The Inland Seas

Towards an Ecohistory of the Mediterranean and the Black Sea

Edited by Tønnes Bekker-Nielsen
and Ruthy Gertwagen

Alte Geschichte

Geographica Historica – 35

Franz Steiner Verlag

The Inland Seas
Edited by Tønnes Bekker-Nielsen
and Ruthy Gertwagen

GEOGRAPHICA HISTORICA

Begründet von Ernst Kirsten,

herausgegeben von Eckart Olshausen und Vera Sauer

Band 35

The Inland Seas

Towards an Ecohistory of the Mediterranean and the Black Sea

Edited by Tønnes Bekker-Nielsen and Ruthy Gertwagen

Franz Steiner Verlag

Published with the financial support of the History of Marine Animal Populations project / Oceans Past Initiative.

Copy-editing by Gina Coulthard, Cherine Munkholt and Berit Panduro Petersen
Translation by Mónica Ruz Manzano
Cartography by Richard Szydlak

Bibliografische Information der Deutschen Nationalbibliothek:
Die Deutsche Nationalbibliothek verzeichnet diese Publikation in der Deutschen Nationalbibliografie; detaillierte bibliografische Daten sind im Internet über <http://dnb.d-nb.de> abrufbar.

Druck: Hubert & Co., Göttingen
Gedruckt auf säurefreiem, alterungsbeständigem Papier.
Printed in Germany.
ISBN 978-3-515-11439-4 (Print)
ISBN 978-3-515-11443-1 (E-Book)

Zum Geleit

Der vorliegende Sammelband kam auf Initiative von Tønnes Bekker-Nielsen und Ruthy Gertwagen zustande. Die Autoren folgten deren Einladung, zur Entwicklung einer Ökogeschichte des Mittelmeers und des Schwarzen Meers beizutragen. Die Drucklegung wurde von der Forschungsinitiative 'Oceans Past Initiative' (ehemals 'History of Marine Animal Populations') unterstützt.

Ökogeschichte, verstanden als die Untersuchung der Wechselwirkungen zwischen Mensch und Umwelt in historischer Perspektive, ist auf das Engste mit Historischer Geographie verflochten und weitet gleichsam deren Horizont. So ist dieser Band in den *Geographica Historica* höchst willkommen.

Eckart Olshausen und Vera Sauer

Contents

Illustrations

Abbreviations

Aelian, *NA*	Aelian. *On the Characteristics of Animals* [*De Natura Animalium*], with an English translation by A. F. Scholfield (LCL 449). Cambridge MA 1971–2.
AI	Archaeo-ichthyology
ap.	*apud* (i. e. the passage in question is preserved in the text of another author)
ARC	Archaeological Research and Consultancy, Groningen.
Athenaeus	Athenaeus, *The Learned Banqueters* [*The Deipnosophists*] 1–8, with an English translation by S. D. Olson (LCL 204, 208, 224, 235, 274, 327, 345, 519). Cambridge MA 2007–12.
BAR	British Archaeological Reports. Oxford.
BE	*Bulletin épigraphique*. Paris.
BP	(years) before present
BSR	Broad Spectrum Revolution
CIESM	Commission Internationale pour l'Exploration Scientifique de la Méditerranée
CIL	*Corpus Inscriptionum Latinarum*. Berlin.
CIRB	*Corpus Inscriptionum Regni Bosporani.* Leningrad 1965.
CoCoNet	Towards COast to COast NETworks of marine protected areas (from the shore to the high and deep sea), coupled with sea-based wind energy potential.
Dig.	Mommsen, T. and P. Krüger (eds), *The Digest of Justinian*, with a translation by A. Watson. Philadelphia 1985.
Dittenberger, *Sylloge*^{3}	Dittenberger, W. (ed.) 1915–1924. *Sylloge Inscriptionum Graecarum*. Third edition. Leipzig.
EEZ	Exclusive Economic Zone
EMT	Eastern Mediterranean Transient
FAO	United Nations Food and Agricultural Organisation
FGrHist	Jacoby, F. 1924–1958. *Die Fragmente der griechischen Historiker*. Berlin 1923–
FL	Fork length
ICAZ	International Council for Archaeozoology
ICret	Halbherr, F. and M. Guarducci (eds) 1935–1950. *Inscriptiones Creticae*. Rome.
IG I^3	D. Lewis and L. Jeffery (eds) 1981–1994. *Inscriptiones Graecae* I: *Inscriptiones Atticae Euclidis anno anteriores* (3rd edition). Berlin.
IG II^2	Kirchner, J. (ed.) 1913–1940. *Inscriptiones Graecae* II *et* III: *Inscriptiones Atticae Euclidis anno posteriores* (2nd edition). Berlin.
IG IV	Fraenkel, M. (ed.) 1902. *Inscriptiones Graecae* IV = *Inscriptiones graecae Aeginae, Pityonesi, Cecryphaliae, Argolidis*. Berlin.

