The Ancient Sailing Season

JAMES BERESFORD

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By

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He that will not sail till all dangers are over must never put to sea.

Traditional English Proverb.

To my parents, for their constant support

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LIST OF JOURNAL ABBREVIATIONS

AHR	American Historical Review
AJA	American Journal of Archaeology
AJAH	American Journal of Ancient History
Am. Meteorol. Soc.	American Meteorology Society
Am. Neptune	American Neptune
Anal. Chem.	Analytical Chemistry
Bibl. Arch.	Biblical Archaeologist
CQ	Classical Quarterly
DOP	Dumbarton Oaks Papers
ExT	Expository Times
G&R	Greece and Rome
Geogr. J.	Geographical Journal
GRBS	Greek, Roman and Byzantine Studies
HTR	Harvard Theological Review
IJNA	International Journal of Nautical Archaeology
IM	Imago Mundi. Journal for the History of Cartography
Isr. J. Earth Sci.	Israel Journal of Earth Sciences
JAOS	Journal of the American Oriental Society
JAS	Journal of Archaeological Science
JHS	Journal of Hellenic Studies
JMA	Journal of Mediterranean Archaeology
J. Navig.	Journal of Navigation
JRA	Journal of Roman Archaeology
JRS	Journal of Roman Studies
J. Sav	Journal des Savants
JTS	Journal of Theological Studies
JWH	Journal of World History
Lib. Stud.	Libyan Studies
MHR	Mediterranean Historical Review
MM	Mariner's Mirror
Nat. Geog.	National Geographic
OJA	Oxford Journal of Archaeology
REA	Revue des études anciennes
REL	Revue des études latines
TAPA	Transactions of the American Philological Association

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INTRODUCTION

THE STATE OF MODERN SCHOLARSHIP

It is the long-standing belief among classical scholars that seafaring on the ancient Mediterranean was highly seasonal in nature. This assumption underlies and permeates our present understanding of Graeco-Roman maritime activities and has gone all-but unchallenged by historians and archaeologists. There has, after all, seemed little reason to question the handful of ancient texts relating to the seasonal limits of the maritime calendar, for while such literature is sparse, on cursory examination there appears to be broad agreement that the sailing season of antiquity was confined within a six- to eight-month period centred on the summer. By contrast, the wintertime was regarded as 'out-of-season' for Greek and Roman seafarers—the period of *mare clausum*, the 'closed sea'. A relatively recent study therefore noted: 'The duration and dates of the sailing season in the ancient Mediterranean are well known and have been fairly thoroughly discussed'.[1] Throughout the following pages it will, however, be argued that, rather than presenting a single, unified picture of the Graeco-Roman sailing season, critical examination of the ancient texts instead reveals that the maritime calendars surviving from antiquity are far from compatible. Indeed, the literature deals with a wide variety of different types of vessels, sailing on very different regions of the Mediterranean Sea. Many of the surviving ancient texts are also separated by broad spans of time that encompassed considerable technological, political and economic change, all of which had profound implications for the length of the sailing season.

While modern scholarship has generally accepted the seasonal parameters of the maritime calendars set down in the Graeco-Roman literature, it has nevertheless been acknowledged that in times of military, political or economic necessity, both warships and trading merchantmen were required to occasionally sail across the wintertime Mediterranean, and numerous exemptions to *mare clausum* have been teased out of ancient texts by historians.[2] However, while these literary examples are of great importance in

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[1] Morton 2001: 255 n. 1.

[2] See especially, Rougé 1952; Saint-Denis 1947. Additional examples are also to be found

demonstrating that voyaging did take place on winter seas, they are generally regarded as anomalies; infrequent exceptions to what was very much the general seasonal rule of Graeco-Roman seafaring. Jamie Morton has therefore noted that fleets of warships 'might be prepared (or forced) to endure hardship and even risk catastrophe out on active service after the end of the sailing season proper', while M.P. Charlesworth long ago commented that, for trading vessels, 'navigation in winter was not absolutely impossible, but the ordinary merchant would not dream of trusting himself to the stormy waters save under strong urgency'.[3] As a result of this presumed suspension in commercial seafaring during the wintertime, it is thus argued that piracy also underwent a seasonal downturn: with virtually no merchant vessels plying their trade on the sea-lanes during the winter months, seaborne marauders remained off the water until the spring when, with the resumption of the sailing season, large numbers of their potential prey once again began to sail on the waters of the Mediterranean.[4]

Any seasonal dislocation to commercial shipping must also have had a major impact on the wider economy of the ancient world. If maritime transport was as seasonally constricted as the sailing calendars of antiquity would suggest, then there must have been a severe seasonal disruption in the patterns of Graeco-Roman trade. As the sea-lanes closed for the winter and voyaging came to an end, the communities clustered about the shores of the Mediterranean would have been deprived of what was, by far and away, the fastest and most cost-effective means of transporting commodities around the ancient world.[5] Advocates of a 'minimalist' model of the ancient economy—in which manufacturing production is regarded as small in scale and the movement of goods generally limited to a highly localised area—have therefore been keen to draw attention to the wintertime suspension of ancient shipping and the adverse effects which such a seasonal adjournment would have had on inter-regional trade.[6]

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in Casson 1995: 270–272. For vessels involved in military operations, see Morrison & Williams 1968 for the Greek Classical period, and Morrison 1996 for the Hellenistic and Roman periods of antiquity.

[3] Morton 2001: 260; Charlesworth 1924: 23. See also, Casson 1994: 150; Jurišic´ 2000: 9; Pryor 1988: 87 f.; Semple 1931: 580.

[4] See Ormerod 1924: 18; Pryor 1988: 87. See below, Chapt. 6.

[5] For the relative costs of sea, river and land transport in the ancient world, see Duncan-Jones 1990; Greene 1986: 39 f.

[6] Both Moses Finley (1985: 199) and A.H.M. Jones (1964: 843; 1974: 248), two of the most influential champions of the minimalist model for the Graeco-Roman economy, therefore emphasised the impracticalities of long-distance trade arising from the wintertime closure of the sea-lanes.

The prevailing scholarly opinion as it presently relates to the Graeco-Roman sailing season is perhaps best encapsulated in Lionel Casson's highly influential *Ships and Seamanship in the Ancient World*:

> [D]uring late fall and winter, sailing was reduced to the absolute minimum—the carrying of vital dispatches, the ferrying of urgently needed supplies, seaborne military movement that was impossible to delay. All normal activity was packed into the summer and a few weeks before and after it; at other times the sea lanes were nearly deserted, and ports went into hibernation to await the coming of spring.[7]

As one of the leading authorities on ancient maritime affairs, Casson's adherence to the sailing season as laid down in the Graeco-Roman literature further reinforced the credibility of the ancient texts. Although Casson accepted that ancient seamen were, through necessity, occasionally forced to undertake wintertime voyages, he clearly accepted that ancient seafaring activities suffered from a pronounced seasonal dislocation. Such a conclusion was also reached by Jean Rougé, another highly influential historian who has published widely on ancient maritime affairs and whose *Ships and Fleets of the Ancient Mediterranean* has proved a basic text for students and researchers interested in seafaring throughout antiquity.

> Owing to the general climatic conditions in the Mediterranean, there are two long seasons: what the Greeks called *cheimon* on the one hand, and *theros* on the other, the 'bad season' and the 'good season' respectively. Furthermore, the ends of these seasons did not coincide precisely with the ends of the four seasons as determined by astronomy. *Cheimon* was characterized by unstable weather, making the prediction of storms or their degree of violence impossible. During this period, sailing on the open seas was not possible; only coastal sailing could be undertaken, and even so, large-scale, commercial shipping was avoided. It was the time the Roman quite typically called the *mare clausum*, the sea is closed—and some texts add, 'to regular sailing'.[8]

In recent years, however, there has been a growing acceptance by some scholars that voyages on the wintertime Mediterranean were being carried out rather more frequently during the Graeco-Roman period than was previously considered the case. In his study of ancient Greek seafaring and its relationship to the physical environment, Morton has therefore argued that at least some vessels remained on the seas around Greece throughout the winter months, although voyages undertaken at this time of year would probably have been made with considerably greater caution than

[7] 1995: 270–271. See also Casson 1991: 40, 195; 1994: 150.
[8] Rougé 1981: 15–16.

was the case during the more settled weather conditions which generally prevail during the summer.[9] Morton thus envisaged these wintertime voyages as taking the form of short coastal 'hops' in which vessels sailed from one sheltered anchorage to the next as and when conditions allowed and the captain and crew deemed it safe to do so.[10] Such a desire to remain in relatively close proximity to the coast would have meant wintertime voyages generally took longer than was usually the case during the summer half-year: vessels were piloted along more roundabout routes, the mariners eager to keep close to the shore so that, should conditions deteriorate, they could make for any shelter which the coastline might offer. While agreeing that wintertime seafaring was carried out during antiquity, a recent article by Oded Tammuz reached a very different conclusion as to the manner in which voyages were made during the winter months: 'The modern notion of navigation in antiquity is that it came to an almost complete standstill in the winter. A survey of pre-Roman sources reveals that this notion is only partially correct. While coastal navigation was brought to a standstill in the winter, open-water routes were open for navigation in summer and winter alike.'[11] Furthermore, the increased frequency of unfavourable weather and sea conditions during the winter months would have forced ships to remain for longer in port or in other sheltered anchorages before they could resume their journey.[12] Little wonder then that Peregrine Horden and Nicholas Purcell have put forward the opinion that, throughout the ancient and medieval periods, 'A bar chart of all nautical ventures (were records of them available) would ... in all probability, show both seasonal peaks, when masters preferred to put to sea, and a lower level of more or less constant activity throughout the year, the reflection of avarice, cunning or necessity'.[13]

Further promoting this belief in seafaring as being a highly seasonal occupation that was nevertheless carried on during the winter half-year—albeit on a much reduced scale—is Michael McCormick, whose *Origins of the European Economy* focused on trade in and around the lands bordering the

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[9] Morton 2001: 258.

[10] Morton 2001: 145.

[11] Tammuz 2005: 145. (For wintertime sailing strategies, see below, p. 181 f.)

[12] Writing of the medieval and early modern Mediterranean, Ferdinand Braudel noted that winter voyages were likely to be longer, more problematic, and therefore less frequently carried out, than were those made during the summer (1972: 249): a situation that probably applied equally well to antiquity. However, see also below, p. 126 ff., for the dangers arising from voyages made close to the shore and what sailors often regard as the relative safety of the open sea.

[13] Horden & Purcell 2000: 143.

late Roman and early medieval Mediterranean.[14] An analysis of references in the literature spanning the late seventh to the late tenth century AD that mention the arrival and departure dates of sea travellers making crossings of the Mediterranean, has led McCormick to reach three conclusions:

> [T]he first is, as one would expect, that activity decreased during the traditional closing of the sea, from November to March. The second is that activity nonetheless was taking place: almost a fifth of all movements occurred during the winter months. The third observation is more interesting still: the winter months present a two-tier level of activity: the nadir, in January and February, and the low but active levels of November, December, and March.[15]

While the use of early medieval literature to analyse the seasonality of Mediterranean seafaring during this period is highly problematic,[16] it nevertheless seems clear that there were relatively large numbers of wintertime voyages being made in the early Middle Ages. During this period of Mediterranean history it would therefore appear that maritime activity between late autumn and early spring, though less frequent than that carried out during the traditional sailing season of summer, was nonetheless still taking place. Was such wintertime seafaring confined to periods following the end of the Graeco-Roman world or did similar voyages also take place during antiquity? Drawing on the sailing calendars set down in the ancient literature, as well as the opinions of modern historians who have accepted the sailing timetables presented in the Graeco-Roman texts, McCormick can certainly feel justified in concluding that, 'In general, early medieval seamen appear to have set sail more commonly in the higher risk periods of early spring and late fall than is believed to have been the case in antiquity … the period of winter closing was shorter in the Middle Ages.'[17] However, McCormick, like other scholars who have studied the seasonality of seafaring on the ancient Mediterranean, has rooted his work in the advice and legislation set down in the Greek and Roman literature; textual evidence which has, for too long, been accepted almost without question. Indeed, McCormick himself notes that while his research indicates mariners of the early Middle

14 McCormick also devotes a chapter of his book to the seasonal rhythms of both land and sea travel during the early medieval period (2001: 444 f.)

15 McCormick 2001: 458.

16 McCormick himself notes that some of these wintertime voyages were mentioned simply because they were considered unusual and therefore worthy of note, while miracles associated with St Nicholas and which tend to focus on his feast day (6 December) may also partly corrupt the figures.

17 McCormick 2001: 468. See also 450, 458, 461.

Ages were more likely to put onto winter seas than were their Graeco-Roman predecessors, he nevertheless adds the proviso that this apparently dramatic medieval revolution in maritime seasonality holds true, 'unless our understanding of late antique shipping patterns requires substantial revision.'[18] It is the belief of this study that our present understanding of the ancient sailing season—not only in late antiquity, but from the end of the Archaic period onwards—does indeed require substantial revision. Over the following pages it will therefore be demonstrated that, contrary to the present academic orthodoxy, wintertime seafaring on the Graeco-Roman Mediterranean was not only possible but was commonplace and large numbers of vessels and mariners routinely made voyages onto what has, for too long, been regarded as a 'closed sea'. While the next chapter will therefore analyse the textual evidence for *mare clausum* in a far more critical and rigorous fashion than has hitherto been the case, the following chapters will then focus on the principal factors that determined the length and pervasiveness of any wintertime downturn in ancient shipping. Chapter two will concentrate on the elements of nature: the weather and sea conditions which affect the Mediterranean during the winter, and the problems and hazards that the marine environment posed for ancient seafarers making voyages at this time of the year. The two following chapters will then analyse the technology at the disposal of Graeco-Roman mariners and the potential for the sailors of antiquity to make safe and accurate voyages on the Mediterranean over the wintertime: chapter three will focus on the ships and sails in use during antiquity, while chapter four will look at the arts of navigation and skilled seamanship as they were understood and practised in the ancient world. It was this interplay between the competing forces of the natural environment on the one hand, and the technology and skills available to Graeco-Roman seafarers on the other, that lies at the heart of the ancient sailing season. Although scholars regard the arts and devices of ancient sailors as sufficiently advanced to allow them to sail ships across the relatively calm seas of the summer months, it is believed the levels of ship-building technology and the navigational expertise were inadequate to allow Graeco-Roman mariners to contend with the more frequent spells of heavy seas and dirty weather which are commonplace on the Mediterranean during the wintertime. It was this seasonally shifting balance between the power of nature and the skills of the mariner that not only shaped the seafaring calendars of antiquity, but which continues to determine the course of maritime activi-

[18] McCormick 2001: 461.

ties on the Mediterranean.[19] Chapter six will shift the focus away from commercial and naval shipping to briefly examine the wintertime operations of Graeco-Roman fishermen, together with the effect that piracy had on the ancient sailing season. Although the focus of this research is on the seas which constitute the Mediterranean, chapter five will provide a brief analysis of the sea routes that spanned the Arabian Sea and connected the Graeco-Roman world with the Indian subcontinent, a maritime link that has profound implications for the ability of ancient mariners to remain on the seas of the Mediterranean throughout the wintertime.

The aim of this volume is therefore twofold. First, to highlight the unsatisfactory position of present scholarship that, through an over-reliance on a handful of ancient texts that have never been properly subjected to critical examination, continue to promote the long-held belief that the sea-lanes of the Graeco-Roman Mediterranean were virtually devoid of shipping during the wintertime. Second, to demonstrate that although voyages made between late autumn and the spring would generally have been more hazardous and prone to weather-induced delay than those undertaken in the summer months, ancient ship and sail construction, in conjunction with the navigational abilities of Graeco-Roman seamen, did allow for considerable numbers of vessels to make voyages during the period of the year traditionally thought of as *mare clausum*. Economic, political and military necessity also demanded that the ships and mariners of the ancient world regularly put onto the waters of the wintertime Mediterranean.

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19 For cruise liners presently operating on the Mediterranean, the season therefore 'extends from the beginning of April through November … Some lines don't operate for the full eight-month span, but they are all available during the key months of May through October' (Ludmer 2002: 143). A similar calendar of operations, running from April to November, exists for yacht hire in the waters around modern Greece.

CHAPTER ONE

THE TEXTUAL EVIDENCE

Our present understanding of the sailing season of the ancient Mediterranean is primarily founded upon three texts. By far the earliest of these is Hesiod's poem, *Works and Days*, composed c. 700 BC while, written more than a thousand years afterwards, two late Roman works—the military manual, *Epitoma rei militaris*, authored by Vegetius in the late fourth or early fifth century, and an edict passed by the emperor Gratian in AD 380 that survives in the *Codex Theodosianus*—also set out clearly defined seasonal parameters for when maritime activity should, or should not, take place.[1] Each of these three texts will be analysed in detail below. However, it should be noted from the outset that all three sailing calendars propose dates which start and finish within virtually a month of each other; a consensus that forms the foundation upon which are constructed the long-held assumptions relating to the seasonality of maritime activities on the ancient Mediterranean. Additional references to the Graeco-Roman sailing season can also be gleaned from a variety of other literary sources, all of which will be analysed throughout the following pages. It is, however, the seafaring calendars set down by Hesiod, Gratian, and especially Vegetius, that are most commonly referred to by modern scholars who have taken an interest in the seasonality of ancient seafaring. At cursory examination, these three key texts do indeed appear to justify the present scholarly consensus that seafaring on the ancient Mediterranean commenced in either March or April and spanned the summer months before drawing to a close in October or November. This six- to eight-month period, which ran from early/mid spring through until mid/late autumn, is still generally considered to be the sailing season of antiquity.[2]

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1 Hesiod, 618–694; Vegetius, 4.39; *Codex Theodosianus*, 13.9.3.

2 This study broadly follows the British Admiralty's seasonal division of the Mediterranean year in which spring corresponds to the months of March, April and May; summer to June, July and August; autumn to September, October and November; winter to December, January and February (Air Ministry 1962: 2).

Hesiod's Sailing Season

> Sailing is in good season for mortals for fifty days after the solstice, when the summer goes to its end, during the toilsome season. You will not wreck your boat then nor will the sea drown your men—so long as Poseidon, the earth-shaker, or Zeus, king of the immortals, does not wish to destroy them: for in these gods is the fulfilment, both of good and evil alike. That is when breezes are easy to distinguish and the sea is painless: at that time entrust your swift boat confidently to the winds, drag it down to the sea and put all your cargo into it.[3]

The above passage contains the earliest piece of advice relating to the sailing season of the Mediterranean. The extremely curtailed seasonal calendar recommended by Hesiod, writing in the Archaic period, is rightly regarded by historians as reflecting the nervousness of a lubberly Boeotian lacking knowledge of the sea and the art of navigation.[4] It is certainly true that the poet possessed only a cursory knowledge of maritime affairs, for while his father and brother were both sea traders, Hesiod himself admits to having 'no experience at all in either seafaring or boats. For never yet did I sail the broad sea in a boat, except to Euboea from Aulis.'[5] Hesiod's personal experience of sea travel was therefore extremely limited; his only 'voyage' on the Mediterranean was when ferried across the Euripus Strait—a body of water so narrow that, less than three hundred years after the poet composed *Works and Days*, it was spanned by a bridge. We therefore have to question whether the ship-owners and sailors of the Archaic period, who undoubtedly possessed far greater knowledge of seamanship and the marine environment than did Hesiod, would have felt compelled to follow the seasonal advice put forward by the poet.

While Hesiod places great stress on the need for seafarers to make voyages at the height of the summertime, G.L. Snider has clearly demonstrated that the Boeotian poet's sailing season was considerably longer than a mere fifty days.[6] Hesiod actually dates the opening of navigation to the period at which 'the leaves at the top of the fig-tree are as big as the footprint a crow leaves as it goes';[7] a time of year that modern botanical evidence indicates would see the commencement of the sailing season in the latter

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3 *Works and Days*, 663–669.
4 E.g. Casson 1995: 270; Pryor 1988: 87.
5 *Works and Days*, 649–651.
6 Snider 1978. See also Tammuz 2005: 146.
7 *Works and Days*, 679–681.

half of March.[8] Although Hesiod does not recommend putting to sea at such an early date, and warns that mariners on the water in early spring would be likely to encounter perilous weather conditions, the poet admits that voyages were nevertheless still made at this time of year.[9] Furthermore, Hesiod also implies that the sailing season terminated considerably later than the fiftieth day after the summer solstice. His advice that seafarers should 'make haste to sail back home again as quickly as possible, and ... not wait for the new wine,'[10] extends the dates of his sailing calendar to a period between mid-September (when Hesiod recommends that grapes be harvested) and the beginning of October (when the wine was ready for drinking).[11] Moreover, Hesiod also expected at least some mariners to be making brief voyages even later in the autumn:

> But if desire for storm-tossed seafaring seize you: when the Pleiades, fleeing Orion's mighty strength, fall into the murky sea, at that time blasts of all sorts of winds rage; do not keep your boat any longer in the wine-dark sea at that time, but work the earth, mindful as I bid you. Draw up your boat onto the land and prop it up with stones, surrounding it on all sides, so that they can resist the strength of the winds that blow moist, and draw out the bilge-plug, so that Zeus' rain does not rot it, lay up all the gear well prepared in your house after you have folded the sea-crossing boat's wings in good order; and hang up the well-worked rudder above the smoke.[12]

It is therefore only with the setting of the Pleiades (a constellation now more commonly known as the Seven Sisters) that Hesiod counselled mariners to finally remove their vessels from the water and make preparations for the stowage of sails and gear during the winter months. With the autumnal heliacal setting of the Pleiades during the Archaic period dated to October 26 by Snider, while H. Grunel calculated that it occurred even later, at a point between the dates of November 5 and November 9, then there is little doubt that, rather than being confined to the heart of the summertime, Hesiod's seafaring calendar extended well into the autumn.[13] Even a Boeotian landlubber therefore acknowledged that the sailing season of Archaic

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8 Snider 1978: 131.
9 *Works and Days*, 682–683.
10 *Works and Days*, 670–672.
11 *Works and Days*, 609–614; Snider 1978: 130.
12 *Works and Days*, 618–629.
13 Snider, 1978: 130–131; Grunel 1952: 2503–2504. See below, pp. 153–154, for Byzantine naval treatises of the ninth and tenth centuries AD which place the setting of the Pleiades on November 14.

Greece spanned a period of the year that ran from late March through to late October/early November: a season more than four times longer than the fifty-days generally credited to Hesiod.[14]

Hesiod's sailing season thus provides a date-range that corresponds closely with the maritime calendars set down in late antiquity. As such, the maritime calendar outlined by the Boeotian poet around 700 BC reinforces the belief that Graeco-Roman seafaring was confined within a reasonably well-defined season running from early/mid-spring until mid/late autumn; a sailing season that was to remain virtually constant from the Archaic period through to the final years of the Roman Empire.[15] It should, however, be borne in mind that 'Hesiod … lived before seamanship was well developed in Hellas', and while this statement was made by E.C. Semple partially as an explanation for what she regarded as the remarkably short mid-summer sailing season outlined by Hesiod, without realising that the Boeotian poet's maritime calendar was considerably longer than a mere fifty days, there is no doubt that Hesiod was writing at a time well before Graeco-Roman seafaring practices had developed to their ancient apogee.[16] It therefore has to be questioned whether the sailing season set down by Hesiod, and that was designed for the ships and navigators of the Archaic era, would still have held true on the Mediterranean during later periods of antiquity. In fact, it must surely be a mistake to directly compare Hesiod's seafaring calendar with those that survive from the late Roman world—maritime timetables that were compiled more than a thousand years after that outlined by the Boeotian poet. Indeed, if we accept Snider's argument that the sailing season of c. 700 BC ran from late March to late October, then, in later centuries, the seafaring calendar was likely to have been extended considerably further into the winter half-year. The introduction of larger, stronger and more sophisticated ships;[17] a better understanding of the coasts and seas of the Mediter-

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14 Snider (1978: 131–133) proposed that Hesiod was actually arguing in favour of a suspension to seafaring for the fifty days immediately following the summer solstice because of the strong etesian winds which blow across the Aegean at this time of year (for the etesians, see below, pp. 64, 72, 80–81). However, such a view appears untenable given the weight of literary evidence referring to voyages being made during the months of July and August: these two summer months cover a period that virtually all scholars would regard as lying at the heart of the ancient sailing season.

15 Referring to the seasonal limitations affecting seafaring throughout Graeco-Roman history, Casson has therefore claimed that, 'in point of fact, this is the way things were for the whole of the ancient period' 1995: 270–271. See also Morton 2001: 256.

16 Semple 1931: 580.

17 As will be seen in chapter 3, it was the later Hellenistic period and early Roman Empire that probably witnessed the apogee of ancient shipping, not only in the volume of seaborne

ranean;[18] an increase in the number and size of harbour facilities along the various shores;[19] greater year-round demand for food and other commodities from larger population centres;[20] and, during the Roman Imperial period at least, more settled political conditions in the lands surrounding the Mediterranean, were all developments in the centuries following Hesiod that must have had a profound effect on maritime activities and provided later generations of seafarers with far greater potential for extending the sailing season further into the winter months than was the case during the Archaic period.[21] To assume that the sailing season remained virtually unchanged across the broad span of antiquity therefore appears unrealistic given such important technological, economic, political and military developments, all of which impacted upon the seasonal strategies of seafaring communities in the long centuries that separate Hesiod's Archaic period sailing calendar from the maritime timetables set down in late Roman texts.

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commerce (e.g. Parker 1992), but also in the technical sophistication of the construction process of both merchant vessels and warships. As has been noted by J.R. Steffy, writing of shipbuilding practices in the first century BC: 'I believe that in this century and the next, the expertise in building strong shells and efficient systems of edge joinery reached its peak' (1994: 84).

18 This is indicated by the increasingly detailed nature of *periploi*. See below, pp. 191–194.

19 The first literary references to attempts to construct an artificial harbour date to c. 530 BC and the efforts of Polycrates of Samos (Herodotus, 3.45, 3.60). Archaeological evidence for artificial harbour works at Thasos also date to about this period (Blackman 1982: 93). Only from the fifth century BC onwards does it appear that artificial harbours began to become more commonplace (Starr 1989: 21), reaching their peak in the Hellenistic and early Roman Imperial periods when, with the use of hydraulic cement, entirely artificial harbours could be created, most famously in the work carried out at the port cities of Portus and Caesarea Palaestinae. The advent of these highly important aids to Mediterranean seafaring are, therefore, long after the time at which Hesiod was writing, and as has recently been noted, 'Homer and Hesiod were barely familiar with man-made harbours: in their writings, ships were normally simply beached and secured in place' (Morton 2001: 106. For a description of this in the works of Hesiod, see *Works and Days*, 624 f. See also Rickman 1985).

20 E.g. Garnsey 1988; Rickman 1980.

21 The clearest evidence in support of this argument for variation in the levels of seafaring activity during antiquity comes from archaeology. The shipwreck corpus created by A.J. Parker (1992: 8 f. figs. 3 & 4) clearly highlights the disproportionate number of ships being wrecked during the later Hellenistic / Late Republican period and into the early Roman Empire, probably reflecting a large increase in the volume of maritime transport passing across the Mediterranean at this time. Klavs Ransborg (1991: 125) has, in fact, gone so far as to interpret this wreck data as the direct result of an increase in wintertime voyages during this period. However, such an assumption is unsupported by archaeological or textual evidence, and has rightly been regarded by Horden and Purcell (2000: 565) as being an overly bold statement.

The Sailing Season of Vegetius

It is the *Epitoma rei militaris*, written by Vegetius at the turn of the fourth and fifth centuries AD,[22] that provides the most precise set of dates for the sailing season of antiquity. Within the military handbook, the late Roman author marks out clearly defined periods of the year during which he regarded seafaring to be 'safe', 'doubtful' or 'impossible'. Although it has been correctly pointed out that the Vegetian maritime timetable comes with no legal support and should only be regarded as a theoretical calendar,[23] nevertheless, it is the seafaring calendar outlined by Vegetius that has provided the foundation upon which rests much of our present understanding of the Graeco-Roman sailing season.

> The violence and roughness of the sea do not permit navigation all year round, but some months are very suitable, some are doubtful, and the rest are impossible for fleets by law of nature. When Pachon has run its course, that is, after the rising of the Pleiades, from six days before the Kalends of June [i.e. 27th May] until the rising of Arcturus, that is, eighteen days before the Kalends of October [i.e. 14th September], navigation is deemed safe, because thanks to the summer the roughness of the sea is lessened. After this date until three days before the Ides of November [i.e. 11th November] navigation is doubtful and more exposed to danger, as after the Ides of September [i.e. 13th September] rises Arcturus, a most violent star, and eight days before the Kalends of October [i.e. 24th September] occur fierce equinoctial storms, and around the Nones of October [i.e. 7th October] the rainy Haedi, and five days before the Ides of the same [i.e. 11th October]. But from the month of November the winter setting of the Vergiliae (Pleiades) interrupts shipping with frequent storms. So from three days before the Ides of November [i.e. 11th November] until six days before the Ides of March [i.e. 10th March] the seas are closed.[24]

The advice put forward by Vegetius certainly presents a clearly delineated seafaring calendar for the late Roman period, one in which the heart of the sailing season was focused on the summertime, while spring and autumn were transitional periods of the maritime year when voyages might be

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[22] See N.P. Milner (1996: xxxvii–xli) for the possible dates during which Vegetius was writing the *Military Science*; a period that potentially spans AD 383–450. However, the most compelling evidence indicates that the work is dateable to the period 388 to 391. See also Barnes 1979.

[23] Saint Denis 1947: 196–198. For the lack of legislation referring to the ancient sailing season, see below, p. 44 f.

[24] Vegetius, *Epitoma rei militaris*, 4.39. Modern dates added by the translator, N.P. Milner (1996: 146–147).

undertaken, though it was considered inadvisable to put to sea. From the second week of November through until the second week of March—the four months spanning the wintertime—Vegetius leaves little doubt that he considered the Mediterranean closed to seaborne traffic. The maritime calendar proposed by Vegetius also carries greater weight than does the far earlier sailing season advised by Hesiod. Whereas the Boeotian poet confessed his own ignorance of seafaring, it would appear likely that Vegetius was reasonably knowledgeable of maritime practices, not only as a result of his research into the works of past authors upon which he bases much of the *Epitoma*, but probably also from personal experience.[25]

Taken at face value, the Vegetian sailing season appears to demonstrate fairly conclusively that the sea-lanes of the Mediterranean were closed during the wintertime and most historians are content to assume that the late Roman author presents a fairly accurate picture of the seasonality of ancient maritime operations.[26] There are, however, a number of problems associated with this late Roman calendar that have never been adequately addressed; difficulties that should lead us to question the use of this sailing timetable as a seasonal template applicable to most vessels and mariners sailing the Graeco-Roman Mediterranean. Indeed, when subjected to close critical analysis, the sailing season advised by Vegetius appears exceptionally limited in scope and was probably of little practical value for the vast majority of seafarers.

The most obvious problem with Vegetius' sailing season, and one that will be dealt with in detail in chapter three, is that it was specifically tailored to suit the needs of late Roman warships. However, while the long, narrow, shallow-drafted war-galleys of antiquity would have encountered serious difficulties when on the water in anything other than relatively calm, flat seas, by contrast, sailing merchant vessels with their deeper hulls and broader beams, were far more competent at dealing with high winds and rough seas. This considerable variation in the levels of seaworthiness that existed between fighting ships and commercial vessels obviously has profound implications for the ancient sailing season and it seems inconceivable

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[25] While Sian Williams (1999: 218 fnt. 634) is no doubt correct to assume that Vegetius gleaned much of his information from studies of previous Graeco-Roman authors, in his *Digesta artis mulomedicinae* (3.6.1), the late Roman writer nevertheless describes his travels across the Empire as having been various and far-flung, indicating that he probably had some personal contact with the maritime world.

[26] See, for example, Casson (1995: 270), Jones (1964: 843), McCormick (2001: 461) and Pryor (1988: 87 f.), all of whom draw heavily upon Vegetius' maritime calendar for an understanding of the ancient sailing season.

that ancient warships and merchantmen ever shared the same calendar of operations. Instead, the relatively small and lightly built warships that are the focus of Vegetius' sailing calendar were inextricably bound by the dictates of nature; through necessity they were forced to adhere to a sailing season that was firmly based on the benevolent conditions that tend to prevail across the Mediterranean during the summer half-year. However, for the more sturdily constructed and seaworthy merchant vessels, that were far better equipped to cope with unfavourable sea conditions, the seasonal limits set out by Vegetius would have proved excessively restrictive.

The other great difficulty in giving prominence to the Vegetian sailing season is that the late Roman author fails to take account of the considerable climatic diversity that exists within the Mediterranean region. This is a major stumbling block for a maritime calendar that, as can be seen from the above quote, attempted to link the practicalities of seafaring with the seasonal changes affecting the weather and sea conditions over the course of the year. While the meteorology of the Mediterranean will be explored in the following chapter, it is enough to say at this point that weather and sea conditions can vary from one maritime locality to another to such an extent that attempts to produce a sailing calendar applicable across the length and breadth of the entire Mediterranean can never succeed. Rather than accepting that the sailing calendar of Vegetius accurately reflects the realities of the ancient sailing season, the following pages will instead seek to demonstrate that localised meteorological, hydrological and topographical conditions gave rise to considerable regional diversity across the Graeco-Roman Mediterranean. On some areas of the Mediterranean, where, even in the wintertime, conditions were generally favourable and allowed relatively safe voyages to be made, commercial shipping continued to ply the sea-lanes for considerably longer than was advised by Vegetius' sailing season. Across certain areas of the Sea, sailors probably continued to make voyages throughout the winter months.

Regional Variation in the Ancient Sailing Season

The most compelling textual evidence in support of the theory that there were a variety of sailing calendars in existence at the same time on different regions of the ancient Mediterranean comes from a private lawsuit delivered in Athens soon after 323 BC, in which an Athenian creditor, Dareius, sought to recover a bottomry loan made to the ship-owners Dionysodorus and Parmeniscus.[27] During his speech Dareius describes how the two defendants, instead of returning to Athens with a cargo of Egyptian grain, as they were obliged to do under the terms of their contract, instead remained in the eastern Mediterranean. This breach of the agreement was, according to Dareius, specifically designed to allow the two ship-owners to take advantage of the more favourable seafaring conditions that existed in this region of the Mediterranean: 'For voyaging from Rhodes to Egypt is uninterrupted, and they could put the same money to work two or three times, whereas here [i.e. Athens] they would have had to pass the winter and to await the season for sailing.'[28]

It would therefore appear that, by at least the end of the Classical Greek period, voyages between Rhodes and Egypt continued to be made throughout the winter half-year—the period during which the Mediterranean is usually envisaged as being closed to seafaring. Equally important is the fact that this wintertime traffic was considered to be commonplace, and there is no suggestion in the speech of Dareius that the two ship-owners were taking excessive risks by staying at sea in this eastern region of the Mediterranean during the winter months. Year-round seafaring was therefore seemingly the rule rather than the exception on the Rhodes-Egypt shipping route during the later fourth century BC.

Support for the belief that the sailing season of the eastern Mediterranean was considerably longer than that of the contemporary Aegean is given further credence by a series of customs duties recovered from the Egyptian city of Elephantine that records the dates of foreign ships arriving and departing from an unnamed Egyptian port in either 475 or 454 BC.[29] Preserved on papyri and hidden beneath the text of a set of Aramaic proverbs, the customs records provide clear evidence for a seafaring season along the eastern seaboard of the Mediterranean that was considerably longer than has previously been thought to be the case.[30] The custom records of this Elephantine Palimpsest record a total of forty-two ships—thirty-six of which were Ionian while the remaining six are listed as Phoenician—arriving and departing the port during the course of a sailing season that began with the departure of an Ionian vessel on March 6 and stretched all the way through to early

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[27] This case is preserved in the *Demosthenic Corpus*.

[28] *Demosthenic Corpus*, 56.30.

[29] Porten & Yardeni (1993), suggest the date was 475 BC, while Briant & Descat (1998: 60–62) argue for the date of 454 BC. Tammuz (2005: 151) has recently put forward the belief that the port was located on the Nile somewhere near the Wadi Natrun.

[30] Porten & Yardeni 1993.

winter when a vessel put to sea on December 14. The importance of these date-ranges for our understanding of the Graeco-Roman seafaring calendar has not been lost on Horden and Purcell who have noted: 'All estimates [of the duration of the ancient sailing season] are likely to be revised in the light of the Elephantine Palimpsest ... attesting year-round navigation in the eastern Mediterranean of the early fifth century BC except for January and February.'[31]

Furthermore, while the date-range revealed in the Elephantine Palimpsest extends the seasonal scope of maritime operations in the eastern Mediterranean far beyond the limits generally credited to Graeco-Roman seafaring activities—pushing the sailing calendar into the middle of December, while seemingly confirming the Vegetian start date of early March—there is no reason to regard these dates as representing the absolute limits of the sailing season in the eastern Mediterranean at the beginning of the Classical period. Indeed, while it cannot be assumed that the five Ionian vessels recorded as entering the unnamed Egyptian port in March had come directly from the Aegean, and they possibly wintered on the Near Eastern seaboard, it would nevertheless seem likely that at least some of these ships were at sea during February.[32] Vessels sailing between the Nile delta and Rhodes, situated at the eastern approaches to the Aegean, would face a voyage of approximately 450 nautical miles (830 km) across open-water. Given that ancient ships could probably average between 4½ to 6 knots (8.3 to 11 kph) with a favourable wind, the journey might have taken only 3 or 4 days of continuous sailing. However, with unfavourable winds, speeds of 2½ knots (4.6 kph) or less were more likely, extending the voyage time to a week or more.[33] Such open-water journeys by ancient ships were undoubtedly undertaken and, in an account of a journey that was made only a few decades after the voyages of the vessels listed in the Elephantine Palimpsest, Herodotus describes approaching the Egyptian coast from the open sea. Nevertheless, it would seem likely that voyages across open-water would have generally been avoided in the wintertime when Graeco-Roman sailors would have preferred the shelter afforded by a coastline to be close at hand in the changeable conditions more likely to be experienced at this time of

[31] 2000: 565.

[32] Tammuz (2005: 151) has thus recently noted: 'The date on which the first Ionian ship arrived in the Egyptian harbour is unknown, but that ship is known to have left Egypt on Atyr 17 (6 March) and must have arrived one or two weeks before that day. It is evident that it left its home port on an island in the Aegean Sea or in Asia Minor in February.'

[33] For the speed of ancient ships, see Casson 1995: 285.

year.[34] Therefore, although Heliodorus' novel, *Aethiopica*, describes how a large Phoenician merchantman made the open water crossing from Crete to the north African coast in early spring, even for 'a vessel whose construction combined grace with immense size and height' the risks in making such a voyage were clear to the crew who were only persuaded to make the journey because of the imminent threat of pirate attack.[35] The danger of being caught on the sea in bad weather was even more acute for the considerably smaller Ionian and Phoenician vessels recorded on the Elephantine Palimpsest, the cargo receipts of which suggest that these ships were of only 'a few dozen tons burden.'[36] For relatively small vessels such as these, the coastal route along the Near Eastern seaboard therefore offered the safer option in the changeable weather of the winter half-year. Yet a coastwise voyage from the southern Aegean to the Nile is approximately 1000 nautical miles (1860 km) and, even with favourable winds, such a voyage would have taken between a week and ten days of constant sailing: a journey that would have increased by several days if, as would often have been likely, the vessels anchored during the hours of darkness or put into various ports to trade.[37] If the wind proved to be fickle for much of the voyage, as would often have been the case between late autumn and early spring, then even vessels constantly at sea would have taken more than two weeks to sail between the south-eastern Aegean and Egypt. A journey time of a month or longer may therefore be a more reasonable estimate of the voyage from

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[34] Herodotus, *Histories*, 2.5.2. (quoted below, p. 196). The ability to seek shelter from the coast in deteriorating weather has been emphasised by Morton as an advantage that 'would clearly tend to be most valued at the beginning and end of the traditional sailing season, and indeed outside it altogether, when the more changeable weather conditions and the periodic passage of depressions with their various winds ... made it more likely that a ship sailing initially in favourable conditions might find itself overtaken by adverse conditions before the end of its journey' 2001: 145. See also Rougé 1952: 316; Starr 1946: 21. However, see Tammuz 2005, who argues that it was open-water voyages that were made in the wintertime, while short coastal hops were suspended until the arrival of the spring (quoted above, p. 4).

[35] Heliodorus, *Aethiopica*, 5.18. Although written in the third century AD, the novel is set several centuries earlier.

[36] Horden & Purcell 2000: 149.

[37] For voyages made from the Aegean to the Nile delta, mariners also have to sail against the current which, although only averaging 1/4 knot (0.46 kph) (*Mediterranean Pilot* 1999: 5.18, though this speed—the consequence of the outflow of the Nile into the Mediterranean—has been reduced since the construction of the Aswan High Dam) along the Levantine seaboard, would have slowed progress of vessels making for the unnamed Egyptian port. (The current would obviously have aided the progress of ships on the northwards leg of their voyage, sailing back to Phoenicia or the Aegean. See Casson 1950; Charlesworth 1924: 42 f.; Mantzourani & Theodorou 1991: 49 fig. 8).

the Aegean to the unnamed Egyptian port given the increased likelihood that unfavourable sea conditions would force vessels to lose several days when sheltering close to the coast while awaiting more favourable weather. The arrival of Ionian vessels at the Egyptian port during early March would therefore indicate that they had put to sea a few days earlier, with at least some of the ships probably beginning their voyages in February. Alexander Kinglake, for example, describes a wintertime voyage which he made between Ionia and Syria during the mid nineteenth century which took him more than a month to complete.[38] If such was the case for the Ionian vessels recorded in the Elephantine Palimpsest, then it may even have been January when some of these ships began their journey.

In addition to revealing that Greek and Phoenician ships were at sea exceptionally early in the year, the Elephantine Palimpsest also clearly extends the sailing season of the fifth century BC into the late autumn and early winter; a period when seafaring is usually envisaged as coming towards its seasonal conclusion, with ancient authors such as Hesiod and Vegetius advising sailors to seek the safety of harbour as soon as possible.[39] Yet in the period following September 14—the date at which Vegetius considered navigation to be 'doubtful and more exposed to danger'—eleven ships are recorded as exiting the Egyptian port. A further six vessels departed after November 10—the date at which Vegetius' sailing calendar marked the seas as closed to shipping. While the last vessel to leave the unnamed Egyptian port was a Phoenician merchantman that departed on December 14 and would probably have taken about a week to return to its home port, more interesting is the date of December 11 when the last Ionian vessel exited the Egyptian port. Assuming that this vessel intended to sail all the way back to the Aegean—which would appear likely given that, although it was the second week of December, the crew of the vessel nevertheless felt sufficiently confident to embark on the voyage rather than choose to winter in the Egyptian port—then the return journey northwards along the Levantine coast and then west under the lee of Anatolia, could be

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[38] Kinglake, 1995: 59. For the vessels travelling between Egypt and Phoenicia, the voyage was, of course, considerably shorter with the distance between Sidon and the Nile delta approximately 250 nautical miles (460 kilometres). With favourable winds, voyages lasting only two or three days were therefore possible, while even journeys made with winds from slightly less advantageous directions probably took little more than four days of continuous sailing. For the Phoenician vessels arriving and departing from the Egyptian port even wintertime voyages would often have taken less than a week to complete.

[39] Hesiod, *Works and Days*, 618–694; Vegetius, *Epitoma rei militaris*, 4.39.

expected to take between two weeks to a month to complete.[40] This vessel would, therefore, be unlikely to have completed its voyage until the latter part of December, or even the beginning of January. Furthermore, as with Dareius' speech in the *Demosthenic Corpus*, there is no implication that the wintertime voyages recorded on the Elephantine customs records are in any way extraordinary: the fact that all the ships arrived with mixed cargoes and left with mineral soda (used in the processing of textiles, the manufacture of glass, and as a component in many ancient medicines) also quashes the possibility that the vessels might have been sent out on highly unusual and risky voyages in response to desperate conditions brought on by famine or other circumstances that demanded excessive risks be taken.[41] The customs records of the Elephantine Palimpsest therefore lend strong support to the later testimony of Dareius that navigation in this eastern region of the Mediterranean was capable of being maintained throughout the winter months. In light of such literary evidence for seemingly routine wintertime voyaging along the Levantine seaboard we would do well to avoid jumping to the conclusion that any references to seafaring—at least in this region of the Mediterranean—must necessarily be dated to the months running from spring to autumn. While maritime activities would certainly have been of greater volume during the summer half of the year we should, nevertheless, question assumptions, such as that made by Casson, that a shipment of various foodstuffs transported by sea from Syria to Alexandria in 259 BC 'must have taken place some time between May and September, since voyaging over open water was confined almost exclusively to these months.'[42]

Further literary evidence for wintertime sailing upon the waters of the eastern Mediterranean comes from Pindar's *Isthmian Odes* which, written soon after the conclusion of the Persian Wars, makes it contemporaneous with the early fifth century customs records preserved on the Elephantine Palimpsest.[43] Writing in praise of Xenocrates, an aristocrat from the southern Sicilian town of Akragas, Pindar notes how 'he would travel to Phasis in

[40] We can be fairly confident that mariners bound for the Aegean from Egypt would, throughout antiquity, have taken this coastal route, utilising the favourable currents that ran along the Levantine coast while, at the same time, avoiding sailing into the prevailing winds which, in winter as well as summer, blow from the north. Casson 1950; 1995: 298; Charlesworth 1924: 247; Pryor 1988: 95 f. See below, pp. 80–82.

[41] For the cargo of mineral soda (also referred to as natron), see Horden & Purcell 2000: 149; Stager 2003: 243; Tammuz 2005: 151.

[42] 1995a: 121.

[43] For the date of the *Isthmian Odes*, see Bowra 1970: 833.

summer seasons, while in winter he would sail to the shore of the Nile.'[44] Whether Xenocrates sailed from the river Phasis, on the eastern shores of the Black Sea, direct to Egypt, or rather made the voyage to the Nile after first returning to Sicily, is unclear. However, regardless of the exact route, it appears that Pindar considered Xenocrates to be engaged in seafaring on the eastern Mediterranean during the wintertime.[45]

Providing additional support for wintertime seafaring on the eastern Mediterranean is an incident from the Peloponnesian War. During the winter of 412/11 BC, Thucydides relates how the Spartan commander, Hippocrates, stationed six warships off the headland of Triopium, near the south-west Anatolian city of Cnidus, in order to intercept Athenian shipping passing between the Aegean and the eastern Mediterranean.[46] Not only does this naval action highlight that ancient states did deploy warships on the seas of winter during times of war, but Thucydides also makes it clear that the Spartan squadron was positioned at this point specifically in order to raid enemy merchant vessels, presumably ships trading along the Levantine coast between Egypt and the Aegean similar to those recorded in the Elephantine Palimpsest, or mentioned by Dareius in the *Demosthenic Corpus*. That the Peloponnesians saw fit to deploy war-galleys off Cnidus in the wintertime would indicate that, even during this time of year, the volume of Athenian commercial shipping entering and exiting the south-eastern Aegean was sufficiently substantial to warrant the Spartans stationing a naval detachment to harry enemy traffic moving along the sea-lanes of this region.

Gratian's Edict

Alongside the maritime season of Vegetius the other principal seafaring calendar surviving from late antiquity is that set out in an edict by the emperor Gratian and recorded in the *Codex Theodosianus*. Dating to February 6, AD 380, the sailing season outlined in the edict is virtually contemporaneous with the advice of Vegetius. As with the *Epitoma rei militaris*, Gratian's

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44 Pindar, *Isthmian Odes*, 2.41.

45 See Morton (2001: 260). While Race (1997: 151 fnt. 3) is in little doubt that Xenocrates sailed to the Nile in the winter, his interpretation of a seasonally shifting wind regime for the eastern Mediterranean, in which, throughout the summertime 'a southern wind favoured travelling to the Phasis River, a winter wind south to the Nile' is a misplaced belief. See below, p. 79 ff., and figures 2.3a–d.

46 Thucydides, 8.35.

edict lays down clearly defined seasonal parameters for maritime transport, in this case decreeing that ships were to leave port no earlier than April 13 and no later than October 15, with the start of November bringing an end to seafaring:

> Emperors Gratian, Valentinian and Theodosius Augustuses to the Shipmasters of Africa, Greetings …
>
> It is Our pleasure, of course, that the month of November shall be exempt from navigation [that from the month of November navigation will be discontinued], but the month of April, since it is the nearest to the summer, shall be employed for the acceptance of cargo. The necessity of such acceptance from the kalends of April to the kalends of October shall be preserved permanently; but navigation shall be extended to the day of the Ides of the aforesaid months …[47]

While this imperial decree does indeed appear to provide clear-cut evidence for a closely defined, government imposed ban on seafaring between the end of October and the middle of April, the edict is, however, considerably more circumscribed in its application than is generally acknowledged. Firstly, it should be noted that the edict only applies to *navicularii* shipping state-owned cargoes from Roman Africa and seemingly had no direct impact upon ship-owners transporting private cargoes from the African province.[48] Thus, for the majority of merchants and seamen employed in maritime commerce in late Roman Africa, the edict should certainly not be considered a legally binding timetable designed to force them off the winter seas.[49] Aimed exclusively at the *corpus navicularorumi africanorum*, Gratian's edict was instead formulated to ensure that vessels chartered to transport state-owned supplies set sail only once the risk to the *annona* cargoes was considered minimal. However, while the late Roman state might not have been prepared to entrust its own shipments of grain and other foodstuffs to the seas for almost half the year, merchants and ship-owners sailing in vessels transporting privately owned cargoes appear to have been free to carry out voyages beyond the seasonal limits imposed by the edict and might therefore have been rather more willing to risk seaborne commerce during the wintertime than was the Roman state. Pliny the Elder, for example, refers to the willingness of maritime traders to sail on winter seas

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47 *Codex Theodosianus*, 13.9.3.

48 Casson (1995: 271. n. 3) therefore noted that the edict is 'addressed to the shippers of Africa', engaged with the 'acceptance and loading of *government* cargoes' (my emphasis).

49 *Contra* Milner 1996: 147.

when 'not even the fury of the storms closes the sea; pirates first compelled men by the threat of death to rush into death and venture on the winter sea, but now avarice exercises the same compulsion.'[50]

It should also be noted that the *navicularii* referred to in Gratian's edict were themselves allowed up to two years in which to carry out private commercial ventures before they were again obliged to transport state-owned cargoes. As such, they may also have been rather more daring in their seasonal schedules when operating under their own judgement than when forced to abide by the imperial seafaring calendar.[51] Indeed, it seems likely that the seasonal constraints imposed by the late Roman state on North African mariners shipping *annona* commodities were unduly excessive. While maritime calendars are usually created in an attempt to balance excessive risk against excessive caution, it is likely that the late imperial government erred towards the latter, producing a seasonal shipping schedule designed to allow *annona* goods to be transported from Africa only at the safest possible time of year in an effort to minimise the chance of loss through storm and wreck. Rather than presenting an accurate picture of the abilities of the ships and their crews to deal with the unfavourable conditions that might be experienced on this region of the Mediterranean between mid autumn and early spring, the sailing season set down in Gratian's edict of AD 380 instead probably reflects the over-cautiousness of the late Roman state.

It is also important to note that Gratian's edict is addressed exclusively to the shipmasters of late Roman Africa; no reference is made to *navicularii* operating vessels from any of the other provinces which bordered the Mediterranean, let alone those with coastlines lapped by the waters of other seas and oceans. It should not therefore be assumed that the edict's seasonal restrictions can be superimposed on to the other maritime regions of the late Roman world. Indeed, as will be demonstrated in the following chapter, the coasts of the Roman province of Africa record some of the greatest frequencies of high winds anywhere across the Mediterranean, while the fact that such winds usually blow from the north or north-west also turns the coast into a lee shore, making it a highly dangerous region for shipping. (See below, p. 69 f.) It may therefore have been the case that the

[50] *Naturalis Historia*, 2.47.125. For similar sentiments, see Vegetius, *Epitoma rei militaris*, 4.39.

[51] For the two years grace between the requirement to ship state cargoes, *Codex Theodosianus*, 13.5.21; 13.5.26. See also Rickman 1980: 203.

sailing season laid down in Gratian's edict was exclusively formulated for the African province, and may have delineated a maritime calendar that was considerably more circumscribed than those followed by the shippers of state cargoes operating along other less hazardous coasts and seas of the Mediterranean.

It has already been seen that, during the Classical and Hellenistic periods, mariners sailing along the eastern seaboard of the Mediterranean appear to have enjoyed a considerably longer sailing season than is generally considered to have been the case for the Graeco-Roman world: a season that possibly extended into year-round seafaring. (See above, p. 16 ff.) It would also seem likely that this area maintained its comparatively long seafaring season through until the close of antiquity. Evidence that the maritime timetable for state shippers operating along the eastern coasts of the Mediterranean possibly began more than two months earlier than that permitted to the *navicularii* of the African province can be found in the so-called 'double-dated edicts'—decrees that were dated at their point of origin (usually the imperial cities of Rome or Constantinople where the emperor was in residence), as well as at their place of delivery. Of the surviving twenty-eight double-dated edicts sent to the Prefect of Egypt during the fourth and fifth centuries AD, half were dispatched to the Egyptian province during the months November through to March—the very time of year when Gratian's edict ordered a suspension of all seafaring. Moreover, it is the winter month of February that, with five edicts sent out to Egypt, records the highest monthly total for the dispatch of double-dated edicts, while the spring months of March and April also register four edicts apiece. The fact that the great majority of surviving double-dated edicts—twenty-three in all—were sent to Egypt between February 4 and July 30 has thus been interpreted as a consequence of 'sailings in spring and summer by grain-ships based in Constantinople which after returning from Egypt normally wintered at home.'[52] If this theory is correct, then the evidence from these edicts clearly emphasises that, along the eastern seaboard of the Mediterranean at least, the state authorities appear to have considered it acceptable for shippers of *annona* cargoes to be commencing their voyages to Egypt from the start of February.

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52 Duncan-Jones 1990: 22. The assumption by Richard Duncan-Jones that the edicts were carried on board vessels which also shipped state-owned *annona* cargoes seems likely given that the edicts were entrusted to imperial messengers who, armed with the postal warrant (the *diploma*), were entitled to the use of state facilities (Casson 1994: 183 f.). It would therefore appear probable that these messengers used their *diploma* to gain passage on

Furthermore, all but three of the double-dated edicts sent to Egypt date to the years spanning AD 380–397, a seventeen-year period which make these edicts virtually contemporaneous with the sailing season set down by Gratian for the shipmasters of Africa. It would thus appear that there were significant regional variations in the seasonal shipping schedules of state-owned cargoes co-existing on the Mediterranean of the late fourth century AD: while African vessels shipping state-owned commodoties were bound by law to remain off the seas until mid-April, *navicularii* sailing over the Aegean and eastern Mediterranean seem to have been allowed to commence their operations more than two months earlier. Therefore, when another edict preserved in the *Codex Theodosianus*, and dated to AD 397, instructs 'shipmasters to deliver a third of the regular tax payment due to the city at the very beginning of navigation,'[53] we should not assume, as some scholars have done,[54] that 'the very beginning of navigation' refers to the middle of April, as is laid down in Gratian's sailing season. Instead, the edict of AD 397 might refer to a multiplicity of different shipping calendars that came into effect at different dates in the late winter or early spring depending on what regions of the Mediterranean the *annona* vessels were making their voyages—a date of mid-April for the *navicularii* of the African coast, but one of early February for state shippers operating on the eastern seaboard of the Mediterranean.

It should also be noted that the sailing season for the African *navicularii* as set down in Gratian's edict was only brought into effect in AD 380 and, as such, the legislation was extremely limited in time; at most the edict endured for only the forty-nine years that elapsed between its implementation and the arrival of the Vandals in the province in AD 429. It would also appear likely that Gratian's legislation became obsolete even earlier. The threat posed to Rome by the invading Gothic tribes at the beginning of the fifth century, with the investment of the capital from 408 and its sack in 410, very probably rendered Gratian's sailing season redundant through force of

government charted ships departing for Egypt. Even if this assumption is erroneous and the edicts were carried on vessels shipping privately owned cargoes, then the seasonal date-range of the Egyptian double-dated edicts still clearly highlight that the seas between Constantinople and her principal grain supplying province were open to seafarers exceptionally early in the year, with February seemingly the month when seaborne transport could once again began in earnest following the winter downturn.

53 *Codex Theodosianus*, 13.5.27. It is unknown whether the city referred to by the edict is Rome or Constantinople.

54 E.g. Rickman 1980: 202.

desperate circumstance, and grain was no doubt shipped to the city from the maritime provinces of the central and western Mediterranean at all times of the year in an effort to alleviate food shortages.[55]

Furthermore, the passage in Gratian's edict immediately preceding that outlining the sailing season also clearly indicates the legislation was bringing into effect a new seafaring calendar rather than confirming any long-standing arrangement: 'Thus in future, all petitions, that is, those about the two and one half percent which you demand from the transport of winter cargo, shall be in abeyance.'[56] In the years immediately prior to AD 380 it thus seems certain that *annona* cargoes had been shipped from Africa considerably earlier than the newly sanctioned date of April 13, and the *navicularii* of the province had been demanding recompense for the extra risk incurred through making voyages rather earlier in the year. This has led J.T. Peña to the conclusion that, 'The issuance of this law suggests that prior to 380 state cargoes were sometimes carried outside the sailing season that it prescribed and that disputes had arisen between the *navicularii* and the state regarding these operations … it may well be that prior to 380 the office of *praefectus annonae Africae* brought pressure to bear on the *navicularii* to recommence operations during the first half of April or perhaps even as early as March.'[57] However, given the large proportion of double-dated edicts transported across the eastern Mediterranean during February,

55 See the letter sent by St Paulinus of Nola to Macarius in AD 409/10, quoted below, p. 35.

56 *Codex Theodosianus*, 13.9.3.

57 Peña 1998: 165. It should not be assumed that the reference to 'winter cargo' contained in Gratian's edict indicates that, prior to 380, *annona* commodities were being shipped at some point between December and February, the months that modern meteorologists regard as constituting the Mediterranean wintertime. Indeed, because the ancient literature has no consensus as to when the winter season finished, the most that can be claimed is that voyages had taken place before April, the latest month at which ancient writers such as Ovid (*Fasti*, 4.125, 4.129–132), Lucretius (1.1ff.), and Macrobius (*Saturnalia*, 1.2.12–14) regard as bringing the spring. However, the claims for remuneration made by the African *navicularii* at the time the edict was brought into effect may have related to voyages made rather earlier in the year with some Graeco-Roman authors dating the annual arrival of spring well before the beginning of April: Thucydides appears to place it in early March (see Gomme 1956: 706; Meritt 1962: 436), while Pliny refers to both the coming of spring and the opening of the sea-lanes as commencing an entire month before this, when he writes, 'the spring opens the seas to voyagers; at its beginning the West winds soften the wintry heaven, when the sun occupies the 25th degree of Aquarius; the date of this is February 8' (Pliny, *Naturalis Historia*, 2.46.122. Though see also *Naturalis Historia*, 2.47.125 (quoted below, p. 239), for Pliny's observation that merchants in pursuit of financial profit were willing to remain on the seas year-round). Saint Denis has also noted that some ancient writers appear to have regarded the days and weeks following the winter solstice as bringing an improvement in the weather which made seafaring practicable (1947: 207).

it may even have been the case that voyages made by the *navicularii* of Africa commenced a month earlier than even Peña seems willing to countenance.

Archaeology has also provided crucial information relating to the sailing calendar contained in Gratian's edict of AD 380 with the recovery and detailed analysis of thirty-two *ostraca* upon which is recorded the reception and weighing process of olive oil delivered to the city of Carthage in AD 373.[58] Of these *ostraca* it is the five used as invoices documenting the receipt of oil amphorae delivered to Carthage by sea that are of primary interest. On both *recto* and *verso* these documents record the arrival of shipments of oil at Carthage and, in addition to recording the name of the shipper, the number, type and provenance of amphorae delivered, together with the number of amphorae rejected, the *ostraca* also 'preserve their dates more or less intact, showing that the series was produced for shipments of oil containers that reached Carthage over a period of time beginning no later than February 3, 373, and extending through April 11 of that year.'[59]

As can be seen in figure 1.1, the winter and early spring of AD 373 saw five different ships arriving at Carthage, each vessel either owned or skippered by a different individual and carrying a cargo of olive oil amphorae, the vast majority of which was received by state officials as part of the *annona*. While the source of the olive oil shipped by Januarius and Ertoriot has not been preserved, the three ships that arrived between February 14 and the first week of March all carried amphorae which, from their title of *caproreses centenaria levi*, probably contained oil that had originated from the district of Caprarienses, a territory lying some 260 km to the south-west of Carthage.[60] It can therefore reasonably be supposed that the ship of Cilinder and that of Felix, which are recorded as arriving at Carthage on February 14 and 15

[58] While the original excavations that recovered the *ostraca* were carried out on the Îlot de l'Amirauté in the city's circular harbour during the early twentieth century, and a brief article recording the transcriptions of ten of the shards was published immediately upon their discovery (Cagnat & Merlin 1911), only a handful of passing references were made to the *ostraca* until a detailed examination of their texts was undertaken by Peña in 1998.

[59] Peña 1998: 127. The *recto* of the *ostraca* have an abbreviated set of notes apparently made as soon as the vessels arrived at the city; the *verso* was an invoice drawn up between one and four days later when the state formally accepted possession of the olive oil (Peña 1998: 122).

[60] Peña 1998: 129. From this region the oil would presumably have been moved overland down the Ubus valley (modern wadi Seybousse) to the coastal city of Hippo Regius (modern Bône), from where it was shipped along the coast to Carthage (ibid. 195 f.). While the ship of Repostus arrived at Carthage sometime between March 2 and March 5, the exact date does not survive.

respectively, began their voyages early in February, while the vessel of Januarius, which arrived on February 3, though carrying unprovenanced oil, was almost certainly at sea in late January. The Carthage *ostraca* thus provide clear evidence of coastwise voyages being made on the wintertime Mediterranean during the heart of the period traditionally regarded as the *mare clausum*. Moreover, while the previous examples of such wintertime sea-traffic tended to focus on the Levantine basin—a region of sea that generally presents mariners with more favourable weather conditions than other regions of the Mediterranean—the waters off the coast of North Africa are considerably more dangerous for seafaring. (See below, pp. 69–70.) Nonetheless, the olive oil records from Carthage demonstrate that, even along such a hazardous coastline, seaborne commerce was being undertaken during the winter months. It remains unclear, however, whether the records on the *ostraca* provide information of voyages that were common occurrences in the late winter and early spring, or whether such shipping was unusual and the result of exceptional circumstance.

The possibility that the shipments of olive oil arriving at Carthage can be treated as exceptions to the seasonal maritime rule prevailing in late antiquity does indeed exist; the revolt of Firmus in the western region of Roman Africa at this time can be regarded as a possible factor inducing the imperial officials of the area to bring forward the dates of oil shipments to Carthage in an effort to remove the ships and their cargoes from the vicinity of the uprising.[61] It would, however, appear to be more than simply coincidence that saw deliveries of amphorae containing olive oil arriving in Carthage at precisely the right time for them to be transhipped on to larger vessels and then transported to overseas recipients of the *annona*. The local nature of the shipping outlined by the Carthage *ostraca* therefore dovetail perfectly with the dates set down in Gratian's edict that demanded state-owned cargoes be loaded from April 1, with voyaging to begin from April 13. Indeed, it has already been seen that, according to a further edict recorded in the *Codex Theodosianus* and datable to AD 397, shipmasters were ordered to deliver a third of the yearly *annona* contribution at the very beginning of navigation.[62] (See above, p. 26.) While this law, like that which sets out Gratian's sailing season, postdates the Carthage *ostraca* evidence, nevertheless, it indicates there was a need to maintain coastal shipping along the north African seaboard during the wintertime in order

[61] *Zosimus*, 4.16.3. See Peña 1998: 207.
[62] 13.5.27.

to ensure that commodities meant for the *annona* were ready for shipment to Rome or other intended overseas destinations as soon as the sailing season for the state shippers of Africa was officially declared open. This is certainly the view taken by Peña who suggests that *annona* shipments, such as the amphorae containing olive oil recorded on the Carthage *ostraca*, were delivered to maritime cities such as the African provincial capital by both land and sea during the winter and early spring in order to allow the *praefectura annonae Africae* to 'process and handover ... as large a quantity of oil as could be mustered so that this could be consigned to *navicularii* for export at the earliest moment that sailing conditions permitted.'[63]

It therefore appears unlikely that the ships and cargoes recorded on the Carthage *ostraca* of AD 373 would have been subject to the limits imposed seven years later by Gratian's edict. Indeed, while the legislation of AD 380 instituted a rigid shipping calendar for African shipmasters, it was a seasonal timetable that still required coastal vessels to make voyages well in advance of the dates prescribed by Gratian. The implication may therefore be drawn that the ship-owners documented on the Carthage *ostraca* were not members of the *corpus navicularii africani* but were instead probably members of the *susceptores canonis*, charged with the responsibility of ensuring that *annona* supplies were gathered and delivered safely to the *corpus naviculariorum Africanorum*.[64] Only after *annona* cargoes had been safely loaded on to state chartered ships did the *navicularii* accept formal responsibility for their safe delivery to Rome. The efficient muster of *annona* commodities at Carthage, and no doubt at a great many other port cities around the Mediterranean, therefore required the preservation of coastal shipping during the winter and early spring if such cargoes were to be ready for transhipment to Rome or other regions of the Empire at the beginning of the officially sanctioned sailing season for state-owned cargoes.

Finally, it is also worth noting that the maritime season set down in Gratian's edict of 380 was formulated at a time when commercial seafaring practices were at their most regulated, and the legislation dates to a period when the state was far more directly involved in economic procedures than had been the case during the Roman Republic or in the early centuries of the Empire. The work of Rickman into the grain supply of ancient Rome clearly highlights the increasing stranglehold that the state bureaucracy came to exert upon the shipment of *annona* commodities. Thus, in the Late Republic

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[63] Peña 1998: 206.
[64] See Rickman 1980: 202.

and Early Empire, 'the problem of transport had been left in general either to independent traders or to such shippers as the companies of *publicani*, or individual speculators, might hire to carry corn for them. By the beginning of the fourth century AD by contrast there were fixed corpora of hereditary *navicularii* who were under permanent control by the state.'[65] In such an economic environment, with increased bureaucratic control over the mechanisms of seaborne commerce, it is hardly surprising to also find the sailing season being made subject to strict guidelines. Therefore, while Gratian's sailing season, like the other maritime calendars surviving from antiquity, is based around prevailing meteorological conditions, nevertheless, it also has the characteristics of a bureaucratic project that sought to implement a rigid timetable for the transport of supplies to Rome. Almost certainly imposed on the *navicularii* in an effort to reduce the rate at which government-owned cargoes were lost at sea as a result of storms and other dangerous weather, Gratian's sailing season therefore restricted shippers transporting *annona* cargoes to the period between April 13 and October 31—a time of year when sailing conditions were usually at their safest and most predictable. It can therefore be argued that the parameters of Gratian's maritime calendar fail to do justice to the seaworthiness of ancient merchant ships or the skills of their crews, both of which would have allowed for a considerably longer sailing season had governmental decree not prevented it. If Rickman is correct in supposing that, throughout the Late Republic and Early Empire, independent traders and ship-owners tasked with shipping *annona* cargoes were not as tightly bound by state regulation as were the *navicularii* of later generations, then they may well have had considerably greater freedom in deciding when to put to sea. It is thus likely that in earlier periods of Roman history even state-contracted vessels would have been able to remain on the water for considerably longer into the autumn and spring. Bureaucratic over-regulation may also have imposed itself on the late Roman navy. The long years of the *Pax Romana*, during which the Mediterranean was controlled by a single, all-powerful state, had removed much of the urgency from naval operations and, in the centuries following Octavian's victory at Actium in 31 BC, there had been an almost complete lack of maritime rivals to stimulate innovation among the imperial fleets of the

[65] Rickman 1980: 87. Such a point was also long ago made by Charlesworth who emphasised that, 'when we reach the age of Constantine everything hardens down into a monotonous routine and a dull hopelessness, and private enterprise has been almost stifled' (1924: xiv). For analysis of how such a change came about, see McCormick 2001: 98 f.; Rickman 1980: 87 f.

Mediterranean. It is therefore hardly surprising that Vegetius felt able to draw up a naval calendar that neatly divided the maritime year into three separate seasons when the sea-lanes were 'safe', 'doubtful', or 'closed' to military shipping.[66]

Ancient Grain Freighters

In the later centuries of antiquity the economic and political need of the empire to secure the delivery of *annona* supplies—especially grain—to Rome and Constantinople also suggests that some of the large merchant vessels that transported the bulky foodstuffs to the burgeoning populations of the empire's capitals, were still plying the sea-lanes during the wintertime. The grain supply was drawn from a variety of Mediterranean provinces; from Spain and Gaul in the west, as well as Sardinia, Sicily and North Africa in the central Mediterranean. It was, however, the grain-rich eastern province of Egypt that became most famous for its export of wheat to the imperial capitals. Each year about 150,000 tons of grain was shipped from Egypt to Rome aboard some of the largest vessels of the ancient world, the freighters of the Alexandrian grain fleet.[67] Most scholars have assumed the voyages made by these grain ships were confined to a sailing season similar to that advised by Vegetius, or laid down in Gratian's edict of 380.[68] There are, however, a number of literary references that indicate there were *annona* vessels transporting supplies from the grain-exporting provinces between late autumn and early spring. As will be seen from some of the examples that follow, wintertime voyages undertaken by large grain freighters may well have been far more common than is generally considered to be the case.

> When there was a scarcity of grain because of long-continued droughts, he [the emperor Claudius] was once stopped in the middle of the Forum by a mob and so pelted with abuse and at the same time with pieces of bread, that he was barely able to make his escape to the Palace … and after this experience he resorted to every possible means to bring grain to Rome, even in the winter season. To the merchants he held out the certainty of profit by assuming the expense of any loss that they might suffer from storms, and offered to those

[66] *Epitoma rei militaris*, 4.39.

[67] See Rickman (1980: 94–119) for the provinces that provided the majority of the contribution of Rome's grain supply. For the figure of 150,000 tons transported annually from Egypt, see Casson (1995: 297) and Jurišic´ (2000: 45), though neither is clear on how this figure is calculated. White (1984: 153) claims the rather lower figure of 100, 000 tons to be a more realistic estimate of the annual amount of grain delivered to Rome from Egypt.

[68] E.g. Casson 1950; 1995: 297 f.

> who would build merchant ships large bounties, adapted to the condition of each: to a citizen exemption from the *lex Papia Poppaea*; to a Latin the rights of Roman citizenship; to women the privileges allowed the mothers of four children. And all these provisions are in force today.[69]

The above passage relates to the famine that threatened Rome in AD 51. Written by Suetonius in the early 120s, it suggests that, following the initial implementation of the measures by Claudius, they remained in effect for at least seventy years as subsequent emperors remained equally eager to ensure the year-round, seaborne supply of grain to Rome. Indeed, there would have been a particular desire on the part of the imperial authorities to encourage shippers to transport grain to the city during the winter and early spring for this was the very time of year at which the population of the capital was most likely to experience shortage and famine as supplies of grain and other foodstuffs started to run low before the new harvest could be taken in during June and July.[70]

It has, however, been assumed that this wintertime importation of grain to Rome initiated by Claudius was an exceptional event brought about by desperate need and the stress of extreme circumstance; Geoffrey Rickman is therefore of the opinion that 'it seems to have been a temporary arrangement designed to meet a sudden crisis: there is no trace of it in later juristic writings.'[71] The belief that the supply of grain to the capital in the winter of AD 51 was a short-term, reflex measure stems from the account of Tacitus who, referring to the same incident, notes: 'It was established that the capital had provisions for fifteen days, no more; and the crisis was relieved only by the especial grace of the gods and the mildness of the winter.'[72] However, instead of using this description to conclude that Tacitus regarded all

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69 Suetonius, *Claudius*, 18–19.

70 See Saint Denis 1947: 205–206. For June and July as the period of the ancient harvest, see below, p. 262.

71 1980: 127. It should be noted, however, that Rickman uncritically accepts the seasonally restrictive picture that has traditionally been painted of Graeco-Roman seafaring and, in particular, the limits set out by the Vegetian sailing calendar: he thus assumes that the ancient sailing season 'stretched from late May to early September, or at the outside from early March to early November' (1980: 128). However, as will be explored in detail below (p. 134 ff.), Vegetius was primarily concerned with warships and his maritime timetable was therefore likely to have been far more truncated than was the case for the more seaworthy merchant vessels, especially the large bulk carriers which transported grain across the open seas from the provinces to the capital. (For additional comment on the presumed temporary nature of Claudius' measures from an earlier generation of scholars, see, for example, Charlesworth 1924: 30 f. and Semple 1931: 580.)

72 *Annals*, 12.43.

wintertime voyages by grain ships as highly unusual, it can instead be interpreted that the Roman author was implying that the exceptional nature of the crisis required that large numbers of grain-bearing vessels—some no doubt requisitioned into the role at very short notice—reach Rome as quickly as possible to ensure the city's grain reserves could be replenished before the fifteen days' worth of provisions had been consumed.[73] It was therefore speed rather than safety that was required of the vessels dispatched to avert the famine of AD 51. However, in other years, when the threat of famine was less acute, grain was probably still being delivered to Rome by sea during the winter months, though, without the pressing need for speedy voyages to alleviate an imminent food crisis, ship-owners, captains and crews of freighters bearing commodities of the *annona* would have been able to display considerably greater caution and prudence: instead of trusting to the 'grace of the gods', they would have been able to take their time in making the voyage to Rome, sailing from one harbour or sheltered anchorage to another, and putting out to sea only when the weather allowed for safe passage-making.[74] The very fact that the crisis of AD 51 was averted within the space of just fifteen days can be taken to imply that numerous grain freighters remained in a state of readiness throughout the winter months, with many vessels potentially already on the water, scuttling between one port and the next as and when the weather allowed.

There are certainly indications in the Graeco-Roman literature that the wintertime importation of foodstuffs to Rome remained common in the years following the implementation of the measures initiated by Claudius. Writing at the turn of the first and second centuries AD, Martial hints at overseas communications between Italy and the great wheat-producing region of Egypt outside of the traditional sailing season when he writes of Egyptian roses being brought to the capital during the wintertime.[75] In the

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[73] Supplying Rome with grain within this fifteen-day deadline would not normally be a major problem and Rickman has pointed out that 'African corn should never have been too far out of Rome's grasp, so far as the journey by sea was concerned. At worst, perhaps no more than a week away' (1980: 128). The grain of Sicily and Sardinia was even closer to hand. Of course, the time-consuming tasks of loading and unloading the cargo at either end of the voyage was also a factor that would have lengthened the time it would have taken to get corn from the closest grain-producing regions to the capital.

[74] See, for example, the account of St Paul's voyage from Malta to Puteoli, in which the Alexandrian freighter upon which he was travelling put into port at Syracuse for a period of three days, before sailing on to Rhegium where the vessel again halted until the following day when a favourable southerly wind allowed for a two-day voyage to Puteoli (Acts 28:12–15. See below, p. 102).

[75] *Epigrams*, 6.8.

mid-second century, Aelius Aristides also implies that commodities were shipped to Rome year-round: 'Here is brought from every land and sea all the crops of the seasons … So many merchant ships arrive here, conveying every kind of goods from every people every hour, every day, so that the city is like a factory common to the whole earth.'[76]

The demand for grain to feed the population of Rome and, no doubt, the other large cities of the empire, was to remain in place until the end of antiquity and would force the state to ensure that *navicularii* continued to transport supplies even at times of the year generally considered to be outside the sailing season. While the threat of famine occasionally led to large-scale, seaborne shipments of grain being dispatched to cities during the heart of the winter—as was initiated by Claudius during the emergency of AD 51—the double-dated edicts dispatched to Egypt during the late Empire also indicate that, even without the spectre of famine looming over the imperial authorities, maritime transport of *annona* commodities routinely began at the beginning of February.[77]

From the same period the double-dated edicts that record seafaring on the wintertime waters of the eastern Mediterranean, a letter written by St Paulinus of Nola also describes an ill-fated voyage of a fleet of grain ships, amongst which was a vessel belonging to a certain Secundinianus, dispatched from Sardinia in an effort to deliver corn to Rome during the winter of 409/10:

> Last winter in Sardinia, in company with other ship-owners he was compelled to make his ship available to take on grain to be transported to the granaries of the imperial treasury, and under pressure from the state authorities he ordered his laden vessel to set sail before the summer weather, not waiting for the time when the regular supplies were sent.[78]

As P.G. Walsh has pointed out, it is likely this fleet was sent out in an effort to transport grain to the population of Rome that, as a result of the depredations of Italy by the Visigothic tribes led by Alaric, was facing famine and in desperate need of corn and other foodstuffs.[79] (See above, pp. 26–27.) This belief is supported by a reference in the *Codex Theodosianus* to a judicial text dating to AD 410 which refers to Italy being devastated by a combination of the Germanic incursions and an exceptionally harsh winter that had forced the emperor Honorius to order ships to leave port and bring grain

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76 *To Rome*, 10–12.

77 For the double-dated edicts, see Duncan-Jones 1990: 22 and above, p. 25 ff.

78 St Paulinus of Nola, *Letter* 49.1.

79 Walsh 1967: 102.

to the city at the first opportunity that the weather allowed.[80] The historian Jean Rougé was therefore of the opinion that this edict encompassed the winter months and, like the measures introduced by Claudius some three-and-a-half centuries earlier, ships were instructed to transport grain to Rome even in the depths of winter, should conditions permit.[81] Yet it would appear that year-round shipments of grain to Rome were already in progress in the years immediately prior to the investment of the capital by the Visigoths. The poet Claudian describes how, under the consulship of Stilicho, no wind, not even that blowing from the south—traditionally regarded as the wind of winter—could halt the ships from keeping Rome well-provisioned with grain: 'now the rainy south-wind and now the north wafts grain to my shores and my granaries are full whatever breeze may blow.'[82] However, the most famous example of grain being transported to Rome by sea during the wintertime comes from the middle of the first century AD and St Paul's voyage to Rome, described in Acts 27–28; an account that provides strong support for the belief that grain freighters were routinely putting out to sea by late January or early February.

The Wintertime Voyage of St Paul

Following a two-year detention in Caesarea as a result of a fracas in the Temple at Jerusalem, it was judged by the Roman governor, Festus, that St Paul was to be transported as a prisoner to Rome where he was to stand trial.[83] The vessel upon which the apostle initially sailed made slow progress from the Judean provincial capital, sailing north and then westwards as far as the city of Myra, at which point the Roman centurion charged with escorting Paul to his trial in the Empire's capital procured passage aboard a vessel of the Egyptian grain fleet that happened to be at anchor in the harbour of the Lycian city.[84] However, over the course of the following days the grain freighter encountered unfavourable winds as it clawed its way westwards along the Anatolian coastline before sailing across the southeast Aegean,

[80] *Codex Theodosianus*, 12.5.34.

[81] Rougé 1952: 324.

[82] *De Consulatu Stilichonis*, 2.395–396. See Williams (1999) for the association adopted by ancient writers between the rainy south wind and the season of winter.

[83] Acts 25:12.

[84] Acts 27:2–6. Although referred to as Myra in Acts 27:5–6, the harbour at which St Paul switched vessels is more correctly referred to as Andriake, a port settlement situated some five kilometres to the south of Myra.

rounding Cape Salmone (modern Cape Sidero) at the eastern extremity of Crete. By the time the grain freighter had reached the southern coast of Crete it was already well into the autumn with the crew and passengers eager to seek the safety of a port in which to pass the winter.[85] Only concerning the location of the harbour in which they should wait out the winter was there disagreement: the captain and the owner of the vessel, with the approval of the centurion guarding St Paul, favoured sailing further along the coast to the port of Phoenix (usually equated with modern Phineka), while Paul himself argued that the ship should remain at its present anchorage of Fair Havens (modern Kaloi Limenes).[86] However, despite the conflicting opinions as to where on the Cretan coast the freighter should pass the coming months, there is no doubting the desire of all on board the vessel to find a safe harbour in which to lie up during the wintertime.

While the exact time of year at which the grain freighter carrying St Paul was attempting to find a safe winter anchorage is difficult to pinpoint with accuracy, it certainly took place in the autumn; the narrator of Acts provides a general indication of the date by noting that Paul's argument for laying up at Fair Havens was because 'the fast was already over and it was risky to go on with the voyage.'[87] This was the fast of the Day of Atonement, Yom Kippur, which, according to the Jewish lunisolar calendar, is dated to Tishri 10. Although the exact year in which St Paul made his voyage to Rome is unknown, and the Day of Atonement cannot therefore be dated with certainty, nevertheless, calculations made by biblical scholars indicate that the fast was likely to have fallen on October 5.[88] With the account in Acts 27:9 clearly noting that it was already some days after the fast when the prominent individuals on board the ship discussed where to pass the winter, then it appears likely that it was probably the second

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85 Acts 27:7–9.

86 Acts 27:10–12.

87 Acts 27:9.

88 In an influential study carried out more than a century ago by W.P. Workman, it was noted that because *καὶ* precedes *τὴν νηστείαν* in the text of Acts 27:9 the implication is that the day of the fast fell later than was usual during the year of Paul's journey. Workman thus concluded that 'Luke is writing of a year in which the Great fast is subsequent to the Autumnal Equinox, or is at all events very late indeed' (1899–1900: 317). According to Workman's calculations, the account of Paul's storm and shipwreck is therefore most likely to have taken place in the year AD 59 which, with the Jewish date of Tishri 10 falling on or about October 5 according to the Gregorian calendar, yields the latest date for the Day of Atonement in any of the years from AD 57 through to 62. For useful discussions of Workman's conclusions, see, for example, Bruce, 1990: 515; Connolly 1987: 115; Rapske 1994: 23–24.

or maybe even the third week of October by the time the grain freighter was seeking a wintertime harbour. Given that the Day of Atonement took place only five days before the beginning of the Feast of Tabernacles, the festival that traditionally marked the end of the Jewish seafaring season, then it becomes understandable that St Paul was so eager to bring the voyage to a swift conclusion.[89] However, according to the narrative contained in Acts, it was the centurion tasked with delivering St Paul to Rome who had the final say in deciding where the grain freighter should pass the winter and, hardly surprisingly, he gave more credence to the advice put forward by the ship's captain and owner than to the words of warning spoken by the apostle. The centurion therefore came down in favour of allowing the vessel to continue her journey along the southern coast of Crete to the anchorage of Phoenix.[90] However, soon after the ship had put out from Fair Havens to make the short journey westwards along the Cretan coast, the vessel was overtaken by a storm blowing from the north-east which, over the course of the next fourteen days, drove the vessel across the Ionian Sea until it was eventually forced aground on the coast of Melita, usually equated with the island of Malta.[91] The detailed account of the ferocity of the storm contained in Acts 27 emphasises the dangers facing Graeco-Roman mariners who dared remain on the seas into the autumn or beyond; the storm and shipwreck in Acts is therefore usually regarded as providing strong support for the belief that, whenever possible, ancient shipping stayed off the seas during the winter half-year. However, while the account of St Paul's ill-fated voyage does indeed appear to reflect the desire of ancient mariners to be off the sea-lanes by the middle of autumn, the narrative contained in Acts also clearly demonstrates that maritime activities were expected to recommence at an exceptionally early point in the year. Despite being wrecked on the Maltese coast in the autumn, St Paul

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[89] For the dating of the Jewish seafaring calendar, see Daniel Sperber (1986: 99–100), whose studies reveal that the Talmud advised a sailing season which began in the late spring with the festival of Shavuot (Pentecost; the Feast of Weeks)—that can generally be expected to fall in the modern month of May—before voyaging was expected to conclude with the autumnal Feast of Tabernacles, usually celebrated in September or October. As such, the Jewish seafaring season was very similar to the other maritime timetables that survive from antiquity.

[90] Acts 27:11.

[91] Acts 27:14–44. A number of islands in the central Mediterranean have been linked to the Melita of Acts, most notably Meljet in the Adriatic (Acworth 1973), and the Ionian island of Cephalonia (Warnecke 1987). Nonetheless, the majority of scholars still accept Malta's long-standing claim to be the site of the shipwreck and wintertime sojourn of St Paul (e.g. Bruce 1990: 530; Hemer 1975: 100–111; Musgrave 1979; Smith, 1880: 124–128).

would be back at sea and continuing his voyage to Rome in late January or early February of the following year, departing Malta during the very heart of the wintertime.

If biblical scholars are correct in assuming that it was around the middle of October when the Alexandrian vessel began its storm-ridden two-week crossing of the Ionian Sea, culminating in its wreck on the Maltese coast, then it would appear that St Paul probably began his winter sojourn on the island in the final week of October, or possibly at the very start of November. Yet we are informed by the narrator of Acts that, 'Three months [on Malta] had passed when we set sail in a ship which had wintered in the island'.[92] It was this ship, another grain freighter out of Alexandria named the *Castor and Pollux*, which carried St Paul to Puteoli via the ports of Syracuse and Rhegium.[93] If the apostle only spent three months on Malta after being wrecked on the island in late October/early November, then it would appear that the final leg of the journey, that took him across the central Mediterranean from Malta to the Bay of Naples, must have begun towards the end of January or, at the very latest, early February. Yet there is nothing in the text of Acts to suggest that the voyage from Malta was considered to be an unusually early departure. Furthermore, despite Paul's protestations the previous autumn against continued sailing along the Cretan coast because of the lateness of the season, the narrator of Acts does not record the apostle as expressing any concern whatsoever about recommencing his voyage during the winter months of the following year. It therefore appears that, for Alexandrian grain ships at least, if there were any restrictions limiting their sailing season then they were effectively at an end by late January or early February, some two-and-a-half months before the beginning of the sailing season laid down by Gratian's edict (April 13), and more than a month before the season described by Vegetius as 'uncertain' was due to commence (March 10), with an additional two-and-a-half months before the late Roman author regarded the seas as truly safe for maritime activities (May 27).[94] By being on the sea at such an early period

92 Acts 28:11.

93 Acts 28:11–13.

94 The considerable diversity that exists between the departure of St Paul's Alexandrian grain freighter from Malta and that of the dates of the Vegetian sailing season is no great mystery. As will be demonstrated below (p. 134 ff.), instead of the large, round-hulled sailing ships of the early Empire, such as that transporting the apostle to Rome, Vegetius was instead concerned with the relatively unseaworthy oared warships of later antiquity. It was this variation in ship type that explains the wintertime sailing of vessels such as the Alexandrian merchantmen and the far shorter sailing season advised by Vegetius.

of the year, vessels transporting grain could ensure that Rome remained adequately supplied throughout the winter and spring, when the stress on food reserves was usually at its most acute. The wintertime departure of the *Castor and Pollux* from Malta does, however, correspond remarkably well with the information which has been gleaned from the late Roman double-dated edicts sent to Egypt and which indicate that grain freighters delivering goods on behalf of the Roman state began their voyaging very early in the year, with February seemingly the month when these ships would recommence operations following the winter downturn. (See above, p. 25.)[95]

Ancient Myth and Religion

The traditional belief that the ancient sailing season began in early spring and concluded in mid or late autumn is seemingly reflected in the ceremonies held in honour of the Egyptian deity Isis who, in the form of Isis Pelagia, was goddess of the sea and navigation. The most famous of the nautical festivals in her honour was that of the *Navigium Isidis*, otherwise known as the *ploiaphesia*, a ceremony that also marked the commencement of the seafaring season. In Apuleius's *Metamorphoses* the goddess herself describes how, with the arrival of the morning of the appointed day, the seas would once again be open for seafaring.

> The day which will be the day born from this night has been proclaimed mine by everlasting religious observance: on that day, when the winter's tempests are lulled and the ocean's storm-blown waves are calmed, my priests dedicate an untried keel to the now navigable sea and consecrate it as the first fruits of voyaging.[96]

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[95] There have been numerous studies by theologians and biblical scholars to try and bring the narrative of Acts into line with the traditional sailing seasons of Gratian and Vegetius, and these have been usefully summed-up by Brian Rapske who writes: 'Several solutions or combination solutions are proposed to address this alleged anomaly [in the dating of the fast and Paul's wintertime departure from Malta after his three-month stay]: 1) assume that a "settling in period" of reasonable duration needs to be added [to the apostle's stay on Malta], bringing the start of the three months of Acts 28:11 well into November; 2) assume that Luke [who is traditionally regarded as the author of Acts] is employing the Syrian-Jewish calendar used by Josephus in which 10 Tishri would occur about 28 October; or 4) assume that Luke is simply inconsistent or has failed to square his dates.' However, as Rapske goes on to note: 'Additional evidence may be put forward ... which suggests that Luke's account of grain carriers travelling in the off-season is neither inaccurate nor anomalous and that the above explanations may be unnecessary' (1994: 24–25).

[96] Apuleius, *Metamorphoses*, 11.5.

While Apuleius fails to present us with a clear date for the *Navigium Isidis*, there is consensus among other ancient literary sources that the ceremony was celebrated on March 5.[97] This date dovetails closely with the start of the sailing calendars formulated by both Vegetius and Gratian, and might therefore be regarded as providing further evidence that the Graeco-Roman seafaring season began in the early spring. However, it should be emphasised that the cult of Isis actually celebrated the opening of the seas some two months earlier than the ceremony of the *Navigium Isidis*; R.E. Witt thus notes: 'The *ploiaphesia* itself was enacted not only in March but also at the beginning of January. This was the occasion for combining the rites of Isis with the naval pageant of the Happiness of the Emperor.'[98] Witt, however, goes on to make the assumption—seemingly based upon the deep-rooted scholarly opinions as to the limits of the ancient sailing season—that 'Isis in January, of course, did not give her sailors the signal to launch their ships. This was a festival of preparation.'[99] However, the fact that this ceremony was celebrated as early in the year as January 2 should raise a question mark over the assumption that it was indeed a festival of simple preparation; it was, after all, celebrated in the heart of the winter and a full two months before the *Navigium Isidis* on March 5. Indeed, the very need for a festival of preparedness seems questionable given that the winter period as a whole could have been, and no doubt was, used for repairing and re-equipping ships and boats.

