Maritime Archaeology in the North Africa – an Introduction

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INTRODUCTION: THE NORTH AFRICAN SEAS

This segment aims to offer a broad perspective on North Africa's maritime past and archaeological findings. Given the extensive nature of this region, encompassing diverse cultures and histories, this introduction will merely scratch the surface of its rich maritime heritage. For those seeking more in-depth information, please consult the provided reading list.

North Africa's coastline borders the western Mediterranean Sea, from Egypt to Morocco and the west coast of Morocco stretches along the vast Atlantic Ocean. It is estimated that, in antiquity, there were more than 300 harbours along the north African coastline, some of which were natural harbours, and others that had artificial structures such as breakwaters and jetties. In this section, we will mainly focus on the Mediterranean coast, but some examples from along the Atlantic coast will also be included.

Map of the North African coastline with some of the major classical-period harbours (Base map, Google Earth Pro).

EARLY EVIDENCE

The coastal regions of North Africa have a rich maritime heritage spanning millennia. Archaeological evidence from Benzú, a rock shelter located in Ceuta along the North African coast of the Straits of Gibraltar, indicates that prehistoric hunter-gatherer groups utilized marine resources during the Middle and Upper Pleistocene. Currently situated 230 m inland, the shelter has yielded valuable

insights through sedimentary analysis, including mollusc shells, amongst other objects such as stone tool.

The Haua Fteah cave in Cyrenaica (Image: Ahmad Emrage).

In Libya, some of the first evidence we have of early humans that engaged with the sea comes from archaeological excavations inside caves such as the Haua Fteah in Cyrenaica. Skeletal remains and stone tools suggest that people lived in this cave from around 160-140,000 years ago. These early people adapted well to living on the Cyrenaican coast during humid periods, using marine resources such as fish and shellfish to supplement their diet. Around 20,000 years ago we have evidence of people directly changing and influencing their environment because they now stayed in the area all year round. Terrestrial and marine molluscs (snails and shellfish) decreased noticeably in size, which suggests overexploitation.

To date, we know relatively little about the very early coastal landscapes of North Africa. This is because Pleistocene coastal environments are now submerged beneath the sea. The numerous glacial periods and subsequent melting during interglacial phases caused sea levels to alternate almost continuously during this period. These fluctuations ranged from levels similar to today's during interglacial periods to those during peak glaciation, such as 18,000 years ago when the sea was over 100 metres lower. At this time, continental landmasses were more extensive, and vast areas of the world's continental shelves were exposed, supporting plant and animal life. The rapid melting of the final major ice sheets led to a sea level rise that approached current levels by the mid-Holocene, approximately 5,000 years ago.

Archaeological evidence suggests that extensive maritime connections between the North African coast and the broader Mediterranean world during the Bronze Age were rare. However, some evidence of limited Bronze Age maritime trade activity

Bates Island in the eastern Lagoon of Marsa Matruh (Image North-West Egypt coastal Survey project).

has been documented at Marsa Matruh on the Marmarican coast in present-day Egypt. On 'Bates Island,' situated in Marsa Matruh's eastern lagoon, remnants of temporary settlement have been uncovered, with Cypriot ware suggesting trade connections in the late fourteenth or early thirteenth century BC.

Around 2000 years ago, during the first millennium BC, Phoenician merchants from Tyre and Sidon in modern-day Lebanon began to regularly visit the Maghrebian coast. Simultaneously, Greek settlers colonized Cyrenaica, driven by overpopulation in their homeland that had resulted in poverty and famine.

THE MAGHREB (TRIPOLITANIA [LIBYA], TUNISIA, ALGERIA AND MOROCCO)

Along the coast of the Maghreb, the Phoenician traders were looking for anchorages and staging points on the trade route from Phenicia to Spain, which was a source of silver and tin. Their preferred anchorage points were offshore islands or promontories with sheltered bays that were easily defensible. Carthage (Tunis, Tunisia) is one such trading point that eventually became the largest Phoenician colony and, eventually an independent imperial power. The earliest archaeological evidence of Phoenician trading points we have is from the 8th century BC in Utica which, in the past, was located at the coast but is now situated much further inland due to the silting up of the river and coastline. Other 7th or 6th century BC Phoenician settlements include, for example, Hadrumetum (Tunisia), Tipasa (Algeria), Siga (Algeria), Lixus, and Mogador (Morocco).