IG IV^2.1	Hiller von Gaertringen, F. (ed.) 1929. *Inscriptiones Graecae* IV. *Inscriptiones Argolidis* (2nd edition). Fasc. 1, *Inscriptiones Epidauri*. Berlin.
IG IX.1^2	Klaffenbach, G. (ed.) 1932–1968. *Inscriptiones Graecae* IX.1 (2nd edition). Berlin.
IG XI.2	Durrbach, F. (ed.) 1912. *Inscriptiones Graecae* XI. Fasc. 2, *Inscriptiones Deli*. Berlin.
IG XII.9	Ziebarth, F. (ed.) 1915. *Inscriptiones Graecae* XII.9. *Inscriptiones Euboeae insulae*. Berlin.
IG XII Suppl.	Hiller von Gaertringen, F. (ed.) 1939. *Inscriptiones Graecae* XII. *Supplementum*. Berlin.
IJNA	*International Journal of Nautical Archaeology and Underwater Exploration*
IK	*Inschriften griechischer Städte aus Kleinasien*. Bonn.
ILS	Dessau, H. (ed.) *Inscriptiones Latinae Selectae*. Berlin 1892–1916.
IMT	Barth, M. and J. Stauber (eds) 1996. *Inschriften von Mysia und Troas*. Munich.
indet.	undetermined species
IOSPE	Latyschev, B. 1885. *Inscriptiones antiquae Orae Septentrionalis Ponti Euxini Graecae et Latinae*. St Petersburg.
IRPCádiz	J. González, *Inscripciones Romanas de la provincia de Cádiz*, Cádiz 1982.
IScM	*Daciae et Scythiae Minoris antiquae. Series altera: Inscriptiones Scythiae Minoris graecae et latinae.* Bucharest 1983-
LCL	Loeb Classical Library
LGM	Late Glacial Maximum
MBSE	Mediterranean-Black Sea ecosystem
MEFRA	*Mélanges de l'École Française de Rome. Antiquité*. Paris.
MNI	Minimum number of individuals
NISP	Number of Identified SPecimens
Oppian, *On Fishing*	Oppian, *Colluthus, Tryphiodorus*, with an English translation by A.W. Mair (LCL 219). Cambridge, MA 1963.
PCG	Kassel, R. and C. Austin (eds) 1983–2001. *Poetae Comici Graeci* 1–8. Berlin.
Pliny, *NH*	Pliny the Elder, *Natural History*, with an English translation by H. Rackham and W.H.S. Jones (LCL 330, 352–3, 370–1, 392–4, 418–9). Cambridge, MA 1938–1963.
POxy	B.P. Grenfell and W.S. Hunt (eds), *The Oxyrhynchus Papyri*. London 1897–
RE	Pauly, A. and G. Wissowa (eds), *Paulys Realencyclopädie der classischen Altertumswissenschaft.* Second edition. Stuttgart 1894–1980.
SEG	*Supplementum Epigraphicum Graecum.* Leiden 1923–
SESAME	Southern European Seas: Assessing and Modeling Ecosystem Changes
SL	Standard length
sp./spp.	species
Strabo	Strabo, *Geography* 1–8, with an English translation by H.L. Jones (LCL 49–50, 182, 196, 211, 223, 241, 267). Cambridge MA, 1917–32.

Tønnes Bekker-Nielsen and Ruthy Gertwagen

Introduction

Few other regions of the world have been studied in such minute detail as the Mediterranean basin. It was home to the earliest human urban communities and some of the earliest literate cultures; it has been the cradle of three great religions. Countless generations of scholars, from Herodotus and Pausanias to Fernand Braudel and David Abulafia,[1] have devoted themselves to investigating the complex history and rich archaeological heritage of the civilisations along the shores of the Mediterranean and the Black Sea. The sea itself, too, has exerted a fascination since time immemorial, although systematic investigations did not take place before the early modern period. Whereas these early studies were motivated by a general scientific interest in the sea as such,[2] more recent studies of the Mediterranean waters have increasingly been driven by concern for the well-being of its marine life.[3] For those who wish to understand better mankind's relationship with the sea around us and the ways in which our actions impact upon the marine environment, the Mediterranean-Black Sea ecosystem offers an incomparable store of information.

1. Mediterraneanism

Drawing on this rich set of data, anthropologists and historians have produced impressive syntheses describing how 'Mediterranean' societies and their relation to the environment have evolved.[4] By and large, however, these have been concerned with the terrestrial environment to the virtual exclusion of the marine environment. For instance, an eleven-page survey of ancient Mediterranean environmental history by Robert Sallares[5] devotes only a few lines to life in the sea, a similar survey by Andrew Wilson[6] a single paragraph and the magisterial 800-page *The Corrupting Sea* by Peregrine Horden and Nicholas Purcell a page and a half.[7]

Also, while concepts such as 'Mediterranean society', 'Mediterranean diet' or 'Mediterranean landscape' may be useful for analytical purposes, they, like all ideal types, carry with

1 Braudel 1949; Abulafia 2009.
2 E. g., Marsigli 1681; Köhler 1832; Schmidt (ed.) 1912–39.
3 E. g., the studies in Gertwagen et al. (eds) 2008; Gertwagen et al. (eds) 2011; Mackenzie and Mariani 2012; see also, more generally, Holm et al. (eds) 2001.
4 Horden and Purcell 2000; Abulafia 2009.
5 Sallares 2009: 165.
6 Wilson 2013: 275.
7 Horden and Purcell 2000: 190–1.

them the risk of over-simplification.[8] Certainly there are some common denominators, but there were also very important differences between life in Corinth and Malaga, or between the institutions of sixteenth-century Venice and Smyrna, just as today's Algiers is a very different place from Novorossijsk. Even under the Roman Empire, when they lived under the same ruler, the same legal code and used the same currency, there were significant differences between the 'Mediterranean' communities, differences which are not always apparent in the textual sources but come to light in the archaeological record.

Indeed, it is perhaps significant that while the ancients had terms – Greek *pontikos*, Latin *ponticus* – to identify those who dwelt along the shores of the Black Sea, they lacked a similar adjective for those living on the coasts of the Mediterranean. The sea itself was known as *he megale thalatta*, 'the Great Sea', to the Greeks; the Romans, with characteristic self-confidence, called it *mare nostrum*, 'our sea'.[9] The adjective *mediterraneus*, from which the modern word is derived, simply means 'surrounded by land', i. e. 'inland' or 'landlocked'. Only as late as the seventh sentury AD is *Mare Mediterraneum* used in its modern sense by the Spanish bishop Isidore (c. 560–636). He was living and writing in Seville, beyond the Strait of Gibraltar: from his point of view it made sense to distinguish between the 'landlocked' sea to his east and the open ocean to the west.

For the title of this volume, we have taken the original sense of *mediterraneus* as 'inland' to describe the four seas that together form our field of study: the Mediterranean Sea, the Black Sea, the Sea of Marmara and the Sea of Azov. These seas are as different as the cities on their coasts, if not more so: in their geology (witness the contrast between the deep trench that forms the Sea of Marmara and the shallow Sea of Azov), in their hydrology (the clear waters of the Mediterranean against the anoxic depths of the Black Sea) and even in their history (that of the Mediterranean goes back millions of years, while the Black Sea as we know it is less than 10,000 years old).