In fact the *ploiaphesia* of January 2 originated as a celebration of a wintertime voyage made by Isis. According to Plutarch, the date marked the goddess's return to Egypt after she had sailed between the Nile delta and the Phoenician city of Byblos in an effort to recover the Ark of Osiris within which was contained the remains of her murdered husband/brother.[100] We are therefore provided with yet another example, albeit one founded in mythology, of wintertime seafaring along the Near Eastern coastline of the Mediterranean. As such, rather than taking Witt's view that the *ploiaphesia* of January 2 was simply a ceremony of preparation, it may be more fruitful to envisage the festival as an acknowledgement that, even in the middle of

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[97] The date of March 5 for the observance of the ceremony is recorded in the Julio-Claudian rural Italian calendars, the *Menologia Rustica* (Degrassi 1963: 526–527; Saltzman 1990: 169f.); the Codex-Calendar from AD 354 (Salzman 1990: 173–174), and the sixth century works of John Lydus (*De Mensibus*, 4.45, see Witt 1971: 178).

[98] 1971: 181.

[99] Witt 1971: 181.

[100] Plutarch, *Moralia*, 50.

winter, seafaring was still taking place and, for many vessels on the Mediterranean throughout antiquity, sailing at this time of year was very much a fact of ancient maritime life.

Although considerably less famous than the *Navigium Isidis*, and generally overlooked as a seasonal indicator for Graeco-Roman seafaring, the annual festival celebrated in Ostia on January 27 that was dedicated to the Dioscuri, in the hope that the twin brothers would bring calm to the seas, is also an important indication that, even in the heart of winter, vessels may already have been at sea or were being prepared for the imminent arrival of the new sailing season.[101] According to Ammianus Marcellinus, during the winter of AD 359, when supplies of grain were running low and the city prefect of Ostia was making sacrifices in the temple of the Dioscuri, the seas suddenly became still and a gentle breeze sprang up from the south allowing a fleet of grain ships to enter the harbour and alleviate the shortage.[102] Not only does this account provide additional evidence that, in order to alleviate the threat of famine, fleets of grain ships were sent to the important cities of the empire even in the heart of the wintertime, but it may be no coincidence that the date of the ceremony in late January also corresponds to the likely departure date of the grain freighter upon which St Paul left Malta some three hundred years earlier; a ship that was also named the *Castor and Pollux* in honour of the Dioscuri. (See above, pp. 37–40.)

The widespread ancient belief in the existence of a period of calm weather during the Mediterranean winter—the 'Halcyon days'—has also never been adequately related to the question of maritime seasonality. The poet Theocritus, writing in the first half of the third century BC, specifically notes that wintertime sailing is hazardous (though he does not claim that voyaging at this time of year ever came to a halt) save during the Halcyon days when, he asserts, mariners can expect good sailing conditions.[103] However, the problem with regarding the Halcyon days as an indicator of wintertime seafaring is that modern meteorological records emphasise that the ancient concept of a fixed set of dates at which the seas would be safe for sailing is a fallacy. Instead, the weather of the Mediterranean during the winter months is highly unstable and conditions vary dramatically not only from one year to the next but also from one region of sea to another.[104] It is there-

[101] See Georg Wissowa (1912: 218–219) for details of the ceremony. As far as I am aware, no scholars have ever connected the ceremony to the sailing season.

[102] 19.10.4.

[103] Theocritus, *Idylls*, 7.52.

[104] Williams 1999: 180, 216–217. See also chapter 2.

fore hardly surprising that, in the ancient literature itself, there is considerable disagreement regarding the timing of the Halcyon days. Theocritus thus assigns them to a time of year when 'the Kids stand in the evening sky ... and when Orion stays his feet in the wet ocean'; celestial markers which place the Halcyon days between mid-February and early March.[105] Such a date corresponds closely to the meteorological calendar set out by Democritus in the early fourth century BC, which marked the Halcyon days as beginning on February 24.[106] By contrast, in the early years of the Roman imperial period, Ovid reckoned the Halcyon days to occur the week before and the week following the winter solstice; a fifteen-day period that ran from December 15 until December 29, during which time, 'Calm lies the sea. The Wind-god keeps his squalls imprisoned and forbids the storms to break, and days are tranquil.'[107] Such disparities in the dating of the Halcyon days appear to demonstrate that in antiquity, as today, the unsettled nature of Mediterranean wintertime weather will not permit annually recurring dates to be fixed for the appearance of spells of tranquil weather.[108] It should, however, be noted that the meteorological calendar of Democritus was designed to be a reliable guide to days of good and bad weather across the course of the year, and the poetry of Ovid relating to the Halcyon days also 'faithfully reflects ancient scientific teaching.'[109] While the philosophers and poets of antiquity might therefore disagree as to the exact timing of the Halcyon days, they nevertheless appear to have believed in this period of calm weather during the heart of the wintertime. Whether such a conviction was shared by Graeco-Roman seafarers who, in consequence, might have trusted their vessels to winter seas in the expectation of benefiting from favourable sailing conditions during this Halcyon period is, unfortunately, a question that the ancient literature leaves unanswered.[110]

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[105] Theocritus, *Idylls*, 7.52–59. See Williams (1999: 217) for the use of constellations to date Theocritus' Halcyon days to late winter or early spring.

[106] Williams 1999: 216 f.

[107] *Metamorphoses*, 11. 747–749.

[108] Williams 1999: 217.

[109] Kenney. In Melville 1978: 442 n. 742.

[110] This tradition of predicting the weather has been carried on into the medieval and modern Mediterranean. For example, the Coptic calendar sets down a list of annually recurring dates during which gales are to be expected and when seafaring should be suspended. According to the author of a modern yachting handbook, personal experience has suggested the accuracy of the predictions made by the Coptic maritime timetable to be in the region of sixty percent (Heikell 1990: 160).

Legislation and Contractual Agreements

Save for the sailing season set down in Gratian's edict of AD 380 which, as has been seen, was severely restricted in its application, there is no evidence that any of the states and empires clustered around the coasts of the ancient Mediterranean ever enacted legislation prohibiting wintertime seafaring; the maritime timetables proposed by Hesiod and Vegetius certainly come with no legal support attached and should be regarded merely as advisory in nature.[111] Furthermore, the very length of the Mediterranean coastline, with its many small harbours and innumerable secluded bays and beaches, would have made it extremely difficult, if not impossible, to effectively enforce any state-issued legislation that might have attempted to place strict seasonal limits upon seafaring.[112] While legal texts outlining the parameters of the sailing season may, of course, have been lost in the long centuries that have elapsed since the end of antiquity, there is no indication of any such legislation appearing in the so-called 'Rhodian Sea-law' which, as part of the fifty-first book of the *Basilica*, contained the reorganised Roman law code as set down in the sixth century AD.[113] Walter Ashburner therefore long ago noted that, while the seafaring calendars of many maritime states of the medieval and early modern periods were dictated by law, the sailing season of the Graeco-Roman Mediterranean was instead governed by 'a rule of prudence.'[114]

The litigations involving the actions of merchants and ship-owners based in Attica and which are preserved as part of the *Demosthenic Corpus* of the late fourth century BC, do however suggest the seasonality of seaborne commerce. These maritime cases were to be presented before the *Thesmothetae* between the months of Boëdromion through to Munichion—approximately September through to April. The time of year at which the court convened would therefore appear to be designed to coincide with the wintertime downturn in seafaring, when all parties concerned in the legal actions would usually have been back in Attica.[115] However, it should

111 Saint Denis 1947: 196 f.

112 Rougé 1952: 316.

113 See Crook 1967: 223; Rougé 1966: 381 ff.

114 1909: cxlii–cxliii. In spite of its age, Ashburner's translation and comments of the Rhodian Sea-law is still considered the standard work of reference for this body of legislation.

115 The *Thesmothetae* was a body which consisted of six archons, though excluding the *Eponymus*, *Basileus* and *Polemarch*. See the *Demosthenic Corpus* (33.24) for the dates at which the *Thesmothetae* was in session. See also Casson 1991: 195; Murray 1965: 218.

not be assumed this provides evidence that the winter seas were closed to commerce and the sea-lanes devoid of shipping. As has already been seen in the case brought against Dionsyodorus and Parmeniscus by the creditor Dareius, the two traders were accused of remaining in the eastern Mediterranean throughout the winter in order to take advantage of the favourable seafaring conditions along the Levantine seaboard that allowed them to continue making profitable voyages between Egypt and Rhodes. (See above, pp. 16–17.)[116]

Even when ancient writers refer to the existence of a 'closed sea' during the wintertime, there is no evidence that seafaring at this time of year was an illegal activity. This can clearly be seen in the following passage, in which the sophist Libanius describes a voyage undertaken between Constantinople and Athens in the winter of AD 336. Despite referring to the Aegean as 'closed to seafarers because of the season', it nevertheless appears to have been relatively easy for Libanius to procure the services of a skipper, crew and vessel, with no indication that there was any legislation preventing them from putting to sea at this time of year.

> I transferred my attention to the sea, but it was now closed to seafarers because of the season. However, I lit upon a well-known sea-captain, won him over easily enough by the mention of a fare, embarked, found Poseidon favourable and went on my way rejoicing. I sailed past Perinthus [Heraclea], and from the deck I gazed upon Rhoetum, Sigeum and the ill-fated city of Priam. I crossed the Aegean and enjoyed a wind no worse than Nestor did.[117] … So I made landfall at Geraestus, and then at one of the harbours of Attica, where I got a bed for the night. Next night I was in Athens.[118]

There is, however, little doubt that, with the onset of winter, many maritime traders, together with the creditors who provided the financial backing for many marine ventures by supplying bottomry loans to those requiring extra funds for commercial shipping, preferred not to engage in maritime commerce. To ensure that sea-captains did not risk their goods or capital on winter seas, creditors would therefore impose strictly defined seasonal parameters dictating when cargoes could, and could not, be shipped;

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116 *Demosthenic Corpus*, 56.

117 Homer, *Odyssey*, 3.176 f.

118 Libanius, *Autobiography*, 15–16. It is also interesting to note that despite having begun the journey in his native Antioch—a city only 15 miles (24 km) from the sea—it is only when Libanius reached Constantinople by land and found himself unable to obtain an official permit allowing him to use the *cursus publicus* (use of the government post was strictly regulated by edict 8.5 preserved in the *Codex Theodosianus*), that the sophist first appears to have considered the use of maritime transport to take him to Athens.

sailing timetables that were enforced by financial penalties in the form of higher rates of interest repayable on the loans. A case from the *Demosthenic Corpus* therefore records the rate of interest to be repaid by two sea-traders as being set at 22½ percent should their voyage to and from the Black Sea be completed before the middle of September. However, should their vessel still be on the Euxine beyond this date, then the interest-rate would increase to 30 percent:

> Androcles of Sphettus and Nausicrates of Carystus lent to Artemo and Apollodorus, both of Phaselis, three thousand drachmae in silver for a voyage from Athens to Mendê or Scionê,[119] and thence to Bosporus—or if they so choose, for a voyage to the left parts of the Pontus as far as the Borysthenes,[120] and thence back to Athens, on the interest at the rate of two hundred and twenty-five drachmae on the thousand; but, if they should sail out from Pontus to Hieron[121] after the rising of Arcturus,[122] at three hundred on the thousand, on the security of three thousand jars of wine of Mendê, which shall be conveyed from Mendê or Scionê in the twenty-oared ship of which Hyblesius is owner.[123]

This legal text certainly highlights that the creditors, Androcles and Nausicrates, perceived seafaring beyond the middle of September to have been sufficiently dangerous to warrant increasing the rate of interest by 7½ percent from that which had been in effect during the summer months. The date of mid-September corresponds closely with the time of year that both Hesiod and Vegetius also counselled mariners to be off the seas, and this case has therefore been seen as providing strong evidence for the highly seasonal nature of ancient seafaring.[124] However, it should also be noted that the higher rates of interest only came into effect if the twenty-oared vessel owned by Hyblesius that was to be used to transport Artemo and Apollodorus' cargo of wine was still on the waters of the Black Sea beyond mid-September: there is no mention of seasonal restrictions on the voyage once the ship had sailed south of the Thracian Bosphorus, into the Sea of Marmara and beyond. This is an important point since among ancient writers the Black Sea had a reputation for being an especially dangerous body of

[119] Towns in the peninsula of Pallenê, in Chalcidicê. According to Murray (1965), weather conditions would determine which of these two ports should be entered.

[120] Modern River Dnieper.

[121] This was a place, called Hieron from a temple of Zeus, at the entrance to the Thracian Bosporus on the Asiatic side.

[122] About the middle of September.

[123] *Demosthenic Corpus*, 35.10.

[124] Casson 1995: 271 fnt. 3.

water upon which to sail. Catullus thus refers to both 'the savage Bosphorus' and the 'unpredictable surface of the Euxine', while Pindar also describes the Black Sea as the 'Inhospitable Sea'.[125] Modern meteorological data also highlights the dangers for vessels remaining on the Black Sea beyond late September and early October: following a brief autumnal transitional period in which the summer weather patterns quickly give way to those of winter, stormy depression systems frequently affect the Sea, bringing with them exceptionally dangerous seafaring conditions, with 'strong gales' and 'storm-force' winds (Beaufort 9–10) recorded across most sea areas, while along the western coast—the very region which the vessel of Artemo and Apollodorus would have sailed were they to journey to the Dnieper—winds of 'hurricane force' (Beaufort 12) can be reached.[126] During the autumn and winter thick cloud cover, heavy rainfall and greater frequencies of fog would also have impeded navigation on the Black Sea to an extent beyond that usually experienced by mariners sailing on the Mediterranean. These adverse conditions, once they have set in, also generally last for considerably longer on the Black Sea than the Mediterranean.[127] Furthermore, the extremely cold temperatures commonly experienced on the Black Sea during winter will usually lead to the formation of sea-ice, especially along the northern and western shores, a hazard virtually never encountered on the Mediterranean.[128] The weather and sea conditions of the Back Sea can, therefore, be regarded as generally more perilous to mariners than was the case on the seas of the Mediterranean.[129] To assume that the seasonal rates of interest on bottomry loans adopted for vessels plying routes across the Black Sea can be directly imposed on shippers of the Mediterranean may therefore be a mistaken belief. In this respect it is interesting to note that Phormio, another merchant recorded in the *Demosthenic Corpus*, was

125 Catullus, *Poem, 4*. Pindar, *Pythian Odes*, 4.203.

126 Black Sea Pilot 2000: 32, 38. Meteorological Office 1963: 75f.

127 Black Sea Pilot 2000: 38–39. Meteorological Office 1963: 39, 102 (cloud and precipitation); 98–101 (fog—which is a particular problem along the northern and western coasts of the Black Sea).

128 Black Sea Pilot 2000: 25, 30–31 figs. 1.56.1, 1.56.2. Though exceptionally rare, sea-ice is not completely unknown on the Mediterranean. In 1891 the harbour of Toulon was ice-bound (Heikell 1990: 151–152), while it was even claimed by medieval chroniclers that there was ice on the Nile (Bintliff 1982: 153; Kendrew 1961: 365).

129 This point has been emphasised by Tim Severin who, while attempting to retrace the route of the Argonauts in a replicated Bronze Age galley, noted: 'The Black Sea has a bad reputation. The locals say that it has only four safe harbours—Samsun, Trebizond, July and August' (1985: 81). For additional information on the weather and sea conditions on the wintertime Black Sea as opposed to those on the Mediterranean, see chapter 2.

also provided with the interest rate of 30 percent on a loan for a voyage across the Black Sea to the Crimea.[130] For trading ventures being undertaken across such relatively dangerous waters, it is perhaps hardly surprising that high interest rates were set on loans. It is therefore questionable if these high rates of interest also applied to shipping that was confined to the Mediterranean, even for vessels making journeys during the wintertime.

In relation to the case of Artemo and Apollodorus, it is also worth pointing out that while rates of interest on bottomry loans may well have been increased towards the end of the summer season—the financial penalty reflecting the increased levels of risk that came from engaging in maritime trade at this time of year—voyaging may, nevertheless, have continued. Shippers and merchants may still have been willing to pay the increased interest on these voyages if the profits generated from them were likely to be sufficiently lucrative. Indeed, the case highlights the fact that creditors were still willing to provide financial backing to those prepared to sail between late autumn and early spring, albeit with the imposition of higher rates of interest on their initial loans. Morton therefore regards the legal action brought against Artemo and Apollodorus as evidence that 'bears witness to the fact that a significant amount of sailing *did* take place on the Greek seas during the winter months.'[131]

It is also interesting to note that the principal complaint made by Androcles and Nausicrates against Artemo and Apollodorus was that when the traders returned to Attica at the completion of their trading voyage to the Black Sea, they failed to enter the Piraeus and instead put in at an anchorage referred to as the 'Thieves' Harbour'. This, as Androcles and Nausicrates emphasised to the Athenian court, 'is outside the signs marking your port; and to anchor in Thieves' Harbour is the same as if one were to anchor in Aegina or Megara; for anyone can sail forth from that harbour to whatever point he wishes and at any moment he pleases.'[132] While this is hardly conclusive evidence in favour of year-round sailing on the Aegean of the late fourth century BC, it nevertheless implies that, should merchants and ship-owners choose to pursue it, then seafaring could indeed be a win-

[130] *Demosthenic Corpus*, 34. While it is unclear, it is possible that this voyage was also undertaken towards the end of the summertime with the creditor, Chrysippus, referring to the fact that, at the end of the outward leg of the voyage to the Crimea, he had arranged for letters to be delivered to one of his slaves who was spending the winter in the region (34.8).

[131] 2001: 259.

[132] *Demosthenic Corpus*, 35.28. Murray assumed the harbour to have been a small cove or inlet commonly used by smugglers (1965: 296).

tertime activity, with states such as Aegina and Megara seemingly placing no seasonal restrictions on the arrival or departure of vessels from their ports.[133]

The seasonally variable interest rates for maritime trade to the Black Sea during the late fourth century BC can be compared to a verbal agreement of the late second century AD recorded in the *Digest*, in which two parties settled on the date of September 13 as the deadline for which the return leg of a voyage from the Italian port of Brentesium (modern Brindisi) to Berytus in Syria had to already have commenced.[134] While there is little doubt that this date was set to ensure that the voyage back to the Levant was completed before the winter season set in, nevertheless, it should be emphasised that this was, once again, an agreement between two private parties and did not adhere to any state-imposed sailing season. It should also be noted that the outward leg of the voyage from Syria to Italy was, under the terms of the contract, expected to last two hundred days. If the return journey therefore began on, or just before, the agreed date of September 13 and took even half the time as the outward voyage, then it would still have been well into December and the heart of the wintertime when the ship and its cargo finally reached Syria.[135] Furthermore, the verbal contract also stated that, should both parties agree to it, then the departure from Brentesium could be extended further into the autumnal period. This provision, if exercised, would obviously have pushed the voyage even further into the winter months.

It should also be borne in mind that the legal cases recorded in the *Demosthenic Corpus* and the *Digest* concerned vessels that were usually engaged in the long-distance shipment of bulk commodities such as grain. Ships such as these would generally have been a good deal larger than the great major-

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133 It is unknown whether some form of seasonal prohibition on sailing was imposed at Piraeus, or whether the statement by Androcles simply refers to the need for ships and traders to abide by more stringent customs regulations before they were permitted to put to sea.

134 *Digest*, 45.122.1.

135 It is unclear why the voyage from Berytus in Syria to Brentesium on the south-east heel of Italy should have been estimated as requiring a passage of two hundred days—a period that spanned virtually the entire sailing season as set down by Hesiod and contained in Gratian's edict of AD 380. Even though the voyage northwards along the Levantine coast would have been in the face of the prevailing winds, nevertheless, it has been calculated that for the Alexandrian grain ships which also plied this route between Egypt and Rome, the journey would usually have taken between one and two months (Casson 1950; 1995: 289 f., 297 f.). Even if we assume that the Alexandrian freighters were better equipped and manned than most other vessels of antiquity, the journey time laid down in the contract recorded in the *Digest* still seems exceptionally conservative.

ity of vessels plying the sea-lanes of the Graeco-Roman Mediterranean. It was the substantial loans required for the chartering of these ships and their crews, together with the purchase of large cargoes which filled their holds, that gave rise to the complex contractual obligations referred to in the legal cases. It is, however, unlikely that the far more numerous smaller vessels of antiquity were ever subject to such bottomry loans and the seasonal stipulations that accompanied them. Traders operating aboard coasting merchantmen of only a few dozen tons burden were therefore unlikely to have had need of entering into detailed contractual agreements with financial backers and, as such, would have had no financial disincentives—in the form of increased interest rates on loans—keeping them off the seas during the winter period.

The legal evidence detailing stringent seasonal restrictions placed by some medieval and early modern maritime states on sailing activities also appears to have coloured scholarly perception of the ancient sailing season. For example, a Byzantine naval document of the tenth century notes that, from the feast of St Philip on November 14 through until February 15, neither warships nor merchant galleys were allowed to put to sea.[136] The Geniza archive from eleventh century Egypt also fails to contain a single reference to vessels on the Mediterranean between November and March.[137] The medieval Italian maritime states also tended to impose strict seasonal regulations on shipping; in both Pisa and Venice port officials were charged with preventing ships leaving harbour at specific times of the year, while fines were levied against ship-owners whose vessels were still on the seas outside the permitted sailing season.[138] It would, however, be wrong to follow the assumption made long ago by Admiral William Smyth, who stated, 'we have sufficient evidence that the ancients dreaded the stormy season ... and were the prototypes of the Venetians in legislating thereon.'[139] As has already been emphasised, the opposite would instead appear to be the case, and there is little evidence from the Graeco-Roman world—save that set down in Gratian's edict of AD 380—that the states and empires clustered

[136] Dolley 1951:12; McCormick 2001: 461 f.

[137] Goitein 1967: I.316–317.

[138] During the mid-twelfth century, the ships of Pisa were to be off the water between St Andrew's Day and the Kalends of March–November 1 until March 1 (Braudel 1972: 248). In Venice a law-code of the mid-thirteenth century set out the seasonal schedule for fleet sailings to and from Romania (Rose 2002: 101), and even as late as the sixteenth century the state was attempting, albeit with little success, to force her mariners to abide by a sailing timetable that ran from January 20 to November 15 (Braudel 1972: 249; Lane 1964: 340).

[139] 1854: 275. Smyth is primarily referring to the Athenians of the fourth century BC.

around the ancient Mediterranean ever imposed laws designed to place seasonal constraints on maritime activity. Even if, prior to Roman imperial domination of the Mediterranean, legislation was enacted that attempted to prohibit maritime activities from certain periods of the year, other rival states may well have chosen to adopt a more flexible approach—one that allowed ship-owners and sea-traders a relatively free hand in deciding when they could put to sea. Examples of such a situation can be witnessed in the inter-state rivalries of medieval and early modern Italy where, despite the sailing calendars used by Venice, her principal maritime rival, Genoa, never imposed any seasonal parameters over the activities of the seafaring community, allowing mariners to continue using her port facilities throughout the wintertime.[140] In this respect it is interesting to speculate whether the comments made by Androcles—in which he refers to the less stringent harbour regulations in Aegina and Megara compared to those in effect at Athens—might imply a similar situation in existence among the Greek states of the fourth century BC as was to develop in medieval Italy, as different states adopted contrasting seasonal calendars for maritime activities.[141]

The Textual Evidence: Conclusion

The primary aim of this chapter has been to demonstrate that our present understanding of the Graeco-Roman sailing season rests upon literary foundations that are far from secure. Although the ancient literature contains numerous examples of mariners engaged in wintertime voyage-making, these have been perceived as aberrations to the seasonal rule: it is instead the maritime calendars set down by Hesiod and, more significantly, those contained in the *Epitoma rei militaris* of Vegetius and in Gratian's edict of AD 380 that generations of scholars have regarded as presenting an accurate picture of the prevailing seasonal practices of the Graeco-Roman seafaring community. However, save for Gratian's edict, there is no record of any ancient legislation that forced the closure of the Mediterranean sea-lanes during the wintertime. Gratian's edict was also extremely constrained in its application, and was probably confined to government-contracted shippers of the province of Africa during a handful of years at the close of the fourth century AD. Even were similar edicts applied to other regions of the Roman controlled Mediterranean, the *ostraca* evidence surviving from

140 Rose 2002: 101.
141 *Demosthenic Corpus*, 35.28.

Carthage of AD 373 indicates that small coasting vessels transporting commodities destined for the *annona* were still required to engage in wintertime voyage-making. It is also likely that many larger ships also remained at sea throughout the winter months, especially at times when famine threatened; during the Roman Empire evidence from around the Mediterranean points to state-chartered merchantmen commonly taking to the seas at the very beginning of February. Moreover, the literature also indicates considerable regional diversity around the ancient world and while the seasonal limitations placed on certain contractual agreements implies that many maritime traders and their investors preferred seafaring to be suspended throughout the wintertime, in some areas of the Mediterranean—most notably along the Levantine seaboard—vessels appear to have routinely been plying the sea-lanes, even in the heart of winter. This regional diversity in weather and sea conditions will be the focus of the following chapter that seeks to determine whether the ancient sailing calendars take full account of the climatic regime affecting the Mediterranean over the course of a year.

CHAPTER TWO

THE MEDITERRANEAN CLIMATIC REGIME

For land-based activities the role of the physical environment can be regarded as but a single factor—albeit a highly important one—among the many that have shaped the course of Mediterranean history. However, for sailors, fishermen, maritime traders and all those with livelihoods dependant on the sea, the character of the marine environment has always reigned supreme. The ever-changing aspect of the weather, and its effect on the state of the sea, has always been of primary concern for seafarers. Modern sailing handbooks continue to emphasise that, even with all the benefits of modern ship construction and navigational technology at their disposal, today's mariners are still required to maintain a healthy respect for the forces of nature: 'Sailing follows the dictates of the weather. We can only do what the weather will let us, and the weather may prevent us from sailing at all. It dictates how fast we go, how comfortable the journey is going to be, and where we are going to end up.'[1] Students of maritime history therefore have little choice but to acknowledge the primacy of the marine environment, a point readily conceded by John Pryor who has noted, 'man had to make his crossings of the sea in harmony with the forces of nature rather than in spite of them or against them.'[2] It was, of course, the seasonally changing weather patterns of the Mediterranean that led to the creation of the Graeco-Roman seafaring calendars: seasonal timetables specifically tailored to suit the prevailing maritime conditions. Hesiod was the first author to emphasise natural forces such as strong and gusting winds, rough seas, mists and heavy rains as hazards that threatened sailors and their ships making voyages beyond the relatively benign summer months.[3] These hazards of nature were to remain constant throughout antiquity; Vegetius, writing towards the end of the Roman Empire, counselled against maritime activity on the wintertime Mediterranean because of the dangers posed to mariners from 'minimal daylight, and long nights, dense cloud-cover, foggy air, and

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1 Cheedle 1994: 121.
2 1988: xiii. See also Fernandez-Armesto 1999: 231; Murray 1987: 139.
3 *Works and Days*, 618 f.

the violence of winds doubled by rain and snow.'[4] It was the physical environment that therefore formed the framework around which the Graeco-Roman sailing calendars were constructed.

Mediterranean Meteorology: An Overview

The climate of the Mediterranean has a pronounced seasonal pattern in which the summers are dominated by warm and dry conditions while the winters are generally mild and wet—a pronounced biannual climatic regime in which summer and winter are separated by the relatively short transitional seasons of spring and autumn.[5] This seasonally shifting climate results from the movements of the great pressure systems which, though situated outside the region, are the dominant influence on the weather of the Mediterranean: it is these pressure systems that dictate the pattern of the seasons and the weather regimes associated with them. Thus, at the start of the summer, the sub-tropical high pressure system of the north Atlantic moves into a position over the Azores and extends in a ridge over western Europe; at the same time extensions from the Indo-Persian low pressure system located over Pakistan govern the weather patterns of the eastern half of the Mediterranean (figure 2.1a). It is these two pressure systems that provide prolonged periods of fine, stable weather in the summertime Mediterranean and also govern the direction of the winds; the clockwise movement of air around the Azores high pressure system provides the western basin of the Mediterranean with winds that are generally from the north, while the anti-clockwise rotation of air around the Indo-Persian low also results in prevailing northerly winds blowing over the eastern basin. However, during the wintertime there is a change in the location of these large pressure systems (figure 2.1b): the Atlantic sub-tropical, high-pressure system migrates to the south-west and into a position from where its influence no longer stretches into the Mediterranean, while the Indo-Persian low dissipates throughout the winter. In consequence, whereas the Mediterranean is only rarely encroached upon by depression systems during the summertime, the climatic picture is very different during the winter months when the region is usually occupied by a trough which divides the

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[4] *Epitoma rei militaris*, 4.39.

[5] This biannual climate is therefore emphasised in modern meteorological textbooks (e.g. File 1990: 79) as well as in the work of geographical historians (e.g. Newbigin 1924: 34; Semple 1931).

Atlantic and Eurasian anticyclones and is a point of contact between cold, dense, polar air coming down from the north, and warmer, lighter, tropical air arriving from southern latitudes. It is along this interface that depression systems develop, causing an increase in overcast skies, rainfall and poor visibility, as well as strong and highly variable winds—the very features of the Mediterranean winter that both Hesiod and Vegetius list among those which Graeco-Roman mariners should seek to avoid.[6]

Despite the importance of the large pressure systems to the east and west that play a highly important role in determining the climate of the region, the Mediterranean is still regarded as a single climatic entity. Nonetheless, the region is far from meteorologically uniform and the various coasts and seas of the Mediterranean record weather conditions of considerable diversity. Mariners are therefore considerably more likely to encounter unfavourable or even hazardous sailing conditions when making voyages across certain areas of the Sea than when sailing on other stretches of its waters.[7] Although the Mediterranean has all-too-often been regarded as a climatically uniform region, Horden and Purcell were correct to emphasise the local meteorological and environmental variations that exist around the different coasts and seas; regional variations they describe as the 'tessellation of spaces into which the Mediterranean world divides.'[8] It is following their approach, which sought to 'emphasize pronounced local irregularity' within the region, and stressed the need to define 'the Mediterranean in terms of the unpredictable, the variable and, above all, the local', that will be adopted in the following pages.[9] By comparing and contrasting such factors as the speed and direction of the wind, the levels of cloud cover, rainfall and visibility, it will be demonstrated that the climatic regime of the Mediterranean is considerably more complex and diverse than many historians and archaeologists appreciate. This fact was long ago emphasised by William Smyth, a nineteenth century British admiral whose many years of

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6 For greater detail on the formation of the depression systems in the Mediterranean, see Air Ministry 1962: 20 ff.; Mediterranean Pilot vol. I 1978: 14 f.; vol. II 1978: 13 f.; vol. III 1988: 22 f.; vol. IV 2000: 19 f.; vol. V 1999: 25 f.; Pryor 1988: Chapt. 2; 1995: 206 f.

7 See, for example, King et al who refer to the 'considerable diversity within the broad Mediterranean climate type' (1997: 31).

8 2000: 80. While the study of Horden and Purcell focused upon the ecology of the territories bordering the Mediterranean—the topography and mineral deposits found in the lands surrounding the Sea, as well as the flora and fauna—the following pages will instead analyse the hydrological and especially the meteorological elements which affect the Mediterranean and that were fundamental to Graeco-Roman seafaring and the seasonal parameters laid down in the ancient sailing calendars.

9 Horden and Purcell 2000: 13.

experience navigating across the region during the age of sail led him to emphasise that 'the Mediterranean is a large and varied space to be thus included under one head.'[10] Using modern meteorological records it will be demonstrated that weather conditions around the Mediterranean vary to such an extent that the advice and legislation dealing with the Graeco-Roman sailing season cannot possibly be applied across the entire Sea. Instead, the cocktail of natural elements listed by Hesiod and Vegetius as being hazardous to mariners are far more likely to be encountered in certain regions of the Mediterranean than in others. This lack of meteorological unity would have made it impractical to implement a single maritime calendar—such as those put forward by Hesiod, Gratian and Vegetius—across all the seas and coasts of the Mediterranean.

Depression Systems

Although Graeco-Roman writers were unaware of the fact, it was the large number of depression systems migrating across the Mediterranean basin during the winter half-year that formed the basis of the ancient sailing season. Usually moving from west to east, these depressions bring with them heavy precipitation, dense cloud cover, poor visibility, and the strong, gusting winds capable of raising white-capped waves from formerly placid seas. Although not large by North Atlantic standards, these depression systems make seafaring on the Mediterranean highly dangerous between late autumn and early spring, the time of year when they are at their most prevalent. The British Admiralty's *Ocean Passages for the World* therefore notes: 'Over the greater part of the open-waters of the Mediterranean ... [f]rom about November to March ... depressions are frequent and often vigorous, while from May to September they are less common and much less intense.'[11] Such modern meteorological surveys correspond closely to the limits of the sailing season put forward by the ancient texts, especially the maritime calendar of Vegetius which, with its outside limits running between March 10 until November 11, and the period considered properly safe for seafaring spanning the period between May 27 and September 14, is a season that dovetails remarkably well with the movement of depression systems across the Mediterranean.

[10] 1854: 210.
[11] Admiralty 1987: 56.

The attempt by Vegetius and other ancient authors to formulate a single seafaring calendar that is applicable to all the seas and coastal regions of the Mediterranean is, however, problematic. As a result of the topography of the Mediterranean basin the movement of the depression systems across the region is far from uniform. Mariners operating along areas of coast and sea across which depressions regularly travel will therefore have to contend with considerably higher frequencies of unfavourable and dangerous weather than sailors who ply their trade on sea-regions located away from the more usual routes traversed by these stormy systems. As such, while the British Admiralty provides a basic outline of the seasonal progression of depressions across the Mediterranean, the Admiralty also recognises the need to produce a series of five separate pilot books to aid maritime navigation throughout the Mediterranean; pilot books that emphasise the considerable regional variations in the seasonal weather patterns across the Sea.[12]

From the average number of 23 depressions that invade the Mediterranean during the course of the year, 7 are usually created to the west by the North Atlantic low-pressure system and enter the region through the Straits of Gibraltar or via the Carcassone and Rhone gaps; the remaining 16 depressions systems are formed in the lee of the Atlas Mountains and invade the Mediterranean in the vicinity of Algiers or across the low-lying North African coastline further to the east. However, the great majority of depressions are generated within the region itself and during the winter half-year the Mediterranean is the world's most active area in the production of depression systems.[13] These depressions tend to form in specific regions of the Mediterranean, primarily around Cyprus, the Ionian Sea, and in the areas of the Gulf of Lions and Gulf of Genoa (See figure 2.2.).[14] As such there is considerable regional variation in the frequency with which these systems usually affect different locations within the Mediterranean basin. For example, during the winter months of December, January and February, the Gulf of Lions and the Aegean both record a seasonal average of 20 depressions either forming or passing over them; the west coast of Greece usually receives about 11 such systems, while on the Near Eastern seaboard the number is reduced to a total of 4 or less.[15] Moreover, the coasts of Egypt and the

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12 The Admiralty Sailing Directions, Mediterranean Pilot, Vols. I–V, were first published in the 1870's and are being continually updated. See bibliography for the different regions covered by each.

13 Radinovic 1987.

14 Air Ministry 1962: 31–42; Kendrew 1961: 355; Mediterranean Pilot Vol. 3 1988: 26.

15 Air Ministry 1962: 31.

Levant will usually expect to experience the passage of fewer depression systems during the course of the *wintertime* than areas such as the Gulf of Lions will generally receive during the *summertime*. This variability in the annual and seasonal frequencies with which different regions of the Mediterranean experience the passage of depressions is crucial to understanding why some areas of the Sea also experience far greater frequencies of the dangerous sailing conditions listed by Vegetius and which will be discussed in detail below.

Furthermore, not all areas of the Mediterranean are visited by depressions at the same time of year. The depression systems formed around the Gulf of Genoa, like those that evolve above the Ionian Sea, are most prevalent in the winter with seasonal averages of 19 and 20 respectively. However, depressions in the eastern Mediterranean tend to be more frequent in the spring when the region around Cyprus records a seasonal average of slightly more than 12 depression systems passing over it. The majority of Saharan depressions also enter the Mediterranean in the springtime. Indeed, of all the depressions that cross the Mediterranean every year, spring is the season in which they are most likely to occur and the months of March through to May record an average of 55 depressions entering or forming within the region, compared to 53 such systems generally expected in the winter season.[16] Even such a simplistic study of the movement of depression systems across the Mediterranean nevertheless emphasises the fact that the area experiences marked inter-regional and inter-seasonal variability in the extent to which depressions—together with the unfavourable weather conditions associated with these systems—affect its various coasts and seas.

Climate Change

Until relatively recently it was argued that, 'From at latest 7000 BC, and possibly earlier, the world-wide climate has been essentially the same as that of today.'[17] However, modern studies instead indicate that past climates have been considerably more unstable than was commonly believed to be the case; what is presently regarded as a 'normal' Mediterranean climatic regime may therefore be considerably different from that which existed

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[16] Air Ministry 1962: 31 f. Although some recent studies contain figures that vary slightly from these statistics, the seasonal proportions remain virtually unchanged.

[17] Raikes 1967: 208.

in the region during earlier periods of history.[18] For an activity such as seafaring, which is dictated by weather conditions, then the character of the climatic regime that prevailed during antiquity is a question that cannot be ignored. There is thus a need to consider whether the meteorological records derived from the present-day Mediterranean can actually be applied to antiquity. Furthermore, it cannot be assumed that the Mediterranean climate remained stable throughout the thousand years that separate the sailing calendar proposed by Hesiod during the Greek Archaic period from those set down by Gratian and Vegetius during the late Roman period.

The reconstruction of the Graeco-Roman climate is achievable only by analysis of the various physical and biological material that act as an indirect record of past climatic trends, providing what is termed 'proxy' data. While this proxy material can be obtained from a wide variety of sources—glacier and snow-line movements, advances and retreats of the tree-line, tree-rings, pollen, peat bogs, or stable isotopes—the use of such data as a means of interpreting the prevailing climatic regime of any one time and place is exceptionally difficult. Extreme caution therefore needs to be exercised when applying such data to the archaeological and historical record. However, by comparing and contrasting the various proxy records, a broad outline of the different climatic phases that have affected the Mediterranean throughout the course of history can be reconstructed and it would appear that, during the last several thousand years, the region has undergone a number of climatic fluctuations. Before analysing these variations, however, it must be stressed that while proxy records can be used to generate a partial reconstruction of the climatic trends that have affected the Mediterranean over broad swathes of time—with some periods warmer/cooler, drier/wetter than others—proxy data cannot be used to recreate the exact meteorological conditions of the past and it is impossible to identify with any degree of accuracy the specific weather conditions that Graeco-Roman mariners would have faced when sailing on the Mediterranean.

For the four thousand years prior to c. 850 BC, the climate of Europe appears to have been at its post-glacial climatic optimum, with temperatures averaging as much as 2–3°C higher than those of the present.[19] During the early Iron Age, however, there seems to have been a fairly abrupt change

[18] The nature of the climate of the past is a factor all-too-often overlooked or ignored by historians and archaeologists who have generally been content to superimpose modern weather data on to earlier periods of history (see, for example, Ingram et al 1981: 18).

[19] E.g. Goudie 1992: 158.

towards a cooler and wetter European climate,[20] one that saw the glaciers of the Alps and eastern Anatolia advance down the mountainsides, while there was a corresponding retreat of the tree line.[21] This so-called 'Iron Age Cold Epoch' appears to have prevailed until c. 200 BC when it was slowly replaced by a warmer climatic phase that lasted throughout the Late Republican and Imperial periods of Roman history until about the sixth century AD.[22] In the centuries immediately following the fall of the Western Roman Empire there was, once again, a climatic deterioration across the Mediterranean region in which generally cooler and wetter weather prevailed until the mid-tenth century AD, from which point the 'Medieval Warm Epoch' saw a return to drier and warmer conditions.[23]

Palaeoclimatic studies therefore indicate that we should be wary of assuming modern weather data can be directly superimposed on to the Graeco-Roman Mediterranean. While one relatively recent study of ancient seafaring on the Mediterranean has argued that 'from the point of view of ancient navigators, changes in climatic parameters since the end of the second millennium BC can be understood to have been insignificant', the indications from the paleoclimatic proxy evidence would suggest otherwise.[24] While the Mediterranean of the later Hellenistic and Roman Imperial periods does indeed appear to have possessed a climatic regime similar to that of the present, by contrast, from about 850 to 200 BC, the region seems to have been experiencing cooler and wetter weather; conditions that indicate not only greater amounts of precipitation but also thicker and more prolonged

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20 E.g. Geel et al 1996.

21 For the expansion of Alpine glaciers in the period c. 1000 BC to 300 BC, see Bintliff (1982: 148) and Goudie (1992: 162). For the advancement of the Anatolian glaciers during the same period, see Brice (1978: 142). There are also literary indications that the Lebanese heights were subject to heavier and more frequent snow cover at this time (Lamb 1977: 420). The tree species of central Anatolia also indicate a wet and cool climate around 500 BC (Erinc 1978).

22 Lamb 1981; 1982: 148. For glacial retreat, see Lamb 1995: 166. For the movement of the tree line back up the mountainsides during the Late Republican and Imperial periods, see Lamb 1995: 125, 142. Evidence from peat bogs in temperate areas of Europe also indicate a drier climate at this time (e.g. Aaby 1976; Aaby & Tauber 1974; Barber 1981: 193; Barber 1982).

23 Crawley & North 1991: 94; Gribben & Lamb 1978: 70; Lamb 1977: 435; 1982: 31. See also the evidence of alluvial sedimentation—the so-called 'Younger Fill'—of the late Roman and Byzantine periods (e.g. Vita-Finzi 1964: 1324; Judson 1963: 899). It should, however, be noted that there are doubts about the evidence gained from such studies of riverine sedimentation (e.g. Bell 1982: 132; Wagstaff 1981).

24 Calcagno 1997: 97. Other historians who have similarly assumed that the modern climate reflects that prevailing in antiquity include Labree 1957: 32; Megis 1961: 374; Morton 2001: 5 f.; Pryor 1988: 12 f.; Semple 1931: 100; Williams 1999: 3 f.

cloud cover—factors that would have impeded navigation through use of the sun and stars and which are therefore listed by Vegetius as among the principal hazards facing ancient seafarers. Furthermore, because it appears that temperatures were also slightly lower across the course of the year during this period of antiquity, it is likely that problematic sailing conditions—which are often associated with invasions of cooler air into the Mediterranean region—extended further into the autumn and spring.[25]

The topography of the Mediterranean basin—especially its mountainous northern and western coasts which channel winds through valleys, straits and mountain passes—dictates the nature and direction of the principal winds entering the region and, as such, suggest that the characteristics of the regional winds encountered by the mariners of antiquity would probably have been similar to those which continue to be experienced by modern-day seafarers. Nevertheless, the cooler and wetter conditions that seem to have affected the Mediterranean during certain periods of the past would imply that greater numbers of depression systems were travelling across the region than is presently the case, bringing with them an increase in the frequency of strong winds and other unfavourable sailing conditions.[26] Furthermore, it has been argued that, during cooler climatic phases of Mediterranean history, regional winds such as the etesians of the Aegean may also have blown with more force than is presently the case.[27]

It would therefore appear that climatic change during antiquity might have had a direct and profound effect on the length of the Graeco-Roman

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[25] Lamb, for example, noted that because the elevation of the tree line is essentially controlled by the prevailing summertime temperatures, the lower tree line during the Iron Age indicates a cooler climate with temperatures remaining fairly low even in the summer months (1995: 125).

[26] As has already been noted, the Mediterranean of the wintertime is an area that experiences some of the highest levels of cyclogenesis in the world. It therefore appears likely that any further increases in the formation and progression of depression systems through the region took place in the spring and autumn rather than during the already over-active wintertime. Furthermore, the fact that the whole of Europe appears to have experienced the conditions of the Iron Age Cold Epoch suggest that the change to the continent's climate was brought about by the movements of the great pressure systems that govern the nature of Europe's seasonal weather patterns. It would thus appear likely that the subtropical high pressure system in the Azores region of the Atlantic, and that of the Indo-Persian low which develops over Pakistan, which together dictate the summertime weather of the Mediterranean, were less prolonged than is presently the case. Instead, the North Atlantic low and Mongolian high pressure systems—those which bring winter weather to the Mediterranean—seem to have been more dominant than at present, extending their influence across Europe for further into the summer half of the year.

[27] Neumann & Metaxas 1979: 185 f.

sailing season. At the time Hesiod was setting out his advice to mariners in c. 700 BC, the Mediterranean appears to have been experiencing a climatic regime that was substantially cooler, wetter and windier than was the case for earlier and later periods of antiquity; a climate that would have been likely to produce weather containing greater frequencies of hazardous sailing conditions for the mariners of this period. It may therefore have partly been a reflection of the Mediterranean's climatic conditions at this time that led Hesiod to outline a sailing calendar that was more seasonally constrained than was generally considered to be the case during the warmer, drier and somewhat calmer conditions which prevailed in later periods of antiquity. Indeed, had the seafaring schedules outlined by Gratian and Vegetius not been concerned with late Roman *annona* shipping, or relatively unseaworthy warships, the rather more favourable climatic regime that existed during the Hellenistic and Roman Imperial periods may have allowed privately owned and operated merchant sailing vessels to adopt a considerably longer sailing season, such as is hinted at by Pliny, or which are preserved in the double-dated edicts from Egypt. Irrespective of any technological developments and improvements in ship construction following the time of Hesiod, it therefore appears likely that, from c. 200 BC through until the sixth century AD, mariners of the Mediterranean may also have been favoured with summers that were generally longer and more conducive to voyage-making than had been the case during the Archaic and Classical periods of Greek history, possibly allowing mariners of the Hellenistic and Roman Mediterranean to extend the sailing season well beyond that advised by the Boeotian poet.[28]

As a result of the fluctuating nature of the climatic history of the Mediterranean it therefore needs to be emphasised that while the following pages will draw heavily on modern meteorological records in an effort to illustrate the inter-regional variations that exist in the weather of the Mediterranean, no suggestion is made that such data corresponds directly to that which existed during antiquity. There is, however, little doubt that, regardless of the prevailing climatic regimes that might have existed throughout

[28] Of course seafaring between late autumn and spring probably did take place on certain regions of the Mediterranean during the Iron Age Cold Epoch and references in literature such as the *Demosthenic Corpus*, the Elephantine Palimpsest, together with remarks by Pindar, all indicate that there was wintertime seafaring in the south-east Mediterranean at this time of year (see above, pp. 16–22). However, in the later centuries of antiquity, mariners may have been presented with a prevailing climatic regime that was slightly more favourable for seafaring during the winter half-year.

the Graeco-Roman period, the various seas and coasts of the Mediterranean received weather conditions as diverse as those of the present. Some regions were far more likely to experience the dirty weather associated with passing depression systems, or the strong blasts of a regional wind, than were other areas.

The Mediterranean Wind Regime

Wind is the controlling force for those engaged in maritime activities. This is obviously the case for mariners aboard sailing vessels that harness the wind as the source of their motive power, but even for seafarers making voyages in oared craft it is the speed and direction of the wind that dictates the state of the sea. It is the wind that determines whether voyages can be undertaken with relative ease and safety, or in conditions that are unfavourable or dangerous. As the novelist Joseph Conrad—who had twenty years of personal experience as a professional mariner—accurately noted: 'There is no part of the world of coasts, continents, oceans, seas, straits, capes, and islands which is not under the sway of a reigning wind, the sovereign of its typical weather. The wind rules the aspects of the sky and the action of the sea.'[29] Moreover, because the Mediterranean is almost bereft of tides, and the currents circulating through the Sea are relatively weak and predictable, the speed and direction of the wind assumes a prominence that is greater than on other seas and oceans where these additional elements also exert a strong force on maritime strategies. As such, while the following pages will examine the various hazards posed to Graeco-Roman mariners by the wintertime weather of the Mediterranean, it is the wind—its speed, direction and effect upon the surface of the sea—that will be the primary focus of this chapter.

Although an understanding of the seasonal movements of the great pressure systems, together with knowledge of the formation and movement of depressions, is of vital importance when examining the seasonality of Mediterranean weather, the complex geography of the region also plays a prominent role in dictating the strength and direction of the winds. Enclosed by three different continents, with open ocean to the west, mountains to the north and deserts to the south and east, these uneven topographical features, in conjunction with the differential heating of land and sea,

[29] 1923: 79 f.

disturb the airflow that moves into, and progresses through, the Mediterranean basin.[30] The resulting disruption to the wind currents can clearly be seen from the wind roses in figures 2.3a–d that reveal there is no season when a single prevailing wind pattern dominates the entire Mediterranean.

As a consequence of the mountainous nature of the Mediterranean, especially its northern coasts, air invading the region from this direction is funnelled through mountain passes creating distinctive regional winds, some of which can blow with incredible power, and may have prompted Vegetius to add 'violent wind' to his list of dangerous elements that brought a four month halt to seafaring. Many of the most notorious of these regional winds can be seen in figure 2.4.[31] Entering the Mediterranean through the Trieste gap before sweeping to the south, the bora can attain hurricane force in the northern Adriatic, its cold winds capable of forcing even modern oil tankers to seek shelter.[32] On the Ionian Sea it was the gregale that drove the grain freighter upon which St Paul was travelling to Rome to its wreck on Malta, while in the eastern basin of the Mediterranean the northerly etesians (the modern meltemi), can 'attain such violence that sailing vessels for weeks at a time cannot beat against them but have to lie up behind islands.'[33] To the west, the Straits of Gibraltar act as a wind funnel, creating the westerly vendaval as well as the easterly levanter. Heated by the Saharan desert, the warm, strong southerly winds of the scirocco blow across the Mediterranean from the African coastline. Perhaps the most infamous of these regional winds is the northerly mistral that blows into the Gulf of Lions, the power of its violent, gusting winds capable of raising seas that are hazardous to even the strongest of sailing ships.[34]

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[30] Air Ministry 1962: 29, 72; Corby 1954.

[31] *Epitoma rei militaris* 4.39. For detailed descriptions of the various regional winds operating within the Mediterranean, see, for example, Biel 1944: 13 f.; Air Ministry 1962: 72 f.

[32] Heikell 1990: 62. See Smyth for examples of sailing vessels of the early nineteenth century wrecked by the winds of the bora (1854: 256).

[33] Semple 1931: 580. St Paul's shipwreck in Acts 27:14–44, see below, pp. 75–76..

[34] See, for example, Smyth's descriptions of the powerful winds and heavy seas frequently experienced by the British Mediterranean fleet while attempting to blockade the French navy in the ports of Marseille and Toulon during the Napoleonic War (1854: 240 f.). It was therefore on this region of the Gallic coast that Augustus ordered the construction of a temple dedicated to the mistral (Seneca, *Quaestiones Naturals*, 5.17).

Strong and Gale-Force Winds[35]

The seasonal frequencies of strong and gale force winds shown in figures 2.5a and 2.5b highlight the sharp divide which exists between summer and winter on the Mediterranean, with seafarers considerably more likely to encounter powerful and dangerous winds should they remain on the seas during the wintertime. However, the charts also emphasise that the Mediterranean is a far from uniform entity and violent winds blow across its seas and coasts very unevenly. Such inter-regional variation is most clearly highlighted by a comparison of the wind-speed records from the Gulf of Lions in the north-west Mediterranean with those derived from the waters off Egypt and the Levant in the south-east corner of the Sea.

While both the Gulf of Lions and the Levantine basin follow the same seasonal trend—in which breezes and light winds predominate during the summer while winter brings a marked increase in strong and gale force winds—the frequencies of violent winds recorded across these two areas of the Mediterranean are very different. As can be seen from figure 2.5a, strong winds and gales constitute 12 percent of the wind-speed records obtained by vessels sailing across the windiest part of the Gulf of Lions during the wintertime. By contrast, figure 2.5b clearly shows that, during the summer months, the percentage of these powerful winds blowing across the Gulf has decreased considerably and they can be expected to constitute little more than 1 percent of the monthly total of wind-speed records during this season. It might therefore appear that the wind-speed charts provide strong support for a closure of the sea-lanes during the winter months, allowing sailors to avoid running afoul of these increased frequencies of strong and gale-force winds. However, the same charts also reveal that while winds of Beaufort 7 or above are extremely rare across the entire Mediterranean during the summertime, in the Levantine basin such winds remain unusual even in winter and data from the extreme south-east of the region records that strong and gale-force winds register only 1 percent of all wind-speeds, even during the time of year that traditionally lies at the heart of the Graeco-Roman maritime closed season. The charts therefore clearly indicate that sailors making voyages across the Gulf of Lions during

35 Strong winds are those of Beaufort force 7 (28–33 knots); winds classed as gales (Beaufort 8, 34–40 knots), and strong gales (Beaufort 9, 41–47 knots). Winds of 48 knots or greater register as storm (Beaufort 10, 48–55), violent storm (Beaufort 11, 56–65 knots), and hurricane force (Beaufort 12, 65 knots and more). See figure 2.10.

the summer are as likely to encounter violent winds as those mariners voyaging on the south-east Mediterranean during the winter.

Records from coastal meteorological stations continue to highlight the sharp contrast that exists between the wind regime of the Gulf of Lions and that of the eastern seaboard of the Mediterranean. Wind-speed data from Marseille, which lies on the north-eastern coast of the Gulf of Lions, confirm that gales and strong winds, though relatively unusual across the year, are at their most frequent during winter and spring: February records a monthly wind-speed average in which strong winds contribute 7 percent to the total of all winds measured, while gale-force winds are observed on 1 percent of occasions; in both April and May strong and gale-force winds usually make up 7 percent of the monthly total; in March—the month in which powerful winds are usually at their most common along the coast of Marseille—6 percent of winds are recorded as strong, while an additional 5 percent usually register as gale-force.[36] During the summer months, however, the frequency of powerful winds striking this region of coastline falls sharply: strong winds only feature on 2 or 3 percent of occasions, while gales are usually restricted to 1 percent of the total or less.[37] While such statistics scarcely appear to indicate that mariners making summertime voyages along this section of coast are greatly threatened by high winds and gales, the records nonetheless provide a stark contrast to the wind data supplied from the south-eastern Mediterranean where winds of Beaufort 7 or greater are extremely rare along stretches of this shoreline. At Beirut, for example, gale-force winds are so unusual they do not feature at all in any of the monthly averages, while February is the only month that any records strong winds, though even then they register a monthly average of only 0.4 percent. This scarcity of winds above the 'strong breeze' of a Beaufort 6 is repeated for much of the Levantine basin: Antalya, on the southern Turkish coast, can usually expect to receive just 1 percent of gales during February; Aboukir, on the western Nile delta, fails to register any gale-force conditions across the year, while winds of Beaufort 7 usually average only about 2 percent during January and February.[38]

Even a brief comparison of the seasonal wind-speed records from the Gulf of Lions and the Near Eastern seaboard therefore clearly demonstrate

36 Air Ministry 1964: 102–103. Also note that these figures, like all that will be used over the following pages, are derived from wind-speed measurements taken at midday or in the early afternoon when winds tend to be blowing at their strongest.

37 Air Ministry 1964: 102–103.

38 Air Ministry 1964: (Beirut) 250–251; (Antalya) 238–239; (Aboukir) 258–259.

that the winds most dangerous to shipping are far more likely to strike certain areas of the Mediterranean than others. While both these regions of sea can expect to receive fewer strong and gale-force winds in the summer compared to the winter, the fact remains that, even during the wintertime, there is a far lower risk that mariners sailing off the coasts of Egypt, the Levant and southern Anatolia will experience winds in excess of Beaufort 6 than is the case for sailors making voyages along the shores of the Gulf of Lions during the summer. Such inter-regional variations must have had vast ramifications for the seasonal sailing schedules of Graeco-Roman seamen plying their maritime trade along these different coasts and seas. The modern wind-speed data may also help explain the extended, and possibly even year-round, sailing season that appears to have been in operation along the Near Eastern seaboard during antiquity, as indicated in several ancient texts—the wintertime arrivals and departures recorded on the Elephantine Palimpsest; in Dareius' legal action preserved in the *Demosthenic Corpus*; in Pindar's poetry; and in the late Roman double-dated edicts sent between Constantinople and Egypt. (See above, pp. 16–22.) This is, of course, not to claim that the seas of the south-east Mediterranean were absolutely safe for seafarers. Stormy conditions, such as those described by Achilles Tatius as befalling the fictional lovers Clitophon and Leucippe when voyaging between Beirut and Alexandria, may be grounded in real experiences. Two Phoenician shipwrecks located in deep water more than 30 kilometres off the coast of Israel near the city of Ashkelon and dated to the eighth century BC, also probably sank as a result of stormy weather.[39] However, while sailing is never a completely safe activity, even in regions of sea where light winds are the norm, meteorological records are clear in emphasising the relatively benign weather conditions which ancient mariners could generally expect to face when sailing in the south-east Mediterranean; conditions that appear to have favoured year-round seafaring.

It is also interesting to note that Vegetius may have been an inhabitant of Spain or Gallia Narbonensis and, as such, possibly based his sailing calendar on observations of the weather and sea conditions commonly experienced in the Gulf of Lions.[40] If such was the case, then the particularly stormy nature of this region of the Mediterranean may well have led the late Roman author to create a maritime timetable that was considerably shorter than

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[39] Achilles Tatius, *Clitophon and Leucippe*, 3.1.1–3.5.6. For the Ashkelon shipwrecks, see Ballard et al 2002; Stager 2003.

[40] For Vegetius' possible Spanish or Gallic ancestry, see Milner 1996: xxxiv.

that adopted by seafarers voyaging across other seas and coastlines where high winds were far less frequent and where sailing might therefore have been practised for longer into the winter period. Perhaps most importantly, the modern wind-speed data also emphasises the impracticality of implementing the sailing calendars proposed by Hesiod, Gratian and Vegetius across the entire Mediterranean. A rigid adherence to the date ranges set down in these ancient texts would surely have proven unworkable given the diverse weather conditions across the various seas and coasts of the Mediterranean.

The seasonal trends in the wind patterns that exist across much of the Mediterranean are also reflected in the wind-speed records gathered from around the Aegean. Across the western half of this Sea, strong and gale force winds, which together comprise up to 12 percent of January's monthly total (8 percent of which are recorded as strong winds, while 4 percent are gales), are significantly reduced during late spring and autumn, while they are virtually absent by the summer.[41] The waters of the eastern half of the Aegean experience a similar trend in which strong winds and gales reach their greatest extent in the wintertime, although this region of the Sea also records a sudden rise in the frequency of such winds during the month of July, the result of the powerful etesian winds which attain their greatest strength during mid-summer. However, even a relatively small and confined sea such as the Aegean exhibits sharp contrasts in the wind-speed data measured at different regions along its coastline. Wind-speed records from Chios, for example, demonstrate that, even during the winter months, mariners are less at risk of encountering strong and gale-force winds (which account for only 0.8 percent of the seasonal average) than is the case in the summertime at Thessaloniki (1.4 percent) or Lemnos (1.2 percent).[42] Indeed, the island of Skiros can, over the course of a year, usually expect to experience winds of Beaufort 7 or greater on almost twice as many occasions than the *combined* totals of Chios and Samos.[43] This picture of inter-regional variability in the Aegean is painted even more vividly south of the Cyclades where, across the course of the year, the island of Milos averages more than four times the level of strong and gale-force winds than does Iraklion in the centre of the northern coast of Crete. The seasonal risk of encountering such high winds is also very different at these two locations: at Milos there is virtually the same level of risk that mariners will encounter strong and

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[41] Air Ministry 1964: 85.
[42] Air Ministry 1964: 234–235, 226–227, 230–231.
[43] Air Ministry 1964: 222–223, 234–235, 236–237.

gale-force conditions between late spring and early autumn—the limits usually ascribed to the ancient sailing season—that sailors on the waters off Iraklion have of experiencing such winds between late autumn through to early spring—the time of year when Graeco-Roman seafaring is commonly regarded as being suspended.[44]

As has been seen in the previous chapter, Gratian's edict preserved in the *Codex Theodosianus* provides the only evidence of Roman legislation that clearly sets out the dates at which the transport of the *annona* was to take place, with a shipping season that ran from April 13 through to the end of October (See above, p. 23). Furthermore, because the document is specifically addressed to the shipmasters of Africa, by focusing on the meteorological data from the coastal region of modern-day northern Tunisia we can hope to gain an insight into what the late Roman authorities may have regarded as the most propitious weather conditions for the shipping of *annona* supplies. It is therefore interesting to note that the wind-speed data obtained at Bizerte (ancient Hippo Diarrhytus) clearly highlight that on this section of the North African coast winds generally blow with a good deal more violence than is usually the case in the coastal waters of Greece and the Near East. In fact, the coastline of northern Tunisia experiences annual frequencies of strong and gale-force winds which are higher than on almost any other shores of the Mediterranean. At Bizerte during the month of February, winds of Beaufort 7 usually contribute 13 percent of the average monthly total, with gale-force winds responsible for a further 7 percent.[45] To the south-east, the city of Tunis also experiences high frequencies of violent winds in February, with strong winds generally constituting 5 percent of the monthly average while gales add a further 5 percent.[46] Such figures are supported by the British Admiralty's pilot book for this region of the Mediterranean which states: 'The prevailing W to NW winds cause heavy seas at times along the coast from Oran to Cap Bon from late October to April …. Gales are most frequent from October to April and reach a frequency of 5% to 10% from December to March'.[47] The sailing season set out in Gratian's edict would therefore appear to correspond well with the modern meteorological and hydrological data observed at coastal sites on the North African coastline. Perhaps even more striking are the relatively high frequencies of strong and gale-force winds that can be expected to blow

44 Air Ministry 1964: 218–219, 214–215.
45 Air Ministry 1964: 134–135.
46 Air Ministry 1964: (Bizerte) 134–135; (Tunis) 132–133.
47 Mediterranean Pilot 1978: Vol. 1.14–16.

along the North African coast in the summer months. During July—a month regarded by even Hesiod as being safe for maritime activities because one could 'trust the winds without any anxiety'—meteorological records from Bizerte show that winds of Beaufort 7 or greater usually contribute 7 percent to the monthly wind-speed total, while, of these winds, 2 percent are gale-force or stronger. Wind-speed records derived from Tunis during July reveal an almost identical average for strong and gale-force winds.[48]

Along stretches of the North African shoreline we are therefore presented with a wind regime vastly different from that commonly experienced across most of the coastal regions of the Mediterranean. High winds and gales can be expected to affect the northern Tunisian coastline far more frequently than is the case along the shores of the Near East or Aegean, not only during the winter months, but also in the summertime—the season during which Gratian's edict makes it clear that most late Imperial *annona* shipments were to be transported to Rome. While it has already been stressed that modern meteorological records cannot be superimposed back on to antiquity with any degree of accuracy, the wind-speed data recorded at Tunisian coastal sites nevertheless provides an indication that sailors aboard vessels owned or chartered by members of the *navicularii* of late Roman Africa, despite limited to voyaging between mid-April and the end of October, were nevertheless at greater risk of encountering violent winds than were Graeco-Roman seamen plying the coastal routes of the Eastern Mediterranean during the heart of the wintertime. Such striking variations in the wind regimes recorded at different areas of coast and sea should caution against perceiving of the Mediterranean as a single climatic entity within which one region can be considered as essentially the same as another. We therefore have to question the validity of applying sailing seasons such as those advised by Hesiod and Vegetius, or legislated for by Gratian, across all the sea-lanes of the Mediterranean, regardless of whether localised climatic conditions corresponded to such maritime calendars.

With the Caesarian conquest of Gaul midway through the first century BC, and the annexation of Britain by Claudius almost a century later, the Roman military, along with merchants intent on exploiting the new markets and trading opportunities opened up by conquest, also had to take account of the maritime conditions of the Atlantic coasts of north-western Europe, especially in the region of the Dover Strait and the English Channel which provided the most direct sea-routes linking Britain with the Continent.

48 Air Ministry 1964: 134–135, 132–133. Hesiod, *Works and Days*, 664.

However, when sailing off these coasts, Graeco-Roman mariners would have encountered weather conditions considerably more hazardous to shipping than those that existed on the Mediterranean.[49] As can be seen from figure 2.6a, during January strong and gale-force winds usually account for about 20 percent of wind-speed records in the region of the Dover Strait and the Channel, making these areas far more prone to violent winds than even the Gulf of Lions—the stormiest region of the entire Mediterranean—which usually averages 12 percent of such winds in the wintertime (figure 2.5a). Although the frequency of powerful winds blowing through the Channel is greatly reduced during the summertime, nevertheless, modern records suggest that vessels sailing between Britain and the Continent in July still expect to encounter strong or gale force winds on about 2 percent of occasions (figure 2.6b).[50] As such, even voyages made in mid-summer on these waters of the north Atlantic posed a greater risk to mariners than was the case for journeys made across many regions of the Mediterranean during the height of the winter. Yet, while most historians regard Mediterranean sea-lanes to have been all-but deserted during the winters of antiquity, there is no suggestion that Graeco-Roman seafaring between Britain and the Continent was impossible during the summer months.[51]

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[49] While native seafarers no doubt continued to play the dominant role in cross-Channel seafaring following the Roman conquest of Gaul and Britain, it is also possible that numbers of seamen and navigators who had learnt their craft on the Mediterranean also found their way on to vessels plying the sea-lanes connecting the Continent with the southern and eastern shores of England. Sailors drawn from the Mediterranean world would almost certainly have been used aboard the warships and fleet auxiliary vessels required as part of the naval forces initially involved in the conquests of Gaul and Britain; ships that were later deployed to safeguard communications across the vital seaway. Other mariners originating from the Mediterranean may also have served on the merchant ships used by traders to exploit the commercial opportunities opened up by the assimilation of the new provinces into the Empire.

[50] Mariners and naval architects have long been aware of the harsher conditions that exist in the Atlantic relative to the Mediterranean. The eighteenth century French navy therefore estimated that 'well-built ships constructed of carefully selected timbers lasted ten years in the Atlantic and twenty years in the Mediterranean' (Pritchard 1987: 126. See also Phillips 1994: 102). It has also been calculated that, because of the weather and sea conditions, British warships based on Atlantic coasts during the same period 'spent only 39 per cent of their time at sea, while in the Mediterranean it was 57 per cent' (Rodger 1986: 38).

[51] It is interesting to note that a relatively recent study of naval activities in Britain during the Roman period assumes that the sailing calendar proposed by Vegetius was equally applicable to the seas surrounding Britain as it was to the Mediterranean (Mason 2003: 56–57, 120). However, such a belief would seem ill-founded given the considerably more hostile nature of the weather and sea conditions off Atlantic north-west Europe.

Powerful Summertime Winds

While strong and gale-force winds are considerably less frequent across the Mediterranean during the summer half-year compared to that of the winter, these winds may, nevertheless, still be encountered from time to time in the summer months and it should be borne in mind that even at the heart of the ancient sailing season, when Vegetius deemed the seas to be 'very suitable' for navigation, Graeco-Roman mariners still had to be prepared to deal with adverse conditions.[52] It has already been seen that summertime winds such as the etesians are capable of reaching gale-force and above, and can raise very heavy seas. The mistral can also be a threat to sailors making voyages across the Gulf of Lions during the summer.[53] Powerful summertime winds can also be encountered in the central Mediterranean between the North African coastline and the shores of Sicily and Italy. Indeed, it was as a result of strong summer winds whipping-up large seas around Sicily that the Romans suffered the most crippling losses of their naval history with storms striking two of their fleets during the First Punic War. Polybius therefore records that 284 warships were sunk during a storm which swept across this region of water in June of 255 BC, while the Greek writer also notes that two years later a further 150 Roman vessels were lost off the Tunisian coast when caught in heavy weather during the summertime.[54] While ancient warships were at danger of being swamped by even relatively small waves produced by little more than a stiff breeze, modern naval vessels in this area of the Mediterranean have also encountered great difficulties resulting from the powerful winds that occasionally blow during the summer.[55] One such occasion came during World War II when, on July 9, 1943, a vast Allied armada came close to abandoning the invasion of Sicily after it ran into gales and heavy seas when steaming eastwards along the North African coast and through the Sicilian Channel.[56] It was through this same region of sea, at the same time of year, that the vessels of the African *navicularii*, for whom the sailing season of Gratian's edict was designed, would have had to pass when carrying their *annona* cargoes to Rome.

52 Vegetius, *Epitoma rei militaris*, 4.39.
53 Mediterranean Pilot Vol. 2 1978: 13.
54 1.37.1; 1.39.1.
55 For the problems facing ancient war-galleys in conditions of Beaufort 5 and above, see p. 138 ff..
56 Bradley 1951: 125 f.

The sailors of the ancient Mediterranean also had to be alert to the possibility of powerful winds associated with thunderstorms; conditions that a modern sailing handbook has noted, 'are the most likely occasions for the cruising yachtsman, who normally confines his sailing to fine summer weather, to experience really strong winds, albeit of short duration.'[57] Created independently of depression systems by an upwelling of warm, moist air, thunderstorms can create extremely violent winds that will also often change direction with great rapidity.[58] An additional hazard associated with thunderstorms at sea is the threat of lightning strike and the possibility of fire—a danger more feared than any other by seamen aboard wooden vessels. Although there is sometimes a tendency for modern sailors, protected by lightning conductors, to dismiss the dangers of a lightning strike, until relatively recently these electrical storms were a very real hazard to seafarers and, as Admiral Smyth long ago noted: 'of all the detriments to Britain's bulwarks and maritime life, none is more dreadful, when the sudden juncture breaks upon us, than lightning.'[59] Smyth goes on to list the log-book entries of thirty-six British naval vessels that suffered lightning strikes in the Mediterranean over a fourteen year period, beginning with the punishment suffered by the *Repulse* off the Catalonian coast in April 1810: 'Ship struck twice. Mainmast splintered from the trunk to the deck. Seven seamen and a boy killed, three mortally wounded, and ten more or less hurt,' through to the *Phaeton* at Gibraltar in September 1824: 'Foremast shivered from the trunk to the deck, and set on fire. Several men struck down. Other spars, and several sails, greatly injured.'[60] Both ships, it should be noted, were struck during months lying within the limits traditionally ascribed to the ancient sailing season. Therefore, although voyages made on the Mediterranean during the summer half-year undoubtedly reduced the risk that Graeco-Roman seafarers would encounter stormy conditions, strong winds and gales were nevertheless still a very real threat, even at the heart of the ancient maritime season. For the sailors, merchants and naval commanders who reserved their activities to the summer months, there was thus the need to develop sailing

[57] Haeften 1997: 25. While Mediterranean thunderstorms can be encountered in any month, they are generally more likely to be experienced near to coasts during the summertime and over open sea during winter (Mediterranean Pilot Vol. 1 1978: 19; Vol. 3 1988: 35; Vol. 4 2000: 33; Vol. 5 1999: 32).

[58] Haeften 1997: 25. However, because thunderstorms are generally short-lived and highly localised in nature, large waves do not usually have an opportunity to develop. See, for example, Seidman 2001: 170.

[59] 1854: 302.

[60] Ibid. 306–307.

strategies that, in combination with strong, seaworthy vessels, would have proved capable of dealing with powerful winds and large seas.[61]

Mediterranean Storms

Storms have, of course, always been a major hazard for sea-going vessels and were especially dangerous for shipping during the age of sail and oar. It should, however, be emphasised that only rarely do sailors experience storms at sea. Indeed, modern seamen and meteorologists only classify conditions as 'stormy' when wind-speeds average 48 to 63 knots (88 to 116 kph), leading to sea conditions in which 'the waves are very high with long overhanging crests, and the sea takes on a white appearance from the foam blown from them, then a storm is in progress.'[62] Even in the Gulf of Lions, winds registering Beaufort 9, 'strong gale', or above are generally only recorded on 11 days every year, and while the mistral, like many of the other regional winds of the Mediterranean, has, on occasion, attained Beaufort 10 or over, such winds are exceptionally rare, even in this most stormy region of the Mediterranean.[63] It has also been noted of winds in the Aegean that, 'Disturbances intense enough to be called storms, with winds of force 10 or more, do occur but are infrequent'; a description that is equally valid for the other seas and coasts of the Mediterranean.[64]

Even for vessels unfortunate enough to encounter heavy weather, there is a tendency for writers, both ancient and modern, to further enhance the strength of the wind, the height of the sea, and the threat of shipwreck:

> Storms occupy a lot of a sailor's time but fortunately most of that time is spent talking about storms rather than experiencing them. Sailing magazines are full of frightening stories, and many fine cruising adventure books tell of storms and rough seas. Let's face it, a cruising yarn without a decent storm is as flat as a leftover glass of beer. The thought of storms, however, raises a spectre much greater than their reality ... Almost everything we hear about heavy weather sailing comes from personal narratives ... With repeated telling the wind often becomes stronger and the seas higher. Once, someone was telling

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[61] See, for example, Xenophon (*Oeconomicus*, 8.14), for a description of how the *proreta* of a Phoenician merchantman kept his vessel in a state of constant readiness should a storm arise while at sea.

[62] See figure 2.10. Winds of 48–55 knots (88–102 kph), Beaufort 10, are classed as 'storm'; those of 56–65 knots (104–120 kph), Beaufort 11, as 'violent storm'; winds above 65 knots (120+ kph), Beaufort 12, 'hurricane' force (e.g. Kemp 992: 827).

[63] Mediterranean Pilot Vol. 2 1978: 13.

[64] Mediterranean Pilot Vol. 4 2000: 25.

> me about his friend who had sailed through a terrible storm with huge seas. I was impressed, and would not have wanted to be out on that cruise. Later I learned that the story originated with one of my crew when I brought *Denali* from St. Thomas to Savannah the previous year. Although it had not been an easy trip, I could not remember 20-foot seas or several other reported events.[65]

A similar inclination to exaggerate sea conditions no doubt holds equally true for many descriptions of stormy voyages that survive from antiquity. Indeed, even in the rare event of Graeco-Roman writers drawing on personal experiences of storm-ridden voyages, it may be doubted whether they ever described events with the greatest of accuracy. As has recently been noted in relation to storm and shipwreck, 'If authenticated facts are simply presented without comment, readers will be bored; they want drama and pathos,' as such, 'No calamity is ever described with perfect truth.'[66] Such an assessment probably applies equally well to the ancient world where surviving texts, penned by the literate elites of ancient society who often possessed little understanding of seafaring and the marine environment, provide highly unreliable narratives of maritime events such as stormy weather; a fact all-too often overlooked by historians who have a tendency to uncritically accept the accounts contained in the ancient literature. Even experienced mariners often have great difficulty in assessing the true nature of sea conditions from the deck of a rolling and pitching vessel, and, in consequence, tend to over-estimate the speed of the wind and height of the waves.[67] For those unaccustomed to the sea, even breezy and mildly choppy conditions might give the impression of stormy weather and lead to the literary portrayal of exceptionally hazardous sailing conditions.

Many of the best known ancient accounts of stormy conditions also carry with them underlying narratives which use the backdrop of a storm at sea to convey other socio-religious commentaries.[68] Undoubtedly the most famous of these is contained in Acts 27 that describes the storm and subsequent wreck of the Alexandrian grain freighter carrying St Paul to Italy.

> But after no long time there beat down from it [i.e Crete] a tempestuous wind, which is called Euraquilo [i.e. the gregale]:[69] and when the ship was caught, and could not face the wind, we gave way to it, and were driven … And as we laboured exceedingly with the storm, the next day they began to throw the

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65 Howard 1994: 256.

66 Alethea Hayter's description of the storm and wreck of an East Indianman off Portland Bill in 1805, which led to the deaths of over 250 passengers and crew (2002: 134).

67 Ericson & Wollin 1968: 94; Haeften 1997: 13.

68 Llewelyn 1992.

69 There would appear little doubt that the Euraquilo (εὐρακύλων) in Acts 27:14 can be

> freight overboard; and the third day they cast out with their own hands the tackling of the ship. And when neither sun nor stars shone upon us for many days, and no small tempest lay on us, all hope that we should be saved was now taken away.
>
> And when they had been long without food, then Paul stood forth in the midst of them, and said, Sirs, ye should have hearkened unto me, and not have set sail from Crete, and have gotten this injury and loss. And now I exhort you to be of good cheer: for there shall be no loss of life among you, but only of the ship. For there stood by me this night an angel of the God whose I am, whom also I serve, saying, Fear not, Paul; thou must stand before Caesar: and lo, God hath granted thee all them that sail with thee. Wherefore, sirs, be of good cheer: for I believe God, that it shall be even so as it hath been spoken unto me. Howbeit we must be cast upon a certain island.
>
> But when the fourteenth night was come, as we were driven to and fro in the sea of Adria, about midnight the sailors surmised that they were drawing near to some country; and they sounded, and found twenty fathoms: and after a little space, they sounded again, and found fifteen fathoms. And fearing lest haply we should be cast ashore on rocky ground, they let go four anchors from the stern, and wished for the day …
>
> And while the day was coming on, Paul besought them all to take some food, saying, This day is the fourteenth day that ye wait and continue fasting, having taken nothing. Wherefore I beseech you to take some food: for this is for your safety: for there shall not a hair perish from the head of any of you. And when he had said this, and had taken bread, he gave thanks to God in the presence of all: and he brake it, and began to eat. Then were they all of good cheer, and themselves also took food. And we were in all in the ship two hundred threescore and sixteen souls. And when they had eaten enough, they lightened the ship, throwing out the wheat into the sea.
>
> And when it was day, they knew not the land … But lighting upon a place where two seas met, they ran the vessel aground; and the foreship struck and remained unmoveable, but the stern began to break up by the violence of the waves. And the soldiers' counsel was to kill the prisoners, lest any of them should swim out, and escape. But the centurion, desiring to save Paul, stayed them from their purpose; and commanded that they which could swim should cast themselves overboard, and get first to the land: and the rest, some on planks, and some on other things from the ship. And so it came to pass, that they all escaped safe to the land.[70]

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equated with the modern gregale/grigal that still blows violently across the Ionian Sea from the north-east and creates large breaking waves and heavy swells. See especially, Bruce 1990: 517 f.; Hemer 1975: 100 f.; Rapske 1994: 38 f.

[70] Acts 27:14–44.

While older scholarship emphasises the historical veracity of this stormy voyage,[71] more recent generations of theologians have tended to cast doubt on the historicity of the account and instead focus on the manner in which the tale draws heavily on themes common to Hellenistic romances.[72] There appears little doubt that the account of the storm and subsequent shipwreck was intended to convey a theological message clearly understandable to the readers of antiquity; one in which Paul was presented both as a man of high social status and therefore worthy of respect, as well as an individual displaying high moral virtue.[73] To this effect it has been argued by some theologians that the entire storm account in Acts was designed specifically to emphasise the apostle's virtuous nature: 'Paul is shown to be brave while the ship, and everyone on it, is overtaken by the total chaos of the storm. Paul does not, like the narrator, and other passengers, lose heart. Furthermore, Paul is the paragon of self-control as he assumes command of the foundering craft.'[74] Finally, it is evident that Acts 27 was also intended as a means of emphasising both the power of God and the innocence of Paul; the apostle's survival from storm and shipwreck was intended to signify that 'Paul was acquitted by a tribunal no less formidable than the divinely controlled ocean itself.'[75] Given these socio-religious foundations upon which is built the story of Paul's stormy voyage between Crete and Malta, it is difficult to unquestioningly accept the authenticity of the account and the details of the storm that were faced by the passengers and crew of the grain freighter. Similar underlying narratives no doubt permeate many other ancient accounts of dangerous weather and sea conditions and, as such, scholars should be wary of uncritically accepting such tales.[76]

Modern meteorological data also raises strong doubts over the authenticity of the events narrated in Acts 27, further highlighting the danger of trusting ancient accounts of stormy voyages. While the biblical narrative has

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71 E.g. Morton 1937: 373–377; Ramsey 1908: 339.

72 E.g. Ladouceur 1980; Miles & Trompf 1976.

73 Lentz 1993: 2, 3, 15, 21, 23, 91; Miles & Trompf 1976: 260. While Paul was a Roman citizen and may therefore have been of higher social status than most of the other passengers on board the grain freighter, studies of Paul's own letters indicate him to be a man who, while from a reasonably prosperous family, was certainly not drawn from among the social elite (Sanders 1991: 13).

74 Lentz 1993: 94–95.

75 Miles & Trompf 1976: 267. See also Ladouceur 1980: 448; Lentz 1993: 105.

76 Moreover, it may be the case that the book of Acts was only composed in the last two decades of the first century AD, some thirty or forty years after the events described in the voyage to Rome, and therefore was possibly not the work of an eye-witness (den Heyer 2000: 22).

the gregale striking the apostle's ship off the southern coast of Crete during the first half of October before the powerful winds then drove the vessel westwards for two weeks,[77] such weather conditions are unlike any recorded by modern data. Meteorological records from Malta, which most scholars assume was the location where Paul's vessel was eventually wrecked, instead indicate that powerful gregale winds are only usually experienced on the island during October once every two years, while the maximum number recorded as striking the island over the course of the month is only two, with neither of these powerful enough to be recorded as gales, let alone storm-force conditions.[78] Moreover, while the gregale has been known to last up to five days, these north-easterly winds commonly endure only one or two days; certainly none are recorded as coming close to achieving the fourteen day span that is accorded to the wind which drove St Paul's vessel ashore.[79] It is also interesting to note that modern weather data indicates that sailors on Maltese waters are most at risk from gregale winds during January and February,[80] yet despite the increased likelihood of encountering such winds at this time of year, it was almost certainly in late January or early February that Paul resumed his journey to Rome when he took passage aboard another grain freighter which put out from Malta bound for Puteoli. (See above, pp. 36–40.) Furthermore, while the gregale can arise from a number of different meteorological circumstances, all of which provide the wind with slightly different characteristics, the most common manner in which the gregale is formed is when cold, dry winds blow down from the mountains of the Balkans; a wind that brings with it clear skies and no precipitation.[81] These weather conditions are very different from those presented in Acts 27 that describe overcast skies in which 'For days on end there was no sign of either sun or stars.'[82] All this is not to imply that strong regional winds such as the gregale are of little threat to seafarers, for they most certainly are.

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[77] Acts 27:14–28. There is now little doubt that the tempestuous winds of the (εὐρακύλων) which the narrator of Acts described as breaking about St Paul's ship soon after it had left the anchorage of Fair Havens can be equated with the modern gregale/grigal that still blows violently across the Ionian Sea from the northeast, creating large breaking waves and heavy swells. (See especially, Hemer 1975.)

[78] Air Ministry 1962: 78. These figures were drawn from a nineteen-year period of observations.

[79] It is, however, possible that the narrator of Acts was drawing upon knowledge of the bora winds, rare spells of which have been known to last for as long as 30 days, though only in the most northerly reaches of the Adriatic (Admiralty 1962: 76).

[80] Air Ministry 1962: 78; Mediterranean Pilot Vol. 1 1978: 17.

[81] Air Ministry 1962: 78; Mediterranean Pilot Vol. 3 1988: 32.

[82] 27.20.

Off the Maltese coast the gregale can raise seas to heights of 20 feet (6 metres) in a short space of time, while in the north-easterly facing harbour of Valetta, the wind has caused immense damage to the port and its facilities over the years.[83] However, the use of meteorological records does provide a clearer perspective of the dangers which ancient seafarers faced when on the wintertime Mediterranean, while also indicating that we should be wary of accepting Graeco-Roman accounts of hazardous weather conditions without first treating them to more rigorous meteorological scrutiny. As such, while there is no argument that the voyage of Paul to Rome recorded in Acts 27–28 is of great interest, and provides an exceptionally valuable source as we seek to more clearly understand how Graeco-Roman mariners dealt with the extreme conditions of storm and shipwreck, the information contained in the narrative nevertheless has to be treated with caution. Over coming pages this study will therefore continue to draw on the account contained in Acts which, if studied carefully and used alongside modern weather data, can yield some exceptionally important insights into how and why sailors continued to make voyages across the Mediterranean during the period of the year traditionally regarded as 'out of season'.[84]

Wind Direction

Although Vegetius refers to the violence of the winds in his list of wintertime seafaring hazards, the late Roman author makes no mention of the increased variation in the direction of Mediterranean winds at this time of year. However, there is no doubt that the unsettled wind regime of the winter months, which can be seen in the wind-roses of figure 2.3d, must have posed serious problems for Graeco-Roman mariners attempting to sail the Mediterranean at this time of year. It has therefore been noted by

[83] Air Ministry 1962: 78; Smyth 1854: 251.

[84] It should be noted that this study makes no judgement on the authorship of the biblical narrative. The events described in Acts 27–28 might be the eye-witness account of a man who may, or may not, have been called Luke; the work of a much later chronicler drawing on records or memories of the event, or even using other travellers tales to concoct a story that was primarily intended to be dramatic and inspirational. Instead, what is important is that the account of the voyage and shipwreck of Paul was written in a manner that leaves little doubt it was intended to be accepted as a real and believable sequence of events. As such, many of the details contained within the narrative should provide a reasonably accurate and believable reflection of the tactics commonly adopted by Graeco-Roman sailors when threatened by storms, as well as the seasonal strategies followed by the owners and captains of the large grain freighters transporting Egyptian grain to Italy.

Jamie Morton that, 'winds tend to change direction far more often and with far less warning in winter than in summer: this made weather prediction more difficult, and obliged sailors to find routes which would be safe and practical even if winds changed direction, and to find sheltering places protected from all, or at least most, likely wind directions.'[85] The unpredictability of the Mediterranean's wintertime winds must also have been physically demanding on a ship's crew, forcing the sailors to constantly set and trim the sail in response to shifting winds. Furthermore, the lack of a stable wind pattern would also have made it difficult for vessels to keep to a set itinerary.

The seasonal wind roses shown in figures 2.3a–d certainly emphasise that Graeco-Roman mariners were more likely to encounter changeable wind conditions during the winter—the time of year when winds are often spread relatively evenly around the compass. However, many regions of the Mediterranean experience highly variable wind patterns, even in the summer months. Wind-roses across the region during July highlight that, although northerly or north-westerly winds prevail across the central and eastern Mediterranean, there is a far less well-defined pattern to the winds which blow across the western basin of the Sea (figure 2.3b). Ancient seafarers making summertime voyages across many regions of the western Mediterranean would therefore have required technologies and strategies that would have allowed them to deal with such inconsistent and shifting wind conditions.

Despite the predictability of the prevailing north and north-westerly winds which blow across the central and eastern Mediterranean during the months of the summer, such winds would not always have proved favourable for passage-making; Graeco-Roman seamen on vessels bound for ports lying to the north would have had to make summertime voyages in the face of these prevailing winds. For example, across the Aegean it is the etesians that govern the wind regime throughout the summer months. They blow from either the north or northeast in the central and northern regions of the summertime Aegean, while, further to the south, they typically blow from the north-west (figure 2.7b). The etesians usually begin to assert themselves from late spring and then dominate the wind regime of the Sea until the early autumn.[86] While these persistent winds allowed for exceptionally straightforward passage-making for south-bound ships, by contrast, Graeco-

85 Morton 2001: 259.
86 Air Ministry 1962: 78 f.; Mediterranean Pilot Vol. 4 2000: 25.

Roman vessels heading for the northern reaches of the Aegean would have had to undertake voyages which involved sailing directly into the face of the wind.[87] The problems for ancient mariners attempting to sail vessels northwards through the Aegean during the summertime were compounded by the fact that the sea-currents, like the prevailing winds, also flow to the south. Although the speed of the Aegean's currents rarely exceeds ½ knot (0.9 kph), strong etesian winds will increase their velocity, especially in the channels that separate the numerous islands from each other and the mainland, making straits like those of Euboea, Andos, Tenos and Mykonos even more difficult to negotiate for vessels attempting to make progress to the north during the summer sailing season (figures 2.8a–d).[88] Furthermore, the currents running through the Bosphorus and Hellespont also usually reach their maximum velocity during the late spring and early summer when large rivers such as the Danube and Don, swollen from the spring thaw, empty into the Black Sea, which in turn discharges the melt-water into the Sea of Marmara and the Aegean.[89] While large, well-manned, oared vessels could make headway against such swift flowing water, for ships reliant on sails the procedure for making progress against the current was probably little different from that of more recent times in which, 'the usual practice for boats going upstream was to wait until one of the rare southerly winds arose, which at least slowed the current and, if strong enough, could be used under sail.'[90]

Many skippers and ship-owners of Graeco-Roman vessels heading towards the northern coasts of the Aegean, or progressing on towards the Black Sea through the Hellespont and Bosphorus, may therefore have opted

87 While the strength and constancy of direction of the etesians varies across the Aegean, at locations such as Samos the north-westerly winds constitute almost 90 percent of recorded wind observations during the middle of the summer: 'values … that are hardly exceeded in the most steady trade-wind regions of the Earth' (Biel 1944: 14).

88 It should be noted that while the direction of a wind is named according to the point from which it blows, currents are instead designated by the direction to which they flow. For the speed of the currents, see Mediterranean Pilot Vol. 4 2000: 14. See also Dassenkis et al 2000: 237; Morton 2001: 37 f.