By the 5th century BC, Carthage power had strengthened. Strong trade connections, particularly with the Greek world, meant that Carthage acquired enough wealth to become one of the most influential and powerful seafaring powers in the Mediterranean. The ancient artificial harbour of Carthage, the Cothon, had two parts. The outer rectangular part was used for merchant shipping, while the interior,

circular division was reserved for warships. It is estimated that sheds and quays were available for 220 warships.

Through this link, you can see a computer animated reconstruction of the harbour[1]:

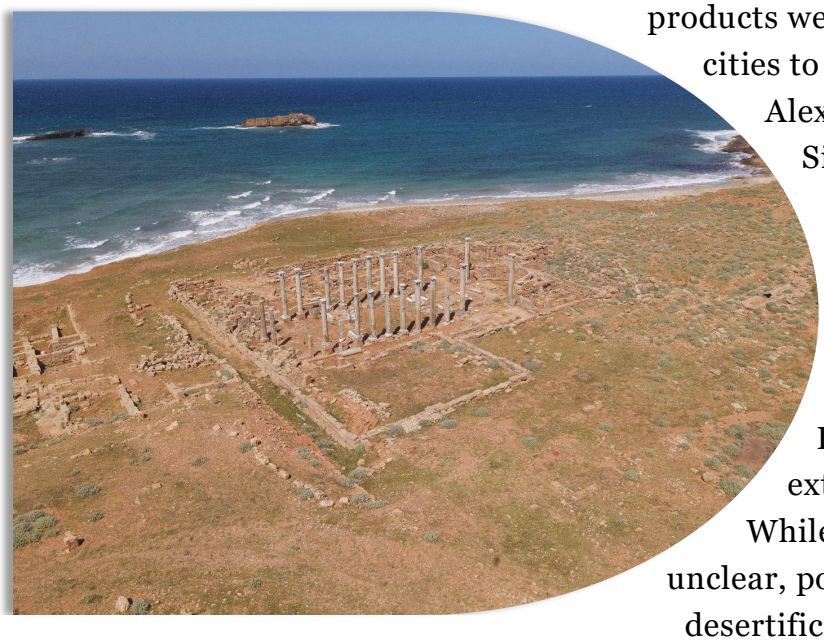
The Carthaginian influence spans from Tripolitania and Sirtica in the west, to the Atlantic coast in the east. Many new settlements were founded along this coast to establish and maintain supremacy in trade. Over time, Lepcis Magna, Oea (Tripoli), and Sabratha in Tripolitania became rich and influential port cities due to the trans-Sahara trade. In the west, Bizerte in Tunisia, Hippo Regius in Algeria, and Tingis in Morocco benefitted and grew due to Carthage's dominance of the Mediterranean Sea.

As Rome expanded its influence in the Mediterranean and advanced toward Sicily, which was under Carthaginian control at the time, these two naval powers began to clash. The Punic Wars, which started in the third century BC, saw Rome and Carthage battling for dominance, ultimately resulting in Carthage's destruction during the third Punic War in 146 BCE. During Roman rule which extended all the way to the western Maghreb, numerous coastal cities in the Maghreb region thrived, reaping the benefits of sea trade with Rome and the broader Mediterranean area. The export of grain, olive oil and raw materials emerged as one of the most significant maritime commercial activities across the Maghreb, with numerous harbours dotting the coastline. Rome’s rule over both sides of the Strait of Gibraltar guaranteed ongoing sea access to its southern Iberian territories and enabled further Atlantic exploration eastward. The Atlantic ports were directly connected to the growing Imperial maritime trade networks.

