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## TRACING FISHING ACTIVITY ALONG THE WESTERN BLACK SEA COAST THROUGH ANCIENT LITERARY SOURCES

Alin MIHU-PINTILIE<sup>1</sup>, Iulia DUMITRACHE<sup>1</sup>

<sup>1</sup> Institute of Interdisciplinary Research, Department of Exact and Natural Sciences, Arheoinvest Center, "Alexandru Ioan Cuza" University of Iași, Romania. Email: [mihu.pintilie.alin@gmail.com](mailto:mihu.pintilie.alin@gmail.com), [iulia.dumitrache@uaic.ro](mailto:iulia.dumitrache@uaic.ro)

**Abstract.** The fishing activity encompasses the potential of exploitable biological and mineral resources, such as fish and sources of salt, as well as the strategies for their valorization through fish processing and marketing. In this framework, this approach presents the preliminary findings of the research project *Halieutica Scythiae Minoris: Fishing and Fish Industry at the Mouth of the Danube in Roman and Early Byzantine Times* (FinDaRT) and discusses its implications for understanding ancient halieutic activities along the western Black Sea coast. The main objective of this project was to develop an interdisciplinary research model using classical and geoarchaeological investigations, as well as GIS-based data integration, to explore the fish resources in the Pontus Euxinus (Black Sea) region. To achieve this, data on 48 fish species described by 35 ancient authors (14 Greek and 21 Roman authors) were integrated, creating GIS-based spatial datasets for each species. These datasets contained information on their native range distribution and whether they were present or absent in the Pontic basin and the fishing area of *Scythia Minor* (western Black Sea coast). The study also overlaid the distribution of fish species with maps focusing on processing centers, fishing and commercial professional associations, and the destinations of exported products, as documented in ancient sources. The findings reveal that 16.6% of the fish species mentioned by ancient authors (8 fish species) are not native to the Black Sea basin, and 20.8% (10 fish species) cannot be found along the *Scythia Minor* coast. It is important to note that the results are solely based on fish species described by ancient authors, which nonetheless provides valuable insights into the fishery resources that were exploited in the Pontic basin, along the *Scythia Minor* coast, and at the mouth of the Danube (currently the Danube Delta), excluding only the fish species specific to other sea basins.

**Keywords:** GIS, fish resources, fishing activity, ancient sources, western Black Sea coast, *Scythia Minor*.

### 1. INTRODUCTION

The fishing activity encompassed the exploitation of various biological resources, particularly fish stocks, and strategic efforts to capitalize on this potential through transportation, storage, resource processing, and marketing of fish products (Dumitrache, 2015; Marzano, 2018). The artisanal transformation of fish utilized different methods, such as salting (Van Neer et al., 2010), drying (Zohar & Cooke, 2019), and smoking (Bekker-Nielsen, 2005), either individually or in combination (Aiken et al., 2023), making use of the diverse fish species available in nature (Bănăduc et al., 2016). This thriving industry also involved the establishment of enduring workshop networks, both at individual and collective levels, providing significant income for those involved in the fish industry in antiquity (Bekker-Nielsen, 2005; 2010).

During ancient times, the *Pontus Euxinus* (Black Sea) region was characterized by the abundance and chronological diversity of historical sources, indicating that fishing and fish-related activities were integral to the daily lives of ancient communities (Aiken et al., 2023; Dumitrache, 2015; Munk Højte, 2005). Additionally, the high-quality Pontic fish products gained renown and were highly appreciated across vast regions in Europe (Dumitrache, 2015). Therefore, in the last decades, there has been a renewed interest in the ancient fish economy (Costa-Pierce, 2022), particularly during Greek and Roman times (Busana, 2018; Galili et al., 2013;

Trentacoste et al., 2018). However, research on the coastal and marine resources of the Black Sea, as a whole, has not received as much intensive and meticulous attention, especially when compared to the Latin-speaking Mediterranean half of the Roman Empire (Marzano, 2013; 2018). This lack of halieutic investigation has persisted, despite the zooarcheological and historical potential for significant contributions in the Black Sea region (Dumitrache, 2015; 2021).