89 Williams 1999: 281 f.

90 Severin 1985: 132. For galleys overcoming the current, see Carpenter 1948: 3 f. The Athenian commander, Timomachus, used triremes to tow grain ships returning from the Crimea southwards through the Hellespont in 361 BC (Demosthenes, *Epistulae*, 50; see also Morrison et al 2000: 124 f.), and it would seem likely that warships would also be used to tow such vessels north-eastwards against the current. Morton has also noted how an inscription from the Bosphorus (*Anthologia Palatina*, 10.7) makes it clear that many sailing vessels required the assistance of the westerly wind to gain access to the Black Sea (2001: 89 fnt. 32).

to undertake voyages in early spring, autumn, or even during the wintertime when, although winds from the north were still the most common, those blowing from other directions, especially the south, were considerably more frequent and would have provided invaluable assistance for vessels working their way northwards (figures 2.7a–d).[91] The absence of the northerly etesian winds during the winter half-year, together with the reduced outflow of water from the Black Sea, results in less powerful currents running through the Bosphorus and Hellespont between autumn and early spring, and also leads to weaker and more variable currents flowing southwards through the Aegean at this time of year (figures 2.8a–d). Such factors may have proved vital for ancient shipping intending to proceed from the Aegean into the Black Sea. It has therefore been conjectured by Morton that, 'The importance of these [southerly] winds in easing the northerly passage of ships through such a strategically and commercially important sea-lane may have been one reason why some sailors would continue to make voyages both before the onset, and after the end, of the more settled conditions of summer proper … the autumn and especially the spring periods were important in the navigation of the Hellespont and Bosphorus: in summer the Etesians were powerful to face, and in winter, although southerly winds prevailed, conditions were often too stormy for sailing.'[92] However, while Morton assumes the Aegean was too stormy for northerly voyages to be attempted by Graeco-Roman seafarers in the wintertime, the ancient literature provides indications that seafaring was being practised on the Mediterranean between late autumn and early spring. As has already been seen, the Elephantine Palimpsest records the departure of Ionian vessels from the Egyptian coast during the winter months; departure dates that might have been designed to take advantage of the greater likelihood of southerly winds blowing in the Levantine basin of the Mediterranean as well as across the Aegean at this time of year. (See above, pp. 17–21., and figures 2.3a–d.) The ship upon which St Paul travelled from Caesarea as far as the Lycian city of Myra during the first leg of his voyage to Rome, was also probably set to continue its journey northwards up the Aegean shoreline as far as the Mysian

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[91] There is some confusion in the meteorological data regarding the frequency of southerly winds blowing across the Aegean during the wintertime. Whereas the wind roses in the Mediterranean Pilot Vol. 2 1978: diagram 6 (figure 2.3d) indicate that the great majority of winds in January are from the southerly quarter, those in Mediterranean Pilot Vol. 4 2000: 26 (figure 2.7d) show instead that winds are more evenly spread around the compass, with a slight predominance in favour of those from the northerly sectors.

[92] 2001: 89. See also Cary and Warmington 1929: 27; Labree 1957: 29 f.

port of Adramyttium on the north-west coast of Anatolia.[93] If, as the narrator of Acts implies, this vessel only began her voyage northward through the Aegean towards the end of September,[94] then the crew would have been able to exploit the southerly winds which usually begin to blow more frequently during the autumn and the winter. Furthermore, the vessel would also have benefited from seasonal changes to the direction of the sea currents flowing along the Anatolian coastline during the winter half-year, in which the south-running seas of summer are reversed and by mid-autumn are replaced by a current regime in which the flow is towards the west or north-west (figures 2.8a–d).[95]

Outside the Aegean, the prevailing northerly winds that characterise the wind regime of the summer across the central and eastern Mediterranean must also have presented a major problem for Graeco-Roman vessels attempting to sail from southern coasts to those of the north, most famous of which were the ships of the Alexandrian grain fleet. While the voyage from Italy to Egypt allowed these freighters to take full advantage of the prevailing summer breezes to make the downwind run to the south-east Mediterranean in only two or three weeks, by contrast the return journey had to be made against the persistent north-westerlies.[96] Since ancient sailing ships could probably sail no closer than about 70° to the wind (see below, p. 164), Alexandrian freighters bound for the Italian ports of Puteoli or Ostia had therefore to take a roundabout route by way of either the southern sea-lanes which followed the African coastline, or by taking a northerly course which ran along the shores of the Levant before swinging westwards to follow the northern coasts and islands of the Mediterranean. Both these routes to Italy would take at least a month, and usually longer, to complete.[97] For the skippers and owners of the Alexandrian grain ships, voyages

93 It is thus noted in Acts 27:2 that the vessel was a ship of Adramyttium that was to sail to the ports along the coast of Asia.

94 Acts 27:2–4. See above (pp. 36–40) for details of the apostle's voyage.

95 Mediterranean Pilot Vol. 4 2000: 14.

96 Casson 1950; 1995: 298.

97 See Casson 1950; 1995: 298; Charlesworth 1924: 247; Williams 1999: 283. While voyages along the North African coastline were favoured by Muslim seafarers during the medieval period, primarily as a result of political considerations (Goitein 1968 Vol. 1: 319 f.), in antiquity the northerly route appears to have been the more commonly used and Lucian (*The Ship*, 5) and Acts 27 both refer to Italian-bound vessels making westerly passages in this manner. Literary evidence from the Middle Ages also suggests that this route was favoured by sailors who were able to take advantage of the high, visible, coastal topography of the northern coastlines of the Mediterranean as well as the northerly currents running along the

made from Egypt and the Levant to Italy before or after the summer months would at least offer the possibility of utilising winds blowing from a more favourable direction than the prevailing summer north-westerlies. Although the winds of the winter half-year are unpredictable in nature, they may nevertheless have been exploited for westerly passage-making.

In his study of the voyage of Ibn Jubayr from Acre to Sicily in AD 1184, J.H. Pryor has therefore demonstrated that medieval shipping on the eastern Mediterranean would sometimes intentionally delay departure to the west until the middle of the autumn in an effort to take advantage of the increase in easterly winds which blow with greater frequency from October until the middle of May.[98] While Pryor assumes that medieval shipping stayed off the seas throughout much of the wintertime, and would have followed a seasonal sailing regime similar to that advised by Vegetius, he nonetheless still argues that medieval ships commenced their journeys to the west right up until the end of October, with a further two months of voyaging still lying ahead of them. Such vessels would, therefore, often only have been reaching their home ports in the western Mediterranean towards the end of December or at the beginning of January.[99] While vast technological differences separate the ships and navigational techniques used on the ancient Mediterranean from those employed during the Middle Ages, and so make it impossible to directly relate Pryor's studies back to the Graeco-Roman period, it may nonetheless have been the case that vessels such as the Alexandrian grain freighters—among the largest and strongest ships of the ancient world—may also have made use of the easterly wintertime winds to make passages to the west. As will be demonstrated below (see chapter 3), the ships of antiquity were, in many respects, more suited to wintertime conditions than the vessels of the Middle Ages. The ability of the vessels and crews of Graeco-Roman merchantmen to regularly navigate the wide expanses of the Indian Ocean during the hazardous conditions of the south-west monsoon would also indicate that

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Near Eastern seaboard (Pryor 1988: 14 f.). While these currents presently only attain speeds of ¼ to ½ a knot (0.5–0.9 kph) (Mediterranean Pilot Vol. 5 1999: 19. See figures 2.9a–b), prior to the construction of the Aswan dams in the twentieth century, the summertime inundation of the Nile, which usually began in late June and continued for the following two months, poured twenty times the volume of water into the Mediterranean than was the case during the winter months (Smyth 1854: 169 f.). This vast inflow reinforced the northerly current running up the Levantine seaboard and so provided vessels of the Alexandrian grain fleet with the opportunity of attaining relatively good speeds as far north as Cyprus.

[98] Pryor 1988: 3.

[99] Pryor 1988: 3–4.

vessels of antiquity were more than capable of taking advantage of the opportunities that the changed wind regime of the wintertime Mediterranean might have afforded them. (See chapter 5.)

The Land and Sea Breeze

Before concluding this investigation of the seasonally fluctuating wind regime of the Mediterranean and the consequences that changes to the wind patterns may have had for Graeco-Roman mariners across the course of the year, there is a need to look briefly at the daily alternating land and sea breezes that affect many areas of the Mediterranean. These coastal winds, which generally extend no more than about 30 kilometres (20 miles) off the shore, are the result of differential rates of heating and cooling of the land relative to the sea throughout the course of the day. During the hours of daylight, when the sun rapidly heats the land, the warm air situated above it rises and is replaced by cooler air drawn in from off the sea. This shoreward movement of air is the sea breeze, which, in mid-summer when temperatures are highest and the breezes they generate at their strongest, usually begins a few hours after sunrise and continues through until sunset, blowing most powerfully in the early afternoon. By contrast, the drop in temperature during the hours of darkness leads to the rapid cooling of the land and the air situated above it, resulting in a reversal of the air-flow; the now denser, heavier air above the land moves seaward and displaces the air over the sea which, on account of the water retaining its heat throughout the night, is kept comparatively warm and light. This land breeze generally sets in after sunset and blows throughout the night until it fades with the arrival of dawn.[100] Although this daily cycle of coastal winds can occur throughout the year, the higher temperatures of the summertime mean that regular land and sea breezes in the Mediterranean usually blow from April until October,[101] thus keeping to a season similar to that usually ascribed to the ancient seafaring calendar. There is little doubt that such regular winds would have proven to be extremely advantageous to Graeco-Roman sailors engaging in coastwise voyages: the land and sea breezes would have allowed vessels to sail parallel to the shore in either direction, by day or night, with the wind on the beam. These breezes might also have proven useful for mariners aboard vessels forced to sail against the prevailing summer

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100 Air Ministry 1962: 93; Horrocks 1981: 162 f.; Seidman 2001: 15.
101 Air Ministry 1962: 93.

winds with the breezes blowing off the land and sea sometimes capable of nullifying the regional wind patterns. Therefore, on seas such as the Aegean, vessels that hugged the coast could often have made progress northwards during the summer in spite of the etesian winds.[102] Although the daytime sea breeze can sometimes be dangerously powerful, this hazard is generally confined to the shores of the southern and eastern Mediterranean which experience the highest summertime temperatures; for the most part, land and sea breezes across the Mediterranean region are usually fairly light, measuring Beaufort 3 to 5.[103] As such, these winds blowing off the land and sea would have been a boon to Graeco-Roman mariners engaged in coastal seafaring during the warm months of summer; an advantage that would usually have been denied to sailors who remained on the Mediterranean during the cooler wintertime.

Wintertime Waves[104]

In a handbook produced for British naval seamen, it has been noted: 'The mariner lives in intimate contact with the waves of the sea and is able to realise better than most people the extent to which their size and energy, as

[102] Air Ministry 1962: 79.

[103] Admiralty 1941: 298; Morton 2001: 52 f. The potential dangers of a strong sea breeze are however noted by Admiral Smyth who warned nineteenth century mariners voyaging along the Syrian coastline that, 'occasionally the sea-winds blow most furiously, and this harbourless coast then becomes a dread and perilous lee-shore' (1854: 284. See also Air Ministry 1962: 93 f.).

[104] It should be emphasised that waves, more than any other weather-related phenomenon, are exceptionally difficult to treat in a quantitative manner. It has therefore been noted in a sailing handbook: 'The interaction of countless factors produces waves in an infinite variety of different forms, so that the statistically-minded yachtsman will probably have difficulty matching them to theory' (Haeften 1997: 44). As such, while the waves that break against the southern coasts of the Mediterranean will often be recorded as 'large' on account of the long fetch to the north (the 'fetch' being the expanse of open water over which winds can blow without obstruction and so generate large sea swells), waves created in this fashion are generally 'rounded and more uniform in height and direction' (Meisburger 1962: 2. See also Beckinsale 1956: 295; Haeften 1997: 38; King 1972: 53 f.; Toghill 1994: 68), and are therefore not usually hazardous to mariners since the long swells tend to produce a 'regular wave movement … [which] can be a pleasant, almost soothing motion' (Haeften 1997: 38). By contrast, waves generated by localised winds, though usually smaller, are 'generally steep, sharp crested, and extremely irregular in height and direction' (Meisburger 1962: 2), conditions that are generally more problematic for sailors since 'Steep seas throw the yacht about more and it becomes increasingly difficult to control' (Haeften 1997: 38). Therefore, while sections of the Levantine coast record relatively high frequencies of large waves as a result of the long

shown by their destructive power, are related to the speed of the wind.'[105] This correlation between wind speed and wave action was also common knowledge in antiquity,[106] while today it is most clearly expressed in the Beaufort scale which is primarily used as a means of enabling sailors to relate the size of the waves to the force of the wind (figure 2.10). As a result of this relationship between the strength of the wind and the state of the sea, the increased frequency of powerful winds that blow across the Mediterranean in the wintertime also mean it is this season which records the highest frequencies of large and dangerous sea conditions. A study of the wave regime of the eastern Mediterranean therefore concluded that the wave climate of this region consists of three wave seasons, with a further two short transitional periods:[107]

– High wave heights (winter) .... December, January, February and March
– Intermediate wave heights (summer) .... June, July, August and September
– Low wave heights (spring/autumn) ...... May, October and November (first half)
– Transitional periods .... April and November (second half)

These wave seasons of the eastern Mediterranean directly coincide with the prevailing meteorological conditions: the high wave heights of the winter are produced by strong winds associated with the passage of depression systems moving through the area; the intermediate wave heights of the summer reflect the stable prevailing north-westerly winds of this season which set up a steady swell across the seas of the area; the low wave heights of late spring and autumn correspond to the time of year at which neither the powerful winter winds or the steady prevailing winds of the summer have yet exerted their influence upon the waters of the eastern Mediterranean. The wave climatology of the eastern Mediterranean therefore appears broadly to

fetch to the west, by contrast, the confined nature of the Aegean, interspersed with numerous islands, will not allow swells to build up, with the result that large waves are exceptionally infrequent in this sea (Meisburger 1962). However, as a result of the relatively frequent strong winds and gales in the Aegean during the wintertime, the waters of the region can be whipped up to create a 'short, heavy, troublesome sea among the islands' (Air Ministry 1962: 184), which, although not achieving great heights, can nevertheless prove dangerous and uncomfortable for seafarers. It is therefore difficult to use records of wave heights to pinpoint areas of Mediterranean coast or sea that can be regarded as particularly hazardous to seafarers. Wave data nevertheless highlights that the state of the sea can vary quite radically from one region of the Mediterranean to another and, like the winds that produce them, the wave patterns of the Mediterranean display pronounced inter-regional variability.

105 Admiralty 1967: 44.

106 See Morton for examples of the numerous Homeric references to the wind creating large seas (2001: 30 n. 64).

107 Goldsmith and Sofer 1983: 42f.

correspond to the seasonal range of the ancient maritime calendars as set down in the Graeco-Roman literature, with seaborne transport principally focused on periods of the year with low or intermediate wave heights.

Hydrological studies have, however, demonstrated the considerable diversity with which different regions of the Mediterranean usually experience large and dangerous waves. According to research carried out by E.P. Meisburger,[108] while most coastal regions of the Mediterranean record wave heights of 8 feet (2.44 metres) or greater on at least one day every month throughout the winter half-year (3 percent of recorded observations. See figure 2.11a), the coasts receiving such waves on two days or more per winter month (7 percent of observations) are virtually restricted to the southern shores of the Mediterranean; the result of the prevailing north and north-westerly winds generating swells in the open water to the north which increase in size as they progress southwards until they break against the North African coastline (figure 2.11b). Only in the Gulf of Lions, where, as has been noted, strong winds and gales are a relatively common occurrence during the wintertime, does the north coast of the Mediterranean receive high frequencies of these large waves. Few shores of the Mediterranean experience waves greater in height than 8 feet (2.4 metres) with any measurable frequency, and only in the Gulf of Lions, together with the coasts of the Levant and the eastern shores of the Gulf of Syrtis are waves of 12 feet (3.6 metres) recorded on at least one day per month (3 percent of observations) during the winter half-year (figure 2.11c). Wave heights in excess of 12 feet are extremely rare across the entire Mediterranean, and only on the shores of Cyrenaica do seas of 14 feet (4.27 metres) register with any frequency (figure 2.11d).[109] Meisburger's research therefore clearly highlights that the coasts of the Mediterranean experience marked regional variations in the size and frequency of large swells. In general terms, it is the coastlines of the south and east, exposed as they are to a long fetch over which travel the prevailing winds, that generally record the greatest frequencies of large coastal waves. By contrast, along the northern shores of the Mediterranean large waves are considerably less likely to be encountered by seafarers; only in the stormy region of the Gulf of Lions do sizable swells appear with any frequency.

[108] Meisburger 1962.

[109] The high wave heights recorded along the Gulf of Syrtis are probably the result of a combination of the long fetch to the north-west and the shallow sea-floor, the shoaling effect of which will cause oncoming swells to rear-up into breakers (Ericson & Wollin 1968: 93; Haeften 1997: 28, 37 f.; Toghill 1994: 9, 67 f.).

It should also be remembered that Graeco-Roman mariners operating along many areas of the Atlantic seaboard would have had to contend with considerably greater frequencies of large waves than would be experienced in the Mediterranean: the large swells arriving from the vast expanses of open ocean, coupled with the effects of the tidal streams that run along the western seaboard of Europe, create far higher frequencies of large waves than would usually be encountered by mariners on the Mediterranean. Large seas would also have been faced by ancient seamen making the voyage across the Arabian Sea to India during the stormy conditions of the south-west monsoon.[110] However, Graeco-Roman seafarers were routinely making voyages on both the Atlantic and Indian Oceans, sometimes covering very long distances over expanses of open ocean, in spite of the far greater likelihood that their vessels would encounter large waves. This is, of course, not to say that mariners will never run into large and dangerous seas when voyaging on the Mediterranean; modern sailing guides for yachtsmen certainly warn against treating the Mediterranean with too much complacency for, although they are rare, exceptionally large and potentially deadly waves may still be encountered on the Sea:

> The Mediterranean is a small area of water in comparison to the oceans, but it does not mean that there are no large waves. The maximum wave height from trough to crest is in the order of 14 metres, except in the centre of a hurricane where the massive winds can create waves over 24 metres high. In the Mediterranean, where there is sufficient fetch waves can reach substantial heights; 12 metres being the maximum recorded, in the channel between Sicily and Tunisia.[111]

It is interesting to note that the region of the Mediterranean in which the highest wave heights have been recorded is close to the area of sea across which members of the *corpus navicularorumi africanorum* were charged with transporting *annona* cargoes from Africa to Rome, and which Gratian's edict of AD 380 limited to a sailing season running between the middle of April and the end of October. It is therefore possible that the relatively short duration of Gratian's shipping timetable was partially a response to the dangerously large seas that are capable of being generated in this region of the Mediterranean during the winter months.

Aside from abnormally large waves, which are very infrequently recorded in areas such as the Sicilian Channel or in the Gulf of Syrtis, the waves

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110 See below (pp. 221 ff.) for conditions on the Indian Ocean during the south-west monsoon.

111 Heikell 1988: 34–35.

and swells of the Mediterranean are relatively small and uncommon, certainly by comparison with those of the North Atlantic and Indian Oceans. Any large swells that are generated on the Mediterranean also tend to last only the short amount of time it takes for the stormy depression systems creating them to pass over the region. As such, even in the wintertime, favourable sailing conditions are often to be found in the interludes that separate the passage of depression systems and 'throughout a normal Mediterranean winter, periods of one to three weeks of cyclonic sequences are each followed by a week or so of quiet, fine weather with high pressure.'[112] For Graeco-Roman sailors who possessed the ability to correctly forecast approaching weather, then short-haul voyages could certainly have been undertaken in the intervals between the winter depression systems. Ethnographic studies demonstrate that mariners in other parts of the world use 'simple observations of the clouds, wind, sea and air mass, and the behaviour of sea birds to provide useful indications of future weather', and there seems no reason to suppose the sailors of antiquity were any less adept at reading their marine environment and making short-term weather predictions which allowed them to embark on brief trading voyages or fishing trips during favourable breaks in the winter weather.[113]

Cloud Cover

Appearing second on Vegetius' list of wintertime hazards confronting Graeco-Roman mariners and forcing the closure of the sea-lanes, is the dense cloud cover associated with this season. At first glance, modern pilot books appear to confirm that the winter months would indeed have presented major navigational difficulties for ancient seafarers. While the summertime skies of the Mediterranean are generally clear, with cloud cover barely averaging 1 okta, during the wintertime the average cloud amount is 4 to 5 oktas.[114] The appearance of greater levels of cloud cover during the winter months would certainly have made it difficult, if not impossible, for

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112 Air Ministry 1962: 187. See also Goldsmith & Sofer 1983: 43.
113 McGrail 1991: 87.
114 Cloud amount is measured in eighths, referred to by meteorologists as 'oktas.' Thus, clear skies register as 0 oktas; scattered cloud between 1–4 oktas; broken cloud between 5–7 oktas; completely overcast conditions as 8 oktas. For the amounts of cloud cover usually expected around the Mediterranean, see Air Ministry 1962: 171 figs. 1.79(a) 1.79(b); Mediterranean Pilot Vol. 1 1978: 18; Vol. 3 1988: 32; Vol. 4 2000: 33; Vol. 5 1999: 32.

ancient sailors to use celestial navigation when setting a course: it has therefore been argued that, 'The reason for the closure of the [wintertime] sea lanes was not only storms, but also the reduced visibility of the sun and stars due to persistent cloud cover in these months.'[115]

Once again, however, it would be erroneous to envisage the Mediterranean as an entirely uniform entity, and different regions of its seas and coasts experience diverse levels of cloud cover. For example, while the skies above the northern Adriatic record conditions of complete wintertime cloud cover between 70–75 percent of the time, on the Syrian coast it is 45–60 percent, while on the French Cote d' Azur less than 35 percent of winter days are usually completely overcast.[116] We should not therefore assume that overcast conditions posed the same problems to ancient navigators across the length and breadth of the wintertime Mediterranean. Furthermore, even if we follow the British Admiralty in taking 4 to 5 oktas as a guideline for the average levels of wintertime cloud cover across the entire Mediterranean, the ability to make safe and accurate voyages under such leaden skies should not be considered beyond the abilities of ancient navigators. Turning again to the stretch of water that separates Britain from the Continent, the Admiralty's pilot books for the Dover Strait and the English Channel also record average levels of summertime cloudiness for these two sea-regions as 4 to 5 oktas.[117] Even at the height of the summer sailing season, mariners plying the sea-lanes that connected Britain to mainland Europe must therefore have frequently undertaken voyages in cloudy conditions similar to those that would usually have been encountered by sailors making journeys on the wintertime Mediterranean. It has thus been correctly pointed out by E.R.G. Taylor that 'in the Mediterranean basin ... the summer sailing season is also the dry season, and so the season of clear skies ... an advantage to the early navigator of those regions which cannot be overestimated. Yet the Celtic and Germanic peoples contrived to navigate the very unpropitious seas of north-west Europe, where grey days at midsummer are common enough to excite little remark.'[118]

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[115] Connolly 1987: 115. See also Calcagno 1997: 97; Casson 1995: 271. While the shadow of the noon-tide sun was used by ancient sailors as a means of determining a southwards bearing (Aczel 2001: 25; McGrail 1991: 86; Taylor 1971: 6), the movements of various stars also acted as useful navigational markers in the night sky (e.g. Lucan, 8.177–181). See below (pp. 207–209) for ancient techniques of celestial navigation.

[116] Martyn 1992: 85, 123, 183.

[117] Channel Pilot 2002: 37; Dover Strait Pilot 1999: 32.

[118] 1971: 64.

Precipitation

While rainfall is rarely the most immediate of concerns for sailors, precipitation can occasionally cause severe problems for mariners attempting to pilot vessels along a coast; a modern sailing manual therefore points out that, 'visibility can ... be reduced to near fog level in heavy rain, not a cheerful experience anywhere close to land.'[119] As such, Vegetius is correct to list rainfall as a potential danger that was best avoided by ancient seafarers. Like cloud cover, to which it is of course closely linked, the rainfall regime of the Mediterranean region is also commonly represented as displaying pronounced seasonal variation: summers are usually regarded as being very dry, while autumn and winter are generally seen as the wettest seasons. Such a simplified understanding of Mediterranean precipitation rates provides additional support for the traditional argument that the sea-lanes of antiquity were closed to shipping during the winter half-year. However, as with the other weather-induced hazards facing ancient seafarers, close examination of the meteorological data highlights that the seasonal levels of recorded rainfall often vary widely across the Mediterranean and the weather records should once again lead us to question the viability of Graeco-Roman sailing calendars that treat the various seas and coasts of the region as meteorologically uniform.

Even a cursory examination of annual precipitation records demonstrates that certain regions of the Mediterranean are considerably wetter than others. Across the western basin of the Mediterranean the rainfall regime displays 'considerable variation from place to place, and some parts are more than twice as wet as others.'[120] Even across the relatively confined Aegean Sea there are sharp variations in precipitation rates. Whereas some coastal districts of Crete record an annual average of only 20 cm of rain, the northerly coasts of mainland Greece usually receive more than three times this amount over the course of the year.[121] As the most extreme examples in the Mediterranean, the coastline of the eastern Adriatic stretching between Trieste and Corfu can usually expect about 130 to 160 cm of rain each year, while, in stark contrast, on the Mediterranean shores of Egypt the annual average can measure as little as 5 cm.[122]

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[119] Cheedle 1994: 125.
[120] Mediterranean Pilot Vol. 1 1978: 19.
[121] Mediterranean Pilot Vol. 4. 2000: 33.
[122] For the Adriatic coast, see Mediterranean Pilot Vol. 3. 1978: 35; Egyptian coast, Mediterranean Pilot Vol. 5. 1999: 32. See also Air Ministry 1962: 3; Heikell 1990: 168.

The start and finish dates of the 'dry' and 'rainy' seasons can also vary radically, not only from year to the next, but also from one region of the Mediterranean to another. Therefore, while the rainy season for the south-east Mediterranean tends to be focused on the winter months of December and January, on more northerly coasts the highest concentrations of rainfall tend to arrive rather earlier in the year, generally falling at the beginning of the autumn.[123] Thus the Mediterranean coasts of Spain receive as much as 40 percent of their annual rainfall in September and October compared to the 15–25 percent usually recorded as falling in the winter months. A similar situation prevails on the southern coasts of France where the heaviest rain is also usually expected in the autumn.[124] As such, it should not be considered the case that the winter months of the Mediterranean have a monopoly on the region's rainfall. While a great deal of precipitation will indeed fall at the time of year in which historians generally assume the sea-lanes of the Graeco-Roman world to have been closed to mariners, nevertheless, similarly high levels of rainfall are also expected in the autumn and spring—yet according to the advice of authors such as Hesiod and Vegetius, maritime activities were regarded as possible, if not entirely without risk, during these seasons, and voyages were certainly being made by many seafarers at these times of year.

It should also be emphasised that in some regions of the Mediterranean it is not easy to clearly differentiate a 'dry' from a 'rainy' season. This is most obviously the case in the Adriatic where depression systems bring heavy rains to the area throughout autumn, winter and spring while, even at the heart of the summertime, heavy showers are of such frequent occurrence that 'in the Central and N Adriatic rainfall is more evenly distributed throughout the seasons largely due to the thundery outbreaks which are a common feature of the summer.'[125] Yet in spite of the regular summer downpours in this area, large numbers of ancient sailors must still have taken to the water, especially in the years following the establishment of the large Roman naval force at Ravenna. Navigators based with this fleet must have grown accustomed to making voyages under conditions of heavy rain and overcast skies. Even in a region such as the Aegean, which is rightly famous for its exceptionally dry summers, and where the southern coasts will often record a complete absence of rainfall during the summertime, 'The seasonal

123 King et al 1997: 31.
124 Wallen 1970: 148, 178.
125 Mediterranean Pilot Vol. 3. 1988: 35.

variation is less towards the NW where appreciable amounts of rain fall during the "dry season" of July and August.'[126] The lack of any major variation in the rainfall regimes of summer and winter is, however, most pronounced in regions outside the Mediterranean basin. For example, along the northern and western coasts of the Black Sea it is the summer months that record the highest levels of precipitation. Graeco-Roman mariners making voyages in the English Channel would, through necessity, also have had to come to terms with sailing in the rain, for even in the summer there are usually between nine and thirteen days in every month during which some rain will fall, while across the course of the year, 'Monthly averages show little seasonal variation.'[127] To therefore assume that Graeco-Roman navigators were incapable of operating in wet conditions is a fallacy and on some seas of the ancient world mariners must have been accustomed to sailing their vessels under leaden skies and through heavy rains.[128]

In addition to the problems that rain caused ancient sailors attempting to navigate accurately and safely, Vegetius also includes snow as a factor inhibiting wintertime seafaring. However, snowfall is an exceptionally rare occurrence across all the seas and coastal regions of the Mediterranean. Even along the extreme northern shores of the Adriatic, which usually receives the highest levels of snow anywhere in the Mediterranean, records show that there is an annual average of just six days of snowfall. Snow is virtually absent from the other coastal regions and some areas of the north African shoreline have never experienced snowfall in living memory.[129] However, outside of the Mediterranean basin snow is a more frequent occurrence. In the English Channel and Dover Strait snow is possible between November and April, yet even here, with only ten to twelve days in every year usually experiencing snowfall, it is a problem that scarcely deserves being listed as a major factor inhibiting maritime activities.[130] Only in the Black Sea, where snow is of frequent occurrence on all coasts between December and March, would it have presented a serious hazard to Graeco-Roman seafarers, especially in the more northerly regions where snow is as common as rainfall and can be expected to fall as often as seven to ten days in every win-

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126 Mediterranean Pilot Vol. 4. 2000: 33.

127 Dover Strait Pilot 1999: 38; Channel Pilot 2002: 37. For the Black Sea, see Black Sea Pilot 2000: 39 (Though the annual rainfall of 30 to 50 cm is relatively small).

128 See below (p. 238 f.) for the heavy rainfall that ancient seafarers would have had to endure when sailing to India.

129 Mediterranean Pilot Vol. 3. 1988: 35. See also Mediterranean Pilot Vol. 1. 1978: 19; Vol. 2. 1978: 14; Vol. 4. 2000: 33; Vol. 5. 1999: 32.

130 Channel Pilot 2002: 37; Dover Strait Pilot 1999: 33.

ter month, while it will also often combine with high winds to produce blizzard conditions of almost zero visibility.[131] However, the Black Sea was probably the only region regularly navigated by Graeco-Roman mariners where snow was likely to cause serious problems. Although we should not rule out the possibility that Vegetius was writing during a period when a colder climate brought greater levels of snowfall to the Mediterranean region than is presently the case, it is nevertheless more likely that, by listing snow as a hazard, the late Roman author is merely emphasising his own limited understanding of seafaring and the risks which wintertime sailing entailed.[132]

Visibility

While heavy precipitation can pose problems for accurate navigation, the principal reasons for reduced visibility on the Mediterranean is because of mist, fog and wind-blown dust.[133] Conditions of poor visibility certainly deserve mention on Vegetius' list of maritime hazards, and even sailors of the present-day are warned that 'The one word you do not want to hear in a weather forecast is fog; this is far more feared than strong winds.'[134] However, as with other elements of the Mediterranean weather, on examination of meteorological records it becomes apparent that visibility levels from around the various coasts and seas of the region are extremely diverse in their seasonal frequencies. Therefore, while Vegetius lists poor visibility as a wintertime hazard—as indeed it is along the northern shores of the Mediterranean, where mists and fogs are usually at their most frequent at this time of year—the Roman author fails to take account of the fact that along southern and eastern coasts low levels of visibility are usually a phenomenon associated with the summer months.[135] In the western basin of the Mediterranean, for example, it has been noted that, 'The season most liable to fog varies widely from place to place. In the neighbourhood of Gibraltar and the Alboràn channel, fog is most frequent in summer … and rare in

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131 Black Sea Pilot 2000: 39.

132 As noted above (pp. 58–63), when Vegetius was writing at the end of antiquity, it would in fact appear that the climate of the Mediterranean was broadly similar to that of today.

133 Air Ministry 1962: 167.

134 Cheedle 1994: 125. The term 'fog' is usually applied to visibility of less than 1000 yards (1097 metres), while visibility of less than 2 miles (3 km) is referred to as 'poor'.

135 The reasons for this north-south seasonal divide lie in changes to the interplay between contrasting air and sea temperatures that generate the mists and fogs. See Air Ministry 1962: 167 f.; Mediterranean Pilot V 1999: 32.

winter. In contrast, around Islas Baleares [Balearic Islands], the most fog occurs in January and February … and less in other months.'[136] This seasonally variable picture is repeated across the Mediterranean: while coastlines such as those of the Adriatic and the Gulf of Lions usually experience the highest incidence of reduced visibility in the winter or early spring, along the shores of much of north Africa, the Levant, and many areas of the Aegean, it tends to be the late spring and summer that register the highest frequencies of mist and fog.[137] We should therefore treat with care the sweeping statements of those maritime historians who, seemingly content to follow the writings of Vegetius, assume the wintertime to have been the season when 'more often do scud and mist veil the cliffs, headlands and mountains, which, sighted from far off, gave skippers fair warning to stay clear.'[138] Instead, on many of the seas and coasts of the Mediterranean, mists and fogs were more likely to be encountered during the months of summer, in the very heart of the ancient sailing season, rather than in the winter half-year. One such example of poor summertime visibility affecting ancient seafarers is supplied by Livy who, describing the closing stages of the Second Punic War, notes that the Roman invasion armada commanded by Scipio was thrown into confusion during its crossing from Italy to Africa in the summer of 204 BC when it encountered fog off the Carthaginian coast.[139] This was certainly no freak event for dense fog-banks remain a problem for modern-day fishermen and yachtsmen on this part of the North African coastline between early May and late September.[140] Furthermore, regardless of which season records the highest frequencies of mist and fog, the Mediterranean region still experiences considerably better visibility over the course of the year than is the case along the Atlantic coasts of north-western Europe.[141]

As well as the mists and fogs that occur along many of the southern and eastern regions of the Mediterranean during the summertime, this season also brings with it the navigational hazard of dust storms. Although

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136 Mediterranean Pilot Vol. 1 1978: 18.

137 For the Adriatic, see Mediterranean Pilot Vol. 3 1988: 35; Gulf of Lions, Mediterranean Pilot Vol. 2 1978: 14; Africa, Mediterranean Pilot Vol. 1 1978: 18; Levant, Mediterranean Pilot Vol. 5 1999: 33; Aegean, Mediterranean Pilot Vol. 4 2000: 33. See also, Air Ministry 1962: 167; Heikell 1990: 161.

138 Casson 1995: 271–272.

139 Livy, *Histories*, 29.27.1.

140 Pardey & Pardey 1981: 158–159.

141 Air Ministry 1962: 167. In areas such as the Dover Strait and English Channel, there is also little seasonal variability in the frequency of mist and fog (Dover Strait Pilot 1999: 38; Channel Pilot 2002: 37).

these storms are especially prevalent during the spring and autumn when dry sand and dust is whipped-up by the easterly moving depression systems, they remain a relatively frequent occurrence throughout the summer months. On the shores of North Africa, wind-blown dust is capable of reducing visibility to less than 45 metres, while the regional and localised winds that blow along coastal areas of the Levantine basin and the Aegean during the summer can create dust storms that severely impair visibility and hamper coastwise navigation; the powerful etesian winds are especially notorious for raising dust-storms in areas of the Aegean and eastern Mediterranean in the heart of the summertime.[142] Strong sirocco winds, which also tend to blow with greater force and frequency in the summer half-year carry Saharan sand from the south, creating fog-like conditions across a wide area of the North African coastline, while dust-laden siroccos can even affect summertime shipping along the coasts of south-east Spain, Malta and much of the south-east Mediterranean seaboard.[143] Although reduced visibility resulting from air pollution was undoubtedly far less of a problem in antiquity than it is today, natural heat-hazes produced during the hot summer months must occasionally have proved troublesome to ancient navigators and pilots.[144] On certain areas of the Mediterranean, especially the more southerly shores of the Sea, reduced visibility was therefore a hazard more likely to be experienced in the months of summer rather than those of the winter.

Darkness and Daylight

Although not a factor influenced by weather or sea conditions, the reduction in the hours of daylight between summer and winter is the first of the elements listed by Vegetius as posing a major handicap to wintertime seafaring. While navigating in darkness was not an insurmountable problem for Graeco-Roman sailors (see below, pp. 204–209.), there is little doubt that a large proportion of ancient shipping—especially mariners on board small coastal traders and heavily manned warships—would, whenever possible, have preferred to pass the night in ports and other sheltered anchorages, or beached on the shore. However, despite the importance that seasonal

142 Air Ministry 1962: 169 f.
143 Air Ministry 1962: 169 f.; Mediterranean Pilot Vol. 1 1978: 18; Vol. 5 1999: 33.
144 See Heikell's pilot guide to the Mediterranean that emphasises summertime hazes in the southern Adriatic and Ionian Sea (1991: 341). For air-pollution affecting navigation, see Calcagno 1997: 4; King et al 1997: 33.

variations in the lengths of daylight and darkness must have had for seafarers, and indeed those engaged in all outdoor activities throughout antiquity, it is a topic that has consistently been overlooked and all-but ignored by scholars.

The definitions of 'sunrise' and 'sunset' used to calculate the changing length of daylight in figure 2.12 refer to the moment at which the upper edge of the disk of the sun is tangential to the horizon.[145] However, prior to sunrise, and following sunset, light from the sun is reflected by the upper atmosphere down on to the surface of the Earth. While this twilight takes effect when the centre of the sun is still 18° below the horizon, it is only when it is within 6° of the horizon that there is sufficient light to allow outdoor activities to take place without the aid of artificial illumination.[146] This is the period of pre-dawn or dusk referred to as 'civil twilight', the times of which are represented in figure 2.13. It should also be noted that all the tabulated figures are estimates based on the longitude and, more importantly, the latitude of each location, and are calculated on the assumption that observation is carried out at sea level with an unobstructed horizon under 'average' atmospheric conditions; conditions that will, of course, often be lacking.[147] While the figures are therefore unlikely to be accurate to the nearest minute, they nevertheless present a clear picture of the seasonal changes affecting the times of daylight and twilight and, as is to be expected, there is an unmistakable trend from long summer days through to long winter nights. There are, however, some highly significant latitudinal variations in the length of day around the different seas and coasts of the Mediterranean.

Between the 14° 37' of latitude separating Trieste (45° 39' N) at the head of the Adriatic, from Alexandria (31° 02' N) on the Nile delta, is enclosed virtually the entire Mediterranean Sea. These two lines of latitude also encompass an area that, as a result of the curvature of the Earth, contains significant regional variations in the amount of daylight and twilight received across the course of a year. Figures 2.12 and 2.13 both clearly demonstrate that in mid-winter the more southerly regions of the Mediterranean will receive considerably longer hours of daylight and twilight than areas to the north: by contrast, in mid-summer it is the more northerly latitudes which

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145 All data for this and the following tables are generated from the U.S. Naval Observatory Astronomical Applications Dept. website—http://aa.usno.navy.mil/AA/data/docs/RS_OneYear.html.

146 U.S. Naval website—http://aa.usno.navy.mil/AA/faq/docs/RST_defo.html.

147 Furthermore, the tabulated figures are presented throughout in 'universal' time and do not take 'summer' or 'daylight saving' time into account.

benefit from longer days. Seasonal variations in the length of the hours of daylight, twilight, and darkness between mid-winter and mid-summer can also be seen to differ far more markedly on the more northerly seas and coasts of the Mediterranean, a fact highlighted in figure 2.14 which records the extension in the amount of daylight received on mid-summers day compared to that of mid-winter. Figure 2.14 also illustrates that Vegetius, while correct to emphasise the difficulties posed to ancient seafarers by the lack of daylight and the long hours of darkness associated with the wintertime, takes no account of the fact that the short hours of daylight would be felt far more acutely by sailors operating on the northerly waters of the Mediterranean, especially in areas such as the northern Adriatic or along the coasts of southern Gaul, where the variation between the length of winter and summer daylight can be as much as seven hours. In contrast, ancient sailors plying the shipping routes that ran along the North African coastline would experience considerably less variation in the seasonal ratios of daylight and darkness; mariners operating off the coasts that stretched from Egypt to Tunisia would have lost only about four hours between the mid-summer maximum and the mid-winter minimum. The flip-side to this wintertime picture is that from March through to September—in effect the seasonal limits traditionally applied to the ancient sailing calendar—mariners making voyages along the northern coasts of the Mediterranean would benefit from considerably longer days and shorter nights than did the sailors working along the southern shores. It is therefore interesting to speculate whether the increased amount of daylight in the higher latitudes of the summertime Mediterranean may have contributed to making the northern coasts more attractive to shipping throughout antiquity and beyond. The longer hours of daylight throughout the summer half-year, combined with a higher, more visible, coastal topography, as well as prevailing winds that generally blow off-shore, would have offered mariners sailing in the northern Mediterranean more favourable conditions than was the case on the often low-lying, lee shores of the southern Mediterranean coasts which could also experience almost two hours less daylight in the summertime than was the case on the most northerly shores of the Sea.

Even though the Greeks and Romans were well aware that variations in latitude also brought about a corresponding lengthening or shortening of the hours of daylight and darkness, depending on the season, it is unlikely that the length of daylight was, in itself, a factor that was important enough to dictate seasonal shipping routes. Nonetheless, it should not be ruled out that mariners aboard ships such as those of the Alexandrian grain fleet might have varied their route depending on the season at which they were making voyages between Egypt and Italy. Navigators who sailed in the summer possibly preferred to follow the sea-lanes that ran along the northern shores of the Mediterranean and, by so doing, would therefore have benefited from considerably longer hours of daylight during this time of year;[148] mariners sailing on board Alexandrian freighters still at sea between late autumn and early spring might instead have opted for a more southerly route which would offer the advantage of increased hours of daylight during the winter half-year.[149]

Tides and Currents

For Graeco-Roman mariners operating along Atlantic coasts, or making the voyage to India across the Arabian Sea, the state of the tide was a factor almost as important as that of the weather.[150] However, in the virtually land-locked Mediterranean 'tides are so irregular, in many parts scarcely perceptible, and mostly so inconsiderable in a nautical point of view, that with a few exceptions they are scarcely worth appreciating.'[151] Only in areas of extensive shallows—such as at the head of the Adriatic or in the gulfs of Syrtis, Gabes and Corinth—would ancient seamen have required some knowledge of tidal fluctuations. Yet, even in these regions of sea, the tides bring little change to the daily sea-level. For example, in the northern Adriatic, where Mediterranean tides are most pronounced, even at springs the tidal range is still generally no more than 0.8 m.[152] By contrast, around the coasts of Britain the tide will rise and fall anywhere from 1.5 to 14 metres twice daily.[153] This is not to say that the tidal range of parts of the Mediterranean, limited though it might be, could not cause problems for ancient sailors. According to myth the *Argo* was grounded at low tide in the shallows of the Gulf of Syrtis, while, in 252 BC, Polybius records that a Roman fleet also found itself stranded in

[148] This was the case for the Alexandrian grain ships mentioned in Acts 27–28 and by Lucian (*The Ship*, 5).

[149] A shipping route along the North African coast was certainly used by smaller coasting vessels (e.g. Synesius, *Letters* 4), while Casson also noted that Egyptian grain freighters frequently used this southerly route and would sail along the African coast at least as far as Cyrenacia when travelling westwards from Alexandria (1995: 298. See above, pp. 83–84).

[150] See McGrail (1983: 314 f.) for the effects of the tide and tidal streams on ancient seafarers attempting crossings of the English Channel, while the *Periplus Maris Erythraei* (45–46) also emphasises the importance of the tidal range along India's west coast.

[151] Smyth 1854: 173–174.

[152] Mediterranean Pilot Vol. 3 1988: 18.

[153] Cunliffe 1987: 34 f.

the gulf by the retreating tide.[154] However, for the most part, tides were a factor that could be safely ignored by ancient mariners plying the sea-lanes of the Mediterranean, and they would certainly have played no part in determining seasonal sailing strategies during antiquity.

Currents flowing around the Mediterranean are also generally weaker than is the case in the open expanses of the great oceans; throughout most of the Sea currents have a velocity that rarely exceeds 1 knot (1.85 kph), except when their speed is increased under the influence of strong winds or where they are channelled through straits such as those of Bonifacio and Messina, at the entrance to the Corinthian Gulf, or in the Euboean Sound.[155] As a result of the high evaporation rates of the waters of the Mediterranean—only one-third of which is replaced by the in-flow from rivers—the Sea requires a strong influx of water. This in-flow comes primarily from the Atlantic via the Strait of Gibraltar where the current generally averages $1\frac{3}{4}$ knots (3.2 kph), though it can reach as high as 5 knots (9.2 kph), especially during the summer when the volume and rate of water being drawn in from the Atlantic increases to counter the increased evaporation rates experienced in the Mediterranean during this season.[156] Water from the Black Sea also enters the Mediterranean through the Sea of Marmara and northern Aegean, setting up strong currents that usually run through the Bosphorus at 4–5 knots (7.4–9.2 kph), though they can be as swift as 7 knots (13 kph), while in the Hellespont the current averages about 3 knots (5.5 kph), rising to 5 (9.2 kph) in the more restricted sections of the channel.[157] In both the Bosphorus and Hellespont the currents usually run fastest in the late spring and early summer. (See above, p. 81.)

Within the Mediterranean the water circulates in a generally anti-clockwise direction, a pattern that remains reasonably constant across the course of the year with only relatively localised seasonal changes to the direction of the water flow (figures 2.15a–b).[158] It has already been seen that seasonal changes to the current regime of the south-eastern Aegean may have allowed Graeco-Roman seafarers to make northwards progress along the

[154] Apollonius Rhodius, *Argonautica*, 4.1240 f.; Polybius, 1.39.3.

[155] For the speed of currents around the Mediterranean, see Mediterranean Pilot Vol. 1 1978: 12 f.; Vol. 2 1978: 12; Vol. 3 1988: 18; Vol. 4 2000: 14; Vol. 5 1999: 17. For the Straits of Bonifacio and Messina, see Cognetti et al 2000: 281; for the Corinthian Gulf, see Cary 1949: 46; Meigs 1961: 375; for the Euboean Strait, see Dassenkis et al 2000: 237.

[156] Couper 1989: 45; Mediterranean Pilot Vol. 1 1978: 12; Walker 1962: 11.

[157] Horrocks 1981: 355 f.; Semple 1931: 65 f.; Walker 1962: 408.

[158] Couper 1989: 45; Walker 1962: 11; Williams 1999: 280.

Anatolian coastline during the winter half-year. (See above, pp. 82–83.) A similar situation may also have prevailed in the eastern Tyrrhenian Sea where the circulation pattern of the summer—in which the currents along Italy's west coast flow to the south—is reversed during the wintertime when, save for the section of coast off the toe of Italy, the current instead flows to the north (figures 2.15a–b). Such changes to the wintertime circulation pattern in this region of the Tyrrhenian Sea, married to the seasonal variation in the wind regime—in which a considerably greater frequency of winds blow from southerly directions during the winter months to replace the prevailing north-westerlies that are dominant during the summer (figures 2.3a–d)—would have made it considerably easier for north-bound vessels to make their way up this section of the Italian coast during the wintertime than was the case in the summer.

It was these seasonal changes to the sea currents and wind patterns along the western Italian coast that may explain why the Alexandrian grain ship, the *Castor and Pollux*, which carried St Paul to Puteoli, put out from Malta in late January or early February. (See above, pp. 36–40.) The resumption of the voyage so early in the year would not only have permitted the vessel to deliver its cargo of grain in the late winter or early spring, when the reserves of Rome would be coming under the greatest pressure, but a departure from Malta at this time of year would also have allowed the freighter to utilise the more favourable currents and winds that were likely to be experienced during the winter and early spring. It was therefore noted by Casson that, 'From Messina to Puteoli, a course roughly NNW, a vessel would have to tack steadily unless, as happened to St. Paul (Acts 28:13), the skipper was willing to wait over at Rhegium for a southerly breeze which would carry him directly northward.'[159] However, Casson failed to note that it was as a direct consequence of the wintertime departure from Malta that the apostle's vessel had a far greater likelihood of experiencing these favourable southerly winds which, in addition to the north-setting currents, made for relatively simple passage-making up Italy's west coast. Had the voyage been made at the heart of the summer sailing season, when the prevailing winds blow from the north-west, then the wait at Rhegium for an advantageous breeze from the south would probably have been considerably longer than the single day which St Paul's ship was required to spend at the port city. Taken together with the seasonal variations to the wind and current regimes affecting the eastern Aegean, the wintertime voyage

[159] 1950: 50.

of the *Castor and Pollux* therefore provides a strong indication that Graeco-Roman mariners were willing to make wintertime journeys, regardless of the increased risk of encountering heavy weather or the navigational difficulties posed by overcast skies or poor visibility. It can be argued that the captain and/or owner of the grain freighter may simply have been incredibly fortunate—his risk-taking rewarded with the favourable winds and currents only through chance. However, such a view surely downplays the maritime skills and nautical knowledge of ancient sailors who were probably well-versed in the seasonally shifting wind and current patterns of regions such as the eastern Tyrrhenian Sea; a knowledge that could only have been borne from many previous experiences of wintertime voyages in these waters.

Inter-Annual Variability

It should be emphasised that, in addition to the inter-regional variability that exists around the various seas and coasts of the Mediterranean, the Sea also experiences great inter-annual fluctuations with considerable differences in weather often recorded from one year to the next. The point is perhaps most clearly made by the casual observations of James Henry Bennett who, as a wintertime resident of Mentone, on the Genoese Rivera, during the middle years of the nineteenth century, noted that, 'As in England, and in most other regions, the seasons, and more especially the winter, vary in different years, so that it is difficult to form a correct opinion from the experience of any one year.'[160] Such an opinion is borne out by recent meteorological data highlighting that, 'The Mediterranean climate is characterised not only by seasonal variability but also by marked variability within and between seasons.'[161] Such inter-annual variability in the weather of the Mediterranean emphasises the impracticality of attempting to create sailing seasons with start and finish dates as rigidly delineated as are those proposed in the ancient maritime calendars of Hesiod and Vegetius, or that set in place by order of the emperor Gratian. It is, however, the ceremony of the *Navigium Isidis*, celebrated on March 5, which most clearly emphasises the impracticality of placing a seasonal straitjacket around ancient seafaring practices. (See above, pp. 40–41.) In Apuleius' *Metamorphoses*, the central character, Lucius, while spending his final night in the form of an ass on

[160] 1870: 70.
[161] King et al 1997: 30. See also Air Ministry 1962: 44.

the shoreline of Cenchreae, drifts off to sleep with the weather and sea conditions on the Saronic Gulf described as still being wintry in aspect—the skies are dark and overcast, the air cold and frosty, rain reduces the visibility, and strong winds send waves breaking against the beach—in essence the same elements listed by Vegetius as making wintertime sailing especially hazardous. By contrast, come the arrival of the *Navigium Isidis* with the dawn of the following morning, Lucius is awoken by the goddess Isis to witness the sudden appearance of spring weather which allowed the seas to be opened up for navigation:

> For a sunny and calm day had come close on the heels of yesterday's frost, so that even the songbirds were enticed by the spring warmth to sing lovely harmonies ... The mighty roar of the tempests was stilled and the boisterous swelling of waves subdued; the sea, now calm, lapped quietly against the shore. The sky too, its darkness dispersed, shone bare and clear with the brilliance of its own true light.[162]

Early March in the Mediterranean is, however, a period of meteorological transition when weather conditions are highly variable. It is therefore impossible that, for every year throughout antiquity, the weather of March 5 could be relied upon to provide conditions sufficiently favourable to allow the ceremonial launching of the Ship of Isis from Cenchreae, let alone for seafarers to suddenly return to the sea.[163] Instead, there were probably many years when the weather would have allowed shipping to get underway earlier in the spring, as is possibly implied by the earlier *ploiaphesia* celebrated at the start of January,[164] and the Elder Pliny's belief that the sailing season commenced in early February.[165] In other years, the weather and state of the sea would probably have forced a postponement of the festival for a few days until conditions provided an opportunity to set the ceremonial vessel on the water and allow it to sail safely away from the shore, not only at Cenchreae, but also at the numerous coastal sites around the Mediterranean where the festival was celebrated. Of course, even in the days and weeks following the Isiac ceremony—or, indeed, any of the start dates for the sailing season advised in the ancient texts—there could be no guarantee that the weather during these spring months would prove favourable to seafaring. We might therefore expect Graeco-Roman sailors to be rather more flexible in regard to the limits of the maritime season than seems to have been the

162 Apuleius, *Metamorphoses*, 11.7.
163 For March 5 AS the date when the *ploiaphesia* was celebrated at Cenchreae, see p. 41.
164 See Witt 1971: 181, and above, p. 41.
165 *Naturalis Historia*, 2.47.125.

case for the social elites who penned the surviving seafaring calendars of antiquity. Despite their superstitious reputations, practical seamen would no doubt often have preferred to follow the dictates of nature rather than adhere to the date-range set down in theoretical sailing timetables or ceremonial religious festivals.[166]

The Mediterranean Climatic Regime: Conclusion

The seasonally shifting character of the weather and seas which faced sailors on the Mediterranean is fundamental to an understanding of the Graeco-Roman seafaring season, a fact acknowledged by writers of antiquity, most notably Vegetius, who highlight the increased likelihood of unfavourable weather conditions during the wintertime as the determining factor around which was framed the seasonal limits of the sailing calendars. However, even a body of water as small and confined as the Mediterranean exhibits profound meteorological variations; modern meteorological data clearly highlights that Graeco-Roman mariners sailing in some regions of the Mediterranean would have been far more at risk of experiencing powerful winds and heavy seas in the wintertime than were sailors making voyages across other areas of the Sea. Furthermore, modern records also emphasise that, on even the most hazardous regions of the Mediterranean, the seafarers of antiquity were considerably less likely to encounter gales and rough seas than was the case for mariners plying their trade on the North Atlantic, the Black Sea, or the Indian Ocean.

Although this concludes the analysis of the prevailing Mediterranean climatic regime, it is the weather conditions usually experienced across the region that form the foundation upon which rests the following two chapters. Chapter four will therefore focus on the abilities of Graeco-Roman seamen to navigate in conditions of thick cloud cover, heavy rain or poor visibility which, together with the reduction in the hours of daylight, are features more usually associated with the winter months. The following chapter will, however, analyse the ability of the different types of vessels sailing the ancient Mediterranean to cope with the strong, blustery winds and rough seas of the wintertime and, by so doing, attempt to re-evaluate the potential for Graeco-Roman shipping to remain on the water, even during the periods of the year at which the Sea has traditionally been regarded as closed to seafaring.

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166 For the superstitious nature of ancient sailors, see, for example, Casson 1994: 155.

CHAPTER THREE

SHIPS AND SAILS

While historians studying maritime activities on the ancient Mediterranean have tended to accept the restrictive seasonal limitations laid down by the Graeco-Roman writers, scholars focusing on the medieval period have been considerably more active in promoting the possibility that seafarers of the Middle Ages were prepared to make regular wintertime voyages. It has thus been argued that, from the beginning of the medieval period, changes in the nature of ship construction and the type of sail commonly in use permitted an increase in maritime activity during the winter half-year. Michael McCormick has therefore asserted that during the early Middle Ages, 'the period in which the sea was reckoned to be closed … was shorter than that which appears to have been observed in antiquity.'[1] However, the traditional view which holds sway in the academic literature is that it was only during the later medieval period, with the appearance of sturdy merchant ships, most notably the cog, together with the introduction of the magnetic compass and maritime chart, that seafarers of the Mediterranean finally came into possession of the technology that allowed a large volume of shipping to remain at sea during the wintertime. As such Pryor has noted that 'the diffusion of the mariner's compass and the development of the cog and carrack ended finally whatever closing of the seas in winter there had ever been in absolute terms.'[2] However, these theories, which argue for a seasonal revolution in seafaring practices during the medieval period, are open to challenge. While the ability of ancient mariners to navigate accurately and safely will be analysed in the next chapter, the following pages will attempt to demonstrate that medieval developments in

[1] McCormick 2001: 462 See above, pp. 4–6.

[2] Pryor 1988: 88. Braudel has also claimed that, 'The arrival of the northern "cog" … seems to have marked the beginning of the Mediterranean victory over bad weather' (1972: 252), and similar sentiments are expressed by Lane (1963: 333 f.). While cogs first appeared in the Mediterranean in the early years of the fourteenth century (Balard 1994: 135; Ellmers 1994: 39; Friel 1994: 78), they had already been in use for at least two centuries in Atlantic Europe, serving as the primary cargo vessels of the Hanseatic League from the second half of the twelfth century until the mid fifteenth century (Ellmers 1994: 38; Greenhill and Morrison 1995: 229; Guilmartin 2002: 37; Hoheisel 1994: 257).

the design and construction of ships and sails, while highly important and ultimately crucial in allowing the European nation states of later centuries to project political and economic power across the globe, did not, on their initial introduction, radically increase the potential for wintertime voyage-making from that which had been the case in antiquity. Indeed, it will be argued that the hulls and sails of ancient vessels were not only equally as competent at dealing with the violent, blustery winds and large seas that might be experienced on the wintertime Mediterranean, but that, in many respects, the ships of the Graeco-Roman period were markedly more resilient to heavy weather than were the vessels of the early Middle Ages, or even the cogs which began to appear in the Mediterranean at the beginning of the fourteenth century.

Construction Methods

From the early medieval period through to the present day, wooden vessels of the Mediterranean have, virtually exclusively, been constructed in what is referred to as the 'skeleton-first' or 'frame-first' shipbuilding technique (figure 3.1). As the name implies, it is the frame and ribs of the ship which are constructed first and, once they have been secured in place, then the planking (the strakes) which comprise the sides of the vessel are nailed directly to them: a hull built in this manner therefore derives virtually all its structural strength and rigidity from the internal skeleton of the framework. However, with the advent of maritime archaeology and the study of ancient shipwrecks it became apparent that the principal method of Mediterranean ship construction during the Graeco-Roman period was of a radically different character—one that is generally referred to as the 'shell-first' technique (figures 3.2–3.3). This construction process was in use from at least the fourteenth century BC where it is attested in the remains of the Late Bronze Age Ulu Burun shipwreck, excavated off the coast of south-west Turkey.[3] By at least the beginning of the Greek Classical period, the shell-first method of hull construction had become the principal method of shipbuilding for sea-going vessels on the Mediterranean and was to remain so until the end of the Roman Empire. In direct contrast to the later skeleton-first method, the strength and rigidity of a vessel built in the shell-first manner was supplied not by the internal framework but through the planking of the hull. This was

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[3] Bass 1986; Bass et al 1984; Pulak 1998.

achieved by building up the sides of the vessel, one strake at a time, from the central keel; the planking was laid edge-to-edge and locked together with tight-fitting mortice-and-tenon joints which were then pegged in place with dowels of hardwood (figure 3.4). As noted by J.R. Steffy, the tenons were made exceptionally strong because 'they were more than mere seam connectors … These slips of wood acted as small internal frames, with their length and close proximity adding considerable stiffness and integrity to the shell of the outer planking.'[4] Indeed, it was these closely spaced, interlocking joints that provided the vast majority of an ancient vessel's strength; the internal framework provided very little additional strength and was only added once much of the hull was already in place.

Perhaps the best example of this Graeco-Roman method of hull construction is the Kyrenia vessel, a well-preserved and intensely studied shipwreck of a small merchant vessel that sank off the northern Cypriot coast near the town of Kyrenia in the late fourth century BC. When excavated at the end of the 1960s, the wreck yielded almost 75 percent of its original hull for investigation (figure 3.5). It has been estimated that, in its complete state, the hull of the small ship would have contained about 4000 mortice-and-tenon joints, usually spaced about 12 cm from the centre of one joint to the centre of the next. The tenons themselves measured between 15–20 cm in length and were individually shaped to fit their mortice holes. Like the pegs holding them in position, the tenons were made from a strong hardwood, Turkey oak, which provided strength and rigidity for the Aleppo pine softwood planking that constituted the hull.[5] Although ancient vessels like that wrecked at Kyrenia derived very little extra hull strength from the internal framework (which was probably not even set in place until much of the hull's planking had been completed), nevertheless, this Graeco-Roman form of shell-first ship construction created hulls that 'were supremely strong, for they were built in the very fashion that is the hallmark of the ancient shipwright, one that more resembles cabinet work than carpentry … The result was a hull that was absolutely staunch and incredibly strong.'[6]

While no wrecks have been recovered of ancient warships, archaeological evidence indicates that these military vessels were also constructed

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[4] 1994: 46. For additional information on the ancient shipbuilding process, see Casson 1964; 1995: 201 f.; Coates 1995: 131 f.; McGrail 2001: 122 f.; Morrison 1993: 13 f.; Steffy 1989: 250, 1994: Chapt. 3.

[5] Steffy 1985, 1989, 1994: 42 f.; Swiny and Katzev 1973.

[6] Casson 1991a: 9–10.

using the same shell-first method identified in the numerous wrecks of contemporary merchant vessels. The discovery of a bronze warship ram dating to the early second century BC that was recovered from the sea off Athlit, Israel, came complete with sixteen fragments of the vessel's bow still adhering to it and these splinters from the ship's hull provided clear evidence that the Graeco-Roman shell-first construction technique was also used on the hulls of ancient warships.[7] However, the shipwrights who constructed this ancient war-galley were well aware of the need for greater rigidity throughout the hulls of warships in order to counteract the heavy stresses that affect a long and narrow hull.[8] Thus, while the Athlit ram indicates that the mortice-and-tenon joints used in Hellenistic warship construction were spaced 12 cm apart—a similar distance to those in the hull of the vessel discovered off Kyrenia—extra strength was provided for the war-galley by giving the tenons a thickness of 1.1 cm, twice that found in the Kyrenia shipwreck.[9] The remains of a Punic galley that sank off the coast of western Sicily near Marsala (ancient Lilybaeum) during the mid-third century BC also emphasise the need for greater rigidity in a slender hull, and although the wreck was of an oared merchant vessel rather than a ship of war, its beam to length ratio of 1:7 necessitated that the mortice-and-tenons be closely spaced, with an average of only 10 cm from the centre of one tenon to the centre of the next. The mortice-and-tenons were therefore considerably more frequent throughout this galley's hull than was the case in the broader-beamed Kyrenia sailing vessel, which had a breadth to length ratio of 1:3.[10] When it came to constructing the *Olympias*, a replica of a fourth century BC Athenian trireme, the modern naval architect and shipwrights tasked with creating the reconstruction felt that about 20,000 mortice-and-tenon joints needed to be incorporated into the hull, each spaced 9.2 cm apart with a tenon thickness of 1.2 cm.[11]

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7 Casson et al 1991.

8 The longitudinal bending stresses on a ship's hull are known as 'hogging and sagging'.

9 Steffy 1983; 1994: 59.

10 Frost 1974: 48; Morrison et al 2000: 201; Steffy 1994: 59.

11 Coates 1989: 20; Coates et al 1990: 3; Morrison et al 2000: 201 f. It is worth noting that during the first set of trials of the *Olympias* in 1987, in spite of the vast number of these closely spaced, mortice-and-tenon joints, the ship's hull nevertheless suffered bending stresses—hogging—because of poorly fitting tenons which allowed slippage in their mortices (Coates 1989: 69 f.). That such a problem befell the replica highlights the high levels of craftsmanship demanded of ancient shipwrights to ensure Graeco-Roman warships did not suffer from similar ill-effects; a level of craftsmanship which present-day ship builders, aided by modern technology, still found exceptionally difficult to replicate.

This is not to say that the shell-first, mortice-and-tenon construction method was the only shipbuilding technique used by the shipwrights of antiquity. The 'sewn boat' method of ship construction—in which the planking of the hull was held in place by means of lashings passed through pre-bored holes which were then secured with pegs—dates back at least as far as c. 2600 BC, where the technique was used to construct the funerary ship of Cheops (Khufu) discovered in a chamber close to the Great Pyramid at Giza in 1954.[12] Shipwrecks displaying the sewn boat method of ship construction have also been discovered in the western and central Mediterranean; vessels such as those recovered near Bon-Porté in southern France, or Giglio in Etruria, both of which date to sixth century BC, provide evidence of the widespread and enduring nature of this shipbuilding technique.[13] When campaigning in Spain in 49 BC, Caesar also mentions the use of the currach or coracle, vessels constructed by stretching animal skins over a lightly constructed wooden frame to produce relatively small, lightweight boat. Lucan also refers to small vessels constructed from animal hide being used in the Po Valley.[14] As will be seen in more detail below (pp. 117–119), the Celtic peoples of north-western Europe also developed their own shipbuilding traditions, creating vessels that relied more heavily upon skeleton-first construction. It was, however, the shell-first, mortice-and-tenon shipbuilding technique that was the method by which the vast majority of Graeco-Roman vessels used on the Mediterranean were constructed—at least by the Archaic period, when Hesiod put forward his advice regarding the limits of the sailing season, through to the maritime calendars set down by Vegetius and Gratian during the late Roman Empire. As such, it is this process of ship construction that will be the focus of the following pages.[15] However, while archaeological, iconographic and literary evidence for ancient hull and sail construction indicate broadly similar trends in ancient shipbuilding practices, it should be borne in mind that there must have been considerable regional variations in the methods of ship construction around the various coasts of the Graeco-Roman Mediterranean. In a study of the sailing vessels of Europe and Asia published at the beginning of the last

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[12] See, for example, McGrail 2001: 23.

[13] Bon-Porté—Parker 1992: 74–75; Pomey 1981; Giglio—Bound 1991; Bound and Vallintine 1983; Parker 1992: 192. For useful overviews of the sewn-boat construction technique in the ancient Mediterranean, see McGrail 2001: 126, 134 f., 145 f.; 2004: 134, 138 f., 146 f.; McGrail & Kentley 1985: 19 f.

[14] Caesar, *Bellum Civile*, 1.54; Lucan, *Pharsalia*, 4.131–133.

[15] See A.J. Parker's (1992) corpus for archaeological evidence of the dominance of shell-first technique throughout the Graeco-Roman Mediterranean.

century, Herbert Smyth therefore pointed out that, 'A journey of a hundred miles along any fairly populated coast will disclose some variation in rig, or in build, or in both, prompted by some curious tradition, or necessitated by some meteorological or physical condition prevailing in that locality, and affected almost invariably by other considerations of an historic or practical kind.'[16] Similar diversity no doubt also existed around the shores of the ancient Mediterranean.

The Transition in Shipbuilding Techniques

Towards the end of antiquity shipwreck evidence indicates a slow yet steady transition in shipbuilding techniques with a move away from the shell-first method that had dominated the Graeco-Roman period towards ever-greater reliance on the strength provided by the internal framework of the hull. While the limited number of wrecks dating to the later Roman and early medieval periods makes it difficult to ascertain the pace and pervasiveness of this transition across the Mediterranean, the pattern of change can, nevertheless, be plotted against a handful of excavated shipwrecks, most important of which are the two wrecks recovered from Yassi Ada, Turkey.[17] The older of the two, which sank in the fourth century AD, comprised a hull that, although displaying the typical Graeco-Roman edge-joined strakes, had mortice-and-tenon joints that were smaller, spaced more widely apart, and were less tightly fitted than was the case in shipwrecks dating to earlier centuries (figure 3.6). Furthermore, the frame of the ship appears to have been erected after only the first five strakes had been set in place.[18] In a poorly preserved wreck which sank close by, but which dates to about AD 625, the transition towards frame-first construction is even more pronounced. While mortice-and-tenons were still being used by the shipwrights of the period they had become spaced well apart and were left entirely unpegged and their purpose appears to have been to aid in the align-

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[16] Smyth 1906: 8 f.

[17] For the lack of information concerning the vessels that plied the sea-lanes of the Mediterranean from the end of antiquity until the twelfth century, see Pryor 1994: 59. However, a number of new and exciting finds of wrecks dating to the early medieval period have been found and excavated over recent years at sites such as Olbia in Sardinia, Istanbul, and Tantura and Dor in Israel. A good deal more information on the transition in hull construction from the late antique to the medieval periods will therefore hopefully soon be available.

[18] Bass and van Doornick 1971; van Doornick 1976. See also reviews in Pryor 1994: 65 f. and Steffy 1994: 79 f.

ment of the planking rather than in providing any additional strength and rigidity to the hull (figure 3.6). Instead, the hull of the early medieval ship relied virtually exclusively on the internal framing for its sturdiness.[19] By the early years of the seventh century AD, the construction techniques of Mediterranean vessels therefore appear to have undergone a protracted, yet nonetheless radical, transformation from those that had been used when building ships such as that discovered off Kyrenia, wrecked almost a millennium earlier. This ever-increasing reliance on the frame of the vessel continued throughout the medieval period and, by at least the eleventh century, vessels such as that excavated at Serçe Limani, Turkey, were produced using a strong and relatively sophisticated skeleton-first construction process without any use of mortice-and-tenons (figure 3.6).[20]

The transition in hull construction that took place towards the close of antiquity and during the early Middle Ages does not, however, appear to have brought with it any immediate improvement in the provision of hull strength. It would, in fact, appear to be the case that, during the early medieval period, shipbuilding was at a level of technical sophistication considerably below that attained by shipwrights working on the shores of the Graeco-Roman Mediterranean when 'ships had been masterpieces of the carpenter's art. The skill and labour involved in their construction with hand tools demand admiration.'[21] Indeed, it is likely that the gradual transition from the shell-first shipbuilding process to that of the skeleton-first method took hold not because of the inadequate strength that the mortice-and-tenons bestowed upon the hulls of ancient vessels, but rather as a consequence of changes in the socio-economic environment of the Mediterranean world. With increasing shortages of slaves, timber and other raw materials, the labour-intensive art of ship construction as practised by earlier generations of Mediterranean shipwrights became economically unviable by the later years of the Roman Empire. This led, slowly but surely, to the adoption of the quicker, easier and more cost effective method of skeleton-first shipbuilding.[22] However, while increasing reliance on the internal frames as the means of providing strength for sea-going vessels made for greater savings in the labour-hours and materials necessary in the

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19 van Doornick 1997: 469; McGrail 2004: 161 f.; Steffy 1982; 1994: 80 f.

20 Bass 1979; Bass and van Doornick 1978; Steffy 1994: 85 f.

21 Pryor 1994: 65. See also Casson 1991a: 9 f. (quoted above, p. 109); Morrison et al 2000: 7.

22 Kreutz 1976: 106 f.; Pryor 1994: 64; Steffy 1994: 85; White 1984 24. It should be noted that although medieval skeleton-first ships generally required less skill from the shipwright, they were built to a set design, necessitating more forethought and planning.

construction process, the early generations of hulls produced in this manner lacked the structural strength and integrity of those created at the apogee of the ancient shipwrights' craft. Even Barbara Kreutz, one of the principal advocates of the increased seaworthiness—and thus the seasonal range—of early medieval sea-going vessels, has therefore noted that, although '[i]t is tempting to think in terms of technological improvements as plainly representing "progress" … any Greek or Roman shipwright not gifted with foresight would surely have rejected an "advance" such as this. After all, it meant replacing craftsmanship with quick and seemingly often even slapdash work; a carefully constructed vessel of the old-style may well have been more seaworthy than most of the early new-style ships, despite their integrated framework.'[23] The greater strength and seaworthiness which the shell-first technique provided for the hulls of ancient vessels, when compared to early medieval ships built in the skeleton-first method, has more recently been emphasised by the naval architect, John Coates: 'Framed construction is heavier, cheaper, easier to repair, but inherently weaker and structurally less elegant than the shell construction of the ancient Mediterranean.'[24] The current archaeological evidence therefore provides little support for the belief that the changed construction techniques used on the hulls of early medieval vessels offered Mediterranean mariners of this period the opportunity to extend the sailing season further into the wintertime than had been possible for Graeco-Roman sailors. Indeed, it would appear that the reverse was in fact more likely to have been the case: the shell-first shipbuilding technique provided the seafarers of antiquity with hulls that were more resilient to rough seas than was the case for vessels produced in the early centuries of the Middle Ages.

It is also interesting to note that the cog, the vessel traditionally regarded as responsible for freeing Mediterranean mariners from their seasonal shackles, was constructed in a technique generally known as bottom-based ship-building. As the name would imply, the shipwrights constructing cogs for use by traders operating from Hanseatic cities of the Baltic and North Atlantic produced vessels that were built up from the bottom. While the sides of the ship were constructed of planks overlapping one another, clinker (lapstrake) fashion, and fastened directly to one another with double-

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[23] 1976: 106–107. Michael Balard also highlights that the vessels constructed by the Muslims during the early medieval periods were 'less solidly constructed' than those built during antiquity (1994: 133. See also Eickhoff 1966: 155 f.).

[24] 1993: 22.

clenched nails, the flat, flush-planked bottoms of cogs were instead laid edge-to-edge. It has therefore recently been noted that 'a cog is structurally a mix of shell and skeleton, with a greater reliance on skeleton in the bottom.'[25] For the shipwrights of north-western Europe, building vessels to endure the harsh conditions of the Atlantic and North Sea, the shell-first shipbuilding technique therefore remained an integral part of their construction repertoire throughout the medieval period.[26] Even well into the twentieth century, ships constructed using the shell-first technique were still being produced in areas of Scandinavia, while on the coasts of the Black Sea during in the late nineteenth century vessels known as *tserniki* or *chektirme* were also being constructed in a shell-first manner; the hull planks stapled to each other edge-to-edge before being fastened to the framework.[27] It was therefore right up until the final days of working sailing vessels that the shell-first construction technique survived as a viable method for creating sea-going ships capable of weathering the conditions of the North Sea, Baltic and the Black Sea; regions where weather and sea conditions are generally more hazardous for maritime activities than is the case on the Mediterranean. Archaeological and textual evidence therefore provide strong indications that the ancient shell-first shipbuilding process was capable of producing hulls sufficiently strong and seaworthy to allow vessels to endure the heavy weather of a Mediterranean winter.

It appears to be the case that the shell-first technique used by the ancient shipbuilders of the Mediterranean created hulls that were considerably

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[25] Hocker 2004: 79. Excavated from the River Weser, near Bremen, in northern Germany, the well-preserved remains of a cog dating to the third quarter of the fourteenth century was the first of numerous archaeological examples to clearly highlight this combination of shell- and skeleton-first construction techniques within the hull of cogs operating in the waters of the north-western Atlantic between at least the eleventh and the fifteenth centuries. (See, for example, Hoheisel 1994: 257; Baykowski 1994: 261; Unger 1997: 72.)

[26] The Anglo-Saxon Sutton Hoo vessel of Mound 1, which dates to the early seventh century AD, was constructed from oak planking laid clinker fashion and directly attached to the strake below with clenched iron nails, while only afterwards were the twenty-six internal frames pegged into place to reinforce the hull (Evans 1975). A similar construction method was employed in the early tenth century Gokstad ship from Vestfold, Norway (Wexelsen 1979–1980), and the five Skuldelev ships from Roskilde, Denmark (e.g. Crumlin-Pedersen 1991). The vessels from both these Viking age finds exhibited variations in hull design and construction. Nevertheless, they followed the same process of clinker fashion construction in which the shell was assembled first; each strake was attached with clenched iron nails to the plank below, before the internal framework was inserted to provide much-needed additional strength to the hull.

[27] Scandinavian shell-first ships—Casson 1995: 206 fnt. 24; Christensen 1997: 173. Black Sea vessels—Prins 1995: 80.

stronger than those built by the late medieval shipwrights of north-west Europe. While both the ancient and medieval construction methods are termed 'shell-first', all similarity ends with this basic definition. Whereas Graeco-Roman shipwrights took great care in laying the planking of the vessels edge-to-edge, joined together with closely spaced, pegged, mortice-and-tenons, the method used along the European Atlantic seaboard during the Middle Ages consisted of over-lapping planking laid clinker (lapstrake) fashion, in which the lower edge of each strake overlapped the upper edge of the plank below, the two being attached together with iron clenches.[28] Furthermore, while the Graeco-Roman shell-first shipbuilding tradition relied on close-fitting mortice-and-tenon joints to ensure the hull was watertight, the cog, like all vessels constructed in the Nordic tradition, relied on caulking inserted between the overlapping planks to keep out water. The methods of ship construction from both the ancient Mediterranean and medieval Atlantic saw the frame fitted into the hull only after much of the shell had already been built up. However, because the clinker-built shell of medieval vessels provided little in the way of strength and rigidity to the hull—certainly when compared to that provided by the Graeco-Roman shell-first method—ships built in this manner derived the greater part of their sturdiness from their frames.[29] There seems little doubt that, if built with care by a skilled shipwright, the ancient method would therefore have produced a hull that was lighter yet considerably stronger than was the case for even late medieval vessels. However, it should be borne in mind that the cog, like other vessels built in the Nordic shell-first tradition and originating from medieval north-west Europe, appears to have been capable of sailing on rough seas: the caulked, over-lapping planking, though lacking the strength and rigidity which the closely spaced mortice-and-tenons bestowed on the strakes of Graeco-Roman ships, was capable of flexing under the force of the waves, producing seaworthy vessels able to remain on the water in even heavy seas.[30] While shell-first medieval cogs were sturdy enough to withstand the rigours of a Mediterranean winter and are attributed with opening up the Sea to wintertime shipping, there seems little reason why the shell-first hulls of Graeco-Roman ships—constructed with high levels of skill and

[28] de Souza 2002: 15; Hoheisel 1994: 257. Although, as already noted, on vessels such as the Bremen cog, the first four strakes making up the flat bottom of the vessel were laid in edge-to-edge, carvel fashion (Hoffmann and Hoffmann 2009: 285; Hoheisel 1994: 257, 259 fig. 2).

[29] Baykowski 1994: 261; Hoheisel 1994: 257.

[30] For the flexing of hulls constructed in the Nordic tradition, see, for example, Wooding 1996: 23 f.

technical sophistication which allowed ancient vessels to attain considerable strength and rigidity—should not also have regularly ventured onto the Mediterranean during the winter months.

The Romano-Celtic Shipbuilding Tradition

In north-west Europe the so-called 'Romano-Celtic' or 'Gallo-Roman' shipbuilding tradition produced vessels very different from those in use on the ancient Mediterranean.[31] Instead of the closely spaced mortice-and-tenons that were used to connect the hull planking of Graeco-Roman shell-first vessels, Romano-Celtic ships appear to have been built clinker fashion, and derived part of their strength and rigidity from large internal timbers.[32] During Caesar's campaign of 56 BC, directed against the Veneti tribe that dwelt in southern Amorica (the modern Breton Peninsula), the Roman proconsul witnessed first-hand ships that were constructed in this manner. Caesar thus stressed the importance of the internal timbers of the Venetic ships which, he noted, 'were made of beams a foot thick and fastened in place with iron bolts as thick as a man's thumb.'[33] Strabo also noted how Celtic shipwrights 'make their ships with broad bottoms, high sterns, and high prows; they make them of oak (of which they have a plentiful supply), and this is why they do not bring the joints of the planks together [i.e. there are no edge-fastened mortise-and-tenon joints] but leave gaps; they stuff the gaps full of sea-weed'[34] Such literary references imply a form of clinker construction as well as some internal strengthening of the vessels. Shipwrecks from the Roman provinces of the north-western Atlantic and dating to the early first millennium AD also bear out the written testimony. Peter Marsden therefore concluded that the heavy oak timbers from a wreck excavated near the River Thames at Blackfriars in London, dateable to the second century AD, had been constructed in a fashion that was primarily skeleton-first:

[31] It has been correctly pointed out that use of 'Romano-Celtic' or 'Gallo-Roman' as terms of vessel classification can be somewhat misleading: rather than describing a fusion of two shipbuilding traditions (although this cannot be ruled out), the binomial refers instead to the geographical distribution of this vessel-type across Celtic north-west Europe, while the date-range of archaeological finds of ships constructed in this fashion are focused on the period throughout which Rome exerted political control over these regions (McGrail 1995: 139; Parker 1991: 363).

[32] For examinations of this process, see Greenhill and Morrison 1995: 56; McGrail 2001: 196 f.; Steffy 1994: 72, 77.

[33] *De Bello Gallico*, 3.13.

[34] *Geography*, 4.4.1.

the frame was erected before the hull planking was attached to it with large iron clenched nails, the seams then caulked using wood shavings and pine resin.[35] Margaret Rule and Jason Monaghan have also argued that a merchant vessel, found at the harbour entrance to St Peter Port on the Channel Island of Guernsey, dateable to the late third century AD, was 'neither wholly skeleton-first nor shell-first, but a stepwise alternation of the two.'[36] The robust construction of the vessels used by the maritime communities of north-western Europe allowed them to more easily cope with the weather and sea conditions of the Atlantic coasts than could lightly constructed ships like Roman war-galleys. During his campaign against the Veneti, Caesar would therefore write:

> When we encountered these vessels, our only advantage lay in the speed and power of our oars; in other respects the enemy's ships were better adapted for the violent storms and other conditions along that coast. They were so solidly built that our ships could not damage them with rams, and their height made it hard to use missiles against them or seize them with grappling irons. Not only that; when a gale blew up and they ran before it, they could weather the storm more easily and heave to more safely in shallow water, and if left aground by the tide, they had little to fear from rocks and reefs. To our ships, on the other hand, all these situations were a source of terror.[37]

Both the archaeological evidence and the literary sources therefore reveal that vessels incorporating at least some skeleton-first construction techniques into their hulls were operating on the seas of north-west Europe long before frames became central to providing the strength and rigidity for the hulls of vessels operating on the late Roman or early medieval Mediterranean.[38] That seafaring communities of the Celtic north-west were constructing vessels in a radically different manner from the shell-first ships of the Graeco-Roman Mediterranean has also led J.M. Morton to conclude that 'the more demanding maritime environment of the Atlantic resulted in the development of far more durable ships than those which were designed for Mediterranean conditions.'[39] However, Morton fails to acknowledge that, in the years following the Roman conquest of Gaul and Britain,

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[35] Marsden 1966, 1994. See also McGrail 1995: 141.

[36] 1993: 28. The wrecks of Roman riverine patrol boats discovered at Mainz also exhibit a similar form of construction (Höckmann 1985; 1993. See also Hocker 2004: 68–72).

[37] *De Bello Gallico*, 3.13.

[38] It has been argued that Romano-Celtic shipbuilding provided the basis for medieval techniques of ship construction in northern Europe that ultimately led to the evolution of the cog (e.g. Ellmers 1994: 34; Runyan 1994: 47).

[39] 2001: 271.

and the incorporation of these provinces into the Empire, the Mediterranean method of shell-first ship construction was nevertheless considered to be of sufficient strength and seaworthiness that it was embraced by the shipwrights and sailors plying their trades along the Atlantic coasts. The County Hall Ship, recovered from central London at the beginning of the last century, provides clear confirmation that the Mediterranean shipbuilding technique, and perhaps even Mediterranean shipwrights, had been introduced to north-west Europe by at least the late third century AD. Although constructed from oak, a timber rarely used for hull construction in the Mediterranean, in other respects the County Hall vessel clearly indicates the ship's Graeco-Roman ancestry: the strakes which constituted the sides of the hull were edge-joined and the planks were connected with the ubiquitous mortice-and-tenon joints characteristic of ancient Mediterranean ship-building. As in most Graeco-Roman shipwrecks, the mortice-and-tenons provided such a tight fit between one plank of the hull and the next that caulking material appears to have been unnecessary. Furthermore, dendrochronological investigation established that the oak timbers of the County Hall ship had been felled in the south-east of Britain, providing a very strong indication that '[t]he ship was probably built in southern England by a shipwright familiar with Mediterranean construction methods.'[40] The County Hall ship therefore confirms that, in tandem with indigenous ship-building traditions, shipwrights working on the Atlantic seaboard were also producing sea-going vessels in the Graeco-Roman mould.[41] It thus appears that the shell-first, mortice-and-tenon method of hull construction, which so dominated shipbuilding on the ancient Mediterranean, was also considered sufficiently strong and seaworthy to cope with the weather and seas found off the Atlantic coasts of northern Europe. Sailors of the Roman Empire presumably used vessels constructed in this traditional Mediterranean manner when voyaging across the North Sea and English Channel where mariners would generally expect to experience far higher levels of inhospitable and hazardous seafaring conditions than would be the case on the seas of the Mediterranean.

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40 Delgado 1997: 116. See also Marsden 1974; McGrail 2001: 195.

41 In addition to the County Hall ship, the first century vessels excavated from the Netherlands, at Vechten near Utrecht, and from Zwammerdam, also attest to the fact that the shell-first shipbuilding technique of the Mediterranean was widely adopted in the North Sea region during the Roman Empire. (See the useful summary of the evidence for Graeco-Roman mortice-and-tenon construction in McGrail 2001: 194–195.)

Trials of the Kyrenia II

The archaeological evidence indicates that the shell-first, mortice-and-tenon method of construction provided the hulls of ancient ships with inherent strength and rigidity. It is, nonetheless, still generally perceived to be the case that one of the primary reasons behind the need for the seasonally constrained maritime calendar as advised by some of the writers of antiquity was the inability of Graeco-Roman vessels to cope with the high winds and rough seas of the wintertime Mediterranean.[42] However, as has already been seen, strong and gale force winds, though usually less frequent between spring and early autumn were, nevertheless, still a potential threat to shipping and would occasionally be experienced by seamen, especially when sailing across regions of the Mediterranean such as the Gulf of Lions. To assume that ancient vessels were incapable of dealing with adverse conditions is a long-standing fallacy; the shipwrights of antiquity, like those of later ages, surely built ships with an eye to coping with unfavourable or dangerous seas, even if the vessels were intended primarily to be on the waters of the Mediterranean during the relatively benign weather conditions expected from the spring to autumn. As was long ago noted by Smyth: 'It is with a view to emergency, in the understanding of the certainty of Nature's passions, that every capable sea-going boat is designed, built, rigged, and sailed by every race. It is not the long summer evening or the steady trade-wind that the sailing boat is built for. At sea more than in any life of man … it is the worst that must be anticipated and prepared for.'[43]

The capacity of ancient ships to come to terms with unfavourable and even dangerous sailing conditions is clearly reflected in the trial voyages of the vessel reconstructed from the remains of the early Hellenistic shipwreck excavated off the Cypriot coast at Kyrenia. On a two-legged voyage undertaken between Piraeus and Paphos, Cyprus, the reconstructed fourth century sailing vessel, measuring only 14 m in length, 4.2 m across the beam, and capable of carrying between 25 and 30 tonnes of cargo (figure 3.7), proved capable of dealing with exceptionally powerful, blustery winds and heavy seas.[44] During the outward, eastwards, voyage, made in September 1986, on two occasions during the twenty-five day journey, the vessel sailed without

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42 See, for example, Morton 2001: 271 f.

43 1906: 11.

44 For more information regarding the dimensions of the *Kyrenia II*, see Katzev and Katzev 1989; Steffy 1994: 42 f.; Swiny and Katzev 1973.

problem through Beaufort 6 conditions.[45] Bearing in mind that a modern yachting manual notes that, 'a force 3 means … excellent sailing; force 4 and things are getting a little boisterous; force 6 and it is "why am I out here and not in harbour, never again!"' then one begins to appreciate the seaworthiness of the *Kyrenia II*.[46]

The *Kyrenia II's* return voyage to Greece was made the following April, a month that both Hesiod and Vegetius counselled as being too early in the year to put to sea with any degree of safety, while Gratian's edict of AD 380 also only permitted voyages to begin mid-way through April. These seafaring timetables might appear to provide prudent advice given some of the weather that the *Kyrenia II* experienced during the nineteen-day voyage. However, despite the stormy conditions encountered during the return voyage to Piraeus, the experimental ship demonstrated the remarkable seakeeping abilities possessed by even small merchantmen of the Graeco-Roman period; a point underlined by the following entry in the *Kyrenia II's* logbook at midday from April 11, 1987:

> The sea has turned white all over. Visibility has decreased sharply … Wind: 45–50 kn. On two occasions it has risen to 53 kn. Vessel's speed: It is incredible, constantly 9–10 kn. On two occasions the crew were cheering, when the ship reached a maximum speed of 12 kn. The speedometer indicator showed 12, which is the highest speed it can indicate and no more. There were instances when we must have exceeded 12 knots. The white mountainaous [*sic*] waves are approaching from the stern and are beginning to break leaving behind a sound like a train approaching on rails. It is incredible—"Kyrenia II" is lifted high up like a cork and the wave breaks under its high stern without a drop of water on deck. The vessel's rocking is slow, magnificent, like a stunningly beautiful girl who is waltzing elegantly, unaffected by the clumsy steps of her wild partner. This experience is unique and difficult to describe … the ship is riding above the 3–4 metre foamy waves. Our voice is muffled by the wind, we can hardly hear each other and hold on to the railings on the bow or sit down to avoid being knocked down by the gale.[47]

Wind-speeds of 45–50 knots (83–93kph) measure 9–10 on the Beaufort scale and are classed as 'severe gales' or 'storm force' conditions. Yet despite the ferocity of the winds, which created seas with very dangerous breaking waves, the little merchant ship seems to have coped remarkably well. Three days after this, when once again caught in stormy conditions, the *Kyrenia II* did suffer damage to the port rudder, while the sail had many of its lead

45 Katzev 1990.
46 Cheadle 1994: 125.
47 Kariolou 1987: logbook entry 164.09, dated 12 pm, 11 April.

guide rings torn away, forcing the ship to be towed to the nearest port so that necessary repairs could be carried out. However, even in this damaged state, at no point was the reconstructed merchantman ever under threat from being swamped or driven out of control by the hostile conditions.[48] The ability of the *Kyrenia II* to sail safely through such hazardous sea conditions provides strong support for the belief that the ancient shell-first method of ship construction was capable of producing hulls that would have allowed Graeco-Roman merchant ships—even those as small as the *Kyrenia II*—to deal with some of the strongest winds and roughest seas likely to be encountered on the Mediterranean. Such endurance potentially permitted voyages to be made by even relatively small vessels during the traditional shipping off-season. The trials of the *Kyrenia II* go a long way to confirming the veracity of surviving texts such as the customs records of the fifth century BC Elephantine Palimpsest, or the fourth century lawsuit brought by the creditor, Dareius, against Dionysodorus and Parmeniscus, and the receipts of the olive oil cargoes delivered to late Roman Carthage, all of which provide clear evidence for small vessels engaging in trading activities during the winter months.[49]

The Changing Technology of Hull Construction in Antiquity

The trials of the Kyrenia reconstruction have highlighted the impressive sea-keeping abilities of the little merchantman from the fourth century BC, and the potential for vessels similar to this to endure some of the worst conditions ever likely to be experienced on the Mediterranean. It has also been noted that, 'The Kyrenia wreck was not a large ship, or specifically efficient, and no doubt many aspects of ancient rigging or sailing have not yet been rediscovered by those sailing the replica, so one could expect a good performance from larger ships.'[50] If this assumption is correct, then it further underscores the abilities of ancient shipwrights to produce vessels that were capable of voyaging through some of the most hostile seafaring conditions the Mediterranean can produce. Furthermore, it should be borne in mind

[48] It should be noted that the report of the incident, and indeed the records of the sea-trials of the *Kyrenia II* generally, provide little more than a basic outline of the voyages of the reconstructed fourth century merchant ship.