CASE STUDY: CYRENAICA, LIBYA AND THE HARBOUR OF APOLLONIA

Cyrenaica in eastern Libya had a slightly different history to the Maghreb. It was settled by Greek colonists in the 7th century BC, while Tripolitania was under Phoenician and later Carthaginian influence. The initial settlers who ventured into Cyrenaica were undoubtedly drawn by the lush, productive lands of the coastal plain and the Jebel Akhtar. The region's temperate Mediterranean climate made it an optimal location for establishing new colonies. They first settled on Platea Island in the Gulf of Bomba before settling near the Wadi Khalij estuary at Aziris. The Greek newcomers founded their first city, Cyrene, in 631 BC, followed by Bakra (now el Marj) in the mid-6th century BC. To support and link these new urban centres and to facilitate trade with the broader Mediterranean region, they developed harbour facilities, taking advantage of the few natural bays along the Cyrenaican coast that were suitable for anchoring ships. These included Taucheira (Tocra), Apollonia (Sousa), Ptolemais, Kainopolis (Al-Ogla), Phycus (El Hamamah), and Euesperides (Benghazi). The cities of Cyrenaica maintained their independence until 322 BC when they fell under Egyptian rule, and later in 96 BC, became part of the Roman Empire.

The region engaged in trade with the wider Mediterranean world. Many local products were shipped from the coastal cities to Greece, and subsequently to Alexandria, Rome, and beyond. Silphium, a plant exclusive to this area, was a key export, highly valued throughout the Mediterranean for its supposed medicinal and aphrodisiac properties. However, this herb became extinct during the Roman era. While the exact cause remains unclear, potential factors include desertification due to climate change, overgrazing, or excessive harvesting.



Archaeological remains of the settlement and harbour at Apollonia (Image: Cyrenaica Coastal Survey Project).

APOLLONIA HARBOUR

Apollonia harbour was established shortly after the founding of Cyrene in the 7th century BC, to serve as the harbour of the city. It is located in one of the few spots along the Cyrenaican coast that forms a natural and safe harbour for ships. It shares similarities with other North African ports, such as Ptolemais, but exhibits greater complexity.

Satellite image of Apollonia showing the main features of the harbour Copyright: Google Earth, CNES/Airbus.

Much of the ancient harbour infrastructure now lies submerged under the sea due to a Late Antiquity earthquake that caused coastal subsidence of up to 3.80 m. However, some features are still visible on satellite imagery and can be observed with the naked eye. Above water, two small rocky islands and a reef near the modern harbour can still be seen. In its heyday, the harbour was fairly substantial and sheltered. It comprised of two basins: an inner (western) basin (1) and an outer (eastern) basin (2), both shielded from prevailing North-West winds. The rocky islands were part of the mainland and accessible on foot until the construction of an artificial channel (3). The inner harbour, partially enclosed by city walls, likely

served warships, while the outer harbour accommodated trade vessels. This hypothesis is supported by the discovery of a 2nd century BC shipwreck and amphora fragments at the bottom of the outer basin.

Throughout its existence, the harbour underwent numerous modifications and renovations. Prior to the second century BC, ship sheds (4) were built on what is currently the western island. Their outline remains visible, carved into the rock with sloping slipways leading to the water. These ship sheds fell into disuse during the early Roman era when quays (4) were built to accommodate merchant vessels. This construction obstructed the entrance to the earlier ship sheds. During the second century BC, an artificial channel (3) was excavated to link the outer and inner basins. The original northern entrance to the inner harbour was sealed off using large, rectangular blocks (5). Access was then only possible through the man-made channel from the outer harbour, enhancing the harbour's protection against natural and human threats. Regular dredging was necessary to maintain the channel's navigability, as evidenced by the earliest silt layer dating to the fifth century AD. Two substantial towers (6) were erected to guard the channel's entrance. A lighthouse and extensive moles were likely situated on what is now the eastern island (7). Additional warehouses (8) and ship sheds (9) were probably constructed during the early Roman period. A platform extending into the eastern harbour was built, possibly housing a temple (10). Several quarries (11) are also evident along the coastline and on the islands. Some quarrying activities during the Byzantine era significantly altered the shoreline's shape. For instance, much of the islands' outer faces had been removed, and other port facilities were covered with debris. Furthermore, during this time, the channel connecting the outer and inner harbours was intentionally blocked with debris, likely for defensive purposes.

The harbour of Apollonia is significant today because so much of its remains still survive underwater. There are no other early ports from the 6th and 7th century BC that survive as completely as that of Apollonia. However, the recent collapse of a sea wall and a reef has caused serious threat to both, archaeology on land and underwater.