Within each of these, there are of course important differences. In particular, the Mediterranean is often conceived as a set of separate seas (the Pamphylian Sea, the Aegean Sea, the Adriatic Sea, the Sea of Sicily) within each of which there are again striking contrasts: between the southern and northern Adriatic, the southern and northern Aegean. In short, life in the sea is as varied as life on land. The one common feature of our seas is their being 'inland', connected to the world's other seas only through the Strait of Gibraltar and, since 1870, by the Suez Canal.

2. Ecology, history and ecohistory

Ecology, like economy, derives its first syllable from the Greek *oikos*, meaning 'household'. Originally a branch of biology, during the twentieth century it developed into a discipline in its own right drawing inspiration from other new fields of science, notably thermodynamics. The influence from thermodynamics is clearly seen in the groundbreaking and highly influential essay by Thomas W. Gallant, *A Fisherman's Tale*; the first attempt to view the history of Mediterranean fishing from a *longue durée* perspective.[10] His focus on marine food as a

[8] Herzfeld 2005: 47–8.

[9] Originally used only for the western Mediterranean, the name was later extended to include the whole sea.

[10] Gallant 1985.

source of calories, i.e. energy, leads Gallant to conclude that given the low calorific content of fish, it could neither have played any significant role in the ancient diet, nor in the ancient economy. But as later studies have pointed out, and several of the contributions to this volume underline, catching or consuming fish is not primarily a question of cheap energy: on the contrary, it involves conscious decisions motivated by complex social, culinary and cultural motives.

Human motives and actions are the subject matter of history. In his book *The Idea of History*, originally written in 1936 but published posthumously in 1946, the philosopher Robin G. Collingwood distinguished two kinds of events: 'mere events', which are governed by physical laws (gravity causes a stone to fall to the ground), and historical events, which are guided by human motives and decisions (a stone flies through the air because I threw it). 'Mere events' are predictable and can be replicated at will; historical events are not and cannot, since each event is essentially unique. 'Mere events' can be understood by reference to natural laws, historical events must be interpreted by re-enactment of the event in the historian's mind.[11]

Collingwood's neat division of events into only two categories has been challenged by subsequent developments in the sciences. Behavioural psychology has demonstrated how some human actions are guided by natural instinct rather than reflection and decision; the social sciences have shown that human actions, while individually unpredictable (for which party will this particular individual vote?) may be predictable when aggregated (what proportion of *all* individuals will vote for this party?). Yet the basic distinction between events determined by natural causes and events guided by human decisions remains useful for defining ecohistory and distinguishing it from environmental history, with which it is often confused.

While environmental history normally takes both types of event into consideration, it does not have to; the history of global temperature variation until AD 1700, for instance, can be written entirely on the basis of natural laws. Although students of climate change will draw on traditional historical sources (e.g., narratives about extreme winters or records of the rise of the Nile at Cairo) these are explored in order to supply facts, not explanations. By this process, known as 'data mining', information recorded by human action is used to test hypotheses based on the laws of natural science. Conversely, while traditional political history can and often does take environmental factors into account, some important events – the death of Nero, to take one example – can be satisfactorily explained by re-enacting them in the historian's mind, without recourse to the laws of natural science.

Ecohistory stands at the interface between these two approaches to the past. Since it concerns itself with the relationship between humankind and the environment, it can afford to ignore neither 'mere events' of nature nor the motives underlying human actions. This also means that the student of ecohistory must strive to understand not only how environmental conditions *were* in the past, but also and sometimes more importantly, how they *were perceived to be*. Likewise, the researcher must attempt to recreate the unquantifiable factors, such as prestige and taboos, or the intangible networks of kinship and clientage, all of which affect the ways in which individuals exploit – or choose not to exploit – the resources around them.

---

[11] Collingwood 1946: 213–5.

Furthermore, ecohistory aims to trace the impact of human actions on the environment over past time, which raises the issue of finding sufficient and reliable source material. The problems involved are common to all branches of ecohistory, but they are particularly acute for the student of marine, as opposed to terrestrial, ecohistory; and for two reasons. First, the impact of human exploitation of the landscape for food or fuel is visible to the naked eye as deforestation and soil erosion, phenomena that were commented upon by Greek observers as early as the fourth century BC.[12] To the observer standing on the shore or the deck, on the other hand, the surface of the sea provides little information about the richness of its fish stocks nor about its environmental health. It is only by using proxy data that we can hope to gain some impression of life in the sea, its variation and its extent.

Ironically, it is for the early, pre-literate periods of human history that we are most likely to possess reasonably reliable proxy data, thanks to the work of modern ichthyoarchaeologists analysing and counting fish remains on coastal settlement sites. From later periods, where we are in general better informed thanks to the existence of written sources, quantitative evidence for marine harvesting is largely absent. This is partly due to the social context of fishing as an activity on the margins of society, but also to a more general, and far more serious problem: that well into the twentieth century, even among the scientific community, it was believed that the effect of human harvesting was too insignificant to have any impact on marine life in the open oceans. Thus insofar as any registration of catches took place at all, its purpose was not to document life in the oceans but to ensure a just division of the fruits of the sea between co-owners; between owners and lessees of fishing rights; or between fishermen and the government. Especially the last category of sources – tax records – raises obvious and disturbing questions about potential bias and under-reporting. Furthermore, systematic division of catches is mainly relevant in a situation where fishing zones are territorialized or fishing opportunites limited: in estuarine and coastal fishing, not on the open sea. Given the quasi-total absence of precise scientific records before the modern period, most of our textual evidence for open water fishing is bound to be circumstantial and in many cases anecdotal.

In sum, there are daunting challenges facing this emergent discipline, and it is with good reason that we have chosen as the subtitle of this volume '*towards* an ecohistory of the Mediterranean and the Black Sea'.

