue to manage the habitat required by the plant species by managed grazing, clearance of other vegetation, monitoring of key flora in the field and manage/enhance key species populations as required.

Strategic objective	**Maintain/ improve conservation status of key indicator species**
Recommendation/Measure	**3.7 Brackish pool management for Dark Spreadwing Damselfly (Orchids walk) & endemic grasshopper *Platycleis kibris* (Merras area)**
Target	Dark Spreadwing Damselfly *Lestes macrostigma* & endemic grasshopper *Platycleis kibris*
Issues addressed	- Natural succession
Area	Orchids walk, Merras area
Timeframe	Short term
Priority	2
Description	The Dark Spreadwing lays eggs on *Juncus* stems in shallow brackish pools that dry out in summer. The pools are currently mostly overgrown with juncus and other marginal aquatic plants. A programme of shallow clearance and possibly rotavation of pools should be undertaken, affecting no more than 50% of a pool and retaining sufficient Juncus on the margins. Maintain monitoring with local Odonata specialists.

Strategic objective	**Efficient & effective General Management** **Public Health**
Recommendation/Measure	**3.8 Sustainable management of mosquitoes and other arthropods of medical and veterinary importance**
Target	Mosquitoes and other arthropods of medical and veterinary importance
Issues addressed	- Impacts of pollution on native & non-native mosquito populations - Impacts of urbanization on native & non-native mosquito populations - Spillovers of pathogens from and to wild bird populations - Native Natural enemies of mosquitoes - Protection measures for the local communities (mechanical trapping for adult mosquitoes)
Area	All Akrotiri Wetlands and adjacent urbanized sites
Timeframe	Ongoing
Priority	1
Description	There is an ongoing mosquito management scheme at the Akrotiri wetland and adjacent urban sites that relies on monitoring mosquito populations and larval control with the use of a biological larvicide (*Bacillus thuringiensis israelensis*) that it is the only product that can be applied to wetland ecosystems. While there is this ongoing mosquito management scheme, there is area for improvement. Natural enemies of native mosquitoes are not studied and alternative methods of control based on natural enemies have not been explored. Furthermore, studies are needed to better understand the impact of major anthropogenic pressures operating in the area on mosquito populations (e.g. pollution, urbanization, invasive alien species). Urbanization especially, is expected to affect mosquito populations directly as more humans will inhabit sites adjacent to the Akrotiri wetland and indirectly through the effects of pollution. Emergence and re-emergence of diseases that can affect humans, domesticated and wild animals should also be further investigated and disease risk should be estimated for humans and wild birds and other animals. Pathogen screening of mosquito populations and wild bird populations and other wild animals is recommended. Finally, educational and awareness activities on both visitors of the area and the inhabitants of adjacent urbanized sites on this issue are very important.

3.2.4 Restore

Strategic objective	**Maintain/ improve habitat quality and extent** **Maintain/ improve conservation status of key indicator species**
Recommendation/Measure	**4.1 Restoration of open, deep and shallow brackish water pools in Zakaki Marsh**
Target	Ferruginous Duck, Black-winged Stilt, invertebrates
Issues addressed	- Habitat loss and degradation - Species conservation status deterioration - Natural succession
Area	Zakaki Marsh
Timeframe	Short term
Priority	1
Description	Maintain open water habitat (deep pools) for benefit for breeding Ferruginous Duck and (shallow pools) for Black-winged Stilt. Follow the agreed action plan by Darwin Plus141 project, which involves: - Mechanical uprooting of reeds in the area in front of the existing bird hide. This area will be ~45 m long and ~25 m wide. The roots of the reeds reach about half a meter below the ground. - A deeper lake will be excavated in the edge of the above area, with a depth of 3 m and a diameter of ~20 m. - Next to the formed deeper lake, there is an existing deeper pool and further down there is an existing islet. - Two corridors with inert material (gravel) will be made on either side of the area, which mechanical uprooting of reeds will take place. These corridors will be used as a base for the tracked excavator to carry out the works, but also in the future it will be easier to maintain the removal of the reeds both manually and mechanically, as well as these corridors will be an additional barrier to the spread of the reeds. - The reeds that will be uprooted will be placed outside two corridors, on top of existing reeds, in order to further limit the spread of the reeds in this area. - At the end of the works, an opening will be made in the gravel corridors at the 2 ends (about 2.5 m) to prevent the access of predators.

