

Tyre beach

Introduction

Ras el Ain is part of the best preserved stretch of sandy coastline in southern Lebanon. It has considerable scenic and recreational value, and its artesian wells are an important heritage site and give rise to a number of notable freshwater habitats. Intertidal and offshore studies have also revealed the diversity of its marine life.

But it is also a fragile ecosystem that, because of its proximity to the city of Tyre and the Palestinian Rachidieh camp, has been threatened from pollution, urban encroachment and other human impacts. With protection decreed by ministerial orders and soon to be given reserve status, the scope exists for a nature conservation initiative encompassing the aims of biodiversity and landscape protection.

Description

Location and geomorphology

The reserve has an area of 3.8 km² which is divided into two: the first to the south of the Tyre Rest House on the edge of Tyre, and the second at Ras el Ain, 4 km further to the south. The Rachidieh camp lies in between them. The reserve areas include stabilised dunes and farmland behind the beaches.

Sand predominates on the stretch of beach nearest to Tyre. Towards Ras el Ain, it is interspersed with pebbly areas and rocky shelves with pools. The beach and sand dune area are made up of a mixture of quartz and carbonate sands which are locally lithified to give beach rock. In places limestone gravels occur. The underlying geology is very significant as it controls the existence of the artesian springs. The main rock units are a sequence of porous and fissured Lower and 'middle' Cretaceous limestones which are overlain by a sequence of Late Cretaceous chalks and marls. These in turn are overlain by a sequence of Lower Tertiary limestones. The entire sequence is gently dipping and broken by local faulting, some of which seems to be relatively recent.

A point of potential significance is that the Tyre coastline was well known in antiquity for being vulnerable to 'tsunami' (tidal waves) (Brown, 1966). Although there are few recent records of such earthquake-induced events in the area they remain a potential hazard.

Hydrology

The Lower and 'middle' Cretaceous limestones form the aquifer that provides the majority of the region's water, although private wells tap the water of the upper Eocene sediments. The capping of the largely impermeable Late Cretaceous has allowed the development of artesian wells where the water rises above ground level under natural pressure. At Ras el Ain there are three artesian wells whose walls were built by the Phoenicians, as well as other small springs. The water at the wells rise to 5 m above the ground level. The wells have a supply of 1500 l/sec (Boulos, 1994) and serve the irrigation needs of the surrounding farmland, provide some of the drinking water needs of the region (a water treatment plant is present next to the wells), and also drain into the sea by a small channel through the beach.

Oceanography

The tides are very small at Tyre, no more than 60 cm between February and October (Boulos, 1994). The current movement of the Lebanese coastline is from south to north. Current velocities have not been precisely measured in the region, although reports from the port authorities of Tyre stated that it ranges from 0.2 to 1.4 m/sec (0.2 m was typical). As with the Palestinian coast to the south the winter storm wave heights here are much higher

than along the northern coast of Lebanon due to the much greater fetch across the southern part of the Mediterranean for absence of the protection of Cyprus. The temperature of the water reaches a minimum of 17°C in February and a maximum of 32°C in August. At a depth of 70 m it is at a constant value of 17-18°C.

Average salinity of the waters is 39.7, with a slight increase in the hot months due to evaporation. The salinity used to decrease to 35.4‰ in September before the Aswan Dam construction, with the Nile River's freshwater affecting the surface water salinity. As the dam was raised, the supply of freshwater diminished, negatively affecting the marine productivity off the Lebanese coastline. At Ras el Ain, the flow of freshwater to the sea produces a small brackish zone.

Vegetation/habitats

1. Beach

The beach is broadest to the north, but it is at Ras el Ain that the beach vegetation survives best. At the back of the beach can be found scattered sea spurge *Euphorbia paralias* and cotton weed *Otanthus maritimus*. The rocks of the Ras el Ain beach support an amount of invertebrate life including limpets.

2. Stabilised dunes

At Ras el Ain these hillocky areas are dominated by the shrubby aromatic inula *Dittrichia viscosa* with low bugloss plants *Echium (angustifolium)*, grasses and ruderals. To the north, there are humid depressions with some stands of rush *Juncus* sp.