[49] See above, pp. 16–21, for Elephantine Palimpsest and Dareius' court action; pp. 28–30, for Carthage *ostraca*.

[50] Parker 1992: 27.

that the original Kyrenia vessel was probably constructed in the 380s BC, well in advance of the period when ancient shipbuilding is usually adjudged to have reached its apogee—a time that scholars usually assign to the late Hellenistic and early Roman Imperial periods.[51]

The Madrague de Giens shipwreck, discovered off the French coast near Toulon, provides a good example of the technical advances that separate this ship of the mid first century BC from that wrecked at Kyrenia which had been constructed more than three hundred years earlier. Measuring about 40 m in length and 9 m across the beam, the Madrague de Giens vessel had a hold 4.5 m in depth allowing the ship to transport about 400 tonnes of cargo, with an overall displacement of about 520 tonnes.[52] In order to carry such large and heavy cargo loads the vessel was provided with an elaborate hull that was 'particularly well built and robust.'[53] Of special note was the double-planked hull consisting of strakes that were 6 cm thick in the main, inner hull, while those comprising the planking of the outer hull were 4 cm thick.[54] Both hulls employed the usual method of edge-to-edge planking attached with pegged mortice-and-tenons, joints that were spaced, on average, 15 cm apart.[55] As with the Kyrenia vessel, as well as the majority of other excavated shipwrecks dating to the Classical and Hellenistic periods, it was the mortice-and-tenons within the shell of the ship that provided the hull of the Madrague de Giens vessel with most of its strength and rigidity which, when combined with the laminating effect produced by the double hull, created what was undoubtedly an exceptionally strong and seaworthy vessel.[56] Furthermore, while the framing of the vessel was probably added only after the planking had been set in place and, as was usual for the ancient shell-first shipbuilding technique, contributed little additional strength to the hull, the heavily constructed ceiling planks provided considerable longitudinal strength and stiffness to the vessel. The substantial timber of the mast-step must also have enhanced the strength of the hull's spine.[57] 'Equipped with a very elaborate hull and powerful square sails carried by two (perhaps

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51 Steffy 1994: 84; Parker 1992. For the construction date of the Kyrenia ship, see Steffy 1985: 82; Swiny & Katzev 1973: 341.

52 Pomey 1982; 1997: 252; Steffy 1994: 62.

53 Pomey 1997: 252.

54 Steffy 1994: 64.

55 The mortice-and-tenons of the outer hull, which usually measured 5.6 cm in width, 6 cm in depth, and 0.7 cm in thickness, were rather smaller than those used on the internal hull which were generally 8–8.5 cm wide, 11 cm deep, and 1.3 cm thick (Steffy 1994: 65).

56 Steffy 1994: 65; McGrail 2001: 156; Pomey 1997: 252.

57 McGrail 2001: 157 f.; Pomey 1997: 252; Steffy 1994: 65.

three) masts, the Madrague de Giens ship, despite its large size and substantial tonnage must have possessed good nautical qualities and have been an impressive sailing ship.'[58] The technical developments that can be glimpsed on the wreck of the Madrague de Giens ship probably continued into the period of Rome's domination of the Mediterranean and it has been noted that ships of the Hellenistic and early Roman Empire 'were bigger, sturdier, and better rigged than [their] … Greek forbears.'[59] It can therefore probably be assumed that while the sea-keeping abilities of the Kyrenia reconstruction were remarkably good, Graeco-Roman ships of the following centuries would often have been even more competent performers when dealing with rough seas.

The technical progress in the design and construction processes of ancient ships should also lead us to challenge the assertion of Morton that there was a 'relative lack of development or change in … maritime technology during the whole period from the reformation of the Greek world in the Dark Age to the Hellenistic period, and to a lesser extent on into the Roman Empire.'[60] Instead, shipwreck evidence is slowly beginning to indicate that the art and skill of the shipwright developed appreciably throughout antiquity. The shell-first technical tradition probably reached its zenith in the later Hellenistic and early Roman Imperial periods before increasing use of the internal framework as a source for hull strength began to transform the nature of the craft which, by at least the late Roman period, was moving inexorably towards the skeleton-first process that would come to characterise ship construction on the medieval Mediterranean. It is also apparent from this chronology of shipbuilding evolution—imperfectly understood though it is—that the principal advice and legislation regarding the ancient sailing season falls towards either end of the shell-first tradition of ship construction. Hesiod's sailing calendar of c. 700 BC was set out more than three hundred years before the Kyrenia vessel was launched, and some six hundred years before the Madrague de Giens ship took to the seas. From the opposite end of the Graeco-Roman period, the sailing timetables set down by Gratian and Vegetius in the late fourth and early fifth century AD appear at a time when the Yassi Ada shipwreck indicates a decline in the technical sophistication of the Mediterranean shipwright's craft and a corresponding move towards shipbuilding techniques that reduced the amount of labour

[58] Pomey 1997: 252.
[59] Casson 1980: 33 fnt. 22.
[60] 2001: 2.

and materials required to produce seagoing vessels. These changes probably resulted in the creation of ships that were neither as strong nor as seaworthy as those being created several centuries earlier. We may therefore question whether the vessels sailing on the Mediterranean at the time when these maritime calendars were set down were rather more circumscribed in their seasonal range than was the case during the Hellenistic and early Roman Imperial periods when ships were being constructed that possessed stronger and more seaworthy hulls than the vessels of earlier and later periods of antiquity. This possibility is hinted at in the work of R.P. Duncan-Jones who proposes a decline in the efficiency of seafaring as one possible reason behind the delay with which double-dated edicts of the fourth and fifth centuries AD were being sent and received.[61] The numerous literary references to wintertime voyages made during the Late Roman Republic and Principate, many of which have been collected by E. Saint Denis and J. Rougé, also indicate that, while no sailing calendar for this period survives, maritime activities on the winter Mediterranean appear to have been regularly undertaken with authors such as the Elder Pliny indicating that year-round voyaging was a common feature on the Mediterranean of the first century AD.[62]

Size, Strength and Seaworthiness

In the study undertaken by Michael McCormick, which argues for an increase in the length of the sailing season at the beginning of the Middle Ages compared to that which had existed in antiquity (see above, pp. 4–6, 107), one of the principal factors that is cited as allowing early medieval mariners to remain at sea longer into the winter months was that 'ships tended to be small, and so could easily keep to shallow waters near shore and beach. Then they could run for shelter in a cove or river mouth when the weather changed, as it was apt to do between mid-September and early May.'[63] However, while ships such as that wrecked at Madrague de Giens, together with other large vessels—most famous of which are the ships of the Alexandrian grain fleet referred to in literary sources—did indeed exist in the ancient

[61] 1990: 21.
[62] *Naturalis Historia*, 2.46.122; 2.47.125. Saint Denis 1947; Rougé 1952. It should, however, be borne in mind that a relatively large body of literature survives from this period of antiquity compared to earlier or later centuries.
[63] 2001: 468.

world, these were very much the exceptions to the general rule. Shipwreck evidence instead indicates that it was the relatively small cargo ships of less than 75 tons burden that predominated throughout all periods of antiquity, with most vessels probably considerably smaller than even this tonnage, making the majority of Graeco-Roman vessels comparable in size to those plying the sea-lanes of the medieval Mediterranean.[64] As such, the boats and ships commonly in use throughout antiquity would have allowed mariners to seek shelter from the coast when weather and seas turned dangerous in much the same way as would the sailors of later ages. Furthermore, the greater number of harbours constructed and maintained around Mediterranean coasts during the Hellenistic and Roman Imperial periods would have provided seafarers with refuges against unfavourable weather conditions that were, in many cases, no longer functional during the Middle Ages.[65] Scholars such as Rougé have therefore long argued that Graeco-Roman seamen, sailing in small merchant vessels, would have remained at sea making coastwise voyages even throughout the winter months.[66]

It should, however, be emphasised that the coastline is not always a place of safety in times of bad weather. A modern sailing handbook focusing on the strategies and tactics best employed to safely ride-out storms at sea therefore notes: 'Old-time sailors are reputed to have felt safer at sea than in harbour in bad weather and perhaps this should be borne in mind when taking a decision to run inshore for shelter. Don't be misled by the comforting sound of the word "shelter". Anyone who knows the sea will think twice before committing themselves to sailing shorewards during a gale.'[67] The coastlines of the Mediterranean therefore offered perils as well

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[64] Parker 1992a (see below, pp. 129–130); Pomey 1995: 125; Pryor 1994: 64.

[65] See, for example, Arner 1985; Blackman 1982.

[66] 1952: 317. Bennet long ago also reached the conclusion that, despite the passing of two thousand years, sailing strategies had remained all-but unchanged on the wintertime Mediterranean. On comparing the methods of wintertime sailing in the Graeco-Roman period with the small merchant craft which he witnessed operating along the Gulf of Genoa in the mid-nineteenth century, he noted, 'Mariners in those days hugged the shore, and at the slightest unfavourable change ran into the nearest port, or took shelter under the nearest headland; and this, notwithstanding all the modern improvements in navigation, they do even now. With a slight breeze, the sea, near the land, is studded with vessels ... but if a stiff wind and a heavy sea rise, they instantly seek shelter, and disappear, not a sail is seen, until fine weather returning, again lures them out of their retreats' (1870: 131).

[67] Haeften 1997: 131. See also MacGregor 1993: 49f.; Pardey & Pardey 1998: 15; Toghill 1994: 141. Vegetius also writes that, 'Safety is greater, the deeper the sea is' (*Epitoma rei militaris*, 4.43), a clear recognition of the dangers of running aground on the reefs and shoals of shallow coastal waters, or of being driven onto a rocky lee shore.

as safety for Graeco-Roman seamen intending to seek shelter from the shore when conditions at sea deteriorated.[68] As such, the ability of ancient shipwrights to produce ships that were considerably larger and stronger than those of the early medieval Mediterranean provided at least some Graeco-Roman mariners with the potential to ride out heavy weather at sea rather than risk being wrecked against the coast. The passage below, although referring to seafarers on the seas around Britain during the final days of working sailing ships, nevertheless offers interesting parallels with the situation that might have been in effect during certain periods of antiquity, in which two different wintertime sailing strategies were employed depending on the size and seaworthiness of the vessel. Smaller ships, engaged in hops along coastal routes, might have remained at sea during the winter months by carrying out short journeys that were often measured in hours rather than days, a wintertime sailing strategy envisaged by scholars such as McCormick and Rougé. By contrast, for the crews of large, well-founded ships, wintertime voyages were also a possibility, though their tactics for surviving heavy weather may have been to trust their vessels to the open sea, confident in the strength of the hull to withstand the winds and waves.

> Big, deep, powerful schooners and brigantines, and big ketches, could draw out to sea and, in the language of the schooner crews, 'punch out a blow'. But to small schooners and ketches coastal voyages in autumn and winter were a succession of hurried scuffles from sheltering place to sheltering place. Such ships could not safely be caught without shelter in their lee … A winter voyage might consist of short passages between … sheltering places in turn … No wonder that at some points there was a deeply ingrained tradition of not going to sea in January and February.[69]

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[68] Even in favourable sailing conditions, it was the entering and exiting of ports that were among the most dangerous moments in a voyage. Synesius, for example, describes how, on departing Alexandria, the vessel on which he was travelling ran aground 'two or three times in the bed of the harbour' (*Letters*, 4: 170). Such problems appear to have been a fairly frequent at Alexandria throughout antiquity and into the medieval period with Goitein providing examples of vessels, cargoes and lives being lost when ships tried to enter the high seas or to sail through the coastal waves on its return. 'It was a common occurrence for ships to be on the brink of disaster or to founder in the very propinquity of the lighthouse of Alexandria' (1967: 1.319). It is therefore hardly surprising that at ports such as Ostia salvage divers (*urinatores*) were represented among the collegia of the city (e.g. Parker 1992a: 94).

[69] Greenhill 1978: 201. See also MacGregor 1993: 49 f. Braudel has also argued for a similar situation affecting wintertime voyages on the early modern Mediterranean—a season when 'small boats might venture out over short distances … on voyages lasting a few hours. Bigger ships, offering greater resistance to the winter, could accomplish even in bad weather voyages that were the more profitable because of the season.' (1972: 249).

It can certainly be considered the case that, as a general rule, larger and heavier ships are better able to cope with the demands of heavy weather than vessels of smaller size. A modern yachting manual therefore notes that, 'If one is looking for points in favour of larger yachts, heavy weather ability is fairly high on the list … The larger mass makes a contribution to the boat's motion in a seaway … Larger yachts drive through the seas more easily, they are less likely to veer off course and can maintain higher speeds when running before a gale. They also offer their crew more protection in the cockpit and below decks. They can be better equipped and are easier to steer.'[70] This point is also observed by ancient authors from as early as the Archaic period with Hesiod advising his brother Perses to praise a small vessel but to place his goods in a large ship.[71] Petronius' fictional character, Trimalchio, also recognised that large vessels are particularly sturdy.[72]

Descriptions of some exceptionally large ships that sailed the Graeco-Roman Mediterranean have been preserved in the ancient literature. One of the earliest and most remarkable of these was the grain carrier built by Hiero II of Syracuse in the late third century BC, although other rulers also appear to have experimented with over-sized cargo ships throughout much of the Hellenistic period.[73] Such shipbuilding anomalies continued during the Roman Empire, usually to fulfil specific tasks, such as the giant vessel constructed by order of Caligula to bring an obelisk from Egypt to Rome.[74] However, the most famous large ships of antiquity were those that sailed the Alexandria-Rome route, transporting as much as 150,000 tons of Egyptian grain to the Roman populace every year. (See above, p. 32f.)[75] It was this need to supply corn and other foodstuffs to the burgeoning population of

[70] Haeften 1997: 55. See also Conrad 1923: 74; Seidman 2001: 19.

[71] *Works and Days*, 660.

[72] Petronius, *Satyricon*, 76.

[73] For Hiero's super-freighter, see Athenaeus 5.206d–209. For giant cargo vessels of the ancient Mediterranean generally, see, for example, Casson 1956; 1995: 184f.; Duncan-Jones 1977.

[74] Pliny, *Naturalis Historia*, 36.67–70. Although Caligula's super-freighter was highly unusual in that it was designed and constructed for a specific cargo, Graeco-Roman vessels were crucial to the transport of building stones around the ancient world. This was especially true of Rome in the century and a half following the establishment of the Principate when '[c]oloured marble columns, pavements, and veneers began to flood in' (Ward-Perkins 1971: 144). Although this supply to the capital appears to have slackened by the second quarter of the second century, high quality imported stones remained in great demand in the provincial municipalities. Only with the breakdown of the *Pax Romana* does the large-scale, long-distance, seaborne transportation of building stones around the Mediterranean appear to have come to an end (Ward-Perkins 1971: 148).

[75] Casson 1995: 297, Jurišic´ 2000: 45; White 1984: 153.

Rome and other large cities located on the shores of the Mediterranean that goes some way to explaining the apparent increase in the size and tonnage of shipping during the Late Roman Republic and early Empire.[76]

A set of dimensions of one such grain ship, the *Isis*, are recorded in an essay by Lucian which dates from the second century AD, although, because the length of the keel goes unmentioned, the vessel's carrying capacity cannot be calculated with any degree of accuracy. However, the ship was undoubtedly large and almost all estimates place its tonnage above a thousand tons, while some scholars have calculated its burden to be far greater.[77] Archaeological evidence in support of Lucian's description is, however, presently lacking and until a wreck of one of the great grain freighters is discovered we should be wary of trusting too readily to a set of dimensions obtained from what is, after all, a piece of satirical literature.[78] Nevertheless, other literary evidence does point to the use of large vessels on the ancient Mediterranean. For example, when the emperor Claudius set in place incentives to encourage the construction of grain ships during the first century AD, a tonnage of 10,000 *modii* (68 tons) was fixed as the lowest limit.[79] While vessels of this size are not particularly large, we know that considerably bigger vessels were also being constructed, their owners exempt from compulsory public services if they 'have had built and furnish for the *annona* of Rome a seagoing vessel no smaller than 50,000 *modii* [approximately 340 tons cargo capacity] or a number of vessels no smaller than 10,000 *modii*.'[80] An inscription recovered from the northern Aegean island of Thasos which dates to the third century BC has also been interpreted as a set of port regulations that restricted use of the inner harbour facilities to vessels of 3,000 talents (80 tons) or over.[81]

Shipwreck evidence also highlights that there were some extremely large vessels operating on the Mediterranean, ships that would potentially have been able to withstand all but the heaviest seas. In his study of ancient shipwrecks, A.J. Parker has therefore distinguished three classes of vessel:

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76 Rickman 1985: 123 f.

77 For details of the *Isis* and early scholarship pertaining to the size of the vessel, see Casson 1950: 51 f.

78 Rougé (1981: 76) is one such historian inclined to believe that Lucian's dimensions for the grain ship owe more to artistic license than to a description grounded in reality.

79 Suetonius, *Claudius*, 1.32.

80 *Digesta*. 50.5.3.

81 The evidence from this inscription is, however, disputed. See Casson (1995: 171 fnt. 23, 183 f.) for the argument in favour of ships greater than 80 tons using the inner harbour of the city, and Hopkins (1983: 99 f.) for the argument against, while Blackman (1995: 76–81) provides a useful summary of the evidence.

1. Those with less than 75 tons cargo capacity: the commonest ship type found in all periods.
2. Those with a cargo weight of 75–200 tons: usually datable to between the first century BC to the third century AD.
3. Those capable of bearing more than 200 tons: usually datable to the Late Republic.[82]

As has already been seen, the trial voyages of the *Kyrenia II*, a vessel capable of carrying about 25–30 tons, have demonstrated that even this relatively small ship could remain on the seas in extremely adverse weather conditions, even though the *Kyrenia II* is small even by the standards of Parker's lowest category of ancient merchantmen. It is interesting to note that the majority of cogs—the vessels usually regarded as finally overturning the seasonal shipping regime of the Mediterranean and opening the Sea to wintertime traffic at the start of the fourteenth century—were also generally less than 100 tons burden.[83] Similarly carvels—the ships that first opened up the globe to European nations—were also relatively small, usually only 60–70 tons burden, and were therefore of a size which straddles only the lower two classes of ancient ships set down by Parker, making the ships of the early modern period considerably smaller than many vessels operating on the Graeco-Roman Mediterranean.[84] Indeed, as has already been noted, large shipwrecks, such as the Madrague de Giens vessel, were probably capable of carrying upwards of 400 tons, with a ship displacement of about 520 tons, a size that corresponds to that of vessels of the early eighteenth century employed on the long and hazardous shipping route between Britain and India by way of the Cape of Good Hope.[85] While such comparisons across broad stretches of place and time fail to take account of the changing technologies in ship construction and navigation, they do, nevertheless, emphasise the considerable size of some of the shipwrecks of antiquity.

The Effects of Vessel Age and Cargo Weight on Seasonality

The larger ships of antiquity may indeed have been more capable of dealing with the dirty weather more commonly encountered on the wintertime Mediterranean, allowing the crews to pull out to sea and 'punch out a blow',

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[82] 1992a: 89.
[83] E.g. Runyan 1994: 49.
[84] For the size of carvels, see Elbl 1994: 92; Guilmartin 2002: 87; Parry 1963: 65.
[85] E.g. Chatterton 1933: 145, 178 f.

while sailors aboard smaller vessels had instead to seek the shelter of the coast. It was, however, necessary for vessels, whatever their size, to possess a resilient hull and it has been pointed out by a modern yachtsman that, 'A sound and seaworthy boat is arguably better insurance even than the finest crew with the best boat-handling skills and experience, for a boat can, and often has, survived on its own through the worst onslaught.'[86] It is therefore younger vessels that are generally the most capable of dealing with strong winds and high seas; their hulls still stiff and strong, unlike those of older ships which, over the course of a lifetime spent enduring the punishment of wind and wave, would have lost some of their structural integrity as the mortice-and-tenon joints slowly loosened, opening-up seams and causing leakage. In the warm waters of the Mediterranean, the actions of shipworm, burrowing into the timbers of hulls unprotected by lead sheathing, would also have greatly weakened a vessel's timbers, while also causing the ship to become waterlogged and heavy.[87]

The age and corresponding seaworthiness of a ship should also be borne in mind when dealing with the Kyrenia wreck and the sea-trials of its reconstruction. The vessel that sank off the northern Cypriot coast towards the close of the fourth century BC had seen a lifetime of service spanning about eighty years. The battered and broken nature of the hull bears testimony to the small ship's long years of voyaging: lead patches had been nailed into place to cover leaky seams; many of the strakes had rotted while others had already been removed and replaced; the keel had cracked and the broken back of the ship had been repaired by the insertion of a wooden block across the fracture.[88] By contrast, the replica ship that started on the first of its trial voyages in September 1986 had only officially been launched fifteen months

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86 Toghill 1994: 25.

87 For the effects of shipworm on ancient warships, see Steinmayer & Turfa 2007. The stormy voyage and shipwreck endured by St Paul while travelling to Rome aboard one of the Egyptian grain freighters, as recounted in Acts 27, may also provide an example of one such old and relatively weak ship, possibly worn out through years of service plying the sea-lanes between Alexandria and the Italian ports of Puteoli and Ostia. While it has already been seen that the ancient shell-first method of ship construction created vessels that were incredibly strong and seaworthy, the sailors on board Paul's ship nevertheless took the precaution of undergirding the vessel by passing cables round the ship to reinforce the hull, a measure usually only taken when it was deemed likely that the ship would be unable to survive the conditions without such additional support. Such a precaution would probably have been unnecessary on a younger Alexandrian grain freighter with such vessels likely to have been constructed to some of the highest standards of the period.

88 Steffy 1994: 54 f.

earlier and, as such, its hull was more rigid, far stronger and therefore more seaworthy than had been the case for the original vessel at the time of its final voyage. To expect the eighty-year-old, fourth century ship, to have been able to weather gale-force winds and breaking seas with the same effortlessness of its modern reconstruction would therefore be a mistake.

When using data contributed by trials of experimental vessels such as the *Kyrenia II*, it should therefore always be borne in mind that these reconstructions are almost always new ships. As such, they are considerably more seaworthy than the majority of craft that would have been sailing upon the Mediterranean at any one time during antiquity. The age of a ship may therefore have partly dictated the seasonal limits at which it was employed on the ancient Mediterranean. While Graeco-Roman seamen sailing aboard vessels fresh from the shipwrights' yard may have been confident in making regular voyages on winter seas, the mariners on board older, less seaworthy, ships would probably have done well to follow J.H. Bennet's advice: 'Leaky vessels should remain in port, where, like Nelson's old ship, the *Victory*, they may long ride with dignity on the smooth waters which surround them. The battle of life—its storms and tempests—must be left to the young and to the strong.'[89] This is, of course, not to say that such advice, no matter how prudent, would necessarily have been followed. If the financial returns on wintertime voyages were potentially lucrative enough, then Graeco-Roman ship-owners may well have risked even old and dangerously unseaworthy vessels on the seas of winter. Numerous examples from more recent centuries provide testimony to the fact that both warships and commercial vessels were often pressed into service on voyages through dangerous waters even if, as was the case with merchantman *Lindsey*, lost when returning to Britain from Jamaica in 1698, such ships might be described as 'old and crazy and not fitt to goe to sea.'[90]

It is also worth noting that the nature and weight of the commodities being transported by merchantmen may also have had a bearing on the seasonal sailing schedule. It has been claimed by Morton that 'heavily laden ships were less buoyant, less manoeuvrable, and slower than empty ships, and so were less suited to voyages through the rougher conditions of the

[89] 1870: 248.

[90] High Court of Admiralty records, Public Record Office 13/82 f. 7v, dep. of Robert Stevens re Lindsey, June 7, 1698. Quoted in Earle 1998: 110–111. See Thomas (1999: 43), for examples of wooden warships during the age of sail also going into action when in similar states of disrepair.

open seas.'[91] Morton fails to take adequate account of the extent to which ancient merchantmen relied on cargo weight and/or ballast to provide displacement and stability. Nonetheless, the efforts of the crew aboard St Paul's Alexandrian freighter in jettisoning some of the ship's gear as well as the cargo of wheat in an effort to lighten the vessel and, by so doing, increase the chances of the ship surviving the tempestuous winds, provide literary confirmation that Graeco-Roman seamen were well aware that by reducing the weight and thus the displacement of their ship, then the vessel might be better able to withstand the stresses of heavy weather.[92] There is also archaeological evidence for the jettisoning of ancient cargoes with long lines of amphorae—known as 'alleys' or 'trails'—surviving undisturbed on the sea-bed of the Mediterranean at sites such as that near the Skerki Bank, a region of deep water lying to the north-west of Sicily, more than 700 metres below the surface of the Tyrrhenian Sea. These amphorae are thought to be the remains of cargoes cast overboard by sailors when caught in stormy conditions while sailing the busy sea-lanes that linked Rome and Carthage.[93] It is therefore possible that ancient vessels carrying only little cargo or merely ballast in their holds might have remained on the Mediterranean for longer into the traditional off-season of winter, with their crews more confident in the ability of a lightly loaded vessel to cope with strong winds and large seas. As such, although Acts informs us that, by early October, the crew of the Alexandrian merchantman on which St Paul was travelling to Rome were intent on finding a suitable harbour in which to spend the winter, it should be borne in mind that this ship was on the westwards leg of its journey, sailing from the corn producing province of

[91] 2001: 153, 280. It should be noted that although the addition of ballast or additional cargo in the bottom of a boat leads to a reduction in freeboard (and thus an increase in draft), it can enhance a vessel's stability by lowering the centre of mass.

[92] Acts 27:20, 38. Jettisoning cargo in such a manner will indeed increase the freeboard of a vessel and, by so doing, increase the ship's reserves of buoyancy. For a detailed examination of the various forces acting upon a ship's hull, see McGrail 1987: Chapt. 3.

[93] Throwing both cargo and gear overboard was a common method of lightening a vessel throughout the days of sailing ships and, as Earle describes, it was still often resorted to in the seventeenth and eighteenth centuries: 'Faced with disaster, they [i.e. sailors] would quickly lighten the ship by throwing the guns and some of the cargo overboard and cutting down one or more of the masts, this being standard practice and often sufficient to save a ship' (1998: 112). Even warships might have need to resort to such tactics, and Smyth describes how, in 1840, the crew of the British man-of-war, *Bellerophon*, had to cast her cannon overboard in order to save the ship from being driven upon a Syrian lee shore (1854: 284). For the deep sea surveys undertaken at the Skerki Bank, see Ballard, et al. 2000; McCann 2000; McCann & Oleson 2004.

Egypt to Rome. The ship would therefore have been fully loaded with grain.[94] For Alexandrian grain freighters heading in the opposite direction—making their way back to Egypt from Italy and riding high in the water with little more than ballast in the hold, then the captain and/or owner might have felt sufficiently confident to undertake the south-eastward voyage rather later in the year.[95]

The Contrasting Seasonality of Warships and Merchantmen[96]

In addition to Vegetius' failure to take into account the variations in weather and sea conditions experienced across different regions of the Mediterranean, it would also appear extremely doubtful whether his sailing calendar can be equally applied to ships constructed for trade as well as those built for war. Although commonly cited by historians as a seasonal template for all Graeco-Roman maritime activities, the sailing season advised by Vegetius was formulated for naval and not commercial activities. Vegetius was, after all, writing an *Epitome of Military Science*, and the section of the work that deals with ships and sailing is focused virtually exclusively upon warships and the art of warfare at sea. At the beginning of his discussion of seafaring, Vegetius therefore clearly states that he is addressing the needs of military commanders 'who sail with an army in an armed fleet'. The point is reiterated at the start of the following crucial passage which is concerned with the seasons for sailing when, once again, it is naval fleets that are the topic under consideration: 'For the violence and roughness of the sea do not permit navigation all the year round, but some months are very suitable, some doubtful, and the rest are impossible *for fleets* by a law of nature.'[97] Yet

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[94] Acts 27:9–13.

[95] See Casson (1995: 298) for Alexandrian grain ships frequently making the down-wind run from Italy to Egypt with their holds all-but empty save for the ballast necessary to provide them with adequate stability. Bearing this in mind, it should be pointed out that the trials of the *Kyrenia II* were also carried out with a cargo of only 35 empty replica amphorae—only one-tenth of the cargo that was recovered from the original shipwreck—and even when the weight of the cargo was increased to 7 tons by the addition of bags of gravel, the reconstructed ship was still carrying only one-third of its potential capacity during its experimental trials (Katzev 1990: 255). Such a relatively light cargo load, together with the new, strong hull, are therefore major factors that need to be borne in mind when analysing the comparative ease with which the vessel coped with strong winds and rough seas.

[96] Many of the ideas and arguments contained in this section were originally raised in a paper delivered at the conference *In Poseidions Reich* XIII, staged in Hamburg, 15–17 February, 2008. See Beresford 2009.

[97] Vegetius, *Epitoma rei militaris*, 4.38 and 4.39. (My emphasis.)

the seemingly obvious fact that ancient warships had a much reduced level of seaworthiness and, as such, a corresponding reduction in the length of their sailing season when compared with contemporary merchant vessels, has tended to be overlooked by scholars. Only three historians have raised the possibility that the sailing season of Vegetius should be applied only to naval vessels: of these scholars, Rougé refers to it only in passing before turning his attention to commercial shipping, while Pryor, following the earlier work of Semple, is mistaken in the belief that 'Vegetius restricted the sailing season for galleys to 26 May to 14 September, whereas sailing ships might sail from 10 March to 10 November.'[98] Instead Vegetius only advises that fleets of warships should remain off the sea between March 10 and May 15, though nowhere in his treatise does he counsel that naval vessels be prohibited from venturing on to the Mediterranean between these dates. The late Roman author instead states that 'greater caution should be shown' when war-galleys put to sea during the spring and autumnal periods, with the seas only envisioned as closed to naval traffic from November 11 to March 10. (See p. 14.)[99]

Throughout antiquity purpose-built warships—from the triremes of Classical Greece, through the polyremes which constituted the fleets of the Hellenistic kings, to the relatively small liburnians of the late Roman Empire—shared a common design and construction concept in which the attributes of speed and manoeuvrability, which were likely to prove most decisive in battle, were the focus of considerable attention.[100] In order to achieve these primary requirements not only did galleys have to be built long and narrow to slice through waves rather than ride over them, but displacement and beam on the waterline also had to be kept to a minimum to reduce the amount of immersed surface area and lessen the friction and drag generated between the hull and the water.[101] For the oar-crew to function as effectively as possible, freeboard—the distance between a vessel's deck and the waterline—also had to be kept low (figure 3.8).[102] In fulfilling this need for speed and agility, the ancient shipwrights proved highly successful and constructed the fastest oared warships ever to operate on the

98 Pryor 1995: 210; Rougé 1952: 318; Semple 1931: 580.

99 Vegetius, *Epitoma rei militaris*, 4.39.

100 Throughout this study, 'polyreme' will be taken to classify any of the large, multi-level warships that derived their primary propulsion from oars that were multi-manned (i.e. there were at least two rowers to a single oar).

101 See, for example, Coates 1989: 17, 1993: 73; Morrison et al 2000: 193; Pryor 1995: 209.

102 Coates 1995: 128; Guilmartin 2002: 106; Morrison 1996: 323.

Mediterranean.[103] However, such features also took a heavy toll on the ability of ancient war-galleys to weather even moderate breezes and relatively small waves. The lack of draft, combined with the relatively narrow beam of ancient warships, together with the fact that most of the weight in these galleys—which included the oar-crew, sailors and marines—was situated above the waterline, while ballast in the bottom of the ships was absent, made ancient warships top-heavy and lacking in stability. The high centre of mass would also have made it difficult for war-galleys to self-right when buffeted by strong winds and rough seas.[104] A low freeboard also made Graeco-Roman warships extremely susceptible to swamping in even relatively small waves.[105] During the design phase of the *Olympias*, the replica of a fourth century BC Athenian trireme (figure 3.9), it was therefore calculated that a wave 1/20th of the trireme's length would swamp the warship.[106] With Classical period Athenian triremes, at most, 40 m long, a wave equal to this length and of 2 m in height would therefore have probably proved fatal to these ancient warships. The fact that waves of this height can be formed in breezes of Beaufort 5 emphasises the vulnerability of Graeco-Roman war-galleys in anything but light winds and all-but flat seas. The danger of being swamped was further compounded in triremes and other three-level warships by the need to have the lowest bank of oars—those of the thalamians—relatively close to the waterline. The danger of taking on too much water through these oar-ports, while partially overcome by fitting leather sleeves known as *askomata* (*ἄσκωμα*, *ἀσκώματα*), may still have occasionally proved hazardous, and although the *askomata* were effective in keeping seawater from entering the thalamian oar-ports during the trials on the *Olympias*, the naval architect

[103] Coates 1994: 249; Guilmartin 2002: 108.

[104] In general terms, stability is determined by the location of the vessel's centre of mass and how this relates to the shape of the immersed hull—especially the beam measurement at the waterline (see, for example, McGrail 1988: 15). Since an ancient warship would generally have possessed a far lesser waterline beam measurement than cargo vessels of comparable size it is to be expected that war-galleys would also possess far less inherent stability than sailing merchantmen and thus be less able to cope with rough seas. Antonio Servello has therefore pointed out that it was probably this lack of stability that is implied by Herodotus when he relates how Persian nobles were ordered to jump off the deck and into the sea in an effort to lighten the weight of the overcrowded and storm-threatened Phoenician trireme on which Xerxes was returning to Persia following the defeat of his naval forces at Salamis (Herodotus, 8.118–119. Servello 1989: 247). Kemp, referring to galleys of all ages, also notes that, 'The galley was basically an unstable vessel, suitable only for use in calm waters.' (1992: 336).

[105] See, for example, Braudel 1972: 252; Gillingham 1999: 66.

[106] Coates 1993: 25.

and designer of the replicated trireme, John Coates, has postulated that the swamping of three of Antigonos Gonatas' warships during his abortive invasion of Egypt in 304–303 BC may have been a direct result of water pouring through these oar-ports.[107] In light of the relative ease with which Graeco-Roman warships could be swamped by even relatively small waves, it would therefore seem likely that galley fleets of the ancient Mediterranean usually had to concede mastery of the wintertime Mediterranean to the powers of nature and follow a sailing season similar to that advised by Vegetius.

For merchant sailing ships charged with moving cargoes safely from one port to another, the ability to keep the sea in poor weather conditions received considerably greater attention than was the case with their naval contemporaries. Such was the difference in seaworthiness of commercial vessels compared to warships that even relatively small merchantmen were capable of remaining at sea in conditions well in excess of those that would have overwhelmed a Graeco-Roman warship. This is at least partially implied by Vegetius himself when he advises that, whenever possible, warships should remain off the seas even following the start date of his sailing calendar on March 10, and only in mid-May does the late Roman writer believe that military operations could safely be carried out on the Mediterranean. By contrast, Vegetius fully expected commercial shipping to have been on the water regardless of the danger posed by dangerous weather and sea conditions:

> But after the birthday, so to speak, of navigation which is celebrated with annual games and public spectacles in many cities [i.e. the *Navigium Isidis*], it is still perilous to venture upon the sea right up to the Ides of May [i.e. May 15] by reason of the very many stars and the season of the year itself—not that the activities of merchants cease, but greater caution should be shown when an army takes to the sea in warships than when the enterprising are in a hurry for their private profits.[108]

Although Vegetius implies that merchant vessels, as well as warships, were bound to the rigid dates of his sailing calendar, nonetheless, commercial shipping was expected to extend considerably further into the year than was the case for naval vessels. Vegetius regards this as the result of greedy

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[107] In Morrison 1996: 4, though Coates fails to provide any reasoning behind this assumption. For the effectiveness of the *askomata* on the *Olympias* replica, see Coates 1993: 23; Coates and Morrison 1993: 135; Greenhill & Morrison 1995: 171; Morrison 1993: 16–17; Morison et al 2000: 168, 216, 274.

[108] Vegetius, *Epitoma rei militaris*, 4.39.

merchants and ship-owners willing to take excessive risks in the pursuit of profit. This view is shared by Pliny who also refers to the willingness of seaborne traders to take to the seas of winter when 'not even the fury of the storms closes the seas; pirates first compelled men by the threat of death to rush into death and venture on the winter sea, but now avarice exercises the same compulsion.'[109] However, underlying this castigation of the dangerous and foolhardy profiteering of merchants is the fact that most Graeco-Roman ships that were constructed in order to engage in trading activities were considerably more competent performers on rough seas, and were capable of remaining on the water at times of the year which would have proved considerably more hazardous for warships. Indeed, when we look in detail at the problems facing ancient war-galleys caught at sea in deteriorating weather conditions, it becomes clear that such vessels must have operated on a very different seasonal schedule than was the case for merchant sailing ships.

Although the danger of swamping was the most obvious threat facing the crews of Graeco-Roman warships on the water in rough weather, the use of oars as the primary means of propulsion on ancient galleys also compounded the problems for warships. Even waves that would not directly swamp a ship nevertheless made rowing extremely difficult, and 'oars … could become almost useless to a boat pitched and buffeted by the short chop left by quickly passing squalls.'[110] The problems facing the oar-crews of Graeco-Roman warships attempting to maintain a regular stroke pattern through choppy seas is thus identified in both the ancient literature and in modern experimental trials of replicated galleys. For example, in the winter or early spring of 430 BC, the choppy waters at the entrance to the Gulf of Corinth made it impossible for the poorly trained Corinthian naval forces to row effectively. When the rowers became unable to maintain a rhythm as their oars became stuck in the waves, the vessels lost forward momentum and became increasingly unresponsive to the helm, making them easy prey for the Athenian triremes manned by better trained crews more capable of dealing with the conditions.[111] A similar problem was encountered by Alexander the Great's fleet in the rough water at the confluence of the

[109] Pliny, *Naturalis Historia*, 2.47.125. See also Milner (1996: 147 fnt. 1) for additional references to ancient authors who emphasise how seaborne merchants, desirous to maximise their profits, would trust their ships to dangerous seas.
[110] Pardey & Pardey 1981: 169 f.
[111] Thucydides, 2.83.3. For a detailed analysis of the battle, see Morrison et al 2000: 71 f.

Hydaspes and Acesines rivers in 325 BC, when the oars of the galleys were rendered ineffective, clashing together and causing rowers to 'catch crabs' so that two ships were lost and many others were damaged.[112] Similar difficulties also beset Tim Severin's replica of a Mycenaean galley, the *Argo*, while in rough seas off Sinope on the Turkish Black Sea coast:

> For a while the crew tried to row as we struggled to claw off the dangerous lee shore, but soon it was completely impossible to handle the oars. The boat was far too unstable. No one could get a grip on the surface of the sea with their blades. Men slipped on the spray-splashed oar-benches, cursed, fumbled their strokes and eventually abandoned the attempt. The crew pulled their blades in as far as possible and wedged the oar handles under the benches so that the blades angled upwards as far as possible clear of the waves. This was not just a question of convenience. There was always the danger that a bank of oars could be caught by a breaking wave, act as a lever and trip the boat.[113]

The *Argo* was modelled on the small, open galleys of the Bronze Age, and might therefore reasonably be expected to be rather more unstable and generally less seaworthy than the larger warships which took to the Mediterranean during later periods of antiquity. Nevertheless, experimental voyages of the *Olympias* have also highlighted the great difficulties facing rowers manning even large Classical era triremes in conditions of disturbed water. The problems on the *Olympias* were felt most acutely by the thalamians, manning the lowest level of oars; in choppy seas their entire oar might become buried in a wave making it impossible to row effectively. Even the thranites, on the top-most oar-bank, had great difficulty in retrieving their blades at the finish of the stroke. Such problems would, of course, be greatly exacerbated in rougher seas.[114] These difficulties of rowing in choppy conditions were noted while *Olympias* was undergoing sea trials off Poros in 1988 when the replicated trireme encountered waves measuring only 0.8 metres from crest to trough—seas that, while by no means large enough to directly threaten the vessel with swamping, nevertheless caused the thalamians to abandon rowing and ship their oars while even the two higher levels of rowers still found it 'really difficult … to synchronise their stroke along the length of the ship since there were sections in that length where oars were impeded by being caught in the crest of a wave, while at the same time there were other parts of the ship where the oars were in the air being over the trough

112 Arrian, *Anabasis*, 6.5.1.
113 Severin 1985: 175.
114 Morrison et al 2000: 248; Whitehead et al 1989: 40.

of a wave.'[115] All oared vessels could expect to encounter similar problems in disturbed water, regardless of the size, strength and seaworthiness of the hull. Throughout antiquity, it would therefore appear that the inherent difficulties of rowing through choppy seas would generally have limited the seasonal operations of war-galleys to the calmer conditions of the summer half-year.[116]

It was certainly possible for oar-crews to take measures that would provide Graeco-Roman warships with slightly better performance in choppy water, and rowing technique was one factor that would almost certainly have been altered whenever rough conditions were encountered. A long, shallow stroke would have been the most efficient technique for generating maximum power and the highest speeds on an ancient war-galley (and indeed any oared vessel) when on calm, flat seas. By contrast, should waves be encountered then the oar-crew would almost certainly have adopted a shorter and deeper rowing stroke which would have allowed the oar a better opportunity to clear the disturbed water.[117] At the same time, rowers aboard ancient warships would also have been able to alter the gearing of their oars in an effort to facilitate rowing this shorter and deeper stroke pattern[118]—slackening-off the leather oar-straps which attached the oars to the tholepins and then pulling slightly more of the oar inboard before re-tying the oar-strap.[119] Increasing the height of a rower with the provision of an additional cushion upon which to sit may also have been used as a means of aiding the oar-crew when it became necessary to row using the more rounded, rough-water technique.[120] However, despite being better suited to choppy sea conditions, this shorter and deeper rowing style would have led to a considerable loss in power and boat-speed and it would have proved difficult for Graeco-Roman galleys caught on the water in high winds and rough seas to make it to the safety of a harbour or resist being swept onto a lee shore.

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115 Coates et al 1990: 44.

116 As will be seen below (p. 153), while the great galleys of the medieval and early modern Mediterranean did frequently put out to sea during the wintertime, these large vessels relied far more upon sail-power than on the use of their oars (Alertz 1995: 152).

117 Coates 1994: 253; Morrison 1996: 284; Morrison et al 2000: 245; Platis 1995: 339; Shaw 1993: 75 f.; 1995: 166 f.

118 The 'gearing' of an oar has been described as 'the ratio between the length of the oar from the pivot outboard to the centre of pressure of the blade and that inboard of the pivot to mid-handle.' (Coates 1994: 249).

119 See Morrison 1996: 334, Weiskittel 1989: 100.

120 Morrison 1996: 335; Morrison et al 2000: 246; Shaw 1995: 166 f.

Modern research has indicated that the shape of the oar-blade used in Graeco-Roman galleys would also have affected the performance of a vessel in different conditions: while a stubby, broad blade is well suited to rowing in calm water, a long, narrow-shaped blade would have performed better in rougher seas.[121] It in unknown whether ancient shipwrights were even aware of the differing attributes of the two blade forms, while there is no evidence that ancient warships deployed on wintertime operations were ever specially equipped with a set of narrow-bladed oars. Instead, iconographic evidence indicates that ancient warships were generally provided with oars possessing the broader blade form,[122] further emphasising the fact that, from their hull design to the shape of the oar-blade, Graeco-Roman naval vessels were committed to attaining the greatest possible speeds on calm seas. As such, they were highly unsuited to the choppy conditions more likely to be encountered on the Mediterranean from autumn through to early spring.

Even were changes made to the shape of the oars and the techniques of rowing with them, the difficulty of synchronising the oar-stroke of a large crew attempting to row through choppy seas must have presented major problems, and the difficulty would have increased with the both the size of the oar-crew and the height of the waves. In fact, during the trials of the *Olympias*, coordinating all 170 of the trireme's rowers, even when on relatively flat seas, was an extremely difficult operation.[123] With the immersed blades of the *Olympias* separated by less than 30 cm of water, the potential for the trireme's oars to clash together was always great. Although the use of the shorter, more rounded, rough-water rowing style would at least have meant that the oars of the three levels of rowers were rather more separated than when using the longer, flatter rowing technique, nevertheless, rowing through the crests and troughs of even small waves would greatly have increased the risk of blade clashes and of 'catching crabs' which would further reduce the oar power and speed of a galley.[124]

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121 Coates 1994: 249; Shaw 1995: 164.

122 Coates 1994: 253; Morrison 1996: 325.

123 Coates et al 1990: 44 f., 75; Morrison et al 2000: 248; Platis 1995: 343; Rankov 1993: 51 f.

124 When rowing the *Olympias* with the long, flat style in calm sea conditions, the tracks of the oars of the three levels of rowers—the thalamians, zygians and thranites—actually cross during the recovery stage of the stroke when the blades are moving through the air (Shaw 1993). However, if, as is now considered to be the case, the interscalmium of the thalamians was slightly longer in the triremes of antiquity than on the *Olympias* replica, then this intermeshing of oars would not have been quite so great a problem even when rowing the longer, flatter stroke (Coates 1993a: 71 f.; Shaw 1993a: 66). Though the ability to recover

In addition to the problems caused to the crews of war-galleys by waves, the duty of the *keleutes* in synchronising the oar stroke must also have become considerably more difficult in conditions of wind, rain and lack of daylight—elements which, as Vegetius points out, were likely to be encountered with greater frequency during the wintertime.[125] Thucydides, for example, draws attention to the difficulty that trireme crews had in hearing commands over the noise of battle, while the trials of the *Olympias* further emphasised the problem of relaying orders to the entire oar-crew in even calm conditions.[126] In the breezier conditions of the wintertime, transmitting commands without their being lost on the wind must therefore have been a major difficulty on board triremes and the other large, multi-banked warships of antiquity.

Potentially causing an even greater difficulty for a crew attempting to maintain a synchronised oar-stroke in a Graeco-Roman war-galley was weather that necessitated the use of side-screens (*παράρρυσις*, *παραρρύματα*) to protect the rowers from elements such as spray and rain.[127] Sitting deep in the hull of a large, three-level warship, the lower two banks of rowers—the thalamians and zygians—were unable to see out of the vessel, and the *Olympias* trials emphasised the importance of the topmost level—the thranites—who, because they were sitting rather higher in the vessel, could see out of the ship and watch the blades as they moved through the various phases of the stroke, putting this top-most rank of rowers in a good position to direct the rowers sitting immediately below.[128] However, when the bad-weather screens of triremes were set in place then even this upper-level of rowers would have been denied visual contact with the surface of the water and the entire oar-crew would have been forced to 'row blind'. Given the likelihood that the times when the screens were being used to ward off wind-driven spray or rain would also often correspond to periods

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after 'catching a crab' increased markedly during the trials of the *Olympias*, nevertheless, even temporary loss of oar power during the recovery process of the stroke might well have proved disastrous for the crew of a galley caught at sea in adverse conditions (Rankov 1993: 52).

[125] *Epitoma rei militaris*, 4.39. (Quoted on p. 14).

[126] Thucydides, 2.84.3, 7.70.6.; Morrison et al 2000: 250. Difficulties in relying commands to the rowers of the replicated trireme actually necessitated the use of a microphone and amplification system for many of the trial voyages (Shaw 1993: 39).

[127] These screens are listed in the naval inventories of fourth century BC Athens as being made from canvas, hair, and leather, and were intended to ward off missiles in battle, or to protect against bad weather (Morrison 1989: 6; Morrison et al 2003: 150). For additional references to the use of side-screens, see Aeschylus, *Supplicants*, 715; Xenophon, *Hellenica*, 1.6.19, 2.1.22.

[128] Rankov 1993: 51f.

when sea conditions were also quite rough, then it must have been enormously difficult to keep an entire oar-crew synchronised when all the rowers were unable to see the blades. A similar problem would have affected galleys on the water during the hours of darkness that, as has been seen, were considerably lengthened during the winter months. (See above, p. 98 f.) After nightfall the thranites would again have been unable to clearly see the progress of the blades as they moved through the stroke, presenting an additional reason for ancient warships to keep off the seas during the short days and long nights of winter.[129]

Despite the problems synchronising the stroke pattern of a large oar-crew at times of deteriorating weather or during the hours of darkness, it must nonetheless have been the danger of swamping and the difficulties of rowing through waves that were the primary factors limiting the seasonal range of Graeco-Roman galleys. The sea-trials of the *Olympias* further highlight the inability of ancient warships to cope with conditions much beyond those of light breezes and smooth seas: when the replicated trireme encountered winds gusting up to 25 knots (46 kph) which were producing choppy seas of 1 metre in height, the thalamians were unable to row and had to stow their oars, while the upper two banks of rowers not only experienced great problems in keeping the stroke rhythm but, after little more than an hour, were physically exhausted and could only propel the vessel forward at a speed of 3 knots (5.5 kph). It was therefore concluded that 'these conditions were about the limit for rowing at two levels. A more experienced crew could no doubt have exerted more power and so have moved faster into the wind, but that is not to say that they could have coped with higher waves.'[130] Ancient warships would therefore appear to have been at the mercy of the sea if caught on the water in conditions above Beaufort 4 or 5.[131] It might be expected that the crews of most ancient war-galleys would usually have had a longer and more rigorous training regime than was the case for the rowers of the *Olympias*, and, as such, Graeco-Roman trireme crews would probably have coped slightly better in adverse weather conditions than

129 See Severin (1985: 83) for the problems of rowing in the dark on a choppy sea. It should, however, be noted that the 'boxing-in' of larger warships from the third century BC onwards (e.g. Greenhill and Morrison 1995: 165; Morrison et al 2000: 150), must have forced the crews of these vessels to adapt to rowing with the whole oar-crew crew unable to see out of the ship.

130 Coates et al 1990: 45. See also Coates & Morrison 1993: 109; Greenhill & Morrison 1995: 172; Morrison et al 2000: 261; Shaw 1995: 167.

131 Coates 1994: 249; Pryor 1995: 209, 216.

did their modern counterparts.[132] However, it is likely that even many of the best oarsmen of antiquity would have had only limited experience of rowing through unfavourable weather and sea conditions. Triremes, like the other large warships of the ancient Mediterranean, were, after all, extremely expensive vessels to build and maintain and would rarely have been taken to sea when waves and swells threatened to overwhelm them. The highly skilled rowers who powered the warships were an equally important asset that would seldom have been risked lightly.[133] Furthermore, the stresses of hogging and sagging which, induced by the action of waves on the hull, would have greatly reduced the operating lifespan of an ancient galley, might also have been a factor in keeping warships off the rougher seas generally expected over the winter half-year.[134] We are therefore informed by Polyaenus that, during the first half of the fourth century BC, the Athenian general Chabrias ordered that additional screens be fitted to the sides of his triremes to stop not only water and spray being cast into the vessels, but also to prevent the rowers from being overcome by fear at the sight of waves.[135] This led J.S. Morrison and R.T. Williams to note: 'Even the crews of Athenian triremes, usually thought of as capable and experienced sailors, were not immune to this fear of deep water and high waves.'[136] There is thus a clear implication that even the large warships of Classical Greece's leading maritime power were seldom deployed on rough water, and so rarely did trireme crews encounter rough seas that, when they did find their vessels besieged by large waves, at least some oarsmen were apt to panic.

Finally, it is worth noting that during the *Olympias* trials seasickness also became a problem for the crew in choppy sea conditions and about 10 percent of the vessel's complement suffered from the effects of the illness after rowing into the 25-knot headwinds and seas of one metre in height.[137] Seasickness would possibly also have been a problem which limited the abilities of even highly trained crews of antiquity, and it would seem unlikely that many Graeco-Roman oarsmen would have experienced rowing in choppy conditions with sufficient regularity to become accustomed to the pitching sensation and so avoid suffering from the debilitating effects of the ill-

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132 Morrison et al 2000: 93, 115 f., 253, 266; Whitehead 1993: 92 f.

133 For the expense of warships, see Morrison et al 2000: 40 f.; Gabrielsen 1994: 4, 218.

134 For hogging and sagging, see Coates 1993: 24 f.: 1993a: 73; Kemp 1992: 391, 737; Morrison et al 2000: 169, 196.

135 3.11.13.

136 1968: 282.

137 Coates 1993a: 72; Coates et al 1990: 36, 45: Platis 1995: 345. For the causes of seasickness on sailors, see Howard 1994: 366.

ness. With rowers suffering from seasickness and unable to contribute to the forward momentum of the vessel, the boat-speed and responsiveness of ancient war-galleys might, once again, be expected to suffer as a result of being caught at sea in unfavourable conditions.

The sea-trials of the *Olympias* and the *Kyrenia II* clearly emphasise the great disparity that existed in the sea-keeping abilities of ancient warships as compared to merchantmen: the performances of the two experimental vessels highlight the impracticality of any attempt to formulate a sailing season that could be equally applied to both types of vessels. As has been seen, triremes were probably unable to operate in winds of more than Beaufort 4–5, and even these conditions were capable of causing major problems for the oar-crew, while waves created in conditions of Beaufort 6 and above would almost certainly have swamped such warships. By contrast, winds of Beaufort 5 are described as providing 'virtually ideal conditions for *Kyrenia II*'.[138] The small, reconstructed merchantman also dealt comfortably with the strong winds and high waves of Beaufort 7, even sailing through the gale and storm-force conditions of Beaufort 9–10 before the vessel was forced to seek shelter. (See above, pp. 121-122.) Even if we question the legitimacy of some of the results generated from the sea-trials of experimental ships such as the *Kyrenia II* and *Olympias*,[139] it is nonetheless clear that Graeco-Roman merchantmen could have taken advantage of a far longer operating season than would have been the case for contemporary warships. It would therefore appear impractical to attempt to apply the same set of seasonal restrictions laid down by Vegetius to all shipping on the ancient Mediterranean. Instead, the results drawn from experimental archaeology reinforce the belief of this study that the eight-month maritime calendar proposed by Vegetius was purely a naval timetable, formulated for the oared

138 Katzev 1990: 249.

139 Questions certainly remain concerning the validity of the experimental sea-trials of both the *Kyrenia II* and *Olympias* reconstructions. The publication record of the *Kyrenia II's* voyages remains sparse, while doubts continue to be aired concerning the design of triremes and other ancient war-galleys. These problems notwithstanding, there can be little question that Graeco-Roman warships and merchantmen had vastly contrasting capabilities when dealing with heavy weather. Even were a rather more detailed record of the *Kyrenia II's* voyages to indicate that the vessel was more susceptible to rough seas than would presently appear to be the case, there is no doubt that the small merchantman would still have been a far better performer in rough and choppy waters than was the *Olympias*. Even if Tilley's (2004) proposals—which argue for Classical Greek triremes being considerably smaller and lighter than the *Olympias* replica—are accepted, then triremes would probably have been even poorer performers in choppy conditions than the *Olympias* trials would suggest.

warships of the late Roman period. In contrast, Graeco-Roman merchant vessels almost certainly possessed a considerably longer seasonal range—one that extended well into the winter half-year and the months traditionally considered the off-season for Graeco-Roman maritime activities.

As a consequence of the dangers and difficulties facing oared warships on anything other than relatively calm seas, naval operations on the Mediterranean were therefore highly seasonal in nature. This would remain true throughout antiquity and the Middle Ages, and even into the modern period until, in the closing decades of the seventeenth century, the superiority of the sailing galleon as a ship of war finally ended the long domination of the galley as the principal vessel-type among the battle fleets of the Mediterranean states.[140] Ferdinand Braudel has therefore noted that during the medieval and early modern periods, 'Galley warfare was ... impossible during winter, a fact that the professionals had to keep explaining to their political masters who remained deaf to their advice ... Galleys that failed to obey the rule were courting disaster.'[141] With the war-galleys of the Graeco-Roman Mediterranean restricted to an operating season similar to those of later ages, J.F. Guilmartin's comments concerning the seasonal nature of galley operations on the early modern Mediterranean are equally applicable to the warships of antiquity; in both periods 'warfare at sea had a strong seasonal character, a character reinforced by the annual cycles of agriculture, recruiting and trade. Operationally, galley squadrons sortied out in the spring and summer to raid, conduct sieges and, occasionally, to confront one another in battle. Campaigning in winter was exceptional, generally involving shorter distances and smaller numbers.'[142]

By contrast with the seasonally constrained nature of naval warfare on the early modern Mediterranean, sailing ships of the period were capable of remaining on the water throughout the year. When the Barbary corsairs began using sailing vessels in addition to their galleys during the early seventeenth century, not only did these sail-powered ships allow them to start operating on the large swells of the Atlantic Ocean for the first time, carrying out raids as far north as Iceland, but 'the introduction of the sailing-ship freed the corsairs from the normal time-table of Mediterranean naval warfare. ... With sailing-ships winter cruises could be enlarged in scope.'[143] The superior sea-keeping qualities of sailing vessels compared to those powered

140 Earle 1970: 50; Kemp 1992: 335; Kennedy 1976: 18.
141 1972: 251 f.
142 2002: 40 f.
143 Earle 1970: 52. See also Braudel 1972: 264.

by oars were also seized upon by the Knights of St John operating from Malta. The commissions authorising ship commanders sallying out from the island state to raid the neighbouring North African coastline were rarely longer than six months' duration and, as such, were usually granted to captains of galleys who carried out operations between spring and autumn. By contrast, for the longer raiding expeditions directed against the Muslim-dominated eastern Mediterranean, the Letters of Marque not only permitted privateering to last for considerably longer periods of time—usually at least a year—but they also dictated that ship commanders were to attack the enemy's seaborne commerce in winter as well as in summer; a proviso that led to sailing ships, rather than galleys, being deployed on these operations to the Levant.[144] On the early modern Mediterranean, as was also the case in antiquity, oared warships were therefore only deemed suitable for the conditions that tend to prevail from mid-spring through to mid-autumn; a cruising season that adhered closely to that set down in the late Roman sailing calendar of Vegetius. For naval operations that were set to take place during the wintertime, it was sailing vessels that were adopted by both Christian and Muslim naval forces as a means of permitting them to remain on the water in the stronger winds and rougher seas which tend to characterise this season. The relative performances of the *Olympias* and *Kyrenia II* in coping with winds and swells indicate that a similar situation also existed on the Graeco-Roman Mediterranean: galleys were usually confined to a six- or eight-month operating season extending between spring and autumn, while sailing merchantmen may well have continued to ply the sea-lanes throughout much of the winter. Such a point was made long ago by Chester Starr when he noted, 'Roman and Greek warships alike were unable to keep the sea for long periods. Even moderate seas were dangerous … In winter the fragile warship … were normally laid up, although the more solidly built commercial craft occasionally ventured winter navigation in the Empire.'[145]

Variations in the Seasonal Range of Warships

There is the possibility that, even when used only as a calendar for warship deployments, the sailing season proposed by Vegetius in the late fourth or early fifth century AD may actually prove too restrictive if applied to

144 Earle 1970: 135 f. See also Sire 1994: 87.
145 1941: 52.

war-galleys operating on the Mediterranean during earlier periods of antiquity. Plutarch, for example, notes that in 449 BC Pericles instituted a training programme for the Athenian fleet whereby sixty triremes were sent out on annual cruises that lasted a period of eight months.[146] It would appear at first glance that this Periclean sailing calendar dovetails neatly with that proposed by Vegetius eight-and-a-half centuries later; each consisted of an eight-month season that spanned the spring, summer and most of autumn.[147] It may even have been the case that Vegetius borrowed from this Classical Athenian example when drawing up the seasonal parameters of his own maritime calendar. However, despite the superficial similarities of these two sailing calendars, there may be considerable diversity.

It has already been seen that although Vegetius set the beginning of his seafaring season on March 10 and advised that it last through the following eight months until the seas were closed on November 11, the late Roman writer nevertheless also stated that the optimal season for naval operations ran from May 27 to September 14, with the other four months of his sailing season described as 'doubtful' for fleets of warships.[148] Yet throughout these months of doubtful navigation, during which Vegetius cautions against war-galleys to putting to sea, it appears that Athenian triremes of the mid-fifth century BC were cruising the Aegean and eastern Mediterranean, the oarsmen honing their skills as rowers, while the war-galleys acted as potent symbols of Athenian naval power. It would, in fact, seem likely that the sailing season of the Classical Athenian fleet was slightly longer than that which Vegetius accords to the warships operating on the late Roman Mediterranean simply on account of the difference in size and power of the vessels concerned. While the Athenian fleet dispatched annually by Pericles consisted of triremes, by the time Vegetius was writing, these large, three-tiered warships may well have disappeared: the last mention of triremes operating on the Mediterranean dates to AD 323, while Zosimus, writing in the late fifth or early sixth century AD, informs us that the design and construction

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146 Plutarch, *Pericles*, 11.4. Eddy (1968), while amending the number of triremes being sent out to sixteen is nevertheless content to accept that the annual tour of duty lasted for the eight month period. See also Gabrielsen 1994: 111; Jordan 1975: 104 f.

147 While Plutarch provides no set of dates outlining at what points in the year the Periclean season was set to commence and to terminate, we can nevertheless be confident in assuming that it straddled the summer half of the year and, like the Vegetian sailing calendar, began in early spring and ran through until late autumn.

148 *Epitoma rei militaris*, 4.39. Quoted above, p. 14.

of these war-galleys had been lost well before his time.[149] Even if triremes were still in existence on the Mediterranean of Vegetius' day, the late Roman author would nevertheless have been far more familiar with the liburnian (λέμβος) warships that, as Vegetius himself makes clear, were the most common type of vessels operated by the Imperial navy at the turn of the fourth and fifth centuries.[150] This move towards a much smaller type of warship was likely to have had important repercussions for the naval sailing season of the late Roman Mediterranean. Even though the seaworthiness of triremes was poor when compared to round-hulled, sailing merchantmen, it would nonetheless seem likely that the ability of liburnians to cope in unfavourable sea conditions was even more restricted.

Developed from Illyrian pirate craft, liburnians were considerably smaller and lighter than were Classical Athenian triremes: the latter measured about 40 m in length and 5.6 m across the beam and, when manned with a full complement of 200, displaced about 48 tonnes. In contrast, the hull of a liburnian, although varying greatly in size, would rarely have exceeded 20 m in length and 4.3 m across the beam and, with its crew of 60, would have displaced in the region of 14.5 tonnes.[151] The deeper draft of a trireme, combined with the war-galley's greater breadth at the waterline, is also likely to have provided these vessels with slightly better sea-keeping qualities than was the case for liburnians.[152] Furthermore, because a Classical Athenian trireme contained an oar-crew of 170, compared with about 50 for a liburnian, coupled with the greater stability which the deeper and beamier trireme provided for its rowers, then it would seem likely that triremes were capable of

149 Zosimus, *Historia Nova*, 2.22.3, 23.3. Morrison et al (2000: 8 f.) are, however, incorrect in their assertion that Zosimus was a contemporary of Vegetius: the former completed his *Historia Nova* post AD 498 (Momigliano 1970: 1150), while the latter was, in all probability, writing some one hundred years earlier (Barnes 1979; Milner 1996: xxxvii–xli).

150 *Epitoma rei militaris*, 5.3.

151 For the dimensions of these and other ancient warships, see Coates, in Morrison 1996: 345. Even though these figures are, to a large extent, based on educated conjecture, and they should therefore not be treated as concrete facts, nonetheless, the designs of ancient warships which have been recreated by J.F. Coates do provide useful approximations which allow scholars a clearer understanding of the nature of the different galleys employed by the various warring powers of the ancient Mediterranean.

152 As larger, heavier vessels, triremes certainly had deeper hulls than did liburnians; a fact that is implied by Tacitus when he records how a naval squadron under Corbulo, which included both these warship types, was forced to separate when navigating the Rhine in AD 47; the triremes were compelled to keep to the main channels of the river on account of their deeper draft, while the liburnians, because of their shallower hull forms, were able to take a shorter, more direct route through the shallower channels (Tacitus, *Annals*, 11.18.2). As such, the reconstructions formulated by Coates give the trireme a draft of 1.1 m, while that of the liburnian measured 0.76 m (Morrison 1996: 345).

generating considerably more power than was a liburnian.[153] The warships of Vegetius' period were therefore probably even less competent at dealing with rough conditions than were triremes—vessels which themselves were poor performers in anything other than fairly flat seas. By implication it would thus appear likely that the liburnians with which the maritime calendar of Vegetius were primarily concerned may have possessed a slightly shorter operating season than did the trireme fleets dispatched by Pericles.

The possibility that larger warships may have been able to cope rather better in rough sea conditions should also lead us to question the length of the sailing season for the large polyremes—the outsized warships that began to be deployed on the Mediterranean from the end of the fifth century BC and which were to serve as the frontline ships in the battle-fleets of all the Hellenistic powers that harboured aspirations of naval supremacy.[154] With their multi-banked arrangement of rowers, together with the use of multi-manned oars, polyremes potentially had greater power and endurance to cope in rough sea conditions than did triremes and, as such, may have been capable of extending their operating season further into the late autumn and early spring. The evidence that can be gleaned from the ancient literature certainly supports the case for the large polyremes possessing greater seaworthiness and, by implication, a longer sailing season, than was the case for the smaller triremes and liburnians. For example, in 390 BC, during his attack on Rhegium, the fleet of Dionysius of Syracuse was caught in a storm. Although the flagship quinquereme (πεντήρης) was sufficiently stable and powerful that it could rowed clear of the lee shore, seven other warships, which were probably triremes, were wrecked.[155] During the

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153 While the size, and therefore the complement, of Roman Imperial period liburnians varied depending on the purposes to which the individual warships were designed and constructed, it would nevertheless appear likely that most had about 50 rowers (Morrison 1996: 317).

154 It should be emphasised that most scholars are now in agreement that three levels was the greatest number practicable on ancient warships. Thus, for galleys rated as larger than a trireme, or 'three', it was the number of rowers wielding the multi-manned oars that gave the vessel its classification. Therefore, in the case of the quinquereme, (the 'five') and the heptereme (the 'seven'), both had three levels of oarsmen, the quinquereme probably having the oars on its middle (zygian) and topmost (thranite) levels double manned, while the lowest (thalamian) level remained single manned. For the heptereme it seems likely that, while the thranite and zygian levels still had oars that were double-manned, it was the thalamian level that had triple-manned oars (See Coates, in Morrison 1996: 285 f., for the descriptions and reasoning behind the various arrangements of oar-crew on ancient polyremes).

155 Diodorus Siculus, 14.100.2. See Morrison 1996: 2.

Second Punic War there is another useful comparison of quinqueremes and triremes when, in an encounter between a Roman and Carthaginian squadron in the Straits of Gibraltar, Livy describes how the triremes were at the mercy of the strong currents which swept through the strait. By contrast the larger polyremes found it considerably easier to handle the conditions, while the quinquereme acting as flagship of the Roman squadron was able to ram and swamp two enemy triremes and cause damage to a third as the Carthaginian ships struggled against the current.[156] Therefore, in the reconstruction by Coates, a quinquereme dateable to about 100 BC is calculated to have had a length of 45 m, measured 7 m across the beam, and possessed a draft of 1.5 m, and, with a full complement of 377 (282 of whom were rowers), displaced about 110 tonnes.[157] As such, the quinquereme was a considerably larger and more powerful warship than the Classical trireme.

The even larger heptereme (ἑπτήρους) also appears to have performed better in rough seas than did smaller warships. For example, while making the crossing from Greece to Tarentum in 280 BC, the fleet of Pyrrhus encountered heavy weather that destroyed many ships and drove others off course. However, the large heptereme that functioned as the king's flagship was better able to deal with the swells of the open sea and even though the ship later encountered problems in the breakers close inshore, it nevertheless appears that the greater size and weight of the heptereme allowed it to better handle the hazardous conditions than was the case for the smaller vessels of the fleet.[158] Assuming the heptereme as reconstructed by Coates is a reasonably close approximation of the dimensions of this warship type, then the increased seaworthiness of the vessel relative to the trireme or the liburnian becomes apparent.[159] Measuring about 47 m in length, with a breadth of about 7.5 m, the heptereme may not appear much larger than a Classical trireme. However, with a displacement of 133 tonnes when fully manned, the heptereme was over three-times heavier than a trireme of the Classical period, and nine-times the weight of a liburnian of the late Roman Empire. With an oar-crew of 390, the heptereme also had 220 more rowers than the trireme, and 340 more than the liburnian. The need to accommodate such a large number of rowers would also have increased the vessel's

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156 Livy, 28.30.3. See also Morrison 1996: 64 f., 343. For the currents flowing through the Straits of Gibraltar, see Cunliffe 2001: 41.

157 In Morrison 1996: 345.

158 Plutarch, *Pyrrhus*, 15.1. While Plutarch does not actually name Pyrrhus' ship as a heptereme, Morrison (1996: 42) provides compelling reasoning behind his assumption that the Epirote king's flagship was a warship of this type.

159 Coates, in Morrison 1996: 345.

breadth on the waterline, which in turn would have enhanced the vessel's stability—a necessity in a warship that carried about 100 marines into battle on its deck.[160] This increase in ship stability not only created a steady fighting platform for soldiers, but would also produce a stable platform for an oar-crew attempting to row in choppy conditions, allowing rowers to take their strokes far more easily than would have been the case in narrower, more lightly constructed galleys. Indeed, the relative instability of a Classical era trireme is implied by the fact that they carried only ten hoplites and four archers on their decks, while the hoplites were even required to throw their javelins from a sitting position so that their movements should not, quite literally, 'rock the boat'. This rolling of the vessel would have made it exceptionally difficult for the rowers to take their strokes effectively.[161]

It is the potential of the heptereme to handle rough sea conditions that led J.S. Morrison to speculate that 'the sea-keeping qualities of the seven [i.e. the heptereme] … [m]ay give one of the reasons for building the larger oared warships.'[162] If this desire for better rough-weather performance was one of the motivating factors behind the construction of large multi-manned polyremes, it may therefore have been the case that for a four-hundred-year period—spanning the time from the invention of the quinquereme at the beginning of the fourth century BC, until the establishment of the *Pax Romana* at the start of the Principate—the use of these large vessels could have extended the operating season for warships. There may thus have been an increase in the seasonal range of Hellenistic navies which operated large polyreme war-galleys. Ships such as the quinquereme and heptereme might have remained active on the seas of the Mediterranean for longer than the eight-month operating season which appears to have constrained both the trireme fleets of Periclean Athens as well as the liburnians used by the late Roman navy. Although it might seem unlikely that the increased levels of seaworthiness provided by polyremes would have allowed the Hellenis-

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160 Coates, in Morrison 1996: 345. See also Coates 1989: 27; Morrison et al 2000: 44 f.

161 See Morrison et al 2000: 160 f. (following Thucydides, 7.67.2). For the problems facing an oar-crew attempting to row on a pitching and rolling vessel, see Severin 1985: 175, quoted above p. 139.

162 1996: 42. However, it should also be borne in mind that because these large and expensive warships would often have acted as flagships for fleet commanders as well as 'showpiece' vessels used to project the naval power of a state, hepteremes were presumably also provided with the best available oarsmen, sailors and helmsmen and, as such, the ability of these polyremes to deal with hazardous sea conditions might owe more to the superior skills of the crew as much as to the shape and size of the hull-form or the nature of the oar-system.

tic states and empires using these large warships to significantly lengthen the sailing season over that noted by Plutarch or advised by Vegetius, such a possibility should not be dismissed out of hand. The late medieval and early modern periods certainly provide interesting parallels as the navies of Venice, Florence, and the Hospitaller Knights of St John on Malta all adopted over-sized galleys which possessed hulls far stronger and heavier than those of other warships operating during the same period, while these war-galleys also had a higher freeboard and were also considerably wider across the beam relative to their length. Although this combination of attributes led to a reduction in speed and manoeuvrability, the increased levels of seaworthiness gave these so-called 'great galleys' a far longer sailing season than was the case for smaller warships of the period. Therefore, in spite of the problems of using oars in the rough seas of winter, and the related difficulties of controlling and coordinating a large oar-crew when on the water in windy and choppy conditions, great galleys regularly operated during the winter months.[163] There is no literary evidence to support the theory that any Graeco-Roman warships routinely took to the seas in the wintertime, or had a sailing season as long as that of the great galleys of the medieval and early modern Mediterranean. Nevertheless, because polyremes were considerably heavier, broader-beamed, deeper-drafted and possessed a higher freeboard than was the case with the late Roman liburnians around which the sailing calendar of Vegetius was probably framed, then there is the possibility that earlier periods of antiquity may have witnessed a more protracted sailing season for oared warships. This extended naval calendar possibly reached its maximum length during the Hellenistic period when large, multi-level war-galleys, powered by multi-manned oars, dominated the navies of the Mediterranean.

Also of interest in this respect are two naval treatises dating to the later ninth or early tenth centuries AD that indicate the sailing season for Byzantine warships along the southern coast of Anatolia was considerably longer

163 Guilmartin 2002: 113; Mallet 1967: 33; Parry 1963: 55; Pryor 1988: 88; Sire 1994: 89. It should, however, be noted that all galleys of the later medieval and early modern periods operated with the oar-crew at only one level (rowing in either the *alla sensile* style, with one man to an oar, or, as skilled oarsmen became harder to recruit in the early modern period, in the *a scaloccio* style, which used several men to a single oar) possibly making it easier to maintain a synchronised stroke, even in poor weather and sea conditions, than was the case on some of the multi-levelled and multi-manned warships of antiquity. Furthermore, despite their large oar-crews, great galleys appear to have relied primarily on the use of the wind for their motive power and were therefore probably far more effective sailing vessels than were the galleys of the Graeco-Roman Mediterranean.

than that set down by Vegetius some five hundred years earlier.[164] Both the Byzantine maritime calendars use the setting of the Pleiades on November 14 to signal the end of the sailing season; a date which falls only three days later than that advised by Vegetius. The disappearance of the Pleiades over the autumnal horizon is also the same celestial marker used by Hesiod to indicate an end to the sailing season.[165] However, despite the broad agreement concerning the end of the maritime season, both Byzantine sailing calendars possess far earlier start dates than do any of those which survive from the Graeco-Roman world: one of the Byzantine documents records February 15 as heralding the start of naval operations, while the other marks January 6 as the point at which war-galleys would once again take to the seas. Both Byzantine calendars therefore point to naval seafaring commencing considerably earlier in the year than the date of March 10 which marks the beginning of Vegetius' sailing season—a date which the late Roman author only regarded as 'doubtful' for seafaring, with another two-and-a-half months still remaining before the Mediterranean was considered properly safe. Michael McCormick has emphasised that these two Byzantine naval timetables provide evidence that maritime operations on the early medieval Mediterranean extended for considerably longer across the year than was the case for the warships of antiquity. However, he fails to take into account the profound technological and political variations that underpinned the sailing calendars of Vegetius' late Roman world and those of the medieval Mediterranean.[166]

The liburnian warships that formed the core of the late Roman battle-fleets on the Mediterranean certainly differed radically from those of the ninth and tenth centuries, during which time the Byzantine navy primarily relied on dromōns, war-galleys that were usually considerably larger than liburnians. While the smallest dromōns probably had a crew of about 50, thus equal in size to the larger liburnians, others carried as many as 230 rowing crew and 70 marines.[167] The early medieval warships were also pre-

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164 McCormick 2001: 461–462. See also Dagron 1990; Dolley 1951. Bearing in mind the considerable meteorological variations which are present across the Mediterranean, and the generally favourable conditions that exist in the Levantine basin, even during the wintertime (see above, p. 16 ff.), McCormick is therefore correct to emphasise that 'The navigational conditions which obtained there [i.e. the southern coast of Asia Minor] perhaps do not automatically apply to the rest of the Mediterranean.' 2001: 462.

165 Vegetius—*Epitoma rei militaris*, 4.39; Hesiod—*Works and Days*, 618.

166 McCormick 2001: 461. McCormick also provides no explanation as to why two contemporaneous maritime calendars, relating to the same region of the Mediterranean, should have start dates for the sailing season which vary by almost six weeks.

167 Alertz 1995: 142 f.; Pryor 1995a: 105 f.

sumably constructed in skeleton-first fashion—a shipbuilding method that, with its reliance on thick and strong internal framing, would have provided dromōns with relatively heavy and deep-drafted hulls. Although this would have made dromōns rather slower and less agile through the water than the shell-first built warships of the Graeco-Roman period, the oar-crews of the medieval warship would have been provided with a more stable rowing platform. Such characteristics would presumably have allowed dromōns to cope better in winds and waves than was the case with the lightweight, shallow-drafted warships of late antiquity, allowing the Byzantine warships to take advantage of the longer operating season reflected in the two naval treatises relating to southern Anatolia.[168] If such was the case, then it reinforces the theory that the empires and other powerful states of the Hellenistic period that operated large, heavily-manned polyremes like the quinquereme and heptereme, might also have adopted sailing calendars that were on a par with, or even longer than, those which survive for Byzantine dromōns of the ninth and tenth centuries.

The variations in the seasonal range that exist between the naval calendars of the late Roman and early medieval Mediterranean may, however, owe more to the vastly different political and military environments in which the sailing timetables were conceived. The naval treatises of the

[168] While no remains of dromōns have ever been recovered, and even shipwrecks of commercial vessels dating to the early medieval period are exceptionally rare, present scholarship would nevertheless indicate that by the late fifth century, when dromōns first appear in the literature (Pryor 1995a: 101), shipbuilding had reached the state where the shell-first method of construction which characterises Mediterranean antiquity, was in the process of being replaced by the skeleton-first method (see above, p. 112 ff.). Although, as far as I am aware, no scholars have ever addressed the possibility, it is interesting to speculate whether the liburnians of Vegetius' day were also still being constructed in the manner of earlier generations of ancient warships. As has already been noted, by the fourth century AD, shipwrecks of merchant vessels, such as that at Yassi Ada, were already displaying moves towards the skeleton-first construction technique. However it remains a mystery whether the warships of late antiquity were also beginning to rely more on their internal framework, or whether they remained true to the shell-first shipbuilding method. It might appear likely that war-galleys would have retained the use of the ancient shell-first shipbuilding process for longer than merchant vessels (this construction technique would, after all, have created lighter vessels possessing greater speed and manoeuvrability, qualities that would have been highly-prized in warships). Nevertheless, in his study of shipbuilding, Vegetius makes no mention of mortice-and-tenons being used in the construction process, referring instead only to the need to use nails made of bronze rather than of iron when building the hull (*Epitoma rei militaris*, 4.34). Whether this stems from the late Roman author's limited understanding of the shipwrights' art, or because the need for closely spaced mortice-and-tenons had become less important compared to earlier centuries, is, however, unclear.

early Middle Ages were borne out of a period of hostilities between Byzantine and Muslim forces; a time when the crews of warships would have been expected to take greater risks with their lives and vessels than would have been the case in times of peace. By contrast, Vegetius' sailing season was formulated during a time when maritime activities on the Mediterranean could be pursued without the constant threat of war: instead of human enemies comprising the greatest danger to war-galleys, it was the powers of nature that posed the most immediate hazards to late Roman warships. As such, the seasonal parameters set down by Vegetius relate to the periods of the year during which sea conditions allowed routine peacetime operations to be conducted in relative safety, without undue risk of damage or loss to the valuable materiel of the Imperial navy. With its focus on the relatively small warships of a peacetime navy, the sailing calendar advised by Vegetius is therefore probably excessively cautious. During earlier periods of antiquity, when various states and empires vied for naval supremacy on the Mediterranean, the operating season for naval shipping would probably have been far longer and considerably more flexible than that proposed by Vegetius, thus explaining the numerous references to warships remaining on winter seas during the Classical and Hellenistic periods when hostilities between rival states and empires was endemic.[169]

While the focus of this section has been upon the warships of antiquity, other forms of Graeco-Roman galleys must also have had encountered problems in rough sea conditions. Without the overriding need for speed and manoeuvrability that dictated the design and construction of warships, galleys that were designed and built for the transport of cargo would have been constructed broader in the beam relative to their length, and with a deeper draft and freeboard than was the case with vessels of war. Oared merchantmen were therefore likely to have been rather more seaworthy than war-galleys. Nevertheless, the problems facing rowers attempting to propel a merchant galley across choppy wintertime seas has great relevance for the sailing season proposed by Hesiod in c. 700 BC, a period when oars, rather than sails, appear to have been the primary form of propulsion for vessels on the Mediterranean. It has therefore been noted that, 'The eighth-century [BC] evidence leads to the conclusion that in this period the oared ship dominated all shipping. There is indeed no ship picture or model

169 For examples of ancient warships remaining on winter seas, see, for example, Morrison 1996; Morrison & Williams 1968; Saint Denis 1947: 201 f.

originating from the Aegean area or the Greek continent that cannot be interpreted as representing an oared ship, and no text manifestly referring to a ship without oars. The first unmistakable picture of such a (pure sailing) ship is dated c. 515 BC.'[170] It would therefore appear that the sailing season proposed by Hesiod was designed around the operating requirements of the relatively small, lightweight galleys used by the aristocratic families of Archaic Greece and was intended to fulfil a variety of roles that included sea-trade, warfare and piracy.[171] Whether manned by rowers seated on one or two levels, it is, nevertheless, 'a safe assumption that galleys were used for all categories of transport … The poet Hesiod's advice on seafaring to his fellow-farmers implies that the latter—at any rate some of them—had their own sea-going galleys, with which they traded their surpluses to remedy shortages.'[172] The likelihood that Hesiod was basing his sailing season on oared vessels is highly important given that the multi-purpose galleys of the Archaic Aegean, like the purpose-built warships of later periods, were highly unsuited to choppy conditions and were poor performers if ever caught on the open sea during the deteriorating weather of a wintertime depression system.[173] Hesiod's sailing calendar—with its outside limits stretching from late March through to late October—is considerably longer than is often acknowledged to be the case (see above, pp. 10–13). However, because the focus of the poet's calendar is on galleys rather than sailing ships, it is therefore likely that the seasonal range of Hesiod's seafaring timetable would have been considerably more constrained than was the case in later periods of antiquity, when both literary and shipwreck evidence suggest that the majority of merchant ships derived their primary motive force from sails rather than oars.[174]

170 Wallinga 1995: 42. See also Morrison & Williams 1968: 85.

171 Gabrielsen 1994: 24 f.; Humphreys 1978: 166 f.

172 Wallinga 1995: 42.

173 While such vessels would normally also carry a sail, the fact that the ship was constructed with an oar-crew in mind would have affected its seaworthiness, while, as will be seen below (p. 159 f.), it is possible that the sail in use during Hesiod's time of writing was considerably less efficient than that used in later periods of antiquity.

174 Casson, for example, notes, 'Many more types of merchant galleys are known than of sailing ships, even there must have been many more of the latter in service at any given time.' (1995: 158. See also, 157 f.; 335 f.). Rauth, however, has argued that the majority of vessels on the Graeco-Roman Mediterranean relied on oar-power to at least some extent, with only the very largest merchant ships totally reliant upon their sails (2003: 152 f.).

Sails

Despite the strength and seaworthiness of the hulls of Graeco-Roman ships constructed in the ancient shell-first manner, many scholars have argued that the ancient square sail—the rig which both epigraphic and literary evidence suggest was the most common sail-type used throughout antiquity—was unsuited to wintertime conditions and thus brought about an adjournment to maritime operations during the winter months. It is therefore frequently claimed that only following the widespread adoption of the lateen rig during the early medieval period did the sailors of the Mediterranean possess a sail that was capable of allowing them to remain at sea in the strong and unpredictable winds of winter. It has therefore been claimed by B.M. Kreutz that the 'Classical square sail was … best suited to stable conditions and set routes designed to take advantage of a following wind. The early Medieval lateen … would certainly have made voyages with erratic or unfavourable winds a bit easier.' As such, Kreutz has argued that the lateen rig was eagerly embraced by Arab forces intent upon pursuing naval campaigns throughout the year, when the Muslim mariners would have had to face the unfavourable winds of the Mediterranean winter.[175] It is opinions such as this—which consistently downplay the abilities of the ancient square sail in blustery and changeable winds while promoting the superiority of the lateen rig for sailing in such conditions—that remain the academic orthodoxy.[176] However, this academic consensus should be at least questioned if not rejected. As the following pages will highlight, on close analysis it appears that the ancient square sail would have been a reasonably safe and effective rig in wintertime conditions. By contrast, it was the lateen sail that was far less suited to the strong and highly changeable winds that characterise the winter half-year on the Mediterranean.

Throughout the entire Graeco-Roman period, the rig in use aboard the vast majority of sea-going vessels was the square sail that sat low and broad on the mast and was controlled through the use of brailing lines (figure 3.10).[177] The nature of ancient rigging—the various sheets, halyards, braces, stays and the other ropes, blocks and pulleys that were all required to either support the mast or were necessary in the hoisting, lowering and trimming of the sail—have been discussed in detail elsewhere and need

175 1976: 98.
176 See, for example, works by Horden & Purcell (2000: 142), or McCormick (2001: 458).
177 E.g. Casson 1995: 68, 232; Roberts 1993: 29.

no repeating here.[178] However, of primary interest when focusing on the question of wintertime seafaring are the brails—the lines attached to the foot of an ancient sail, from where they were taken up and over the yard and then back down to the deck and secured aft of the mast.[179] It was these brail lines that were used to either take up or lower down ancient square sails. With the introduction of brail rings, whereby the brail lines were attached directly to the surface of the sail rather than just at its foot and at the yard, the sail could be furled with ease, and also shaped and set in a variety of ways in order to get the maximum benefit from different wind conditions. All this could be achieved by sailors hauling on the lines while remaining safely on deck, with no need to climb up into the rigging or to the yard except when securing a fully furled sail (figure 3.11).[180] This system of sail handling allowed the rig of ancient vessels to be adjusted quickly and easily, and even small crews could handle a large square sail effectively.[181] It has thus been noted by O.T.P. Roberts that, 'The merits of this rig are undeniable and over a period of 1800 years it changed little except in detail. Brails were fundamental to the development of sailing techniques.'[182] The iconographic evidence has also led Roberts to speculate that the introduction of brail rings may only have come into widespread use in the eastern Mediterranean c. 700 BC.[183] As such, the considerable benefits which these rings provided to ancient seamen when setting and shaping the sail might have been unavailable to the seafaring contemporaries of Hesiod when the Boeotian poet was creating his maritime calendar. If this was the case, then later generations of Graeco-Roman sailors, who operated rigs that had brailing rings sewn into place, would have been able to exert a greater degree of control over the

178 See, for example, Casson 1995: 68 f., 239.

179 See Casson 1995: 70. However, see also Roberts for the probable existence of an older method of using the brails in which the lines passed round both sides of the sail and were attached directly to the yard (1990: 288, 1993: 30 f.). Both brailing systems would have exerted considerable stress on the yard, however, by means of fishing the yard (i.e. securing an additional piece of wood in order to reinforcing a perceived weak point of a yard or mast in the manner of a splint) ancient sails could probably have withstood even very strong winds, though the ends of the yard would often bend downwards towards the deck, producing the curved yards which are seen in many representations of Graeco-Roman vessels under sail (Roberts 1993: 29).

180 Casson 1995: 70.

181 Casson 1995: 70; Roberts 1993: 30. The speed and ease of use with which brailing lines allowed the sail to be manipulated have also been evidenced on various full-size, working reconstructions of ancient vessels such as the *Argo* (Severin 1985: 84), the *Kyrenia II* (Katzev 1990: 246, 252 f.), and the *Olympias* (Morrison et al 2000: 224, 257; Roberts 1993: 35 f.).

182 1993: 34.

183 1990: 290.

sail in the blustery winds more commonly encountered during the winter months, and might therefore have felt more confident in extending the season of their operations beyond the limits Hesiod set down in *Works and Days*.

In sharp contrast to the relatively undemanding nature of the ancient square sail, the lateen can be a notoriously difficult rig to operate. Often considered by seamen to be one of the most graceful of sailing rigs, the triangular, or near-triangular,[184] lateen sail is set on a long yard angled obliquely from a short, forward-raked mast (figure 3.12); this creates a high peak to the lateen sail that channels the airflow to generate a great deal of driving power and therefore speed.[185] However, the very length of the yard, together with the large amount of canvas contained in the sail, have always presented mariners with problems when handling the lateen rig in strong and blustery winds. Even raising or lowering the sail on a large lateener was often a difficult process, as was made clear by H.W. Smyth who witnessed such procedures on lateen-rigged dhows of the Indian Ocean at the start of the twentieth century: 'Getting up sail is a very lengthy, not to say noisy operation. The yard and sail are very heavy, and take the full force of seventeen men or so who form the crew to hoist. … It takes half an hour to get the sail up in ordinary weather, and more if there is any wind, while shortening sail is an equally lengthy process, and in squally weather becomes really dangerous.'[186] Yet, in spite of its slow and cumbersome raising process, it has been argued, and with some legitimacy, that one of the great virtues of the

184 The lateen rig traditionally used in the Mediterranean was a 'true' lateen, in that it possessed a three-sided sail. By contrast, the lateen used on the dhows of the Indian Ocean and Red Sea was actually a four-sided sail, possessing a short luff at its forward edge, a rig known as a seltee (or settee) lateen (Kemp 1992: 466–467). It is a measure of the difficulties encountered when dealing with sail technology that while Smyth (1906: 261–263) regards the triangular Mediterranean lateen as possessing superior performance to the seltee lateen, more recent writers such as Harvey (1997: 79) instead emphasise the improved airflow and ease of use provided by the latter version of the rig.

185 Dimmock 1946: 35; Pryor 1994: 67. It was the greater speed bestowed on vessels carrying a lateen sail that has been emphasised by some scholars as the primary reason for the widespread adoption of this sail type on the waters of the post-Roman Mediterranean: the confused and often dangerous political environment of the early Middle Ages made speed a prime requirement for sea-going vessels (e.g. Lopez 1959; Pryor 1994: 64).