3. Prehistory

The first two contributions, by Arturo Morales-Muñiz and Eufrasia Roselló-Izquierdo on 'Fishing in Mediterranean prehistory' and by Dimitra Mylona on 'Fish and seafood consumption in the Aegean', share an archaeo-ichthyological approach. By focusing on the actual remains of fish that were consumed on a site, the authors enter into direct contact with their primary data material and are able to construct time series reaching far back into the prehistoric period. As both papers stress, however, the fish assemblages found on coastal sites do not reflect what species were present in the sea. First, there are the problems of ta-

[12] E. g., Plato, *Critias* 111b on deforestation and soil erosion in ancient Attica: 'what now remains compared with what then existed is like the skeleton of a sick man, all the fat and soft earth having wasted away'. For divergent interpretations of this passage, compare Williams 2000: 35 and Nenninger 2001: 193–8.

phonomy: large individuals with robust skeletal structures will be over-represented in the material, while small fish and cartilaginous species will be under-represented. Furthermore, the authors find clear evidence for selection: fishermen and fish consumers did not mechanistically target whatever was available in the sea. Thus variation in the archaeo-ichthyological assemblages over time need not reflect variation in species composition; it is more likely to reflect changing preferences for different categories of seafood. Finally, the papers highlight the methodological shortcomings that characterise older excavations where fish remains were either not studied at all or in an unsystematic fashion.

The following paper by Christophe Morhange, Nick Marriner and Nicolas Carayon, on 'The ecohistory of ancient Mediterranean harbours', likewise takes an archaeological approach but directs our attention to the points of contact between humans and the marine ecosystem: harbours. Properly investigated and interpreted – processes which require the combined efforts of many disciplines – harbour installations can yield important information not only about human activities (fishing, transport, evolution of construction techniques) carried on at the site but also about environmental events such as sea level fluctuation and coastal erosion or silting.

4. Fishing in context

With the following seven papers, we move from the archaeological evidence to the social context within which marine resources were exploited. As pointed out already in the first two papers of the volume, fishing, even in prehistoric societies, is a selective process directed at certain species and virtually ignoring others. This selection in turn reflects a variety of factors such as the legal régime governing the exploitation of marine resources (Ephraim Lytle), the prestige associated with certain marine products and the technology available for producing marine derivatives such as purple dye (Carmen Alfaro Giner), the demand for and production of salt-fish and garum (Robert I. Curtis, Dario Bernal-Casasola and Emmanuel Botte). Unlike fresh fish, which before the advent of refrigeration could only be consumed within a restricted time-space window, derivatives had a long shelf life; they could be, and were, transported by sea or land to distant markets (Benedict Lowe).

In this respect, the harvesting of tuna with mobile or fixed nets poses special challenges. It requires the coordinated efforts of many hands working together and will, on occasion, produce windfall catches far too large to be consumed by the fishing community or its hinterland; thus it also requires the organisational skills and capital resources – both far beyond the capacity of the small-scale family business or the craft fisherman – necessary to process the catch at short notice and transport it to urban markets. The social context of ancient tuna fishing is discussed by Ephraim Lytle in his paper and Enrique García Vargas explores its history in the western Mediterranean from the second to the eighteenth century AD.

5. Regional studies

The papers that follow have a regional rather than a thematic focus. Tønnes Bekker-Nielsen discusses the present state of our knowledge of Black Sea fishing and fish processing in antiquity, and the potential contribution of fish deposits from the sea's anoxic depths to the study of its faunal history.

Constantin Ardeleanu traces the evolution of Danube fishing in the *longue durée* from antiquity to the twentieth century. As we move into the early modern period, the first fishing statistics in the form of market and tax records emerge, enabling historians to assess the quantitative evolution of fishing with more confidence. It becomes possible to trace patterns of growth and decline,and to assess the negative effects of overexploitation or the positive consequences of new fisheries policies such as that implemented in Romania at the turn of the twentieth century.

Studies of fishing in the eastern Mediterranean basin and the Levant coasts have, by and large, been scarce and somewhat patchy, partly due to the misconception that the eastern Mediterranean is poorly stocked with fish, thus *a priori* unlikely to support a fishing industry; and partly to the nature of the textual sources, written in a variety of languages (Greek, Hebrew, Arabic, Latin) and divided among archives and libraries from Cairo and Istanbul to Venice and Genoa. As Ruthy Gertwagen's paper reveals, fishing activity was rife along the Levant coast and in the north-eastern Mediterranean; it is documented by a rich body of texts, much of which still awaits the attention of scholars. Likewise, Venetian and Genoese archives offer important insights into the – otherwise poorly documented – fish processing industry in the northern Black Sea, and complement the information of the Byzantine sources about fish trade and consumption in Constantinople.

Sabine Florence Fabijanec provides an overview survey of fishing and fish marketing on the mid-Adriatic coast in the fifteenth and sixteenth centuries, and an analysis of their social context. In early modern Dalmatia, as in Sicily, the activities of the fishermen were embedded within a complicated framework of informal and formal relationships of ownership, patronage, kinship, religion and political authority. The urban communes played a particularly important role in Dalmatia, levying taxes on the fishermen and serving as arbiters – not always impartially – between rival fishing interests.

6. History and environmental change

In the concluding chapter, Ferdinando Boero demonstrates how a better understanding of the past ecohistory of the Mediterranean-Black Sea ecosystem can lead to informed decisions affecting the future of the world's oceans, whose waters are joined together by a great oceanic 'conveyor belt' (thus vindicating the ancient Greek belief that a single Ocean surrounds the entire inhabited world). The Mediterranean has its own 'conveyor belt'; it is, in a sense, a small-scale replica of the oceanic system. Studying the effects of global warming on the Mediterranean – or as a case study, the Adriatic – provides insights which could guide decision-makers of the future. The Pope's clear statement on the need for sustainability and the success of the COP21 meeting in Paris gives Boero grounds for cautious optimism that humanity will be able to make informed choices in accordance with the laws of nature.

A pessimist would point out that whereas the international community has demonstrated ability to take concerted and effective action against some of the threats facing humanity (the eradication of smallpox and the phasing out of CFC gases are notable examples) it has been unable to deal in a similar manner with the problems of commercial whaling or overfishing of Mediterranean tuna. Here, the decision-makers have allowed the laws of economy to take precedence over the laws of nature.

So at the end of the day, it all comes down to motives and decisions. Human motives and decisions are important not only for understanding the past but also for shaping the future. And as Boero points out, action will in any case, sooner or later, be taken to reduce the human impact on the global environment. If we, the human species, fail to do so, nature will.

Tønnes Bekker-Nielsen
Department of History, University of Southern Denmark
Campusvej 55, DK-5230 Odense M
tonnes@sdu.dk

Ruthy Gertwagen
Byzantine and Modern Greek Studies, University of Haifa,
Mount Carmel, Haifa 3498838, Israel
ruthygert@gmail.com

7. References

7.1 Primary sources

Plato 9: *Timaeus, Critias, Cleitophon, Menexenus, Epistles*, with an English translation by R. G. Bury (LCL 234). Cambridge MA 1925.

