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SMJER VJETRA – JEDAN OD PROBLEMA U ANTIČKOJ PLOVIDBI JADRANOM

WIND DIRECTION AS ONE OF THE PROBLEMS IN NAVIGATION ON THE ADRIATIC IN GREEK AND ROMAN PERIOD

SAŽETAK

Aspekt plovidbe Jadranom koji u dosadašnjoj literaturi nije previše razmatran, a svakako je to zaslužio, utjecaj je vjetrova na plovidbu objema stranama Jadranskoga mora u antičko doba. Antički izvori koji opisuju istočnu obalu Jadranskoga mora čine to u pravilu u smjeru NW – SE. Vjeruje se da je razlog tome što antički brodovi nisu mogli jedriti u smjeru vjetra; štoviše, nisu mogli jedriti kursom koji se razlikovao manje od sedam zraka na kompasu od smjera vjetra. To je uvjetovalo da su Grci u Jadran, koristeći jedra, uplovljavali ploveći uz zapadnu obalu, dok su u povratku slijedili istočnu obalu Jadrana. Rad analizira prevladavajuće vjetrove tijekom godine na različitim točkama na istočnoj obali Jadrana i njihov utjecaj na plovidbu. Također se daje usporedba s jednom od najvažnijih pomorskih ruta Rimskog Carstva, Rim – Aleksandrija – Rim.

Ključne riječi: *smjer vjetra, antička plovidba Jadranom*

SUMMARY

An often (undeservedly) neglected aspect of navigation on the Adriatic is the influence of wind direction on the sailing along both shores of the sea in Greek and Roman period. The classical literary sources that describe the eastern shore of the Adriatic generally proceed from NW to SE. I believe that the reason behind this is the fact that ancient ships could not sail directly upwind; moreover, they could not sail on a course that lay within seven compass points of the direction of the wind. This conditioned the fact that the Greeks had to sail into the Adriatic along its western shore, while they followed its eastern shore on their way back. The most frequent winds during the course of the year at different points on the eastern shore of the Adriatic and their influence on navigation are also discussed. Finally, a comparison is offered with one of the most important sea routes in the Roman Empire, the Rome-Alexandria-Rome route.

Key words: *Greek and Roman navigation on the Adriatic, wind direction*

"*No žestok je (zrak) i prevrtljivo se mijenja ponajviše ljeti,*

kad njime šibaju munje, udaraju gromovi i kad bjesne vihori."

(Ps. Scymn. 384-387, Kozličić 1990: 160; usporedi Penzar, Penzar i Orlić 2001: 18)

1. UVOD

Aspekt plovidbe Jadranom koji u dosadašnjoj literaturi nije previše razmatran, a svakako je to zaslužio, utjecaj je vjetrova na plovidbu objema stranama Jadranskoga mora u antičko doba. Morske struje sugeriraju plovidbu u smjeru SE – NW uz istočnu obalu Jadrana, te NW – SE uz zapadnu, talijansku obalu (vidi kartu na str. 14 u *Peljaru* iz 1952–1953, sl. A i C nasuprot stranicama 20 i 22 *Mediterranean Pilota*, Kojić-Barbarić 1975: 21, sl. 9 na str. B11 *Peljara* iz 1999., sl. 7 na str. 25 *Peljara* za male brodove iz 2002. i 2003., kartu 4 u Kozličić, 1990., *Prilozi*). No u antičkoj je plovidbi mnogo važniji faktor bio smjer i snaga vjetra – jednako se to odnosi na obalnu plovidbu kao i plovidbu otvorenim morem.

"*But it (the air) is severe and changes unpredictably, especially in summer*,

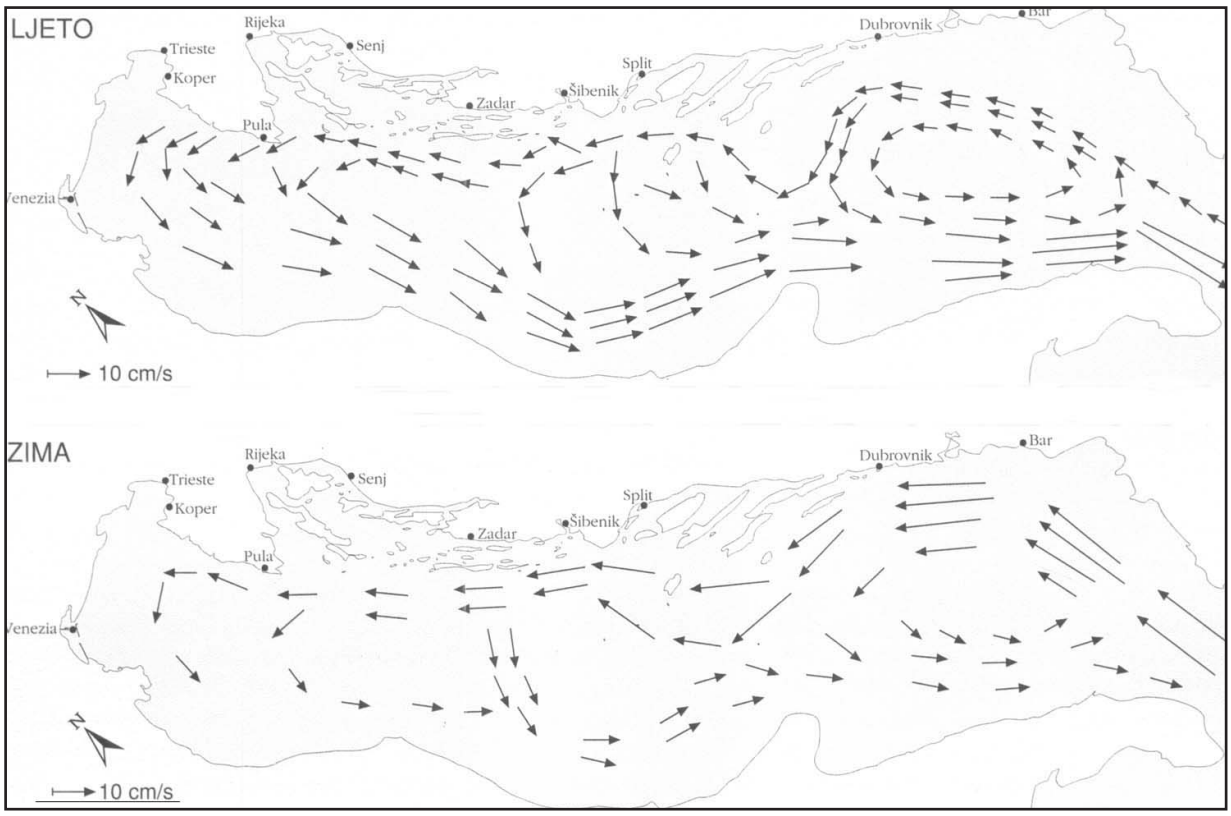
when hurricanes and tempests rage, and thunderbolts strike."