3. Cultivated land

In the reserve area the main irrigated cultivation is of vegetables including lettuce, onion and aubergine. Palm and citrus plantations occur further back, with walls around the field and plantation perimeters or else windbreaks of cane *Arundo donax* or cypress trees *Cupressus sempervirens*. Other trees and shrubs in the area include eucalyptus, pines, palms, castor oil plant *Ricinus communis*, and loquat. Irrigation is by raised concrete channels leading from the artesian wells, and ditches running along the fields boundaries.

4. Artesian wells

Of the three closely grouped artesian wells, two have been reinforced with straight sided concrete edges and surroundings. The third, however, is carved into the rock and retains a special natural character. The edge of the rock at places overhangs the water, and around the margins is a well-developed vegetation of hydrophytic plants. Some emergent plant life is also to be seen in the well, and mosses are present on the walls. The water has an average temperature of 22°C and pH of 7.9, making them very suitable for supporting freshwater and marine life (Boulos, 1994).

5. Ditches and marshy depressions

At Ras el Ain, drainage water running down a ditch from the wells is retained by some levees before seeping out to sea. A marshy area is created here, dominated by mats of watercress and with small stands of reedmace *Typha* sp and cane, providing cover for birds, certainly Squacco Heron and Snipe and possibly Coot and Moorhen. The ditches themselves are also clogged with watercress and other vegetation (eg willow-herb, sedges and grasses), providing cover for numerous frogs and no doubt other animal life.

Lots of the Tyre Reserve:

Lot #	Surface area	Remarks
56	59.988.00	
1507	760.00	
1576	9.701.00	
1577	56.065.00	
1578	48.377.00	
1579	54.467.00	
1580	43.834.00	
1581	46.199.00	
1582	49.894.00	
1583	49.866.00	
1584	50.235.00	
1585	49.402.00	
1586	52.527.00	
1587	50.363.00	
1599	13.112.00	
1600	10.139.00	
1601	10.905.00	
1602	11.023.00	
1603	11.001.00	
1616	14.579.00	
1617	10.331.00	
1618	10.147.00	
1619	10.195.00	
1620	10.390.00	
1631	15.508.00	
1632	9.628.00	
1633	10.618.00	
1634	10.340.00	
1635	10.438.00	
60	1.722.00	Ras El Ain Springs
61		-
62	304.00	-
63	798.00	-
64	2.849.00	
65	44.287.00	Lots surrounding Ras el Ain
66	48.827.00	-
67	423.00	-
68	12.907.00	-
69	15.156.00	-
70	37.291.00	-
71	43.614.00	-
72	32.045.00	-

Lots of the Tyre Reserve

(contd):

73	45.216.00	-
1203	36.435.00	
1205	19.900.00	-
1206	2.649.00	
1209	4.606.00	
1517	7.700.00	
1531	42.281.00	
1532	8.679.00	
1538	30.771.00	Part of it reserved for pumping station
1539	30.332.00	-
1540	44.214.00	
1547	42.743.00	
1548	35.230.00	
1553	46.537.00	
1554	22.079.00	
1555	17.220.00	
1936	54.770.00	

Total: 3883.253.00 m2

Existing land uses

The irrigated farming has already been described. The stabilised dunes are used as rough pasture for small herds of cattle, which are also led to the freshwater sources on or near the beach. At Tyre the beach is a strong tourist attraction in the summer months, when wooden cafes are set up adjacent to the Rest House. Some fishing was observed at the beach of Ras el Ain.

Terrestrial biodiversity

Avifauna

A list of 24 bird species has been made from a visit to Tyre beach in April, and two further visits in the Autumn. These are given in Appendix 7. Doubtless a very much larger list could easily be produced.

A number of species have been recorded in the pools and environs of the landfill site near the Roman hippodrome in 1996, and these records are also relevant to the reserve area. They are listed in Appendix 8.

Those people who have watched birds in Lebanon consider that this far south the effects of the active conservation and shooting restrictions in Israel are to be noted. The birds appear to be more numerous and less timid.

Other fauna

Little is known about the terrestrial fauna of this area. Sightings of frogs, sand lizards, dragonflies, grasshoppers and butterflies were made on a recent visit, suggesting that there is much to be discovered. Small burrows were present in some low sandy banks on the beach at Ras el Ain and could be the work of small mammals. The long-established artesian well that retains its semi-natural character looks to be a potentially interesting site for reptiles and amphibians. Frogs were seen here.