Overall, when referring to tracing fishing activity during Greek and Roman times, the research areas include mapping and interpreting the network of circum-Mediterranean fish processing centers, paleolimnology, and landscape archaeology (archaeozoology, amphoric archaeology, epigraphy, anthropology of food). While the Mediterranean and western provinces have been extensively studied (Trakadas, 2005), the circum-Pontic area is still lacking consistent results. However, recent archaeological research in the Sea of Azov region (Munk Højte, 2005), southern Crimea (Čechová, 2014), and the southern Black Sea and the Bosphorus (Ulman et al., 2020) has unveiled numerous pottery workshops and fish processing facilities, offering valuable insights into the extent of the salted fish industry in the Hellenophone part of the Roman Empire (Dumitrache, 2015). Nevertheless, when it comes to *Scythia Minor* or today Dobruja, which is divided between Romania and Bulgaria on the western coast of the Black Sea, the historiographic landscape remains relatively poor compared to the Mediterranean or Pontic basin (Dumitrache, 2021). Furthermore, while classical Antiquity is mentioned in some syntheses regarding the political or economic history of Roman Dobruja (Romanescu et al., 2016), specific works dedicated to fishing, fish processing, and fish consumption are scarce.

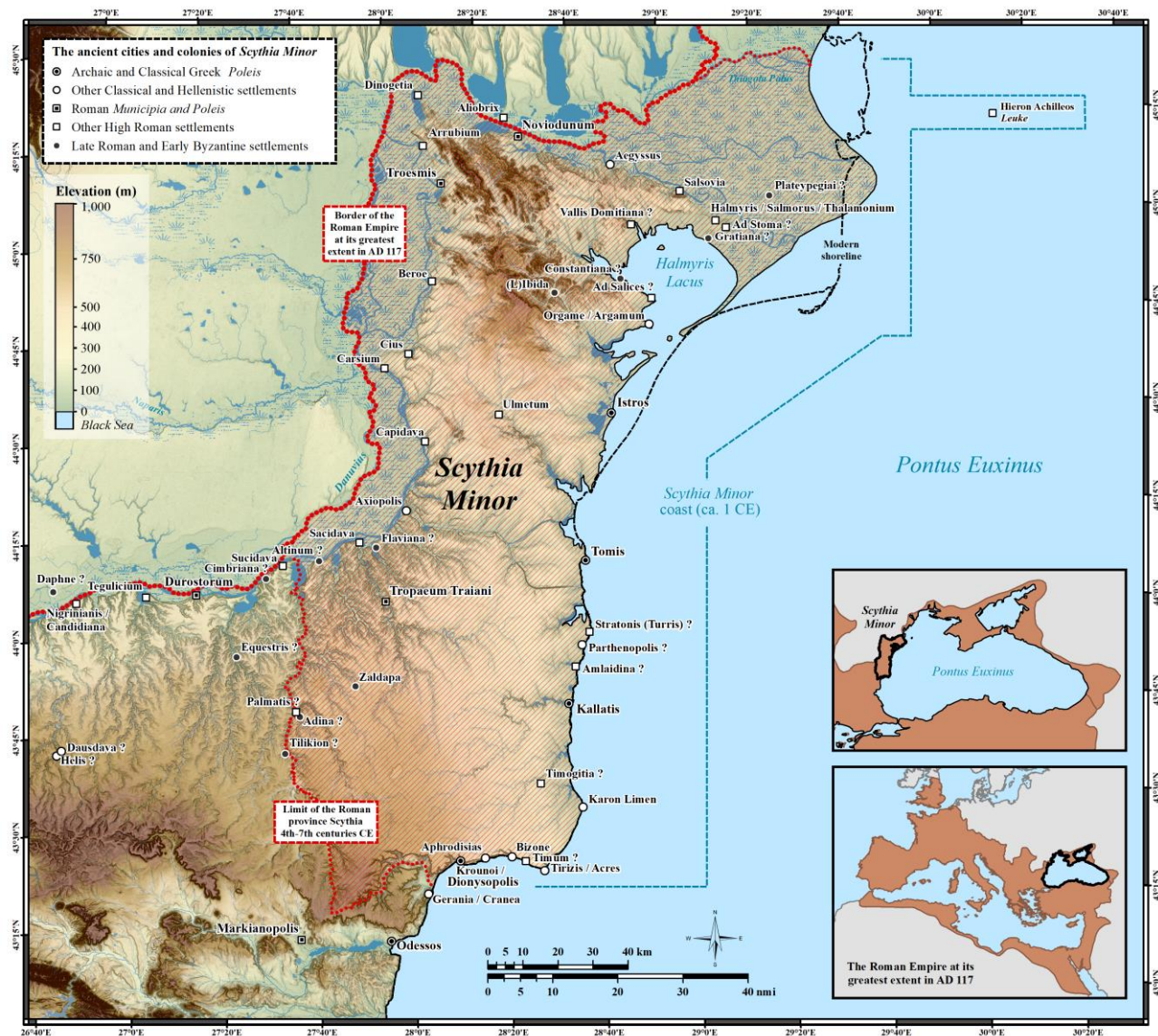
In this context, the "Halieutica Scythiae Minoris: Fishing and Fish Industry at the Mouth of the Danube in Roman and Early Byzantine Times" (FinDaRT) project (<https://www.findart.page/>) aims to fill a part of this knowledge gap and shed light on ancient fishing activities along the western Black Sea coast. To achieve this goal, six specific objectives have been formulated as concrete steps (Dumitrache & Miha-Pintilie, 2023), of which the primary objective is to develop an interdisciplinary research model that explores fish resources in the Pontic (Black Sea) region through classical and geoarchaeological investigations, along with GIS-based data integration. Therefore, this study presents some preliminary findings related to the first objective of the FinDaRT project, which focuses on fish resources in the *Pontus Euxinus* (Black Sea) region during ancient times. To achieve this, we have established connections between ancient literary sources (including 35 authors, 14 Greek, and 21 Roman), the native range distribution of 48 mentioned fish species, and whether they were present or absent in the fishing area of *Scythia Minor* (western Black Sea coast). All these discoveries have been integrated into a GIS database, which includes native range maps of potential sea fish species exploited along the western Black Sea coast. The outcomes provide a better perspective on halieutic activity and the ancient fish industry in the western Pontic basin and contribute to the existing literature with a new fish species list aimed at enhancing our understanding of fishing and the fish industry during the Roman and Early Byzantine periods at the mouth of the Danube and on the *Scythia Minor* coastline.