THE MEDIEVAL PERIOD

The medieval period saw a shift in trading networks as Islamic dynasties emerged. In the earlier medieval period political division of different regional dynasties across the MENA region existed, but the region was integrated in the wider trading networks of the Mediterranean. Desert oases flourished due to caravan trade routes that transported raw materials, finished products, and slaves from sub-Saharan Africa to market centres. Ports on the north Atlantic and Mediterranean coasts connected sub-Saharan goods to overseas markets.

Medieval map of the harbour of Alexandria (1575) by Georg Braun and Frans Hogenberg. Metropolitan Museum of Arts, Accession Number: 2013.642. Available at https://www.metmuseum.org/

Over time, influential European maritime powers sought to exploit the wealth emerging from the region and control access through the Strait of Gibraltar. By the twelfth century, Ifrīqiya (modern day Tunisia, Eastern Algeria and Tripolitania) no longer served as a significant centre for Muslim merchant traffic, as their commercial focus shifted increasingly towards Egypt (Alexandria) and the eastern Islamic regions. Portugal began establishing fortified ports along Morocco's Mediterranean and Atlantic coastlines in the 15th century. This provided protection for merchants and controlled the export of goods from Africa's interior. Genoese, Spanish, Dutch, and English merchants also showed interest in the caravan trade. They competed for trading concessions in western Maghrebian ports for several centuries. Piracy persisted along the coasts well into the late nineteenth century, as local groups attempted to capitalize on the foreign-controlled maritime movement of the region's portable wealth.

In the late medieval period, obstacles to trade and communication such as warfare, territorial losses and new European markets and merchants, coupled with emerging political and religious divisions, caused Muslim traders to change their Mediterranean trade routes. Our information about Muslim traders during this time is less abundant compared to earlier periods, and their activities were evidently more limited.

CASE STUDY: ESSAOUIRA, MOROCCO - A PORT WITH A LONG HISTORY

Historically known as Mogador, Essaouira has served as a vital maritime hub for millennia, facilitating trade along the northwest African coast. The nearby Îles Purpuraires contain some of the earliest archaeological traces of external contacts. On Essaouira (Mogador) Island, a Phoenician trading and manufacturing site dates to the 7th–6th centuries BC. Later layers include Punico-Mauretanian ceramics and a Roman villa (5th century BC–4th century AD), complete with a mosaic floor, peristyle courtyard, and fish-salting vats. Pliny (Natural History 6.36.202) associates these islands with Mauretanian king Juba II, who established a purple dye industry here in the 1st century BC/AD.

European interest in Essaouira intensified during the early modern period. The Portuguese built Castelo Real in 1506 to protect the natural anchorage, but Berber resistance forced its abandonment by 1512. English and French forces attempted occupations in 1577 and 1629 but failed. In the mid-18th century, Sultan Mohammed Ben Abdellah selected Essaouira as Morocco's principal trans-Saharan trade port, replacing Agadir. French architect Théodore Cornut designed the fortified city, featuring Sqala de la Kasbah and Sqala de la Marine, whose cannon-lined ramparts still overlook the Atlantic.

View from Sqala de la Marine north along the city ramparts to the point of Sqala del la Kasbah. Taken in 2019 (Image: A. Trakadas available at https://marea.soton.ac.uk/2020/09/01/essaouiras-maritime-cultural-heritage-morocco/)

Archaeological investigations have primarily focused on Essaouira Island. French-Moroccan excavations (1951–1960) revealed Phoenician industrial activity, possibly linked to ironworking and a shrine to Astarte. Later research (2000, 2006–2008) confirmed a continued presence into the Roman period, with a necropolis and evidence of Mediterranean trade, including amphorae from the Aegean and Iberia. Animal remains—elephants, peacocks, lions, fish, and shellfish—suggest exploitation of both local and exotic resources. Despite Pliny's claims, no direct evidence of purple dye production has been found, though murex shells with possible traces of burning hint at related activity.

Coastal changes have significantly impacted the region. In the Phoenician-Roman periods, Essaouira Island and the mainland were separate, with a lagoon inland. Sediment analysis suggests that by 700 BC, the island was connected via a tombolo, but historical maps (1736–1790s) indicate its gradual erosion. The Oued Ksob river mouth has shifted repeatedly, influencing the positioning of key structures like Borj el-Baroud and Dar Soltane. Modern dam construction and sand dune migration continue to reshape the landscape, highlighting the interplay between natural and anthropogenic processes in Essaouira's archaeological record. For more information have a look at this MarEA blog[1].