7.2 Secondary literature

Abulafia, D. 2009. *The Great Sea: A Human History of the Mediterranean*. Oxford.

Braudel, F. 1949. *La Méditerranée et le Monde Méditerranéen a l'époque de Philippe II*. Paris.

Collingwood, R. G. 1946. *The Idea of History.* Oxford.

Gallant, T. W. 1985. *A Fisherman's Tale* (Miscellanea Graeca 7). Ghent.

Gertwagen, R., T. Fortibuoni, O. Giovanardi et al. (eds) 2011. *When Humanities Meet Ecology: Historic changes in Mediterranean and Black Sea marine biodiversity and ecosystems since the Roman Period until nowadays: Languages, methodologies and perspectives.* Rome.

Gertwagen, R., S. Raicevich, T. Fortibuoni et al. (eds) 2008. *Il mare, com 'era: le interazioni tra uomo ed ambiente nel Mediterraneo dall'Epoca Romana al XIX secolo: una visione storica ed ecologica delle attività di pesca.* Chioggia.

Herzfeld, M. 2005. 'Practical Mediterraneism: excuses for everything, from epistemology to eating' in W. V. Harris (ed.), *Rethinking the Mediterranean*. Oxford, 45–63.

Holm, P., T. Smith and D. J. Starkey (eds) 2001. *The Exploited Seas: New Directions for Marine Environmental History*. St John's, Newfoundland.

Horden, P. and N. Purcell 2000. *The Corrupting Sea: A Study of Mediterranean History*. Oxford.

Köhler, H. K. E. 1832. 'Τάριχος, ou recherches sur l'histoire et les antiquités des pêcheries de la Russie méridionale', *Mémoires de l'Académie Impériale des Sciences de Saint-Pétersbourg* 6th s., 1, 347–490.

Mackenzie, B. R. and P. Mariani 2012. 'Spawning of bluefin tuna in the Black Sea: historical evidence, environmental constraints and population plasticity'. PloS ONE 7.7: e39998.

Marsigli, L. F. 1681. 'Internal observations on the Thracian Bosphorus, or true channel of Constantinople, presented in letters to Her Majesty, Queen Christina of Sweden', reprinted 1935 in *Bolletino di Pesca, Piscicoltura e Idrobiologia* 11, 734–58.

Nenninger, M. 2001. Die Römer und der Wald: Untersuchungen zum Umgang mit einem Naturraum am Beispiel der römischen Nordwestprovinzen (Geographica Historica 16). Stuttgart.

Sallares, R. 2009. 'Environmental history', in A. Erskine (ed.), *A Companion to Ancient History*. New York, 164–74.

Schmidt, J. (ed.) 1912–39. *Report on the Danish Oceanographical Expeditions 1908–10 to the Mediterranean and Adjacent Seas*. Copenhagen.

Williams, M. 2000. 'Dark ages and dark areas: global deforestation in the deep past', *Journal of Historical Geography*, 26, 28–46.

Wilson, A. 2013. 'The Mediterranean environment in ancient history: perspectives and prospects' in W. V. Harris (ed.), *The Ancient Mediterranean Environment between Science and History*. Leiden, 259–76.

Arturo Morales-Muñiz and Eufrasia Roselló-Izquierdo

Fishing in Mediterranean prehistory: an archaeo-ichthyological overview

1. Introduction

The Mediterranean is arguably the oldest continuously and intensively humanised seascape of the world. It also ranks among the best documented, despite the fact that we are still lacking critical knowledge in many areas. One such area is the relationship between fish and humans of the prehistoric period, when humans started to fish. The development of such human-marine interactions fostered coastal settlement, fishing technology and seafaring, among other impacts.

This is a fascinating story that still lacks many details, due partly to the sheer diversity of the ecosystem. Like the lands surrounding it, the Mediterranean is an extremely varied environment where fish abundances shift dramatically from place to place, often on a daily basis.[1] Mediterranean fishermen, since times immemorial, have had to adapt to these micro-regional ecologies and the erratic availability of resources. Under such circumstances, chance must have played a significant role in the success – or otherwise – of fishing expeditions.[1]

To understand the story better, however, we can employ archaeo-ichthyology (AI), the branch of zooarchaeology devoted to the study of fish remains from archaeological sites. This is a comparatively young discipline that emerged in the 1970s as researchers felt the need for a more precise knowledge of fishing. In recent decades, archaeo-ichthyology has witnessed a dramatic development, but there is still a long way to go, and the archaeo-ichthyology of the Mediterranean is no exception to this general rule.[2]

In this paper, we shall try to summarise what AI can tell us about early human exploitation of the Mediterranean's fish resources and also the limitations of the data, which demand caution in their interpretation. As will become apparent, there is no single linear story of the emergence of fishing; rather, it is a story composed of many entwined tales, repeated through time and space, and that often resist unification into all-encompassing patterns. The patterns that do occasionally emerge are currently provisional, and require confirmation

---

1 Margalef (ed.) 1985; Bas et al. 1985. The effects of the Mediterranean oceanography underlying the unpredictability of the catch (i. e. the 'myth of the bitter sea') has provided the basis for many folk stories, like the one recounted by the Arab historian al-Waqidi: when fishermen offend the Mediterranean, the sea responds by refusing to give them food (Jones (ed.) 1966).

2 Fortibuoni et al. 2010; Rick and Erlandson (eds) 2008.

before being integrated into a general frame of reference concerning fishing in the ancient Mediterranean.

2. What can archaeo-ichthyology tell us about early human fishing?

The main contribution that AI can provide to our precise knowledge of the past is to confirm the presence of a particular species at a given place and time. This is often no simple task, but, when successful, can provide a wealth of information. It is also possible to determine biological attributes such as size, sex, age and weight. These data, in turn, may inform us about matters such as how much meat the fish remains represent, where and at what time of year it was caught and, if a large sample is available, whether fish of a given size (i.e. age) or the whole population was targetted.