Strategic objective	**Maintain/ improve habitat quality and extent**
Recommendation/Measure	**4.2 Removal/ Management of alien invasive and non-native species that are likely to damage habitat quality**
Target	- Habitats
Issues addressed	- Habitat loss and degradation - Species conservation status deterioration - Competition with invasive species
Area	Akrotiri Peninsula (all areas)
Timeframe	Short term and ongoing
Priority	1
Description	An invasive alien species that is prominent on the Peninsula, as well as in the whole Cyprus is Acacia (*Acacia saligna*), a fire-adapted bush

	or tree, native to southwest Australia, that significantly affects the composition and function of natural ecosystems, leading to homogenization and loss of biodiversity. At the same time, non-natives species like Eucalyptus trees cover the area north of the Salt Lake. Eucalyptus plantations are vulnerable to fire risk, increasing with climate change, with native species being far more resistant. An ongoing gradual program of removal of these species from key areas of habitat must be implemented. In particular, there should be a significant reduction in these species in the Eucalyptus forest area north of the Salt Lake, with a transition to native trees and shrubs, and in some areas, a restoration of wetland habitat.

Strategic objective	**Maintain/ improve conservation status of key indicator species** **Maintain/ improve habitat quality and extent**
Recommendation/Measure	**4.3 Restoration of dune habitat**
Target	Dunes habitat, Key flora species, Turtle nesting areas
Issues addressed	- Increasing tourism and unmanaged access - Species conservation status deterioration - Habitat degradation and loss - Erosion
Area	Lady's Mile beach
Timeframe	Short term
Priority	1
Description	By implementing measure 2.2 "Regulation of human access and human activities in turtle nesting and key dune areas", many dune areas will be restored by allowing spread of mobile dune habitat without any disturbances. Areas of high-quality potential dune habitat will be identified and protected from disturbance to allow restoration.

3.2.5 Create

Strategic objective	**Maintain/ improve conservation status of key indicator species** **Maintain/ improve habitat quality and extent**
Recommendation/Measure	**5.1 Creation of filtering pools/wetland with reed margins**
Target	Water quality
Issues addressed	- Pollution
Area	Eucalyptus forest
Timeframe	Medium Term
Priority	1
Description	In combination with the removal of non-native species and the restoration of native forest, a series of pools below key run-off points can be created that will receive water and filter through reeds before flowing to the Salt Lake.

Strategic objective	**Maintain/ improve habitat quality and extent** **Maintain/ improve conservation status of key indicator species** **Efficient & effective General Management**
Recommendation/Measure	**5.2 Creation of infrastructure for education/raising awareness**
Target	Children, Visitors, Tourists, Locals
Issues addressed	Raising awareness of importance of the Peninsula
Area	Akrotiri Peninsula
Timeframe	Medium Term
Priority	1
Description	Raising awareness of the many issues raised in this review is a key objective. Much existing infrastructure exists e.g. viewing structures at Akrotiri & Zakaki Marsh, walking trails (Lady's Mile & Kourteli), Viewing Screen/ Info Point at Lady's Mile, that are now used for educational visits. Further infrastructure should be considered that would benefit both visitors to the Peninsula and the key habitats.

Strategic objective	**Maintain/ improve conservation status of key indicator species**
Recommendation/Measure	**5.3 Creating islands/structures to facilitate Greater Flamingo possible nesting**
Target	Greater Flamingo
Issues addressed	- Disturbance - Predation - Species conservation status deterioration
Area	Akrotiri Salt Lake
Timeframe	Long term
Priority	3
Description	Creation of new or adaptation of existing islands to facilitate breeding of Flamingos. The sites where breeding was attempted (but failed) could be improved by reducing access by predators. Additionally, the creation of new islands could be considered.

Strategic objective	**Maintain/ improve conservation status of key indicator species**
Recommendation/Measure	**5.4 Creation of floating islands for nesting sites of Ferruginous Duck**
Target	Ferruginous Duck
Issues addressed	- Lack of nesting sites
Area	Bishop's Pool
Timeframe	Long term
Priority	2
Description	Installation of floating vegetated structures, which the species selects positively for nesting, could improve the breeding success of the species.

Strategic objective	**Maintain/ improve conservation status of key indicator species**
Recommendation/Measure	**5.5 Creation of reedbed pools for Ferruginous Duck nesting**
Target	Ferruginous Duck
Issues addressed	- Lack of nesting sites
Area	Akrotiri Marsh
Timeframe	Medium term
Priority	2
Description	The growth of the reedbed at the Akrotiri Marsh has reduced the available habitat for the Ferruginous Duck. The creation of additional deeper pools of >2m, where the reeds struggle to grow, would open up some areas and favour the establishment of Ferruginous Duck population. At the same time, this action would also boost biodiversity.