## 2. STUDY AREA

*Scythia Minor*, also known as *Lesser Scythia*, was a Roman province during late antiquity, encompassing the territories between the lower Danube region and the western shores of the Black Sea (Romanescu et al., 2015; 2018) (Figure 1). Today, these lands constitute Dobrogea (Dobroudja), divided between Romania in the north and Bulgaria in the south. The Roman province *Scythia Minor* covered an extensive geographical area, spanning over 20,000 km<sup>2</sup>, with approximately 450 km of shoreline along the Black Sea, which includes the continental coast of the Razim–Sinoie lagoon complex (formerly known as Halmyris Bay in antiquity) (Romanescu et al., 2018). The region belongs to the physical-geographic region of Eastern Europe, specifically the Black Sea – Danube River sub-province (Bănăduc et al., 2016). It is naturally bounded by the Danube River / Danube Delta and the Prut River to the west, northwest, and north, by the Black Sea to the east, southeast, and south, and by the Dobrich Valley to the southwest (Romanescu, 2013). Notably, the northern part of Dobroudja is characterized by the oldest rocky formations in Romania, including the Macin Mountains, plateaus, and hills from the pre-Cambrian era. The Danube Plain marks the western limit of *Scythia Minor* or Dobroudja. The climate is temperate-continental, with cold winters in the west and milder winters in the south. The eastern part is influenced by the sea breeze, resulting in long autumns and late springs (Bănăduc et al., 2016; Romanescu, 2013; Romanescu et al., 2015; 2018).