At the level of the isolated bone, one last category of data is that revealing its post-mortem story. Surface marks such as digestion traces or gnawing marks inform the analyst whether agents other than humans accumulated fish remains, so blurring the signals of human activity.[3] Traces of digestion, cut-marks and the like provide additional information about how fish were treated after being caught and processing evidence may suggest local consumption or trade.

Proceeding beyond the level of the isolated find, a 'faunal assemblage' provides information about the marine habitat and, occasionally, about the time of year when fishing took place. Such analysis requires numerical estimates of abundance, the most common ones being the number of identified remains/specimens (NISP) and the minimum number of individuals (MNI). Estimates of abundance need to be taken as rough indications of the overall composition of the catch, given that most fish samples do not represent fishing 'events' (i.e. isolated episodes) but rather time-average series.[4] Some researchers treat weight values as if they were indicators of abundance, when, at best, they only calibrate importance, and then only in a limited manner (i.e. the amount of meat provided).

One element of the study of ancient fishing where AI might be expected to make a meaningful contribution, yet rarely does so, is the study of fishing methods and equipment. This matter has been discussed at length elsewhere[5] but the major arguments should be repeated here. Briefly stated, the main problem is one of equifinality.[6] Whilst a single species can be caught using a variety of equipment (e.g., tuna can be hooked, netted, speared, etc.), equally, one type of equipment, e.g., a seine, can be used to catch a large variety of

---

3 Erlandson and Moss 2001; Barrett et al. 2002.

4 When it comes to evaluating abundance, there is far too much simplistic determinism implied in certain interpretations of fish assemblages. Claims along the line that 50% of an assemblage being formed by remains of species A and 10% by remains of species B indicates that A, though perhaps not five times as frequent as species B, was nevertheless far more abundant than it, need to be framed, at the very least, in terms of: (a) sample size (in a sample of a few bones the finds under consideration may represent chance events); (b) retrieval biases (defectively retrieved samples, with remains of species A being larger than those of B); (c) identification biases (eg. species A being the only one in its genus and species B belonging to a multi-species genus whose morphological similarities often preclude identification below genus level). The matter becomes even more troublesome when abundance is equated with importance.

5 Morales 2010.

6 Morales 2010: 46–8.

fish – along with turtles, porpoises or even birds.[7] Under such circumstances, a specific fish assemblage can, at best, offer the analyst a range of methods or tackle that were certainly *not* employed to generate a particular taxonomic spectrum (e. g., shark and ray are not caught by nets, sole seldom takes the hook, etc.). In order to make deductions about fishing methods and fishing equipment, AI needs to be contextualised; the faunal data require comparison with other sets of data.

New techniques have recently enlarged the scope and capabilities of AI. Molecular analyses of ancient DNA or stable isotopes have already produced remarkable results relating to Mediterranean fish.[8] Although we shall comment briefly on these here, these techniques, which are still in their initial stage of development, do not yet have a story to offer; thus, at best, they serve to complement data obtained through more conventional means.

Neither modern nor traditional methodologies are without limitations. Given that the main aim of this paper is the identification of patterns, it seems appropriate to explain, first, the range of data included in the database that is presented and to follow this with a discussion about the major types of limitations that often preclude taking the archaeological record of Mediterranean fish at face value.

2.1 The dataset

Given that we are concerned with what AI can tell us about ancient Mediterranean fishing, the dataset was restricted to include only marine fish and to exclude adjacent geographical areas such as the Black Sea and the Bay of Cádiz, the fishing industries of which have traditionally been studied on the basis of commercial fish-processing enterprises (figs 1.1–2).[9] Data from these areas and related to freshwater fish or even marine molluscs may occasionally be incorporated if they help reinforce an argument or make a pattern more robust.

We are presently aware of close to 500 publications mentioning fish in the Mediterranean, yet many of these are useless for our aims. Thus, in addition to freshwater records, papers reporting fishes as '*Pisces indet.*' are obviously of no value. Equally useless are papers reporting fish on a qualitative (i. e. presence/absence) basis. For the most part, these are older reports referring to small samples retrieved by hand, but occasionally some recent papers report large and well-excavated collections in this deficient manner.[10]

The Franchthi Cave, a highly emblematic Mediterranean site, presents a different kind of problem. For trench FAS, for example, M. Rose (1995) fails to provide NISPs, offering instead a graph of vertebral counts for the main taxa. For trench HB1, M. C. Stiner and N. D. Munro (2011) provide NISPs only for the most important taxa (i. e. bluefin, barracuda and the combined sea bream (Sparidae) count). At the same time, although 76 % of these assemblages are reported as 'Fish *indet.*', the authors mention the presence of other taxa, including grey mullet (Mugilidae), sea bass (*Dicentrarchus labrax*) and gilthead (*Sparus au-*

---

7 Brandt 1984; Sahrhage and Lundbeck 1992.

8 E. g., Arnt et al. 2003; Lightfoot et al. 2011.

9 Ponsich and Tarradell 1965; Ponsich 1988; Curtis 1991; García Vargas 2001; Lagóstena-Barrios 2001; Étienne and Mayet 2002; Morales and Roselló-Izquierdo 2006; 2008; 2012; Morales et al. 2007; see also the papers in Bekker-Nielsen (ed.) 2005.