186 1906: 305–306. See also Harvey (1997: 21) who refers to the disadvantage of lateen-rigged vessels having such a long yard. Such descriptions by professional sailors and sail-makers also highlight the deficiencies that abound in the works of historians unacquainted with the technology of their periods; Earle Bradford, for example, regards the lateen rig of the medieval Mediterranean as requiring little manpower to hoist and set (2002: 80).

lateen rig is that in squally conditions the sail can quickly and easily be let fly—the sheets released and the sail allowed to billow out, 'spilling' the wind—thus preventing powerful gusts of wind from tearing the sail.[187] This assumes, of course, that a crew is always alert to the approach of squally winds and would have time to take the necessary action before their arrival. The failure to do this might lead to the destruction of the sail and leave the vessel at the mercy of the winds and seas. Such a situation was described by Norman Lewis who, voyaging on the Red Sea in a lateen-rigged dhow in 1937, noted the effect of a sudden squall on the vessel: 'Five crew members were on deck busying themselves with the sails, but they were too late, for the first blast of the wind to reach us ripped the mainsail to shreds.'[188] Even if a lateen rig were safely let fly in an effort to prevent the sail being torn apart by increasingly strong winds, it still remained a major problem to then take in the canvas and furl it to the long yard. It was therefore noted by Smyth that while the process 'naturally varies with the size of the vessel … even in a moderate sea, furling a fifty-footer's lateen sail is no fun if you have had no practice at it and are not possessed of prehensile toes.'[189] Furthermore, in strengthening winds, lateen sails are seldom reefed but are instead completely replaced by another of smaller size. Such a procedure is often extremely time-consuming and in rapidly deteriorating weather conditions the lack of control that the helmsman would be able to exert over the vessel while one sail was being exchanged for another might prove fatal. It is therefore hardly surprising the lateen rig has been described as 'hazardous in any but calm waters.'[190] As will be seen in chapter five, while the square-sailed ships of the late Hellenistic and early Roman Imperial periods made crossings to India on the strong and often gale-force winds of the south-west monsoon, by contrast, during the twentieth century even the stoutest lateen-rigged vessels rarely braved the Arabian Sea during that season. (See below, p. 223 ff.) Given the inability of the lateen sail to handle strong and blustery winds, the wintertime Mediterranean was hardly an ideal environment for vessels carrying this rig. While strong winds and gales were generally more of a danger to seafarers during the winter months than at other times of year, the lower air temperatures of the wintertime also caused additional problems for lateen-rigged ships.

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[187] Smyth himself notes this ability of the lateen rig (1906: 254).
[188] 2001: 37.
[189] 1906: 303.
[190] Kemp 1992: 467.

With cooler air being denser than air at warmer temperatures, vessels at sea on a cold winter's day should therefore expect winds to exert greater pressure on the sail, even though the actual wind-speed might be rather less than that encountered on a warm summer's day.[191] The increased power of these winter winds would have posed a greater problem to seafarers aboard lateen-rigged craft than for mariners on vessels carrying the ancient brailed square sail.

In addition to the problems afflicting lateen-rigged vessels in strong and squally winds, one of the other main drawbacks for seamen handling this type of sail is the difficulty in changing from one tack to the other with 'lateen rigs ... not well suited for frequent tacking on constricted water.'[192] Instead of tacking with the bows of the vessel pointing across the wind, as is the normal method when going-about on modern fore-and-aft rigged yachts and which would also have been the case on ancient square-sailed vessels, on a lateener the process almost always involved wearing around. This procedure demanded that the vessel be brought on to the opposite tack by presenting the ship's stern to the wind at which point the sail was let fly and allowed to billow forwards while the long and cumbersome yard was brought to the vertical, hauled around the mast and, once the sail was sheeted in, the vessel was set on its new tack (figure 3.13).[193] On anything other than a small boat, such a procedure has always proved awkward and required the strength and skill of a large crew. In heavy seas, on a pitching and rolling deck, the manoeuvre was highly problematic and even Kreutz, a strong advocate of the merits of the lateen rig, describes wearing round a lateener as 'an awkward manoeuvre in light air and highly dangerous in a heavy wind.'[194]

In contrast to the complexities and hazards involved in changing tack on a medieval lateen-rigged ship, going about on a Graeco-Roman vessel carrying only one or two square sails was a far simpler procedure because either end of the yard could be pointed towards the wind, obviating the need to swing it from one side of the mast to the other. Thus, on the *Olympias*, which carries a replica of an ancient brailed square sail, 'Tacking and wearing can

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191 Harvey 1997: 53.

192 Guilmartin 2002: 33. See also Runyan 1994: 49.

193 For detailed descriptions of the manoeuvre, see Castro et al 2008: 349; Kemp 1992: 929; Pryor 1994: 67; Smyth 1906: 311.

194 1976: 107–108. While it is possible to tack a large lateen-rigged ship, the procedure has always been considered highly unusual because of the stresses that the heavy yard and sail exerted on the unstayed mast. See Dimmock 1946: 40 f.; Norton 1957; Parry 1963: 58 f.

be carried out easily and with little loss of speed.'[195] Indeed, it was the relative ease with which square-sailed vessels could switch from one tack to the other that can be regarded as a crucial factor in allowing the square-sailed cog to supplant the lateen-rigged medieval round ship and thereby open up the Mediterranean to wintertime navigation. It has therefore been asserted that, 'The medieval "nautical revolution" was marked by the replacement of the lateen rig with square sails.'[196] It would thus appear that, in the strong and highly variable winds more commonly experienced during the winter months of the Mediterranean, it was the ancient brailed square sail, rather than the lateen rig, that was more suited to the conditions. The safe, if slow, ancient square rig, with the easily handled brailing lines, appears to have provided mariners aboard Graeco-Roman vessels considerable potential to safely weather the blustery winds of winter. In contrast, the lateen sail was considerably more difficult to handle and was unsuited to squally conditions.[197]

Windward Sailing

It would seem that many of the arguments put forward in support of the abilities of the lateen rig to master the Mediterranean winter during the Middle Ages stem from the confusion of two very different requirements demanded of sails. First, a sailing rig should have the capacity to cope with

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[195] Platis 1995: 344. However, no details of the procedure carried out on the replica trireme were provided, while Roberts (1993: 35), the designer of the warship's rig, expressed concern about the lack of stability inherent in the hull-shape of the long and narrow war-galley to tack in anything more than a light breeze. However, on broader, deeper-drafted merchant ships of the Graeco-Roman Mediterranean there would, presumably, have been little to concern the crew when bringing the vessel's head into the wind. As such, we should therefore question Moses Finley's assertion that ancient sailing vessels had a 'limited ability to tack' (1985: 130). For references to tacking in the ancient literature, see Casson 1995: 274; Neumann 1988: 417.

[196] Balard 1994: 135. See also Runyan 1994: 49. However, this should not be regarded as a return to ancient sail technology, for while Graeco-Roman mariners controlled the square sail by means of brails, such lines were not used on the cog.

[197] This point was noted by I.C. Campbell (1995: 18–19), in whose study of the lateen rig it was emphasised that, 'The perception that the lateen is a superior sail [compared to the square rig] has obscured the fact that the two sails are functionally different, and each has its own advantages and disadvantages. … The disadvantage of the lateen is that it makes the vessel less stable, requires a larger crew, and is less easily handled than a square sail. Unlike the square sail, its size is not easily adjusted to cope with different conditions. No lateen was capable of being furled or reefed or brailed, so lateens had to be lowered when winds became too strong for the sail area being carried.'

strong and variable winds; second, a sail should allow a vessel to make at least some progress against the wind. The potential to sail at least partially to windward is crucial, not only in order to make the safety of a harbour in the face of a wind blowing from an unfavourable direction, but also to prevent being swept on to a lee shore.[198] While it has therefore already been seen that the medieval lateen rig was certainly not well suited to blustery and squally winds, there is little doubt that it was a highly effective performer when sailing against the wind. The long yard of the lateener formed a stiff leading edge for the sail, while the large and baggy cut of the rig would also catch the wind more effectively than was the case on square sailed vessels.[199] However, even when it came to sailing against the wind, the abilities of the brailed square sail have been consistently underrated and trials of replicated Graeco-Roman ships indicate that windward sailing was feasible using the sail technology of antiquity. For example, it has been described how, on April 20, 1987, the reconstructed fourth century BC merchantman, *Kyrenia II*, equipped with a low, broad, brailed square sail, showed herself to be an effective performer to windward: 'During a two hour period around sunset Kyrenia II sailed 50 to 60° off the eye of a 2 Beaufort wind, close-hauled, port tack, making over 2 knots speed—evidence of her ability to sail effectively into the wind.'[200] Even the *Olympias*, a galley designed and constructed for speed under oar rather than for good sailing qualities, also turned in creditable performances when sailing to windward, managing between 60 to 70° off the apparent wind, with an additional 7 to 10° of leeway. Such results clearly emphasise that we would be misguided in assuming that the ancient square rig was incapable of making any ground when sailing against the wind.[201] Indeed, it is interesting to note that even lateen-rigged

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198 Roberts 1995: 312; Tilley 1994: 310.

199 de Souza 2002: 12; Kreutz 1976; Parry 1963: 58 f.; Seidman 2001: 24; Sire 1994: 89.

200 Katzev 1990: 254. See also Katzev & Katzev 1989: 174; Steffy 1994: 57. However, one would have to question the legitimacy of such a figure since even the best clipper ships of the nineteenth and early twentieth centuries only managed about 60° off the wind, while modern fore-and-aft rigged yachts struggle to get any closer than 45° to the wind (Carter 2001: 64; Seidman 2001: 26, 40, 44). As such, it is rather unlikely that the *Kyrenia II* could sail as close to the wind as has been claimed. (Presumably this was also the apparent rather than the actual wind, and without the effects of leeway being taken into account, though this is not stated by M.L. Katzev.)

201 Coates et al 1990: 33, 39, 41: Coates & Morrison 1993: 109; Greenhill & Morrison 1995: 171; Platis 1995: 340–341; Roberts 1993: 35. The ability of the *Olympias* to sail so well into the wind would imply that ancient merchantmen—vessels were specifically constructed with the sail rather than the oars as the principal source of power—may have been even better performers when sailing against the wind.

Arab dhows rarely managed to get closer than 70° to the wind.[202] Sea trials of two different reconstructions of the fourteenth century Bremen cog, with a replicated square sail equipped with reefing points, also indicated that the windward performance of this medieval type of square rig was no better than the brailed sails used during antiquity. For example, sea-trails in 1992 on the replica *Hansekogge*, indicated the ship was a poor performer to windward: 'Close-hauled she did not sail well and could not be pointed more than 70° to the wind—closer she would lose headway and her leeway increased. Over the ground she could make no better than 90° to the true wind. The sailing tests confirmed the students' assessments of hull and rig: The cog was a seaworthy ship. Her single square-sail rig would perhaps have allowed her to tack, but close to the wind the flat-bottomed hull with its lateral resistance made too much leeway.'[203] It is therefore hardly surprising that, despite their reputation as the vessels that opened the Mediterranean to wintertime shipping, medieval cogs have nevertheless been described as 'mainly coast-huggers that sailed in a start-stop fashion according to the vagaries of wind and weather.'[204] Even as late as the eighteenth and nineteenth century, when vessels were carrying highly complex sail combinations, 'ships were incapable of clawing off a lee shore in many conditions of wind and sea.'[205]

The marriage of the ancient brailed square sail with the strong, shell-first hull therefore produced powerful vessels capable of dealing with strong and blustery winds as well as heavy seas. While the windward capabilities of Graeco-Roman vessels were probably slightly inferior to those of lateen-rigged ships of the Middle Ages, nevertheless, the ability of the ancient square rig when sailing against the wind appears to be at least comparable with, and possibly rather better than, that of the cog—the vessel credited with opening up the Mediterranean to wintertime seafaring. Furthermore, it should also be borne in mind that, even for more recent generations of mariners aboard ships carrying modern weatherly rigs, the procedure of beating against a headwind has always proved to be such a time-consuming

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202 Dimmock (1942: 35 f.) and Seidman (2001: 24) also both note that the baggy cut of the Arab lateen sail did not allow vessels carrying this rig to point better than 5 points into the wind, while the shallow, straight keel used on these medieval vessels also resulted in large amounts of leeway.

203 Hoffmann & Hoffmann 2009: 290. Wolf-Dieter Hoheisel (1994: 259) and Uwe Baykowski (1994: 263) come up with similar figures for other trial voyages in this and other reconstructions of the Bremen cog, with Baykowski noting that this vessel's 'restricted close-hauled qualities increased the danger of her being wrecked or driven ashore' (1994: 263).

204 Gould 2000: 187.

205 Rodger 1988: 48–49.

and uncomfortable process that it was generally avoided whenever possible. Instead, ships' captains usually preferred to remain in port until they could take advantage of winds blowing from a more favourable direction.[206]

Fore-and-Aft Rigs on the Ancient Mediterranean

Following the incorporation of brailing rings into the rig of ancient ships during the Archaic period, mariners had the ability to manipulate the ancient square sail into a variety of different shapes by the simple means of taking up some of the brailing lines while slackening off others.[207] Through such use of the brailing lines, and by swinging the yard longitudinally along the length of the ship and taking in the after part of the sail in a manner described by both Aristotle and Achilles Tatius, the ancient square sail could also be made to resemble a fore-and-aft rigged vessel that would allow the sail better windward performance.[208] While the setting of a sail in this manner is rightly regarded as an inefficient method for sailing against the wind,[209] certainly when compared to a vessel carrying a lateen rig, it nevertheless illustrates the versatility that brailing lines brought to ancient vessels, allowing the sail to be shaped and set in a variety of ways to get the most from the particular wind conditions.

Furthermore, while the adoption of the lateen rig has traditionally been associated with the expansion of the Arabs into the Mediterranean region,[210] there now seems little doubt that the sail-type was already in use on the Sea well before the Muslim conquests got underway in the seventh century AD.[211] While Arab terms for some of the components of the rig indicate

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[206] Harvey 1997: 35; Smyth 1906: 303–304; Tilley 1994: 310 f.

[207] The *Kyrenia II* and *Olympias* replica ships both demonstrated a wide variety of different sail configurations made possible by the brailing lines sewn into the ancient square sail (e.g. *Kyrenia II*—Katzev 1990: 246; *Olympias*—Morrison et al 2000: 224–226; Roberts 1990: 296; 1993: 33 f.).

[208] Aristotle, *Mechanica*, 7.851b; Achilles Tatius, *Leucippe and Clitophon*, 2.32, 3.1. See also Casson 1995: fig. 188; Roberts 1993: 32, fig. 5.3. A sail brailed into this triangular shape also led Casson to speculate that such a configuration may even have led to the development of the lateen rig (1995: 277).

[209] Casson 1995: 277; Pryor 1994: 68; Tilley 1994: 312.

[210] See, for example, Hourani 1995: 103; Kingsley 2004: 78–79.

[211] See especially Casson 1971. It has, in fact, recently been pointed out that evidence for Arab sailors using the lateen rig prior to the twelfth century is slight (McGrail 1996: 87). Nonetheless, even recent publications continue to perpetuate the belief that it was only following the Muslim conquest of the Near East and North Africa that the lateen came to the Mediterranean (e.g. Harvey 1997: 21).

a Graeco-Roman derivation—not least of which was the very name of the sail: lateen/Latin—Casson long ago also drew attention to iconographic representations of what certainly appear to be lateen-rigged vessels that date back to at least the second century AD (figure 3.14); these images overturned the long-standing conventional wisdom that only the square sail was in use during antiquity.[212] The presence of lateen-rigged craft sailing on the Roman Mediterranean is now accepted by most scholars. The argument that an increase in wintertime sailing during the early medieval period was because of the adoption of the lateen sail at this time would therefore seem erroneous.[213]

The possibility that the sprit sail was also in use on the Graeco-Roman Mediterranean—and the iconographic evidence for the existence of such a rig in antiquity is especially strong (figures 3.15 and 3.16)—is even more intriguing.[214] Like the lateen the sprit sail is a fore-and-aft rig, with the sail taking its name from the long spar—the sprit—that runs diagonally upwards from near the foot of the mast to support the peak of the four-sided sail (figure 3.17). However, when it comes to rough weather performance and the question of wintertime seafaring on the ancient Mediterranean, the use of the sprit sail is even more interesting, for while a lateen rig performs best in light and steady winds, the sprit sail is well-suited for relatively small vessels operating in rough conditions, and the sail can be rapidly taken in and reefed with ease by even a small crew, should winds become blustery or squally.[215] From the sixteenth century AD onwards, the sprit sail was therefore widely adopted by seafaring communities on both sides of the North Sea and the rig proved well-suited to this region of the Atlantic where strong and variable winds are a common occurrence.[216] It should, however, be noted that while the sprit rig is an easily managed sail on smaller vessels it becomes

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212 Casson 1956a; 1995: 243 f. For a recent investigation of iconographic images representing lateen rigged vessels from the late Roman Mediterranean, see Whitewright 2009.

213 While historians such as J. Rougé have questioned the existence of fore-and-aft rigs in the Graeco-Roman world (1981: 51), few scholars now doubt that lateen rigged ships were operating on the Roman Mediterranean. It has therefore recently been noted that, 'the introduction of the lateen sail in the Mediterranean was gradual and spanned a very long period. The appearance of a lateen sail in Mediterranean iconography dates to the 2nd century AD, and the disappearance of the square rig to around AD 525' (Castro et al 2008: 348. See also Whitewright 2009: 98).

214 Casson 1960; 1995: figs. 175–179. Casson argues that this rig was in use by at least the second century BC, with reliefs indicating that it was present in the eastern and central Mediterranean (1995: 244).

215 Smyth 1906: 281 f.

216 Harvey 1997: 80; Kemp 1992: 826.

unwieldy when increased in size for use on larger ships: 'Scale works against the sprit sail … far from being the beautifully simple little rig it is for small boats, big spritsails are among the most complicated, and handling them takes powerful tackles and plenty of muscle.'[217] Nevertheless, on smaller vessels, the sprit rig, in conjunction with the sturdy ancient shell-first hull, would appear well suited to a Mediterranean winter. The small coastal trading vessels and fishing boats depicted on Hellenistic and Roman Imperial reliefs carrying the sprit sail were therefore well-adapted for remaining at sea throughout the year, making short hops along the coast during breaks in the wintertime weather systems. If we are correct in the interpretation of the iconography as evidence for the use of lateen and sprit sails by Graeco-Roman mariners, then the lack of information passed down in the ancient literature concerning the variety of ancient sail types in use on the Mediterranean emphasises the gulf that existed between seafaring communities and the writers of antiquity. It was the sailors who regularly handled ancient ship and sail technology, and understood how best to use them under a variety of different sea conditions. By contrast, the literate elites—upon whose words so much of our current understanding of Graeco-Roman seafaring is founded—were invariably drawn from the landed classes, and their lack of descriptive detail of maritime affairs and the art of seamanship as practiced on the ancient Mediterranean would appear to indicate that they remained largely removed from, ignorant of, and unconcerned with, maritime affairs. This is a point that should be borne in mind when dealing with the ancient seafaring calendars—seasonal timetables that were also formulated by the social elites of the ancient world.

Steering Gear

In addition to the manner in which it was rigged and the method of its hull construction, the other main area in which the cog was radically different from both ancient and early medieval vessels operating on the Mediterranean was in the nature of the steering mechanism. Indeed, it has been postulated that it was the adoption of the vertical, stern-mounted, pindle-and-gudgeon rudder during the thirteenth century that allowed the cog and its successors to cope far more easily with the rough sea conditions of the wintertime. By contrast, throughout antiquity and most of the Middle Ages vessels had been equipped with side-rudders which, mounted on a vessel's

[217] Harvey 1997: 81.

stern quarters, provided a steering mechanism often thought 'may not have performed very well, either through being too fragile or through having poor manoeuvrability.'[218] However, recent research fails to bear out such long-held assumptions. In some respects, it would even appear that the ancient method of mounting the rudders on the sides of a vessel was actually better suited to dealing with the heavy seas of winter than was the pindle-and-gudgeon rudder that was eventually to supplant it. (See figures 3.18–13.19.)

There is no doubt that the large size and weight of Graeco-Roman side-rudders often made them unwieldy and, when fully immersed, their resistance through the water would have been very high, resulting in a corresponding reduction in boat speed.[219] However, ancient vessels with side-rudders were far more responsive to the helm and thus more easily steered than the cog with its stern-rudder.[220] Furthermore, the Graeco-Roman rudder system would also have proved extremely useful when acting as a lee-board, aiding in the reduction of leeway and therefore allowing for better close-wind performance than would otherwise have been the case. At the same time the side-rudders would have acted to increase the stability of a vessel by lessening the effects of yawing and rolling.[221] Lawrence Mott's *The Development of the Rudder: A Technological Tale*, conjectured that ancient vessels carrying side-rudders may have been more difficult to steer and control in following seas than were later ships mounting a stern-rudder. However, if we accept the accuracy of the account in Acts 27, then the ability of St Paul's crew to run before the tempest for at least the first day of the storm without sustaining damage to the steering mechanism would indicate that Graeco-Roman side-rudders were reasonably effective in even stormy conditions.[222]

[218] Morton 2001: 274. See similar sentiments expressed in Morrison 1984: 221 f.

[219] The size and awkwardness of ancient side-rudders would not have been a major factor on smaller vessels—the steering-oars on the *Olympias* trireme, for example, measured 5 m in length and weighed 250 kg (Coates 1989: 24; Coates et al 1990: 8; Mott 1997: 14). However, on large merchant ships the rudders must have been of vast dimensions and those needed to control the Madrague de Giens ship are calculated have been about 12 m in length with a weight of 3 metric tonnes. For a vessel the size of the Alexandrian grain freighter described by Lucian (see above, p. 129), two side-rudders, each of 18 m and 14 metric tonnes would have been required (Mott 1997: 14). For the water resistance and corresponding lowering of boat speed caused by ancient rudders, see Coates 1994: 255; Coates et al 1990: 21, 40, 42; Mott 1997: 132 f.; Platis 1995: 137; Shaw 1989: 84.

[220] Mott 1997: 115, 127, 132. See also Morrison et al (2000: 163) for the ease with which the *Olympias* was controlled using her side-rudders.

[221] Mott 1997: 99; Roberts 1984: 138; 1994: 15.

[222] Mott 1997: 113. Acts 27:14–44.

In terms of wintertime seafaring, however, the most important factor was for rudders to withstand heavy weather. In this crucial respect there would seem little doubt that side-rudders were more vulnerable to the elements than the later stern-rudder.[223] This has been partly borne out by trials of replicated ancient vessels; the tiller of the *Kyrenia II* broke under the stress of the waves during one of the ship's voyages, while the *Argo's* port steering oar also snapped in heavy seas.[224] However, even were Graeco-Roman vessels to suffer damage to their steering gear while at sea, the methods by which these side-rudders were attached to the hull did at least allow for relatively simple retrieval and repair. Furthermore, because there were two such steering oars on ancient ships, should one suffer breakage then the other would allow the helmsman to retain control over the vessel while work on the damaged rudder was carried out.[225] By contrast, the later medieval stern-rudder was exceptionally difficult to detach from the hull should it suffer damage, making running repairs at sea highly problematic. Because there was only ever one rudder in place, a vessel with a damaged stern-rudder would have been at the mercy of the elements.[226]

For Graeco-Roman mariners making short, coasting voyages during the wintertime, and who were ready to seek the shelter of the coast as soon as bad weather threatened, the ancient side-rudder also offered great versatility in that, unlike the stern-rudder, it could easily be raised and lifted in shallow water, greatly reducing the risk that the steering mechanism would sustain any damage if the vessel ran aground. Thus, in the biblical account of St Paul's shipwreck, we are informed that once the sailors of the grain ship had resolved to deliberately run the vessel aground in an effort to allow the passengers and crew to make it safely to land, they 'loosened the lashings of the steering-paddles, set the foresail to the wind, and let her drive for the beach.'[227] This tactic of loosening the bindings which attached the side-rudders to the hull of the freighter would have allowed the steering oars to be raised up and kept clear of the seafloor, allowing the merchantman to be run as far inshore as the depth of the keel permitted. Even were one of the rudders to collide with a submerged object, or be struck by powerful breakers close to the shoreline, it would simply rotate upwards keeping the steering-

223 Mott 1997: 14, 14, 129, 133 f.
224 *Kyrenia II* (Katzev 1990: 253 f.); *Argo* (Severin 1985: 167).
225 Mott 1997: 129.
226 Mott 1997: 115 f.
227 Acts 27:40.

oar intact and functional while allowing the helmsman to retain control of the freighter until the moment of grounding.[228] Therefore, while the stern-rudder used on the cog and the other late medieval and modern ships that followed did indeed offer many advantages over the ancient side-rudder it has, nevertheless, been noted: 'Because of the numerous drawbacks in using a PG-rudder [pindle-and-gudgeon stern-rudder] it is not surprising that this rudder was not at first widely accepted in the Mediterranean.'[229]

Ships and Sails: Conclusion

Recent studies of the excavated remains of Graeco-Roman ships, together with trial voyages of experimental replicas have proved invaluable for scholars attempting to understand how the various vessels of antiquity coped with weather and sea conditions. The experimental trials of the trireme, *Olympias*, together with those of the merchantmen, *Kyrenia II*, emphasise the great gulf that existed in the levels of seaworthiness of galleys built for war and sailing vessels built for commerce. The trials of these two vessels have also highlighted the fundamental problem inherent in Vegetius' maritime calendar which, despite being the most detailed and oft-quoted of the ancient sailing calendars, was nevertheless designed around the abilities of the relatively small war-galleys—the liburnians—of the late Roman Mediterranean. Although triremes, and especially the larger warships in operation throughout the Hellenistic period, may have extended the length of the sailing season beyond the limits advised by Vegetius, nonetheless, it appears certain that sailing merchantmen, with hulls constructed using the sturdy shell-first shipbuilding technique, could have withstood sea conditions far in excess of those that would have overcome warships and, in consequence, would have been able to take advantage of a much longer operating season. For larger merchant ships, such as those constructed at the apogee of the ancient shipwright's craft during the Hellenistic period and on into the Roman Principate, and which sported new, strong hulls and carried only light cargoes, wintertime voyages may well have been regularly undertaken, not only on relatively benign regions of sea, such as in the

228 Mott 1997: 20 f., 128, 132.

229 Mott 1997: 132. It is therefore interesting to note that as late as the Battle of Lepanto in 1571, the great galleys of the Christian fleet, while primarily reliant on the stern-rudder, also carried a pair of side-rudders, such was the lack of trust in the pindle-and-gudgeon steering mechanism even three hundred years after it had been introduced onto the Mediterranean (Alertz 1995: 151).

south-east Mediterranean, but also across areas where powerful winds and large waves are far more commonly experienced. Experimental archaeology has also indicated that the ancient square sail was considerably more versatile and better adapted to wintry conditions than most scholars are willing to acknowledge. Epigraphic evidence has also highlighted that at least some Graeco-Roman vessels also carried fore-and-aft rigs such as the lateen and sprit sail. Taken in combination, the ancient, brailed, square sail, together with the shell-first hull, would have resulted in merchant vessels that were well adapted to weather conditions on the wintertime Mediterranean. Scholars still point to the technological innovations of the medieval period that enabled mariners to regularly engage in wintertime shipping—be it the adoption of the skeleton-first shipbuilding technique and the use of the lateen rig during the early Middle Ages or, more commonly, the arrival of the cog with its reefed square sail and northern European method of shell-first hull construction. However, it appears likely that Graeco-Roman merchant vessels also had the necessary technical sophistication to allow their crews to undertake regular voyages upon the waters of the Mediterranean during the winter months.

CHAPTER FOUR

NAVIGATION

It will have become clear over previous pages that in recent decades the discipline of archaeology has made a vital contribution to maritime scholarship: the location, excavation and analysis of shipwrecks and their cargoes, together with the reconstruction of ancient vessels, have greatly expanded our knowledge of the commercial and naval ships that sailed the Mediterranean during antiquity. By contrast, however, there is very little in the way of artefactual evidence relating to ancient methods of navigation, while the surviving Graeco-Roman texts also provide few clues to the skills and navigational knowledge in use on the seas of antiquity because the literate elites of the ancient world generally paid scant attention to the arts being practised by their contemporaries in the seafaring community. As such, studies of ancient navigation suffer from a paucity of evidence. Nonetheless, it has been pointed out that our understanding of Graeco-Roman navigation can be greatly increased by 'identifying the nature of the navigational problems, many of which are not specific to region, culture or time, and [by] integrating the meagre documentary evidence … it is possible to make reasoned suggestions about early navigational and pilotage techniques by studying how recent pre-industrialised maritime cultures have tackled analogous problems.'[1] A combination of the ethnographic record and the information that can be teased from the ancient literature may, therefore, provide the basis for an understanding of some of the navigational techniques practised by Graeco-Roman seamen and the extent to which such methods would have allowed seafaring to take place on the wintertime Mediterranean.

It is a long-held and deep-rooted belief that only following the widespread adoption of the magnetic compass and the sea-chart during the Middle Ages did sailors of the Mediterranean finally possess the necessary navigational equipment which permitted them to cast off the seasonal shackles that had confined maritime activities to the period between spring and autumn.[2] Although the Chinese had been using the lodestone as a

[1] McGrail 1987: 275. See also McGrail 1996: 89 f.

[2] This thesis was first proposed by Lane in 1966 and remains accepted to this day (e.g. Aczel 2001; Fernandez-Armesto 1999: 232 f.; May 1981).

direction indicator from as early as the first century AD, and the Arabs had become aware of its properties by the ninth century, it was only towards the close of the twelfth century that mariners aboard European vessels are first described as utilising the magnetic compass.[3] It was at approximately the same time that the compass was being adopted by European sailors that the first charts aimed at meeting the practical needs of sailors—the so-called *portalan* charts—also began to be carried on Mediterranean ships; the earliest extant example, the *Carta Pisana*, dates to c. 1275, while the first references to the use of marine charts also begin to occur in the literature at this time.[4]

There is certainly no question that the introduction of these two medieval innovations gave Mediterranean seafarers a priceless technological advantage which had been unavailable to their ancient forebears. From the late twelfth century onwards, the mariners of the Mediterranean had acquired the navigational tools that allowed them to estimate a vessel's position and steer a course with far greater ease and accuracy than had hitherto been the case; a huge benefit for sailors on the sea during the long nights and problematic weather conditions expected during the winter. That there appears to have been an extension of the Mediterranean seafaring calendar as a direct consequence of the simultaneous introduction of the chart and compass to the region is indicated by the harbour records of the Italian maritime states which show that, by the end of the thirteenth and start of the fourteenth centuries, commercial shipping was regularly venturing to sea throughout December and January. By the later Middle Ages, it has therefore been noted that although 'captains still respected the winter waters and preferred port during the bad months, the seasons had lost their overriding significance.'[5]

Although there can be no doubt about the benefits which the chart and compass brought to navigation, it remains to be seen if these tools were indispensable assets for direction-finding during the wintertime, or whether the skills and knowledge of ancient seafarers would nevertheless have allowed them to put to sea without such scientific aids, even during

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[3] Reference to the use of the compass as an aid to navigation is first attested in Europe in Alexander Neckham's *De Natura Rerum* (2.98), which was written in the final quarter of the twelfth century. For the Chinese usage of the lodestone, see May 1981: 415; Needham 1962: 4.239 f. For the Arabs adopting the compass, see, for example, Mitchell 1932: 116.

[4] See, for example, Fernandez-Armesto 1999: 233 f.; Taylor & Richey 1962: 23; Williams 1994: 28.

[5] Herlichy 1958: 108. See also Aczel 2001: xii, 27 f., 103, 129 f.; Lane 1966.

conditions of poor visibility or thick cloud cover. Furthermore, there is also a need to distinguish between two related, yet fundamentally different, sets of navigational skills, both of which need to be mastered if voyages are to be made with any degree of accuracy and safety. While open water navigation can be defined as 'the true art of navigation [which] involves taking a ship from one place to another while out of sight of land',[6] coastal or inshore navigation—commonly referred to as the art of pilotage—deals instead 'with the problems of narrow channels littered with banks, rocks and islands: with the entrances to difficult harbours and with berths inside them: with bad weather in narrow water.'[7] Open water seafaring and coastwise pilotage therefore presented very different navigational problems that required very distinct sets of skills if they were to be successfully overcome. This chapter will therefore focus on these two different navigational challenges confronting Graeco-Roman mariners and investigate whether pre-instrumentational methods of course-setting and direction-finding would have allowed sailors to make accurate and safe voyages, even during the wintertime.

Open Water Navigation

Despite the long-standing belief that ancient seamen 'hugged the coast', there is 'plenty of evidence that, from earliest times, seamen … not only ventured out of sight of land but … conducted regular passages across open sea. To the seaman, it is the coast that spells danger and nothing is more misleading than to think of the sailor bound reluctantly seaward, for the peril of rough weather is nothing to that of being driven on to a lee shore.'[8] Graeco-Roman literature certainly indicates that large ships often plied the open-waters of the Mediterranean; vessels of the Alexandrian grain fleet routinely made the down-wind run from Italy to Egypt across the heart

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[6] de Souza 2002: 30. See also Parry 1963: 83.

[7] Greenhill 1978: 199. See also Cunliffe 1987: 25; Kemp 1992: 578; Parry 1963: 83; Seidman 2001: 174. Despite the considerable overlaps which exist between these two navigational techniques—sailors accustomed to coastal voyages occasionally finding it necessary to cross stretches of water out of sight of land, while seafarers whose voyages will generally be made across open water obviously refer to the coastline when bringing their vessel in or out of harbour—the broad distinction between the two skills is a valid one.

[8] Taylor & Richey 1962: 1. See also Aczel 2001: 11 f.; Toghill 1994: 101 f., while Morton analyses in detail the fallacy of Graeco-Roman mariners as 'coast-huggers' (2001: Chapt. 3, 143 f., 262, 279).

of the eastern basin of the Mediterranean, where they would have been well out of sight of land for days at a time.[9] Furthermore, crews aboard the bigger and stronger vessels of antiquity, which were more likely to have been better performers in heavy weather than were smaller boats, may well have preferred to pull out to sea in order to 'punch out a blow.'[10] Nevertheless, the experimental voyages of the *Kyrenia II* have also demonstrated that even relatively small Graeco-Roman ships had a remarkable capacity to endure strong winds and large waves, and we might reasonably expect that their skippers would have made frequent voyages that were well out to sea and removed from any sight of land. Thus, in the narrative of Synesius, in which the churchman recounts his troubled voyage from Alexandria to Cyrenaica at the beginning of the fifth century, it is noted how vessels, both large and small, might often be found well out to sea even during the winter half-year: 'Presently a fresh south wind springs up and carries us along, and soon we are out of sight of land and have come into the track of the double-masted freighters, whose business does not lie with our Libya; they are sailing in quite another course. Again we make common cause of complaint, and our grievance now is that we have been forced away too far from the shore.'[11]

While Synesius may have felt uncomfortable about sailing beyond sight of the shore, the captain of the small trading vessel was confident in his abilities to navigate accurately while well out to sea. The large, twin-masted freighters witnessed by Synesius were probably ships bound for Alexandria after talking the direct open-water route across the eastern Mediterranean, utilising the prevailing north-west winds to make the crossing to Egypt from Greece, the Balkans, or Italy. From the western basin of the Mediterranean, trails of amphorae and shipwrecks on the sea-floor in the deep water of the Skerki Bank, some 200 km north of the Tunisian coast and far to the west

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[9] Casson 1950; 1995: 297 f.

[10] Greenhill 1978: 201. See above, p. 127.

[11] *Letters*, 4.171. For the season of Synesius' voyage, see Fitzgerald (1926: 17–18, 80) and Meijer (1986: 67)—both of whom believe the journey to have taken place in January—while Garzya (1979: 11) proposes a time of year at some point between January and May. In his recent analysis of Synesius' voyage, Kahanov assumes that the journey took place between March and October (2006: 436, 442), although he applies these seasonal boundaries based on the conventional understanding of the ancient sailing season as spanning the months between March and November (2006: 436), i.e. the maritime calendars of Vegetius and Gratian; outside of these months Kahanov assumes the seas to have been closed to shipping. (Once again, an uncritical acceptance of the traditional start and finish dates of the ancient sailing season can potentially lead to errors that permeate through to our understanding of ancient society.)

of the Sicilian shoreline, provide archaeological testimony for the ability of ancient seafarers to sail directly across open water which is well beyond sight of land in even the clearest of weather.[12]

Navigation by Reference to Wind and Swell

For pre-instrumentational mariners venturing out of sight of the coast, or for inshore navigators caught at sea in poor visibility, winds could be used as direction indicators. Even modern yachting handbooks note that 'all winds have a personality'[13]—a set of distinctive characteristics that are dictated by the different regions over which the winds have travelled. These distinctive attributes are formed from elements such as the levels of dust, humidity and precipitation carried on the air, the temperature of the wind, even the smells which are borne across the seas of the Mediterranean by the different regional winds. It is by reference to the distinguishing qualities of the air currents blowing over the sea that even recent generations of seamen have orientated themselves by the 'feel' of the wind.[14] Should the sun and stars be hidden by cloud, or if darkness, mist or fog obscured the coast from view, Graeco-Roman mariners well versed in the wind-lore of the Mediterranean may therefore still have been able to navigate with a reasonable degree of accuracy by reference to the wind.

It was the different directions and distinctive characteristics of the various regional winds of the Mediterranean that were also to form the basis of the wind-roses of the ancient world, beginning with the twelve-point rose which, first described by Aristotle in the fourth century BC, continued to be used throughout antiquity and on into the Middle Ages.[15] However, from at least the early Hellenistic period, an eight-point wind-rose, based on halving the four cardinal points of north, east, south and west, also appears to

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12 See Ballard 1998: 34; Ballard & Archbold 1990; Ballard et al 2000: 1594; McCann 2000: 443 f.; McCann & Oleson 2004; Weitemeyer & Döhler 2009. It is surely no coincidence that this area of sea lies on the direct, open water route connecting Carthage and Rome.

13 Seidman 2001: 167. See also Aczel 2001: 41; Morton 2002: 217 f.; Taylor 1971: 15. See especially Williams 1999 for a detailed study of the ancient winds.

14 E.g. Calcagno 1997: 97 f.; Fenton 1993: 49.

15 *Meteorologica*, 2.4–6, and *Problemata*, 26. See, however, Williams who notes that while Aristotle was the first to describe the wind-rose in literature, 'sailors must have known of this apparatus for centuries' (1999: 198). She goes on to postulate that the twelve-point wind-rose was possibly Babylonian in origin, while there are indications of its usage in Homeric literature (Ibid. 200). For the use of the twelve-point wind-rose in the medieval period, see, for example, Taylor 1971: 53; Williams 1994: 25.

have been widely used and 'is more likely to have been favoured by seamen: for halving directions is straightforward, whereas the division into twelve involves arithmetic.'[16] This assumption that the eight-point wind-rose was more useful to the practical navigator is impossible to prove given the silence of professional seamen in the ancient literature. Nevertheless, the depiction of the eight wind gods on the octagonal Tower of the Winds in the Roman agora of Athens (figure 4.1)—one deity to each wall of the building—does indicate that the population of Athens at the beginning of the Roman Imperial period was at least familiar with the eight-point wind-rose.[17]

In those areas of the Mediterranean with a long fetch, swell patterns also provide directional indicators for experienced navigators. The pre-instrumentational navigators of Oceania certainly proved capable of navigating across thousands of miles of open ocean, achieving distant landfalls by reference to wind-generated swell and the refraction of the swell patterns created by even small islands.[18] While the pronounced swells found in the Pacific, Indian and Atlantic Oceans are far less common in the relatively small and enclosed Mediterranean, nonetheless, the prevailing winds, which tend to blow across both basins of the Mediterranean from the northern quarter, can, at times, generate relatively large and regular swells. (See above, p. 86 ff.)[19] Although there is no mention in the ancient literature of seamen navigating by reference to such wave patterns, it nevertheless seems likely that many sailors on the Graeco-Roman Mediterranean were skilled navigators and would have possessed at least some ability to set a course by reference to the swell. It has therefore been noted that 'such an ability was probably more widespread in earlier times, but atrophied with the advent of instrumental aids.'[20]

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[16] Taylor & Richey 1962: 2. The eight-point rose is credited to the third century Rhodian Admiral, Timosthenes, and was described in the lost works of Poseidonius, as well as in Varro's *De Ora Maritima* and *Ephemeris Navalis*, before being set down in Vitruvius's *De Architectura* (1.6.9). It should, however, be borne in mind that the conclusions of Taylor and Richey appear to be drawn from the considerably later adoption of the sixteen and thirty-two point wind-roses portrayed on medieval compass cards rather than from any surviving ancient evidence.

[17] The building, actually a water clock, was designed by Andronicus of Cyrrhus and dates to either the first century BC or AD (Dokru-van Rossum 1996: 27; Stewart 1990: 231 f.). It should also be noted, however, that, inscribed into the pavement of the 'Square of the Winds' at the inland North African city of Dougga, is a twenty-four point wind-rose, based on twelve wind gods (Poinssot 1983: 33).

[18] E.g. Davenport 1960: 19 f.; Fenton 1993: 46, 54; Lewis 1972: 90; McGrail 1996: 89.

[19] Goldsmith & Solver 1983: 42 f.; Herut & Galil 2000: 256.

[20] McGrail 1987: 281. See below (pp. 188–189) for the possibility that it may have been the

It has already been seen that the wind regime of the summertime Mediterranean tends to be settled and regular; the well-defined, light winds of this season would therefore have presented considerable opportunities for Graeco-Roman mariners to navigate through use of the wind and swell. However, from late autumn through to the middle of spring, not only does the strength of the wind generally increase, but there is far less consistency in direction as the winds tend to shift more frequently from one point to another (figures 2.3a–d). Moreover, gusty squalls, commonly associated with the passage of depression systems across the Mediterranean, are also considerably more frequent in the wintertime when, as Hesiod notes, 'blasts of every kind of wind rage.'[21] Navigation by reference to wind or swell would, therefore, usually be considerably more difficult for Graeco-Roman mariners during the shifting wind patterns typical during a Mediterranean winter. However, despite this changeable wintertime wind regime, it should not be assumed that such conditions were beyond the capabilities of pre-instrumentational navigators. It has long been noted that Viking-age mariners, while lacking the compass and chart, nonetheless navigated successfully across the waters of the north Atlantic—a region of ocean that was, 'even in the spring and summer months, one of the wildest and most hazardous sea-routes in the world. For here there was no region of steady trades and seasonal monsoons. In the unsettled conditions of these high latitudes the weather could never be counted on for long. Sudden shifts of the wind were of common occurrence.'[22] Yet even among more recent maritime communities sailing on the waters of the north Atlantic, the sight, sound, and motion of the sea-swell was still used as a directional indicator, even when the winds were highly variable.[23] If Graeco-Roman sailors possessed similar navigational skills, then even the changeable wind direction and confused swell patterns commonly encountered on the Mediterranean during the wintertime may not have proved an insurmountable obstacle for ancient navigators to overcome.

The possibility that strong, seaworthy vessels were making wintertime voyages across open water should certainly not be disregarded. The storm-ridden voyage between Crete and Malta forced on the crew of the

swell patterns refracting from the shoreline that first alerted the seamen aboard the grain freighter carrying St Paul across the central Mediterranean to the presence of the Maltese coastline (Acts 27:27).

[21] Hesiod, *Works and Days*, 620.

[22] Solver & Marcus 1958: 19.

[23] Binns 1980: 20; McGrail 1987: 281.

Alexandrian grain freighter transporting St Paul to his trial in Rome clearly highlights the ability of ancient sailors to navigate their vessels across the open sea in even exceptionally poor conditions. Despite tempestuous seas, and leaden, overcast skies, the mariners on board the apostle's vessel proved capable of setting a course that avoided drifting into the ill-omened Gulf of Syrtis, and, even though the ship was at the mercy of the storm for two weeks, the crew were nevertheless able to sense the imminent approach of land and avoid running on to the Maltese coast in the middle of the night.[24] Vessels of the Alexandrian grain fleet on the easterly return run from Italy to Egypt, with little more than ballast in their holds, may have continued to make voyages across the open sea of the eastern Mediterranean, regardless of the greater likelihood of encountering unfavourable weather.[25] The greater frequency of easterly winds blowing off areas of the Levantine coast throughout the wintertime may also have encouraged the crews of these large grain-carrying vessels to strike out across open water during this time of year in an effort to take advantage of the changed wind regime to make voyages to the west. (See pp. 83–84.)[26] The departure of a Sardinian grain fleet bound for Rome in the winter of AD 409/10 also emphasises that out-of-season voyages across open water were occasionally made by ancient seafarers, especially at times of political and economic crisis. (See above, pp. 35–36.)[27] It will also be seen in the following chapter that large numbers of vessels routinely sailed across the Indian Ocean during the Hellenistic and Imperial periods; a journey that was made during the time of the exceptionally dangerous south-west monsoon. Voyages such as these highlight not only the strength and seaworthiness of the ships and rigs used by Graeco-Roman sailors, but also demonstrate that navigational skills and expertise were sufficiently sophisticated to allow voyages to be made across vast expanses of open water, even in conditions of dense cloud cover, heavy rain and poor visibility.

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[24] Acts 27:27–30.

[25] While there is no direct reference in the literature to Alexandrian freighters making this voyage during the wintertime, we have already seen that Synesius refers to 'the track of the double-masted freighters'; vessels which were sailing far out to sea, well beyond sight of land, at a time of the year that probably fell somewhere between late autumn and early spring (*Letters*, 4. 171. See above, p. 176). While Synesius fails to make clear in which direction these twin-masted vessels were sailing, nevertheless, the late Roman churchman's account highlights that large ships were still making open water voyages across this part of the Mediterranean at a time of year when overcast skies and poor visibility were very likely.

[26] Pryor 1988: 3.

[27] St Paulinus of Nola, *Letter* 49.1.

Changing Seasonal Sailing Strategies?

For the vessels and crews of antiquity that did remain at sea during the wintertime, it is possible they made seasonal adaptations to their sailing strategies, with a shift away from long voyages across large stretches of open water towards journeys that were based on making shorter coastal 'hops' from one harbour or sheltering place to another whenever the weather proved favourable—voyages that were measured in hours rather than days. Coastwise navigation certainly appears to have been the most favoured method of passage-making for the majority of shipping during antiquity. For the warships of the Graeco-Roman Mediterranean, the need to stay close to the shore was a prime requirement when planning and executing naval campaigns or carrying out training exercises simply to allow the large oar-crews had opportunity to sleep and eat on the land rather than in the cramped confines of ancient war-galleys. The vulnerability of oared warships in anything but relatively calm conditions also necessitated that they remained close inshore, ready to run to the shelter afforded by the coast should conditions deteriorate. The desire to stay close to shelter provided by the shore would no doubt also have prompted most ships and boats to pursue a primarily coastal sailing strategy, and even into relatively recent times it was accepted practice that smaller vessels at sea during the wintertime would make short coastal hops.[28] The early travel writer, Alexander Kinglake, when describing a voyage from Smyrna to the Levant which he made on a Greek brigantine late in 1834, therefore relates how he already 'knew enough of Greek navigation to be sure that our vessel would cling to earth like a child to its mother's knee, and that I should touch many an isle before I set foot upon the Syrian coast ... My patience was extremely useful to me, for the cruise altogether endured some forty days, and that in the midst of winter.'[29] Such coastwise sailing strategies were probably equally common for the majority of ancient seafarers making voyages during the wintertime; the relatively small size of most Graeco-Roman vessels and their engagement in 'tramping' voyages—trading from one coastal community to another, buying and selling cargo as they went—necessitated coastwise sailing that kept both shelter and markets close to hand. It is therefore of little surprise that the literary evidence for wintertime voyages deals almost exclusively with coastal journeys.[30]

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28 Braudel 1972: 249, 266; Greenhill 1978: 201; MacGregor 1993: 49 f. See above pp. 125 ff.

29 1995: 59.

30 See, for example, Libanius, *Autobiography* 15–16 (quoted above p. 46), the Carthage

What remains uncertain, however, is whether the large vessels of antiquity, such as the freighters of the Alexandrian grain fleet, or the ship wrecked off the French coast at Madrague de Giens, might also have pursued a similar coastwise sailing strategy during the wintertime. As has been noted above, the demand for wintertime shipments of grain to Rome made by the emperor Claudius in an effort to alleviate the threat of famine hanging over the Empire's capital, indicate that large grain ships probably did make voyages across winter seas. Although neither Suetonius or Tacitus, both of whom refer to the incident, present any details concerning the origins of the vessels which successfully restocked Rome's granaries in AD 51, it would seem likely that the majority came from north Africa and Sicily, the closest grain-exporting provinces to the capital.[31] It is certainly possible that some of these vessels used the direct, open water routes, which led across the Tyrrhenian Sea: the amphorae trails which lie in the deep water just off the Skerki Bank are testament to the fact that, during the first century AD, ancient seamen did make voyages across this open expanse of sea and were occasionally caught in heavy weather, jettisoning their cargoes in a desperate effort to lighten the vessels and allow them to ride out the storm, while shipwrecks from the area suggest that not all such attempts were successful. However, it cannot, of course, be assumed that the trails of amphorae and shipwrecks found in the deep waters of the Mediterranean bear witness to voyages made during the wintertime and they may have been sent to the bottom during summer storms. It instead appears likely that many grain ships bound for the ports of Rome from regions such as North Africa and Sicily may have chosen to change sailing strategies, shifting from primarily open-water voyages during the summer months, to coastal voyaging in the wintertime that allowed greater use to be made of ports and harbours whenever the weather turned unfavourable. It was a coastwise wintertime sailing strategy that was implemented by the master of the *Castor and Pollux* when

ostraca (p. 28 ff.). While the vessels recorded on the Elephantine Palimpsest (p. 17 ff.) or in the *Demosthenic Corpus*, 56.30 (p. 16 f.) which were still sailing on the waters of the eastern Mediterranean during the winter half-year may have been making open-water voyages, it nevertheless seems more likely that they too were engaged in coastwise journeys along the Levantine seaboard. However, in a recent article by Oded Tammuz it has been claimed that this wintertime seafaring in the eastern Mediterranean was only carried out by vessels making open-water voyages well away from the hazards presented by the coast: 'while a journey in open water was relatively safe in summer and winter alike, coastal navigation was impossible in winter' (2005: 156). Such a conclusion does, however, appear to move too far beyond the evidence currently available.

[31] Suetonius, *Claudius*, 18–19; Tacitus, *Annals*, 12.43 (see p. 32 ff.).

it carried St Paul on the final leg of his trip to Rome in late January or early February: a voyage that involved a series of short coastal hops starting at Malta and progressing up the Sicilian and Italian coastlines to reach Puteoli by way of the harbour cities of Syracuse and Rhegium. (See above, pp. 102–103.)[32] Such a predominantly coast-hugging route would have allowed even ships as large as Alexandrain grain freighters to utilise the harbour facilities of important port cities as 'stepping-stones', sailing from one to the next as and when winds and weather proved favourable.

Pilotage: The Visible Coastline

For mariners, especially those operating in familiar waters, the visible coastline has never been superseded as an aid to navigation. Even following the widespread introduction of the compass and chart, 'experienced navigators in regions they knew at first hand, kept close to the coasts and navigated between landmarks.'[33] Therefore, while we may question whether Graeco-Roman shipping on the Mediterranean was irrevocably tied to the coast, there is little doubting the importance of the visible shoreline to seafarers; the coastal topography provided a point of reference that has always been 'the navigator's best aid and surest compass.'[34]

The mountainous and enclosed nature of much of the Mediterranean basin certainly makes it a relatively simple task for mariners to keep land in sight, even when sailing well out to sea or making open water crossings from one distant coast to another. It was therefore long ago noted by E.R.G. Taylor that, 'The earliest and most frequented sea-lanes ran from island to island and from island to mainland, so that the navigator was hardly out of sight of one landmark before he picked up another.'[35] This ability to navigate across much of the Mediterranean while remaining in visual contact with the land is most clearly illustrated in charts depicting the theoretical ranges at which the Mediterranean coast remains visible to mariners on the sea (figure 4.2). As can be seen from these charts, aside from the region of sea to the east and west of Sardinia, it is only off the low-lying African coast that large tracts of water remain out of sight of land, a fact noted by Horden and Purcell who emphasised that 'Mutual visibility is at the heart of the navigational conception of the Mediterranean ... There are

32 Acts 28:11–13.
33 Fernandez-Armesto 1999: 232.
34 Braudel 1972: 103, 105 f.
35 1948: 103.

only relatively restricted zones where, in the clearest weather, sailors will find themselves out of sight of land. And these unintelligible "deeps" of the sea are the areas that have held the greatest terror for the Mediterranean seafarer from Odysseus onward. Yet a map of them shows how confined they are.'[36]

Given the importance of navigation by reference to observations of coastal features, it is therefore of little surprise to find that the lookout assumed a position of great importance on both naval and commercial vessels of the ancient world, ranking just below the highly important position of helmsman in the shipboard hierarchy.[37] The fifth century church father Theodoretus makes plain that the principal duty of the lookout was to maintain a close watch on the coastal topography while also attempting to detect any hazards, such as rocks and shoals, which might lie in the water ahead.[38] Even following the widespread introduction of increasingly sophisticated navigational instruments during the medieval and modern periods, it was still 'proverbial among seamen to trust a good lookout than a bad reckoning.'[39] To this day yachtsmen continue to place great stress on the need to post a lookout in the bows of a vessel, especially in conditions of poor visibility.[40] The importance attached to the abilities and keen sight of a ship's lookout are also highlighted in ancient myth and Lynceus, acting as lookout aboard the *Argo*, was famed for his ability to 'cast far his piercing eyes.'[41] Recent accounts also credit experienced seamen with being able to discern coastal and marine features with far greater clarity and understanding than appears possible to non-mariners. Norman Lewis, recounting a voyage he made on the Red Sea in the 1930s, thus writes of how the helmsman of the dhow on which he was travelling 'boasted that he possessed abnormal strength of vision—he used to point over the sea to towns and villages that remained invisible to us. To his credit it must be said that when we were on the lookout for a landmark or land he was always the first to see it; often a man had to be sent up the mast to confirm the sighting.'[42] Even in conditions of reduced visibility such men were often capable of navigating vessels

[36] 2000: 126.
[37] See, for example, Casson 1995: 307, 310, 319. The lookout or bow officer: Greek *prorates* (or *proreus*) πρῳρεῦσι; Roman *proreta*.
[38] *Orations*, 8.
[39] Rodger 1986: 48.
[40] E.g. Seidman 2001: 169.
[41] Apollonius Rhodius, *Argonautica*, 4.1466.
[42] Lewis 2001: 29.

with considerable accuracy, especially when in familiar waters. This was emphasised by Joseph Conrad, who, drawing on his twenty years of personal experience as a professional mariner, noted in his novel *Youth*: 'A pilot sees better than a stranger, because his local knowledge, like a sharper vision, completes the shape of things hurriedly glimpsed; penetrates the veils of mist spread over the land by the storms of the sea; defines with certitude the outlines of a coast lying under a pall of fog, the forms of landmarks half buried in a starless night as in a shallow grave.'[43]

For mariners pursuing a navigational strategy based on observations of the land, accurate navigation was therefore contingent upon being able to see and identify the coastal topography. Horden and Purcell are thus correct to draw attention to the requirement for '*the clearest weather*', while as long ago as the 1930s, Semple's seminal study of the central role played by geography on the course of Mediterranean history also highlighted the importance of the 'prevailing high reliefs, visible at a great distance *in the lucid air*.'[44] However, during the winter months, reduced levels of visibility, together with the extended hours of darkness, would have meant that the air was often far from lucid or clear.[45] Nevertheless, despite the often unfavourable conditions facing navigators at sea during the winter months, we should reject the assumption that, prior to the introduction of the compass and chart, wintertime sailing was beyond the skill of ancient mariners.

Environmental Navigation

Throughout maritime history sailors lacking even the most basic navigational instruments have proved capable of piloting vessels safely and accurately along stretches of dangerous coast in appalling weather conditions by relying on their skill, knowledge and experience. However, with the development of technological aids to seafaring, seamen have become reliant on instrumentational navigation and, in consequence, have grown increasingly divorced from the marine environment. In the modern world the array of navigational technology at the disposal of the modern mariner has, as one seaman has observed, 'all but obviated the need for the direct use of his natural senses.'[46] Without the advantages of the compass and chart, or

43 *Youth* 1902: 250.
44 1931: 589. (*My emphasis.*)
45 E.g. Calcagno 1997: 76.
46 Cotter 1981: 280.

the later technologies that have become such indispensable facets of modern seamanship, sailors of the ancient Mediterranean undoubtedly entered into a far more intimate relationship with the environment, developing navigational strategies based on information and knowledge gleaned from their marine surroundings. It has therefore been pointed out that, 'Navigation is now regarded as a science but has not always been so; until relatively recently it was also an art—in the sense of the use of personal skills—achievement depended on handed-on experience, local knowledge and detailed observation of natural phenomena.'[47] Ethnographic research has also emphasised the profound familiarity that can exist between pre-instrumentational seafarers and their marine environment; a relationship in which 'navigation of the ship is attributable to a complex mode of direct perception employing several of his physical senses, together with a fundamental understanding of the natural environment.'[48] Such finely honed senses were undoubtedly utilised by ancient navigators, especially when visibility was poor, while even modern yachting manuals continue to stress the importance of sounds and smells when groping along fog-bound coasts.[49]

Sailors and fishermen possessing detailed knowledge of the local marine environment were certainly employed as pilots in antiquity: the responsibilities of pilots were deemed sufficiently important to warrant their inclusion as one of the seven occupational classes in ancient Egypt.[50] Synesius also recounts that when the vessel on which he was travelling from Alexandria to Cyrenaica during the late Roman period ran aground near the harbour of Azarium, it had to be piloted through the shallows to a safe anchorage by an old man possessing detailed local knowledge of that part of the North African coast.[51] For Graeco-Roman seafarers making voyages across

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47 McGrail 1987: 275. It has also been recently noted by Cunliffe that, 'The accoutrements of more sophisticated navigation, which developed in the Mediterranean in the thirteenth and fourteenth centuries, gave no particular advantage to the coastal sailor well schooled in his locality' (2001: 107).

48 Fenton 1993: 56. See also Cunliffe 2001: 33, 79; Cunliffe 2001a: 119 f.; McGrail 1987: 275.

49 E.g. Skightholme 1986: 168. The fact that Cheedle (1994: 120), in a recent handbook for yachtsmen, is forced to stress that the sense of smell really can offer a major contribution to navigation and is not simply a 'joke', highlights how far most modern sailors have become divorced from their environment and nowadays trust to technology rather than their innate sensory perception.

50 Herodotus, 2.164.

51 Synesius, *Letters*, 4.176. See also Polybius (4.39), who writes of the need to use a local pilot when large vessels sail in the shallows of Lake Maiotis (Sea of Azov), while Theophrastus (*Concerning Weather Signs*, 3) also counsels for the use of local pilots which, he claims, are widespread across the Mediterranean, and whose advice should be sought and heeded.

the Arabian Sea during the first century AD, the Indian ruler of the trading city of Barygaza was said to have employed local fishermen to guide merchant vessels safely through the shoals that lay at the mouth of the Narmada River.[52] Local familiarity with coast and sea was also invaluable for those engaged on military activities and the naval commanders of antiquity certainly recognised the tactical advantages that could be derived from the use of local pilots. During the First Punic War, for example, Polybius describes how a Carthaginian commander, nicknamed 'The Rhodian', was continually able to run the Roman naval blockade of the Sicilian city of Lilybaeum (modern Marsala), using his knowledge of the coastline to pick out the safe routes through the shallows.[53] In the prelude to the Battle of Korykos in 191 BC, Livy also remarks that, while the sailors of the combined Roman and Rhodian naval force were handicapped by their lack of familiarity with the coast, the mariners of the Seleucid fleet possessed good local knowledge: 'Their [i.e. the Seleucid mariners] acquaintance with the sea, the lands and the winds would also help greatly, and all these would make trouble for an enemy unfamiliar with them.'[54] A similar problem was faced by Caesar during his campaign against the seafaring Veneti in 56 BC, in which he noted that operations along the Atlantic coasts of Amorica (the Breton peninsula) 'would be difficult for us on account of our ignorance of the waterways and the scarcity of the harbours … while we were … unacquainted with the shoals, harbours, and islands of the coast on which we should have to fight; and sailing in a wide ocean was clearly a different matter from sailing in a land-locked sea like that of the Mediterranean.'[55]

It is through such intimate relationships with the marine environment that sailors lacking even the most basic navigational instruments have been able to perform extraordinary feats of navigation that at times appear to border on the supernatural. It is therefore interesting to compare the following two passages, and while it is a simple matter to reject Homer's reference to the sentient, magical black ships of the Phaeacians as a mythological flight of fancy, nevertheless, the account drawn from the Baltic Sea of the early twentieth century, also implies a similar form of abnormal perception:

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[52] *Periplus Maris Erythraei* 44:15.4–5. The need to employ local pilots would have been even more pressing in such an estuary environment where riverine deposition would constantly change the contours of the sea and river bed and the position of safe channels and dangerous shallows.

[53] *Histories*, 1.46.4.

[54] 36.43.7–8.

[55] *Bellum Gallicum*, 3.9.3.

> Our Ships know by instinct what their crews are thinking, and propose to do. They know every city, every fertile land, and hidden in mist and cloud they make their swift passage over the sea's immensities with no fear of damage and no thought of wreck.[56]

> A ship I know of was steering south through Aland's Haf on a wild night in October 1910. Her old sailmaker was born in the north part of the Stockholm archipelago and knew every stone and every drop of water in Aland's Haf. He told the mate that the ship would not get through on the course she was steering. The mate told the master, and in the end the old sailmaker was called aft to con the ship. How he did it nobody really understood, as they sighted nothing; but the ship got through. Another vessel, the *Bardowie*, was lost that very night in the same waters, the two ships having been in company on the day before.[57]

Both passages emphasise that mariners in possession of detailed knowledge of the waters through which they were sailing might prove capable of navigating an accurate course through the most unfavourable weather conditions. Although the old sailmaker who was called upon to pilot the ship through the stormy waters of the Baltic Sea would undoubtedly have been able to refer to a compass and chart, it is nonetheless clear that it was his familiarity with the surrounding marine environment, rather than any technological assistance, that saved his vessel and crewmates. There is little in the way of direct literary evidence for sailors on the Graeco-Roman Mediterranean displaying such sensory navigational skills. However, this should come as little surprise given that the social elites, who penned almost all the surviving texts from the ancient world, rarely display any interest in, or appreciation of, the skills of professional sailors, while it is likely that the vast majority of ancient sailors were illiterate. Nevertheless, the account of St Paul's wreck on Malta, like Homer's description of the ships of the Phaeacians, provides an indication that the mariners of antiquity were considerably more attuned to the surrounding marine environment than were their lubbery passengers. Although the narrator of Acts was himself oblivious to the imminent danger of being driven on to the Maltese shore, the sailors aboard the Alexandrian grain freighter—despite having been at sea for two weeks and enduring the appalling navigational conditions brought on by powerful winds, high seas and overcast skies—were still able to discern the approach of the coast under their lee even though it was the middle

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[56] *Odyssey*, 8.559–563.

[57] Quoted in Solver & Marcus 1958, and Fenton 1993: 44. It should also be noted that this description of navigational expertise which borders on the miraculous, is but one account drawn from an extensive body of modern anecdotal evidence (Fenton 1993: 44).

of the night. Although a sounding lead was deployed to measure the depth of the shoaling water beneath the ship, it was only used to confirm their fears.[58] Unfortunately, we are not informed as to how the mariners aboard the freighter were able to sense that the vessel was approaching land. Sights, sounds and smells coming from the shore are some of the possibilities that might have alerted the sailors to the approaching danger.[59] However, because the incident took place in darkness, and with the north-east gregale wind blowing in the direction of the land, rather than off the coastline, it would therefore have been unlikely that smells and sounds would carry out to the ship. The presence of shore lights or other visual references would probably also have been noticed by the passengers as well as the seamen. As such, the mariners appear to have been forewarned to the danger of the rapidly approaching lee shore by more subtle and less discernable signals. These may have taken the form of changes to the pattern of the waves as the ship was swept into shallow water—a danger signal that, while obvious to the crew of the ship, was likely to have gone unnoticed by the passengers who were not similarly attuned to the movement of the vessel upon the water or the marine environment through which they were sailing.[60]

For the mariners of antiquity, accurate coastal navigation therefore depended on an intimate relationship with the surrounding environment; a relationship that was founded upon personal experience of the seascape—of the topography of the coast and sea-bed, the location and movements of various flora and fauna, methods of foretelling the approaching weather and sea conditions. Such a comprehensive understanding of the marine environment would have been constructed over many years spent at sea, plying increasingly familiar sea routes, while navigational knowledge would also have been transmitted orally down through the generations and across ancient seafaring communities; a pre-literate tradition that is represented in antiquity by the Homeric epic poems, or in the memory training of the Iron Age communities of north-west Europe.[61] Ditties, songs and sea-shanties,

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58 Acts 27:27.

59 Morton (2001: 208) and Smith (1880: 118), for example, both assume that it was at least one of these factors that was sensed by the sailors and allowed them to prevent the grain freighter from being swept onto the Maltese coast in the darkness.

60 Oleson has therefore recently conjectured that while the presence of land might have been betrayed by observations of species of land birds, or cloud formations spotted by the sailors on board the grain freighter during the hours of daylight on the previous day, the seamen may also have sensed the rapidly shoaling water through 'changes in the shape and direction of swells and waves' (2008: 117–118).

61 See, for example, McGrail 1987: 277.

together with local myths and legends, might also have been used to pass on information about regional sea conditions. Navigational knowledge was therefore almost certainly transferred by word of mouth, from one sailor to another, long before it began to be set down in written form. It was through this combination of personal and communal knowledge that Graeco-Roman seafaring communities steadily accumulated detailed knowledge of the seas and coasts of the Mediterranean and would have been able to create what have been described as 'mental charts' or 'sensory maps': detailed mental images of the local environment that, even in conditions of poor visibility, would have allowed mariners to navigate accurately by 'direct recognition of what has been learned and recounted, seen and recognised, on countless occasions before.'[62] Such an intimate understanding of local marine conditions would undoubtedly have been used to navigate vessels on the ancient Mediterranean and could well have allowed voyages to be undertaken even in the unfavourable sea and weather conditions associated with winter. It would, after all, appear likely that many of the more important and long-established sea-lanes had become exceptionally well known by mariners making frequent voyages across the same stretch of water, and it has therefore been noted that, 'once large numbers of ships visited a region regularly, navigational expertise for those voyages would mount disproportionately in contrast to less-frequented routes.'[63] Knowledge of the marine environment would nevertheless have been at its most detailed among local seamen who regularly engaged on short trading ventures or fishing trips along the same stretch of coast; it was mariners such as these, whose activities tended to be limited to a highly localised section of sea, that almost certainly constituted the vast majority of the seafaring population of the ancient world.[64] Increased familiarity with the local seascape and coastal topography would not only have made for safer passage-making but might also have stimulated an increase in the seasonal range of shipping along such routes as sailors, possessing a confidence born from in-depth knowledge of the environment, were prepared to remain at sea for longer into the winter months on regions of the Mediterranean with which they were intensely familiar.

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[62] Fenton 1993: 45 f. See also McGrail 1987: 281.

[63] Mattingly 1988: 54.

[64] Although impossible to prove, we would probably not be too far wrong in assuming that the situation on the Graeco-Roman Mediterranean was similar to that which existed in Britain and the other European maritime states of the early modern era, when shipping records indicate that 'nearly two-thirds of all sailors never went far from home, since they were employed in inshore fishing and in the coasting trades' (Earle 1998: 6).

Charts and Periploi

Although the magnetic compass was first introduced into the Mediterranean region during the Middle Ages, it is nevertheless possible that some mariners of antiquity had access to charts. The creation of rudimentary sea-charts would have presented little technical difficulty to the cartographers of antiquity whose attempts to map the world had begun by at least the early sixth century BC.[65] With both the Greeks and Romans using maps widely, it is certainly possible that basic maritime charts, depicting the coastline and principal sea-routes, were sometimes carried on ships of the ancient world.[66] However, even if charts did exist for the ancient Mediterranean, they would have been of dubious assistance to seamen. Not only do Graeco-Roman writers emphasise the unreliability of contemporary maps,[67] but sea-charts, in order to be of practical use to mariners, require a vast amount of additional information above and beyond that included on maps. A recent sailing handbook has therefore noted that 'Charts show hidden obstructions, topography above and below water, *soundings* (depths), bottom characteristics, landmarks, buoys, wrecks, channels, and much more.'[68] The acquisition and illustration of such detailed navigational information was probably beyond the abilities and immediate concerns of ancient cartographers.[69]

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[65] Diogenes refers to the maps drawn by Anaximander of Miletus at this time (2.1.2), while Strabo emphasises the importance of the coastline to the cartographers of antiquity (*Geography*, 2.5.17).

[66] For the possibility of charts being used by Graeco-Roman navigators, see, for example, Taylor 1971: 55.

[67] Herodotus, 4.36; Pliny, *Naturalis Historia*, 3.17. The many inaccuracies contained in Ptolemy's *Geographia* also suggest that ancient maps were highly inaccurate (Brown 1949: 77 f.).

[68] Seidman 2001: 176. See also Cunliffe 1987: 6 f.; Simpson 1991: 81 f.

[69] In this respect we should question the importance of the medieval *portolan* charts that also lacked such important navigational information and were of such small scale that their benefit to practical navigation can be questioned (Fernandez-Armesto 1999: 233). Furthermore, as J.H. Parry has pointed out, 'Most of the surviving medieval charts are highly decorated examples which probably were never used at sea, but graced the offices of shipping firms or the libraries of great men' (1963: 102). Even were other less ornate but more practical charts used by medieval mariners at sea, then they could not have supplied the necessary details to allow sailors to navigate accurately along a coastline in poor visibility unless the captain or members of his crew already possessed detailed knowledge of the local marine environment. Indeed, throughout the early modern period many mariners had little use for charts (Taylor & Richey 1962: 10; Williams 1994: 35), and, even as late as the nineteenth century, charts of the Mediterranean, let alone those depicting more far-flung and newly discovered regions of the world, were still dangerously inaccurate (e.g. Callender 1924: 232 f.; Kennedy 1976: 164; Rodger 1986: 48; Smith 1880: xxxiif.).

Despite the lack of practical charts—as well as the absence of the magnetic compass, or the various other ship-based navigational instruments that began to be adopted by Mediterranean mariners during the medieval and early modern periods—the seafarers of antiquity did have access to *periploi*.[70] These were written sailing directions: early versions of modern pilot-books that continue to provide modern navigators with such information as the various sea-routes, landmarks, marine dangers, harbours, and the availability of drinking-water and other supplies essential for sailors making coastwise voyages.[71] The sailing directions laid down in the ancient *periploi* provided the most useful ship-based navigational aids available to Graeco-Roman seafarers and it has been noted that, even for sailors of the medieval period and beyond, 'many centuries were to pass after the introduction of the pictorial charts in the thirteenth century before the chart superseded sailing directions to become the instrument of coastal navigation *par excellence*.'[72] The oldest extant version of these ancient *periploi* dates to the fifth or fourth century BC and is attributed to (pseudo-)Scylax of Caryanda.[73] It describes the coastal features of the Mediterranean and Black Sea together with parts of the Atlantic seaboard and provides sailing distances from one place to the next; it has therefore been regarded as 'the very prototype of sailing directions for the Mediterranean.'[74] Commencing at the Nile delta, the *Periplus of Scylax* begins with a description of the sea-route westwards along the coast of North Africa:

> And the mouth of the Plinthine gulf to Leuke headland is a voyage of a day and a night, and that to the inner end of the Plinthine gulf twice as much … And from Leuke headland to Laodamanteios harbour the voyage is a half of a day.[75]

As voyages along the coasts and seas of the Mediterranean became more commonplace, and navigators became better acquainted with the various coastal routes and landmarks, later *periploi* also became increasingly

[70] The word '*periplus*' (περίπλους) is usually translated as 'a sailing around' or 'a circumnavigation'.
[71] For brief summaries of the various *periploi* known to have existed in antiquity, see Casson 1995: 245 f.; Huntingford 1980: 3; Warmington 1992: 802.
[72] Cotter 1981: 282.
[73] Herodotus (4.44) notes that Scylax carried out his circumnavigation in the sixth century.
[74] Smyth 1854: 314. Earlier *periopl oi* may well have existed in the Greek world and it has been suggested that Herodotus and Thucydides, when writing their histories, consulted written sailing directions that were already in circulation (How & Wells 1912: 1.331 f.; Hammond 1967: 471 f.).
[75] *Periplus of Pseudo-Scylax*, 107.

detailed. By the time the *Stadiasmus Maris Magni* was compiled by its anonymous author in the third or fourth century AD, the sea-routes of the Mediterranean were considerably better known than had been the case during the time at which Herodotus believed Scylax to have been navigating the Mediterranean, some seven centuries earlier, making the later *periplus* 'much fuller and more precise than its earlier prototype.'[76] This is highlighted in the following passage which, focusing on the same stretch of North African coast described above, contains rather more topographical detail, while distances are also more accurately recorded in stades rather than in terms of a day's sail:

> From Leuce Acte to Zygris 90 stadia: there is an islet: put into the place with it on your left: there is water in the sand. From Zygris to Ladamantia 20 stadia: close by lies a rather large island: put in with this on your right. There is a harbour accessible with any wind: water is to be found.[77]

Although historians tend to emphasise the importance of *periploi* to ancient navigation, it is difficult to ascertain whether they played a prominent role in Graeco-Roman seafaring. While it might reasonably be expected that commercial transactions required merchants and traders to be at least partially literate, it is unclear what proportion of ancient mariners were able to read and write and thus capable of navigating by reference to *periploi*.[78] However, even were literacy levels amongst the maritime communities of the ancient Mediterranean rather higher than is generally assumed to be the case, the expense of papyrus and parchment, let alone the cost of a finished work, would have made *periploi* prohibitively expensive and unobtainable for all but a small minority of seafarers.[79] Moreover, even the later, more detailed *periploi*, such as the *Stadiasmus Maris Magni*, still lacked many important navigational details—the location of dangerous rocks and shoals, the whereabouts of deep-water channels, the safest approaches to harbours. Instead, the sailing directions that survive from antiquity provide only a

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[76] Taylor 1971: 52. J.L. Myres (1896: 610) long ago linked the introduction of *periploi* to the colonising and commercial activities being pursued by various Greek city-states during the late Archaic and Classical periods.

[77] *Stadiasmus Maris Magni*. Trans. Taylor 1971: 52.

[78] It has been argued by W.V. Harris that, throughout antiquity, literacy was generally limited to males drawn from the higher socio-economic classes (1989: 22, 102–103, 140 f., 159). However, in contrast to this minimalist view of ancient literacy, recent studies of the Vindolanda tablets suggest that the ability to read and write had permeated further down the social structure than has previously been believed (Bowman 1994: 82, 89, 95 f.).

[79] For the high cost of papyri, parchment and books throughout antiquity, see Harris (1989: 194 f.).

sketched outline of the distances of various sea routes; the names of coastal towns and landmarks; together with a scattering of other information pertinent to navigational and trading purposes. Rather than follow current academic belief which assumes *periploi* were created specifically for practical seamen, it therefore appears more likely they were primarily designed for a clientele whose relationship with the sea was rather more transitory: perhaps commanders of naval fleets or detachments of warships who would find the *perploi* useful when planning military campaigns; or commercial ship-owners, sea-traders, and even wealthy passengers, all of whom may have desired a brief overview of the nature of the route along which they would be sailing and who possessed the financial means with which to acquire these expensive pilot books. By contrast, professional sailors and fishermen probably continued to rely on personal knowledge and 'mental charts' when making voyages, and, as such, *periploi* almost certainly represent only a fraction of the accumulated navigational knowledge that was maintained through the oral culture of ancient seafaring communities. This collective body of knowledge and experience allowed the mariners of antiquity to create detailed mental images of regions of coast and sea which would have been considerably richer in navigational detail, and eminently more useful to practical seamen, than were the brief descriptions recorded in the *periploi*. It was this oral culture, preserved through memorised knowledge, that might have allowed sailors to accurately pilot vessels along a coast even in conditions of poor visibility brought on by wintertime mist, fog, or heavy rain.[80]

Water Depth

For the inshore pilot the colour of the sea can also prove useful assistance to navigation and will often provide indications of the depth of the water, allowing a ship's lookout to safely avoid rocky outcrops and shoal water by keeping to the deeper channels. Even modern pilot books therefore stress the importance of sea colour as a navigational aid:

> As a general rule the following colour coding applies to the depth of water: brown to yellow-brown means 2 m or less, green 2–5 m, blue-green 5–25 m and a dark green-blue 25 m plus. This is in relatively calm water with the

[80] See Harris (1989: 30 f.) for the capacity and importance of ancient memory, while R. Thomas has also stressed that ancient Greece was 'an oral society in which the written word took second place to the spoken' (1992: 6).

> sun overhead. On days when there is scattered cloud identification is more difficult as you will get dark shadows moving over the water which make it difficult to see what is going on … In disturbed water where the sand has been whipped up or blown off the shore, the water is murkier and it is more difficult to work out the depths.[81]

While the only mention of this relationship between water colour and water depth in the ancient literature comes from Apollonius Rhodius' *Argonautica*,[82] there would seem little doubt that seamen of antiquity were well aware of the ways in which the colour of the water passing before the bows of their ships could be used as useful aids to navigation. For pilots and lookouts on the ancient Mediterranean, careful observation of the sea colour would often have allowed them to set a safe course which avoided rocky outcrops and shoals by keeping to the darker, deeper channels. However, as the above passage makes clear, during overcast conditions, or when the wind whipped up waves and disturbed the sea-surface, ancient navigators would have been unable to make such colour-coded estimates of water depth. The choppy seas and cloudy skies more likely to be encountered during the winter months would therefore have made life considerably more difficult for pilots guiding vessels through coastal waters. However, in the sounding-rod and especially the sounding lead, the mariners of antiquity possessed tools that, even in the poorest visibility, would have allowed them to avoid running their vessels onto submerged hazards. Through use of these navigational instruments, seamen in familiar waters would even have been able to locate their position by reference to the topography of the sea-floor.[83]

The sounding-rod is the simplest and, as such, probably the earliest navigational instrument used by the sailors of the ancient Mediterranean with the archaeological and iconographic evidence for their use dating back to Egypt of the mid-third millennium BC.[84] In its most basic form the

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81 Heikell 1999: 5. See also, HMSO 1967: 267 f.; Skightholme 1986: 114.

82 However, even in Apollonius' version of the tale, there is little emphasis on the ability of skilled pilots to discern variable water depth from subtle changes in the colour of the sea. Thus, when Trition showed the Argonauts the exit from his lake into the Mediterranean, he describes it as 'the outlet to the sea, where the deep water lies unmoved and dark; on each side roll white breakers with shining crests; and the way between for your passage out is narrow' (4.1573 f.).

83 The following section with its brief analysis of the sounding technology used by ancient seafarers, owes a great deal to the detailed research of John Oleson (2000, 2008), to whom readers should refer for additional information relating to lead-lines.

84 See, for example, Jones 1988: 197 f.; Landström 1970: various figures; Oleson 2008: 131; Wachsmann 1998: figure 2.15.

sounding-rod was simply a long wooden pole that was thrust into the water until it made contact with the sea-floor and thus measured the depth of water beneath the ship. Even though sounding-rods were only practicable to depths of about two metres, and a vessel had to be stationary if they were to be employed effectively, their ease of use ensured that they remained in operation throughout antiquity.[85] However, from at least the fifth century BC onwards, both the literature and archaeology provide evidence for the Mediterranean-wide use of sounding leads (βολίς καταπειπητηρίη)—also commonly referred to as lead-lines or sounding weights—which consisted of a lead plummet made fast to a hemp rope (figure 4.3).[86] When taking soundings the lead was cast well forward of the ship by a seaman stationed in the bows so that by the time the plummet had descended to the sea-bed the headway of the vessel caused the line to be close to the vertical, enabling the leadsman accurately to ascertain the depth of the water underneath the ship. To further enhance the information provided by lead-lines, Graeco-Roman plummets often contained a hollowed-out base which, when 'armed' through the insertion of adhesive substances such as tallow, wax, pitch, or resin into the base cavity, would allow the lead to bring up loose fragments from the sea-bed and provide a sample of the material which constituted the sea-floor.[87] A lead thus armed could therefore provide important information to the ancient navigator and Herodotus clearly describes how a sounding lead would be used to alert mariners sailing across the open water of the eastern Mediterranean, bound for the trading ports of the Nile delta, to the proximity of the Egyptian coastline: 'The physical geography of Egypt is such that as you approach the country by sea, if you let down a sounding-line when you are still a day's journey away from land, you will bring up mud in eleven fathoms of water. This shows there is silt [washed down by the Nile] this far out.'[88] In poor visibility soundings could also inform sailors of the

[85] Oleson 2008: 131. Writing in the late second century AD, and compiling information from the Late Republic and early Imperial periods in Roman history, Festus (*De Uerborum Significatu*, 236.4–6) therefore refers to rods being employed to measure the depth of the water.

[86] Stone plummets were also undoubtedly used, though because these would often take the form of a simple rock bound with rope, they are often invisible in the archaeological record and Oleson lists just eight examples in his recent corpus (2008: 122 fnt. 12, 135).

[87] A Byzantine sounding lead recovered off the Israeli coast at Dor has provided traces of beef tallow still adhering to its base cavity (Rosen et al 2001).

[88] 2.5.2. While modern charts suggest that a day's sail from the Egyptian shoreline would actually put a vessel beyond soundings, the ancient author is correct in his claim that, even when still well to seaward of the delta, yellow Nilotic silt would be brought up by the lead (Taylor 1971: 35).

approach of an obscured landfall and allow them to take measures to prevent their vessel from running aground. It was through the use of a lead-line that the sailors of the Alexandrian freighter upon which St Paul was travelling to his trial in Rome confirmed that the vessel was being driven onto a rapidly shelving lee shore; despite the lack of visibility resulting from the stormy conditions and long hours of autumnal darkness, the soundings convinced the mariners of the urgent need to deploy four anchors from the stern of the vessel in an effort to halt the ship's progress.[89] For Graeco-Roman seamen the lead-line was therefore a highly important piece of equipment that allowed 'coastal navigators to facilitate safe navigation, especially in thick or hazy weather.'[90] For sailors intimately familiar with the local topography and composition of the sea-bed, the information provided by the sounding lead could also be used to ascertain a vessel's exact position based on depth and sea-floor material, allowing mariners to avoid shallows and pick out safe channels in even the most unfavourable of weather conditions. This form of navigation—which referred the information provided by the sounding lead to a sailor's 'mental chart'—was to remain in evidence in European waters into even recent times.[91]

The sounding lead continued to be the most important piece of navigational equipment for sailors operating in the relatively shallow waters of the North Sea and Baltic, even long after the introduction of the magnetic compass.[92] By contrast, however, the seas of the Mediterranean are considerably deeper and generally have only a narrow continental shelf beyond which the sea-floor plunges rapidly into deep water well beyond soundings.[93] The

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[89] Acts 27:28.

[90] Kemp 1992: 471. Ericson & Wollin provide the apt metaphor that 'The lead line was to the mariner in a fog or off an unknown coast what a cane is to a blind man' (1968: 146).

[91] H.W. Smyth's description of a skilled mariner working the Thames estuary and North Sea coasts at the beginning of the last century clearly illustrates that safe and accurate courses could be steered without any other form of navigational instrumentation save for the lead-line: 'If anyone would know the full the meaning of these things, let him ship on board a Brawley boat from Leigh or Whitstable on an autumn morning, and with no chart, but with a lead-line and with the astounding memory of the skipper of the little boat, find his way down to the Gunfleet and back. In all that intricate network of sands and channels, given the hour of the tide, the depth and the character of the bottom as disclosed by the lead, a Bawley man will tell you exactly where you are, although, as in the case of an old friend of my own, he can neither read nor write, and has never seen a chart' (1906: 7. See also Cotter 1981: 281; Cunliffe 2001: 80; McGrail 1987: 278).

[92] E.g. Ellmers 1994: 40; Lane 1966: 338; Taylor & Richey 1962: 9.

[93] Only about 20 percent of the Mediterranean's sea-floor is shallower than 200 m with the other 80 percent containing some very deep areas of ocean which can descend as far as 4,900 m below sea level. (See, for example, Frisbee 1990: 57; Luciani 1984: 15).

great depth of the water therefore made Graeco-Roman navigation through use of the lead-line impractical across much of the Mediterranean and perhaps explains why relatively few ancient leads have been recovered from the Sea.[94] However, in those regions of the Mediterranean with relatively shallow waters,[95] the sounding lead would have proved an invaluable boon to ancient seamen, potentially allowing sailors operating in familiar waters to navigate accurately even at night or in conditions of mist and fog. Furthermore, it is also interesting to note that John Oleson's recent corpus of sounding-weights indicates that, 'Although sounding weights certainly existed by 500 BC, 83.8 percent of the datable sounding weights fall in the period from the mid-second century BC to the second century AD (62 out of 74), the period of most intensive long-distance trade in the Mediterranean.'[96] It would thus appear that the sounding lead—'the most important physical tool Greek and Roman sailors had to assist them in navigation'[97]—achieved its most widespread use during the late Hellenistic and early Imperial periods; the same three-hundred-year period at which ancient shipbuilding technology also appears to have reached its technological zenith. While it might appear unlikely that the widespread dissemination of this one navigational tool would have allowed sailors of the Hellenistic period and the early Roman Empire to extend the sailing season beyond the dates advised by Hesiod's in the Archaic period, or those set down in the late Roman seafaring calendars formulated by Gratian and Vegetius, nonetheless, the increase in the usage of sounding leads between c. 150 BC–AD 150 may suggest that Graeco-Roman navigational expertise, like the shipwright's craft, reached its ancient apogee during this period of antiquity; a combination of maritime skill and technology that may have allowed a greater volume of shipping to operate on the wintertime Mediterranean than was the case in the centuries before or after.

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[94] See, however, Oleson (2008: 131 f.), whose recent corpus records 177 examples of ancient sounding leads recovered from around Europe. Oleson has also argued that the high rates of loss in antiquity, coupled with the melting down of many such leads over the centuries, has greatly distorted the picture of the extent of their usage on Graeco-Roman vessels (2000: 308).

[95] On the southern shores of the Mediterranean these are notably the area around the Nile delta and in the seas lying between the African coastline and Sicily. Along northern shorelines they include areas such as the Spanish coast to the west of the Balearics; the Gulf of Lions; in the Adriatic Sea (Luciani 1984: 17).

[96] Oleson 2008: 139.

[97] Oleson 2000: 294.

Shore-Based Navigational Aids

Along many shallow shorelines of the Mediterranean, and especially in the vicinity of ports and harbours, it is likely that markers were erected in the sea-bed to warn ancient pilots and navigators away from submerged hazards, or to point out safe channels of deeper water. At the mouth of Lake Cataderbis, at the head of the Persian Gulf, Arrian therefore noted that 'the shallows were marked on either side by poles driven down, just as in the strait between the island of Leucas and Acarnania signposts have been set up for navigators so that the ships should not go aground on the shallows.'[98] Rutilius Namatianus also described how, during the fifth century AD, laurel branches, set upon piles driven into the sea-floor, were used to pick out navigable channels along the coast of Pisa.[99] Similar sea-floor markers remain in common use to this day, and a recent sailing guide for British coastal waters notes that, 'In a shallow creek the withies often mark the limits of navigable water, and the yachtsman ignores them at his peril.'[100] Artificial navigational aids such as these, which are all-but invisible in the archaeological record, were almost certainly in widespread use along many of the coasts of the ancient Mediterranean and, even when visibility was poor, they would have allowed Graeco-Roman seamen to grope their way along safe shipping channels marked by poles or branches.

Although a high and prominent coastline provides the most useful means by which coastwise pilots can identify their sea-position and which open water navigators might use to determine points of departure and landfall,[101] the natural topography of the Mediterranean coastline has also often been augmented by human action to provide even clearer positional indicators for mariners out at sea. In Homeric literature there are a number of references to barrows being raised on headlands, and although these structures were primarily constructed to honour the dead housed within, nevertheless, they also appear to have been intentionally designed to act as navigational markers for seafarers.[102] Promontories and headlands across

98 *Indike*, 8.41.

99 *De reditu suo*, 1.453–462.

100 Cunliffe 1987: 24.

101 See Morton (2001: 185–193) for the ways in which coastal topography was used as an aid to navigation in the ancient Mediterranean.

102 *Iliad*, 7.85 f.; *Odyssey*, 11.71 f.; 12.8 f.; 24.80 f.; all of which are referenced by Morton who also points out that 'The Greek term for these tombs, σῆμα, literally denotes a "sign", and it is clear that, from a very early date, the Greeks believed these tombs to have been set up at specific points on the coast so as to be seen by mariners out to sea' (2001: 194).

the ancient Mediterranean were also frequently topped with temples as a means of marking important landfalls or of warning seafarers of a potentially hazardous coastline. The navigational importance of these temple sites is emphasised by Aelius Aristides who, speaking to the inhabitants of the Marmaran city of Cyzius during the second century AD, regarded their city temple as 'equal to the mountains, and you alone have no need for beacons, signal fires, and towers for those putting into port. But the temple fills every vista.'[103] That many of these promontory temples tended to be located along the principal Mediterranean shipping routes would further indicate that they fulfilled a navigational as well as a religious function. These twin roles have, in many cases, been carried over into the present, with churches and mosques founded on or near the sites of many pagan temples.[104]

While temples and other prominent coastal features—whether of natural or human construction—were a blessing to mariners seeking a readily identifiable landmark to aid navigation, they could do little to pierce the veils drawn about the coast by darkness, mist and fog. In at least some instances, however, the priests of coastal temples would light beacons to provide navigational markers that acted either as guides or as warnings to mariners on the sea at times of darkness or poor visibility. At the narrow northern channel of the Thracian Bosphorus, Philostratus the Elder, writing in the early third century AD, therefore describes one such temple where 'the beacon light at the entrance ... is hung up to warn from danger the ships that sail out from the Euxine.'[105] While beacons had also been used to relay signals along Mediterranean coasts from at least Homeric times, the literature provides little clue as to when such lights and fires began to be specifically used as navigational aids for seafarers and it has recently been pointed out that, prior to the fifth century BC, there is no mention in the ancient literature of lights to guide mariners in and out of harbour.[106] Nonetheless, there would seem little doubt that, from earliest times, simple beacons lit on a

[103] *Orations*, 117 f. For more details, see Calcagno 1997: 192; Morton 2001: 195 f.; Semple 1931: 615 f.