From a historical standpoint, *Scythia Minor* was established as a separate province by the Roman Emperor Diocletian, who detached it from *Moesia*, between 286 and 293 AD (Teodor, 2010) (Figure 1). The provincial capital was Tomis, known today as Constanța (Romanescu et al., 2018). Other significant Roman villas discovered in the region were Noviodunum (Bivolaru et al., 2022), Halmyris (Romanescu et al., 2015;

Stanc et al., 2020; 2023), Ulmetum (Petcu, 2015), and Tropaeum Traiani (Mitrovici, 2016). The cities in the province included ancient Greek settlements established along the coast, such as Istros (Bivolaru et al., 2021), Tomis (Curca & Miha-Pintilie, 2023), Kallatis (Preoteasa, 2019), and Krounei / Dionysopolis (Matei-Popescu, 2014), as well as more recent Roman foundations situated along the Danube, such as Noviodunum (Bivolaru et al., 2022; Romanescu, 2013; Romanescu et al., 2015), Dinogetia (Opaiț et al., 2020), Troesmis (Bugoi et al., 2018), Beroe (Anghel, 2020), Capidava (Romanescu, 2013; Romanescu et al., 2015), Sacidava (Romanescu, 2013), and so on. Many of the Roman fortifications in the area date back to the *Tetrarchy* or the Constantinian dynasty. According to ancient sources like the *Laterculus Veronensis* from around 314 AD and the *Notitia Dignitatum* from around 400 AD, *Scythia Minor* was part of the Diocese of Thrace. The province ceased to exist around 679–681 AD (Dumitrache, 2015; Stanc, 2009; Stanc et al., 2022).



**Figure 1.** Geographic location of the *Scythia Minor* (study area) along the western Black Sea coast during ancient times. The map presents both the ancient and modern shoreline configurations.

### 3. DATA AND METHODS

#### 3.1. Fish species in ancient literary sources

A comprehensive interdisciplinary approach to various aspects of ancient fishing seems to be primarily focused on the Anglo-Saxon, German, and Italian Franco-Iberian regions, as indicated by the current research in the field (Bekker-Nielsen, 2005; 2010). Within the study area (*Scythia Minor* coast), most ancient literary sources merely offer general information about the fish found in the Black Sea. Nevertheless, a select few authors, including Ovid (43 BC – 17 AD), Pliny the Elder (23 – 79 AD), and Athenaeus (175 – 235 AD), have

delved into greater detail concerning the biological traits, behaviour, and migration patterns of fish species (Dumitrache, 2015). Continuing, several examples of texts from ancient authors on this subject are indicated:

- ARISTOTLE, History of animals, 6. 17: “Moreover almost all other fish also have a rapid growth, but that of all fish from Pont is still faster” (Dumitrache, 2015).
- OTHERS: PLINIUS, 9. 20: “Many pass the summer in the Sea of Marmara without entering the Black Sea; the same is the case with the sole, though the turbot does enter it. Nor does the sepia occur there, though the cuttlefish is found. Of rockfish the sea-bream and whiting are lacking, as are some shellfish, though oysters are plentiful; but they all winter in the Aegean”; LUCIAN, Dialogues of the courtesans, 2 (perches); OPPIAN, Halieutica, 1, 509–512 (breams); OPPIAN, Halieutica, 1, 595–637; AELIAN, On animals, 9. 59 (dolphins) (Dumitrache, 2015).
- MACKEREL: AELIAN, On animals, 10. 6: “It seems that the Spanish Mackerel of the Euxine imitate the Persian king who spends the winter at Susa and the summer in Ecbatana. For these fish pass the winter in the Propontis as it is called since that region is warm, but in the summer they live about Aegialus, because the first named sea affords them gentle breezes”; PLINIUS, 9. 19; ARISTOTLE, History of animals, 8. 13. (Dumitrache, 2015).
- AELIAN, On animals, 4. 9: “the majority of fishes are eager for sexual intercourse throughout the springtime, and withdraw for choice to the Black Sea, for it contains caverns and resting-places which are Nature’s gift for Fishes. Besides, its waters are free from the savage creatures that the sea breeds. Only dolphins roam there, and they are small and feeble. Moreover it is devoid of octopuses; it produces no crabs and does not breed lobsters: these are the bane of small fishes” (Dumitrache, 2015).
- PLINIUS, 9. 19: “Fishes of all kinds grow up exceptionally fast, especially in the Black Sea”
- OPPIAN, Halieutica, 1, 595–599: When in spring the oviparous fishes are full of roe, some of them remain quietly in their homes, each tribe in its own place; but many gather together and pursue a common path to the Euxine Sea (Dumitrache, 2015).