10 This is the case for the Phoenician settlement at Cerro del Villar (Málaga, Spain): Rodríguez Santana 1999.

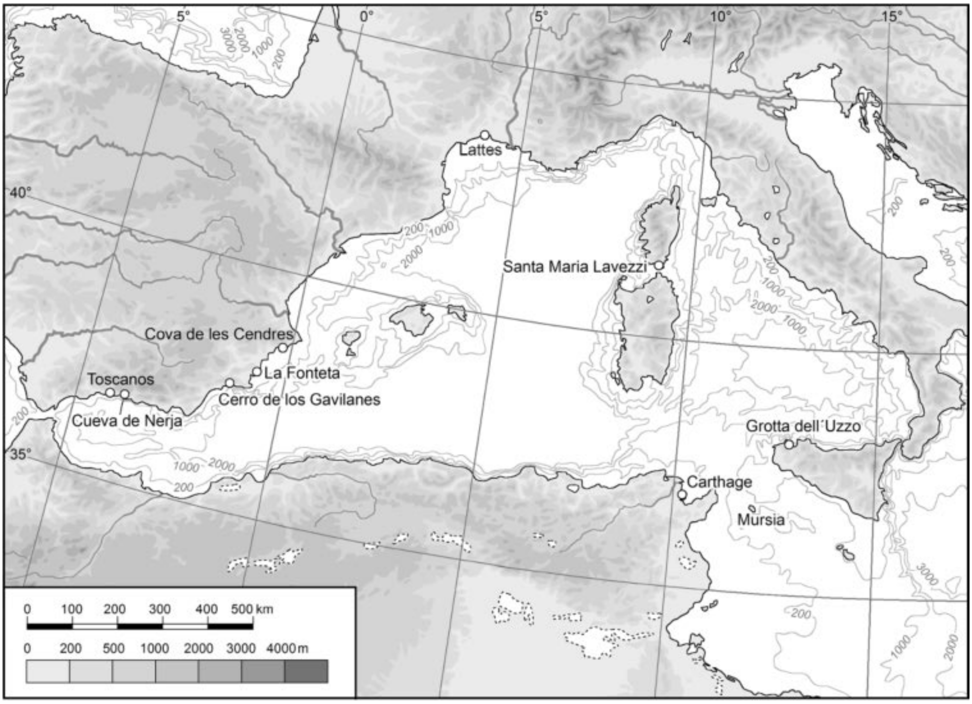

Fig. 1.1: The Western Mediterranean, with principal sites mentioned in text. (Richard Szydlak).

rata).[11] Although the data from Franchthi are very valuable for the purposes of this paper, we have relied on the accounts provided by the authors and refrained from including the fish assemblages in the dataset.

Fishing can best be inferred from primary deposits. For this reason, we omitted from our database both inland sites, where fish were selectively transported, and fish factories, which provide too biased a view of fishing proper; these matters have been dealt with satisfactorily elsewhere.[12]

Three features we looked for in the collections were a meticulous retrieval of remains, large sample sizes and long-term sequences. Few assemblages conform to all three requirements, thus meeting two of them was often deemed sufficient for inclusion. The resulting database consists of 45 assemblages, mostly sieved, representing 29 sites that span a period of c. 20 millennia (Table 1). The database is painfully biased, both geographically (e. g., there is only one site on the southern rim; cf. figs 1.1–2) and chronologically (e. g., there is only one post-Roman site), yet, for the time being, we will have to take it as representative. Its limitations highlight both the need to continue basic research and to be very wary about considering currently discernable patterns as established dogma.

---

11 Stiner and Munro 2011: 627.

12 E. g., Waelkens et al. (2004); the papers in Bekker-Nielsen (ed.) 2005.

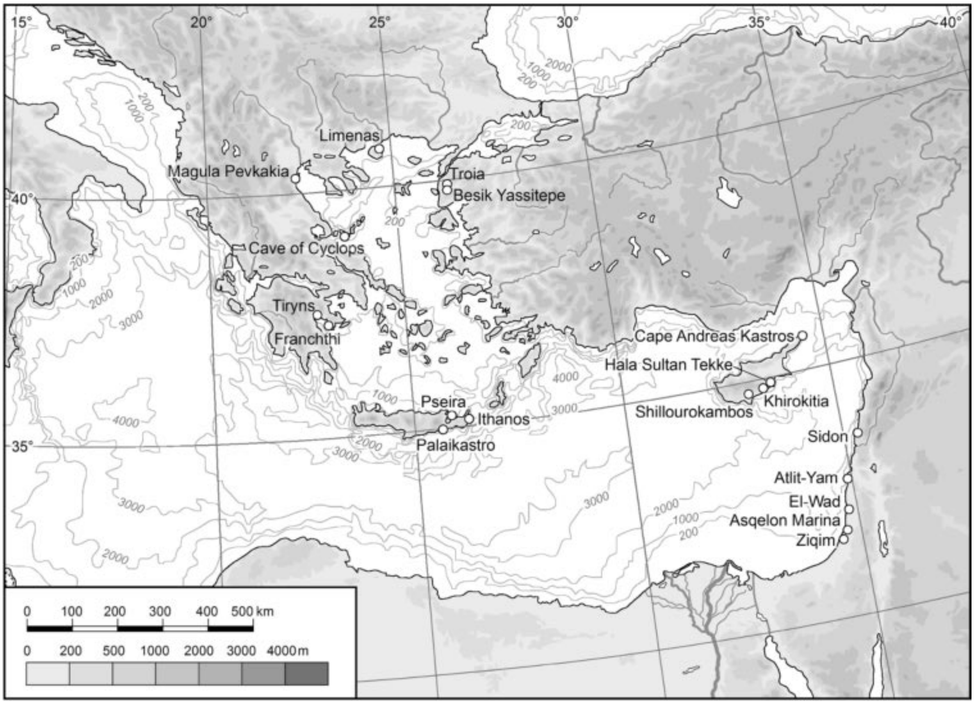

Fig. 1.2: The eastern Mediterranean, with principal sites mentioned in text. (Richard Szydlak).

The approach we have followed is essentially comparative, carried out at a qualitative level and taking into account the available data on present-day Mediterranean fish stocks.[13] Comparisons were made with NISPs and their corresponding percentages, and a measure of diversity, Richness (S), was incorporated; this refers to the number of taxonomic categories in a given assemblage.[14] The premise that 'an increasing species spectrum can be indicative of more efficient fishing equipment and of the exploitation of multiple fishing grounds, both offshore and inshore'[15] is one of the accepted dogma that will be submitted to scrutiny.

Inference of habitat and fishing grounds relies heavily on the concept of bio-indication. The aim is to look for stenoic fish (i. e. those that exhibit narrow margins of tolerance to specific features of their environment) as these happen to be the best bio-indicators. Under such a simple premise, in the past a lot of categorisation was undertaken that classified species as pelagic (open water), demersal (close to the bottom), benthic (on the bottom), euryhaline,

---

13 Whitehead et al. (eds) 1984; Bas et al. 1985; Margalef (ed.) 1985; Gil de Sola 1998; Coll et al. 2010.

14 That is, the taxonomic categories taken into account include species as well as supra-specific categories, provided these contain no representatives at a lower taxonomic level (i. e. the family *Sparidae* would not count in case sparid remains had been recorded already at the level of the genus or the species).