(Ps. Scymn. 384-387, Kozličić 1990: 160; compare Penzar, Penzar and Orlić 2001: 18)

1. INTRODUCTION

An often (undeservedly) neglected aspect of navigation on the Adriatic is the influence of wind direction on the sailing along both shores of the sea in Greek and Roman period. The direction of sea currents suggests the navigation from SE to NW along the eastern shore of the Adriatic, and from NW to SE along the western, Italian shore (see the map on p. 14 in *Peljar* from 1952-1953, fig. A and C opposite pp. 20 and 22 in *Mediterranean Pilot*, Kojić-Barbarić 1975: 21, fig. 9 on p. B11 in *Peljar* of 1999, fig. 7 on p. 25 in *Peljar* for small-size ships from 2002 and 2003, map 4 in Kozličić 1990, *Appendices*). But a much more important factor in Greek and Roman navigation was the direction and

Karta 1. Prevladavajuće morske struje na Jadranu
Map 1 *Sea currents on the Adriatic*



Izvor: *Peljar* I: B11, sl. 9 / ***Source:*** *Peljar* I: B11, fig. 9

Antički izvori koji opisuju istočnu obalu Jadranskoga mora čine to u pravilu u smjeru NW – SE. Tako već Teopomp (FGrH 115F129 *ap*. str. VII.5.9) procjenjuje vrijeme plovidbe Jadranom počevši od krajnje točke (*muchos*) zaljeva; Pseudo Skilakov *Periplous* (poglavlja 20-28), *Argonautika* Apolonija Rođanina (IV. 327-337, 522-525, 561-576), te Pseudo Skimnova *Periegesis* (360-440) opisuju istočni Jadran počevši od sjevera i zemlje Histra pa prema jugu sve do Epira. Kasnije su (uglavnom) isti smjer slijedili i drugi autori, kao Strabon, Pomponije Mela (koji se možda i najsustavnije suprotstavlja uvriježenom smjeru opisivanja, navodeći gradove i narode u smjeru SE – NW), Plinije st. i Klaudije Ptolemej. Najstariji grčki opisi, Teopompov, Ps. Skilakov i Ps. Skimnov, kao i Apolonijeva *periegesis* zaogrnuta plaštom mitologije, zasigurno potječu od izvještaja najranijih grčkih pomoraca i njihovih opisa novootkrivenog mora ili zaljeva. Iznenađuje stoga, upravo isključiv smjer opisivanja od sjeverozapada prema jugoistoku. Naime, logika bi nalagala da Grci – bilo kao trgovci, kolonisti, istraživači ili sve u jednom – u Jadran uplovljavaju istočnom obalom. Obalni put iz Grčke prema sjeverozapadu vodio je, uostalom, upravo uz istočnu obalu današnjeg Jonskog mora, s Kerkyrom/Krfom kao ključnom točkom na daljnjem putu prema Italiji preko Otrantskih vrata. Ništa nije logičnije nego put prema sjeverozapadu nastaviti uz obalu istočnog Jadrana, čemu su zasigurno mogle pridonijeti i prevladavajuće morske struje, koje upravo pogoduju takvom pravcu plovidbe. Zašto onda Grci Jadran u pravilu opisuju "naopako", kao da su, preplovivši Otrantska vrata, put prema sjeverozapadu nastavljali uz zapadnu obalu Jadrana, te su se tek na povratku susretali s istočnom obalom? Grčko nepoznavanje najsjevernije obale Jadrana – što je omogućilo da se ovdje postavi ušće Istra, kao i brojne mitološke konstrukcije vezane uz taj prostor, nemali broj kojih susrećemo upravo u *Argonautici* Apolonija Rođanina – nadovezuje se na problem plovidbe Jadranom kako je ovdje prikazan. Sigurno je kako je liburnska kontrola sjeverno i srednjojadranskih pomorskih putova uz istočnu obalu bila značajan faktor kako u grčkom nepoznavanju sjevernog Jadrana tako i u usmjeravanju plovidbe njihovih trgovaca, istraživača i, osobito, kolonista, ali ona ne objašnjava u potpunosti zašto najraniji opisi Jadrana teku u smjeru NW – SE.

strength of wind, both in coastal and in open-sea navigation.

The classical literary sources describing the eastern shore of the Adriatic generally proceed from NW to SE. Thus already Theopompus (FGrH 115F129 *ap*. Str. VII.5.9) estimates the duration of the journey along the Adriatic starting from the innermost point (*muchos*) of the bay; Pseudo Scylax's *Periplous* (chs. 20-28), the *Argonautica* of Apollonius of Rhodes (IV.327-337, 522-525, 561-576), as well as Pseudo Scymnus' *Periegesis* (360-440) describe the eastern Adriatic starting from the north (the land of the Histri) towards the south all the way to Epirus. Other later authors, such as Strabo, Pomponius Mela (who is probably the author who most systematically challenges the usual direction of the description, listing cities and nations from SE to NW), Pliny the Elder and Claudius Ptolemy followed the same direction. The earliest Greek descriptions, Theopompus', Ps. Scylax's and Ps. Scymnus', as well as Apollonius' *periegesis* shrouded in a cloak of mythology, are certainly derived from the reports of the first Greek sailors and their descriptions of the newly-discovered sea or bay. It is thus surprising that the direction of these descriptions is regularly and exclusively NW-SE. It would be logical that Greek merchants, colonizers, explorers – if these distinctions are indeed applicable – sailed into the Adriatic following its eastern shore. The coastal route from Greece towards the north-west followed precisely the eastern shore of the – as it is known today – Ionian Sea, with Kerkyra/Corfu as the key point on the further voyage towards Italy across the Strait of Otranto. It would indeed be logical to continue the voyage towards the north-west along the eastern shore of the Adriatic, which would also be favoured by the local sea currents. Why is it that the Greeks describe the Adriatic "upside-down" as if they, sailing across the Strait of Otranto, were continuing their voyage towards the north-west along the western shore of the Adriatic, and only faced its eastern shore on their way back? Greek ignorance of the northernmost shores of the Adriatic – allowing them to place the mouth of the Ister in this region, as well as numerous mythical concepts associated with it, a number of which can be found in the *Argonautica* of Apollonius of Rhodes – is connected to the problem of Adriatic navigation as discussed in this paper. The Liburnian control of the northern and central Adriatic marine routes along the eastern shore of the sea was cer-