[104] Calcagno 1997: 192; Semple 1931: 617 f. See Kapitän (1989) for archaeological evidence of votive offerings made by mariners at sea when in the vicinity of such temples.

[105] *Imagines*, 1.12.28–31.

[106] Morton 2001: 212. The tradition of Nauplius using beacons to lure Greek vessels returning from the Trojan War to their wreck on the rocky coast of south-east Euboea, 'by the light of his treacherous star' (Euripides, *Helena*, 1131), does not appear in renditions of the tale prior to the Euripidean version of the fifth century BC (Morton 2001: 212 f.). However, by the Roman Imperial period, wrecking appears to have been a major problem and is noted as such in the *Digest* (47.9.4; 47.9.7. For further references, see Braund 1993: 205).

beach or headland were used to guide local fishermen or coastal traders to safety. By the Hellenistic period paintings and mosaics indicate that these signal fires had evolved to include free-standing towers or columns that were used to provide a platform to project the light further out to sea, while these purpose-built structures would also have made useful coastal landmarks during the hours of daylight.[107]

It is only a small step from the placing of coastal beacons upon plinths to the development of the lighthouse, a structure which, to this day, remains the most important artificial navigation aid for mariners caught at sea in darkness or poor visibility: 'The lighthouse is the greatest boon ever to be bestowed upon navigators. By means of its signal … ships can move along the most treacherous coast at night or in a fog with perfect safety.'[108] As with barrows, temples and beacon plinths, lighthouses provided visual reference points for Graeco-Roman navigators during the hours of daylight, greatly extending the distance at which sailors out to sea could maintain visual contact with the coastline. It was, however, during the hours of darkness, or in conditions of mist, fog or heavy rain that lighthouses continued to offer an invaluable point of reference to the shore. While it would seem likely that primitive lighthouses were constructed on Mediterranean coasts prior to the third century BC, it was only following the erection of the great lighthouse of Alexandria, on the island of Pharos, that a period of major construction of these aids to navigation was ushered in during the Hellenistic and Roman Republican periods, and continued during the Roman Empire.[109] However, with just over twenty examples known from the ancient world, lighthouses were a rarity on the coastlines of the Graeco-Roman Mediterranean and, as such, it has been argued that their impact upon navigation was minimal.[110] Furthermore, in many cases it is probable that ancient lighthouses were erected as much to reflect the political aspirations of rulers

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[107] Vann 1991: 124. Yachting handbooks also note that, even today, the plinths of disused beacons continue to provide useful points of coastal reference against which pilots can gauge their position in the daytime (see, for example, Cheedle 1994: 117 f.).

[108] Beaver 1971: 1 f.

[109] The lighthouse at Alexandria was built under the rule of Ptolemy Philadelphus by the architect Sostratos of Cnidus (Eusebius, *Chronicle*, 124.1; Pliny, *Naturalis Historia*, 36.8.3; Strabo, 17.1.6.) and it was to remain the largest and grandest example of an ancient lighthouse until its eventual destruction in the Middle Ages. Calculations of the height of the structure range from 85 m (Singer & Holmyard 1956: 521 f.) to 140 m (Hague & Christie 1977: 63 f.), great heights that allowed its signal fires, possibly intensified by the use of burnished bronze mirrors, to be visible far out to sea. (Lucian's assertion that the light of the Pharos was visible as far as 300 miles distant is, however, clearly an exaggeration. *Icaromenippus*, 12.)

[110] Jurišic´ 2000: 53.

and/or cities as to provide navigational assistance to seafarers. However, for Graeco-Roman mariners sailing along a stretch of coastline served by a lighthouse, navigation undoubtedly became a good deal safer as a result of the light the structures cast forth, and although mist, fog, heavy rain or dust storms would all have greatly reduced the range at which the beam of ancient lighthouses would have been visible out to sea, nevertheless, the presence of a signal fire would still have provided great assistance to sailors. Strabo therefore emphasised the importance of the lighthouse at Alexandria in guiding mariners safely to the city and preventing vessels from falling foul of the dangerous shoal waters and low-lying coastline of the western Nile delta; the lighthouse provided 'those who were sailing from the open sea ... [with a] lofty and conspicuous sign to enable them to direct their course aright to the entrance of the harbour.'[111] However, while the Pharos of Alexandria was constructed on a scale unrivalled elsewhere in the ancient world, during conditions of poor visibility the great height of the structure may actually have proved something of a drawback. When modern lighthouses are erected in regions where mist or fog are prevalent 'the tendency has been to place the lighthouse as near sea level as possible in order to achieve maximum visibility in these conditions.'[112] In spite of the large and elaborate nature of the structure erected at the harbour mouth of Alexandria, the lower elevations more typical of ancient lighthouses may therefore have proved to be of greater benefit to sailors at sea in conditions of reduced visibility.[113]

The crucial question in regard to wintertime seafaring is, however, whether lighthouses on the coasts of the ancient Mediterranean would have continued to cast forth a signal during the winter months, or if their fires were lit only during the limits traditionally ascribed to the Graeco-Roman sailing season. Unfortunately, it is a question for which the ancient literature provides no direct answer. It is nevertheless interesting to note that, at the beginning of the fifth century, St Paulinus, when writing of the ordeal of a lone seaman trapped aboard a Sardinian grain vessel at the mercy of strong wintertime winds, describes how the sailor, when swept eastwards into sight of Ostia, 'beheld the lighthouse in the harbour of the capital.' (See above p. 35.)[114] Paulinus was not an eyewitness to the event, and his description

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111 *Geography*, 17.1.6.
112 Kemp 1992: 483.
113 For a comparison of heights and sizes of known Graeco-Roman lighthouses, see Vann 1997.
114 *Letters*, 49.8.

of the events surrounding this voyage are primarily intended to emphasise divine intervention. Nonetheless, given the fore-knowledge that a fleet of Sardinian grain transports was expected to arrive at the mouth of the Tiber, then it would appear likely that the signal fires of the lighthouse at Ostia would have been lit, even though it was still winter and well before the start dates usually attributed to the sailing season of the late antiquity. If such an assumption is correct, then it would also seem plausible to suppose that, throughout the Imperial period, Rome's port cities of Ostia and Puteoli kept their lighthouses operational throughout the year. This would have been especially necessary when famine threatened the capital, requiring vessels to transport grain across the Mediterranean during the winter and early spring. Such was the case with the incident related by St Paulinus, or, more famously, when Claudius demanded that wintertime shipments of corn be delivered to Rome in AD 51 in order to avert the threat of starvation. (See above, p. 32 f.)[115] However, even during years when the threat of famine in Rome was not so pressing, grain-bearing vessels were probably still regularly arriving and departing from many of the larger Mediterranean ports, as the voyage of the Alexandrian grain freighter *Castor and Pollux*, carrying St Paul from Malta to Puteoli during late January or early February, would seem to imply.[116] (See above p. 39 f. and 102 f.) That the apostle's vessel is also described by the narrator of Acts as travelling in coastwise fashion along the Sicilian and western Italian shorelines, putting in at Syracuse and Rhegium, also suggests that these ports—and perhaps many other major harbour cities of the Mediterranean—continued setting fires from lighthouses and signal beacons throughout the period normally defined as the *mare clausum* in an effort to aid navigation for mariners crewing the *annona* ships which were transporting shipments of state-owned cargoes across the seas of winter. Furthermore, the ancient literary evidence, which, as we have already seen, provides strong indications that voyages were being regularly undertaken on the wintertime Mediterranean—whether carried out at the behest of a state, or undertaken for purely private commercial reasons—would probably have provided a strong incentive for those ports large and important enough to merit the construction of a lighthouse, to keep the signal fires burning year-round in an effort to provide these vessels with some navigational assistance during the winter months.[117]

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115 Suetonius, *Claudius*, 18–19; Tacitus, *Annals*, 12.43.

116 Acts 28:11–13.

117 It has already been seen that state-owned cargoes were being transported across the

Night-Time Sailing

The development and construction of artificial navigational aids such as beacons and lighthouses were obviously designed primarily to benefit Graeco-Roman mariners at sea during the hours of darkness—the element which heads Vegetius' list of wintertime hazards.[118] There is no doubt that vessels at sea during the night-time were at a greatly increased risk of running afoul of rocks and shoals, or even colliding with other vessels in crowded seaways,[119] and it has been emphasised that, 'In ancient seafaring, wintertime and night-time were the most commonly avoided periods, for obvious reasons.'[120] With the short days and long nights experienced during the winter, it is therefore hardly surprising that ancient seafaring has traditionally been regarded as undergoing a seasonal suspension.

Whenever possible the oared warships of antiquity certainly spent the night in harbour or moored on a sheltered shore, allowing crews the opportunity to exercise, eat and sleep on land rather than in the crowded confines of their ship.[121] For merchant vessels, especially those of smaller tonnage engaged in coastwise 'tramping' voyages, the deepening gloom of dusk must also have led many pilots to seek the safety of a convenient port or the protection of a natural coastal feature, particularly in regions for which the crew might possess no, or very limited, local knowledge. Procopius thus informs us that, on the Red Sea of the sixth century AD, mariners 'always anchor along the … coast when night comes on. For it is impossible to navigate in the darkness on this sea, since it is everywhere full of shoals.'[122] A papyrus fragment dating to AD 63 which outlines a contract for the shipment of a cargo along the Nile, also contains a clause that reads: 'Neither is he [the captain]

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wintertime Mediterranean, with records of *annona* olive oil shipments to Carthage during the late winter and early spring of AD 373 (Peña 1997. See above, p. 28 f.), or the transport of grain, which was almost certainly destined for the corn-dole, been carried out between Egypt and Constantinople across most of the year according to double-dated edicts of the fourth and fifth centuries AD (Duncan-Jones 1990: 22. See p. 25 f.). Both Pliny (*Naturalis Historia*, 2.47.125) and Vegetius (*Epitoma rei militaris* 4.39) also highlight the private commercial voyaging carried out by merchants and traders throughout the Roman period. (See above, pp. 137–138.)

118 *Epitoma rei militaris*, 4.39.

119 For the possibility of running aground at night, see, for example, Synesius (*Letters*, 4.176), while Pliny also notes that 'collisions occur, usually at night, between ships on the opposite tacks' (*Naturalis Historia*, 2.48.128). Modern yachtsmen also highlight the dangers of sailing in the dark (e.g. Haeften 1997: 103).

120 Morton 2001: 255.

121 See, for example, Casson 1994: 151; Morrison et al 2000: 95 f.

122 *De Bello Persico*, 1.14.5–6.

allowed to sail at night nor during stormy weather. And he is to drop anchor each day at the safest anchorages.'[123] However, it should be emphasised that, despite the increased dangers these texts associate with the hours of darkness, neither source refers to the Mediterranean and there is no indication that night-time sailing was ever prohibited on the Sea at any time in antiquity.[124] Indeed, it would appear that night-time sea journeys were a common occurrence for merchantmen throughout antiquity; Vegetius' warnings concerning the hazards of seafaring during hours of darkness might therefore be seen as further confirmation that the seafaring section of his military treatise—including its closely defined sailing season—were directed exclusively at war-galleys and not the more sturdy and spacious merchant sailing vessels.

In times of military and political need even warships were sometimes deployed in night-time operations; throughout antiquity there are numerous literary references to naval operations being carried out under cover of darkness.[125] For merchantmen making crossings of large expanses of open-water, there was little option but to continue sailing through the night, and even when on shorter passages Graeco-Roman sailors were often content to remain at sea during the hours of darkness provided there was no possibility of running into shoal water. Night-time sailing is therefore frequently mentioned in the ancient *periploi*,[126] while Heliodorus, in his novel, *Aethiopica*, indicates what was probably common navigational practice when he has one of his characters describe how mariners would 'spend the night at sea

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123 *Oxyrhynchus Papyri*, 3250. 2.22–24 (Trans. Connolly 1987: 74).

124 A.L. Connolly also believes that the early Roman Imperial Nilotic contract prohibiting sailing during the hours of darkness was not so much a consequence of navigational difficulties posed by night-time voyages but rather as an attempt to reduce night raiding by pirates (1987: 115).

125 For example, during the Persian invasion of 480 BC Herodotus describes night-time operations off Artemisium (8.9), while the Peloponnesian War occasionally saw triremes remaining on the sea throughout the hours of darkness (Thucydides, 1.48; 2.81 f.; 4.42 f.; 4.31 f.). In the struggles for naval supremacy between the various states and empires of the Hellenistic period, warships were regularly deployed at night (see Morrison 1996 for various examples). At the close of the Roman Republic, Caesar was just one of the military commanders willing to commit his forces to seaborne operations during darkness, and in both of his campaigns in Britain the initial Roman invasion force was ferried across the Channel at sunset for a crossing that lasted throughout the night, a procedure repeated on the return to the Continent (*Bellum Gallicum*. 4.23.1, 4.31.2, 5.8.1, 5.23.1). In one of the final actions of the Roman Republican period, the prelude to the Battle of Mylai saw Agrippa sailing Octavian's fleet from the island of Hiera at night, successfully using the cover of darkness to achieve surprise over the fleet of Sextus Pompey (Appian, *Bellum Civile*, 5.106).

126 See, for example, Brown 1949: 120.

and proceed with lowered sails, calculating just how much wind we need to reach the land at daybreak.'[127] For seamen with good local knowledge of the coastline, or when approaching a particularly well lit and well marked harbour, vessels were even occasionally taken into port during the hours of darkness. Eunapius, for example, notes that a vessel carrying the fourth century Christian rhetorician, Prohaeresius, across the Aegean to Athens on an autumnal voyage, only arrived and docked at Piraeus following nightfall.[128]

Despite Vegetius' emphasis on the hazards of night-time sailing which, because of the short hours of daylight during the winter months, made voyaging at this time of year particularly dangerous, it is nevertheless likely that it was during the summer half-year that night-time sailing was most commonly practised on the ancient Mediterranean. It has already been noted that land and sea breezes are a common feature along the coasts of the Mediterranean during the summertime, and, together with the virtual absence of tides, which in other seas and oceans dictate the times at which vessels can enter and exit a harbour or approach a shore, Graeco-Roman mariners putting to sea would therefore have been able to exploit the breezes blowing away from the coast—sailing their ships out of harbour on winds that usually set in soon after sunset and continued through the night until just before dawn. (See pp. 85–86.) These night-time land breezes would therefore have allowed mariners to sail their vessels well clear the shore and gain adequate sea-room before the diurnal wind regime was reversed and, with the rapid heating of the land during the hours of daylight, the winds switched direction and began blowing off the sea and on to the coast. This method of exiting harbours and coastal anchorages was certainly in use by at least the Archaic period with Homeric references to voyages that commenced on the 'wine-dark sea' probably evoking 'the sunset departure of ships bound on night-time navigations by the stars.'[129] Writing during the third century AD, Heliodorus also noted that 'there is much to be said for setting sail at night, when the land breezes still the waves and speed vessels on their way.'[130] It may even have been the weakening of the land and sea breezes during the wintertime, rather than the increased risk of encountering heavy weather, that led Aratus to counsel seafarers not to trust to night-time voy-

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[127] *Aethiopica*, 5.17.
[128] *Lives of the Philosophers*, 485.
[129] Rutherford-Dyer 1983: 127–128. Homer, *Iliad*, 1.482. *Odyssey*, 2.388; 2.421–428; 4.786; 13.93–95.
[130] *Aethiopica*, 4.16. See also Neumann 1973: 6 fnt. 24.

ages from November onwards[131]—advice that carries with it the implication that, beyond this month, 'sailing by day … was still considered relatively safe and was commonly undertaken during the winter months.'[132]

Graeco-Roman seamen who did sail the Mediterranean during the hours of darkness were almost certainly well-versed in techniques of celestial navigation and 'like any other out-of-door man … whether sailing by night or day, could read the clock face of the revolving heavens, and take bearings from the hourly positions of the sun and stars.'[133] However, while pre-instrumentational navigators of some seafaring cultures—most notably the mariners of Polynesia—proved themselves capable of crossing vast expanses of open ocean by fixing their bearings and steering an accurate course against a variety of stars and stellar constellations, in the relatively high latitudes occupied by the Mediterranean Sea the obliquity of celestial motion precludes the stars from fulfilling a similar navigational role.[134] Nevertheless, use of the stars to determine directions when sailing at night are an age-old method of navigation and, even today, fishermen of the Kerkennah Islands, off the east coast of Tunisia, continue to use stellar navigation to reach their fisheries at night.[135] For the seafarers of the ancient world, it was the celestial pole—which at present is marked by the star *Polaris*, but in antiquity was picked out by *Kochab*—that maintains a fixed position (the so-called 'null point') in the rotating firmament, that was the most important directional point of reference. However, writing in the third century BC, the Cilician poet, Aratus, informs us that Greek and Phoenician navigators differed in their choice of which constellation offered the most accurate means of pinpointing the celestial pole:

> Encompassing it [i.e. the celestial pole] two bears wheel together … One men call by the name Cynosura, and the other Helice. It is by Helice that the Achaeans on the sea divine which way to steer their ships, but in the other the Phoenicians put their trust when they cross the sea. But Helice appearing large at earliest night is bright and easiest to mark, while the other is smaller, yet better for sailors, for in a smaller orbit wheel all her stars. By her guidance, then, the men of Sidon steer the straightest course.[136]

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131 *Phaenomena*, 300 f.
132 Morton 2001: 259.
133 Taylor 1948: 106.
134 McGrail 1987: 281.
135 Holbrook 1998.
136 *Phaenomena*, 426–453 (Trans. Taylor 1971: 43). Aratus probably based his work on a now lost treatise written by the fourth century mathematician and astronomer, Eudoxus of Cnidos (Barber 1970: 92).

Therefore, while Homer describes how Odysseus navigated at night primarily by reference to Helice, the Great Bear, by at least the time of the Roman Principate seafarers appear to have referred exclusively to the constellation of Cynosura, the Lesser Bear, that includes *Kochab* within its constellation.[137] An approximation of the angular elevation of the celestial pole by measuring *Kochab* against the mast and yard would also have provided Graeco-Roman mariners skilled in celestial navigation with an estimate of changes to their vessel's latitude and thus indicate the distance travelled to either the north or south.[138] As such, even without any form of navigational instrumentation, many sailors of the ancient Mediterranean were probably capable of achieving a reasonable degree of directional accuracy when navigating at night, *as long as the skies remained relatively cloudless*. It is, however, this proviso that would often have gone unfulfilled during the winter months, when the Mediterranean generally records its highest annual levels of overcast. (See above, pp. 90–91.) Nonetheless, even during the wintertime, not only will there be many clear days interspersing those dominated by leaden skies, but it has already been seen that the Mediterranean region is also subject to significant regional diversity during this season. Furthermore, the skies of the wintertime Mediterranean are generally no more overcast than those above the Atlantic coasts of north-west Europe during the summer when sea trade was undoubtedly carried out by the maritime communities before, during and after the extension of the Roman Empire over the regions of the Atlantic facade. (See above, p. 91.) It will also be seen in the following chapter that, for Graeco-Roman mariners making the voyage to India, the skies above the Arabian Sea were also far more likely to be obscured by cloud than was the case for the wintertime Mediterranean, yet large numbers of vessels regularly made the trip to the Indian subcontinent during the Hellenistic and early Roman Imperial periods. Moreover, the strategies followed by recent generations of Mediterranean fishermen also suggest that Graeco-Roman vessels would often have remained on the water during the hours of darkness; research undertaken amongst the fishing communities of the modern Aegean thus highlights that, 'The best conditions for [catching] the tunny are when it is dark and rainy—you can see the shoals by their phosphorescence.'[139] There seems little reason to suppose

[137] *Odyssey*, 5.271–278. The constellation of the Great Bear is also known as the Wain, Plough or Big Dipper. For Roman navigation: Strabo, *Geography*, 1.1.6; Lucan, 8.177–181. See also Taylor 1971: 9.

[138] Lucan, 8.177–181. See Calcagno 1997: 78; McGrail 1987: 279.

[139] Bintliff 1977: 1.217.

that the fishermen of antiquity would have passed up the opportunities so eagerly grasped by their modern counterparts when attempting to take large hauls of tunny, a species of fish highly important to the fishing communities of the ancient and modern Mediterranean alike.[140] We should therefore not be too hasty in assuming that seamen on the Graeco-Roman Mediterranean were unable or unwilling to have undertaken voyages during overcast conditions.

Slave Sailors and the Seasonality of Mediterranean Seafaring

The transfer of large numbers of slaves from the Atlantic seaboard into Mediterranean lands during the Late Roman Republic and on into the early Imperial period also had the potential to affect the seasonality of navigation in the ancient world. Although the use of slave labour on ancient warships is recorded in the literature, especially during periods of military crisis,[141] oarsmen of servile status appear to have been rare on naval vessels; following the establishment of the Principate there is no evidence to suggest that slaves were in service on Roman war-galleys.[142] Slaves did, however, play an important role on merchant vessels throughout antiquity. The *Demosthenic Corpus* of the fourth century BC refers to Attic ships crewed by slaves without any indication that such a practice was at all unusual.[143] Supply ships used by Caesar in the Adriatic during the Civil War also appear to have been manned by slave mariners,[144] while during the Roman Empire slaves are recorded in the *Digest* as serving aboard merchant vessels, not only as officers and seamen, but also as shipmasters.[145]

It has already been seen that ancient shipbuilding technology and navigational expertise appear to have reached their apogee during the later Hellenistic/Late Roman Republic and on into the first century-and-a-half following the establishment of the Principate (see above, pp. 123, 171). The

140 Further evidence for fishermen of the ancient Mediterranean remaining at sea during the night also comes from the Rhodian Sea Law which notes a ban on fishermen using lights, a prohibition presumably brought into force because of the possibility that such lights would be mistaken by other seafarers for shore-based beacons (Morton 2001: 214; Radcliffe 1921: 179).

141 Thucydides, for example, refers to slaves as rowers aboard warships during the Peloponnesian War 1.55.1, 2.103.1, 8.4.2, 8.15.2. See also Casson 1966; Graham 1992.

142 Reddé, 1986a: 473 f.; Starr 1941: 66–70; 1989: 69.

143 33.8–11.

144 *De Bello Civili*, 3.14.

145 *Digest*, 4.9.7, 9.4.19.2, 14.1.1.4.

transfer of vast numbers of skilled and experienced sailors and navigators from northern Europe into Mediterranean lands as slaves during this period might have partly contributed to these increased levels of maritime sophistication and may also have had a profound impact on the seasonal character of maritime activities in the ancient world. Slave sailors originally drawn from the maritime communities of the Atlantic seaboard would have been far more accustomed to dealing with hazards such as powerful and changeable winds, large seas, and overcast skies—weather conditions which are common to this hazardous region of ocean, even during the summer months. As such, the wintertime weather of the Mediterranean may not have held any great terror for mariners who had originally plied their trade off the hostile coasts of north-western Europe. Celtic sailors brought into the Graeco-Roman world as slaves to be employed on ships sailing the Mediterranean therefore offered the potential for a radical change in maritime seasonality. Although there is no evidence to support such speculation, the arrival of large numbers of slave mariners who had learnt their skills on the more demanding seas of the North Atlantic may partly explain the increase in references to wintertime voyages which can be teased from the literature of the late Hellenistic and early Roman Imperial periods.

The literary evidence for large numbers of slaves being brought into the Mediterranean world from north-west Europe comes primarily from Late Republican Rome: Cicero, for example, refers to the trader Lucius Publicius bringing slaves to Italy from Gaul in 83 BC. Diodorus Siculus also notes: 'Italian merchants, induced by the love of money which characterizes them, believe that the love of wine of these Gauls is their own godsend. For these transport the wine on the navigable rivers by means of boats, and through the level plain on wagons, and receive for it an incredible price; for in exchange for a jar of wine they receive a slave, getting a servant in return for the drink.'[146] It has therefore been noted that 'in the late second and first

[146] *Histories*, 5.26.1. See also Cicero, *Pro Quinctio*, 24. Although the trade in humans is difficult to quantify through the archaeological record, with only rare finds, such as the slave chain from Llyn Cerrig Bach, Anglesey (Fox 1945), providing direct evidence of slavery, the trade in wine is clearly manifested in the archaeological record with vast numbers of amphorae used in the export of wine from the Mediterranean to communities in northern Europe. At Chalon-sur-Saône (ancient Cabilonnum), for example, more than 24,000 Dressel 1 wine amphorae were extracted from the river bed during the last century and it is believed that the site might contained as many as half a million of these wine containers (Tchernia 1983:88–90). At Mount Beuvray (ancient Bibracte), archaeological excavations carried out at the close of the nineteenth century uncovered thousands of amphorae sherds, while the containers are common to Late Iron Age sites across north-western Europe and Britain. (See, for example, Fitzpatrick 1985; Loughton 2003.)

centuries BC Gallic slaves were regularly exchanged for Italian wine, to the possible number of 15,000 each year, until Augustus' reorganization of Gaul brought such activity to an end.'[147] While such figures are highly speculative, the numbers of slaves of northern European ancestry in Mediterranean lands during the Late Roman Republic was undoubtedly large and would have been swelled by the Caesarian military campaigns undertaken during the 50s BC. The later Germanic Wars of the Augustan Principate, together with the Claudian invasion of Britain, also uprooted vast numbers of people from north-western Europe, conveying them to Italy and the other Mediterranean provinces where they would be put to work, usually as servile labourers.

As has already been noted, in 56 BC Caesar waged a campaign against the maritime Veneti, a tribe that dwelt on the southern Breton peninsula and who were the dominant trading and naval force of the English Channel.[148] (See above, p. 117.) Following the destruction of the Venetic fleet, Caesar had all the tribal elders put to death and the rest of this seafaring people were sold into slavery.[149] Although the vast majority of the Veneti captives, as well as slaves brought from other maritime regions of northern Europe, would probably have ended up working the land or engaged in other heavy manual labour that required little in the way of prior knowledge or skill, it would, however, not appear unreasonable to suppose that at least some slaves were employed in positions for which they were already well qualified. Slaves that had been appropriated from seafaring communities on the western European seaboard might therefore have found their way into the boat yards of the Mediterranean, or on to ships voyaging across its seas. If this was indeed the case, then these northern European shipwrights and sailors had the potential to transfer a rich new source of both shipbuilding knowledge and navigational skills from the Atlantic and North Sea to the waters of the Mediterranean. Given the substantial numbers of people from north-west Europe enslaved during the Late Roman Republic and early Empire, there was certainly the possibility for the large-scale transfer of maritime skills learnt on the hostile waters of the Atlantic to the generally less dangerous seas which constituted the Mediterranean.

147 Bradley 1987: 59. According to the calculations of Andre Tchernia (1983: 98), by the 70s BC there were probably in the region of 300,000 Gallic slaves in Italy.

148 Caesar, *De Bello Gallico*, 3.9. For the trading contacts that existed between southern Britain and Amorica in the late first century BC, see Cunliffe & de Jersey 1997.

149 *De Bello Gallico*, 3.16.

Navigation: Conclusion

Despite the paucity of navigational technology that was available to the seafarers of antiquity, it should not be assumed that, prior to the arrival of the twin innovations of the magnetic compass and the sea-chart during the Middle Ages, sailing on the wintertime Mediterranean was always avoided. Through detailed knowledge of the marine environment, coupled with careful observations of the sea, the wind and the coastline, skilled seamen would often have been able to sail an accurate course, even if the sky was overcast, or if visibility was reduced by mist, fog or by darkness. Although the limits of coastal visibility would often have been greatly reduced during the wintertime, nevertheless, the shorelines of the Mediterranean, especially those of the northern coasts with their generally higher, more prominent and easily discernible profiles—many of which were also augmented by man-made features—would greatly have aided Graeco-Roman pilots. Examination of the sea-floor, either visually or with the aid of a sounding lead, would also have enhanced the potential for the pilots of antiquity to navigate accurately along a coastline, even in thick weather. While the ancient *periploi* would probably have been of little use to the majority of illiterate sailors, and these early pilot books also lacked the necessary navigational detail to make them practical tools for seafarers, they nonetheless provide a glimpse of the underlying wealth of navigational knowledge that was preserved in an oral tradition, and was disseminated within and among the maritime communities of the ancient Mediterranean. While the ability to navigate across the open sea was considerably more problematic during the winter months, possibly leading to a change in seasonal sailing strategies and a move away from open water routes towards those that were within sight of the Mediterranean coastline, there appears no reason to assume that Graeco-Roman mariners were incapable of making regular voyages outside of the limits traditionally ascribed to the ancient sailing season.

CHAPTER FIVE

THE SAILING SEASON OF THE INDIAN OCEAN

Mariners of the Near East had been venturing on to the Erythraean Sea—the name by which Graeco-Roman writers referred to the more northerly reaches of the Indian Ocean and which include the Red Sea, the Arabian Sea, and the Gulfs of Aden and Arabia—throughout antiquity.[1] However, it is only during the first century AD that we are provided with detailed information regarding the nature of maritime trade in the northern waters of the Indian Ocean, through the sixth book of Pliny's *Naturalis Historia*, and in the anonymously authored *Periplus Maris Erythraei* (to be referred to throughout the rest of this chapter as the *Periplus*). While the latter translates as '*A Sailing Round the Erythraean Sea*', it was noted by Casson that the title of the work is somewhat misleading for the text is primarily focused not on maritime conditions or navigational concerns but appears instead to be 'first and foremost a guide for merchants,' in which 'the emphasis is overwhelmingly on trading information.' It is this focus on trade which led Casson to conclude that the *Periplus* was probably written (in Greek) by a merchant out of Egypt and was based, at least in part, on personal observation.[2] There was certainly a demand for information regarding maritime trade across the Erythraean Sea during the early decades of the Roman Principate, with Strabo referring to the 'large fleets' of commercial ships which, from at least the time of Augustus, were making voyages from Roman Egypt, sailing down the Red Sea and into the Gulf of Aden, from where they would venture out on to the Arabian Sea. Some of these merchant vessels would sail south and make for the trading ports along the African coast; other ships exiting the Gulf of Aden would instead have their prows turned to face eastwards and every year 'as many as one hundred and

[1] Prior to the Roman Imperial period, there are literary references to Egyptians, Phoenicians and Hellenistic Greeks trading with East Africa, while, as early as the third millennium BC, Babylon had trading links to both Africa and India (Casson 1995: 20 f.; Oppenheim 1954).

[2] Casson 1989: 7 f.; 1991a.

twenty vessels were sailing from Myos Hormos [modern Quseir al Quadim, on the Egyptian Red Sea coast] to India.'[3]

Evidence for the ancient maritime trading links between the Mediterranean and India is also to be found in the archaeological record, most notably from the site of Arikamedu near Pondicherry on the Coromandel Coast of south-eastern India.[4] Excavated remains of Mediterranean pottery assemblages recovered from the site indicate it was used as a port-of-trade by Graeco-Roman merchants from at least the second half of the second century BC, while the settlement appears to have reached its trading peak during the early years of the Principate, thus closely linking it to the upsurge in maritime trade between Egypt and India indicated by the literature from this time.[5] While it seems that commercial contacts between the Mediterranean and India declined during the later Empire, the Peutinger Table still records the existence of a temple dedicated to the Imperial cult at the city of Muziris on the west coast of India. Recent finds of late antique and early medieval pottery from sites such as Pattnam on India's Malabar Coast also provide an indication that contact across the Arabian Sea was maintained throughout late antiquity and even into the Middle Ages.[6] The archaeological and textual evidence therefore indicate that ancient exchange between the Mediterranean and India involved 'a seagoing commerce of significant scale and sustained duration.'[7]

Of principal interest to this study, however, is not so much the scale or longevity of the trade between the Mediterranean and India, but rather the

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[3] *Geography*, 2.5.12. See also 17.1.13. For the results of recent excavations conducted at the site of Myos Hormos, see Peacock & Blue 2006.

[4] E.g. Begley et al 1996; Suresh 2007; Wheeler 1954: 145 f.

[5] For pottery analysis from Arikamedu, see Will 1991; 1996. It is also interesting to note that Tamil Sangam literature dating to the first and second centuries AD also makes frequent reference to foreigners from the west acting not only as merchants but also mercenaries and craftsmen (see Rashe 1978: 645; Rajan 1988). While it cannot be assumed that all or indeed any of these were of Mediterranean origin since the Tamil term *Yavana* refers to any western foreigners, be they of Mediterranean, African or Arabian extraction, it is probably of no coincidence that, during the first two centuries AD, pottery and glassware from this region of south-west India exhibit strong Mediterranean stylistic influences (Rashke 1978: 671). Indeed, it has recently been pointed out that in the ancient Tamil poem, the *Purananuru*, composed c. 200 BC–AD 100, 'the poet urges the local king to taste the sweet teral (wine), brought by the lovely ships of the *Yavanas* and served on trays of chiselled gold, by beautiful damsels with sparkling wrists. These pointed references to the *Yavanas* bringing gold and wine to south India indicate that the *Yavanas* were primarily Romans, because we know from other sources that gold and wine were among the chief commodities exported from the Mediterranean region to India' (Suresh 2010: 29).

[6] Raschke 1978: 673; Rauth 2003: 101; Shajan et al 2008.

[7] Rauth 2003: 99.

lessons that can be learnt from drawing comparisons between the weather and sea conditions faced by seamen voyaging across the Erythraean Sea with those that would be encountered by mariners plying the sea-lanes of the wintertime Mediterranean. Despite the very obvious differences which exist between these two seas, analysis of the meteorological and hydrological conditions encountered by the ships and crews crossing the Indian Ocean at the times of year and along the routes described in both the *Periplus* and the works of the Elder Pliny nonetheless has profound implications for our understanding of the seaworthiness of ancient vessels and the skills of the seamen and navigators who manned them. It will thus be argued that the seasonality of maritime commerce carried out across the Arabian Sea compels a re-evaluation of the sailing season of the ancient Mediterranean. Therefore, while previous research into Graeco-Roman maritime commerce on the Indian Ocean has provided striking insights into the abilities of the ships and sailors of antiquity to deal with adverse sailing conditions encountered while voyaging across the Arabian Sea,[8] the following pages aim to move this research one stage further by taking the results which have been gained from studies of the ancient sea routes used by mariners crossing the Indian Ocean and applying them back on to the Mediterranean. The voyages made by Graeco-Roman mariners across the Arabian Sea clearly emphasise the ability of Hellenistic and Roman sailors to navigate their vessels even at times of strong and gale force winds, large seas, poor visibility and overcast skies—in short, the very conditions which are generally considered by modern historians as beyond the abilities of ancient technology and seamanship and which are cited by both ancient authors and modern scholars as bringing about a dislocation of the sailing season on the Mediterranean between late autumn through until early spring.

While the Mediterranean is situated in the middle latitudes of the northern hemisphere and has a year commonly divided into four distinct seasons, in the sub-tropical latitudes of the northern Indian Ocean terms such as ‘spring’, ‘summer’, ‘autumn’ and ‘winter’, have little meaning. Instead the seasons of this region are dominated by the winds of the two monsoons that are generated by the changing heat distribution that exists between the waters of the Indian Ocean and the continental landmass of Asia.[9] Thus, from April/May through to September/October heat from the Asian landmass

[8] See especially the research undertaken by Casson 1980; 1984; 1989; 1991a.

[9] The very term ‘monsoon’ is derived from the Arabic *mawsim* meaning season (Heikell 1999: 29).

draws in air from the sea, setting in motion the prevailing south-west wind which gives its name to this monsoon. By contrast, from roughly November to March the cooling of the continent results in air being drawn seawards, giving rise to the north-east monsoon wind. Separating these two principal seasons are the transitional inter-monsoonal periods during which winds are generally light and highly variable.[10] It was this changing monsoonal cycle that was crucial in allowing Graeco-Roman seafarers to make voyages to and from the Indian subcontinent—utilising the winds of the south-west monsoon ancient sailors could make the outward voyage to India, while the north-easterly monsoon winds powered the ships on the return trip back to Egypt.

According to the author of the *Periplus* it was the Egyptian ports of Myos Hormos and Berenice (modern Quseir al-Qadim and Medinet el Haras respectively) on the north-western shores of the Red Sea that acted as the start and finish points for Graeco-Roman ships plying the sea route to India.[11] The *Periplus* also notes that vessels bound for the Indian subcontinent would seek to depart during July, a date confirmed by Pliny and one that would have provided the ships with favourable northerly winds which usually blow down the Red Sea at this time of year, allowing an easy down-wind run to the Strait of Bab el-Mandeb, which separates the Red Sea from the Arabian Sea (figure 5.1).[12] Once out into the Gulf of Aden skippers bound for India had several choices of sea-routes depending on their intended destination. One method of sailing to the subcontinent was by taking the coastal route and a large section of the *Periplus* is devoted to a detailed account of this circuitous passage that hugged the shores of the Arabian peninsula and the coasts of modern-day Iran and Pakistan.[13] By at least the mid-first century AD, however, we are informed that skippers and merchants intent on reaching India were also making direct, open water passages across the Arabian Sea:

> The whole coastal route just described, from Kanê and Eudaimon Arabia, men formerly used to sail over in smaller vessels, following the curves of the bays. The ship captain Hippalos, by plotting the location of the ports of trade and the configuration of the sea, was the first to discover the route over open-water ... In this locale the winds we call 'etesian' blow seasonally from the direction of the ocean, and so a south-westerly makes its appearance in the Indian Sea, but it is called after the one who first discovered the way across. Because of

[10] See, for example, Admiralty 1987: 59, 262; Heikell 1999: 29; Met. Office 1991: 260; *West Coast of India Pilot* 1998: 32; Wilson & Klaus 2000: 50.

[11] 1:1.1.1–4.

[12] *Periplus*, 14; *Naturalis Historia*, 6.104.

[13] *Periplus*, 26–56.

> this, right up to the present, some leave directly from Kanê and some from the Promontory of Spices, and whoever are bound for Limyrike hold out with the wind on the quarter for most of the way, but whoever are bound for Barygaza and whoever for Skythia sail only three days and no more, and, carried along (?) the rest of the run on their own proper course, away from the shore on the high seas, over the [?ocean] off the land, they bypass the aforementioned bays.[14]

From the time of Hippalus,[15] Graeco-Roman vessels were therefore venturing directly across the Arabian Sea by using the south-westerly monsoonal winds which the author of the *Periplus* describes as 'etesians.'[16] The passage also informs us of the exact courses taken by ancient seafarers when crossing the ocean (figure 5.1). Vessels sailing north-eastwards across the Arabian Sea bound for the coasts of Scythia and its primary port city of Barbarikon, or voyaging to the trading centre of Barygaza further down the Indian coast,[17] are described as departing from the port of Kanê (modern Husn al Ghurab), on the northern shores of the Gulf of Aden, and coasting along the Arabian Peninsula for no more than three days until reaching the promontory of Syagrus (modern Ras Fartak), at which point they would strike out across the open water towards the north-east. For skippers intent on sailing from the Gulf of Aden to the markets of Limyrikê, on what is today known as the Malabar Coast, the *Periplus* informs us that a course would instead

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[14] *Periplus* 57.

[15] While the *Periplus*, Pliny (*Naturalis Historia*, 6.100) and Ptolemy (*Geography*, 4.7.41), all credit Hippalus with being the first ancient navigator from the Mediterranean world to make the open water voyage to India using the south-westerly monsoon, and thus have the wind named in his honour, Strabo considers Eudoxus of Cyzicus, who led two maritime expeditions to India near the end of the second century BC, to have been the first to make the crossing (*Geography*, 2.3.4. See Thiel 1966). Of greater concern to us, however, is not so much *which* of these two mariners first made the voyage across the Arabian Sea direct to the subcontinent at the time of the south-west monsoon, but rather *when* they first began to do so. Casson (1989: 224) was of the opinion that it was only from the last quarter of the second century BC that mariners from the Mediterranean first began making the open water journey from the Gulf of Aden to India, while Hourani (1995: 24–25) put forward a similar date, regarding the early years of the first century BC as the latest date at which Graeco-Roman sailors started to make voyages across blue water. Such dates correlate well with the archaeological evidence from Arikamedu where artefacts imported from the Mediterranean world begin to make an appearance in the second half of the second century BC (see p. 214).

[16] The name refers not to the direction of the Aegean's northerly summer winds, but rather to the fact that the winds of the south-west monsoon, like those that blow across the eastern Mediterranean, are predictable and annually recurring in nature.

[17] The former region is centred on the Indus flood plain, though extends eastwards to the Gulf of Kutch, while the latter city is modern Bharuch/Broach, close to where the Narmada River empties into the Gulf of Cambay (Casson 1989: 186, 199 f.).

be set almost directly eastwards from the Promontory of Spices where the Gulf of Aden meets the Arabian Sea.[18] For mariners and traders bound for the south-western shores of the Indian subcontinent, Pliny states that, 'the most advantageous way of sailing to India is to set out from Cella; from that port it is a 40 days' voyage, if the Hippalus is blowing, to the first trading-station in India, Cranganore.'[19] However, it has been pointed out by Casson that, since literary accounts indicate that ancient merchantmen averaged between 4 and 6 knots (7.5 to 11kph) with a favourable wind, then it might be expected that vessels making the two thousand nautical mile (3700 km) crossing between the ports on the Gulf of Aden and the south-west coast of India would take about half the time suggested by Pliny, reaching the subcontinent in about twenty rather than forty days.[20]

The various sea-routes used by ancient mariners when crossing from the Gulf of Aden to India are therefore reasonably well known. However, what makes these voyages of such great interest to this study is that, in addition to being able to identify which sea-lanes the Graeco-Roman sailors and traders were using when they sailed across the Arabian Sea, we also have a fairly clear idea as to the time of year when these open water passages were being carried out. By analysing modern meteorological and hydrographical records for these sea regions during the months when ancient shipping would have been passing across the water we can therefore gain an insight into the weather and sea conditions with which the ancient mariners and merchants plying these routes would have had to contend as they sailed between Egypt and India: conditions that most scholars would usually consider well beyond the capabilities of the ships and sailors of antiquity.

Voyages Across the Arabian Sea

The timing of the westward voyage across the northern reaches of the Indian Ocean—sailing from the subcontinent across the Arabian Sea to the Gulf of Aden, followed by the journey northwards up the Red Sea to Egypt—is

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18 Mod. Cape Guardafai/Ras Caseyr on the north-east extremity of Somalia.

19 *Naturalis Historia*, 6.106. Cella is a port which stands on the Straits of Bab el Mandeb and which is referred to as Ocelis in the *Periplus*. Cranganore is modern Muziris and stands on the Malabar Coast at the mouth of the Periyar River. It should also be noted that, save for the first, all of these crossings of the Arabian Sea were being made over large expanses of open-water, something which many historians are often unwilling to credit to the abilities of Graeco-Roman mariners.

20 1980: 32–33; 1984: 190–191.

clearly set down by Pliny who states: 'Travellers set sail from India on the return voyage at the beginning of the Egyptian month of Tybi, which is our December, or at all events before the sixth day of the Egyptian Mechir, which works out at before January 13 in our calendar.'[21] Hellenistic and Roman seafarers making the westward crossing at this time of year would have been able to take full advantage of the prevailing wind regime in the northern seas of the Indian Ocean (figures 5.2 and 5.3a–b). The arrival of the north-easterly monsoon winds from about mid-November allowed merchant vessels, their holds loaded with cargoes of Indian goods, to make for the Gulf of Aden, either running directly before the wind if they were returning from areas of the subcontinent in the region of the Indus or Gulf of Cambay or, for those vessels making the voyage back from the more southerly Malabar Coast, sailing with the wind on the starboard quarter.[22] Furthermore, the winds and seas associated with the north-east monsoon present little threat to seafarers: winds are usually between Beaufort 3 to 5 while those exceeding force 6 are uncommon (figure 5.2). Graeco-Roman seafarers returning from India during December and January would therefore usually have enjoyed conditions which one modern sailing guide to the region has described as 'making for very pleasant passage making.'[23]

By stark contrast with the return journey from India, the eastwards voyage across the Arabian Sea would not have been so kind to the seamen of antiquity. While neither the *Periplus* nor Pliny provide exact dates as to when vessels bound for the various regions of India would have begun the open water leg of the route across the Arabian Sea, it is nevertheless possible to calculate approximately when this outward journey took place with both sources in broad agreement as to when ships making for the subcontinent should depart from the ports of Egypt. The author of the *Periplus* thus notes that, for ships bound for all ports on the west coast of India, the time to leave Egypt was around the month of July.[24] Pliny also observes that ships departed from the Egyptian port of Berenice in mid-summer, before adding

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21 *Naturalis Historia*, 6.106.

22 Casson 1980: 23, 33. While Pliny actually claims that mariners used a south-east wind (*Volturnus*) for the homeward voyage, both Warmington (1974: 48) and Casson (1980: 33), following Rawlinson (1926: 211), are in little doubt that the Roman writer is merely confused about the actual direction of the wind.

23 Heikell 1999: 29. See also, Admiralty (1987: 63) for wind and sea conditions associated with the north-east monsoon.

24 *Periplus*, 14.

that the voyage down the Red Sea and out into the Gulf of Aden would take 'about thirty days.'[25] We would therefore probably not be too far wrong in following the calculations of Casson who estimated that ancient shipping bound for India would depart from the ports on the Gulf of Aden about the middle of August.[26]

The sailing timetables provided by the author of the *Periplus* and by Pliny, while lacking in detail, nevertheless both appear to indicate that Graeco-Roman seafarers bound for India would have begun their voyages across the Arabian Sea during August—a month that would have allowed mariners to make good use of the favourable direction of the south-west monsoon winds to propel their vessels out from the Gulf of Aden and across the Arabian Sea to the trading ports on India's west coast. However, while the south-west monsoon blows from an advantageous direction, it nevertheless brings with it conditions that turn the Indian Ocean an extremely hostile environment for seafarers. As will be examined in greater detail below, powerful winds, large swells, thick cloud cover, heavy rainfall and poor visibility are all characteristic features of the weather on the Arabian Sea near the zenith of the south-west monsoonal period—weather conditions which correspond closely to those identified by Vegetius as bringing about the end of the sailing season on the Mediterranean. Yet while ancient writers and modern scholars generally regard Graeco-Roman mariners and their vessels as being unwilling and unable to contend with the rigours of a Mediterranean winter, on the waters of the Indian Ocean the ships and sailors of the Hellenistic and Roman periods proved themselves more than capable of overcoming conditions which were every bit as dangerous as those which would have had to be faced when sailing on the wintertime Mediterranean. It was the ability of ancient mariners to make regular voyages across the exceptionally hostile seas of the northern Indian Ocean during the south-west monsoon that should lead us to question the long-held assumptions regarding the

[25] *Naturalis Historia*, 6.104. Casson (1980: 32f.) highlighted the discrepancy which exists within Pliny's text whereby the Roman author assigns the voyage time of 'about thirty days' to reach not only Oceltis, lying on the Straits of Bab el Mandeb, but also the port of Kane, which is over two hundred miles further east along the northern shore of the Gulf of Aden, probably requiring a further three or four days' sail. However, given the inexact nature of determining the speed and voyage times of ancient sailing ships, dependant as they were on the fickle elements of nature, for the purposes of this study there would seem little reason to be concerned about trying to incorporate three or four extra days into what was already a very loosely based sailing schedule.

[26] 1980: 32f.

inability of Graeco-Roman shipping to sail in unfavourable conditions, and, by implication, reassess the potential for seafarers to remain active on the ancient Mediterranean throughout the wintertime.

Winds and Swell During the South-West Monsoon

Modern meteorological data leaves little doubt that Graeco-Roman seamen sailing out from the Gulf of Aden during the month of August and bound for the north-west shores of the Indian subcontinent—such as the major trading centre of Barygaza, or the region around the mouths of the Indus—would have been crossing regions of ocean where powerful winds and heavy swells are commonplace at a time of year when the south-west monsoon was still near the peak of its power. As can be seen from figure 5.6b, powerful winds of Beaufort 7 and above, although relatively rare in the most northerly reaches of the Arabian Sea during August, are considerably more common along the shores of the Arabian peninsula where they usually constitute between 10 and 20 percent of all recorded wind speeds during the month.[27] For vessels bound for the Malabar coast in south-west India, the frequency of strong winds likely to be encountered during August was even more extreme. Graeco-Roman vessels taking departure at the Promontory of Spices, or indeed from any of the ports situated on the Gulf of Aden, and then making the open water voyage across the Arabian Sea, would have sailed directly through the stormiest waters of the entire Indian Ocean; an area of sea situated some 400 kilometres east of the island of Socotra. During July, at the height of the south-west monsoon, half of all winds blowing across this region are recorded as Beaufort 7 or above (figure 5.6a),[28] while even in August, powerful winds of force 7 and over still constitute more than 30 percent of all wind-speeds recorded on the seas lying to the east of the horn of Africa and the island of Socotra (figure 5.6b).[29] Graeco-Roman mariners

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[27] Met. Office 1949: 59.

[28] Met. Office 1949: 59. See also Heikell 1999: 29. Such wind-speed records also indicate that Casson is in error when he stated that Graeco-Roman mariners 'had to carry out a good part of their ocean crossing during the time when the south-west monsoon was blowing its hardest' (1980: 34. See also 1991a: 9). Instead, the West Coast of India Pilot makes it clear that 'winds of force 7 or more are most frequent in July at the height of the SW monsoon' (1998: 45). Yet, as has been seen, the literary evidence is reasonably clear that the mariners of the late Hellenistic and Roman Imperial periods only began their voyages across the Arabian Sea in August, a month when the frequencies of dangerous winds had moderated slightly from those usually recorded in the previous month.

[29] Met. Office 1949: 59. See also West Coast of India Pilot 1998: 45. These exceptionally high

aboard vessels sailing to India could, therefore, expect to experience significantly higher frequencies of strong and gale-force winds than would their contemporaries sailing on the wintertime Mediterranean, a sea where even the stormiest region, the Gulf of Lions, records a wintertime average of only 12 percent of these powerful winds (figure 2.5a).[30]

As a consequence of the strong winds and the constancy of their direction, waves on the Arabian Sea during the south-west monsoon also tend to be large.[31] The considerable expanses of open water over which the winds travel—the fetch—also allow the south-westerly monsoon winds to transfer more of their energy to the water, further increasing the size of the waves and producing heavy swells over much of the northern Indian Ocean across which ancient seafarers would have been sailing when on the voyage to India.[32] As such, Graeco-Roman vessels making the run to the Malabar coast and passing to the east of Socotra would also have encountered large seas during August and hydrological records indicate that almost 50 percent of all swells for the month can be classified as 'heavy' in this area of the Arabian Sea.[33] Ancient shipping bound for Scythia and Barygaza on India's north-western coasts could expect to experience even greater frequencies of these high seas. At the promontory of Syagrus (modern Ras Fartak), where the *Periplus* informs us that ancient ships would normally strike out across the open ocean after three days of coasting along the Arabian peninsula,[34] heavy swells usually account for 56 percent of observations during August.[35] Although the frequency of these large waves would have steadily decreased as Graeco-Roman sailors progressed further to the north-west, even coastal regions around the mouths of the Indus or in the area of the Gulf of Cambay record heavy swells comprising almost 40 percent of all sea conditions at this time of the year.[36]

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frequencies of strong and gale force winds along the east African seaboard, and especially to the east of the Gulf of Aden, are the result of a low-level jet stream which overlays and reinforces the already strong south-west monsoonal winds in the western Indian Ocean (Findlater 1974).

30 Air Ministry 1962: 108; Mediterranean Pilot Vol. II. 1978: Diagram II. See above, p. 65.

31 For the problems inherent in attempting to provide wave and swell conditions with scientific categorisation, see above, p. 86, n. 104.

32 Admiralty 1987: 62; Heikell 1999: 29. The terminology used to classify the height of swell, from the trough to the crest, is: 'low' (0 to 2 m); 'moderate' (2 to 4 m); 'heavy' (over 4 m).

33 Met. Office 1949: 60 f.

34 *Periplus*, 57. Quoted above, pp. 216–217.

35 Met. Office 1949: 60 f.

36 Met. Office 1949: 60 f.

In contrast to the meteorological and hydrographical picture that emerges from the northern Indian Ocean, the state of the Mediterranean Sea during the wintertime is far less hostile to shipping. It has already been seen that waves of more than 4 m in height are exceptionally rare around Mediterranean coasts and only along the shores of western Cyrenaica do such seas occur with any measurable frequency during the wintertime though, even then, they contribute only about 3 percent of the recorded wave heights for the winter half-year (figure 2.11d).[37] Similarly, while the long fetch to the west means that the shores of Israel receive some of the largest swells in the Mediterranean, even on this coastline, records of waves greater than 1 m in height only appear in 30–40 percent of observations, with only a small fraction of these classed as 'moderate' let alone 'heavy' swells.[38] In the western basin of the Mediterranean heavy swells are also rare and in the seas between the Balearic Islands and Corsica hydrological records usually show conditions of heavy swell on only 10 percent of observations from November through until March.[39] There is thus little doubt that Graeco-Roman seafarers making the voyage to India during the south-west monsoon were likely to encounter sea conditions considerably more demanding and dangerous than those generally found on the wintertime Mediterranean.

The large seas that are whipped up by the violent winds of the south-west monsoon cause problems for even modern vessels and recent editions of sailing directions advise that engine-powered shipping reduce speed by 20 percent when making eastwards passages across the northern Indian Ocean, while it is recommended that ships cut their power by 60 percent when sailing directly into or across the wind and waves, such are the demanding conditions in the western Arabian Sea during the south-west monsoon.[40] As one scholar of Arab seafaring on the Indian Ocean has noted: 'The problem is one which readily occurs to any modern sailor who knows the Indian Ocean. When the south-west monsoon is on, from June to October, the wind is boisterous and the sea rough; sometimes no sailing ship can face it.'[41] However, while mariners of the Hellenistic and Roman periods were

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37 Meisburger 1962: 19. Fig. 14.

38 Goldsmith & Solver 1983: 42 f. See also Air Ministry 1962: 183 f.; Herut & Galil 2000: 256; Mediterranean Pilot V 1999: 20, Chart 1.153.1.

39 Admiralty 1987: 57. This region often experiences some of the largest seas in the entire Mediterranean.

40 Admiralty 1987: 63; West Coast of India Pilot 1998: 1. See Tchernia (1980: 191) on the difficulties faced by even specially designed research vessels when attempting to carry out hydrological studies in the conditions of the south-west monsoon.

41 Hourani 1995: 26.

crossing some of the roughest regions of the Indian Ocean at precisely this time of year, sailors on these waters throughout the Middle Ages, and right up until the arrival of large European vessels in the sixteenth century, generally avoided the south-west monsoon. Medieval seamen, like many sailors and yachtsmen of more recent centuries, preferred instead to trust their craft to the gentler winds and calmer seas which accompanied the north-east monsoonal period.

> Consider the sailing conditions of the northern Indian Ocean again for a moment. To state that voyages were made one way with the north-east monsoon, and the other way with the south-west ... is not correct, for the south-west is a season of much bad weather and when it has set in properly, conditions are often unfit for sailing. Sailing traders in the Indian Ocean had to use the good season—the north-east—for their passages *both* ways, taking care to get back to port before the full force of the south-west monsoon broke on them. This is exactly what the Arab, Persian and Indian seagoing dhows have done from time immemorial.[42]

Yet in both the *Periplus* and Pliny's *Natural History* it is made plain that Graeco-Roman ships were voyaging across these same waters near the height of the south-west monsoon, regardless of the gales and rough seas. Hellenistic and Roman mariners were able to utilise the direction of the south-westerly winds to make the crossing from Arabia to India in conditions described in understated fashion by the *Periplus* as 'hard going but absolutely favourable and shorter.'[43]

The inability of medieval ships to weather the conditions of the south-west monsoon can partly be attributed to the nature of shipbuilding practised in the Arabian Sea region during this period. Vessels were of sewn-plank construction in which ropes, usually woven from coconut fibres, were stitched through pre-bored holes, lacing one plank of the hull to the next, with not a single nail of either metal or wood used in the entire construction. It was a method of shipbuilding that appears to have been employed by communities on the shores of the Arabian Sea from antiquity through until the arrival of Portuguese mariners at the end of the fifteenth

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42 Villiers 1952: 52.

43 39.13, 39.13–14. This reference to the voyage to India as 'hard going' is, in fact, the only point at which the *Periplus* mentions the adverse weather and sea conditions that mariners of the ancient world would have had to face were they to depart the Gulf of Aden in August. One cannot help but wonder what the narrator of St Paul's last voyage and shipwreck, or a traveller like Synesius, would have made of these voyages through such high winds and heavy seas: it is unlikely either would have treated the conditions with as much brevity as does the author of the *Periplus*.

century: both the author of the *Periplus*, together with Procopius writing in the sixth century AD, therefore refer to Arab and Indian vessels using this method of ship construction.[44] Vessels from southern Arabia, which were still being constructed in this manner up until relatively recent times, were observed to stand up to large waves and surf very well, and it has also been argued that vessels built with sewn-plank hulls could be exceptionally seaworthy.[45] Nonetheless, it appears to have been the case that, for the most part, vessels of sewn-hull construction operating on the Indian Ocean 'were fair weather craft which would fall apart in heavy seas. It is extremely unlikely that they ever went out in the south-west monsoon.'[46] Even following the widespread adoption of iron nails in ship construction during more recent centuries, vessels of the Arabian Sea tended to remain off the water for much of the south-west monsoon; the lateen-rigged dhows still unable to cope with the conditions during this period of the year.[47]

While the nature of the vessels plying the sea-lanes which linked Hellenistic and Roman Egypt with India goes unmentioned in the literature, it would seem almost certain that they were of a similar design and construction to those operating on the contemporary Mediterranean. The author of the *Periplus* certainly implies that the ships used by the sailors and merchants operating from the Graeco-Roman world were of a different type to the craft employed by contemporary Arab seafarers who were also trading with the Indian subcontinent 'using their own outfits'[48]—possibly an oblique reference to Arab sailors using vessels of sewn-plank construction. Furthermore, Egypt of the Ptolemaic and Roman periods had a maritime tradition very much rooted in the Mediterranean world. Wealthy merchants and financiers intent on gaining profits from the lucrative trade across the Arabian Sea and willing to have ships constructed specifically for the purpose of bringing back the much sought-after luxury products that could be acquired in the markets of India—a variety of spices, precious and

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44 *Periplus*, 15–16, 36, 60; Procopius, *De Bello Persico*, 1.19.23. Hourani (1995: 93) also provides a number of references to medieval texts that describe the ongoing use of this shipbuilding technique in the Arabian Sea.

45 McGrail 2001: 76 f. See also Villiers 1952: 41; 1962: 124 f.

46 Hourani 1995: 28.

47 In a study of the Indian Ocean region carried out in the 1970s, the U.S. Central Intelligence Agency therefore noted that, 'Monsoon storms and rough seas from June through August make sailing difficult for the essentially fair-weather dhow' (1976: 20).

48 *Periplus*, 21.

semi-precious stones, pearls, ivory, tortoise shell, silks and fine cottons, exotic animals destined for the games, etc.[49]—would presumably have taken advantage of the shipwrights already working in Egypt. These skilled craftsmen would probably also have produced vessels of the ancient Mediterranean type, built using the ancient shell-first method of hull construction which was reliant on thousands of closely spaced mortice-and-tenon joints for strength and structural integrity.

Such assumptions would seem to be corroborated by pictorial graffito discovered at the Egyptian Red Sea port of Berenice that depicts a large, round-hulled, square-sailed merchantman of the mid-first century AD; such a ship is comparable to contemporary vessels in use on the Mediterranean.[50] Fragmentary remains of brailed square sails recovered from a midden deposit at the Egyptian port city and datable to the first century BC further indicate that vessels plying the sea-lanes to India were also rigged with the low, broad, square-sail in common use on the Mediterranean throughout much of antiquity. That some of the cotton used in the construction of these sails was seemingly spun in India provides an additional indication that the ship which carried these sails had been engaged in the trade between Ptolemaic Egypt and the Indian subcontinent. It may even have been the case that the Indian fabric had been required to make repairs to the sails of a vessel which had suffered storm damage when sailing through the blustery winds of the south-west monsoon on the outward leg of the voyage to the subcontinent. It has thus been noted that, 'The evidence from Berenike suggests Mediterranean-style ships, or at least sails, constructed of Indian materials.'[51] It would therefore appear safe to follow the assumption made by Casson that the vessels plying the sea routes running between Egypt and India were the same as those used on the Mediterranean. There is, however, no archaeological evidence to support Casson's conviction that the ships voyaging across the Arabian Sea were of a similar large size to the great Alexandrian freighters. Nevertheless, it is a compelling possibility that the Graeco-Roman vessels sailing to India were essentially the same as the large vessels that fulfilled the important task of supplying Rome and later Constantinople with grain; freighters that we have already seen may well have been active on the wintertime Mediterranean.

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[49] *Periplus* 39 refers to some of the vast range of products that could be obtained in India. See also, Casson 1984; Sidebotham 1986: 20 f.

[50] Sidebotham 1996.

[51] Wild & Wild 2001: 218.

> Presumably the vessels that made these monsoon passages were the same types that plied the Mediterranean. This certainly must have been true for the passage to India since it involved the rough winds and waters of the southwest monsoon, and the Mediterranean seagoing freighters were particularly well suited for such work. Not only were they big—the largest were well over 1,000 tons burden—but they boasted massively strong hulls whose planking was held together by thousands of close-set mortice-and-tenon joints, a method of construction unique to Greek and Roman shipwrights.[52]

The ancient sailing schedule to India thus appears to indicate that Graeco-Roman vessels, similar to those used across the contemporary Mediterranean, were considerably better suited to the rough seas and strong winds of the south-west monsoon than were ships of the medieval period which, with their less stoutly constructed hulls and lateen rig, were usually unable to put out onto the Arabian Sea when this monsoon was near its peak. If this was indeed the case, then we might also ponder whether the ships and mariners of antiquity were also more capable of remaining on the waters of the Mediterranean during the wintertime than were the vessels and seamen of the Middle Ages.

The ability of ancient vessels to make crossings of the Arabian Sea during the south-west monsoon highlights not only the capacity of the Graeco-Roman shell-first method of hull construction to cope with stormy seas, but also the ability of the ancient square sail to deal with powerful winds. There is certainly little doubt that this sail could stand up to gale-force winds far better than the lateen-rigged craft used by sailors on both the Indian Ocean and the Mediterranean during the medieval and modern periods (see above, pp. 158 ff.): the brailing lines of the ancient rig allowed for quick and effective adjustments to be made to the shape and trim of the sail, while the square cut would have made it an effective performer on the long downwind runs to India's west coast. Indeed, while the winds of the south-west monsoon can be very boisterous they nevertheless blow across the

[52] Casson 1989: 284. See also Casson 1991a: 10 f.; Young 2001: 63. It is somewhat strange that Casson—a scholar who did more than any other to highlight the ability of Graeco-Roman mariners to navigate across the northern waters of the Indian Ocean during the exceptionally hazardous conditions commonly expected during the south-west monsoon—should have neglected to translate his findings to the Mediterranean. Instead he remained content to accept the opinions expressed by the ancient writers that, between late autumn and early spring, the sea-lanes were virtually devoid of maritime traffic (Casson 1995: 270 f. See above p. 3). Indeed, for Casson, the limiting factor on ancient ships was not the construction of their 'massively strong' hulls but rather the inability of the brailed square sail, which he regarded as 'slow and only effective with a following wind' (1989: 285).

Indian Ocean with a great constancy of direction,[53] proving ideal for the mariners aboard ancient square-rigged vessels intent on reaching any part of India's western coastline. Thus Graeco-Roman ships departing from the Gulf of Aden and aiming to make landfall around the mouths of the Indus could sail with the wind dead astern, while vessels making for Barygaza or the Malabar coastline could harness the wind on either a broad or beam reach (see figure 5.1).[54] However, although the Indian sea-trade appears to confirm the robustness of the ancient square sail and its ability to deal with strong winds, it is rather more difficult to assess the capacity of the rig to cope with a more unsettled wind regime, such as that of the wintertime Mediterranean, where winds can shift direction with great rapidity and frequency. (See above, pp. 79 ff.) Indeed, it might well be the case that the principal reason Graeco-Roman seafarers made the hazardous voyage to India on the winds of the south-west monsoon was dictated by the limitations imposed by the ancient square sail. Since it is generally considered impossible for vessels carrying the Graeco-Roman square rig to sail close to the wind, ancient ships were therefore unable to harness the less dangerous winds of the north-east monsoon to make eastwards voyages to India, as was the custom for the mariners of the medieval and modern periods whose vessels mounted the more weatherly lateen-rig.[55]

The south-west monsoon therefore allowed ancient square-rigged ships bound for India to benefit from winds which, although very strong and blustery, were from an entirely favourable direction for the voyage across the Arabian Sea. Such winds did, however, turn India's west coast into a hazardous lee shore and it must have been a prime concern of Graeco-Roman sailors to ensure that they maintained a safe distance from the Indian coastline until a break in the powerful winds of the south-west monsoon would have allowed them to close with the shore in safety.[56] This was especially

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53 At the height of the monsoon in the Arabian Sea, winds from the south-west can account for more than 90 percent of all recorded wind directions (Heikell 1999: 29).

54 Casson 1991a: 9.

55 For the ability of medieval and modern ships to make the eastwards journey across the Arabian Sea on the wings of the north-east monsoon, see, for example, Viadya 1945: 55; Villiers 1952: 52 (quoted above, p. 224).

56 The possibility of running onto a lee shore has always been one of the greatest perils facing seamen aboard sailing ships caught in strong winds. A modern sailing guide has therefore observed: 'Few situations at sea create such a severe problem as being blown down on a lee shore. It was the nemesis of the old salts in the windjammers [i.e. square rigged vessels] of yesteryear and still haunts the seagoing adventurer of today. Nothing is more calculated to strike fear into the heart of any seaman than the proximity of a dangerous lee shore. Sailing craft are most vulnerable because they have to "claw" their way into the wind

true for vessels bound for the trading ports of Limrikê, because 'the Malabar coast lacks harbours, and it is not safe to remain offshore in a strong westerly wind.'[57] However, even vessels with large expanses of open water separating them from the nearest landfall can, under the sustained influence of strong and steady winds, find themselves swept onto a lee shore.[58] It would therefore appear likely that the brailed square sail used on ancient vessels had at least some windward capability which allowed ships to beat away from the lee shore of the Indian coast and maintain a safe position out at sea until lighter winds and calmer conditions allowed them a safe run into a sheltered anchorage. Such a characteristic would also have been highly desirable when making voyages in the fickle wind regime of the wintertime Mediterranean. The sailing rig of antiquity thus appears to have been a competent performer during the heavy weather of the south-west monsoon, and, by inference, should have been equally capable when faced by the high winds and rough seas often likely to be encountered on the wintertime Mediterranean.

Navigation on the Arabian Sea

In addition to its favourable winds, the north-east monsoon provided ancient seafarers making the westwards voyage from India to the ports of Egypt with weather conditions that have been described as 'gracious, as clear, and as balmy as a permanent trade'.[59] Little wonder then that this monsoon is often referred to as 'the fine weather season'.[60] In stark contrast, conditions during the south-west monsoon were far more demanding of Graeco-Roman navigators as they attempted to set an eastwards course

to get away from it .... The old windjammers were particularly vulnerable because their rig made it hard for them to work to windward and, once on a lee shore, few were able to regain the safety of the open sea' (Toghill 1994: 141).

[57] Hourani 1995: 26. See also Pliny's reference to Cranganore—the first trading-station in India that mariners would reach after making the crossing to the Malabar coast—as being undesirable as a commercial centre because 'the roadstead for shipping is a long way from the land and the cargoes have to be brought in and carried out in boats'. (*Naturalis Historia*, 6.26.104.) The vessels riding at anchor would therefore have been extremely exposed to the strong winds and heavy seas expected during the south-west monsoon.

[58] The point is exemplified by the wreck of St Paul's Alexandrian grain freighter which was first caught in the winds of the gregale while coasting off southern Crete and, over the course of two weeks, was relentlessly blown to the south-west, eventually being wrecked on the Maltese coast, roughly 500 miles (800 km) distant (Acts 27:14–44).

[59] Villiers 1952: 32.

[60] West Coast of India Pilot 1998: 32.

across the wide expanses of the Arabian Sea to the Indian subcontinent. Indeed, the ability of the sailors of antiquity to make voyages across the Arabian Sea during the south-west monsoon provides remarkable insights into the capacity of Graeco-Roman mariners to navigate accurately in conditions that promised to be as unfavourable as any which might be experienced on the wintertime Mediterranean. During the south-west monsoon, 'The sky is overcast: frequently the rains fall for forty or fifty days, with brief intervals of fine weather. It is during this period that the dhows take shelter and the big steamers make the ports of Aden and Columbo with their funnel caked white with salt. Visibility is often very poor, and conditions for navigators can be trying.'[61] The sailors and merchants of antiquity, bound for the markets of the Indian coast, would therefore not only have had to contend with high winds and rough seas, but also with the wet and overcast conditions which characterise the south-west monsoon and have led to it being labelled 'the rainy season.'[62]

As has already been seen, it is the perceived inability of ancient navigators to accurately ascertain their direction or location by reference to the stars or sun during overcast conditions that is commonly regarded as one of the principal reasons for the seasonal curtailment of maritime activities on the wintertime Mediterranean, at least until the adoption of the magnetic compass during the Middle Ages. (See above, p. 173 f.) However, overcast skies are also a common feature on the Indian Ocean during the south-west monsoon and, at the time of year when both Pliny and the author of the *Periplus* inform us that Graeco-Roman mariners were venturing across the Indian Ocean, thick cloud cover would undoubtedly have proved a major problem, severely hindering accurate navigation. While the skies over the Arabian Sea are usually at their cloudiest during July, at the height of the south-west monsoon, overcast conditions remain common, especially along the west coast of India, throughout the following two months.[63] During August, cloud cover over the coasts of Malabar and modern Pakistan averages 5 oktas, while on the Gulf of Cambay slightly greater cloud amounts of 6 oktas are usually recorded. Even with the lessening of the effects of the monsoon during September, cloud conditions still average 4 oktas along most of the western seaboard of the subcontinent.[64] With this cloud also comes a high level of precipitation and a modern pilot book of the region therefore notes

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61 Villiers 1952: 16–17.
62 West Coast of India Pilot 1998: 32.
63 Admiralty 1987: 59; Hastenrath & Lamb 1979: xiii; West Coast of India Pilot 1998: 45.
64 Met. Office 1949: 66. It should be noted that these figures were derived from a publica-

that, 'along much of the coast of Pakistan and the W coast of India most of the rainfall is associated with the SW monsoon.'[65] Even in the regions of the western Arabian Sea, along the coasts of east Africa and southern Arabia, where cloudy skies and heavy rains are uncommon across the whole of the year, most of the annual rainfall occurs during the period of the south-west monsoon. The south-westerly winds, having travelled across the large expanses of open sea in the southern Indian Ocean, are loaded with water vapour which the monsoonal winds then proceed to shed in the form of heavy rain as they approach these coastal regions.[66]

The extent of cloud cover over the eastern Arabian Sea during the south-west monsoon is therefore very similar to that recorded across much of the Mediterranean during the winter months when, despite a high degree of local variability, cloud amount tends to average between 3 and 5 oktas across the entire Mediterranean region, with only the cloudiest regions such as the Adriatic or the south-eastern Aegean commonly recording monthly averages of 6 oktas.[67] The meteorological data therefore highlights that, at the time of year when ancient seafarers were making crossings to India, cloud conditions of the eastern Arabian Sea were on a par with, or even worse than, those of the wintertime Mediterranean. However, while many scholars assume that overcast conditions severely limited the capacity for accurate navigation on the ancient Mediterranean during the winter months, and that cloud cover was a major factor in forcing a halt to maritime activities until the arrival of clearer skies in the spring, Graeco-Roman seafarers were nevertheless routinely overcoming similar overcast conditions while making voyages across the open-waters of the Arabian Sea.

Sailors of antiquity making the voyage to India during the south-west monsoon would certainly have benefited from considerably longer hours of daylight than mariners on the wintertime Mediterranean (figures 2.12–2.13).[68] Thus, in the middle of August, Cape Cormorin, situated at the

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tion that still used the old system of measuring cloud amount in tenths of sky covered, unlike the present system which measures cloud cover in eighths—oktas (see above, p. 90, n. 114). Figures for the Indian Ocean have therefore been converted to the more recent system, and although the results are only broad averages, they should nevertheless prove sufficiently accurate to provide a general picture of the cloud conditions in the Arabian Sea during the months of August and September.

65 West Coast of India Pilot 1998: 32.

66 Admiralty 1987: 59; Hastenrath & Lamb 1979: xiii; Tchneria 1980: 179.

67 Mediterranean Pilot Vol. I 1978: 70; Vol. II 1978: 14; Vol. III 1988: 32; Vol. IV 2000: 25; Vol. V 1999: 32.

68 All data used in these figures are generated from the U.S. Navy's website for daylight times. http://aa.usno.navy.mil/AA/data/docs/RS_OneYear.html.

southern tip of the subcontinent, records almost two hours additional daylight than does Alexandria during the middle of January, and over three hours more daylight than is received by Trieste in the winter. Seamen bound for India's north-west coast during August could expect even longer hours of daylight; modern Karachi records more than two-and-a-half hours more daylight each day than is received by Alexandria in mid-January, and over three-and-a-half hours more than Trieste at the heart of the wintertime. Figures 2.12 and 2.13 therefore provide a good indication of the longer days and shorter nights that would have benefited the mariners making the voyage to India during August and September compared to sailors attempting to make passages on the Mediterranean during the middle of the winter.

Although the longer hours of daylight were obviously a great boon to Graeco-Roman sailors making the voyage to India during the south-west monsoon, nevertheless, visibility on the Arabian Sea at this time of year can be a major problem. While fog is rare across the western Indian Ocean at all times, visibility is often reduced by mist and haze, both of which are especially frequent in northern and western areas of the ocean where visibility is generally reduced to 5 miles (8 km) or less on 50 to 60 percent of observations during the peak of the south-west monsoon in July.[69] When Graeco-Roman mariners were voyaging to India during August, visibility along the coastlines of the Arabian Sea continued to remain relatively poor. At the eastern entrance of the Gulf of Aden visibility of less than 5 miles will normally be recorded on 30 to 40 percent of observations during the month, a situation that would have created problems for ancient navigators attempting to take departure for the eastwards voyage to the Malabar Coast. Visibility is rather better along the eastern coastlines of the Arabian Sea and modern observations from the more southerly shores of India's west coast generally record visibility of less than 5 miles accounting for only 10 to 20 percent of observations during August, while further to the north along the coasts of modern Pakistan, less than 10 percent of such observations are made in the month.[70] However, ancient vessels bound for the latter region still had to sail through the area of ocean situated off Arabia's southern coastline where mists are considerably more frequent and where visibility of 5 miles or less usually accounts for more than 40 percent of observations in August. Thus, Graeco-Roman mariners making for India—especially the north-west coasts and the major trading ports of Barbarikon and Barygaza—

[69] Admiralty 1989: 59; Africa Pilot 1980: 33.
[70] Admiralty 1989: 59; West Coast of India Pilot 1998: 47.

had to cope with poorer visibility than was generally the case on the wintertime Mediterranean; a sea where visibility is usually good except during periods of heavy rain or when southerly winds loaded with Saharan dust occasionally reduce it to less than 5 miles.[71] Only at the head of the Adriatic, where fogs are relatively frequent in the winter and can account for up 20 percent of records between November and February,[72] are conditions on the Mediterranean usually worse for maritime navigation than was the case on the Arabian Sea during the south-west monsoon.

In spite of the various difficulties facing ancient navigators as they sailed to India during the south-west monsoon, there was still a pressing need for them to maintain a good awareness of their position. As has already been seen, Graeco-Roman sailors would have been intent on avoiding the lee shore of India's west coast during conditions of high winds and heavy seas and would therefore have been desperate to keep a close track of their position relative to that of the Indian coast. Furthermore, the seafarers of antiquity would have been well aware that approximately 180 miles (300 kilometres) to the west of the Indian shoreline, and lying directly in the path of ancient shipping plying the route between the Gulf of Aden and the Malabar trading ports, were the Lakshadweep Islands.[73] While there are about thirty main islands in the chain, 'Lakshadweep' translates as 'the hundred thousand isles' and, in addition to the larger islands, there are numerous small coral reefs, shoals and banks, many of which barely break the surface of the water.[74] Although an attentive lookout at the masthead or the prow of an ancient merchantman would, on a calm and sunny day, be able to pick out channels between these atolls and reefs, in the high winds, heavy swells and overcast conditions of the south-west monsoon, piloting a course through the coral reefs would have become a hazardous operation. Even use of the lead-line would have been of little benefit since, 'Owing to the great depths near the islands, sounding gives no warning of their proximity, therefore great caution is needed in reduced visibility.'[75] It

[71] Admiralty 1987: 56. See p. 98 ff..

[72] Mediterranean Pilot IV 1988: 35.

[73] Formerly known as the Laccadives. Even today, Mincoy, the southernmost island of the chain, lies on the major shipping lane that runs between the Red Sea and the Straits of Malacca (Central Intelligence Agency 1976: 54).

[74] Even the larger islands in the Lakshadweep chain are low-lying with none more than 9 m above sea-level. Therefore, while some of the islands are topped with coconut palms which can measure up to 24 m, modern mariners are still warned that the islands are 'not generally discernible from any great distance and should be avoided' (West Coast of India Pilot 1998: 108. See also Ramachandran 2000: 194).

[75] West Coast of India Pilot 1998: 108.

is therefore hardly surprising that the Lakshadweep islands have claimed large numbers of shipwrecks over recent centuries, and a great many ships no doubt also foundered on their coral reefs during antiquity. Nonetheless, from the sailing instructions laid down in the *Periplus*, it is clearly stated that ships leaving the Gulf of Aden and 'bound for Limyrike [should] hold out with the wind on the quarter for most of the way'[76]—a course that would point vessels directly towards the Lakshadweep islands. It therefore appears certain that Graeco-Roman ship-owners and sailors bound for the trading ports of south-western India were willing to stake their vessels and lives on the ability of navigators to accurately thread their way through this chain of low-lying islands which barred their way to the subcontinent, despite the heavy weather and poor visibility which could be expected during the south-west monsoon.

The Sailing Season of the Indian Ocean: Conclusion

The sailing season adopted by Hellenistic and Roman mariners plying the trade routes that ran between the ports of Egypt and India has profound implications for the seafaring calendar of the ancient Mediterranean. By making voyages to the Indian subcontinent during the south-west monsoon, ancient mariners could have expected to encounter powerful, blustery winds and heavy sea swells which, together with the high frequencies of overcast skies and reduced visibility, produced a cocktail of dangerous elements that made the Arabian Sea of August and September every bit as hazardous for Graeco-Roman mariners as was the Mediterranean during the heart of the winter. However, while many recent generations of sailors have decided that discretion is the better part of valour and chosen to entirely avoid the seas of the northern Indian Ocean during the south-west monsoon, ancient writers such as Strabo leave no doubt that during the Hellenistic and early Imperial periods that large numbers of ships and sailors were passing with annual regularity across these hostile seas.[77] If Graeco-Roman mariners bound for India were capable of overcoming the storms and navigational difficulties presented by the south-west monsoon, then there seems little reason why their seafaring contemporaries could not also have sailed across the sea-lanes of the Mediterranean during the wintertime.

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[76] *Periplus*, 57.
[77] Strabo, *Geography*, 2.5.12, 17.1.13.

The ability of Graeco-Roman sailors to deal with the south-west monsoon also raises some interesting possibilities concerning Mediterranean wintertime sailing strategies. While the wind regime of the summertime Mediterranean is relatively settled with steady, prevailing winds blowing across both major basins of the Sea, the winds are considerably more variable during the winter months and these fickle, shifting winds undoubtedly made sailing considerably more problematic at this time of year. Nevertheless, the wind patterns of the wintertime did offer distinct advantages for some Graeco-Roman mariners plying the Mediterranean sea-lanes. Perhaps the most significant of these was the change in the wind regime that presented mariners sailing from Egypt and the Levant with the prospect of making voyages to the west quickly and more easily than would be the case during the summer half-year; an opportunity that applied most notably to the ships of the Alexandrian grain fleet. For seafarers prepared to remain on the seas of the eastern Mediterranean beyond the limits traditionally ascribed to the ancient sailing season, this change in the wind regime offered the potential for considerably faster runs to Italy than would usually have been possible during the summer months.[78] Such wintertime voyages would increase the risk that vessels would encounter high winds, rough seas, thick cloud cover and poor visibility. Nevertheless, the ancient maritime trade with India clearly demonstrates that both the ships and seamen of antiquity were more than a match for such hazardous conditions. Provided the wind direction favoured a voyage to their intended destination, Graeco-Roman seamen appear to have willingly accepted the opportunity to make crossings across large expanses of open water that even modern mariners regard as hazardous. This was certainly the case for seafarers on the Indian Ocean during antiquity and, as such, there appears little reason why mariners plying the sea-lanes of the Mediterranean would not also have been willing to put to sea during the winter months, when weather conditions were not dissimilar to those on the Arabian Sea during the south-west monsoon.

[78] Pryor 1988: 3. See above, p. 84.

CHAPTER SIX

ANCIENT PIRATES AND FISHERMEN

This study has, thus far, focused upon the Graeco-Roman sailors aboard round-hulled, square-sailed merchant vessels, or the seamen and rowers who manned the narrow-hulled, fine-lined war-galleys. Over the course of this chapter, however, the emphasis will shift to the pirates and fishermen of the ancient world—two of the most important seafaring communities that regularly operated on the waters of the Mediterranean whose activities have important implications for our understanding of the ancient seafaring season. Ancient writers occasionally make passing references that help shed some light on the seasonality of pirate activity on the Mediterranean. Analysis of the vessels and tactics commonly employed by piratical groups offer additional insights into the capacity for these seaborne marauders to operate on the seas of winter. The following pages will also address how the migratory patterns of important fish stocks into and through the Mediterranean may have kept many fishermen on the seas well into the wintertime as they attempted to secure large catches, while the harvesting of purple-bearing shellfish may also have necessitated frequent trips on to the water throughout the winter months.

Directly related to the great variation in the abilities of galleys and merchantmen to cope with high winds and large waves is the effect of such adverse conditions upon the seasonal operations of pirates. It has already been seen that the hazards of nature—in the form of strong and variable winds, rough seas, overcast skies, mist and fog, together with a lack of daylight—presented a formidable threat to maritime activities on the wintertime Mediterranean. These dangers should not be underestimated and, whenever possible, they would surely have been avoided by ancient mariners. Nonetheless, the threat posed to shipping from human hazards—in the form of pirates, privateers, buccaneers, and other commerce raiders—would, for long periods of Graeco-Roman history, have provided a strong incentive for ship-owners and merchants to risk their vessels and cargoes on winter seas in an effort to avoid the dangers presented by these seaborne predators.[1]

[1] While those engaged in acts of maritime violence are often separated into various

Mention of pirates mounting wintertime operations is certainly extremely rare in the ancient literature. Henry Ormerod, in his classic study, *Piracy in the Ancient World*, had little doubt that the reason behind the apparent cessation of pirate activities during the winter months was a direct result of the closure of the sea-lanes during this period of the year: with the seas closed to commercial shipping, 'the pirate's business was suspended and the opportunity taken to refit.'[2] If Ormerod is correct in this conclusion, then the seasonal nature of pirate activities was a simple matter of cause and effect; piracy was not a viable occupation throughout the winter months because the merchant vessels that were the targets of these seaborne marauders were themselves not usually at sea during the winter. However, it has already been seen that commercial shipping on the ancient Mediterranean appears often to have ignored the maritime calendars laid down by writers such as Hesiod and Vegetius, or legislated for by the emperor Gratian. As such, although the evidence is meagre, there are nonetheless strong indications in the ancient literature that voyages were regularly being made by merchant vessels throughout the winter months. Furthermore, if the general lack of pirate activity in the wintertime was simply the result of an absence of seaborne prey, then pirates could still have carried out raids against coastal settlements at this time of year, for 'pirates lived by raiding the land more than by raiding ships at sea.'[3] Rather than the lack of opportunities for seizing booty during the wintertime, the absence of piracy from late autumn through until early spring is probably as much a reflection of the inability of the vessels and tactics employed by pirates operating on the Graeco-Roman Mediterranean to come to terms with the weather and sea conditions of winter. While round-hulled merchant vessels, reliant upon the brailed square sail for propulsion, were able to contend

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categories such as privateers, corsairs or buccaneers, there was often a great deal of similarity in the types of vessels used and the tactics employed when intercepting and capturing seaborne prey. As such, for the purpose of examining the seasonality of their operations, unless otherwise stated, all will therefore be referred to under the general label of 'pirates'. Indeed, the ancient literature also tends to lack any precision when describing acts of maritime violence (Gabbert 1986: 156; Ormerod 1924: 61), while for the sailors, merchants and passengers who were the victims of these various seaborne marauders, their fate, like that of the ship on which they were travelling and the cargo they were transporting, would often have been the same regardless of the exact definition applied to those who had captured their vessel. As such, piracy will be defined in its broadest sense as 'the act of taking a ship on the high seas from the possession or control of those lawfully entitled to it' (Kemp 1976: 650).

[2] 1924: 18. See also Pryor 1988: 87.

[3] McKechnie 1989: 107. See also Braund 1993: 206; Reddé 1986: 452.

with the powerful winds and rough seas often encountered during the winter months, the lightly constructed vessels favoured by pirates, with their long, narrow hulls and dependence upon oar propulsion, were even more unsuited to such wintertime conditions than were the triremes and other large, multi-banked warships of the ancient world—vessels which, as we have already seen, were at the mercy of even mildly breezy and choppy sea conditions. (See above, pp. 134 ff.)

Pliny the Elder was certainly convinced that maritime trade was conducted year-round during the first century AD as merchants sought to maximise their profits by shipping cargoes across the waters of the Mediterranean throughout the wintertime: a season when 'not even the fury of the storms closes the sea; pirates first compelled men by the threat of death to rush into death and venture on the winter sea, but now avarice exercises the same compulsion.'[4] Pliny thus makes it clear that, in his understanding at least, although shipping had always been plying the sea-lanes of the Mediterranean during the winter months, the factors motivating such voyages had changed. The merchant vessels that put to sea in the wintertime during the early Roman Empire did so purely in an effort to increase their opportunities for economic gain. By contrast, during earlier periods of antiquity voyages had been undertaken by seafarers who preferred to face the natural hazards of a Mediterranean winter rather than put to sea during the summer when they would have risked the human threat posed by pirates.[5] Pliny clearly implies that, in the years prior to the establishment of the Principate, not only was piracy considered to be a summertime phenomenon, but that it had become common practice for merchant vessels to make voyages during the traditional off-season of winter in an effort to avoid the unwanted attentions of these seaborne marauders.

The Seasonal Range of Pirate Vessels

In antiquity, as in later ages, pirate craft came in a wide variety of shapes and sizes. It was thus noted by Ormerod that 'in most cases, the would-be pirate was content with the first boat that came to hand by theft or

4 Pliny, *Naturalis Historia*, 2.47.125. See above, p. 138.

5 While Pliny does not actually state that piracy was a summer-only occupation, it is scarcely possible to interpret his statement in any other way. Harris Rackham thus adds the footnote to his translation of Pliny's text: 'It was thought that there was less likelihood of encountering pirates in the winter' (1958: 266 n. *a*).

purchase'.[6] Fishermen and merchants might, on occasion, also have used their vessels to indulge in opportunistic acts of piracy should easy prey present itself. However, vessels constructed with the specific intention of successfully pursuing and overhauling other ships, or to engage in hit-and-run raids on coastal settlements, had to be built for speed. They therefore possessed hulls that were long and slender, were shallow in draft, and they derived their principal means of propulsion from oars which allowed the pirate crew to generate the speed necessary to catch merchant vessels, as well as hold off pursuit from warships which might occasionally be sent out by maritime states in an effort to provide protection for their merchant marine.[7] As has already been seen to be the case with ancient warships, these characteristics made purpose-built pirate vessels highly unsuited to the strong winds and rough seas more frequently found on the Mediterranean between late autumn and early spring. (See above, pp. 135 ff.) The operating season for pirate activities was therefore likely to have been very similar to that proposed by Vegetius: the seasonal peak of pirate endeavours would probably have focused on the months spanning May to September, while their operations slowly tailed off in the months before and after, reaching a trough between November and March. As such, it may have been the case that sailors aboard strongly built, broad-beamed merchant vessels, powered by the easily controlled and highly adaptable brailed square sail, were prepared to brave wintertime seas in the knowledge that, at this time of year, the threat from maritime raiders was greatly reduced.

Throughout Mediterranean history pirates have generally preferred to operate small craft that were fast and shallow-drafted, allowing raids to be carried out in shallow waters close inshore. These vessels therefore tended to be light of build, permitting them to be easily and quickly removed from

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[6] Ormerod 1924: 29. For fishermen engaging in piracy, see Petronius, *Satura*, 114; Dio Chrysostomus, *Orationes*, 7.32; Plato, *Laws*, 823 e; Aristotle, *Politica*, 1256 a 37. See also Braund 1993: 206; de Souza 1999: 199. For traders as part-time pirates, see especially McKechnie 1989: 117 f.; also de Souza 1999: 199, Harris 1980: 124; Brulé 1978: 117–138.