[1] https://marea.soton.ac.uk/2020/09/01/essaouiras-maritime-cultural-heritage-morocco/

THE DISCIPLINE OF MARITIME ARCHAEOLOGY IN NORTH AFRICA

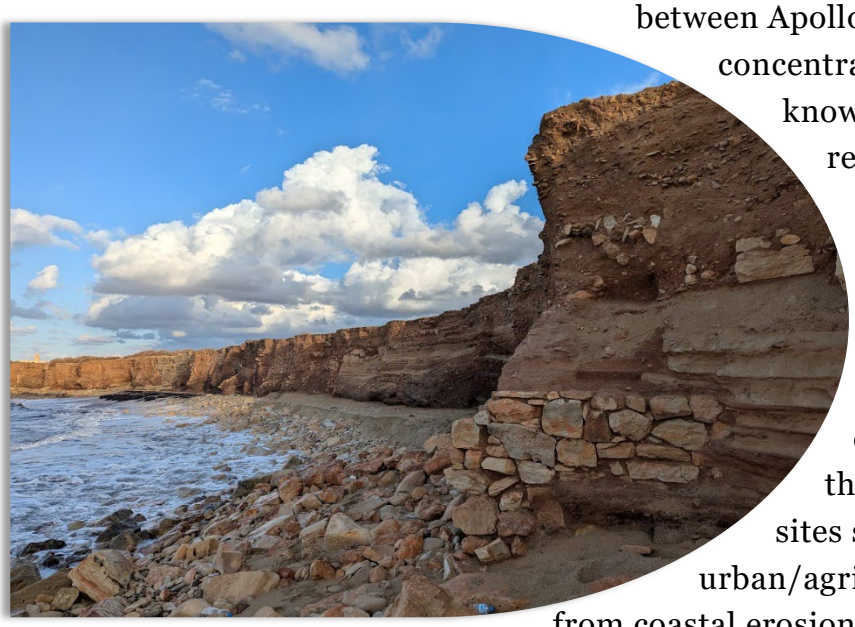
LIBYA

Libya has hundreds of coastal archaeological and historical sites and monuments from different cultural periods, located directly the coast, and many are submerged under the sea. An earthquake in Late Antiquity or in the early Islamic period caused subsidence and parts of Cyrenaican coastline submerged by up to three metres. Ancient harbours such as Apollonia, Ptolemais or Tocra are now located under the sea.

Libya has ratified the UNESCO 2001 Convention on the Protection of the Underwater Cultural Heritage in 2005. Depside this, many coastal and submerged maritime sites are still underexplored because maritime archaeology is still a young and emerging discipline in Libya. The most comprehensive study of maritime sites and wider connectivity is that of M. Hesein (2014; 2015) who conducted a survey along the Cyrenaican coast to record harbours, anchorages and industrial installations between Tocra and Ras et-Tin.

In 2012, the Department of Antiquities established a Maritime Archaeology centre in Shahat (Cyrene). Since its inception, the centre has conducted limited underwater investigations at select Cyrenaican sites, including Ptolemais and Apollonia. However, most underwater explorations have been performed by international teams. British, Italian, French, and more recently Polish missions examining the harbours of Apollonia, Ptolemais, Tocra, Lepcis Magna, and Sabratha and conducted some surveys along the coast. Recent coastal surveys have emphasized the abundance of Libya's coastal archaeology and the population's connection to the sea.

In 2020 the MarEA project in collaboration with the Department of Antiquities, Libya, the University of Benghazi and Al Bayda University carried out the Cyrenaica Coastal Survey project. The survey project assessed the condition of coastal sites between Apollonia and Tocra, concentrating on smaller, lesser-known coastal sites. The project recorded small harbours and anchorages such as at Al-Ogla and Al Haniyah, as well as industrial sites, farms and settlements predominantly from the classical periods. It found that most of the damage at sites stems from the ongoing urban/agricultural expansion and from coastal erosion.



Example of coastal erosion at Tocra (Image: Cyrenaica Coastal Survey Project).