2. PLOVIDBA JADRANOM U ANTIČKOM RAZDOBLJU

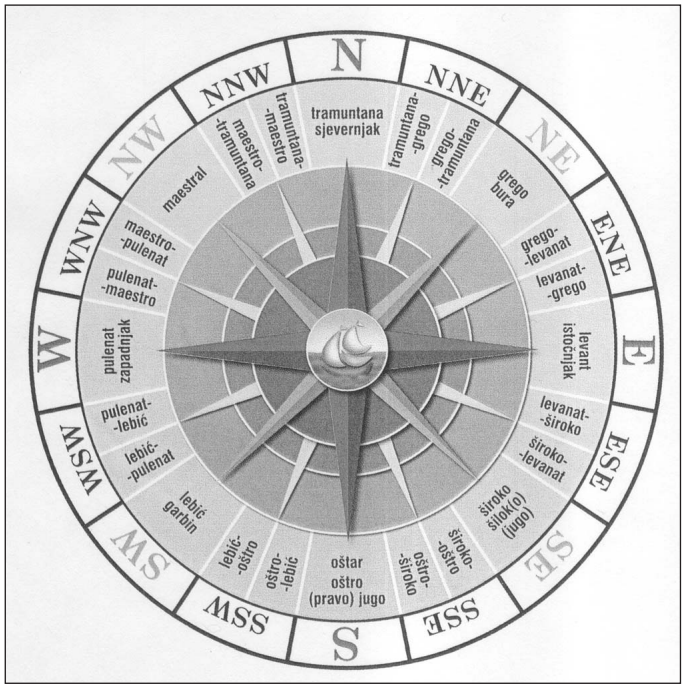
Plovidbena sposobnost antičkih brodova daje barem dio odgovora na to pitanje. Naime, antički brodovi nisu mogli jedriti u smjeru vjetra; štoviše, nisu mogli jedriti kursom koji se razlikovao manje od sedam zraka na kompasu od smjera vjetra (Casson 1950: 145). To znači, primjerice, da antički brod nije mogao ploviti kursom manjim od 123° 45' (SEbE) i većim od 326° 15' (NWbN) ako je puhala bura (uzmimo iz idealnog smjera od 45°, NE; prema *Peljaru* iz 1999: B 18 bura puše između NNE i ENE, 22° 30' i 67° 30'; usporedi Penzar, Penzar i Orlić 2001: 125: NNE, NE ili ENE, ponekad čak i N ili NW). Ta situacija onemogućivala bi antičkom brodu plovidbu u smjeru sjevera (0°) ili istoka (90°), te bi mogao ploviti tek na sjeverozapad (315°) ili jugoistok (135°).

Isto tako, pri jugu (uzmimo da puše iz smjera SE, 135°; prema *Peljaru* iz 1999: B 20 jugo puše između ESE i SSE, 112° 30' i 157° 30'; usporedi Penzar, Penzar i Orlić 2001: 137: ESE, SE ili SSE), nije se moglo ploviti kursom većim od 56° 15' (NEbE) i manjim od 213° 45'(SWbS). Tako je potpuno bila onemogućena plovidba prema jugu (180°) ili istoku (90°), a moglo se ploviti tek na sjeveroistok (45°) ili jugozapad (225°).

tainly an important factor in both the Greek ignorance of the northern Adriatic and in diverting the itineraries of their merchants, explorers and, especially, colonizers, but it does not explain in total why the earliest descriptions of the Adriatic follow the direction from NW to SE.

2. THE NAVIGATION ON THE ADRIATIC IN GREEK AND ROMAN PERIOD

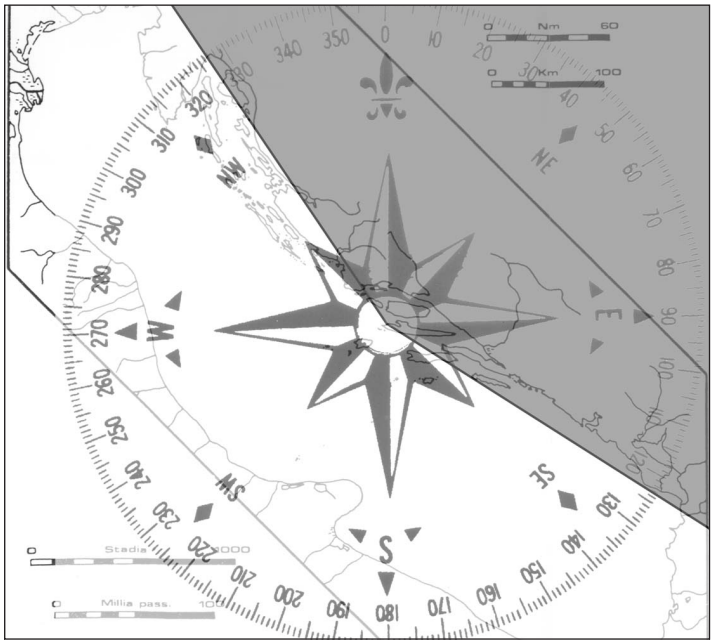
Navigational capabilities of Greek and Roman ships provide at least one part of the answer to this question. Ancient ships could not sail directly upwind; moreover, they could not sail on a course that lay within seven compass points of the direction of the wind (Casson 1950: 145). This means, for example, that a Greek or Roman ship could not sail by a course smaller than 123° 45' (SEbE) and larger than 326° 15' (NWbN) if the bora was blowing (it blows ideally from 45°, NE; according to *Peljar* from 1999: B 18 the bora blows from between NNE and ENE, 22° 30' and 67° 30'; compare Penzar, Penzar and Orlić 2001: 125: NNE, NE or ENE, sometimes even N or NW). This meteorological situation would disable a Greek or Roman ship in sailing towards north (0°) or east



Slika 1. Ruža vjetrova na Jadranu
Figure 1 *Wind rose for the Adriatic*

Izvor: Vučetić i Vučetić 2002: 96 / ***Source:*** Vučetić and Vučetić 2002: 96

Karta 2. Bura – nemogućnost plovidbe između SEbE i NWbN
Map 2 *The bora – impossibility to sail between SEbE and NWbN*



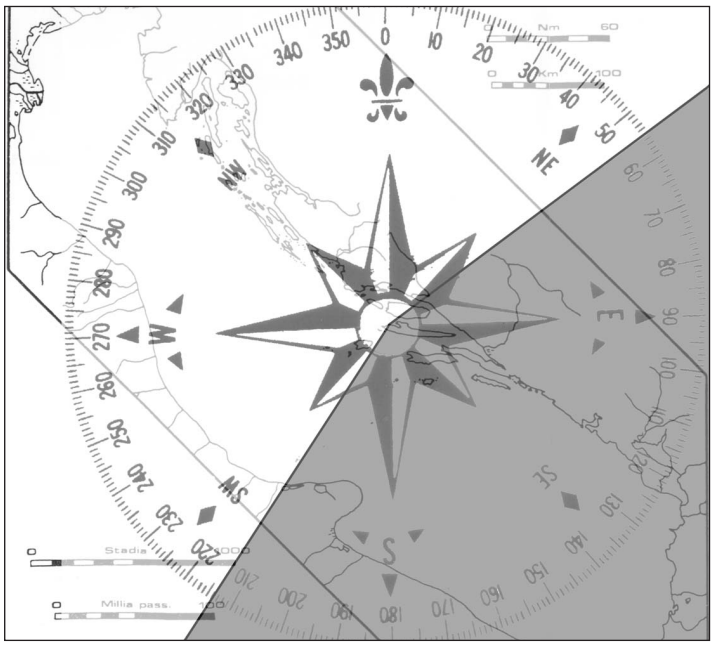
Izvor: Autor / ***Source:*** Author

Od osobite je važnosti na Jadranu tijekom ljeta maestral; taj vjetar na otvorenom puše iz NW, ali se "prilagođava" konfiguraciji obale te često puše iz smjera N, W ili čak SW (Splitski kanal). U svakom slučaju on je onemogućavao plovidbu u smjeru NW, jednako kao što je uve-

(90°), and it could only sail towards north-west (315°) or south-east (135°).