[7] References to pirates using vessels that were powered primarily by sails rather than oars are virtually absent from the ancient literature. The only clear exception to this rule dates from the years following the capture of Carthage by Gaiseric's Vandals in AD 439, when the Germanic tribe came into possession of numerous merchant vessels, among which were those of the *annona* fleet, that had been captured with the fall of the city. It was with these ships that the Vandals carried out their piratical raids of the fifth and sixth centuries. It should be noted, however, that the piracy of the Vandals was primarily, if not exclusively, in the form of coastal raiding rather than ship-to-ship encounters, and their vessels were unsuited to the latter form of maritime marauding. See, for example, Courtois 1955: 205–209; de Souza 1999: 231–232 n. 25; Diesner 1966: 123–128.

the water for portaging or hiding on land.[8] It was small craft of this kind that were the vessels of choice for the pirate communities of the ancient world—a point confirmed by Appian who, writing of the Cilician pirates, noted that, up until the first century BC, they had used the relatively small vessels which he names as the *myoparo* (μυοπάρων) and the *hemiolia* (ἡμιολία). Only as a consequence of the hostilities waged between Rome and Mithridates VI from 88 BC through until the final defeat of the Pontic king in 74 BC did these pirates begin to adopt larger vessels such as biremes and even triremes. (Quoted below, p. 251.)[9] Of the *myoparo* we know little except that it was in use by at least the mid-second century BC and was a vessel greatly favoured by pirate communities: small numbers of these vessels were also put to use by the navies of both Carthage and Rome.[10] While there is no reliable evidence relating to the size or appearance of the vessel, Casson was probably correct to assume that, as a consequence of its use by pirates, together with the fact that it is the first—and therefore almost certainly the smallest—of the vessels listed by Appian, then it was likely to have been a seaworthy open galley that, while inexpensive to construct and easy to crew, was still swift under oars.[11] Together with the *myoparo*, the *hemiolia* or 'one-and-a-half' was the favoured craft of Hellenistic pirates.[12] The vessel seems to have acquired its name from the design of its oarage in which forward and aft there was only a single level of rowers, while the mid-section of the ship contained a slightly raised second bank of oar-crew.[13] According to the calculations of John Coates a *hemiolia* of fifty oars would have a length on the waterline of 21 m, its waterline breadth would only have been 2.7 m, with an average draft of 0.78 m, and when fully manned the craft would displace just 14 tonnes.[14] Dimensions such as these would have made the vessel highly unsuited to choppy sea conditions.

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8 Thucydides, 4.67.3; Strabo, *Geography*, 11.495; Tacitus, *Historiae*, 3.47.

9 Appian, *Mithridates*, 92.

10 Appian (*Punic Wars*, 121) notes that the Carthaginians used *myoparones* in 147 BC when defending their city during the Third Punic War. See Casson (1995: 132 fnt. 125) for further references to the use of this vessel type in antiquity.

11 Casson 1995: 132.

12 Casson 1995: 128; Ormerod 1924: 29 f. See also Morrison 1980.

13 For a reconstruction of the *hemiolia* and the arrangement of its oar-crew see the designs of Coates (in Morrison 1996: 318). However, note that the number of oar-crew, and thus the size of the vessel, was variable, and while Alexander the Great used vessels on the Indus with an oar-crew of thirty (Arrian, *Anabasis*, 6.18.3), Coates believes the maximum number of rowers for the vessel was fifty.

14 Coates, in Morrison 1996: 318, 345.

Perhaps the most famous of ancient pirate vessels was the *lembos* (*λέμβος*), which was widely used by the piratical communities of the Illyrian coast from at least the middle of the third century BC.[15] As in the case of the *hemiolia*, there appears to have been considerable diversity from one *lembos* to another; the oar-crew varied from as little as sixteen rowers up to fifty, and while some of the vessels had but a single level of oars later versions appear to generally have had two banks of rowers.[16] Like the *hemiolia*, *lemboi* were also adopted into the navies of various Hellenistic states and, from at least the time of the Macedonian War of 170 BC, the vessels were used as reconnaissance and dispatch boats by the Romans, while by the Battle of Naulochus in 36 BC, the Late Republican navy was operating a form of the *lembos* as a warship; a vessel that is generally referred to as a liburnian.[17] It was liburnians that formed the mainstay of the Roman Imperial fleets, and it is likely that Vegetius had these vessels in mind when he set out the parameters of his sailing calendar. (See above, p. 149 f.)[18] However, as has already been seen, liburnians were unlikely to have been able to cope with wintertime conditions. This would hardly be surprising given the vessel's ancestry as a fast, fine-lined pirate craft which, when fully manned, displaced only half a ton more than the *hemiolia* and, at 3 m in breadth on the waterline, was only slightly broader in the beam, while its draft of 0.76 m was fractionally less than the *hemiolia*.[19] While such a shallow draft would have permitted these pirate vessels to operate very close inshore—allowing them to raid coastal settlements, pursue merchant prey from ambush points close to the shore, or to use shallow water to escape the larger and deeper-drafted warships occasionally deployed by the ancient maritime powers to police the sea-lanes—the dimensions of *lemboi* would also have reduced the seaworthiness of the ship in rough water and the oarcrew would have found it very difficult to take efficient strokes as the vessel pitched and rolled. The relatively small size and limited breadth-on-the-waterline of the

15 See Casson 1995: 125 f. fnt. 103.

16 Casson 1995: 126 f.; 133 f. It was probably the later and larger *lemboi* to which Appian is alluding when he refers to pirates of the Late Roman Republic using biremes (*Mithridates*, 92).

17 Macedonian War: Livy, 43. Battle of Naulochus: Appian, *Bella Civilia*, 5.111.

18 Vegetius 4.39. For the liburnian as the primary warship of the late Roman Empire, see, for example, Casson 1995; 141 f.; Starr 1941.

19 See above (p. 149) for more details of the size of the liburnian. The figures are drawn from the reconstruction conceived by Coates (in Morrison 1996: 316–317; 345) of one such ship of the Imperial navy of the first and second centuries AD; a reconstruction that provides the vessel with a slightly larger and heavier build than was the case for the original pirate craft.

myoparo, *hemiolia*, and *lembos*, added to the fact that each of these galleys also required a low freeboard to allow the rowers to operate their oars effectively, indicate that Graeco-Roman pirate craft must have been at considerable risk of swamping in even relatively small waves. Pliny's assertion that sailors and merchants of the Late Republican period had taken to wintertime seas as a means of avoiding the depredations of pirates therefore makes a great deal of sense given the lack of seaworthiness of the vessels favoured by these seaborne raiders.[20] The winter months thus provided a seasonal refuge in which seafarers aboard broad beamed, round hulled sailing ships may have been reasonably content to confront the fickle forces of nature in the knowledge that the stronger winds and rougher seas that occur with greater frequency at this time of year would also provide a measure of protection from pirates whose lightly built vessels were unable to cope with such conditions.

The Seasonality of Pirate Tactics

In addition to the problems that pirate vessels would have experienced when sailing on winter seas, the tactics commonly employed by ancient sea marauders would also have been generally unsuited to the conditions often found on the Mediterranean between late autumn and early spring. While in the summertime visibility across the region is generally good and has rightly been regarded as favouring ancient navigational tachniques, it would also have greatly aided pirate communities on the look-out for potential prey. Ormerod, for example, emphasised the advantages that the natural topography of the Cilician coast provided for the pirate communities that resided there: 'On these rugged headlands and precipitous crags above the sea … were the eyries of the pirates who in the last century of the Republic were the masters of this coast. From these look-out points the presence of any vessel rash enough to approach the coast could be detected, and a wide view be obtained across the channel between the Cilician coast and Cyprus, by which the Levant traffic must pass.'[21] For sailors aboard merchant ships

[20] Pliny, *Naturalis Historia*, 2.47.125.

[21] 1924: 198–199. See also the similar picture that Ormerod paints of the Illyrian coast that was also infamous for its piratical communities (1924: 167). However, it should be noted that the significance which Ormerod gives to geography in the development of piracy among communities in certain specific locations of the Mediterranean has been questioned by R.F. Willetts (1955: 242) who instead invokes social factors as the primary motivating force in the growth of Graeco-Roman piracy.

wishing to sail unnoticed along coastlines inhabited by pirate communities the greater frequencies of mist, fog and heavy rain expected during the wintertime, together with the long hours of darkness of this time of year, may have provided the means to pass undetected. Although the natural hazards encountered by mariners at sea during the winter months would often have made accurate navigation problematic, the reduction in visibility would also have proved a hindrance to maritime raiders. It is true that such conditions would also have made it easier for pirates to approach their prey with less risk of detection.[22] Nevertheless, limited visibility would have made it considerably more difficult for the lookouts of pirate communities—whether they were perched upon headlands overlooking the sea-lanes or on the prow or masthead of vessels—to locate their prey. Even were seaborne marauders provided with prior information regarding the movements of merchantmen sailing through waters on which they were operating, there is little doubt that mist, fog and limited daylight would have made the detection and interception of such vessels considerably more difficult than would have been the case if visibility was good.

In addition to poor visibility, other wintertime hazards may also have been regarded with favour by the crews of Graeco-Roman merchant vessels who saw in such conditions the means by which they might elude the maritime predators that would commonly have been encountered on the Mediterranean in more clement weather. During the summer half-year commercial sailing vessels engaged in coastwise passage-making faced the threat of pirate attack at a variety of points on the coast. Theophrastus, for example, in his study of the various characteristics displayed by humans, labels as coward any man who, when at sea, continually mistakes headlands for the fast, oared *hemiolia* vessels often favoured by Hellenistic pirates.[23] The obvious implication of this statement is that encounters with pirate galleys were expected to take place at headlands where sailing merchantmen would often have been making barely any headway as they attempted to round a promontory in the face of adverse winds, allowing them to be easily overhauled by pirate galleys lurking in the vicinity.[24] Straits and channels presented similar opportunities for pirates to use the coastline to their

[22] See Ormerod (1924: 26, 111), who believes that merchantmen were often captured at night by pirates boarding them under cover of darkness.

[23] Theophrastus, *Characters*, 25.2.

[24] Thucydides (8.35), for example, relates how, during the Peloponnesian War, the Spartan commander, Hippocrates, stationed six commerce raiding warships off Triopium, a headland of Cnidus, with orders to seize all the Athenian merchant vessels which had to round the promontory on the voyage back from Egypt.

advantage and lie in wait for any vessels which might become becalmed in the lee of a coast, or could be captured when labouring against the wind or current.[25] However, while pirates could take up such ambush positions during the light breezes or calm conditions which characterise a Mediterranean summer, the higher frequencies of strong winds and rough seas during the wintertime would have made such tactics extremely difficult to implement. With their narrow hulls and light construction, pirate vessels, and even the larger warships sent out to raid enemy commerce in times of war, would have found it difficult to maintain positions along specific stretches of coast in even light winds and moderate swells; the generally stronger, more variable winds of winter would often have caused the formation of heavy and confused seas which would have made many coastal regions simply too hazardous for galleys attempting to keep station. The increased size of waves and swells during the wintertime would also have made it difficult for pirates intending to gain the open sea in pursuit of potential prey by launching their vessels from a beach or when exiting the shelter of a creek or harbour, something that would have been especially true close inshore where waves increase rapidly in height and steepness at they make contact with the sea floor, rearing up dramatically before collapsing as breakers.[26] Such large and steep waves would have proved exceptionally hazardous to lightly constructed pirate galleys that would have risked being dashed against the shoreline by the breakers.

Even when pirate vessels were able to maintain their positions near headlands and promontories, or be rowed safely clear of a harbour or beach, the strong winds and rough seas of the winter period would have caused additional problems for marauders attempting to catch and board their merchant prey. Heliodorus, for example, describes a spring voyage across the eastern Mediterranean made by a large Phoenician ship sailing south from Crete where the vessel had undergone repairs; a voyage that quickly took a turn for the worse when the sailors and passengers on board the merchantman became aware of another vessel following in their wake:[27]

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25 Such problems were possibly experienced by the Athenian corn fleet when it was seized by the warships of Philip of Macedon at the entrance to the Bosporus in 349 BC (Didymi, *de Demosthenes Commenta*, col. 10–11).

26 Bryant 1991: 60; Horrocks 1981: 138; Meisburger 1962: 2.

27 It should also be noted that the voyage began in the winter and continued through the early part of spring because the master of the ship, fearing pirate attack while wintering in a harbour on Zacynthos, preferred to chance the ship on the winter seas rather than face the threat from pirates which, he believed, were about to raid his vessel. Heliodorus, *Aethiopica*, 5.22 f.

> … the time of day when the yeoman looses his oxen from the plough, when the blustery wind begins to ease, slackening little by little until it was blowing in our sails with ineffectual weakness, merely rippling the canvas with no forward thrust. Eventually it subsided into complete calm, as if it were departing with the setting sun, or, more truthfully, as if it were collaborating with our pursuers. For as long as we were running before the wind, the cutter and her crew lagged far astern of our merchantman, as one might have expected with our larger sails catching more of the wind; but when we were becalmed on a smooth sea and forced to take to our oars, they were upon us quicker than it takes to tell, for the whole crew was rowing hard I imagine, to propel their cutter, which was a nimble craft and more responsive to the oar than our vessel.
>
> They were almost alongside when one of our crew who had joined ship at Zakynthos yelled: 'The game is up, my friends! It is a gang of pirates! I recognize the cutter. It is Trachinos's!' …
>
> The pirates came alongside, then cut across our bows. In an attempt to take the merchantman without bloodshed, they held their fire and circled around us, forcing us to a standstill. They were like a besieging army, eager to negotiate the capitulation of the ship …
>
> [T]hen one of the pirates, bolder than the rest, leapt aboard the ship and started cutting down all who crossed his path, giving a clear indication that war is decided only by bloodshed and death. As the rest swarmed aboard, the Phoenicians had a change of heart and fell at the knees of the enemy, pleading for their lives and promising to do whatever they were told.[28]

Although the passage describes a fictional event, it nevertheless provides a fascinating insight into the tactics adopted by the pirates of the ancient Mediterranean.[29] Heliodorus highlights that when the large Phoenician vessel had sufficient wind to fill her sails she was easily able to outdistance the pirate's small, light vessel; only once the wind dropped and a calm robbed the merchantman of her means of propulsion could the oar-crew aboard the pirate boat begin to overhaul the freighter and draw within striking distance. This greater speed of large, round-hulled merchant vessels over that of galleys—at least when conditions were suitably windy—is also illustrated by Appian who notes that, during the naval blockade of Carthage in the Third Punic War, 'the ships of Bithya and an occasional merchant, whom the love of gain made reckless of danger, watching for a strong wind from the sea, spread their sails and ran the blockade, the Roman galleys not being able to

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[28] Heliodorus, *Aethiopica*, 5.23–24.

[29] Ormerod (1924: 270) certainly regarded Heliodorus as closely modelling the scene upon factual accounts of Graeco-Roman piracy.

pursue merchant ships sailing before the wind. But these chances occurred seldom, and only when a strong wind was blowing from the sea.'[30] Appian therefore indicates that oared warships—in this case probably triremes, the fastest oared warships ever to operate on the Mediterranean—were unable to overhaul a merchantman whose sails' were filled with a fresh breeze. This inability of commerce raiding warships to catch merchantmen in windy conditions was probably due not only to the force of the wind propelling the vessels forward, but also because even relatively light breezes will create waves that, even if they do not directly threaten to swamp a warship or pirate vessel would, nevertheless, have made it difficult for the oar-crew to row efficiently. As has already been seen, such conditions would have lead to a loss in oar-power and speed. (See above, pp. 138ff.) For mariners aboard Graeco-Roman merchant ships wishing to avoid the attentions of seaborne marauders the generally stronger winds and rougher seas of the winter period might therefore have been regarded as a relatively safe environment which offered the best possible conditions should it ever become necessary to outrun piratical pursuers.

Even when pirates were able to overhaul their merchant prey, choppy sea conditions would have made it extremely difficult, if not impossible, for the raiders to employ the boarding tactics described by Heliodorus. Warships pressed into service as commerce raiders were relatively large vessels and it has been calculated that the deck of double-banked Roman liburnian was likely to have been about 2 m above the waterline, while that of a trireme from c. 400 BC was probably about 2.5 m above the surface of the sea.[31] However, with their two or three banks of rowers, war-galleys such as the liburnian or trireme were far larger than the vast majority of craft used by most ancient pirates which, like the small cutter employed by Trachinos, would have sat considerably lower in the water. Furthermore, while most warships from the Classical period onwards were provided with a deck to protect the rowers from the elements and enemy missiles, as well as to provide a fighting platform for the marines,[32] pirate craft were likely to have been left uncovered, which not only allowed for easier and cheaper construction, but would also have substantially reduced a vessel's weight making it both quicker through the water as well as easier to portage and hide when on shore. However, the lack of a deck also meant that a

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30 Appian, *Punic Wars*, 120.

31 Coates, in Morrison 1996: 345.

32 The term for a decked warship is cataphract (Greek—κατάφρακτος; Latin *tectus* 'covered', or *constratus* 'decked'. See Morrison 1996: 255–257).

vessel's height above the waterline would also be greatly reduced and it would therefore often have been difficult for the pirates to leap onto their merchant prey in the manner described by Heliodorus. While this would be of little consequence when pirates were attempting to capture small vessels such as that found off Kyrenia—which was itself probably sunk following an attack by pirates, with iron spear heads found embedded within the timbers of the hull—many merchant vessels of the ancient Mediterranean were considerably larger than the Kyrenia ship, and, as such, would have been high-sided with decks that were often several metres above the surface of the sea.[33] It must therefore have been an exceptionally difficult task for pirates to board such vessels even on a relatively calm sea; in choppy conditions the task of transferring a pirate crew from one pitching and rolling vessel to the deck of another ship that was sitting far higher in the water must have been fraught with problems which would only have been intensified if the sailors of the merchantman put up any resistance.[34]

In light of the dangers facing their fragile vessels, as well as the problems locating and capturing merchant ships at sea during the winter months, it would therefore appear likely that, throughout most of antiquity, the activities of pirates were primarily confined to the summertime. If this assumption is correct, then the wintertime inactivity of seaborne marauders might well have prompted at least some sailors and merchants to ignore the relative climatic safety of the summer half-year and instead risk their vessels on the sea-lanes of the Mediterranean during the traditional off-season which spanned late autumn through to early spring. Despite the generally more hostile weather and sea conditions at this time of year, mariners could nevertheless expect that the threat posed by piratical depredations would be greatly reduced.

Wintertime Activity by Pirates

Despite the unsuitability of pirate ships and tactics when employed in wintertime conditions there is, nevertheless, little doubt that, during certain periods of antiquity, seaborne marauders did take to the seas during the

[33] For the loss of the Kyrenia vessel as a result of pirate action, see, for example, Parker 1992: 232.

[34] J.F. Guilmartin has therefore noted that 'before the advent of heavy gunpowder ordnance, galleys engaged sailing vessels of moderate size at a tactical disadvantage and were effectively impotent against competently defended large ones' (2002: 114). See also Roberts 1994: 12.

winter months in search of maritime prey. Such a case is highlighted in the following passage, taken from a speech made by the Athenian aristocrat Andocides in the last years of the fifth century BC:

> [F]or when is man in greater peril than on a winter sea-passage? Are we to suppose that the gods had my person at their mercy on just such a voyage, that they had my life and my goods in their power, and that in spite of it they kept me safe? Why, could they not have caused even my corpse to be denied due burial? Furthermore, it was war-time; the sea was infested with triremes and pirates, who took many a traveller prisoner, and after robbing him of his all, sent him to end his days in slavery.[35]

Although Andocides emphasises the dangers posed by the forces of nature to the life and livelihood of seafarers who made voyages during winter, nonetheless, the passage makes it clear that all manner of vessels were still operating on the waters of the Mediterranean at this time of year, engaging in trade, warfare and piracy. While the speech therefore stresses the perils of wintertime sailing, references to the sea-lanes being 'infested' by warships and pirates, and the statement that large numbers of maritime travellers were being captured and sold into slavery, suggest that, at the close of the fifth century, a great deal of maritime activity was still taking place during the winter months.[36]

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[35] Andocides, *On the Mysteries*, 137–138. We cannot be sure whether Andocides is referring collectively to a number of voyages upon the wintertime Mediterranean, or if he is speaking of only a single experience. He also neglects to clarify exactly when or indeed where his voyage was carried out. However, it may be the case that the passage refers to wintertime voyages carried out in the months prior to the naval battle of Cyzicus in April 410 BC, for in an earlier speech Andocides highlights his part in the successful provisioning of the Athenian fleet which was wintering at Samos before the battle, and 'thus equipped, the forces in Samos went on to defeat the Peloponnesian at sea.' (*On the Return*, 11–12).

[36] The passage comes from Andocides' successful legal defence in response to a renewed attempt to have him excluded from both the Agora and temples of Athens, thus effectively barring him from the public life of the state. (Andocides fell under these provisions, which were laid down in the decree of Isotimides, as a result of a confession made in 415 BC in which he admitted that, in association with many other friends and acquaintances of Alcibiades, he defaced stone images of Hermes which lay in Athens, as well as performing profane parodies of the Eleusinian Mysteries.) It was as a result of this original debarment from Athenian public life that Andocides went into self-imposed exile, establishing himself as a merchant with far-flung maritime connections that stretched from Cyprus to Sicily (see Cawkwell 1970: 62–63. Maidment 1967: 4 fnt. *a*). Therefore, his comments in regard to sea travel in the later fifth century BC are almost certainly based upon personal observation and, as such, carry more weight than can generally be attributed to many of the aristocratic commentators of the Graeco-Roman world, whose knowledge of ships and sailors, not to mention the seasonal sailing patterns, was probably far more cursory in nature.

Following the destruction of the fleet at Syracuse in 413 BC Athens was deprived of much of her naval strength and probably also lost her ability to adequately protect the convoys of her merchant shipping, as well as to sweep the sea-lanes of pirates and other commerce raiders which might prey upon the maritime lines of supply crucial to the well-being of the Athenian state. Without the large numbers of warships which had previously provided protection to the state's merchant marine, the result may well have been an upsurge in the levels of predatory actions against Athenian shipping by enemy triremes indulging in commerce raiding, as well as by the smaller vessels operated by privateers and pirates. Given the relative seaworthiness of merchant vessels in relation to war-galleys, Athenian sea captains and merchants might, in the closing years of the Peloponnesian War, have therefore considered it a prudent step to carry out much of their voyaging during the winter months—preferring to risk the stronger winds and rougher seas of the traditional off-season in the knowledge that sturdy merchantmen, carrying the brailed square sail, would be better able to cope with such conditions than were narrow-hulled, lightweight galleys used by seaborne raiders. However, while this would explain the need for merchant vessels to remain at sea in the winter months, Andocides also leaves it in little doubt that triremes and pirate craft were also operating on the Mediterranean at this time of year.[37]

It has already been proposed above that the enlargement in the size and displacement of war-galleys, together with an increase in the number of rowers, may have brought about a lengthening in the operational season of Graeco-Roman warships (see above, pp. 147 ff.), and the same might also be true of pirate craft. Referring to the Cilician pirate threat which plagued

[37] We can safely assume that, in an effort to convince the court of his innocence of any accusations of offences against the gods, Andocides exaggerates the extent of both the natural and human hazards that he faced while voyaging across the winter seas (see Maidment 1967: 337). Nevertheless, it should be borne in mind that Andocides was appealing to the Heliaia, a court that usually numbered several hundred citizens, all above thirty years of age. (For a brief outline of the Athenian law courts, see Bonner & Smith 1930–1938; MacDowell 1970: 342 f.) As such, a large proportion of the jury could be expected to have served in the Athenian fleet and would have had first-hand knowledge of the extent to which triremes might be encountered on the seas of the wintertime Mediterranean. For Andocides to succeed in winning the support of the Athenian citizens sitting in judgement upon his case, he could surely not hope to gain their favour by providing them with information that many jurors would have known to be grossly inaccurate. Therefore, in spite of the trials of the *Olympias* highlighting the extreme danger which conditions of Beaufort 5 and above posed for triremes, it would nevertheless appear that—in times of war at least—these warships would sometimes be risked upon the wintertime Mediterranean.

the Mediterranean during the first half of the first century BC, Dio Cassius therefore notes 'how they robbed and pillaged those sailing the sea, no longer permitting them any safety even during the winter season, since as a result of their daring, practice, and success they made voyages in security even then.'[38] While Dio Cassius attributes such wintertime voyaging to the skills and courage of the pirates who manned the vessels, it is probably no coincidence that during this same period the Cilicians were taking advantage of the confused political conditions to acquire larger, more seaworthy ships for use in their piratical operations. This was especially true during the protracted Mitridatic Wars in which the Pontic king appears to have made resources available to the pirate communities, allowing them to employ far larger ships than had previously been the case:

> When Mithridates first went to war with the Romans and conquered Asia (Sulla being busy with Greece), believing that he could not hold Asia for long, he despoiled it one way and another … and sent out pirates on the sea. At first they harassed people by sailing around in a few small boats, as pirates do, but, as the war dragged on, they became more numerous and sailed in larger ships. Having acquired a taste for rich plunder, they still did not cease their activities when Mithridates was defeated, made peace and retreated … . they harvested the sea instead of the land, first in *myoparones* [*μυοπάρωνες*] and *hemioliai* [*ἡμιολίαι*] then in biremes [*δίκροτα*] and triremes [*τριήρεις*], cruising around in squadrons, under the command of archpirates just like generals in a war.[39]

It would thus appear that, through a combination of skilled and daring seamanship, together with the use of larger galleys, Cilician pirates were able to increase their seasonal range to such an extent that Dio Cassius regarded them as posing a threat to merchant shipping 'even during the winter season'. However, the trials of the *Olympias* have demonstrated that even galleys as large as triremes were relatively unseaworthy vessels and would have been in great difficulty if caught on the water in conditions beyond the fresh breezes and choppy seas of Beaufort force 4–5. (See pp. 136, 143, 145.) The use of these fully-fledged warships by Cilician pirates in the first century BC may have allowed them to adopt a longer operating season than had previously been the case when their operations had been carried out in

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[38] Dio Cassius, 36.21.2.

[39] Appian, *Mithridates*, 92 (Trans. de Souza 1999: 116–117). See also Appian, *Mithridates*, 63, 119. Plutarch (*Pompeius*, 24) also states that Mithridates allied himself to the Cilician pirates and promoted their activities. However, see de Souza (1999: 116 f.) for a more critical review of this alliance, regarding it to be the result of Roman propaganda directed against the Pontic king.

smaller vessels such as the *myoparo* and *hemiolia*. Nonetheless, the limited sea-keeping abilities of even multi-level war-galleys such as triremes still made wintertime maraudering a hazardous undertaking for pirate communities. Even the large polyremes, which might occasionally be sent out on commerce raiding missions by maritime powers during the frequent hostilities that arose during the Hellenistic period, would have major problems coping with the high winds and rough seas commonly encountered during a Mediterranean winter. In times of endemic warfare, and the increased levels of piracy and privateering which flourished during such politically unstable periods, the crews and owners of merchant sailing vessels may, therefore, still have felt considerably safer when making voyages during the winter months when, despite nature's hazards, the chances of being molested by seaborne predators would have been greatly reduced.

It is certainly the case that, throughout the many wars and political disputes of the Classical and Hellenistic periods, various states and empires deployed warships to raid the commercial shipping of their rivals. However, the use by piratical communities of large, multi-banked galleys should be considered as exceptional: the vessels employed by the vast majority of pirates throughout antiquity would have been relatively small in size. Not only would the costs required for the construction (or purchase) and maintenance of ships as large and complex as triremes have proved prohibitively high, but, in order to be effective, such vessels required as many as two hundred skilled oar-crew and sailors.[40] Moreover, war-galleys had little space in which to store provisions for such a large number of rowers, let alone any booty that might be acquired during raids against commercial ships or coastal settlements. Limitations such as these made most large warships impracticable for the great majority of pirate communities. Even the period during which the Cilicians were said to have operated triremes as raiding craft is relatively short, only spanning the years following the start of the First Mithridatic War in 88 BC until the defeat of the pirates by Pompey in 67 BC; a short spell of, at most, only twenty-one years. There was also an even briefer period when Sextus Pompey deployed large warships as part of his pirate fleet from 43 BC until his defeat at Naulochus in 36 BC.[41] The use of large

[40] See Gabrielsen (1994) on the vast costs that had to be shouldered by the trierarchs of Athenian triremes in the fifth and fourth centuries BC.

[41] For triremes operated by Sextus Pompey, see Appian, *Bella Civilia*, 5.77. However, de Souza (1999: 185 f.) argues that Sextus's reputation as a pirate leader is unjustified; the result of a smear campaign undertaken by Octavian that was designed to allow the triumvirs to break faith with a treaty agreed between them and Sextus.

warships by Graeco-Roman pirates was therefore extremely limited in time and should probably be considered as an exception to the general piratical rule.

Writing as a contemporary of Late Republican piracy, Cicero also addresses the threat posed by the Cilicians to Mediterranean shipping in the years prior to the passing of the *Lex Gabinia* and Pompey's command against the pirates in 67 BC. Unlike Dio Cassius, however, the orator regards the seas as being relatively clear of seaborne raiders between late autumn and early spring, stating: 'Every man who went out in a ship risked death or slavery; unless he sailed in winter, the only alternative was to embark on a pirate-infested sea.'[42] Cicero therefore adopts a view similar to that later taken by the Elder Pliny,[43] and both writers are of the opinion that pirates—even those equipped with vessels as large as triremes—were unable or unwilling to put to sea in search of maritime prey during the wintertime. Such was the magnitude of the threat posed by pirates in the years immediately prior to 67 BC that Cicero believed even Roman warships and troop transports to be at risk of attack during the months of the summer sailing season and, as such, 'never even dared venture upon the crossing from Brundisium [modern Brindisi] except in the depths of winter.'[44] Cicero's assumption that vessels were able to sail unmolested in winter even across stretches of water such as the Strait of Otranto—one of the busiest sea-lanes in the entire ancient Mediterranean and thus a rich hunting ground for pirates—provides additional support for the belief that, despite the widespread nature of piracy during the Late Republican period, it nevertheless went into a state of hibernation for the duration of the winter.[45]

Cicero also writes of how Pompey began his campaign against the pirates by securing the sea-lanes most important to Rome and Italy. The Roman general deployed his fleet to clear the pirates from their bases along the coasts of Sicily, North Africa and Sardinia, while naval detachments were also sent into the Adriatic and to the maritime regions of Transalpine Gaul and Spain. All this was achieved despite the fact that, according to Cicero, it was 'not yet the season for navigation,'[46] implying that the operations

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42 Cicero, *De Imperio Cnaeus Pompeius*, 31.

43 Pliny, *Naturalis Historia*, 2.47.125. (Quoted above, pp. 138, 239.).

44 Cicero, *De Imperio Cnaeus Pompeius*, 31.

45 The Strait of Otranto was vitally important to ancient maritime transport along the northern shores of the Mediterranean: the Strait connected not only the east-west shipping lanes which linked the coast of Italy with that of Greece, but was also a crucial north-south maritime route, linking the Adriatic Sea with that of the Ionian.

46 Cicero, *De Imperio Cnaeus Pompeius*, 31.

occurred very early in 67 BC, and probably before March when even writers such as Hesiod and Vegetius acknowledge the sea-lanes to have been open to shipping.[47] The anti-pirate campaign which was planned and put into effect by Pompey therefore seems to have been designed primarily to catch the Cilicians unprepared and off the water. If such was the intention then it worked admirably; the Cilician pirates appear to have been disorientated and unable to react to the pre-seasonal Roman naval offensive, indicating that their own raiding activities were either postponed on account of the season, or were being carried out at a much reduced level for the duration of the wintertime. The unpreparedness of the pirates and their inability to effectively counter Pompey's offensive against them is reinforced with additional comments supplied by Appian, who claimed that the pirates had themselves been planning to attack the Roman fleet at the beginning of the sailing season but were caught unaware and proved unable to respond to the Roman advance which, according to Cicero, was 'planned by Cnaeus Pompeius at the end of a winter, tackled in earliest spring, and carried to its conclusion before midsummer of the selfsame year.'[48]

This is, of course, not to say that we should uncritically accept Cicero's descriptions of large volumes of maritime trade during the wintertime as a direct result of attempts by sailors and merchants to avoid the pirate fleets which all-but controlled the Mediterranean during the summer months. Cicero may well have deliberately magnified the threat posed by the Cilician pirates, using his speech, *De Imperio Cnaeus Pompeius*, as a propaganda tool to bolster the reputation of the warlord who Cicero lauded as quickly and efficiently removing the great danger which the marauders presented to the Roman world.[49] We should therefore be wary of placing too great an emphasis on the strength of the pirates in the years prior to 67 BC. Nonetheless, even if Cicero did knowingly exaggerate the power of the Cilicians, there appears little reason for the orator to intentionally falsify

[47] Hesiod, *Works and Days*, 679–681; Vegetius, *Epitoma rei militaris*, 4.39.

[48] *De Imperio Cnaeus Pompeius*, 31; Appian, *Mithridates*. 12.14.95. See also Ormerod (1924: 239) who notes that the Cilician pirates were surprised by the operations of Pompey and his subordinates that were begun 'at the earliest possible season.' An earlier campaign waged against the Cilicians in 102 BC by Marcus Antonius may also have adopted a similar tactic of commencing operations in late winter or early spring in an attempt to catch the pirates in a state of unreadiness immediately following the wintertime dislocation of their activities. See also de Souza 1999: 106; Reddé 1986: 459.

[49] de Souza 1999: 172 f.

the restricted operating season of the pirate communities and the stimulus which this provided for wintertime voyage-making by other seafarers eager to avoid piratical predation.

It should not, however, be assumed that piracy was a hazard which affected mariners only during the summertime. In the same way that warships might venture out during the winter if military or political need was pressing, then pirates might also put to sea if the lure of capturing a rich prize proved exceptionally tempting, despite the inadequacies of their vessels in dealing with the conditions which might frequently be encountered on winter seas.[50] However, the comments made by writers such as Andocides and Dio Cassius, which indicate that pirates were commonly active during the winter months, seem questionable in light of the limitations of the design, construction, and tactical use of pirate galleys. And while the use of triremes or other large galleys may have allowed some increase in the seasonal range of pirates, it nevertheless appears unlikely that they would have been regularly operating outside the limits traditionally ascribed to the Graeco-Roman sailing season. It may therefore be the case that the period stretching between autumn and spring—the months when maritime activity is generally regarded as undergoing a major downturn as a result of the increased frequency of natural hazards—may ironically have been one of the safer times of year for merchant vessels to take to the seas as the weather conditions commonly encountered during the wintertime provided a degree of security against the threat of piracy and commerce raiding.

Piracy and the Sailing Calendars of Antiquity

Although the threat of pirate attack may have forced considerable numbers of merchant sailing vessels onto the wintertime Mediterranean, the seasonal effects of piracy probably had little impact on the two most detailed maritime calendars that survive from antiquity, and which have proved influential in shaping scholarly understanding of the ancient sailing season. Although the naval calendar penned by Vegetius, together with the roughly contemporaneous shipping timetable which Gratian's edict sets down for

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[50] As was the case in the *Aethiopica*, when Trachinus' pirate vessel followed the Phoenician sailing ship across wintertime seas from the Gulf of Corinth to Crete, before finally taking possession of the merchantman on the springtime seas as it made for north Africa (Heliodorus, *Aethiopica*, 5.23. Quoted above, p. 246).

members of the *corpus navicularorumi africanorum*, were created with very different types of vessels in mind, nonetheless, in their separate ways, the ships which form the focus of both these calendars had little to fear from pirate activity. The late Roman warships which are the concern of Vegetius' sailing season would, of course, have been well able to take care of their own defence and pirates would have avoided them whenever possible. Although Gratian's edict concentrates on sailing merchantmen, the vessels chartered by the state for the shipping of *annona* commodities from Africa to Rome were generally large ships,[51] and even at the time the edict was set down in AD 380, when vessel sizes were likely to have been considerably smaller than in earlier periods of antiquity, the ships which are the focus of the edict were probably still relatively large by the standards of the day.[52] Such big merchant ships would have had little to fear from pirate attack, regardless of the season in which they sailed: the high freeboards and large crews of vessels such as the Alexandrian grain freighters would have made them all-but unassailable to pirates whose vessels sat considerably lower in the water. (See above, pp. 247–248.) Furthermore, because we know *annona* ships often sailed as a fleet, should they ever suffer attack from seaborne raiders, the large merchantmen would have derived additional security from the mutual protection the fleet provided.[53]

It should also be noted that the sailing calendars of Vegetius and Gratian were conceived during the late Roman period, and although piracy was becoming a problem for the Imperial navy as migratory tribes embarked on maritime raids from the Black Sea into the Aegean and eastern Mediterranean, nevertheless, piratical activity appears to have been at a much reduced intensity compared to that which had been the case during the Classical and Hellenistic periods. Moreover, inter-state warfare, which had provided a major impetus to piracy during earlier periods of antiquity, had also been all-but eradicated from the Mediterranean for much of the previous four centuries.[54] Neither of these two late Roman texts is therefore likely

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[51] Casson 1995: 171 fnt. 23. Though see A.H.M. Jones (1964: 843) who refers to the state chartering vessels as small as 15 tons for the transport of *annona* commodities from Egypt to Constantinople.

[52] For changing vessel sizes throughout antiquity, Parker 1992; 1992a.

[53] See Casson (1995: 297 fnt. 2) for a number of literary references to the large grain freighters travelling as a fleet.

[54] For the stimulus which warfare provided to piracy during the Classical period, see de Souza (1999: chapt. 2) and Ormerod (1924: 110 f.); while for the Hellenistic period, see de Souza (1999: chapts. 3–5), Gabbert (1986), Jackson (1973), Rostovtzeff (1953: 1031 f.), and Walbank (1981: 163). Although recent studies have highlighted that piracy was almost certainly still a

to have placed great emphasis on seasonal strategies for avoiding pirates or other seaborne marauders. However, in the years before and after the relatively secure conditions of the Roman empire, the threat from piracy may have encouraged large numbers of commercial vessels to follow a sailing season very different from that advised by Vegetius or outlined in Gratian's edict. Mariners on the sea during the Classical and Hellenistic periods may therefore have chosen to brave the waters of the wintertime Mediterranean rather than await the arrival of the summer half-year when piracy reawakened from its wintertime hibernation and once again flourished on the seas.

At the time when Hesiod was setting down his sailing calendar in c. 700 BC, piracy was also a very real hazard; indeed, most maritime communities of the Archaic period probably regarded seaborne plundering directed against other communities and foreigners as an acceptable occupation.[55] It has, however, already been seen that the vessels to which Hesiod tailored his sailing season were likely to have been relatively small and derived their primary power from oars rather than sails, making such ships little different from the craft regularly employed by pirate communities. Indeed, the vessels employed by Archaic Greek aristocrats to carry agricultural surpluses and other cargoes to market were also likely to have been employed for piratical activity whenever easy prey presented itself. It is therefore of little surprise that Hesiod's maritime calendar makes no mention of wintertime sailing; the Archaic vessels with which he would have been most familiar were as equally vulnerable to fresh winds and choppy seas as the pirate craft of later ages, making them subject to the same seasonal constraints which generally confined their activities to the summer half-year.

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threat for coastal communities and seaborne trade during the Imperial period, nevertheless, the general absence of warfare in the Mediterranean region during the first four centuries of the Roman Empire undoubtedly reduced piracy on its seas. A single unified empire controlled the entire coastline of the Mediterranean and had eliminated inter-state rivalries which, in earlier and later centuries, had led to fleets of privateers and state-owned warships engaging in commerce raiding against enemy and, all too often, neutral shipping (Braund 1993: 206; de Souza 1999: 197).

[55] See especially Thucydides, who refers to piracy as an honourable profession in earlier periods, an attitude that prevailed among some communities of mainland Greece through until his own day (1.5). See also Jackson (1973: 249–250), following Homer (*Odyssey*, 14.199–285, 16.418–430). Ormerod (1924: 68) thus noted that the political and commercial rivalries of the seventh and sixth centuries BC gave 'rise to a form of buccaneering in the truest sense of the term.' (Buccaneers being distinct from pirates only by virtue of the fact that they do not prey upon vessels or seamen of their own state. Kemp 1992: 115.)

The Seasonal Cycles of Fishermen

Aside from sailors themselves, the occupation with the closest relationship to the sea is that of the fisherman. The seasonal rhythms of the Mediterranean certainly influenced the fishing communities of antiquity in ways that were similar to mariners aboard commercial and naval vessels. As such, most historians have assumed that, like the other activities undertaken by seafarers of the ancient Mediterranean, fishing was also a maritime occupation primarily focused on the summer half-year. Furthermore, it is generally considered to be the case that, throughout antiquity, fishing as a livelihood remained 'subordinate and supplementary' to that of agriculture.[56] This belief is supported by ethnographic studies carried out among traditional fishing communities on the modern Mediterranean, as well as research into the socio-economic relationship between fishing and agriculture which still operates in other areas of the world.[57] However, it has already been seen that Graeco-Roman mariners crewing broad-beamed merchant vessels built using the shell-first method of ship construction, and powered with the brailed square sail, were capable of remaining on the waters of the Mediterranean for considerably longer than the sailing calendars of antiquity would have us believe. The same probably holds true of fishermen of the ancient world who, plying their trade in vessels that were usually constructed using the same mortice-and-tenon method, were still very much in evidence on the seas throughout the winter.

In antiquity, as remains the case today, the seasonal migrations of large shoals of pelagic fish species[58]—such as the tunny, mackerel and sardine—into the Mediterranean to spawn in shallow coastal waters, allowed large hauls of the fish to be made in a short period of time. These catches supplied a major source of food for the fishing communities themselves, while the surplus fish would have been sold at markets in nearby towns and cities, or to the fish-salting and *garum* processing establishments which were often sited on the migratory routes of pelagic species.[59] In the western basin of the Mediterranean, large shoals of pelagic fish arrive through the Straits

[56] Gallant 1985: 43 f. See also Edmondson 1987: 113; Powell 1996: 32 f.

[57] For work on the fishing communities of the mid-twentieth century Mediterranean, see, for example, D.S. Walker 1962: 15. For studies into the relationship of fishing to farming elsewhere in the world, see, for example, T.M. Fraser's work in southern Thailand 1960: 36, 86.

[58] Pelagic fish are those caught at or near the surface of the sea.

[59] See, for example, Edmondson 1987: 112 f.

of Gibraltar in late spring, returning to the open-waters of the Atlantic in July and August thus limiting large catches to the summer. In the eastern Mediterranean, however, the migrations usually occur in the winter months; the shoals of mackerel and tuna move southwards from the Black Sea in the autumn and return through the Hellespont and Bosphorus the following spring or early summer.[60] It is therefore during the early winter that the greatest influx of migratory fish begin to arrive in the waters of the Aegean, forcing modern fishermen to put to sea during the months traditionally regarded as 'out-of-season' to seafarers in order to take advantage of this wintertime bounty. In his study of the fishing practices of the modern Cycladic communities, J.L. Bintliff therefore noted that, in the winter half-year, large concentrations of fishing vessels are to be found in the more confined stretches of water through which the migrating fish usually pass. Furthermore, these wintertime fishing expeditions should not be regarded as being limited to just a few days' duration and it was observed that, 'Since the fish runs are not simultaneous the fishermen travel from one favoured location to the next.'[61] As such, fishing vessels are often to be found on the Aegean for many weeks at a time during the winter and early spring, regardless of the greater likelihood of encountering dangerous weather and sea conditions. Moreover, in addition to the migratory pelagic fish, demersal species[62]—such as the flounder, sole, turbot, mullet and hake—are found in the Mediterranean throughout the year and provide a valuable food resource that could be tapped during any season, including the winter.

While T.W. Gallant has argued that fishing vessels of the ancient Mediterranean were 'incapable of undertaking sustained voyages in open-water',[63] such an assertion appears doubtful when, as Gallant himself notes, Graeco-Roman fishermen are known to have used fairly large ten- or twelve-oared vessels with an optional sail which were probably employed in open water trolling.[64] It may therefore have been the case that fishermen on the Mediterranean of antiquity adopted practices similar to those which are still being followed to this day, in which fishermen from mainland Greece were 'accustomed to sailing to the Cyclades, Crete and northern Africa, even in winter.'[65]

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60 For the seasonal migrations of pelagic fish species into and out of the Mediterranean, see J. Powell 1996: 33.

61 Bintliff 1977: 1.350.

62 Demersal fish are those that live on the seabed or in deep water.

63 1985: 12.

64 Gallant 1985: 12.

65 Bintliff 1977: 1.217.

Modern Turkish fishermen also remain on the water throughout the winter months, living and working aboard their vessels as they follow westward migrating fish, primarily the tunny, across the Aegean.[66] The winter is therefore one of the most productive times of the year for fishermen operating on regions of the Mediterranean such as the Aegean, when large catches of tunny can be expected. If the fishing strategies of antiquity were similar to those of more recent history, then it would appear highly likely that Graeco-Roman fishermen not only put out on to winter seas, but were also often on the water at night, or during times of rainfall, when the skies would have been overcast and visibility reduced. While these are the elements envisaged by Vegetius as bringing about an end to seafaring between late autumn and spring, they are the weather conditions which offer the best prospect for fishermen to obtain substantial catches from the large shoals of migratory pelagic fish.[67] Despite the seasonal sailing advice propounded by Graeco-Roman writers, for many fishing communities of the ancient Mediterranean it may have been the case that the seas were never closed.

The harvesting of the *murex* and *purpura* shellfish—the dye of which was the necessary requirement in the ancient manufacture of purple—may also have required that fishermen trust their vessels to the winter seas: Pliny thus notes that the most profitable time to harvest the molluscs was 'after the rising of the dog-star or before the spring time.'[68] Furthermore, because the dye had to be obtained from the shellfish shortly after death,[69] frequent trips out on to wintertime seas were necessary in order to fish for the creatures.[70] By at least the early Principate, when many coastal regions

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[66] Bintliff 1977: 1.217.

[67] Bintliff has therefore noted: 'The best conditions for [catching] the tunny are when it is dark and rainy—you can see the shoals by their phosphorescence' (1977: 1.217. See above, p. 208). Vegetius, *Epitoma rei militaris*, 4.39.

[68] *Naturalis Historia*, 9.62.

[69] Pliny *Naturalis Historia*, 9.60. See also Zimmern 1947: 35.

[70] So ingrained is the concept of a closed sea during the wintertime for Greek sailors that A. Zimmern, while highlighting the fact that manufacture of the purple dye in the Greek Aegean would have necessitated wintertime seafaring, nevertheless went on to note that, 'As the ancients did not go to sea in the winter, it must have been left either to natives or to strangers with regular establishments on the coast' (Zimmern 1947: 35). While Zimmern regarded such 'strangers' on the southern coasts of early Greece as Phoenician traders and settlers, such a view is no longer tenable and recent archaeological research has demonstrated that the manufacture of purple dye from shellfish probably originated on Crete as early as 1750 BC (Stieglitz 1994). Indeed, although Zimmern failed to go into further detail, the 'natives' he notes were carrying out wintertime fishing trips is an apparent reference to local inhabitants of the Peloponnesian coast who, along with the 'strangers', were already putting on to the waters of the Bronze Age Aegean during the wintertime.

of the Mediterranean were engaged in large-scale commercial production of purple dye,[71] fishermen would often have been required to make regular voyages during the winter months in an effort to harvest sufficient quantities of the shellfish. It may also be no coincidence that there has always been a particularly strong association of the production of purple dye with the Levantine seaboard.[72] It has already been seen that the weather and seas in this area were relatively benign when compared to those facing seamen and fishermen operating in other sea regions of the Mediterranean and, as such, may have proved ideal for the harvesting of the shellfish from coastal waters during the wintertime. (See above, pp. 16 ff.) There thus appears little doubt that fishermen in search of *murex* and *purpura* shellfish, like those following the migrating shoals of pelagic fish, were willing to regularly put out on to winter seas.[73] Furthermore, because fishing vessels often play an important role in local transport, communications and trade,[74] then wintertime fishing voyages onto the Graeco-Roman Mediterranean offered the potential for the movement of both people and goods during this season as fishermen, eager to generate additional income, may have engaged in small-scale, localised sea-trade as a financially lucrative sideline with which to supplement their primary means of subsistence. It is also likely that the fishermen of antiquity, like those of more recent centuries, often served as crew aboard merchant or naval ships.[75] If this assumption is correct, then their experience at sailing and navigating in the often trying weather conditions of winter may have been put to good use by the owners and skippers of vessels who were willing to ignore the limits of the seafaring season as set out by writers such as Hesiod and Vegetius as they attempted to generate additional profits over the course of a longer sailing and trading season.

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71 Pliny, for example, notes that the 'best Asiatic purple is at Tyre, the best African is at Meninx and on the Gaetulian coast of the Ocean, the best European in the district of Sparta' (*Naturalis Historia*, 9.60).

72 Large-scale dye production appears to have been in effect at Tel Shikmona from as early as 1200 BC (McGovern & Michel 1985), while mounds of crushed *murex* shells recovered from the site of Sarepta provide a similarly early date (Pritchard 1978).

73 While evidence for wintertime fishing is virtually absent from the Graeco-Roman literature, Heliodorus does make mention of a local lobster fisherman putting out to sea during the winter period (*Aethiopica*, 5.17).

74 E.g. Bintliff 1977: 2.559; Hunger 1976; McCormick 2001: 266.

75 See, for example, the manner in which English fishermen of the seventeenth and eighteenth centuries also regularly served in the merchant marine and Royal Navy (Earle 1998: 7).

The Seasonal Relationship of Seafaring and Agriculture

While the activities of pirates, together with the migratory patterns of some fish stocks and the harvesting requirements of purple-bearing shellfish, may have induced many Graeco-Roman mariners and fishermen to remain active on winter seas, the seasonality of ancient agriculture also raises highly important questions concerning the maritime calendar of antiquity. The sailing season of the ancient Mediterranean certainly appears to have been in direct conflict with the agricultural calendar of the region and, with summer the busiest time of the year for both seafaring and farming, it is difficult to make the case for a seasonal labour-force which worked the land in the winter half-year and then pursued maritime occupations during the summertime. In the seasonal cycle of Graeco-Roman agriculture, the months of summer were among the most demanding of the year when the labour-force was required to harvest and process the grain crop. Writing during the Late Roman Republic, Varro therefore advised that farmers should begin the reaping of the corn between the solstice and the rising of the dog star—a period of twenty-seven days running from June 21 until the middle of July.[76] Almost a century later, Columella also recommended that the harvest should be completed during the second half of July, if not earlier.[77] The agricultural timetable set down by these two Roman authors is still followed by traditional farming communities of the present-day Mediterranean. Research carried out by Paul Halstead and Glynis Jones among the farming community of Arkesini, on the Aegean island of Amorgos, revealed that June and July coincided with the harvesting and processing of the autumn-sown cereal crop; while on the island of Karpathos, June is traditionally known as 'therishis' (reaper) and July as 'alonistis' (thresher).[78] The production of the two other staples of the ancient world—grapes and olives—tended to be slightly later in the year. In warmer regions of the Mediterranean, such as north Africa or southern Spain, grapes were set to mature early in August, while in the slightly cooler climates which typify much of the land of the Mediterranean littoral, the vintage month was September.[79] The olive harvest was expected even later in the

[76] *De Re Rustica*, 1.27.3.
[77] *De Re Rustica*, 2.7.2, 11.2.54.
[78] 1989: 41 f.
[79] White 1970: 229.

year and in Roman Italy it tended to commence in autumn and reach its peak during December.[80]

The seasonal advice of the ancient agronomists, combined with recent ethnological studies, would therefore indicate that the summertime cereal harvest of the Mediterranean coincided with the heart of the Graeco-Roman sailing season, while even during the late summer and autumnal periods the ancient farming cycle demanded that the agricultural workforce remained tied to the land as they carried out the harvesting and processing of essential foodstuffs. Although there were many other important and time consuming tasks which had to be attended to throughout the year,[81] for the majority of farmers and agricultural labourers it was the demanding work of the harvest periods, particularly that of the all-important grain crop, which especially placed farmers under what Halstead and Jones have termed 'time stress'.[82] This appears to be borne out by a study of the marriage cycle of Roman Italy in which the epigraphic evidence indicates marriage ceremonies were far more common in the winter period, with December and January the most favoured months for marriage: with the summer months of June, July and August there came a pronounced down-turn in the number of marriages.[83] The basic motive forces forming this distinctive nuptial cycle have been interpreted as 'economic or occupational, with most marriages taking place during down times following the most labour intensive periods in the annual cycle of agricultural production.'[84] It would therefore appear that the most important point in the agricultural year, when Graeco-Roman cereal farmers around the Mediterranean were faced with greatest 'time-stress', came in mid-summer—the very heart of the ancient sailing season. This seasonal conflict between agriculture and seafaring may well have provided the impetus for the formation of a specialised seafaring class within ancient society; a body of professional, full-time mariners who were divorced from the land and would remain at sea regardless of the demands

80 Columella, *De Res Rusticae* 12.52.1–2; Pliny, *Naturalis Historia* 15.4. Pliny does, however, note that some damp resistant varieties of olives were not picked until the early spring.

81 For example, the sowing of the grain and pulse crop in the autumn and sometimes also in the spring (Hesiod, *Works and Days* 2.383 f.; Columella, *De Re Rustica* 2.10.15) as well as on-going tasks such as ploughing, hoeing, weeding and pruning of the various crops throughout the year.

82 1989: 53.

83 Shaw 1997: 70 f.

84 Shaw 1997: 72.

of the agricultural seasonal cycle, while, during periods of relatively low activity in the farming calendar, this class of full-time mariners might be supplemented by part-time sailors whose primary means of livelihood was derived from agriculture.

CONCLUSION

The Mediterranean, like all seas and oceans, has always been a potentially perilous environment for human endeavours. This was especially the case during the long ages of sail and oar, when even strongly built vessels might quickly find themselves at the mercy of the wind and waves. Even for today's mariners, assisted by modern technology, it remains impossible to ensure that every voyage will be made on flat seas and with favourable winds. From the deepest reaches of prehistory through to the present-day, there have been a multitude of hazards, both natural and man-made, that have threatened mariners: storm-force winds, broiling seas, rock-bound lee shores, the clash of warships, pirate attack. Such dangers have, over the course of each passing century, destroyed many thousands of ships and claimed the lives of innumerable sailors. Nevertheless, with scant regard for past losses, and in spite of the dangers that hang over every voyage, ships built for commerce and for war have persisted in plying their trades across the sea-lanes of the world. However, while there in no doubting the ability of the mariners of late medieval or early modern Europe to sail their ships across the confined seas of the Mediterranean, or to traverse the great oceans of the world all-but regardless of the season, when maritime scholars turn their attention to the ancient world there is a long-standing tendency to assume that Graeco-Roman seamen were both unwilling and unable to confront the hazards of the wintertime Mediterranean and were far more cautious in risking their vessels and their lives on the untameable sea. As such, the seasonal seafaring calendars advised by Hesiod and Vegetius, or legislated for by Gratian, are often regarded as mere reflections of the state of ancient maritime affairs. Given the limited shipbuilding technology and navigational equipment available in antiquity, it is understandable that scholars have long considered the closure of the seas to have been necessary during the wintertime. It is, however, this uncritical acceptance of the ancient literary sources that the previous pages have attempted to call into question, and while most scholars still tend to automatically regard Graeco-Roman shipping as more vulnerable to nature's hazards than were the vessels and seafarers of later ages, this deep-set assumption requires reanalysis.

To a large extent the present academic orthodoxy, with its minimalist outlook on ancient maritime trade and acceptance in the wintertime closure of the sea-lanes, is merely a faithful reflection of the surviving

Graeco-Roman literary evidence. Maritime historians studying the late medieval and modern periods have a wide variety of original source material at their disposal—detailed harbour records, customs ledgers, ship manifests, and launching and hulking dates—which, taken together, clearly illustrate a strong and vibrant maritime economy. There is, however, an absence of similar evidence for ancient seaborne trade, and classical scholars are invariably forced to rely upon the surviving texts penned by the literate elites of Graeco-Roman society; a section of the population that usually had little but the most cursory interest in affairs of the sea, and only a limited knowledge or understanding of maritime practices. Even when ancient writers do comment upon seafaring matters, the texts are liable to come complete with long-standing prejudices firmly opposed to maritime trade and the sailors and merchants who sought their livelihood from the sea.

For most of the literate elites of antiquity, as indeed for the majority of the land-based population of the Graeco-Roman world, the sea was an environment both alien and dangerous; those who gained their employment upon the waves were generally viewed with suspicion and regarded as socially and morally suspect. Plato thus reflects these ancient mores when he writes of the sea as breeding 'shifty and distrustful habits of soul.'[1] It has therefore been noted that, 'Both the Greeks and Romans had a strong social prejudice against traders, who were considered inferior in moral and social terms to landowners. The Romans attempted to legislate against a high level of involvement in maritime trade among their aristocracy, limiting the size of ships that senators could own. It seems that ... such laws were aimed at maintaining the image of a ruling aristocracy which was above the petty affairs of merchants.'[2] While economic and military necessity demanded the states and empires huddled about the shores of the ancient Mediterranean make effective use of the seas, maritime activities nonetheless tended to be regarded with distrust by the landowning gentry who, in word, if not

[1] *Laws*, 4.705a. This image of seaborne traders was to remain in place throughout much of European history. The literate, landed elites continued to regard the sea as 'a socially invisible place; a space so bereft of respectable life that it was like a black hole ... it was undifferentiated space. It lay outside of the world of good manners and social responsibilities. It was also famously the resort of filthy people—low-caste types, like fishermen ... It was a social lavatory, where the dregs landed up.' Theroux (1996: 441), quoting Jonathan Raban.

[2] de Souza 2002: 52. See also Meijer & van Nijf (1992) for a variety of literary references drawn from the literature of both Greece (pp. 3–14) and Rome (pp. 14–20), which emphasise the low opinions held by landowning writers for their contemporaries engaged in trade and maritime activities.

always in deed, championed the primacy of agriculture and the accumulation of wealth derived through ownership and husbandry of land. Indeed, it was possession of land which provided the foundations upon which were raised the economic, political and military structures of ancient society. The literature that survives from antiquity is therefore not only often ignorant of maritime affairs—including the length of the sailing season—but also comes loaded with the socio-economic prejudices of the authors. As such, the surviving texts often present a distorted picture of the true state of seafaring on the Mediterranean throughout antiquity; a picture which is, unfortunately, all too readily accepted by classical scholars. The majority of Graeco-Roman literature tends to view sailors as incompetent and foolish,[3] or as weak-willed and cowardly.[4] Only occasionally are we presented with glimpses of what are probably more accurate reflections of the skill and courage of Graeco-Roman mariners and the seafaring abilities which might have allowed many sailors to remain at sea even during the more hazardous conditions of the wintertime. Sophocles, for example, describes the daring of Greek seafarers who remained on the Mediterranean in the winter months, regardless of the heavy seas which would often be whipped up by the stormy south wind: 'Many things are formidable, and none more formidable than man! He crosses the grey sea beneath [Notos] the winter wind, passing beneath the surges that surround him.'[5]

The lack of understanding or interest that most ancient writers displayed toward seafaring communities and the maritime world as a whole is manifested in the impractical attempts to formulate a single sailing calendar that was applicable to all the seas and coasts of the Mediterranean. Analysis of modern meteorological records thus highlights the striking variations with which different regions of the Mediterranean experience weather that would have impeded or endangered Graeco-Roman seafarers engaging in wintertime voyaging. While certain maritime areas, most notably the Gulf of Lions, can usually expect to receive relatively high frequencies of powerful winds and high waves, mariners voyaging on a sea-region such as the Levantine seaboard would normally have had to face far less trying conditions. Modern meteorological and hydrological data therefore correlate

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[3] E.g. Synesius, *Letters* 4.172; Pliny, *Naturalis Historia*, 2.47.125; Vegetius, *Epitoma rei militaris*, 4.39.

[4] E.g. Acts 27:10; Heliodorus, *Aethiopica*, 5,24.

[5] *Antigone*, 332–337. Notus, the south wind, was usually associated with the winter months, during which time the wind would be expected to blow powerfully across the Aegean and also deliver heavy rainfall to the region (Williams 1999: 90). The south wind therefore provided major navigational difficulties for mariners on the Aegean during the wintertime.

well with observations made in some of the ancient texts which indicate that, even as early as the fifth century BC, seafarers remained active on some regions of the Mediterranean for considerably longer than was the case in other areas. The comments made in the *Demosthenic Corpus* regarding year-round sailing between Egypt and Rhodes, supported by the detailed records of the Elephantine Palimpsest, together with the implications which can be drawn from Pindar's *Isthmian Odes*, all indicate that mariners of the Greek Classical period had sufficient confidence in their navigational skills, and the strength and seaworthiness of their vessels, to overcome the weather and seas expected on this region of the Mediterranean during the winter months. Given the substantial variations in wintertime weather across the length and breadth of the Mediterranean, it would therefore appear unreasonable to continue to accept that the sailing calendar formulated by Vegetius—the most frequently quoted of the shipping calendars surviving from antiquity—provided a seasonal template that was closely followed by Graeco-Roman seafarers regardless of exactly where on the Mediterranean they were sailing.

The other major stumbling block for traditional scholarship's uncritical acceptance of the seasonal limitations placed on maritime activities by the ancient authors is that none of the surviving texts which directly address the duration of the sailing season were written during the Hellenistic or early Roman Imperial periods when shipbuilding technology was at its ancient apogee. Instead, there is a yawning gap spanning more than a thousand years from Hesiod's Archaic period sailing season through to the maritime calendars set down by Gratian and Vegetius during the late Roman Empire. Thus, at the very point when the shell-first, mortice-and-tenon method of ship construction had reached its zenith—producing hulls that were larger, stronger and better able to cope with adverse sea conditions than at any other time in antiquity—there is an absence of textual evidence which refers directly to the sailing season. There are, however, strong indications in the literature dating to the Late Roman Republic and on into the Principate that ships were regularly making voyages during the winter months. Analysis of the final leg of St Paul's voyage to Rome suggests that the apostle departed Malta in January or February, while Suetonius' description of the measures initiated by the emperor Claudius to ensure grain continued to reach Rome during the wintertime also points to continuing sea transport between late autumn and early spring. The reference by Pliny to the excessive greed of merchants willing to venture out onto winter seas in the quest for financial gain also implies year-round sailing during the early Roman Imperial period.

Even during late antiquity, vessels were still operating at times of the year generally assumed to be beyond the normal seasonal range of ancient maritime activities. Despite the regulations set down in Gratian's sailing calendar, there seems little doubt that it was common practice for large ships, such as government chartered grain freighters, to be at sea in the winter months. Smaller vessels were also required to routinely make coastwise voyages at this time of year to ensure that foodstuffs destined for the *annona* were delivered to collection points in the large coastal cities prior to the arrival of spring. Although private contractual agreements between shippers and creditors often contained clauses designed to provide a financial disincentive and so restrain ship-owners and captains from remaining at sea during the wintertime, nevertheless, the ability of ancient ships to sail to India during the stormy conditions of the south-west monsoon clearly emphasises both the sturdiness of Graeco-Roman hull and sail construction, as well as the skills of ancient navigators and seamen. Even with the increased bureaucratic controls which stifled the economy of the late Roman state, double-dated edicts sent from Constantinople to Egypt indicate that it remained common practice for vessels bearing cargoes destined for the *annona* to be at sea during months when scholars have traditionally tended to assume the sea-lanes were devoid of maritime traffic. There may, however, have been a shift in sailing strategies depending on the season. While long-distance voyages, passing across large expanses of open water, were frequently undertaken during the summer, especially by large vessels, mariners at sea in the winter months may have opted instead to make shorter coastwise passages, sailing from one harbour to the next as and when the frequently changing weather patterns permitted.

The influx of large shoals of important migratory fish species, most notably the tunny, into regions of the Mediterranean during the winter months indicates that ancient fishing communities were also likely to have remained active throughout the year and continued to make voyages across winter seas in pursuit of these migratory fish stocks in a manner similar to that still practised by modern generations of fishermen. Similarly, the desire for *murex* and *purpura* also required the Graeco-Roman fishermen engaged in harvesting these valuable shellfish to continue making frequent journeys along the coast during the wintertime. It would also appear that the demands of the agricultural calendar had vast implications for the seasonality of the maritime workforce: the heavy workload of the summertime grain harvest competed for manpower resources with the seafaring communities during the very heart of the sailing season.

Vegetius' oft-quoted list of wintertime hazards facing Graeco-Roman mariners correctly emphasises the difficulties caused by the 'minimal daylight, and long nights, dense cloud-cover, foggy air, and the violence of winds doubled by rain and snow.'[6] Nevertheless, in spite of these dangerous conditions, voyages were taking place across winter seas. The sea-lanes of the northern Indian Ocean witnessed the passage of large numbers of ancient merchant ships at the time of the south-west monsoon—voyages that highlight the ability of ancient mariners to navigate safely and with accuracy across even large expanses of open water, despite the leaden skies, heavy rain and poor visibility which accompany the monsoon. Although there is no doubt that the arrival of the magnetic compass and sea-chart provided Mediterranean seamen of later ages with a huge technical advantage over their ancient forbears, the relatively confined nature of the Mediterranean, together with the detailed local knowledge surely possessed by many Graeco-Roman seamen, allowed skilled mariners to make voyages along the coast with considerable accuracy, even in thick weather. A variety of shore-based structures, most notably beacons and lighthouses, further aided the navigators and pilots of antiquity, many of whom may have been able to sail an accurate course in even the poorest visibility by use of the sounding lead.

Vegetius' sailing calendar would also appear to have been intended for naval commanders operating relatively small late Roman war-galleys. The greater levels of seaworthiness incorporated into the design and construction of round-hulled merchantmen would have given these trading vessels a considerably longer seasonal range than oared war-galleys: indeed, any attempt to adopt a sailing season that applied equally to both ancient warships and sailing merchantmen would appear to be inherently impractical. While Graeco-Roman texts do refer to warships operating on winter seas as a result of pressing military need, experimental voyages of the replicated vessels *Olympias* and *Kyrenia II* have emphasised the very different abilities of warships and merchant vessels to cope with rough seas. Although the large, multi-banked polyreme war-galleys of the Hellenistic period may have increased poor weather performance and extended the naval sailing season, nevertheless, the reliance on oars supplying the primary motive power would have made it exceptionally difficult for any galley to remain on winter seas. As such, the maritime calendar outlined by Hesiod, based upon the small, multi-role galleys of the Archaic period, is also

6 *Epitoma rei militaris*, 4.39.

likely to have been considerably more constrained than was the case in later centuries of antiquity. The seasonal effect of piracy upon seaborne transport may also be an important factor in tempting Graeco-Roman mariners onto wintertime seas: sailors crewing round-hulled, sailing merchantmen may have deliberately chosen to make voyages during the winter months in the knowledge that the lightly built galleys favoured by pirates and other seaborne marauders were unlikely to take to the seas between late autumn and the spring. Even was it the case that pirates and commerce raiders using larger warships were able to extend their operating season—a possibility that is implied by the increased wintertime threat from the Cilician pirates when they began adopting triremes during the Late Roman Republic—nevertheless, the recent trials of *Olympias* would seem to reinforce the opinion of Cicero that, even when operating large, multi-level galleys, piracy was an activity generally confined to the seas of the summer.

In addition to the sturdiness of the ancient shell-first method of hull construction, the design and handling characteristics of the brailed square sail also provided Graeco-Roman mariners with a rig that was well suited to the strong and blustery winds common to parts of the wintertime Mediterranean. Despite the drawbacks inherent in all square-sailed vessels, most notably the difficulty of sailing to windward, it would nevertheless appear to be the case that ships carrying the ancient brailed sail were better suited to wintertime seafaring than the lateen-rigged vessels that dominated the medieval Mediterranean. The ancient brailed rig also compares favourably with the reefed square sail used on late medieval cogs. Indeed, despite the long-held belief that it was the introduction of the cog that finally allowed mariners of the Mediterranean to make regular wintertime voyages, the strength and sturdiness of the hulls of ancient merchant vessels, used in conjunction with the Graeco-Roman square sail, suggest that the sailing ships of antiquity would have proved equally as competent at dealing with wintertime conditions as were the vessels of the Middle Ages.

The probability that large numbers of Graeco-Roman vessels remained at sea throughout the winter months also has profoundly important implications for the wider society and economy of the ancient world. Sailors would have been required to crew vessels plying the shipping lanes of the Mediterranean on a year-round rather than seasonal basis. A large shore-based workforce would also have been necessary were merchant ships to continue trading effectively throughout the wintertime. There would thus have been a constant demand throughout the year for lightermen (*levamentarii*) operating the small harbour craft used in the loading and unloading of ships' cargoes. The presence of *suburrarii* would have been necessary to ensure that ships being loaded for a sea voyage were correctly ballasted.[7] A workforce of stevedores, together with a variety of other dock-workers and labourers, would also have been required year-round in order to facilitate the efficient movement of goods into and out of the holds of merchant vessels. Shipwrights, carpenters, sail-makers, etc., would all have been needed to keep ships properly equipped and serviced, while a great many other occupations would have provided a multitude of goods and services for the sailors, passengers and the harbour-side labourers. Larger port cities, especially those located on major shipping routes that could expect a steady stream of maritime traffic even in the heart of the winter, would have provided employment to a variety of trades and businesses linked to the maritime sector of the ancient economy—not merely during the eight months centred on the summer which are traditionally regarded as comprising the ancient sailing season, but across the course of an entire year. There was undoubtedly a seasonal downturn in seaborne transport and trade from the middle of autumn through to the following spring. Nevertheless, we should question the assumption that the harbour towns of the Graeco-Roman Mediterranean suffered a seasonal dislocation and, during the wintertime, went into 'hibernation to await the coming of the spring.'[8]

Even with a sharp decrease in the volume of shipping during the wintertime, a year-round supply of goods transported by sea would have had immense benefits for the populations of ancient coastal settlements. Ready access to the sea also made it far easier for towns and cities clustered about the shores of the ancient Mediterranean to cope with shortages at this critical point in the year. It has been seen how shipments brought across the seas to Rome during the winter on AD 51 alleviated the threat of famine hanging over the city, and the importance of access to the sea was fully recognised by Gregory of Nazianzus who, writing in the fourth century AD, noted: 'Cities on the sea coast easily endure a shortage … importing by sea the things of which they are short. But we who live far from the sea profit nothing from our surplus, nor can we produce what we are short of, since we are able neither to export what we have nor import what we lack.'[9] The words clearly emphasise the importance that the churchman attached to the ability of coastal towns not only to import food at times of famine, but also for such settlements to exploit maritime links for regular commercial transactions. Access to the sea-lanes of the Mediterranean permitted coastal

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7 See Rougé 1981:69.
8 Casson 1995: 271.
9 *Funebris oratio in laudem Basilii*, 34 f.

cities to contribute to, and benefit from, the wider economy to a extent that was denied to cities and regions located well inland. It is no mere coincidence that the largest cities of antiquity—most notably Athens, Corinth, Alexandria, Antioch, Carthage, Rome and Constantinople—all benefited from maritime trade and had ready access to staples imported from overseas should famine threaten. Maritime commerce thus permitted coastal cities to grow beyond the supportive capacity provided by their immediate hinterland. It was seaborne transport that provided the only effective method of moving large volumes of commodities—especially bulky foodstuffs—over long distances, leading Lionel Casson to note that, 'Sailing ships were the backbone of ancient commerce and travel.'[10] The considerably lower costs involved in transporting cargoes by sea rather than by land or by river has been emphasised by R.P. Duncan-Jones who, drawing on the commercial haulage rates set down in Diocletian's Edict on Maximum Prices, has calculated that, during the late Roman Empire, it was almost five times more cost-efficient to transport goods by sea rather than by river, while it was at least twenty-eight times more economical to move commodities by ship rather than by land.[11] There would thus have been a strong economic incentive on behalf of both private and state shippers to keep the sea-lanes open throughout the winter, despite the greater unpredictability of the weather that threatened vessels with delay or even shipwreck.

It is, however, interesting to speculate on the possible effects that the dangerous sailing conditions of the wintertime may have had on the cost-price ratios of the different transport regimes. According to the traditional model of the ancient sailing season—which envisaged the great majority of shipping as being confined to port for the duration of the winter—it would, of course, have been impossible to transport commodities by sea-going ship during this time of the year. Merchants who were intent on moving goods between late autumn and spring would therefore have been required to shift their operations from the sea towards either river- or land-based methods of transportation.[12] However, while ancient writers highlight the importance of

[10] 1951: 136. While older scholarship has tended to downplay the role of maritime transport across the ancient Mediterranean (e.g. Finley 1985: 199; Hopkins 1983: 105; Jones 1964: 843; 1974: 248), more recent studies have emphasised the importance of Graeco-Roman seaborne commerce to the wider economy (e.g. Horden & Purcell 2000: 143 f.).

[11] 1974: 368. See also Greene 1986: 39 f.

[12] This seasonally shifting nature of ancient transport has never been analysed in any detail and only Ray Laurence has stressed how the period of the *mare clausum* would have provided a seasonal impetus for the movement of goods and people by land rather than by sea: 'the availability of sea transport would have been affected by the weather and

roads as economic arteries—at least over short distances[13]—and the highways constructed by the Romans certainly provided overland routes that allowed for year-round movement of goods and people, the great majority of ancient roads were generally of poor quality. The rugged and mountainous nature of many of the lands surrounding the Mediterranean would also have prevented fast and effective transport by road, inhibiting the long-distance movement of commodities and people by land.[14] There is no doubt that rivers were used as transport links throughout antiquity; Strabo, for example, draws attention to the importance of the river systems for the movement of commodities across Gaul during the Roman Principate.[15] At large harbour cities such as Ostia, located on the banks of the navigable Tiber, there was thus a profusion of river boats and barges designed to carry goods upstream to Rome.[16] Furthermore, the greatest levels of rainfall in the Mediterranean region generally occur between late autumn and early spring, augmenting the watercourses and making them most suitable for river traffic during the winter months. It has therefore been noted that, 'The navigational season on the river is in conflict with that of the sea.'[17] However, the scarcity of large, navigable rivers flowing into the Mediterranean severely limited the

was considered impractical in winter (from October to April) … Therefore, land transport complemented transportation by sea when the seas did not permit sailing.' (1998: 143). However, while Laurence appears content to adopt the sailing timetable as laid out in Gratian's edict of AD 380, it has already been seen that the seasonal limits placed upon this late Roman maritime calendar are considerably more restrictive than those which would have applied to the vast majority of sailors and sea traders, especially those making voyages during earlier periods of antiquity. (See above, p. 30 f.)

13 Cato, *De Re Rustica*, Bk. 1; Columella, *De Re Rustica*, 1.23; Pliny, *Naturalis Historia*, 17.28. All refer to the need for villas to be located near a good road network to allow the transport of agricultural supplies to the nearest market town. Archaeological research has also emphasised that, in addition to the political and military motives behind their construction, roadways also played an important role in the ancient economy (e.g. Laurence 1998; 1999; Potter 1979: 108).

14 It should, however, be noted that, when setting down the hazards facing seafarers during the wintertime, Vegetius stresses that transport by land was also more problematic during this season (*Epitoma rei militaris*, 4.39).

15 *Geography*, 4.1.2.

16 Casson 1965: 32.

17 Leighton 1972: 127. The effects of this seasonal dichotomy between sea and river are difficult to judge. While some commodities which had initially been shipped to river-mouth towns in the summer were possibly stockpiled until the winter period before being taken upstream, the dual use of small sailing craft such as the *codicariae*—boats carrying an effective spread of sail which were used for both coastal trading and river work (Casson 1965: 39)—may have changed roles depending on the season, fulfilling seaborne operation during the summer half-year and then focusing on riverine duties with the arrival of winter.

opportunities for merchants to take advantage of the wintertime inundations of the watercourses. Save for a number of waterways—most notably the Nile, Po, Tiber, Rhone and Ebro—the rivers which empty into the Mediterranean are unsuited for navigation by any vessels, save for very small, shallow-bottomed craft, severely limiting the scope for Graeco-Roman traders to use riverine networks as an alternative to maritime links during the wintertime. It is instead probable that, although there would have been a seasonal downturn—though never a complete standstill—in maritime commerce during the winter months, the high cost of transport by land would have made it impractical to move goods or people over long distances, while the limited geographical coverage provided by navigable waterways also severely restricted the usefulness of riverine communications. Even during the winter months, movement by sea therefore remained the only effective means of long-distance transport available to merchants and travellers. This was noted by Libanius following his arduous overland journey from Antioch to Constantinople in the winter of AD 336, which left him 'little better than a corpse', and forced the sophist to complete his journey to Athens by sea.[18]

This volume began with the traditional proverb, 'He that will not sail till all dangers are over must never put to sea.'[19] It is fitting that it should be used again at the conclusion because it reminds us of the daring and adventurous spirit required of mariners throughout the ages. For too long we have tended to view the seafarers of antiquity through the tainted lens of the literate elite and, in consequence, have downplayed the technical skills and seafaring abilities of the seamen who plied their dangerous trade on the waters of the Mediterranean. There is thus a need to begin reassessing not only the length of the Graeco-Roman sailing season, but also question many of the other accepted 'facts' of the ancient maritime world bequeathed to us in the texts that have survived from antiquity. While the sophisticated shipbuilding technologies, navigational skills, and high levels of seamanship practised by Graeco-Roman sailors are seldom mentioned in contemporary literature, underwater archaeology has provided new and exciting evidence that is slowly allowing us a clearer understanding of the highly sophisticated and multi-layered skill-sets that were developed by the maritime communities of the ancient Mediterranean.

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18 Libanius, *Autobiography*, 15. Quoted above, p. 45.

19 Apperson 1993: 544.

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ILLUSTRATION SECTION

Fig. 1.1. Vessels arriving at Carthage in AD 373 transporting cargoes of olive oil amphorae. (Table generated from information in Pena 1998: 213 f.)