SELECTED EXAMPLES OF MARITIME HERITAGE:

Shipwrecks: Not much is known yet about shipwrecks along the Libyan coast, but there must be many. At Apollonia there are two shipwrecks (Apollonia A and B). Apollonia B dates between t 180 – 150 centuries BC (Apollonia B) and carried Megarian bowls from the eastern Aegean. Apollonia A is dating between 150 – 130 centuries BC and was carrying pottery. In Sirtica three shipwrecks are known, two at Marsa El Brega and one at Sidi Ahmad. The Roman period shipwreck from Sidi Ahmad carried two white marble columns with green veins destined for Tripolitania. The Roman period shipwreck at Marsa Brega from the first century AD carried over 100 amphorae. The Byzantine era shipwreck of Marsa Brega carried cooking pots, and fineware of African Red Slip. Near Tobruk a late- Roman shipwreck (3rd-4th century AD) carried amphorae. Many shipwrecks from the first and second World War are also located in the waters of Libya, but we have relatively little information about them.

Anchorages/harbours: Libya had a large number of harbours and anchorages, including harbours at Sabratha, Oea, Homs, Lepcis Magna, Marsa Brega, Euesperides/Berenice, Taucheira, Ptolemais, Phycus, and Apollonia as well as smaller anchorages at, for instance, El Hanyah or Ras El Etten. Have a look at the

case study in section about the harbour of Apollonia. As mentioned above, an earthquake in Late Antiquity caused the coastline to sink, particularly in Cyrenaica, which means that most harbour features along this coastline are now submerged.

Production and distribution infrastructure: Along the coast of Libya, there are sites that show evidence of fish salting or *garum production,* typically consisting of a series of waterproof basins. Evidence of such activities can, for instance, be seen at Phycus in Cyrenaica. One of Libya's main exports during the Roman period was olive oil and grains, evidenced by the many open and later fortified farms in the region.

TUNISIA

Underwater archaeological research in Tunisia is a slowly but steadily advancing field in Tunisia, with numerous underwater archaeological sites yet to be uncovered. Tunisia has ratified the UNESCO 2001 Convention on the Protection of the Underwater Cultural Heritage in 2009.

The discovery of the first century BC Mahdia shipwreck in 1907 first brought the richness of Tunisians maritime heritage into the spotlight. Greek sponge fishermen stumbled upon an ancient vessel submerged 40 meters beneath the sea near Mahdia at just off the Tunisian coast. This shipwreck has significantly impacted underwater archaeology, not just in Tunisia, but across the Mediterranean region. The ship's cargo was extraordinary, containing artworks, marble and bronze statuettes, architectural components, and various other valuable items. Some scholars suggested that some of these artifacts were plundered from Athens by Sulla in 86 BC, intended for transport to Rome. It wasn't until 1948, following the enhancements in underwater equipment and working conditions, that Jacques Yves Cousteau and Philippe Tailliez undertook systematic archaeological investigations of the wreck.

In 1994 the Department for Underwater Archaeology was established. Since then, several collaborations with international institutions have led to the detailed recording and surveying of the Mahdia shipwreck (with e.g. sonar and metal detectors). Recent projects of the Tunisian Department of Underwater Archaeology include the Zembra archipelago and La Galite, as well as the exploration of coastal locations such as Kerkenna and Cap Zebib. These investigations encompassed both underwater archaeological surveys and the documentation of submerged structures, carried out in collaboration with skilled commercial divers.

SELECTED EXAMPLES OF MARITIME HERITAGE:

Shipwrecks: We have already mentioned the Mahdia shipwreck above. Another eight shipwrecks were discovered at Skerki Bank, a shallow approx. 60 km of the Tunisian coast. These included five Roman-period trading vessels, one early Medieval fishing ship, and two late 19th to early 20th century sailing ships. Studies of Skerki Bank yielded an important insight into ancient Mediterranean commerce and transportation. The concentration of shipwrecks indicate that this area served as a popular maritime route, connecting not only Carthage and Rome but also linking the eastern and western parts of the Mediterranean Sea. This Skerki Bank project was an extraordinary undertaking as it used a nuclear submarine and remotely operated vehicles (ROV) to examine these deep-sea shipwrecks. The Isis, one the Roman period Skerki Bank shipwrecks, was one of only three Romans Shipwrecks from North Africa that can be associated with grain transport.