The beach at Ras el Ain is thought to be rich in crustaceans, with a good potential for shrimps and crayfish (Boulos, 1994).

Flora

The following list of plants was made in a preliminary survey of the vegetation surrounding the artesian well:

Verbenaceae	<i>Verbena officinalis</i>	Vervain
Labiatae	<i>Mentha</i> sp	Mint
Compositae	<i>Pulicaria</i> sp	Fleabane
	<i>Eupatorium cannabinum</i>	Hemp agrimony
	<i>Dittrichia viscosa</i>	Aromatic inula
	<i>Bidens</i> sp	Bur-marigold
Rosaceae	<i>Rubus</i> sp	Bramble
Malvaceae	<i>Malva/Lavatora</i> sp	Mallow
Convolvulaceae	<i>Convolvulus</i> sp	Convolvulus
Gramineae	<i>Hyparrhenia hirta</i>	
Cyperaceae	<i>Cyperus</i> sp	

In addition, there was an unidentified legume, and an *Asplenium* fern. For the other areas, identified species are mentioned in the vegetation descriptions.

The area is covered by Mouterde's 1970 flora of Lebanon, but a specific study or list for this site is not known.

Marine biodiversity

The marine biodiversity was studied by Boulos (1994) as part of a regional water and wastewater study. He discovered 91 species of phytoplankton (centrate and pennate diatoms), 34 species of algae, 4 marine angiosperms (*Cymodocea nodosa*, *Posidonia oceanica*, *Zostera marina* and *Z. nana*), 68 species of zooplankton, 8 species of sponges, 32 species of Cnidarian, 3 flatworms, 7 ribbon worms, 42 segmented worms, 106 molluscs, 26 echinoderms, and around 92 fish in the coastal waters of the Tyre district. (Larger figures accurate to within 5 species.) Ras el Ain, with its freshwater supply, was the richest area.

The Red Sea pours into the Mediterranean ten months of the year, while in the remaining two months the reverse is the case. This provides the Mediterranean with rich tropical fauna. Of the available species for fishing in Tyre waters, 20 come from the Red Sea.

Ozhan (1993) made the observation that the beaches of Tyre appeared suitable for the breeding of Mediterranean Sea Turtle, and that the nesting of Green Turtle *Chelonia mydas* and Loggerhead Turtle *Caretta caretta* was possible. Both these latter species are included in the Lebanon biological diversity study of UNEP (1996, draft report). Turtles were popularly known to be breeding on these sands at Tyre in the past, but this hasn't been confirmed in recent years. One turtle was caught in a net by a fisherman one year ago (Ghandour, pers. comm.).

Threats

1. Pollution

The following notes refer to Anouti's (1996) report on marine pollution at Tyre:

Sea water quality: Some analysis have been taken along the coast as part of the CDR water and wastewater study for Tyre (CDR, 1995). The results show very high total coliforms counts near the harbour and the existing outfall. Along the beach areas to north and south of the old town, the coliform numbers varied from 50 to more than 4000/100 ml, with numbers decreasing the further away from the town.

Organic wastes: The biodegradable part of the produced wastes is mainly composed of organic wastes which could result from domestic and industrial waste water. In Tyre, there is no waste water treatment plant. Neglect and absence of enforced regulations have resulted in the haphazard dumping of these wastes either directly into the sea or indirectly by being washed into the sea from rivers and underground aquifers.

In Tyre, there are poultry farms and olive pressing factories. Their organic wastes are decomposed upon reaching the sea, utilising the dissolved oxygen. An increase in the anaerobic species is the result and foul-smelling and toxic end products such as methane, hydrogen sulfide and ammonia will occur. Foul odours were smelt around the Rachidieh camp.

Organic matters in sewage and agricultural wastes contain high levels of nitrates and phosphates. The introduction of these into marine and fresh waters will lead to algae blooms. This may explain the dead algae that has been observed in excessive amounts near the Rachidieh camp area. Fish and zooplankton die under algal bloom conditions. Also, organic matter can contain pathogenic organisms that may lead to disease.

Sewage collection systems only exist in the town of Tyre, the remainder of the region's population is served by cesspools. Around the Rachidieh camp area cesspools are used to collect sewage and wastewater. These pools are not built in accordance with the standards for such systems. They do not have proper disposal fields and therefore pollute the shore and the sea.