Similarly, when the sirocco was blowing (ideally from SE, 135°; according to *Peljar* from 1999: B 20 the sirocco blows from between ESE and SSE, 112° 30' and 157° 30'; compare Pen-

Karta 3. Jugo – nemogućnost plovidbe između NEbE i SWbS
Karta 3 *The sirocco – impossibility to sail between NEbE and SWbS*



Izvor: Autor / ***Source:*** Author

like olakšavao plovidbu u smjeru SE. Ako uzmemo da maestral općenito puše iz smjera NW (315°), antički brod nije mogao ploviti kursom većim od 236° 15' (SWbW) i manjim od 33° 45' (NEbN), dakle niti prema S (0°) ili zapadu (270°). Moglo se ploviti tek na NE (45°) ili SW (225°). Ova je tehnološka činjenica morala imati velik utjecaj na plovidbu Jadranom, ali treba imati na umu da se navedeni zaključak odnosi na "idealni" smjer maestrala, dok je promjenjivost toga smjera o(ne)mogućavala plovidbu prema dugim kursovima, ovisno o smjeru vjetra na određenoj lokaciji u određeno vrijeme.

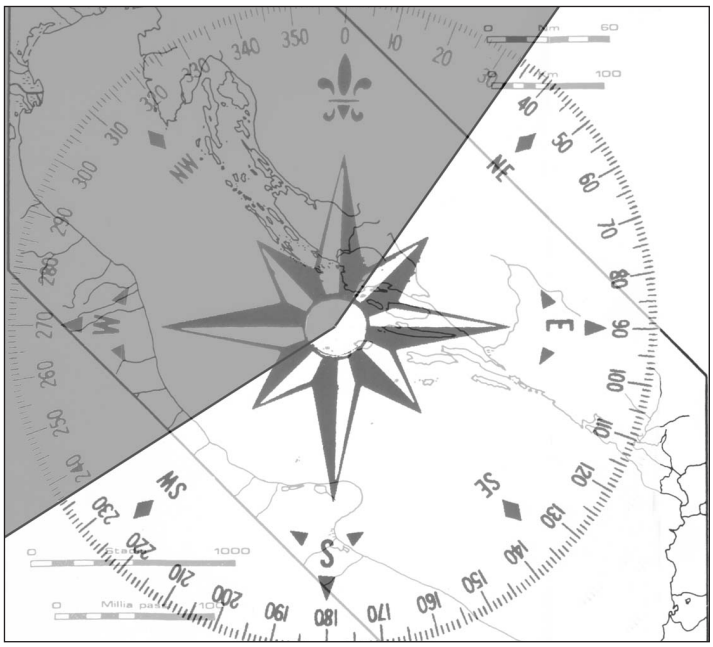
Na ovome mjestu važno je napomenuti što se zapravo nalazi iza pojma "maestral". Prema hrvatskim meteorolozima (Penzar, Penzar i Orlić 2001: 141-142, 215-219; Vučetić i Vučetić 2002: 42, 48-49, 96) maestral je zapravo spoj etezijskog vjetra koji tijekom ljeta puše na pučini iz smjera NW te dnevnog periodičkog vjetra, tzv. smorca, koji prati sunčev dnevni hod; smjer toga dnevnog vjetra se poslijepodne – upravo kada je najjači – približava smjeru iz kojeg s otvorenog puše etezijski vjetar; na taj način nastaje ono što nazivamo maestral.

Brusić 1970: 555 spominje ograničene mogućnosti u manevriranju plovidbe na jedra u prethistoriji i antici, općenito opisujući kako se "vjetar kao glavno pogonsko sredstvo mogao

zar, Penzar and Orlić 2001: 137: ESE, SE or SSE), a ship could not sail by a course larger than 56° 15' (NEbE) and smaller than 213° 45' (SWbS). Thus sailing towards south (180°) or east (90°) was completely impossible, and one could only sail towards north-east (45°) or south-west (225°).

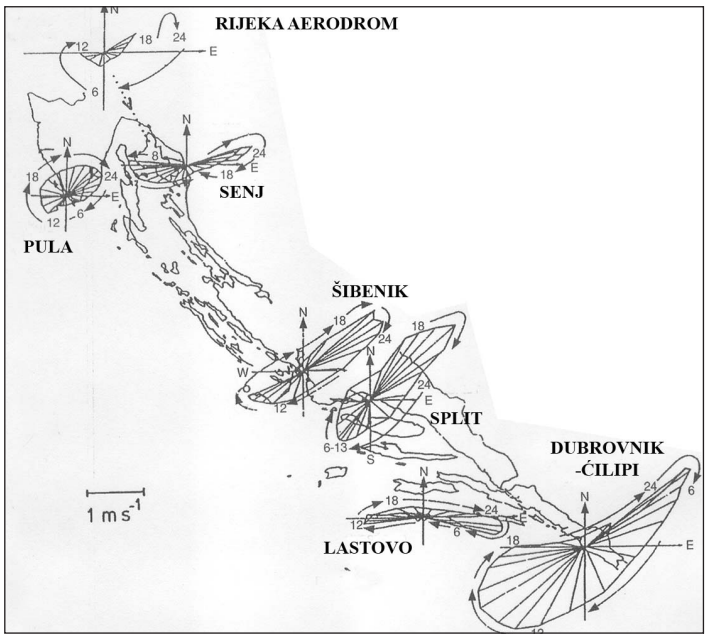
The maestral is especially important in the Adriatic during the summer months; in the open sea it blows from NW but it "adapts" to the configuration of the shore and often blows from N, W or even SW (the Split Channel). In any case, it made the sailing towards NW impossible, in the same time considerably alleviating the sailing towards SE. If a provisional general direction from which the maestral blows is taken to be NW (315°), a Greek or Roman ship was not able to sail by a course larger than 236° 15' (SWbW) and smaller than 33° 45' (NEbN), thus neither towards S (0°) nor west (270°). It could only sail towards NE (45°) or SW (225°). This technological fact must have strongly influenced the navigation on the Adriatic, but one must keep in mind that this conclusion refers to the "ideal" direction from which the maestral is supposed to blow, while the actual variability of this direction made the sailing by other courses (im)possible, depending on the direction of the wind at certain location at certain time.

Karta 4. Maestral – nemogućnost plovidbe između SWbW i NEbN
***Map 4** The maestral – impossibility to sail between SWbW and NEbN*



Izvor: Autor / ***Source:*** Author

Karta 5. Dnevni hod vjetra na Jadranu
Map 5 *The diurnal courses of the wind on the Adriatic*



Izvor: Penzar, Penzar i Orlić 2001: 217, sl. 6.3 / ***Source:*** Penzar, Penzar and Orlić 2001: 217, fig. 6.3

koristiti samo ako puše u smjeru plovidbe", što nije sasvim točno. On inzistira kako je istočna jadranska obala bila pogodnija za plovidbu u prethistoriji i antici od zapadne, te naglašava kako se plovidba u smjeru SE odvijala uz pomoć maestrala, no ne daje uvjerljivo objašnjenje plovidbe u smjeru NW (Brusić 1970: 557–558). *Peljar po Jadranu* (1952–1953: 51–52), s druge strane, ističe nepovoljne vremenske prilike za jedrenjake koji žele ploviti u smjeru NW tijekom ljeta – što je jedino razdoblje tijekom kojeg se mogla odvijati intenzivnija plovidba – te preporuča korištenje rute uz zapadnu obalu Jadrana, neovisno o protivnoj morskoj struji. Zimska plovidba Jadranom u smjeru NW prepuna je opasnosti, te *Peljar po Jadranu* (1952–1953: 50–51) nabraja niz zaklona – na obje jadranske obale – koja mogu poslužiti pomorcima u nevolji; štoviše, veći dio teksta o zimskoj plovidbi u smjeru NW bavi se nabrajanjem upravo tih zaklona.