Carthage harbour, available at https://commons.wikimedia.org/wiki/File:Vue_a%C3%A9rienne_de_Salambo_et_Carthage.jpg

Anchorages/harbours: In Tunisia, harbours were plentiful. Carthage had the largest harbour, but others include Carpis, Misua, Hadrumetum, Ruspina, Leptiminus, Thapsus, Mahdia, Sullecthum, Acholla, Cercina, Gigthis, Ras Segala and Meninx to name a few.

Traditional fishing methods: At Kerkennah Island we can still find a wonderful example of intangible maritime heritage called *charfia* fishing, a traditional fishing method of the region. The *charfia* is a stationary fishing method that make use of natural features of the sea and the land, including water currents, seafloor topography, and available resources. This system employs a V-shaped barriers made of palm fronds inserted into the seabed. These intercept fish carried by the receding tide and guide them into holding areas. Unlike destructive bottom trawling techniques, this method keeps fish alive. Traditionally, the *charfia* is only set up and used between the autumn equinox and June to ensure sustainable practice. The annual reconstruction of *charfias* is accompanied by communal activities such as shared meals and prayers.

Charfia fishing at Kerkennah Island, ©Institut National du Patrimoine, Tunisie, 2019, available at https://ich.unesco.org/en/RL/charfia-fishing-in-the-kerkennah-islands-01566.

ALGERIA

Algeria is very rich in archaeological sites, including harbours and other maritime installations, but we know still relatively little about its underwater archaeological heritage which is waiting to be discovered and recorded. From ancient and contemporary sources, we know that there were over 60 harbours along the Algerian coast. Of these, 27 ancient ports have been identified, with similar number of ports existing during the medieval period.

The UNESCO 2001 convention has been ratified by Algeria in 2015, and the country has also implemented legal frameworks for safeguarding underwater cultural heritage. To date, no comprehensive inventory of its submerged archaeological sites has been established, and while some locations are familiar to divers, scientific investigations have been rare and mostly without full documentation.

SELECTED EXAMPLES OF MARITIME HERITAGE:

Shipwrecks/sunken objects: Off the coast off Chercell two ancient shipwrecks are known, Chercell A (25BCE – AD 75) and Cerchell B (150 BCE – AD 400). In 2021, a recreational diver identified a sunken vessel carrying hewn stones in shallow waters near Trois Ilots, el Hamdania. The shipwreck measures approximately 18 m in length and 8 m in width, containing over 100 cut-stone pieces of diverse forms and dimensions, resembling ancient building blocks. The discovery of a pulley on the wreck exhibiting marks from a mechanical saw has cast doubt on its attribution to the classical era.

In the centre of Rocher Blanc Cape's Bay, a collection of cannons lies underwater at depths ranging from 3 to 5 meters. These were initially discovered and examined by a local organization in the 1990. The first official documentation of these cannons occurred during a preventive campaign in 2018, using photogrammetry techniques. Based on a cannonball discovered at the site, the cannons are believed to date back to the 16th century AD. No remnants of the actual ship were found, leading to the conclusion that the cannons were likely jettisoned during a maritime disaster.

Group of cannons, submerged between 3 m and 5 m at Rocher Blanc Cape bay (image: R. Khellaf, Figure 5 in Khellaf, Bourai and Bensalah 2023).

Anchorages/harbours: Algeria had many harbours along its coastline, including at Iol Caesarea (Cherchel), Icosium (Algiers), Hippo Regius Tipasa, Ras el Meskouta, and Thalefsa. However, relatively little is known about them, and many have been covered by modern harbour construction or have silted up (e.g. Hippo Regius). The best known is perhaps Cherchel. Here, two basins made up the harbour of Cherchel, the outer basin was a large anchorage protecting merchant ships from the easterly winds with an artificial mole. The inner basin was connected to the outer one via a channel, where warships could dock. Excavations on the small island have uncovered a complex array of structures from various time periods, including a lighthouse that featured an octagonal foundation. Ancient texts suggest

that the lighthouse was up to 36 m in height. Beneath this structure, a grotto was carved into the cliff, serving as a sanctuary. A sturdy defensive wall encircled the island. Evidence of Punic occupation has also been discovered, including walls and cisterns. Additionally, diverse remnants of houses with mosaics dating from the 1st century BC to the 3rd century AD have also been recorded.