15 Van Neer et al. 2005: 146.

stenohaline, migratory, sedentary, etc. Few fish will fit into such narrow categories; this is bad news for the analyst trying to infer the locations of ancient fishing grounds. To circumvent this problem, large, diverse assemblages are sought, since the combined tolerances of many stenoic species convey a far more reliable picture of a former environment than an inference based upon a few taxa.

The selected assemblages have been reorganised according to criteria that allow one to identify patterns or trends (Tables 2–8). For an environmental categorisation of fishing, only the largest and most informative sites and taxa were considered (Table 5). This is the case for the three migratory groups selected (i. e. the bluefin, *Thunnus thynnus*, the mackerels of the genus *Scomber* and the combined count of all the scombrid fishes) and also, within the sedentary groups, the case for the benthonic *Pleuronectiformes* (i. e. flatfishes) and a series of mid-water (i. e. demersal) taxa. Among the latter, the groupers (genus *Epinephelus*) thrive in rocky shore areas, gilthead, sea bass, grey mullet and eel, *Anguilla anguilla*, do so in brackish-water environments and sea bream (Sparidae), probably the most representative of the Mediterranean fish through time, are littoral (i. e. inshore) over a wide range of depths and sea floors.[16]

3. The limitations of the dataset: problems of 'visibility'

Can the compiled data be taken at face value? Probably not. The reasons for such a conclusion have been mentioned briefly above, but, before we take a more detailed look at the data, we should comment further on the problem of biases affecting the record by discussing three situations in which these may be affecting the visibility of marine resources through time and space, distorting our frames of reference.

3.1 The visibility of the fish record and the onset of fishing in the Mediterranean

It has long been known that sea levels in the Mediterranean experienced changes of up to 120 m during the Pleistocene.[17] What these changes meant at the regional and local scales emerged later,[18] and, although the subject was raised by J. C. Shackleton (1985), not until recently was it realised what these changes implied for the visibility of the archaeological record.[19]

Sea level changes have had a significant effect on the marine resource record, given that fishing and mollusc gathering took place on the coast, their traces becoming weaker and sparser as one moves away from it. In the Mediterranean region, there is ample evidence that this record may be woefully biased prior to the Neolithic, when the shoreline stabilised more or less at today's level.[20] These phenomena have not yet been adequately reconciled with pro-

16 Whitehead et al. (eds) 1984; Gil de Sola 1999.
17 Thiede 1978.
18 E. g., Goy et al. 1996; Antonioli 1997; Lambeck et al. 2004.
19 E. g., Bailey and Flemming 2008.
20 During the past two or three millennia there has been a 5–6 m sea level rise in many parts of the Mediterranean that has contributed to shape the profile of the present-day coastline (Margalef 1985).

posals such as K. V. Flannery's now classical Broad Spectrum Revolution (BSR) hypothesis that considers fish to be a latecomer to the dietary repertoire of humans.[21]

Still, many of the problems we face when considering the earliest evidence for fishing are of a taphonomic nature. Indeed, the earliest marine fish in the archaeological record were reported to have been found at the Acheulean site of Vallonet (France, 900,000 years BP), but subsequent analyses revealed them to be a natural deposit.[22] The Acheulean has also provided other fish deposits in Israel (Ubeidiya, 1,500,000 BP; Latamné, c. 700,000 BP), Spain (Aridos, 160,000 BP) and France (Lazaret, 140,000 BP); again, none of these show signs of human activity and only Lazaret is on the coast.[23]

The debate that this evidence has prompted about an early origin of fishing in the hominin lineage may finally be concluded with the analysis of the data emerging from the Middle Acheulean site of Gesher Benot Ya'akov (Israel, 780,000 BP). Located on the palaeo-shore of former Lake Hula, this site has produced the largest collection of fish remains found in the Mediterranean (< 20,000) and, within it, examples that show clear signs of human activity on the bones.[24]

How will the finds from Gesher Benot Ya'akov affect our currently held views on the origins of fishing? According to the BSR hypothesis, fish constitute low-rank prey (i. e. catching them consumes a large amount of energy – capture cost – compared to the amount of energy they provide as food) and low-rank prey should appear in the archaeological record only once high-ranked prey, such as ungulates, have become depleted or disappeared.[25] Such depletion, according to the BSR hypothesis, started to be felt only during the Upper Palaeolithic. Prior to this, there would not have been any fishing around the Mediterranean. In other words, no hominin other than *Homo sapiens* apparently ever felt the need to fish. The problem is that the individuals from Gesher Benot Ya'akov were not *Homo sapiens*.

Fish finds on Neanderthal sites are scarce and their evidence inconclusive.[26] Still, Mousterian deposits have been found in the westernmost and easternmost margins of the Mediterranean,[27] suggesting that the association between Neanderthals and marine fauna could be more than a mere coincidence. Data from the Bajondillo Cave (Málaga, Spain) reveals that Neanderthals were consuming marine molluscs in the Mediterranean at the same time that *Homo sapiens* were doing so for the first time in South Africa (i. e. 150,000 BP), and plenty of later Mousterian sites throughout the Mediterranean testify to such a practice.[28]

Marine harvesting was neither an exclusively *Homo sapiens* tradition, as some have recently argued, nor restricted to shellfish.[29] Data from Vanguard Cave and Gorham caves in Gibraltar reveal that Neanderthals were actively hunting marine mammals c. 32,000–

---

21 Flannery 1968; Stiner 2001.

22 Cleyet-Merle 1990.

23 Morales 1980; Desse and Desse-Berset 1999; Van Neer et al. 2005.

24 Zohar 2011; pers. comm.

25 Stiner 2001.

26 Roselló-Izquierdo and Morales 2005–2006.

27 At the inland sites of the Tabun Cave, the Amud Cave and Shubbariq in Israel, and of Cueva Millán in north-central Spain (Morales and Roselló-Izquierdo 2005–2006; Van Neer et al. 2005).

28 Evidence for shellfishing at the Grotta dei Moscerini (Italy) has been securely dated to between 110/115,000–65,000 BP (Colonese et al. 2011); see also Cortés-Sánchez et al. 2011.

29 E. g., Jerardino and Marean 2010.