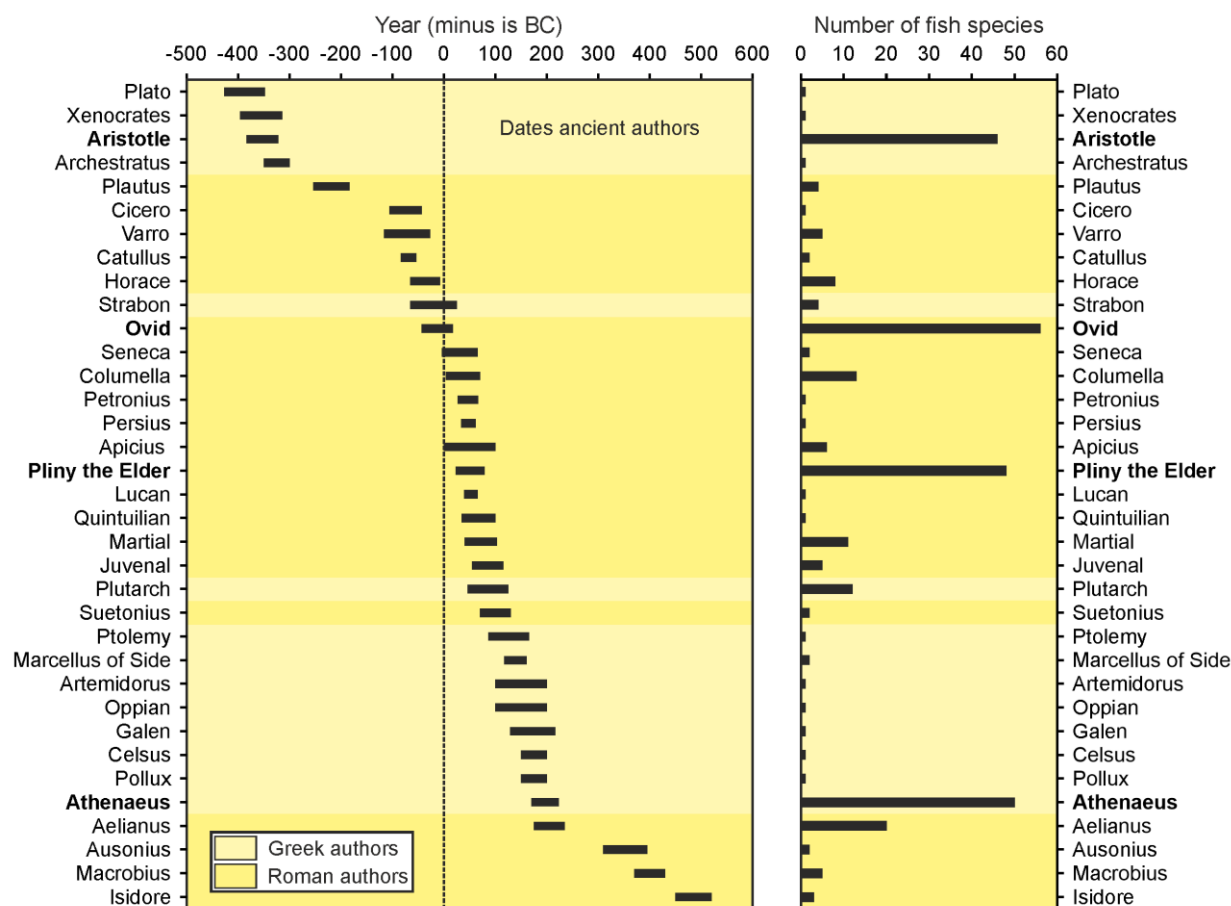
In Figure 2, we present the first methodological step of fish resource inventory by indicating the dates and contributions (Figure 2, left chart) of 35 ancient authors who wrote about fishing activity in the Pontic basin. This group includes 14 Greek and 21 Roman authors, along with the number of fish species they described (Figure 2, right chart). Among these authors, Aristotle (384 – 353 BC) stands out with 37 species, Ovid (43 BC – 13 AD) with 47 species, Pliny the Elder (23 – 79 AD) with 42 species, Athenaeus (175 – 235 AD) with 42 species, and Aelianus (175 – 223 AD) with 31 species. This context sheds light on the existence of 48 distinct fish species that served as potential halieutic resources along the western Black Sea coast during ancient times (Table 1). All the literary information has been cross-referenced, whenever possible, with archaeological data that uncovered the remains of numerous fish species in the Pontic basin (Čechová, 2014; Munk Højte, 2005; Ulman et al., 2020) and on the shoreline of ancient *Scythia Minor* (El Susi, 2008; 2011).