Production and distribution infrastructure: Industrial establishments linked to maritime activities can be seen, for instance, at Tipasa. There, several basins and water tanks, the presence of large storage jars (dolia) and many amphora sherds suggest fish salting or the production of *garum*, a fish sauce used during the Roman period. Water channels drained directly into the sea.

View of the western rocky coast of the area from Cape Amesfout. (Image: R. Khellaf, Figure 4 in Khellaf, Bourai and Bensalah 2023).

Maritime villas often also had industrial functions. For instance, at Cape Amesfout stood a substantial peristyle villa, measuring 1800 m², which was constructed around a cruciform basin featuring a central fountain. This basin supplied water to two large underground cisterns in the north and two salting basins at the western corner. Agricultural activities were concentrated in the northern section of the villa. Within the villa complex, a structure housed four basins dedicated to fish salting.

MOROCCO

Like many other countries, Morocco faces the challenge of having few in-country maritime experts. However, the need for addressing cultural heritage resources has been recognized through recent international and national legislation. The country ratified the UNESCO 2001 Convention on the Protection of the Underwater Cultural Heritage in 2011, focusing on tangible cultural heritage resources. Subsequently, Morocco adopted the UN Integrated Coastal Zone Management (ICZM) Protocol in 2012 and implemented national ICZM legislation in 2015, both of which encompass aspects of tangible cultural heritage in coastal and intertidal areas. The Morocco Maritime Survey Project, a collaboration between the Institute of Nautical

Archaeology, USA and INSAP, Morocco from 2001 to 2006 shed more light on the rich maritime heritage of Morocco, focusing on the Tangier peninsular in northern Morocco. Recent studies have attempted to establish a crucial baseline assessment of how various factors impact Marine cultural heritage, but these assessments often remain broad.

SELECTED EXAMPLES OF MARITIME HERITAGE:

Shipwrecks: Shipwrecks in Morocco are still under-investigated. In the 1960s scuba divers collected artifacts and provided site descriptions to land-based archaeologists. The items retrieved included anchors, lead ingots, and amphorae from a suspected second-century AD shipwreck near Cap Spartel, as well as amphorae from multiple assemblages of similar age found in Tangier Bay. Additionally, a pre-Roman wreck was discovered off the Atlantic shoreline in the proximity of Rabat. The Morocco Maritime Survey project further investigated three shipwrecks at Cap Spartel from the Roman period and from the 17th century AD.

The wooden shipwreck on the beach at Essaouira, demonstrating the exposure and sedimentation processes of the dynamic coastline (view to the south-west): A) in August 2021 (photo: A. Zakaria; B) in October 2021 (photo: A. Trakadas).

Case Study: In October 2021, the Morocco MarEA team led by Azzedine Karra and Athena Trakadas conducted an emergency survey of a historical shipwreck at Essaouira's intertidal zone. Initially exposed in 2018, the wreck reappeared in late summer 2021. The brief two-day campaign documented debris and collected samples, aiding Moroccan authorities in managing the site. The remains, over 20 m in length, include lower frames and a keelson. Nearby finds include an iron cannon, cannon balls, ceramics, and other metal artefacts. Preliminary C-14 dating suggests a mid-eighteenth-century origin. Sediment re-deposition and storm events complicate

documentation. These findings guide further heritage management efforts. For more information have a look at our blog[2].

Anchorages/harbours: We have already looked at Essaouria Port in one of our case studies. Of the harbours located along Morocco's coast dating to the Punic and Roman periods, none seem to have had artificial port structures, like observed elsewhere along the North African coast. There was a harbour at Sala and Lixus along the Atlantic coast, and in the Mediterranean, there was Septem (modern Ceuta). Tangier's natural bay (ancient Tingi) still provides save harbour for cargo and passengers ships that cross the straight of Gibraltar, and probably has done so in the past.

Production and distribution infrastructure: Roman-period fish salting installations can be found, for instance, at Lixus featuring 142 vats with a combined capacity of 1,012m^3. 11 locations for fish salting were recorded by the Morocco Maritime Survey. Exports from Morocco to Rome included grain, olives, vine, figs and salted fish products, as well as 'beasts' for the arena such as elephants and ostriches.

[2] https://marea.soton.ac.uk/2022/02/24/documenting-a-shipwreck-in-the-intertidal-zone-in-essaouira-morocco/