3. RUTA RIM – ALEKSANDRIJA: SMJER VJETRA I DIO GODINE POVOLJAN ZA PLOVIDBU U ANTICI

Do koje mjere je vjetar mogao utjecati na plovidbu možda najbolje ilustrira ruta Rim –

It is important to elaborate on the meaning of the term "maestral" at this place. According to Croatian meteorologists (Penzar, Penzar and Orlić 2001: 141-142, 215-219; Vučetić and Vučetić 2002: 42, 48-49, 96) the maestral is actually a combination of etesian winds blowing on the open sea during summer months from NW and the diurnal periodical wind, the so-called sea breeze, following the sun's diurnal course; the direction from which this diurnal wind is blowing approaches in the afternoon – precisely when it is strongest – the direction from which etesian winds blow from the open sea; in this way the maestral is created.

Brusić 1970: 555 mentions a limited manoeuvring abilities of sailing boats in prehistory and Greek and Roman period, generally describing how "the wind, as the main mean of propulsion, could have been used only when it blew in the direction of the sailing", which is not completely true. He insists that the eastern shore of the Adriatic was more favourable to sailing in prehistory and Greek and Roman period in comparison with the western, and further emphasizes that the sailing towards SE was accomplished with the help of the maestral, but does not give a plausible explanation of sailing towards NW (Brusić 1970: 557-558). *Adriatic pilot* (1952-1953: 51-52), on the other hand, emphasizes the unfavourable weather conditions

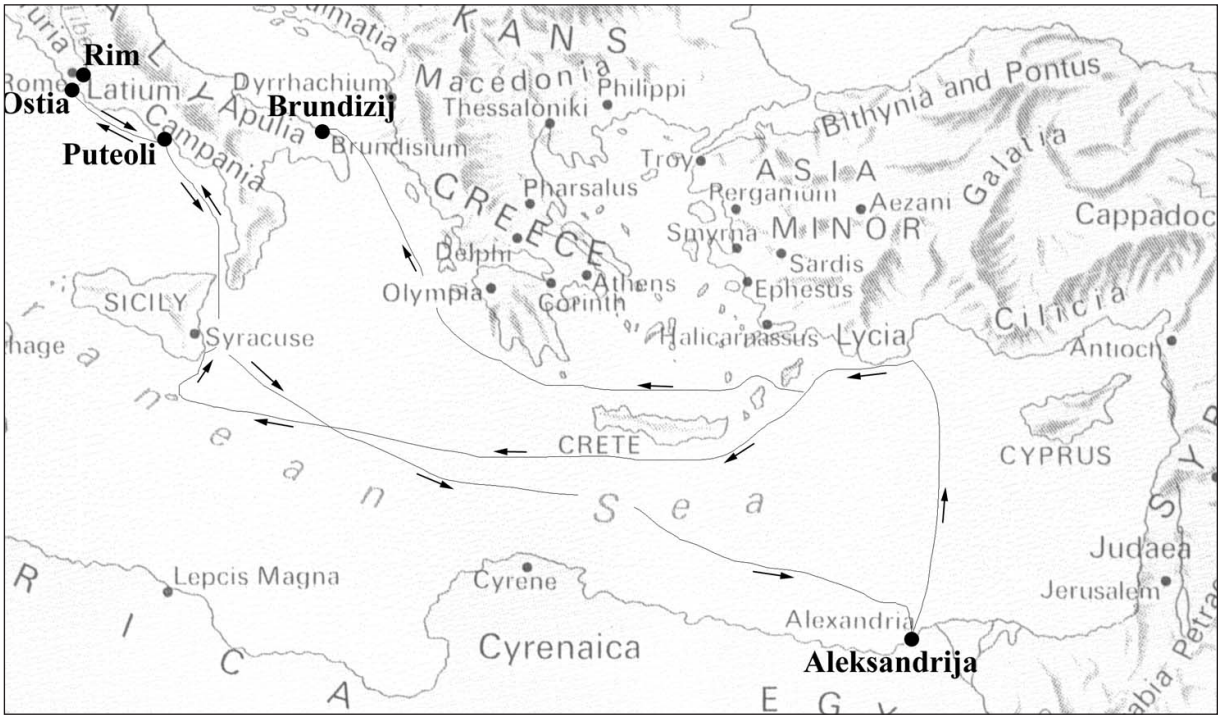
Aleksandrija, zasigurno jedan od najfrekventnijih i najvažnijih pomorskih putova Rimskog Carstva. Plinije donosi kako se iz Puteola do Aleksandrije (1000 M) moglo doploviti za svega devet dana uz lagani vjetar, ili za šest do sedam dana od Mesinskog tjesnaca do Aleksandrije (830 M; HN XIX.1.3). O brzini plovidbe od Puteola do Aleksandrije govori nam i Filon (In Flacc. V.26–27, XIII.109–110). Plinije iznosi najbrža putovanja, a prosječno je moglo trajati nekih dvadesetak dana. Tako brzu plovidbu omogućili su povoljni vjetrovi, a plovilo se gotovo isključivo otvorenim morem. No, povratak je bio nešto sasvim drugo. Zbog nepovoljnih vjetrova iz Aleksandrije nije se moglo ploviti direktno na zapad ili sjeverozapad, već prema sjeveru do južne obale Male Azije, zatim uz obalu Male Azije do Roda pa na Kretu (upitno je, uz južnu li sjevernu obalu otoka). Zatim se plovilo, uz kontinuirano nepovoljan vjetar, preko Sicilskog mora do Malte te dalje kroz Tjesnac prema Ostiji ili Puteolima. Takvo putovanje proteglo se na nekih 1700 M, a trajalo je najmanje dva mjeseca, pa je ova ruta očit primjer utjecaja vjetrova na antičku plovidbu (Casson 1960: 234; cf. 1950: 48–50; 1971: 297; upravo ovom rutom plovio je Pavle, Dj 27–28).

for the sailing boats wishing to sail towards NW during summer months – which is the only period favourable for more intensive navigation – and recommends the using of a route following the western coast of the Adriatic, regardless of the contrary sea currents. The winter sailing on the Adriatic in the direction of NW is full of danger, and *Adriatic pilot* (1952-1953: 50-51) lists a number of shelters – on both shores of the Adriatic – for sailors in distress; moreover, the majority of the text discussing the winter sailing in the direction of NW deals with the listing of these shelters.