The sewage system dates to the 1960s and is in poor condition. In 1990 approximately 15 km of pipes were replaced or added. Most of the waste water does not reach its outfall but is discharged by overflow into the harbour and other locations on the coast of the old town.

The crops of Ras el Ain area are sprayed with pesticides. While walking through the fields to reach the shore, empty boxes of insecticides and fungicides were found near an irrigation channel. Fertilizers could also be used, thus explaining the presence of algae blooms and the excessive amounts of dead algae on the shore. Phosphates and nitrates act as nutrients to algae. The World Bank's 1995 assessment of the environment pinpointed problems of inappropriately large amounts of pesticides being used in irrigated agriculture, sometimes for lack of information on application, and the lack of control on their use (e.g. there is no quality control on imported pesticides).

Inorganic wastes: These include heavy metals and detergents. These compounds affect the sea organisms and the chemical balance for the marine environment. Animal mortality may result from the accumulation of inorganic pollutants in tissues.

Oils and Hydrocarbons: Illegal disposal of oils (e.g from petrol stations and garages, and the clearing of ballast waters from ships, constitute the main channels by which oil reaches the

coast. Evidence for such pollution is tar on the beaches. Floating oil can kill birds and marine mammals. An oil coating reduces buoyancy and prevents the flight of birds. The reduced insulating and water proofing characteristics of such oiled feathers results in an increased susceptibility to cold and diseases, and subsequently death.

Two observations are worth adding from a November 1996 visit. The first is that a high degree of illegal dumping creates another pollution hazard, with potentially toxic effluent washing onto the dunes and beach. The second is that a channel of polluted wastewater was seen crossing the beach at one point below the Rachidiyeh camp

2. Dumping and litter

Large scale but illegal dumping occurs in the back dunes of the beach area south of the Tyre Guest House. Everywhere else, plastic, metal and paper litter is strewn, including some materials hazardous to wildlife (e.g. fine fishing nets) and potentially toxic materials (e.g. used syringes). Scrap metal was seen at the bottom of one of the artesian wells. A certain amount of the litter will have been washed up from the sea and is probably from Israel. The majority, however, is from local sources.

Clearance of some of the rubbish apparently takes place in the summer months by the owners of the cafes that are seasonally erected on the beach.

3. Urbanisation

For most of this century Tyre has been expanding over surrounding areas of beaches and dunes, covering, for example, the sandy area left alone by the Romans between the old town and the hippodrome. A rapid building programme of new houses and apartments started in 1986, with people seeking to invest their money and buildings, and many Beirutis migrating south. Although the town plan of the early 1980s stipulated a maximum of 3-4 stories, apartment blocks of up to 13 stories were erected, and new large buildings are still appearing, detracting from the scenic value of the area (Ozhan, 1993).

A housing complex at El Bass built in the 1930s for Armenian refugees and now occupied by Palestinians, and the Rachidieh refugee camp, have both encroached on beach-dune systems. Hard-core and scrap metal forms a sea defence at the back of the beach beside the camp. A final example is a road constructed by militia along the back dunes of the coast south of Tyre in 1985-6 by filling and using rubble protection (Ozhan, 1993).

Urbanisation close to the coastline not only leads to the destruction of the beach/dune habitats and their wildlife communities, but it also leads to coastal erosion by disturbing the natural processes and dynamics of sand replenishment, and dissipation of wave energy. Dunes have the function of replenishing beach sand lost during catastrophic storm events and preventing coastal erosion. The loss of dune sand obviously impedes this important beach-dune interaction.

Coastal erosion is evident from the fate of the Government Rest House, built in the 1960s, and located 100 m inland of the shoreline. After a number of storms in the winter of 1992, the shoreline had receded up to the building, whose foundations were seriously undercut by the wash of storms occurring the following winter. The damage was repaired and breakwaters were constructed to protect this stretch of coastline from further erosion. The construction of sea defences have their own effects on shoreline dynamics, and sand accretion can be seen at the southern side of the breakwaters. Coastal erosion is a problem along much of the Lebanese coastline. For example, a stretch of disused railway line between Beirut and Saida can be seen collapsing into the beach in places.