Date of Arrival at Carthage during AD 373	Name of Shipper	Total Number of Amphorae	Number of Accepted Amphorae	Number of Rejected Amphorae
February 3	Januarius	220	215	5
February 14	Cilinder	216	208	8
February 15	Felix	221	208	13
March 2–5	Repostus	218	210	8
April 11	Ertoriot	208	200	8

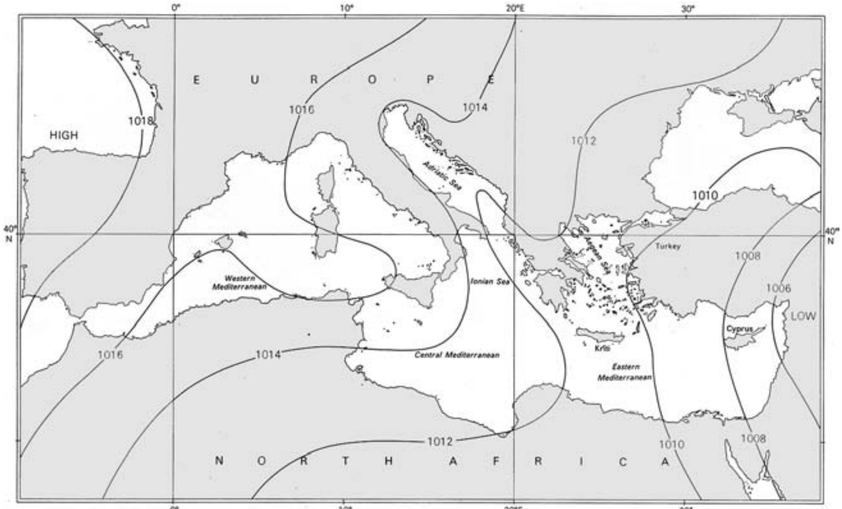

Fig. 2.1a. Pressure systems typical for the Mediterranean region during July. Image: courtesy of the Met. Office. (Mediterranean Pilot Vol. I 1978: diagram 4)

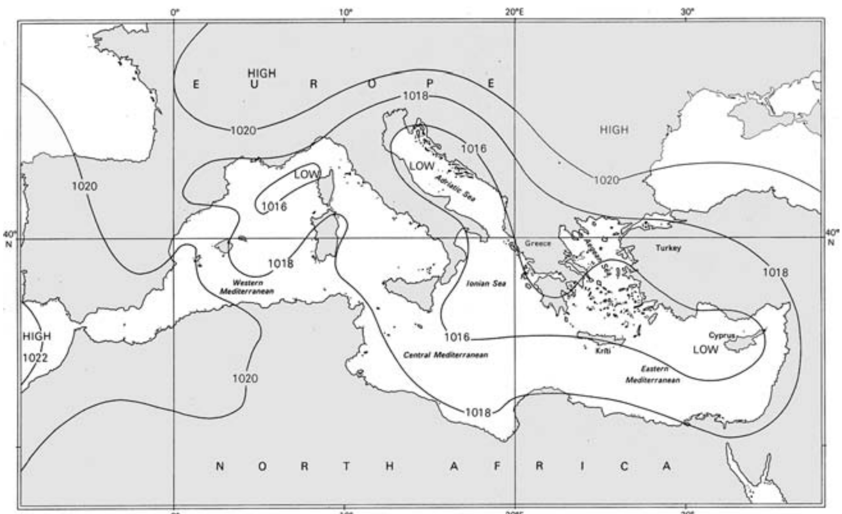

Fig. 2.1b. Pressure systems typical for the Mediterranean region during January. Image: courtesy Met. Office. (Mediterranean Pilot Vol. I 1978: diagram 3)

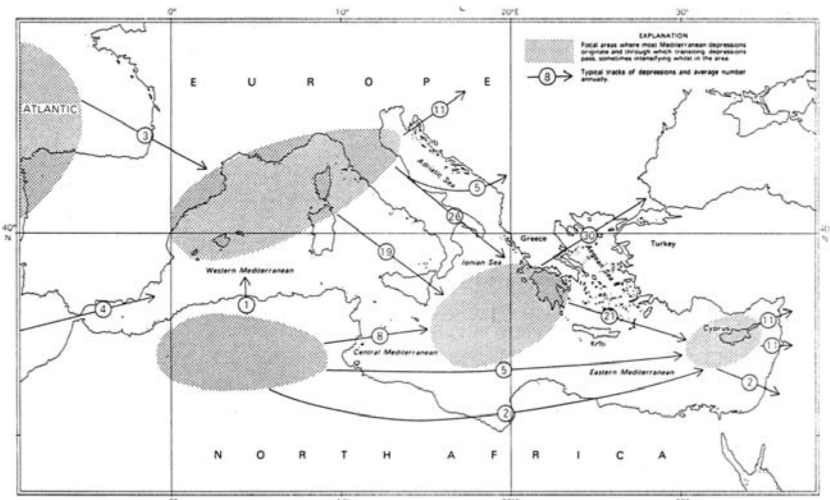

Fig. 2.2. Origins and tracks of depression systems common to the Mediterranean region. Image: courtesy of the Met. Office. (Mediterranean Pilot Vol. III 1988: Fig. 1.177)

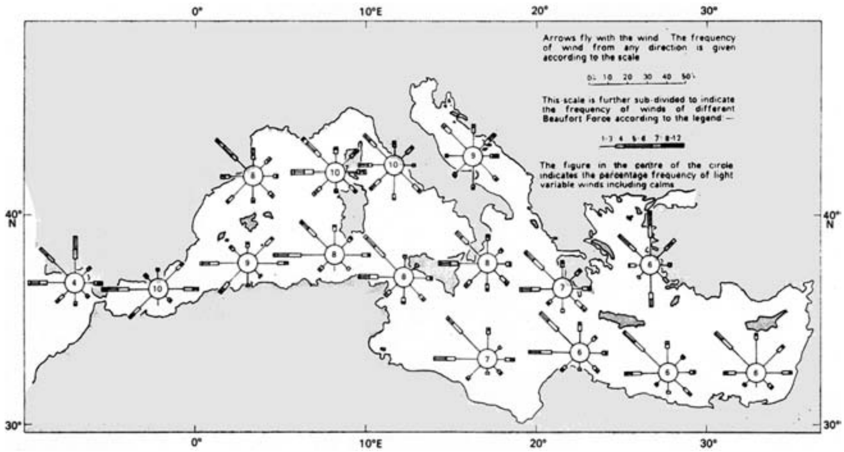

Fig. 2.3a. Wind roses depicting directions and strengths of winds across the Mediterranean typical for the month of April. Image: courtesy of the Met. Office. (Mediterranean Pilot Vol. II 1978: diagram 7)

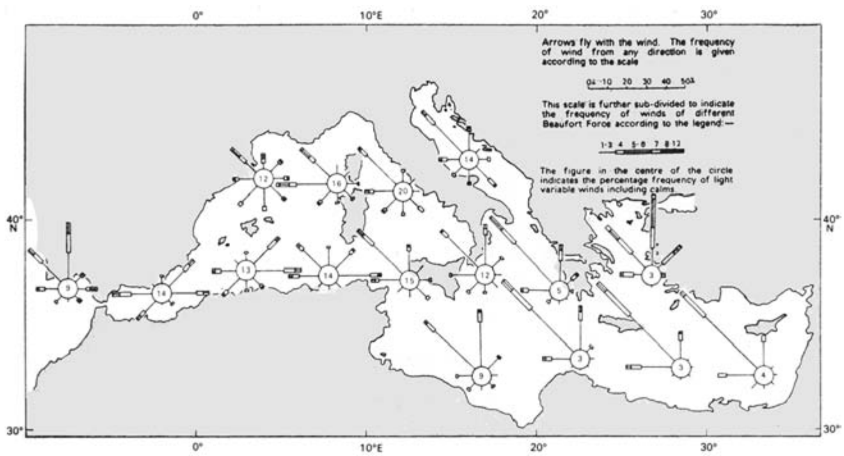

Fig. 2.3b. Wind roses depicting directions and strengths of winds across the Mediterranean typical for the month of July. Image: courtesy of the Met. Office. (Mediterranean Pilot Vol. II 1978: diagram 8)

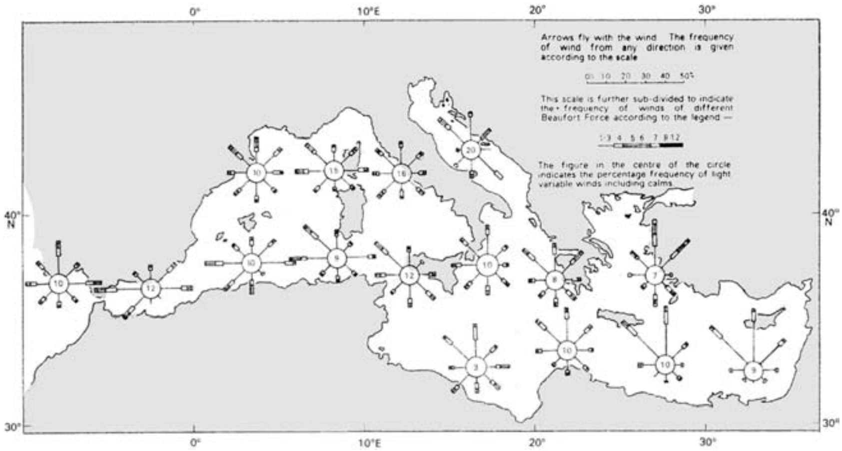

Fig. 2.3c. Wind roses depicting directions and strengths of winds across the Mediterranean typical for the month of October. Image: courtesy of the Met. Office. (Mediterranean Pilot Vol. II 1978: diagram 9)

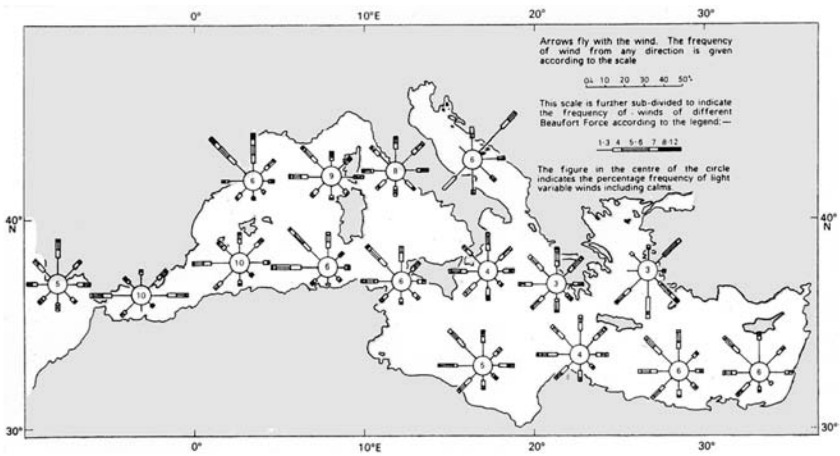

Fig. 2.3d. Wind roses depicting directions and strengths of winds across the Mediterranean typical for the month of January. Image: courtesy of the Met. Office. (Mediterranean Pilot Vol. II 1978: diagram 6)

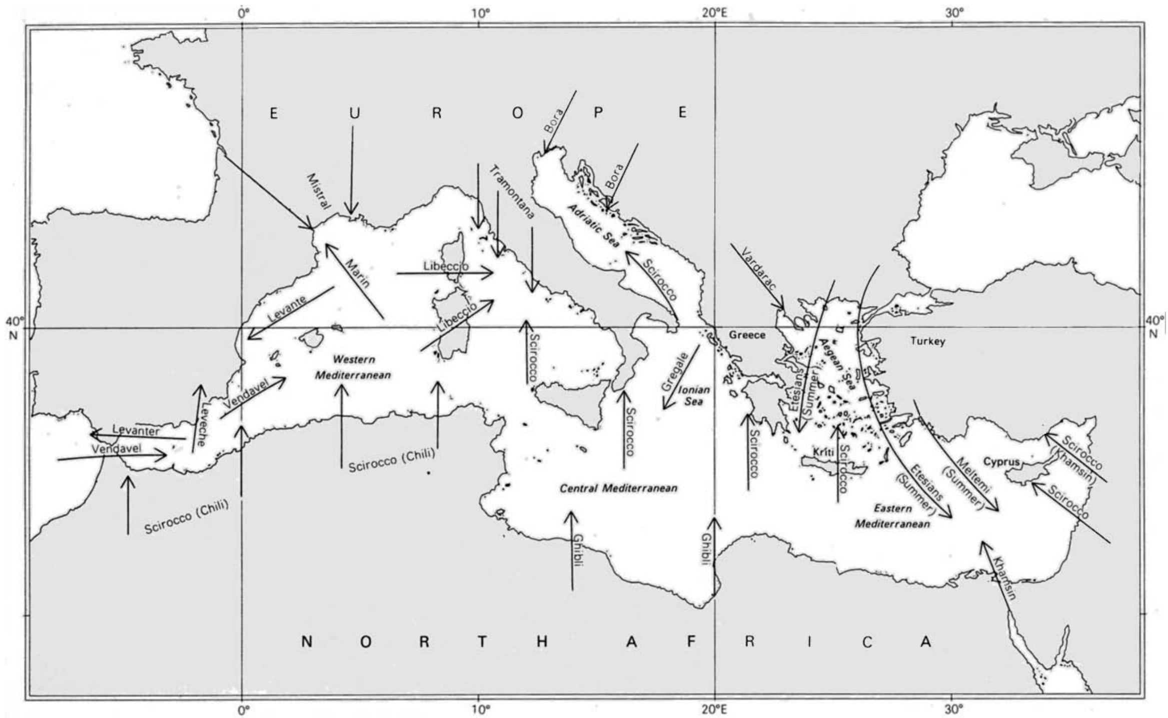

Fig. 2.4. The principal regional winds blowing through the Mediterranean. Image: courtesy of the Met. Office. (Mediterranean Pilot Vol. I 1978: diagram 10)

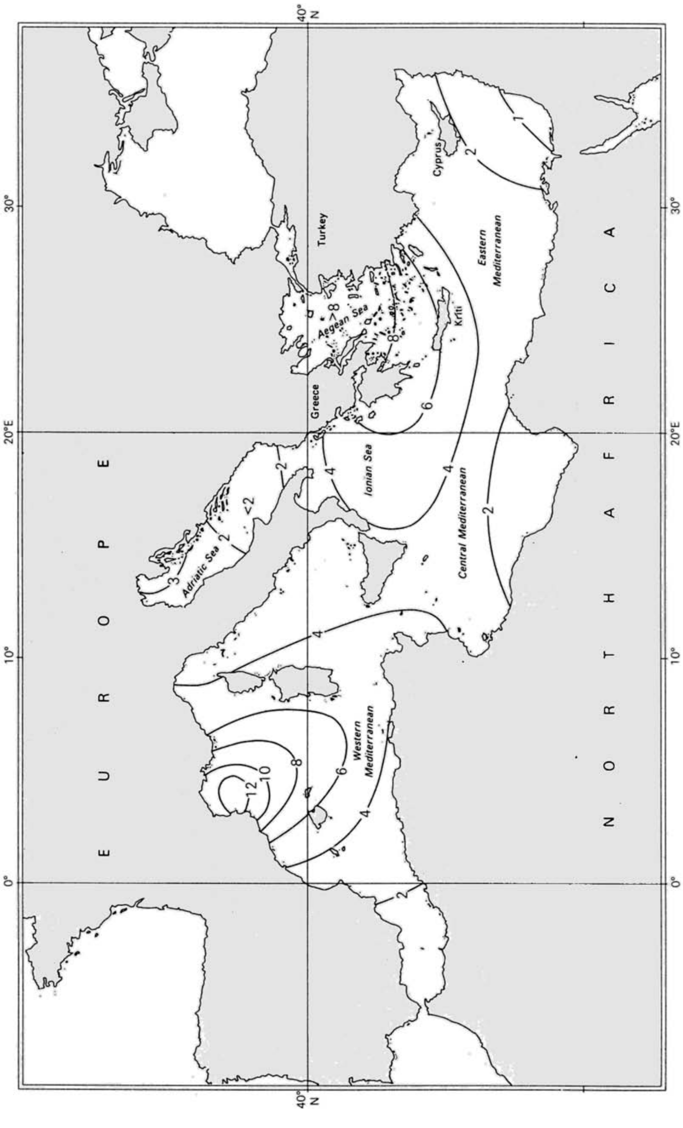

Fig. 2.5a. Percentage frequency of winds measuring Beaufort 7 (strong winds) or greater typically expected across the Mediterranean during the winter (December to February). Image: courtesy of the Met. Office. (Mediterranean Pilot Vol. III 1988: Fig. 1.195.1)

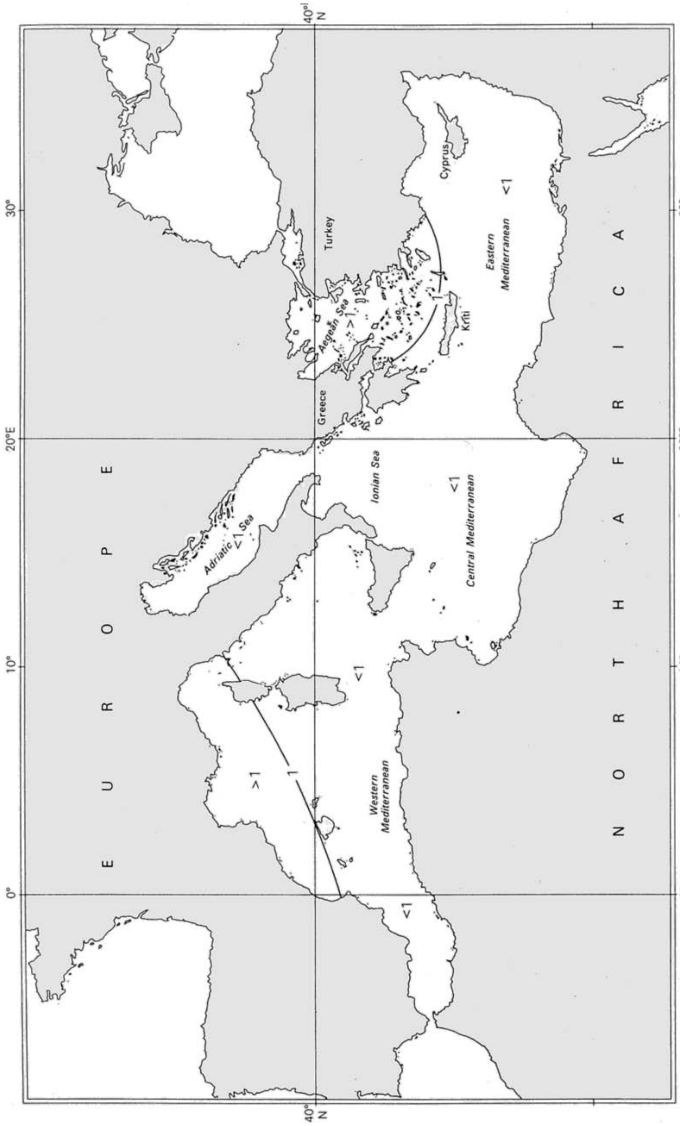

Fig. 2.5b. Percentage frequency of winds measuring Beaufort 7 (strong winds) or greater typically expected across the Mediterranean during the summer (June to August). Image: courtesy of the Met. Office. (Mediterranean Pilot Vol. III 1988: Fig. 1.195.2)

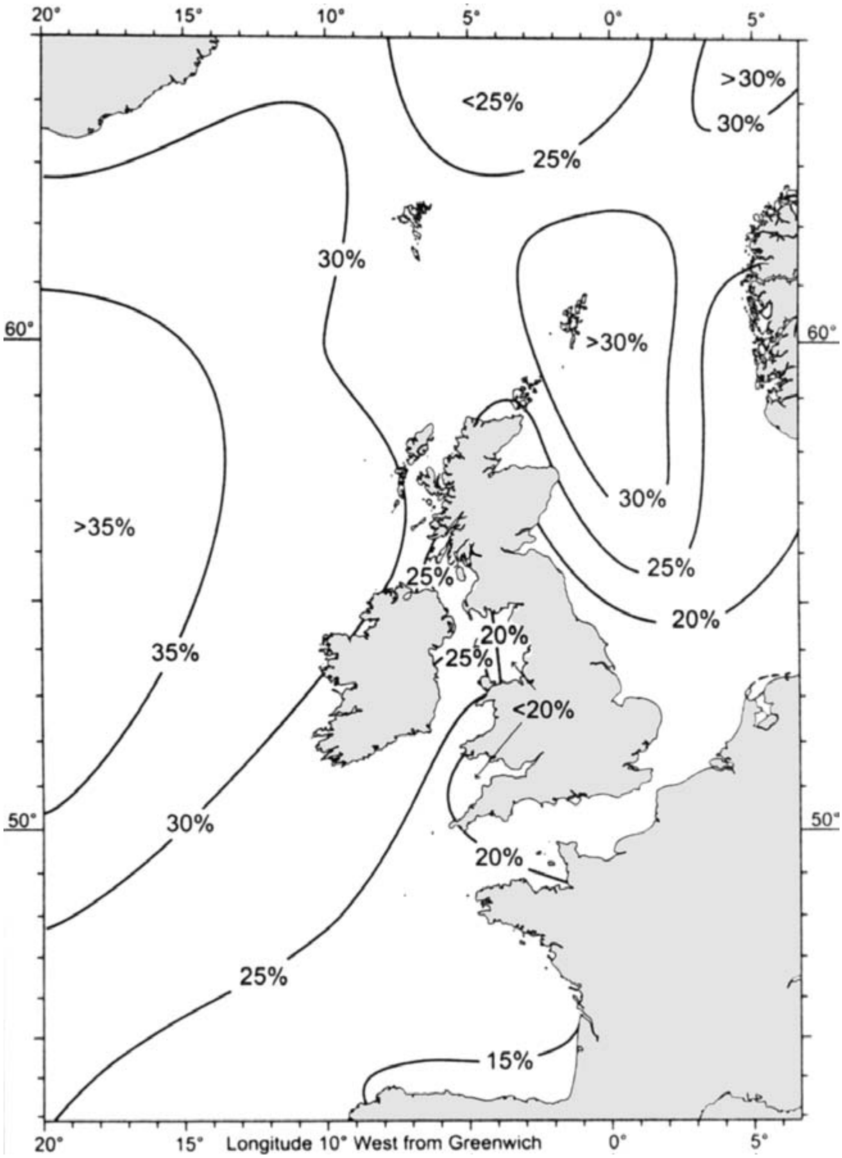

Fig. 2.6a. Percentage frequency of winds measuring Beaufort 7 or greater typically expected across the North Sea and north-east Atlantic during January. Image: courtesy of the Met. Office. (Dover Strait Pilot 1999: Fig. 1.198)

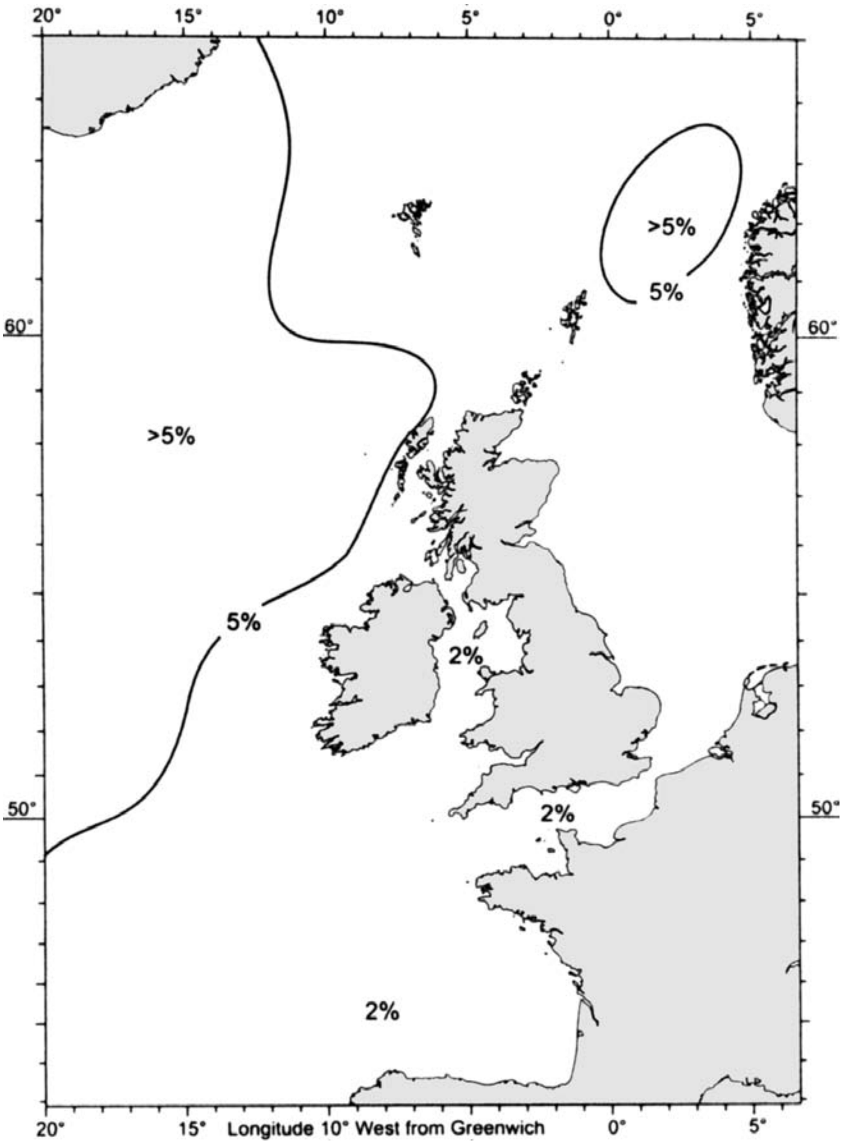

Fig. 2.6b. Percentage frequency of winds measuring Beaufort 7 or greater typically expected in the North Sea and north-east Atlantic typical of July. Image: courtesy of the Met. Office. (Dover Strait Pilot 1999: Fig. 1.198)

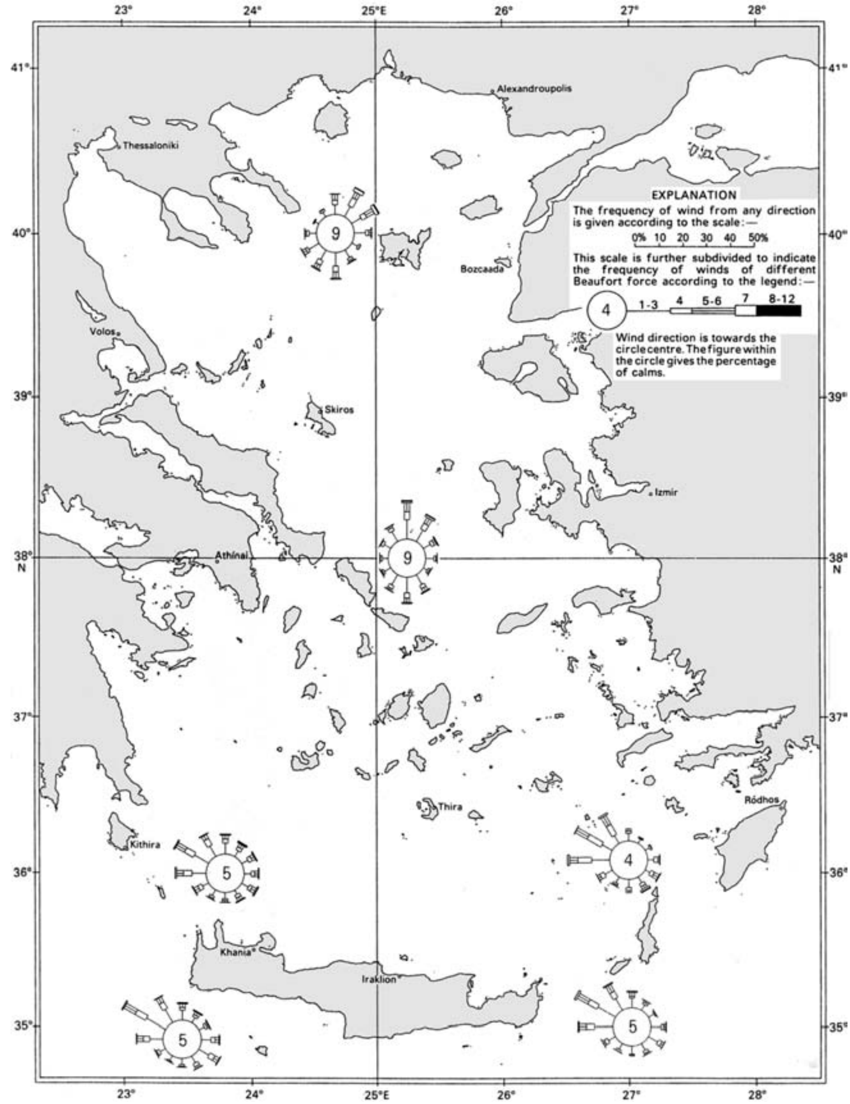

Fig. 2.7a. Wind roses depicting directions and strengths of winds across the Aegean typical of the month of April. Image: courtesy of the Met. Office. (Mediterranean Pilot Vol. IV 2000: Fig. 1.124.2)

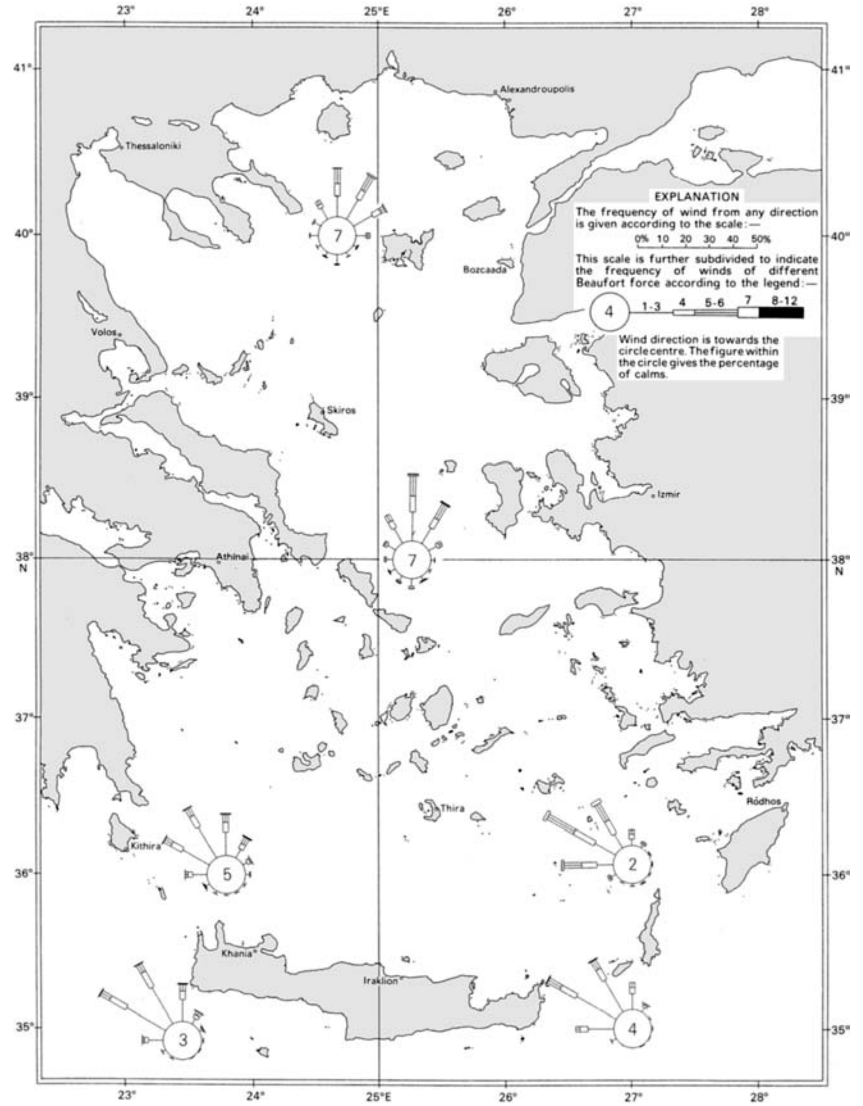

Fig. 2.7b. Wind roses depicting directions and strengths of winds across the Aegean typical of the month of July. Image: courtesy of the Met. Office. (Mediterranean Pilot Vol. IV 2000: Fig. 1.124.3)

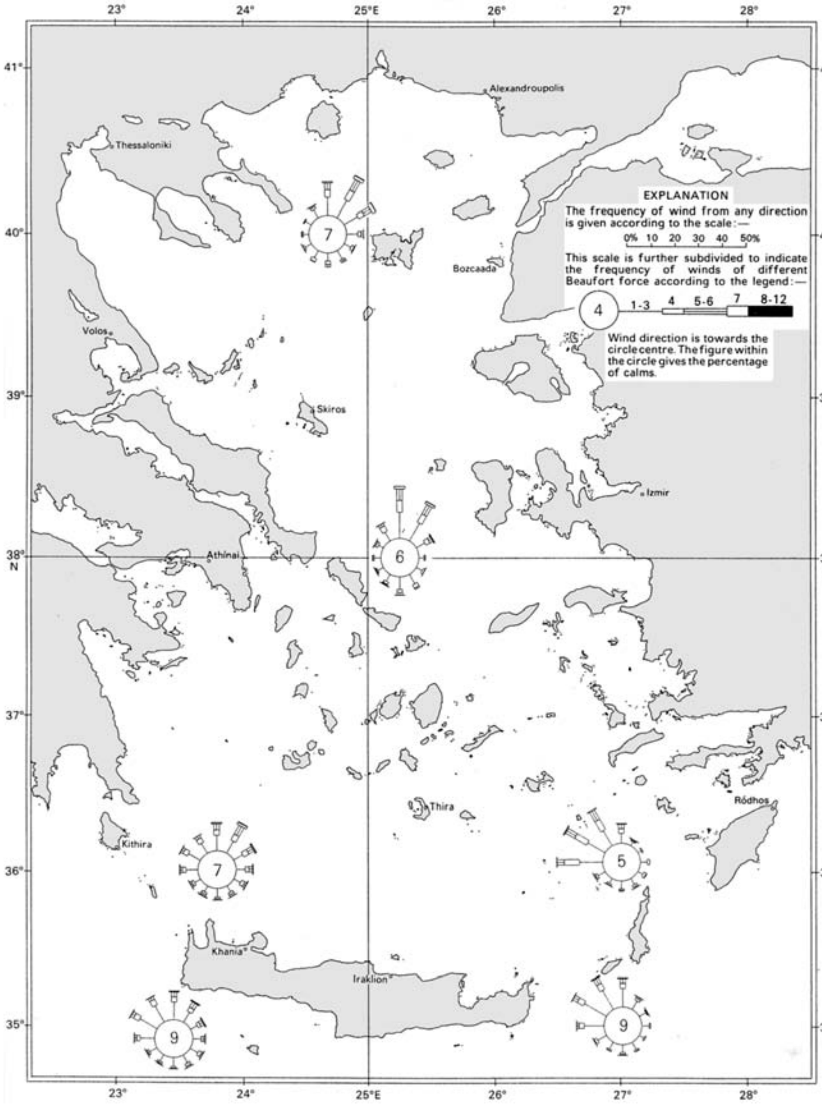

Fig. 2.7c. Wind roses depicting directions and strengths of winds across the Aegean typical of the month of October. Image: courtesy of the Met. Office. (Mediterranean Pilot Vol. IV 2000: Fig. 1.124.4)

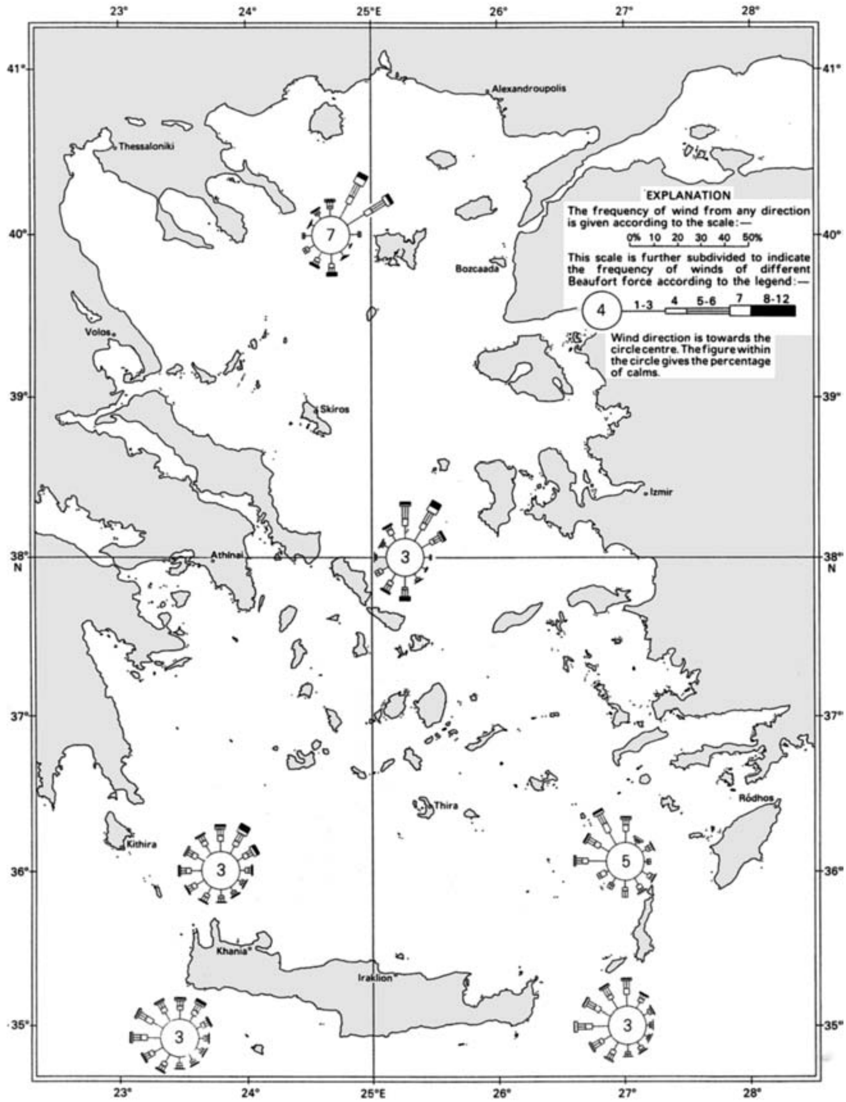

Fig. 2.7d. Wind roses depicting directions and strengths of winds across the Aegean typical of the month of January. Image: courtesy of the Met. Office. (Mediterranean Pilot Vol. IV 2000: Fig. 1.124.1)

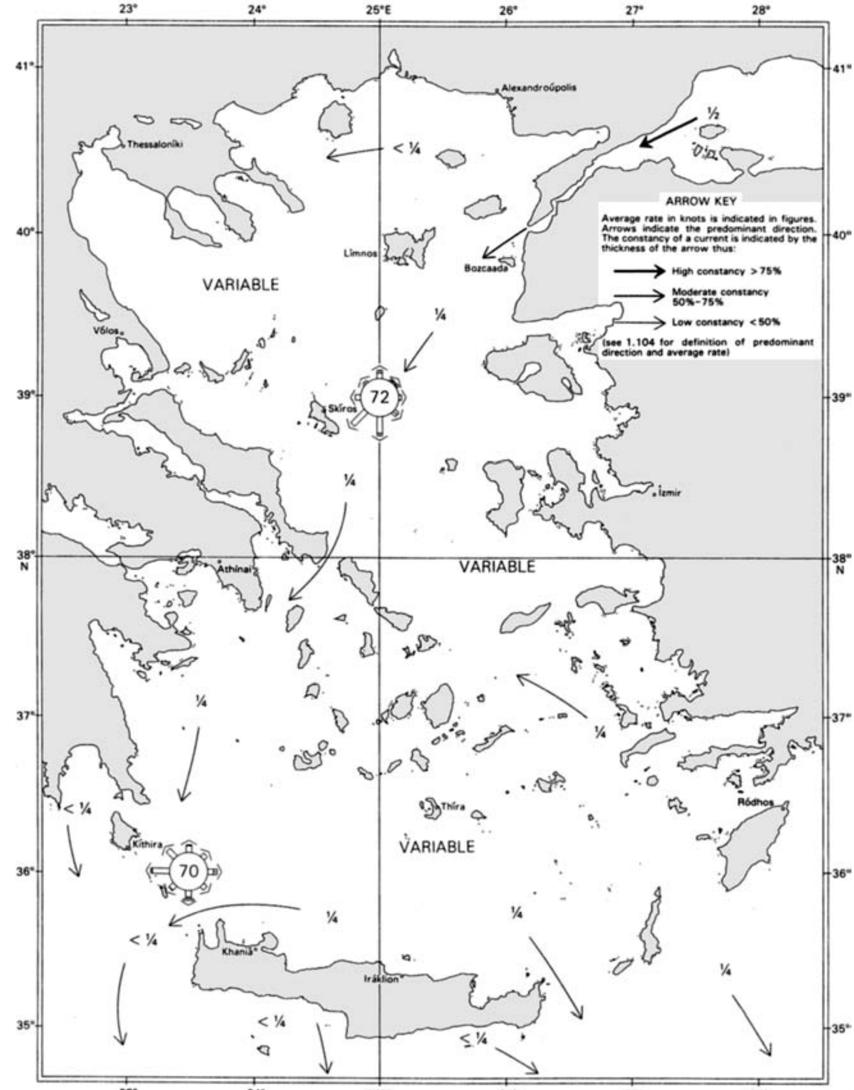

Fig. 2.8a. Sea currents flowing through the Aegean typical of the spring (March to May). Image: courtesy of the Met. Office. (Mediterranean Pilot Vol. IV 2000: Fig. 1.106.1)

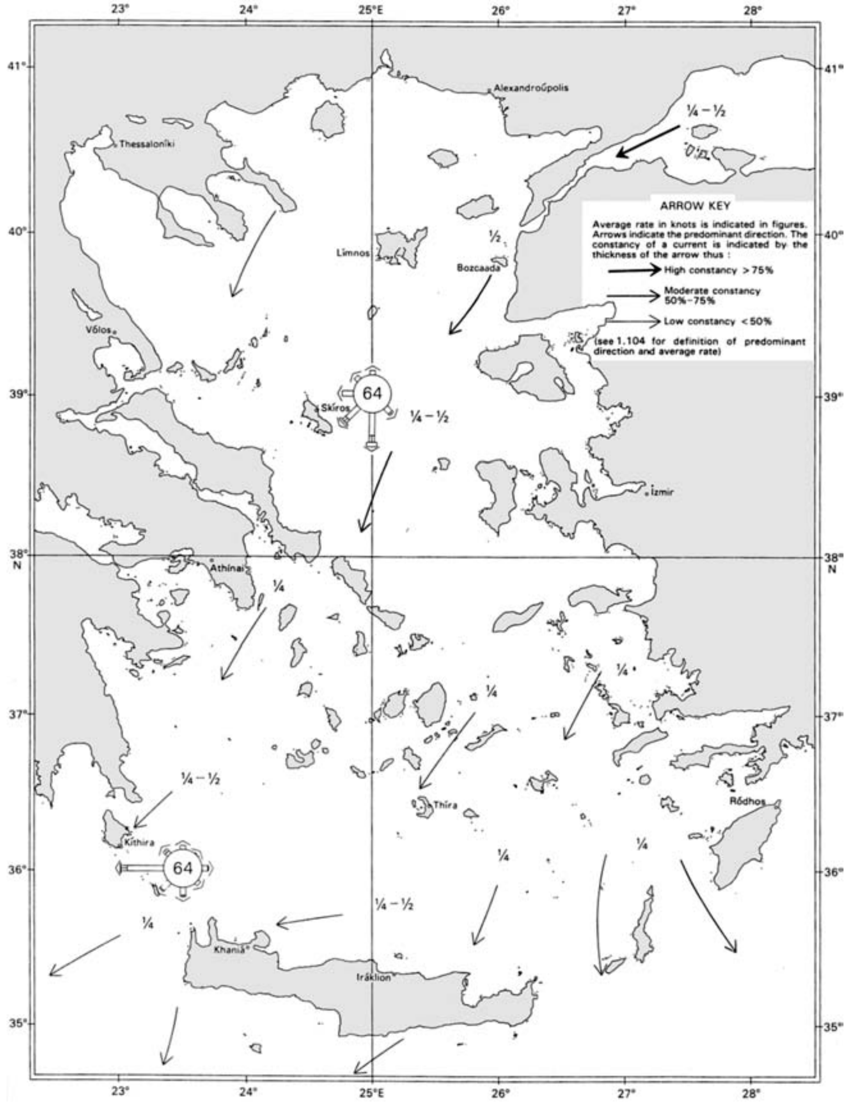

Fig. 2.8b. Sea currents flowing through the Aegean typical of the summer (June to August). Image: courtesy of the Met. Office. (Mediterranean Pilot Vol. IV 2000: Fig. 1.106.2)

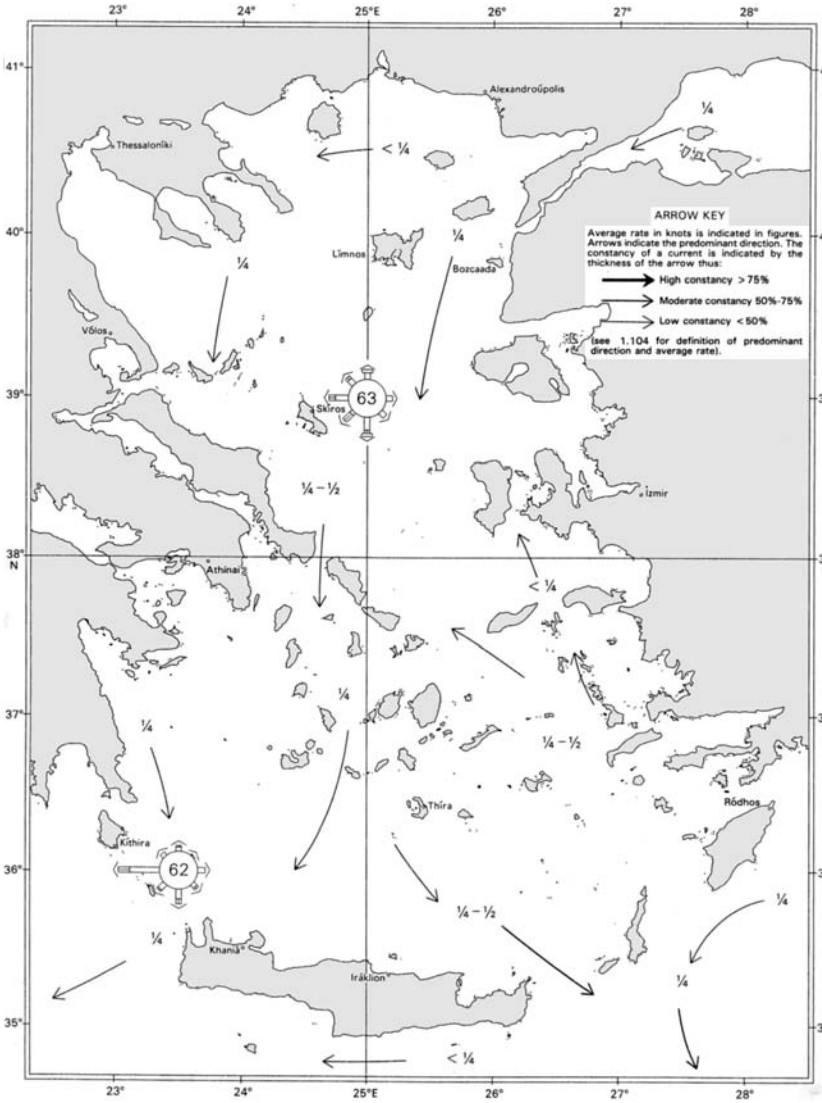

Fig. 2.8c. Sea currents flowing through the Aegean typical of the autumn (September to November). Image: courtesy of the Met. Office. (Mediterranean Pilot Vol. IV 2000: Fig. 1.106.3)

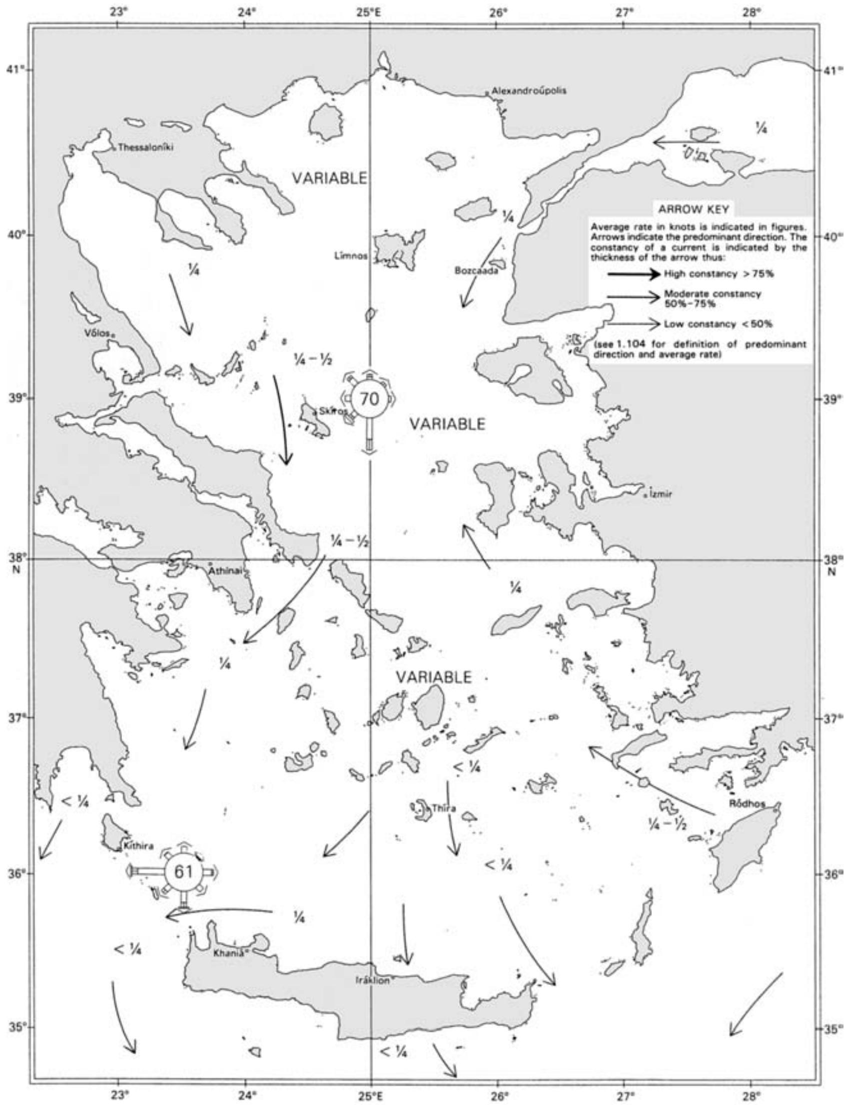

Fig. 2.8d. Sea currents flowing through the Aegean typical of the winter (December to February). Image: courtesy of the Met. Office. (Mediterranean Pilot Vol. IV 2000: Fig. 1.106.4)

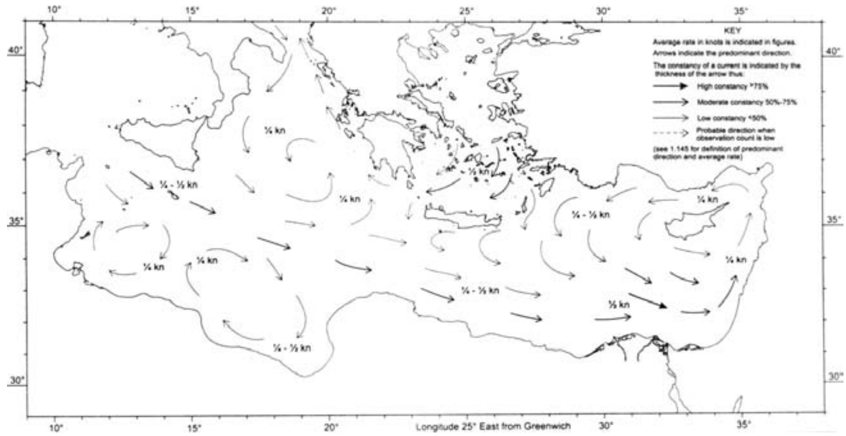

Fig. 2.9a. Sea currents flowing through the eastern and central Mediterranean typical of the summer (June to August). Image: courtesy of the Met. Office. (Mediterranean Pilot Vol. V 1999: Fig. 1.145.2)

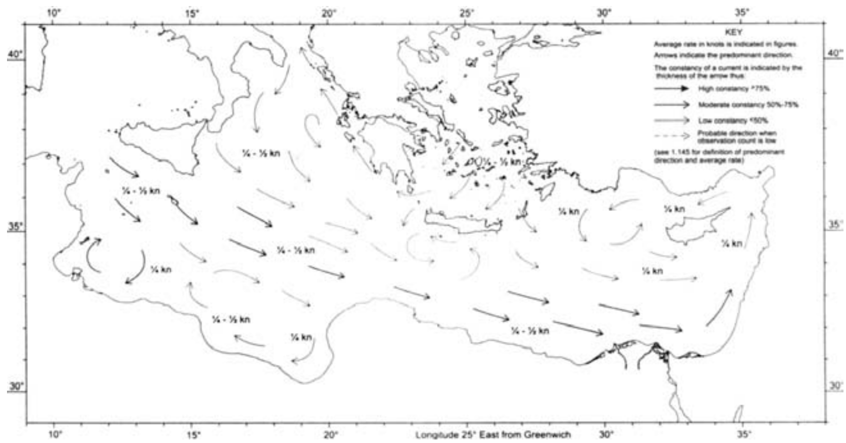

Fig. 2.9b. Sea currents flowing through the eastern and central Mediterranean typical of the winter (December to February). Image: courtesy of the Met. Office. (Mediterranean Pilot Vol. V 1999: Fig. 1.145.1)

Fig. 2.10. The Beaufort Scale, designed to allow sailors to gauge the force of the wind by reference to its effect on the surface of the sea.

Force	Wind speed (m/s)	Wind speed (knots)	Average wave height	Maximium wave height	Wind description	Sea state
0	0–0.2	< 1	Flat	Flat	Calm	Glassy smooth
1	0.3–1.5	1–3	0.1	0.1	Light Air	Ripples
2	1.6–3.3	4–6	0.2	0.3	Light Breeze	Small wavelets
3	3.4–5.4	7–10	0.6	1.0	Gentle Breeze	Large wavelets
4	5.5–7.9	11–16	1.0	1.5	Moderate Breeze	Small waves dotted with whitecaps
5	8.0–10.7	17–21	2.0	2.5	Fresh Breeze	Moderate waves covered with whitecaps and spray
6	10.8–13.8	22–27	3.0	4.0	Strong Breeze	Large foaming waves and more spray
7	13.9–17.1	28–33	4.0	5.5	Near Gale	Large waves creating streaky foam
8	17.2–20.7	34–40	5.5	7.5	Gale	High waves with crests forming spindrift
9	20.8–24.4	41–47	7.0	10.0	Severe Gale	High waves with rolling crests and dense streaks of foam
10	24.5–28.4	48–55	9.0	12.5	Storm	Very high waves with dangerous, overhanging crests
11	28.5–32.6	56–63	11.5	16.0	Violent Storm	Extremely high breaking waves; sea white with foam and spray
12	32.7+	64+	14+	16+	Hurricane	Huge breaking waves; visibility seriously impaired by spray

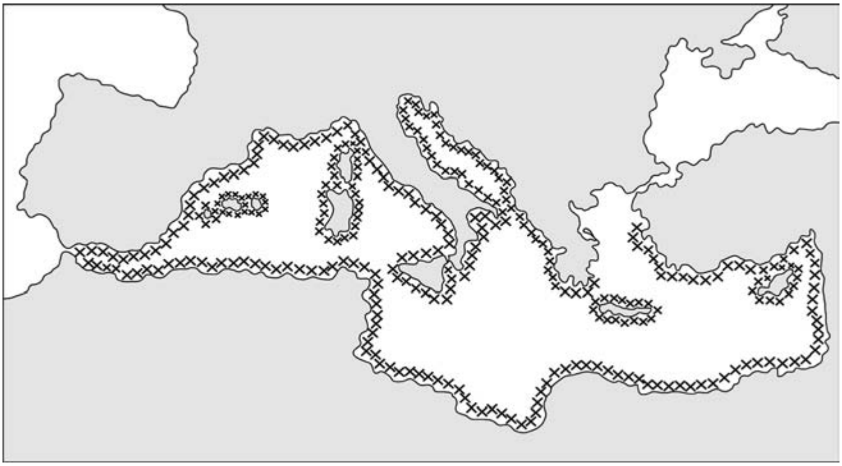

Fig. 2.11a. Records from coastal waters where waves that are equal to, or greater than, 8 feet (2.44 m) in height are expected to occur with a frequency of 3 percent or greater in at least 2 quarters of the year. (Redrawn from original charts in Meisburger 1962: 6)

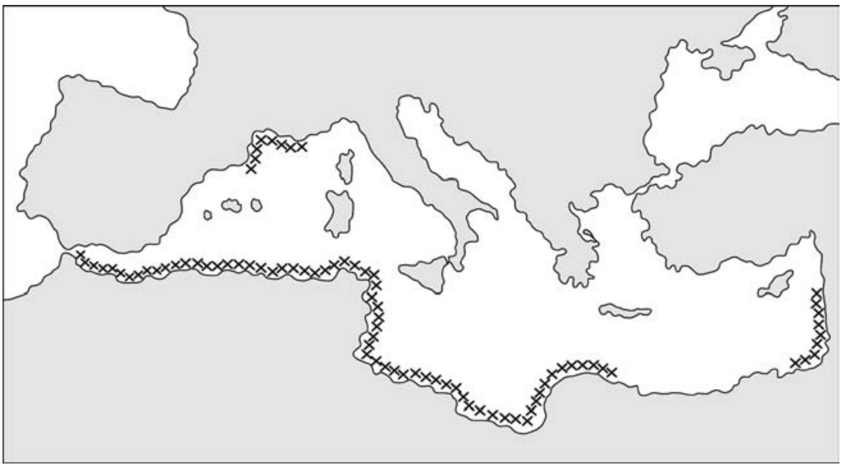

Fig. 2.11b. Records from coastal waters where waves that are equal to, or greater than, 8 feet (2.4 m) in height are expected to occur with a frequency of 7 percent or greater in at least 2 quarters of the year. (Redrawn from original charts in Meisburger 1962: 7)

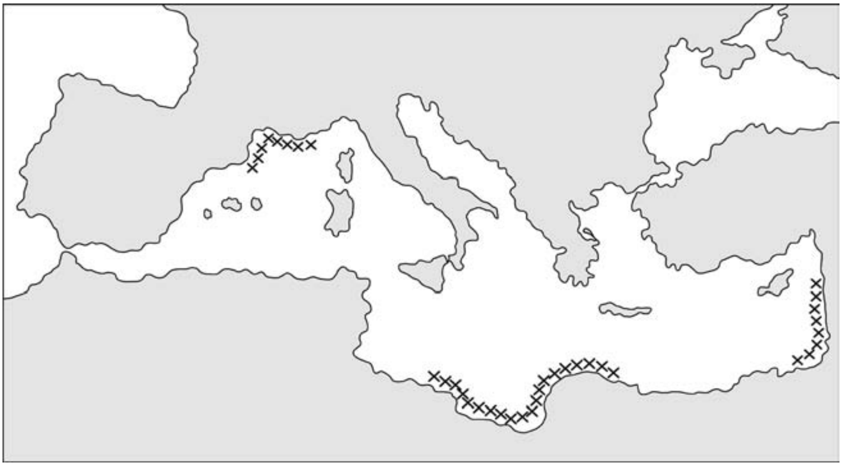

Fig. 2.11c. Records from coastal waters where waves that are equal to, or greater than, 12 feet (3.6 m) in height are expected to occur with a frequency of 3 percent or greater in at least 2 quarters of the year. (Redrawn from original charts in Meisburger 1962: 14)

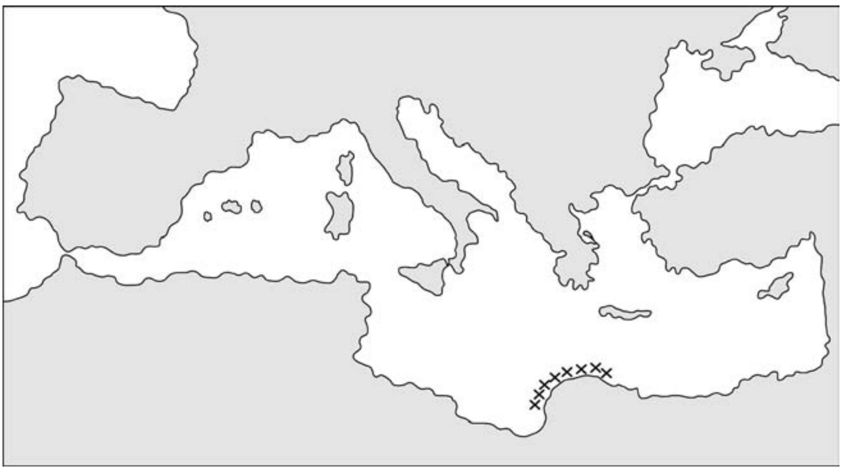

Fig. 2.11d. Records from coastal waters where waves that are equal to, or greater than, 14 feet (4.3 m) in height are expected to occur with a frequency of 3 percent or greater in at least 2 quarters of the year. (Redrawn from original charts in Meisburger 1962: 19)

Fig. 2.12. Changing length of daylight—sunrise to sunset—at a variety of locations in the Mediterranean and Indian Ocean over the course of a year. Figures calculated for the 15th of each month. Table created from data obtained on the website of the U.S. Naval Observatory Astronomical Applications Dept. http://aa.usno.navy.mil/AA/data/docs/RS_OneYear.html

Latitude	*Longitude*	*Location*	*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
45' 39' N	13' 46' E	Trieste	09:04	10:23	11:54	13:33	14:55	15:41	15:21	14:07	12:33	10:57	09:29	08:41
41' 48' N	12' 36' E	Rome	09:22	10:36	11:55	13:22	14:33	15:12	14:55	13:51	12:29	11:06	09:50	09:10
38' 00' N	23' 44' E	Athens	09:49	10:47	11:56	13:11	14:19	14:47	14:42	13:38	12:26	11:13	10:07	09:33
33' 52' N	35' 30' E	Beirut	10:08	10:58	11:58	13:02	13:55	14:23	14:11	13:24	12:23	11:21	10:25	09:55
31' 02' N	29' 09' E	Alexandria	10:21	11:05	11:59	12:56	13:44	14:10	13:58	13:17	12:21	11:26	10:35	10:09
24' 50' N	66' 59' E	Karachi	10:45	11:19	12:00	12:44	13:21	13:41	13:32	13:00	12:18	11:35	10:57	10:37
18' 54' N	72' 49' E	Bombay	11:06	11:32	12:01	12:34	13:02	13:16	13:09	12:36	12:15	11:43	11:15	11:00
08' 05' N	77' 33' E	C. Comorin	11:42	11:52	12:04	12:18	12:30	12:35	12:33	12:23	12:10	11:57	11:45	11:40

Fig. 2.13. Changing length of daylight—dawn to dusk—at a variety of locations in the Mediterranean and Indian Ocean over the course of a year. Figures calculated for the 15th of each month. Table created from data obtained on the website of the U.S. Naval Observatory Astronomical Applications Dept. http://aa.usno.navy.mil/AA/data/docs/RS_OneYear.html

Latitude	*Longitude*	*Location*	*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
45' 39' N	13' 46' E	Trieste	10:11	11:23	12:53	14:35	16:05	16:57	16:33	15:12	13:33	11:57	10:34	09:51
41' 48' N	12' 36' E	Rome	10:30	11:32	12:50	14:20	15:37	16:21	16:01	14:51	13:25	12:02	10:50	10:13
38' 00' N	23' 44' E	Athens	10:56	11:41	12:49	14:06	15:13	15:51	15:34	14:34	13:19	12:07	11:03	10:32
33' 52' N	35' 30' E	Beirut	11:03	11:49	12:47	13:53	14:51	15:22	15:08	14:18	13:13	12:11	11:12	10:50
31' 02' N	29' 09' E	Alexandria	11:13	11:54	12:47	13:46	14:17	15:04	14:52	14:07	13:10	12:14	11:26	11:02
24' 50' N	66' 59' E	Karachi	11:35	12:05	12:46	13:31	14:11	14:32	14:22	13:48	13:04	12:21	11:45	11:26
18' 54' N	72' 49' E	Bombay	11:54	12:16	12:45	13:19	13:48	14:04	13:57	13:32	12:59	12:27	12:01	11:48
08' 05' N	77' 33' E	C. Comorin	12:26	12:34	12:46	13:00	13:14	13:21	13:18	13:06	12:52	12:39	12:29	12:24

Fig. 2.14. Variation in the number of hours of daylight from mid-summer to mid-winter at a variety of locations in the Mediterranean. Table created from data obtained on the website of the U.S. Naval Observatory Astronomical Applications Dept. http://aa.usno.navy.mil/AA/data/docs/RS_OneYear.html

Location	Trieste	Rome	Athens	Beirut	Alexandria
Length of day, 21st December	08:41	09:08	09:31	09:54	10:08
Length of day, 21st June	15:42	15:13	14:48	14:24	14:10
Variation between mid-winter's day and mid-summer's day	07:01	06:06	05:17	04:30	04:02

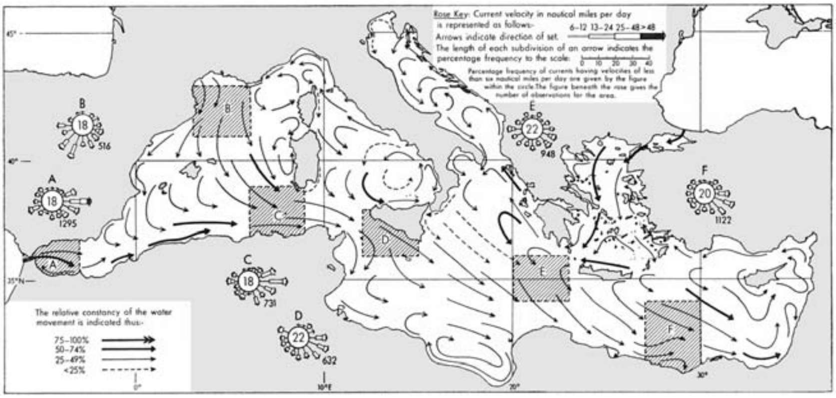

Fig. 2.15a. Direction and constancy of sea currents typical of the Mediterranean during January. Image: courtesy of the Met. Office. (Mediterranean Pilot Vol. I 1978: diagram 1)

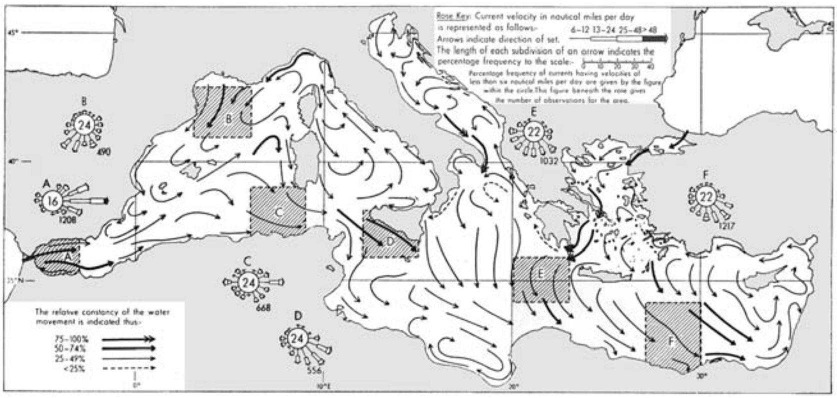

Fig. 2.15b. Direction and constancy of sea currents typical of the Mediterranean during July. Image: courtesy of the Met. Office. (Mediterranean Pilot Vol. I 1978: diagram 2)

Fig. 3.1. A traditional wooden 'skeleton-first' fishing boat being built on the beach at Petite-Anse in Cap-Haitien, Haiti. As can be clearly seen, the frame or 'skeleton' of the vessel is erected first. Once in position, the planking of the hull is then nailed directly to the ribs of the vessel. Photo: Rémi Kaupp.

Fig. 3.2. The ancient shell-first method of ship construction. A shipwright cutting mortice holes into a garboard on a trial section of a replicated Classical trireme. Picture courtesy of Malcolm Adkins.

Fig. 3.3. Shell-first ship construction. Trial section of a replicated Classical trireme depicting tenons positioned in their mortice holes below and awaiting to be guided into those of the planking above. Hardwood pegs, which provide additional strength to the mortice-and-tenons, can also be seen, locking the tenons in place. Picture courtesy of Malcolm Adkins.

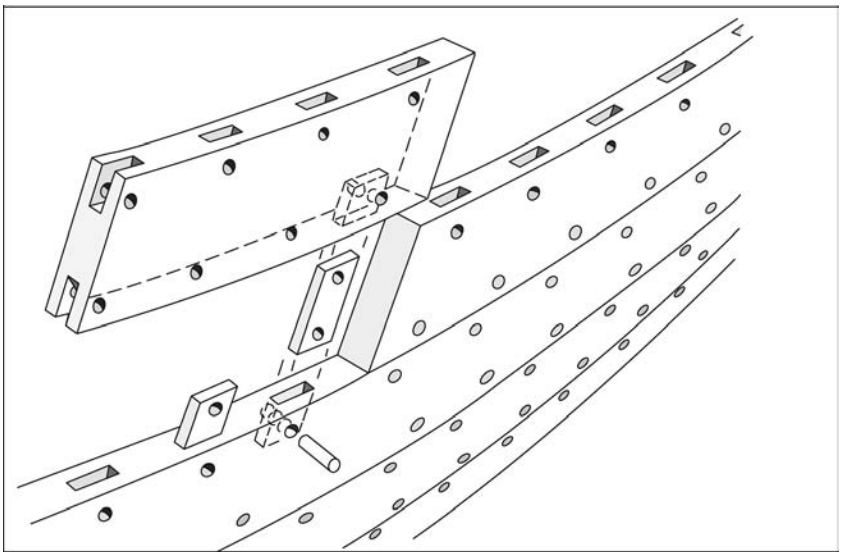

Fig. 3.4. Diagram explaining the shell-first ship construction technique in which mortice-and-tenons are pegged in position to secure the hull planking of ancient vessels. (Redrawn from McGrail 1996: 76 Fig. 8)

Fig. 3.5. Wreck of the fourth century BC merchantman excavated off the Cypriot coast in the late 1960s and now on display in Kyrenia Shipwreck Museum, Kyrenia, North Cyprus. Photo: Anja Leidel.

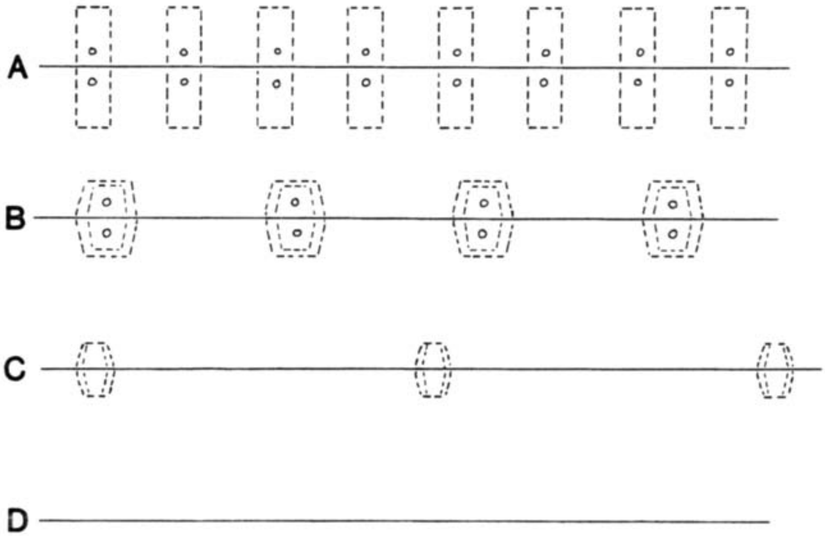

Fig. 3.6. The transition in the spacing of mortice-and-tenons used in shell-first ship construction throughout antiquity and the medieval period. (A) The fourth century BC shipwreck discovered off Kyrenia; (B) the fourth century AD Yassi Ada shipwreck; (C) the seventh century AD Yassi Ada shipwreck; (D) the eleventh century AD Serçe Limani shipwreck. (Redrawn from Steffy 1994: 84, Fig. 4–8)

Fig. 3.7. The *Kyrenia II*, a replica of a fourth century BC merchant vessel. Courtesy of the Kyrenia Ship Project.

Fig. 3.8. Three Roman war-galleys operating on the Danube: a double-banked vessel in the foreground and at the rear, while between them is a larger warship with oars at three levels, very probably a trireme. Cast taken from Trajan's column (erected AD 106–113). Museo della Civiltà Romana, Rome. Photo: James Beresford.

Fig. 3.9. The replicated trireme *Olympias* under oars during sea-trials off Poros in 1988. Photo: Courtesy of The Trireme Trust.

Fig. 3.10. Relief of a Roman square-sailed merchantman of the third century AD. Cast in the Museo della Civiltà Romana, Rome. Photo: James Beresford.

Fig. 3.11. Relief depicting sailors on the yard while furling the mainsail of a merchant vessel as it enters port. From a tombstone at the Herculaneum Gate, Pompeii, probably dating to the mid-first century AD. Photo: James Beresford.

Fig. 3.12. A modern lateen-rigged fishing vessel off the coast of Unguja (Zanzibar Island), Tanzania. Photo: Geof Wilson.

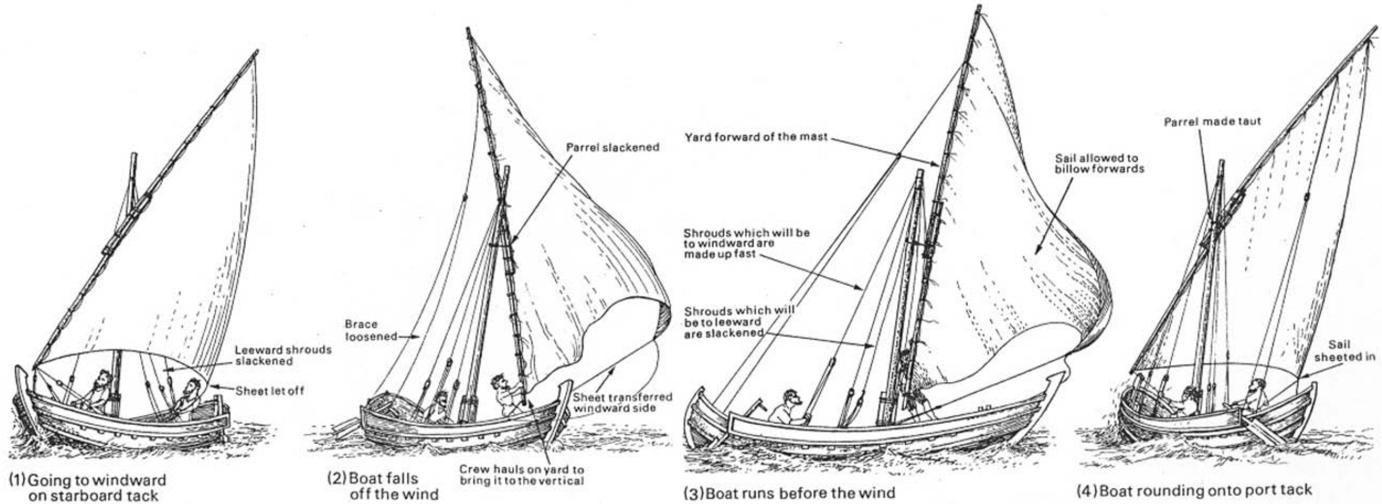

Fig. 3.13. The difficult procedure involved in 'wearing-round' a lateen-rigged vessel. Image drawn by Denys Baker (following Landstrom) to illustrate Pryor 1994: 67. Efforts to trace the original copyright holder have failed.

Fig. 3.14. The grave stele of Alexander of Miletus, probably dating to the second century AD, and discovered at the Piraeus. The stele appears to depict a lateen-rigged vessel with a long and gracefully curving yard above the heads of the sailors. Courtesy of the Archaeological Museum of Piraeus.

Fig. 3.15. Relief dating to the second century BC depicting a naked sailor fitting the heel of a sprit into the snotter at the base of the mast. Courtesy of the Archaeological Museum of Thasos, 18th Ephorate of Prehistoric and Classical Antiquities.

Fig. 3.16. Three sailors operating a small sprit-rigged Roman vessel as it enters the harbour at Ostia. Third century AD. From a cast in the Museo della Civiltà Romana, Rome; the original in Ny Carlsberg Glyptothek, Cophenagen. Photo: James Beresford.

Fig. 3.17. Thames barge of the early twentieth century carrying a traditional sprit rig. Photo: Liz Henry.

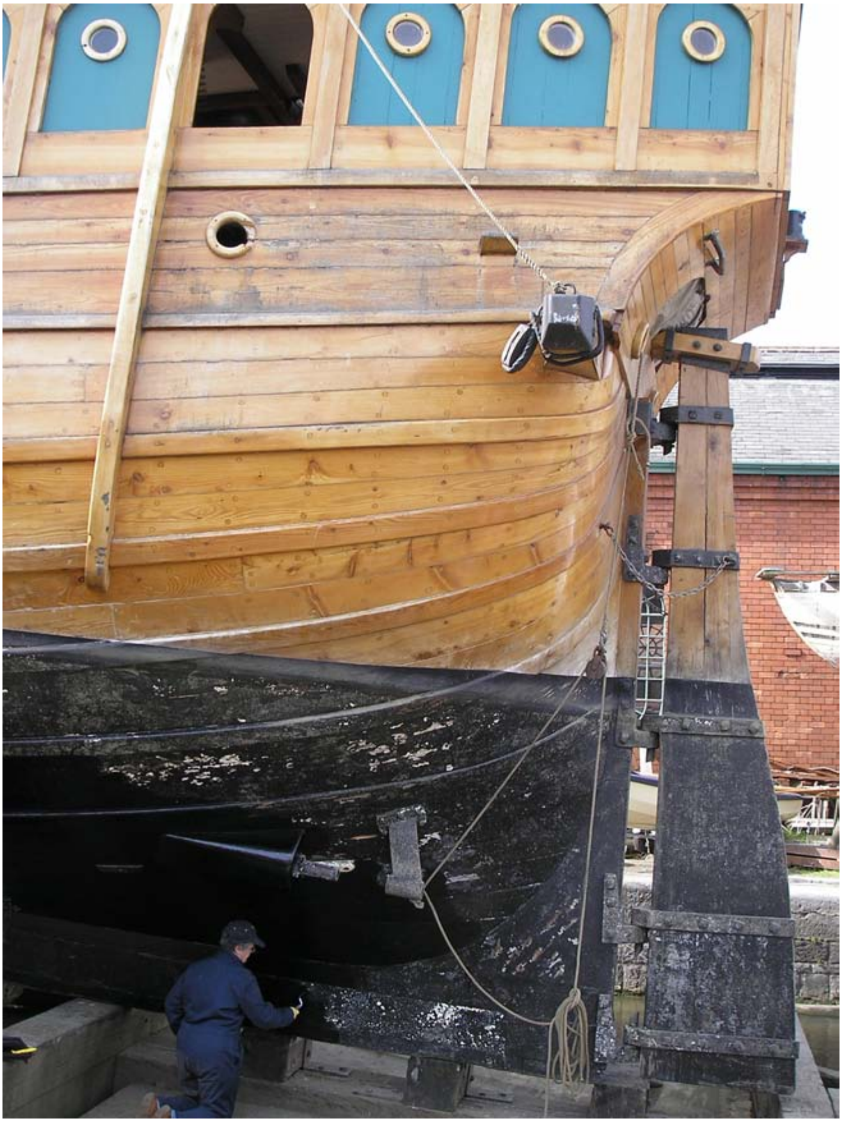

Fig. 3.18. Pindle-and-gudgeon rudder system on the replica of a late fifteenth century caravel, the *Matthew*. Photo: James Beresford.

Fig. 3.19. Pindle-and-Gudgeon rudder system on display at the Maritime Museum, Rotterdam. Photo: 'Artshooter'.

Fig. 4.1. Tower of the Winds in the Roman Forum, Athens. Depicting a deity on each of its eight sides, the structure was built in the first century BC/AD. Photo: James Beresford.

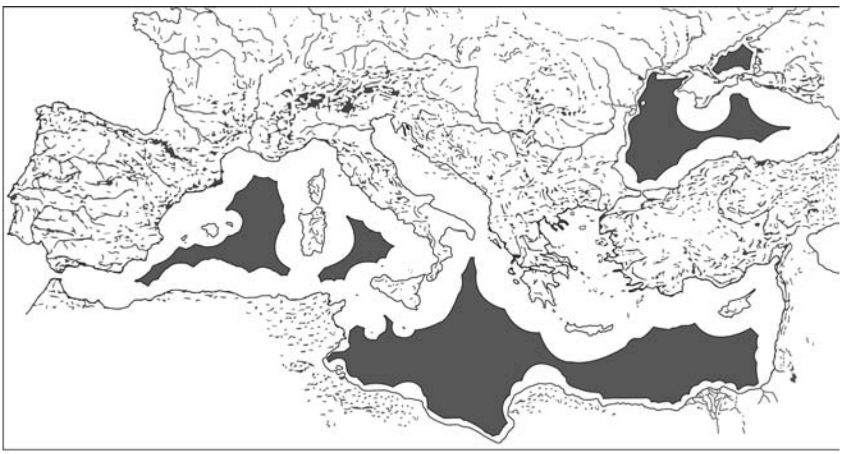

Fig. 4.2. Chart of coastal intervisibility depicting the regions of the Mediterranean out of sight of land. (Redrawn from Henkel 1901)

Fig. 4.3. Lead sounding weights, probably of early Byzantine date, recovered from the seabed off Haifa. The cavities in the bases of the two leads allowed them to be armed with wax or tallow. Israel Antiquities Authority. Photo: courtesy of John Oleson.

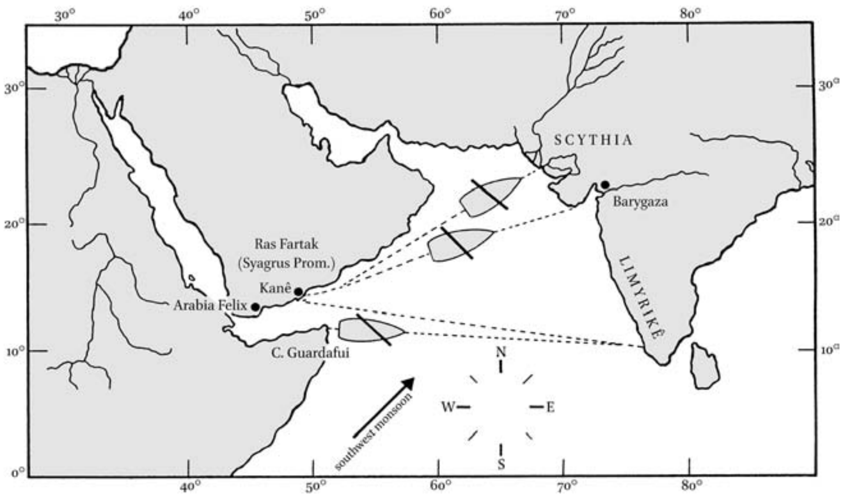

Fig. 5.1. Ancient shipping routes across the Arabian Sea as described in the *Periplus Maris Erythraei*. (Redrawn from Casson 1991a: 9. Map 1.1)

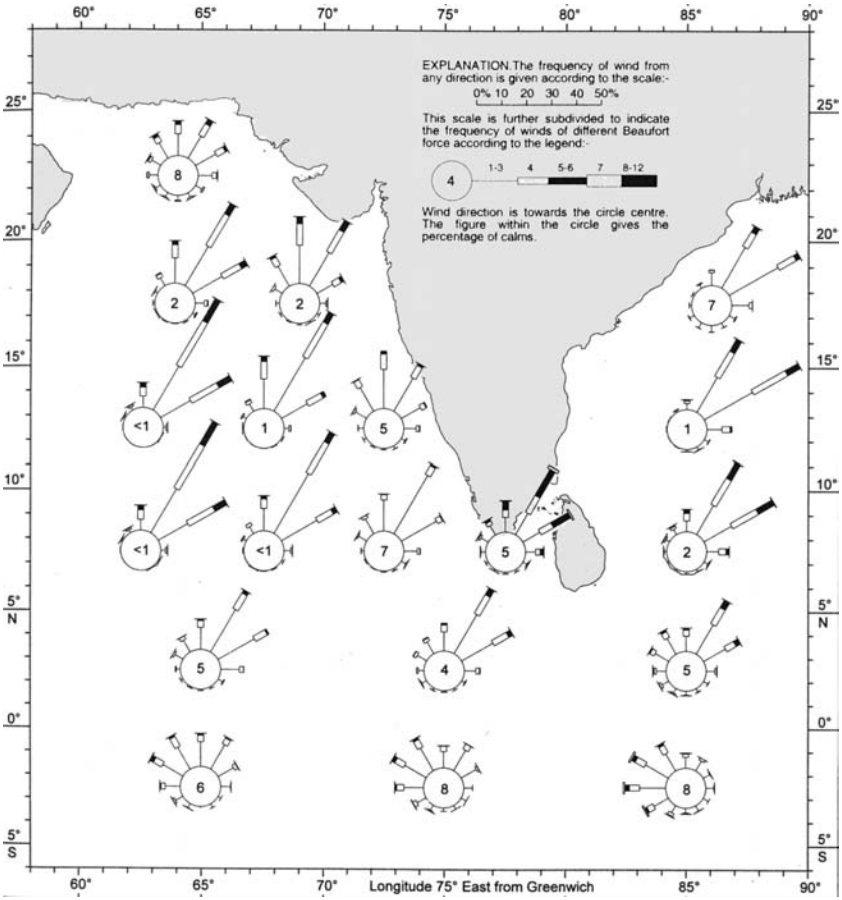

Fig. 5.2. Wind roses of the northern Indian Ocean during a typical January. Image: courtesy Met. Office. (West Coast of India Pilot 1998: 39. Fig. 1.179.1)

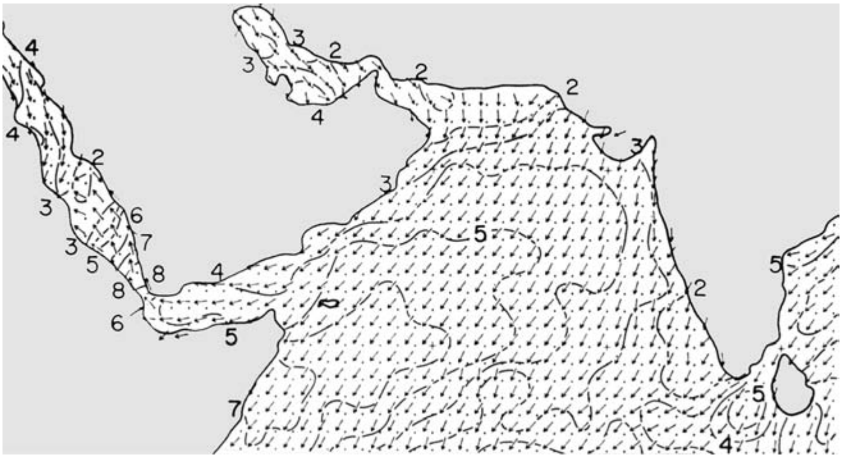

Fig. 5.3a. Typical directions and speeds (in metres per second) of winds blowing across the Arabian Sea during the north-east monsoon in December. (From Hastenrath & Lamb *Climatic Atlas of the Indian Ocean. Part 1*, 1979: Fig. 25)

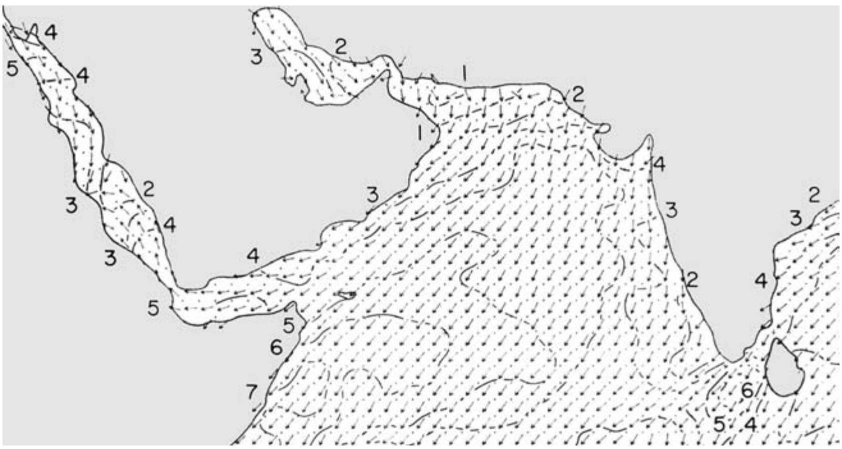

Fig. 5.3b. Typical directions and speeds (in metres per second) of winds blowing across the Arabian Sea during the north-east monsoon in January. (From Hastenrath & Lamb *Climatic Atlas of the Indian Ocean. Part 1*, 1979: Fig. 14)

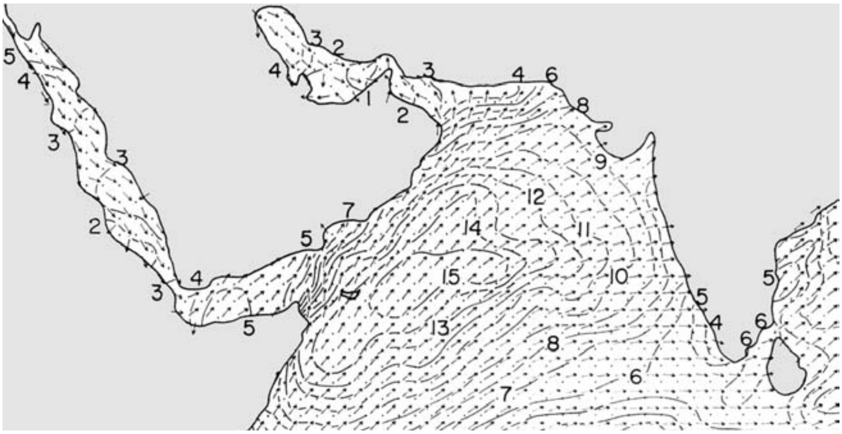

Fig. 5.4a. Typical directions and speeds (in metres per second) of winds blowing across the Arabian Sea during the south-west monsoon in July. (From Hastenrath & Lamb *Climatic Atlas of the Indian Ocean. Part 1*, 1979: Fig. 2)

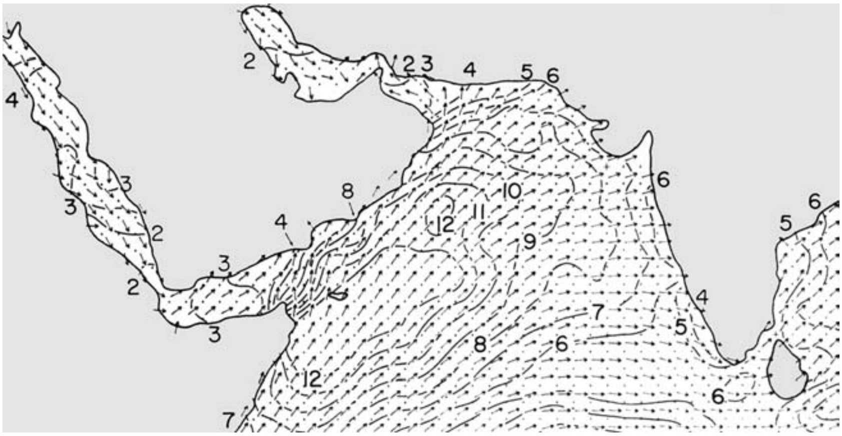

Fig. 5.4b. Typical directions and speeds (in metres per second) of winds blowing across the Arabian Sea during the south-west monsoon in August. (From Hastenrath & Lamb *Climatic Atlas of the Indian Ocean. Part 1*, 1979: Fig. 21)

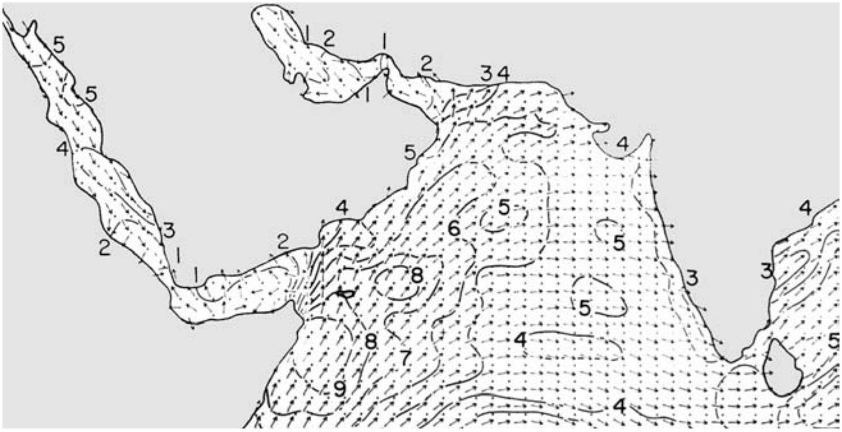

Fig. 5.4c. Typical directions and speeds (in metres per second) of winds blowing across the Arabian Sea during the south-west monsoon in September. (From Hastenrath & Lamb *Climatic Atlas of the Indian Ocean. Part 1*, 1979: Fig. 22)

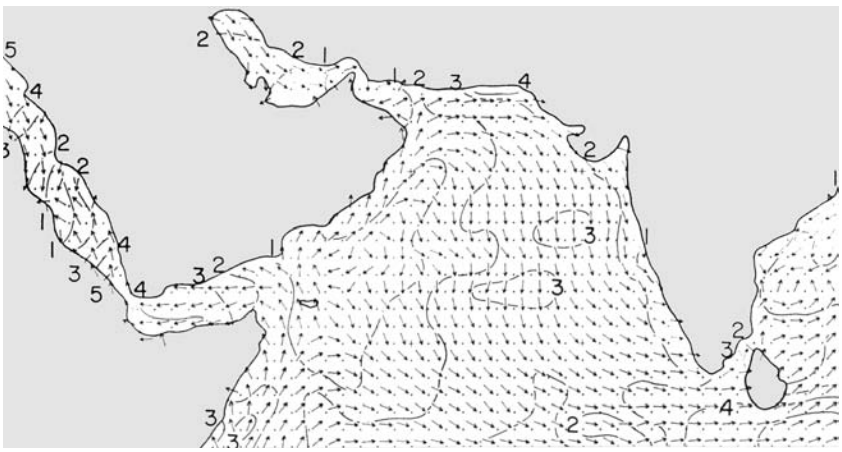

Fig. 5.4d. Typical directions and speeds (in metres per second) of winds blowing across the Arabian Sea during the south-west monsoon in October. (From Hastenrath & Lamb *Climatic Atlas of the Indian Ocean. Part 1*, 1979: Fig. 23)

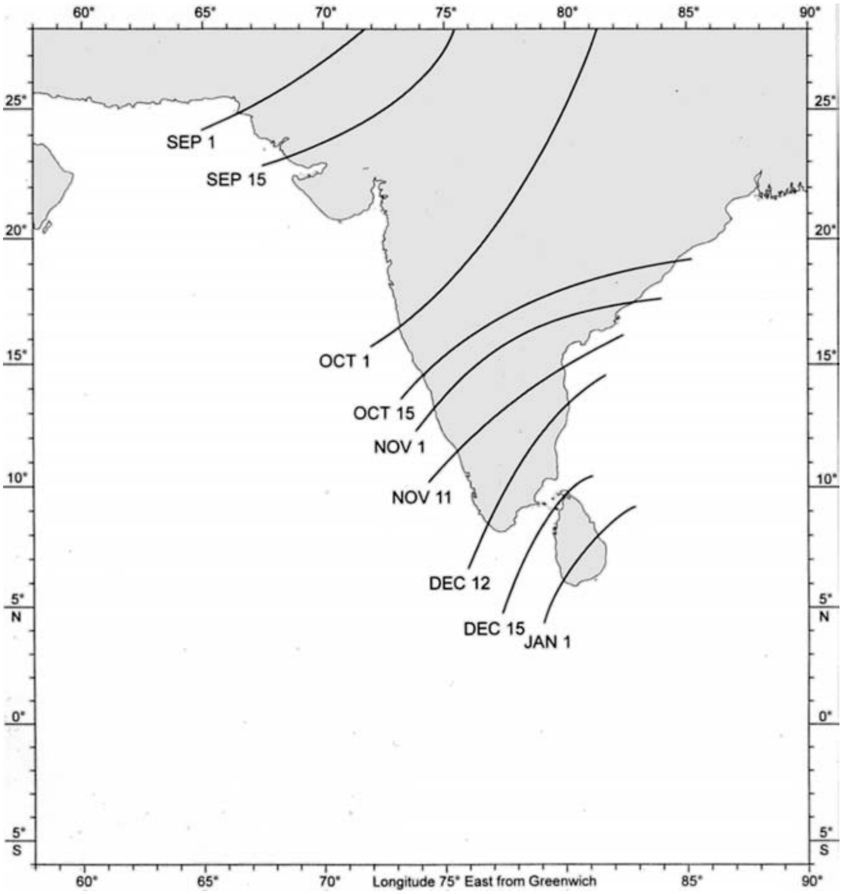

Fig. 5.5. Typical end dates of the south-west monsoon as it retreats southwards across Pakistan and India. Image: courtesy of the Met. Office. (West Coast of India Pilot 1998: 44. Fig. 1.179.6)

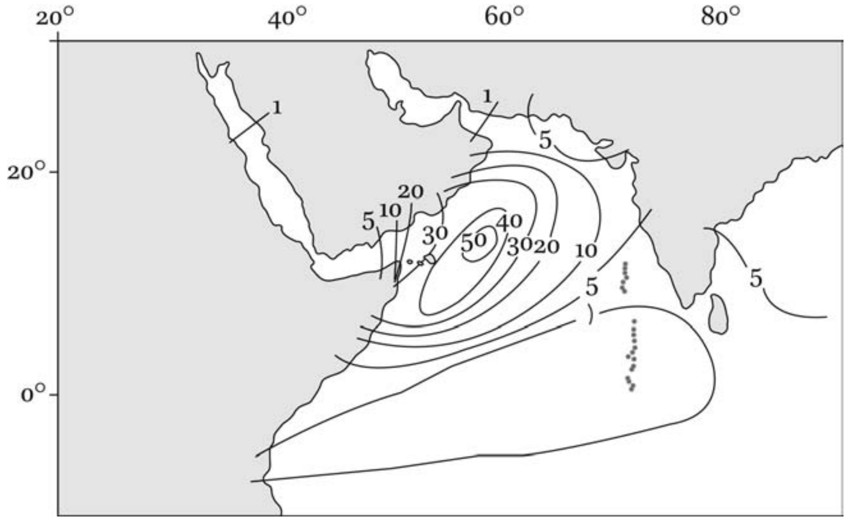

Fig. 5.6a. Percentage frequencies of winds measuring Beaufort 7 or greater across the Northern Indian Ocean during a typical July. (Redrawn from Met. Office, *Monthly Meteorological Charts of the Indian Ocean* 1949: 51)

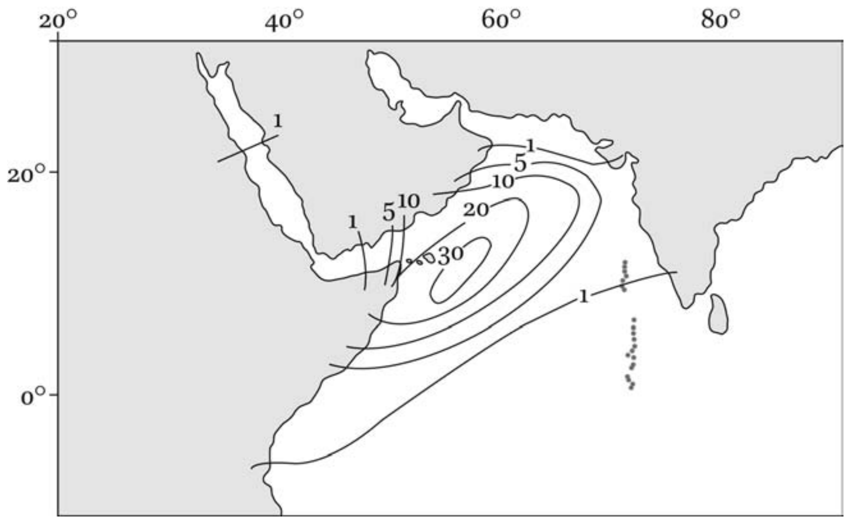

Fig. 5.6b. Percentage frequencies of winds measuring Beaufort 7 or greater across the Northern Indian Ocean during a typical August. (Redrawn from Met. Office, *Monthly Meteorological Charts of the Indian Ocean* 1949: 59)

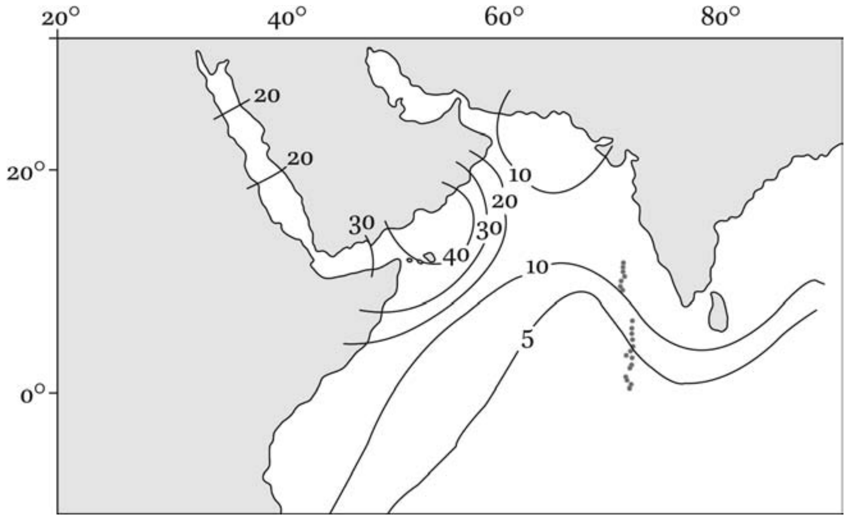

Fig. 5.7. Frequency of visibility of less than 5 miles (8 kilometres) typical across the northern Indian Ocean during August. (Redrawn from Met. Office, *Monthly Meteorological Charts of the Indian Ocean* 1949: 66)

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