3. THE ROME-ALEXANDRIA ROUTE: THE DIRECTION OF THE WIND AND THE PART OF THE YEAR FAVOURABLE FOR SAILING IN GREEK AND ROMAN PERIOD

In what measure the wind could influence navigation is perhaps best illustrated by the example of the Rome-Alexandria route, certainly among the most frequented and most important marine routes of the Roman Empire. Pliny reports how

Karta 6. Ruta Rim – Aleksandrija i Aleksandrija – Rim
***Map 6** The Rome-Alexandria and Alexandria-Rome route*



Izvor: Autor / ***Source:*** Author

Činjenica je da su tijekom antičkog razdoblja samo lipanj, srpanj, kolovoz i rujan smatrani mjesecima pogodnim za plovidbu, ožujak, travanj, svibanj i listopad bili su na glasu kao opasni mjeseci, dok je tijekom studenoga, prosinca, siječnja i veljače more bilo "zatvoreno" (Casson, 1971: 270–271; Bilić, 2004: 241–242; Tammuz, 2005: 145–146, n. 9, 10). Pogotovo se to odnosilo na obalnu plovidbu, dok su rute preko otvorenog mora mogle funkcionirati i tijekom zimskog razdoblja (Tammuz, 2005: 156), primjerice upravo ruta Rim – Aleksandrija (Tac. Hist. IV.51) i Aleksandrija – Rim (Philo In Flacc. XV.125, Leg. XXIX.190; Joseph. AJ XIV.14.2, BJ I.14.2-3). Iz navedenog možemo zaključiti da je promet istočnom jadranskom obalom bio najintenzivniji ljeti, recimo od kraja svibnja do polovine rujna, iako plovidba zasigurno nije potpuno zamrla čak niti zimi. Plovidba "sredinom" Jadrana – tzv. vanjski plovni put – mogla je funkcionirati tijekom cijele zime, no i na nju se jednako odnosi opasnost koju donosi olujna bura, kao i sva ograničenja uvjetovana smjerom vjetra koja su već navedena.

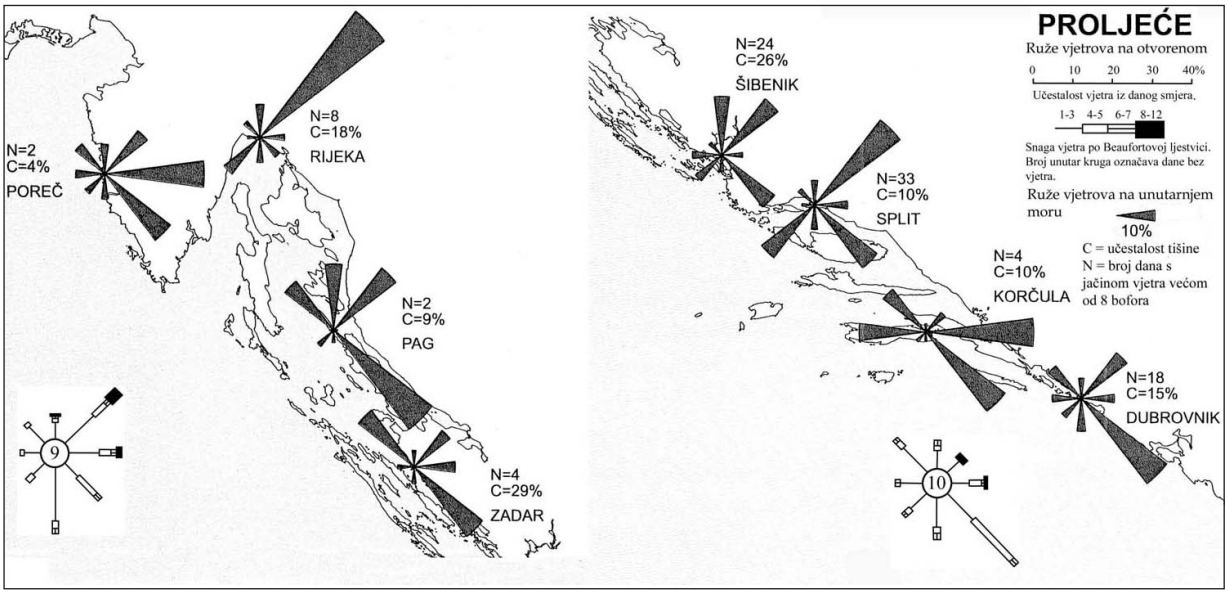
4. ZAKLJUČNA RAZMATRANJA

Kao što se može vidjeti na priloženim kartama te tablici, upravo je ljeti smjer vjetra najnepovoljniji za jedrenje od SE prema NW. Razlog tome je jadranski maestral, koji nastaje sinergi-

one could arrive from Puteoli to Alexandria (1000 M), carried by a moderate breeze, in mere nine days, or in six or seven days from the Messina Strait to Alexandria (830 M; HN XIX.1.3). Philo also mentions the large speed accomplished on the Puteoli-Alexandria route (In Flacc. V.26-27, XIII.109-110). Pliny describes only the fastest voyages, while an average one could have taken some 20 days. This speed was enabled by favourable winds, and the route almost exclusively traversed the open sea. But the way back was something completely different. Because of unfavourable winds one could not sail directly to west or north-west from Alexandria, but had to sail towards the southern shore of Asia Minor to the north, following this coast westwards to Rhodes and then to Crete (it is uncertain whether the route continued along the northern or southern coast of the island). The sailing continued, against the continuously unfavourable winds, across the Sicilian Sea to Malta and further through the Straits towards Ostia or Puteoli. This voyage encompassed some 1700 M, and it took at least two months, making this route a paradigm for the influence the winds had on the navigation in Greek and Roman period (Casson 1960: 234; cf. 1950: 48-50; 1971: 297; this is precisely the route taken by Paul, Acts 27-28).

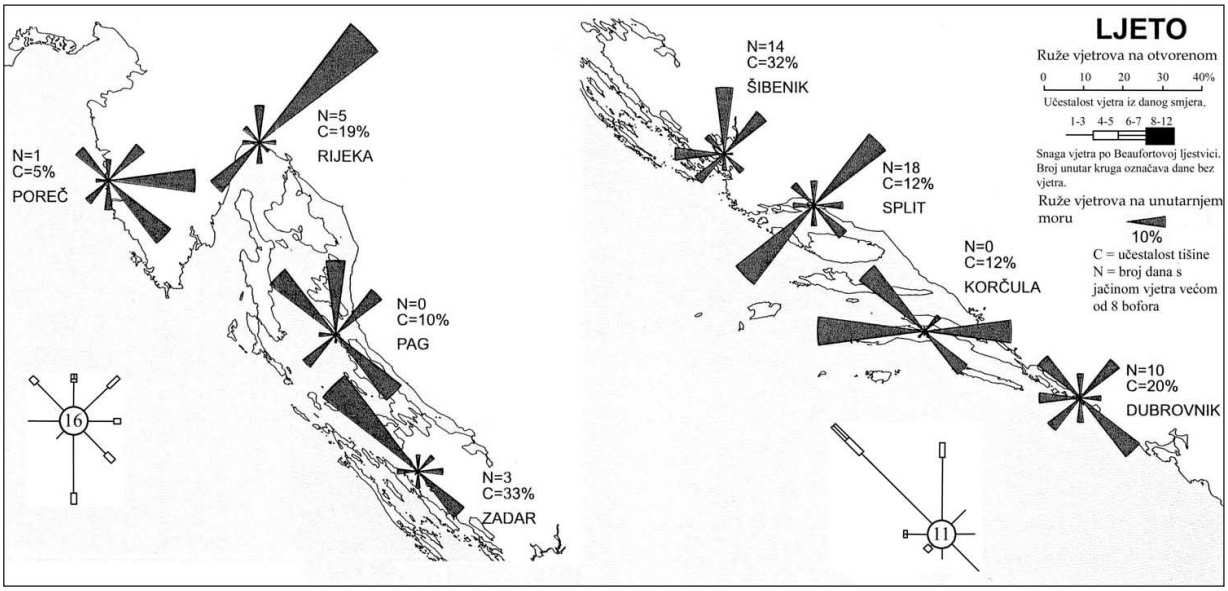
It is a well-known fact that only June, July, August and September were considered favourable to sailing, March, April, May and October