4. Sand mining

The high market value of sand due to the extensive building taking place led to its illegal mining from the coast in the 1980s. Some of the sand was taken directly from the dunes, but some was dredged from the sea at a water depth of 6 m and pumped ashore. Mining of sand from the sea bed was also practiced for 6-8 months in 1991 (Ozhan, 1993). There are now tighter controls on illegal mining, but there are still signs that it takes place on a small scale. Natural recharge of sand by long shore drift northwards along the coast from the south of Tyre is now probably minimal.

Sand mining can have harmful effects on the marine flora and fauna, seriously altering their habitats. Shrimps, for example are affected. Even though the excavations have stopped, the quantity of sand removed is unknown and the disturbance to animal populations may still be felt. For example, fish spawning grounds may have been destroyed.

Sand withdrawal also leads to the occurrence of valleys in the sea which is dangerous to swimmers because of the tides that are generated.

The fact that much of the sand is calcium carbonate shell fragments rather than pure quartz reduces the economic value of it. Further work is needed but it is probably not a sand suitable for high quality building.

5. Disturbance to habitats and wildlife

The beach south of Tyre is a prized bathing beach in the summer, when large numbers of people fill the stretch nearest to the town. Disturbance to any wildlife is therefore great during this period. In November 1996, a few vehicles were seen on the beach here, probably belonging to fishermen.

Access to the beach at Ras el Ain is much less easy and there are a number of military checkpoints here. Human disturbance is therefore less. However, at this part of the coast, the cattle using the rough pastures of the stabilised dunes cause damage to the habitat both by grazing and trampling, especially when they roam onto the more fragile beach sands. The effects of trampling could be seen at the margins of the marshy depressions, where there were exposed muddy areas.

The artesian wells are used for swimming.

Conservation strategy

Despite the threats to the area described above, the recreational value that the Tyre beaches have for many people is a possible starting point for a conservation project here. There are obvious benefits to people of a clean environment; there are obvious benefits to wildlife too.

The creation of a reserve area at Tyre is an opportunity to make it both the pride of the local people and a place of high biological diversity. With Tyre being a World Heritage Site, the potential exists to see that the reserve is appreciated for its natural heritage and recognised as an important local asset.

The aesthetic impact of the waste and dumping on the beach and dune areas detracts greatly from the scenic value of the site, and represents a pollution hazard for human health and wildlife. Tackling this problem should be one of the first foci of active conservation management in the area. It would signal to the public that the area is actively being looked after, and would make it easier for people to appreciate and respect the area's natural wealth. From that basis, conservation study and management would be able to proceed in a more effective manner.

Another immediate need is to reconcile the utilisation of the area for recreation and farming, and preserve and enhance the value of the existing habitats for animal and plant life. The freshwater habitats of Ras el Ain are very important, the wells serving important economic functions as well as being of historical and biological value. Measures to protect these water sources and maintain a high quality of the water draining into the freshwater and marine/brackish areas should be a priority. The quality of the water to a large extent determines the health of the ecosystem and the biodiversity it can support.

As at Aammiq, agricultural extension work is needed to help implement environmentally sensitive cultivation methods. This also helps opens up the opportunity to create a local agrotourism venture, which is one of the aims of the local NGO, Amwaj.

It should be noted that a study for the development of a more effective sewage treatment and disposal system has been carried out. There needs to be a continuing dialogue between planners, contractors and representatives of the reserve to avoid any serious environmental impacts.

A strategy that tackles the waste problem across both parts of the reserve area, and seeks to formalise a system of zonation to meet the second of the priorities, will be most effective for the reserve. Suitable zones can be defined as following:

Zone A Tyre beach and dunes Amenity zone for tourists, with a minimum of restriction to activities.

Zone B Ras el Ain wells, dunes and beach Nature reserve, with access and activities restricted for the purposes of habitat preservation and restoration and minimum disturbance to wildlife.

Zone C Ras el Ain cultivated land Zone of farming practice sympathetic to the habitat requirements of wild flora and fauna.

In order to select the best options for ecological management in the nature reserve (Zone B), a better understanding is needed of its terrestrial faunal biodiversity. In particular, the possibility of encouraging breeding populations of sea turtles in this area should be looked into. If present, they could become a regional symbol in the way that the cedars have become a national one.

Wetland types extracted from text: A, E, Tp, Y, 3

Criteria extracted from text: 1a