Strategic objective	**Maintain/ improve conservation status of key indicator species** **Maintain/ improve habitat quality and extent**
Recommendation/Measure	**5.6 Creation of suitable habitats for various species**
Target	- Colonising species
Issues addressed	- Species conservation status deterioration - Habitat degradation and loss
Area	Akrotiri Peninsula (all areas)
Timeframe	Long term
Priority	2
Description	Undertake a review to identify beneficial species that may establish in the area due to changing climatic conditions. These could be birds, Odonata or other invertebrates etc. If suitable habitat conditions are not available, then consider creation. For example, this could be more wetland habitat – brackish pools – or nesting areas for bird species.

Strategic objective	**Maintain/ improve conservation status of key indicator species**
Recommendation/Measure	**5.7 Restoration of brackish water pools in Zakaki Marsh area**
Target	Black-winged Stilt, invertebrates
Issues addressed	- Species conservation status deterioration - Habitat degradation and loss
Area	Zakaki Marsh
Timeframe	Long term

Priority	2
Description	The input of fresh water run-off into Zakaki Marsh has resulted in the loss of shallow brackish water communities. The creation of new pools and scrapes away from the fresh water influence will restore some of the brackish water habitat for the benefit of the associated species.

3.3 Summary of Recommendations

Table 3.1: Summary of proposed recommendations/ measures

(Timeframe: ongoing, immediate (1-2 years), medium term (3-5 years), long term (5-10 years); Priority: 1- High, 2-Medium, 3- Low)

Category	Recommendation/ Measure	Strategic Objective(s)	Area	Timeframe	Priority
Audit	**1.1 Six-year habitat audit cycle**	Habitat and Species Systematic Monitoring	Akrotiri Peninsula (all areas)	Immediate and ongoing	1
	1.2 Monitoring species population trends	Habitat and Species Systematic Monitoring	Akrotiri Peninsula (all areas)	Immediate and ongoing	1
	1.3 Monitoring breeding success and productivity of ground-nesting waders	Habitat and Species Systematic Monitoring	Akrotiri Peninsula (all areas)	Short term and ongoing	1
	1.4 Monitoring of prey abundance in Salt Lake	Habitat and Species Systematic Monitoring	Akrotiri Salt Lake	Immediate and ongoing	1
	1.5 Systematic monitoring of water quantity and quality in all wetland system	Abiotic systematic Monitoring Understand and quantify hydrological and hydrogeological regime changes	All Akrotiri Wetlands	Immediate and ongoing	1
	1.6 Development of the model of the Akrotiri aquifer, considering existing conditions and future trends	Understand and quantify hydrological and hydrogeological regime changes	Akrotiri Peninsula	Immediate	1
	1.7 Development of a centralised monitoring database & Data input of monitoring results (past, present, future)	Habitat and Species Systematic Monitoring Abiotic systematic Monitoring	Akrotiri Peninsula	Immediate and ongoing	1
Protect	**2.1 Regulation of human access and human activities in key nesting, feeding and roosting areas of Kentish Plover and non-breeding visitors**	Maintain/ improve conservation status of key indicator species	Lady's Mile Pools, Merras area	Short term and ongoing	1
	2.2 Regulation of human access and human activities in turtle nesting and key dune areas	Maintain/ improve conservation status of key indicator species	Lady's Mile beach	Immediate and ongoing	1
	2.3 Reduction of collision risk with antennae, high infrastructure towers (telecommunication antenna towers) & electrocution risk in medium tension network	Maintain/ improve conservation status of key indicator species	Akrotiri Marsh, Merras area	Short term	1