### 3.2. Native range distribution and GIS data integration

The GIS methodological step employed to trace fishing activity along the western Black Sea coast involves identifying the distribution of fish species described by ancient authors using native range maps accessible on FishBase online platform (<https://www.fishbase.se/search.php>). This process was achieved by associating the common or scientific names of the selected fish species with translated literary information from Greek or Latin sources (Dumitrache, 2015). We chose FishBase platform due to its capability to generate native range maps for fish species across the globe (Froese & Pauly, 2023).

The final methodological step involved GIS-based data integration. To accomplish this, native range maps for each selected fish species (Table 1) were downloaded from the FishBase platform in *csv*. format (Froese & Pauly, 2023) and converted in *shp*. format using ArcGIS 10.3 software. More than 48 maps were generated to serve as the foundation for charting species distribution across the eastern Mediterranean and Black Sea basin. The digital maps enhance the visualization and rapid identification of fish species within the eastern Mediterranean and Pontic basins, including their presence along the *Scythia Minor* coast (the coastline of Romania and Bulgaria along the western Black Sea). This aspect holds substantial importance in identifying local halieutic resources, particularly within the fishing areas at the mouth of the Danube during Roman and Early Byzantine times, while also filtering out non-native fish species (Figure 3).



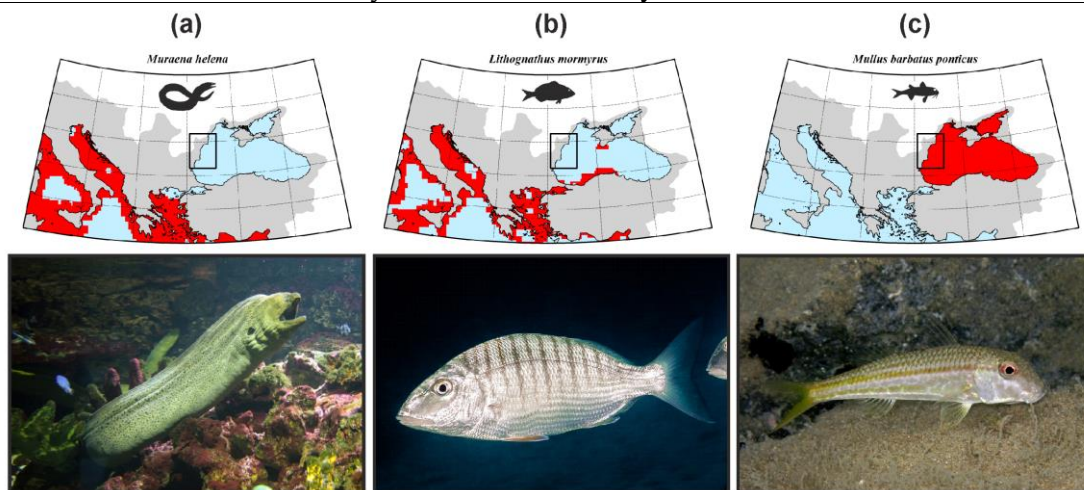


**Figure 2.** The dates of ancient authors (left chart) and the number of fish species they described (right chart).

**Table 1.** Summary of fish species mentioned by the ancient authors in various literary sources

Scientific / Latin name	Greek name	Common name	Number of mentions
<i>Acipenser ruthenus</i>	Έλοψ	Sterlet sturgeon	11
<i>Acipenser sturio</i>	Άκκιπηνσιος	Common sturgeon	5
<i>Anthias anthias</i>	Άνθίας	Swallowtail sea perch	7
<i>Cephalopterus giorno</i>	Βοϋς	Devil fish	7
<i>Chelidonichthys lucerna</i>	Έτεραξ	Tub gurnard	5
<i>Conger conger</i>	Γόγγος	European conger	8
<i>Coris julis</i>	Ίουλis	Mediterranean rainbow wrasse	8
<i>Coryphaena hippurus</i>	Ίππουρος	Common dolphinfish	5
<i>Dentex dentex</i>	Συνόδους	Common dentex	7
<i>Dicentrarchus labrax</i>	Λάβραξ	European seabass	13