Karta 7. Ruže vjetrova na sjevernom i južnom Jadranu – proljeće
Map 7 *Wind roses for the northern and southern Adriatic in spring*



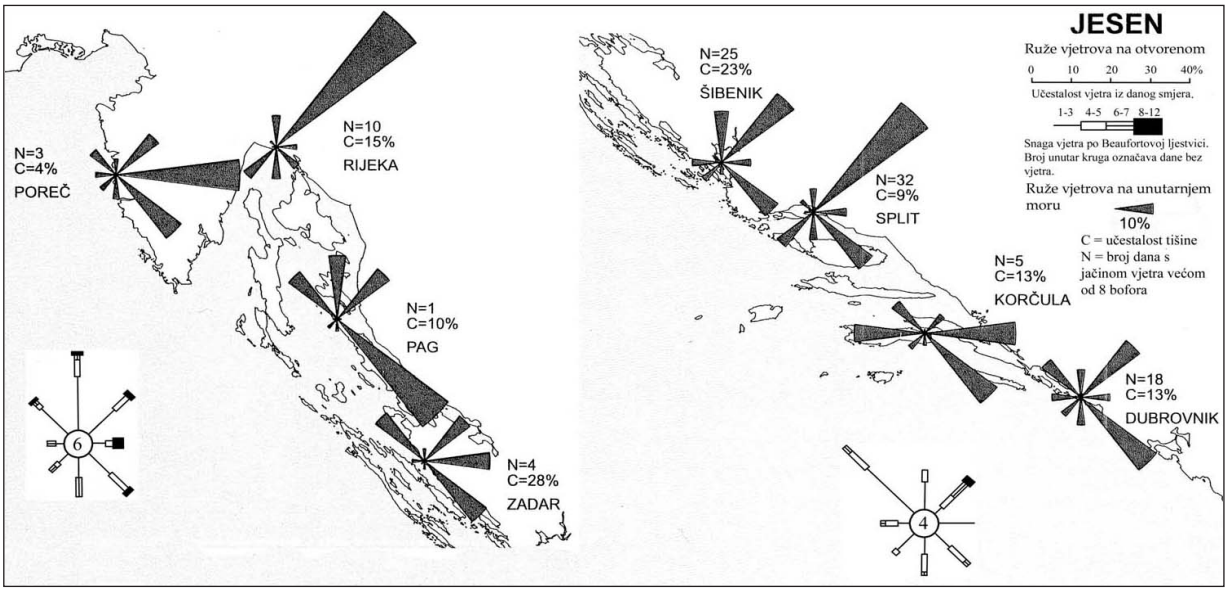
Izvor: *Peljar za male brodove* I: 34–35, sl. 17 i 18 te Med. Pilot III, fig. 6; autor T. Bilić
Source: *Peljar za male brodove* I: 34-35, fig. 17 and 18 and *Med. Pilot* III, fig. 5; author T. Bilić

Karta 8. Ruže vjetrova na sjevernom i južnom Jadranu – ljeto
Map 8 *Wind roses for the northern and southern Adriatic in summer*



Izvor: *Peljar za male brodove* I: 34–35, sl. 17 i 18 te *Med. Pilot* III, fig. 5; autor T. Bilić
Source: *Peljar za male brodove* I: 34-35, fig. 17 and 18 and *Med. Pilot* III, fig. 6; author T. Bilić

Karta 9. Ruže vjetrova na sjevernom i južnom Jadranu – jesen
Map 9 *Wind roses for the northern and southern Adriatic in the fall*

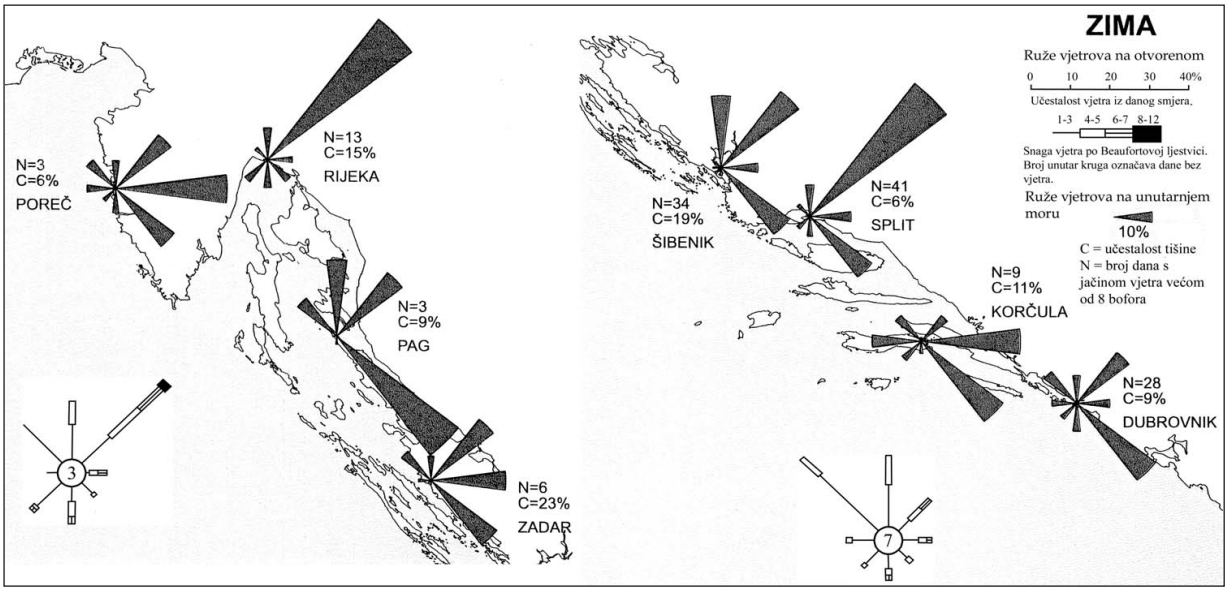


Izvor: *Peljar za male brodove* I: 34–35, sl. 17 i 18 te *Med. Pilot* III, fig. 7; autor T. Bilić
Source: *Peljar za male brodove* I: 34-35, fig. 17 and 18 and *Med. Pilot* III, fig. 7; author T. Bilić

jom sezonskih etezijskih vjetrova koji pušu iz smjera NW s dnevnim hodom smorca, odnosno vjetra koji tijekom dana puše, *ugrubo*, s mora prema kopnu. U Dubrovniku je postotak NW vjetra u lipnju svega 9%, u srpnju 16%, a u kolovozu visokih 38%. Kada se tim iznosima pribroje ostali nepovoljni vjetrovi, kao i razdoblja tišine, jasno je da je plovidba u smjeru NW znatno otežana. Niti na drugim lokacijama nije

were considered dangerous, while during November, December, January and February the seas were "closed" (Casson, 1971: 270-271; Bilić, 2004: 241-242; Tammuz, 2005: 145-146, n. 9, 10). This was especially applicable to coastal sailing, while the open-sea routes could have been opened during the winter months (Tammuz, 2005: 156), for example, the already discussed Rome-Alexandria (Tac. Hist. IV.51) and Alexan-