Category	Recommendation/ Measure	Strategic Objective(s)	Area	Timeframe	Priority
	2.4 Anti-predation measures through fencing or predator control for nesting Kentish Plover, Black-winged Stilt and Spur-winged Lapwing	Maintain/ improve conservation status of key indicator species	Lady's Mile Beach, Akrotiri Marsh, Merras area	Long term	2
	2.5 Prevent and/or manage fish introductions in all areas, but esp. to key Merras pools with Killifish	Maintain/ improve conservation status of key indicator species	All Akrotiri Wetlands, esp. Merras area	Medium term	1
	2.6 Reduce predation by feral cats by a trap, neuter, shelter/ rehome scheme	Maintain/ improve conservation status of key indicator species	Akrotiri Peninsula (all areas)	Medium term	1
	2.7 Monitor, audit and work with stakeholders, local authorities and existing developers in order to minimize any input of pollutants in any of the Akrotiri Wetlands	Maintain/ improve conservation status of key indicator species Maintain/ improve habitat quality and extent	All Akrotiri Wetlands, esp. development areas north of Salt Lake	Immediate and ongoing	1
	2.8 Regulation of human access and human activities in the Orchids Walk area	Maintain/ improve conservation status of key indicator species Maintain/ improve habitat quality and extent	Orchids walk	Short term and ongoing	1
	2.9 Implementation of Awareness and Education actions	Maintain/ improve habitat quality and extent Maintain/ improve conservation status of key indicator species Efficient & effective General Management	Akrotiri Peninsula (all areas)	Short term and ongoing	1
Manage	**3.1 Update of Akrotiri Peninsula Management Plan according to the Sovereign Base Areas environmental legislation with a protection status similar to that of the NATURA 2000 sites**	Efficient & effective General Management	Akrotiri Peninsula	Immediate and ongoing	1
	3.2 Patrolling and Legislation enforcement	Efficient & effective General Management	Akrotiri Peninsula	Immediate and ongoing	1
	3.3 Management of key reedbed habitat features	Maintain/ improve habitat quality and extent	Akrotiri Marsh, Zakaki Marsh	Short term and ongoing	1
	3.4 Sustainable grazing in Akrotiri Marsh	Maintain/ improve habitat quality and extent	Akrotiri Marsh	Short term and ongoing	1
	3.5 Improvement of open grazed meadows for the nesting of Black-winged Stilt and Spur-winged Lapwing	Maintain/ improve conservation status of key indicator species	Akrotiri Marsh	Long term	3

Category	Recommendation/ Measure	Strategic Objective(s)	Area	Timeframe	Priority
	3.6 Akrotiri Marsh flora conservation & management	Maintain/ improve conservation status of key indicator species	Akrotiri Marsh	Immediate and ongoing	1
	3.7 Brackish pool management for Dark Spreadwing Damselfly (Orchids walk) & endemic grasshopper *Platycleis kibris* (Merras area)	Maintain/ improve conservation status of key indicator species	Orchids walk & Merras area	Short term	2
	3.8 Sustainable management of mosquitoes and other arthropods of medical and veterinary importance	Efficient & effective General Management Public Health	All Akrotiri Wetlands & adjacent urbanized sites	Ongoing	1
Restore	**4.1 Restoration of open, deep and shallow brackish water pools in Zakaki Marsh**	Maintain/ improve habitat quality and extent Maintain/ improve conservation status of key indicator species	Zakaki Marsh	Short term	1
	4.2 Removal/ Management of alien invasive and non-native species that are likely to damage habitat quality	Maintain/ improve habitat quality and extent	Akrotiri Peninsula (all areas)	Short term and ongoing	1
	4.3 Restoration of dune habitat	Maintain/ improve habitat quality and extent Maintain/ improve conservation status of key indicator species	Lady's Mile beach	Short term	1
Create	**5.1 Creation of filtering pools/wetland with reed margins**	Maintain/ improve conservation status of key indicator species Maintain/ improve habitat quality and extent	Eucalyptus forest	Medium term	1
	5.2 Creation of infrastructure for education/raising awareness	Maintain/ improve habitat quality and extent Maintain/ improve conservation status of key indicator species Efficient & effective General Management	Akrotiri Peninsula	Medium Term	1
	5.3 Creating islands/structures to facilitate Greater Flamingo possible nesting	Maintain/ improve conservation status of key indicator species	Akrotiri Salt Lake	Long term	3
	5.4 Creation of floating islands for nesting sites of Ferruginous Duck	Maintain/ improve conservation status of key indicator species	Bishop's pool	Long term	2
	5.5 Creation of reedbed pools for Ferruginous Duck nesting	Maintain/ improve conservation status of key indicator species	Akrotiri Marsh	Medium term	2

Category	Recommendation/ Measure	Strategic Objective(s)	Area	Timeframe	Priority
	5.6 Creation of suitable habitats for various species	Maintain/ improve conservation status of key indicator species Maintain/ improve habitat quality and extent	Akrotiri Peninsula (all areas)	Long term	2
	5.7 Restoration of brackish water pools in Zakaki Marsh area	Maintain/ improve conservation status of key indicator species	Zakaki Marsh	Long term	2

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Annexes