<i>Diplodus sargus</i>	Σάργος	White seabream	6
<i>Echeneis naucrates</i>	Έχενής	Live sharksucker	6
<i>Epinephelus marginatus</i>	Όρφως	Dusky grouper	5
<i>Gobius niger</i>	Φύκης	Black goby	5
<i>Labrus merula</i>	Κόσσυφος	Brown wrasse	7
<i>Labrus viridis</i>	?	Green wrasse	3
<i>Lithognathus mormyrus</i>	Μόρμυρος	Sand steenbras	6
<i>Lophius piscatorius</i>	Βάτραχος	Angler	6
<i>Merluccius merluccius</i>	Σάλπη	European hake	6
<i>Micromesistius poutassou</i>	Όνίσκος	Blue whiting	5
<i>Mugil cephalus</i>	?	Flathead grey mullet	12
<i>Mullus barbatus ponticus</i>	Μύλλος	Blunt-snouted mullet	7
<i>Mullus surmuletus</i>	Κεστρεύς / Κέφαλος	Surmullet	12
<i>Muraena helena</i>	Μύραινα	Mediterranean moray	11
<i>Naucrates ductor</i>	Πομπίλος	Pilotfish	7
<i>Oblada melanura</i>	Μελάνουρος	Saddled seabream	7

<i>Pagellus erythinus</i>	Έρυθίνος	Common pandora	7
<i>Pagrus pagrus</i>	Φάγρος	Red porgy	6
<i>Platichthys flesus</i>	?	European flounder	5
<i>Prionace glauca</i>	Γλαυκός	Blue shark	6
<i>Raja clavata</i>	?	Thornback ray	2
<i>Scomber scombrus</i>	Σκόμβρος	Atlantic mackerel	10
<i>Scophthalmus maeoticus</i>	Ρόμβος	Black Sea turbot	6
<i>Scorpaena porcus</i>	Σῶς ? / Ὕς ?	Black scorpionfish	3
<i>Scorpaena scrofa</i>	Σκορπίος	Red scorpionfish	10
<i>Sepia officinalis</i>	Σηπία	Common cuttlefish	7
<i>Serranus cabrilla</i>	Χάννος	Comber	6
<i>Serranus scriba</i>	Πέρκη	Painted comber	5
<i>Solea solea</i>	Βούγλωσσα	Common sole	7
<i>Sparisoma cretense</i>	Σκάρος	Parrotfish	14
<i>Sparus aurata</i>	Χρύσοφρυς	Gilthead bream	12
<i>Spicara maena</i>	Τράγος	Blotched picarel	4
<i>Spicara smaris</i>	Σμαρίς	Picarel	4
<i>Spondylisoma cantharus</i>	Κάνθαρος	Black seabream	5
<i>Thunnus thynnus</i>	Θύννος	Atlantic bluefin tuna	9
<i>Umbrina cirrosa</i>	Σκίανα	Shi drum	8
<i>Xiphias gladius</i>	Ξιφίας	Swordfish	7
<i>Zeus faber</i>	Χαλκεύς	John dory	6



**Figure 3.** The example of the fish species mentioned by ancient authors in various literary sources: (a) fish witch are not native for the Black Sea (*Muraena helena*), (b) fish which are native to the Black Sea but not for the *Scythia Minor* shoreline (*Lithognathus mormyrus*) and (c) fish which are native only in the Black Sea (*Mullus barbatus ponticus*). The fish species distribution maps were created based on native range maps available on FishBase (Froese & Pauly, 2023). The photos of the exemplified fish species correspond to the dedicated page on FishBase online platform.