Karta 10. Ruže vjetrova na sjevernom i južnom Jadranu – zima
Map 10 *Wind roses for the northern and southern Adriatic in winter*



Izvor: *Peljar za male brodove* I: 34–35, sl. 17 i 18 te *Med. Pilot* III, fig. 4; autor T. Bilić
Source: *Peljar za male brodove* I: 34-35, fig. 17 and 18 and *Med. Pilot* III, fig. 4; author T. Bilić

Tablica 1. Učestalost smjera vjetra tijekom ljetnih mjeseci prema višegodišnjim mjerenjima
Table 1 *Frequency of wind direction during summer months according to long-term measurements*

Lokacija *Location*	Mjesec *Month*	LIPANJ *JUNE*									SRPANJ *JULY*								
	Smjer *Direction*	N	NE	E	SE	S	SW	W	NW	t	N	NE	E	SE	S	SW	W	NW	t
DUBROVNIK		0	2	1	**22**	8	15	**19**	9	**24**	0	2	1	**17**	8	12	11	**16**	**33**
PALAGRUŽA		**17**	5	6	16	15	5	7	**24**	6	**20**	3	4	8	11	3	11	**32**	7
ŠIBENIK		7	9	0	10	13	**19**	**28**	10	4	8	10	1	4	9	**21**	**28**	**17**	2
RIJEKA		3	11	4	5	6	**41**	14	5	11	3	9	6	10	4	**38**	13	3	14
TRST		2	13	7	4	1	16	**27**	**29**	1	4	15	7	3	0	**17**	**27**	**26**	1

Lokacija *Location*	Mjesec *Month*	KOLOVOZ *AUGUST*									Prosjek ljetnih mjeseci *Summer months average*								
	Smjer *Direction*	N	NE	E	SE	S	SW	W	NW	t	N	NE	E	SE	S	SW	W	NW	t
DUBROVNIK		2	2	1	16	7	5	10	**38**	**19**	1	2	1	**17**	8	11	13	**21**	**25**
PALAGRUŽA		**25**	2	3	8	14	4	6	**31**	8	**21**	3	4	11	13	4	8	**29**	7
ŠIBENIK		7	13	0	5	13	14	**34**	11	3	7	10	0	6	12	**18**	**30**	13	3
RIJEKA		1	13	6	3	8	**39**	9	3	**18**	2	11	5	6	6	**40**	12	4	15
TRST		1	**20**	7	2	1	13	**31**	**23**	2	2	16	7	3	1	15	**28**	**26**	1

Izvor: *Med. Pilot* III: 40–44 / ***Source:*** *Med. Pilot* III: 40-44

ništa bolje; tako na Palagruži u lipnju postotak NW vjetra iznosi 24%, u srpnju 32%, a u kolovozu 31%, dok je postotak sjevernog vjetra u tim mjesecima 17, 20 i 25% . U Šibeniku je postotak NW vjetra relativno niskih 10, 17 i 11% u lipnju, srpnju i kolovozu, ali je postotak W vjetra, također nepovoljnog za plovidbu u smjeru NW 28, 28 i 34%. U Rijeci, zbog lokalne konfiguracije terena, NW vjetar nije čest, ali zato ljeti puše W (14, 13, 9%) i SW vjetar (41, 38,

dria-Rome route (Philo In Flacc. XV.125, Leg. XXIX.190; Joseph. AJ XIV.14.2, BJ I.14.2-3). It can thus be surmised that the traffic utilizing the eastern Adriatic routes was most intensive during summer, from late May to mid-September, although some sailing activity was certainly present even during winter months. The sailing along the middle of the Adriatic – the so-called outer route – could have been active during entire winter, but the dangers accompanying the

39%), dok su u Trstu najčešći NW (29, 26, 23%) i W (27, 27, 31%) vjetar. Tijekom ostalog dijela godine situacija je nešto povoljnija, no kako je ljeto bilo glavno razdoblje sigurne plovidbe, možemo pretpostaviti da se najraniji grčki istraživači, kolonizatori ili trgovci nisu bili odvažili ploviti u nepoznate ili gotovo nepoznate krajeve tijekom razdoblja nepovoljnog ili čak opasnog za plovidbu.

Iz svega navedenog može se zaključiti da su najraniji antički posjetioci istočne obale Jadrana uz nju ljeti plovili, koristeći jedra, iz smjera NW prema SE, dok je samo uplovljavanje u Jadran bilo vrlo teško, te su za smjer plovidbe SE–NW vjerojatno bile korištene obje jadranske obale. Također, veslanje se vjerojatno često koristilo kao pomoćno sredstvo u plovidbi, možda češće nego na nekim drugim rutama.

gusts of bora also apply to this route, together with the constraints conditioned by the already discussed issue of wind direction.

4. CONCLUDING REMARKS

As one can see from the accompanying maps and table, the direction from which the wind blows on the Adriatic is the most unfavourable for sailing from SE to NW precisely during summer months. This is caused by the Adriatic maestral, created by the synergy of the seasonal etesian winds blowing from NW with the diurnal course of the sea breeze, that is, the wind that blows during the day, in general, onshore. At Dubrovnik, the percentage of the NW wind in June is mere 9%, in July 16%, and in August as much as 38%; when other unfavourable winds are added to these figures, together with periods of calm, it is obvious that the sailing towards NW is made considerably harder by these facts. Other locations show a similar pattern: for example, at Palagruža the percentage of the NW wind in June is 24%, in July 32%, and in August 31%, while the percentage of northerlies during respective months is 17, 20 and 25%. At Šibenik the percentage of the NW wind is relatively low 10, 17 and 11% in June, July and August, respectively, but the percentage of the wind blowing from W, also unfavourable for the sailing towards NW is 28, 28 and 34%. At Rijeka, due to the local terrain configuration, the NW wind is less frequent, but during summer months the wind often blows from W (14, 13, 9%) and SW (41, 38, 39%), while at Trieste the NW (29, 26, 23%) and W (27, 27, 31%) winds are the most frequent ones. During the rest of the year the situation is somewhat more favourable, but since summer months are the prevailing period for safe sailing, one can presume that the earliest Greek explorers, colonizers or merchants did not dare to sail into the unknown or almost unknown regions during the period unfavourable or dangerous for sailing.

From all the above one can conclude that the earliest Greek visitors of the eastern shore of the Adriatic sailed along it during summer months from the direction of NW towards SE, while the very sailing into the Adriatic was rather complicated, and both sides of the Adriatic were utilized for the sailing from SE towards NW. Furthermore, rowing, as auxiliary propulsion, was most probably used more often than on some other routes.

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