## 4. RESULTS AND DISCUSSION

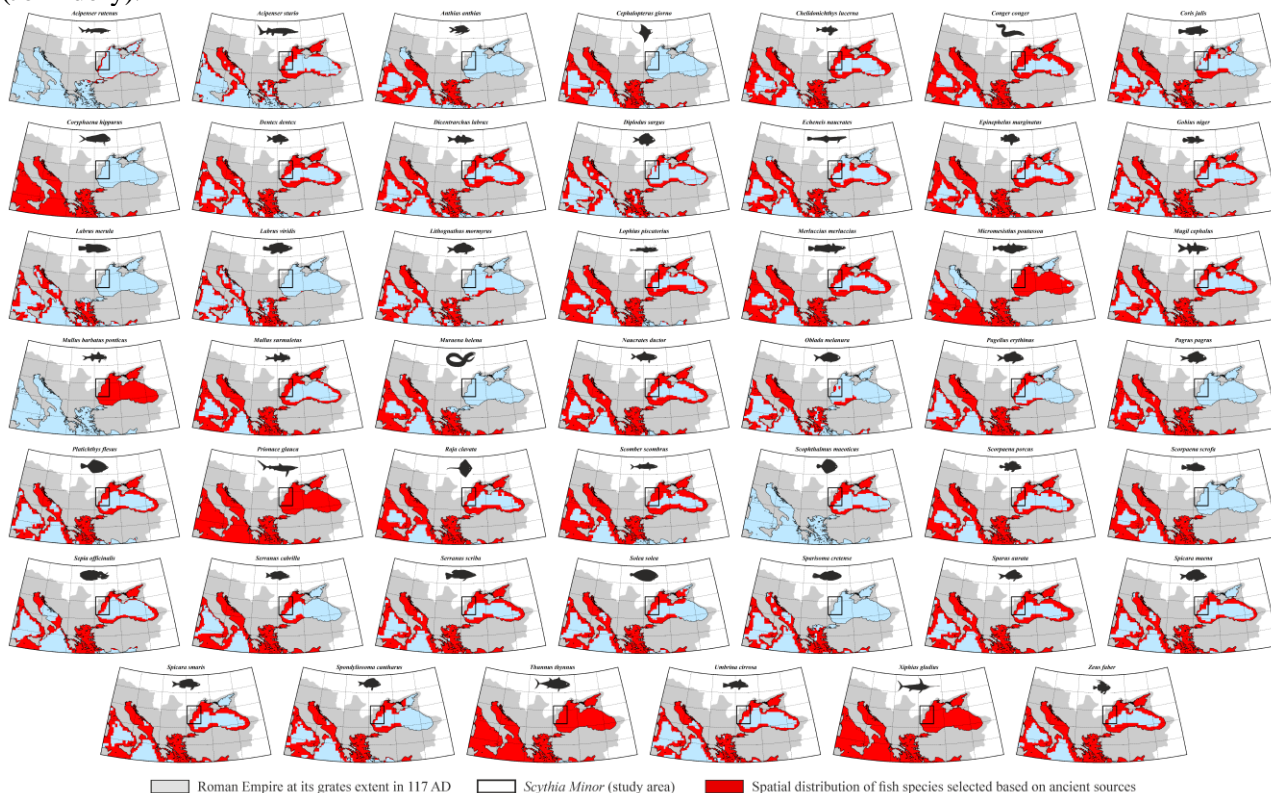
### 4.1. Sea fish species on *Scythia Minor* coastline

As mentioned in the introductory chapter, undoubtedly, fish played a crucial role in the diet of people in the Black Sea region during the Greek, Roman, and Early Byzantine periods. However, it should be noted that most archaeological findings along the coast of *Scythia Minor* do not indicate the specific type of fishing activity and whether the fish was collected solely for local consumption or also for trade. This outcome is especially relevant for archaeological sites where signs of typical fish processing infrastructure are lacking, such as the majority of port cities along present-day Romania's coastline. This is in contrast to the Roman ports in the northern Black Sea or those around the Bosphorus Strait (Dumitrache, 2015).

In this context, the ancient literary sources documented in this study, starting with the list of fish from Ovid's "Halieutica," have been a rich source of information regarding the fish resource and fishing activity

during his exile in Tomis, known today as Constanța (Curca & Mihiu-Pintilie, 2023; Romanescu et al., 2018). Similarly, ancient writings with ichthyological references by Aristotle, Aelian, Pliny the Elder, and Oppian have been invaluable in identifying fishing practices and the overall fishing activity in the study area. However, although not all literary references have an exact geographical correspondence, such an approach has been necessary to trace the transmission of information from one author to another and to understand both continuity and gaps in fish resource exploitation over time, as well as variations in dietary habits. Lastly, for periods or areas where direct information is severely limited or even absent, we can infer, through analogy, how things might have unfolded.

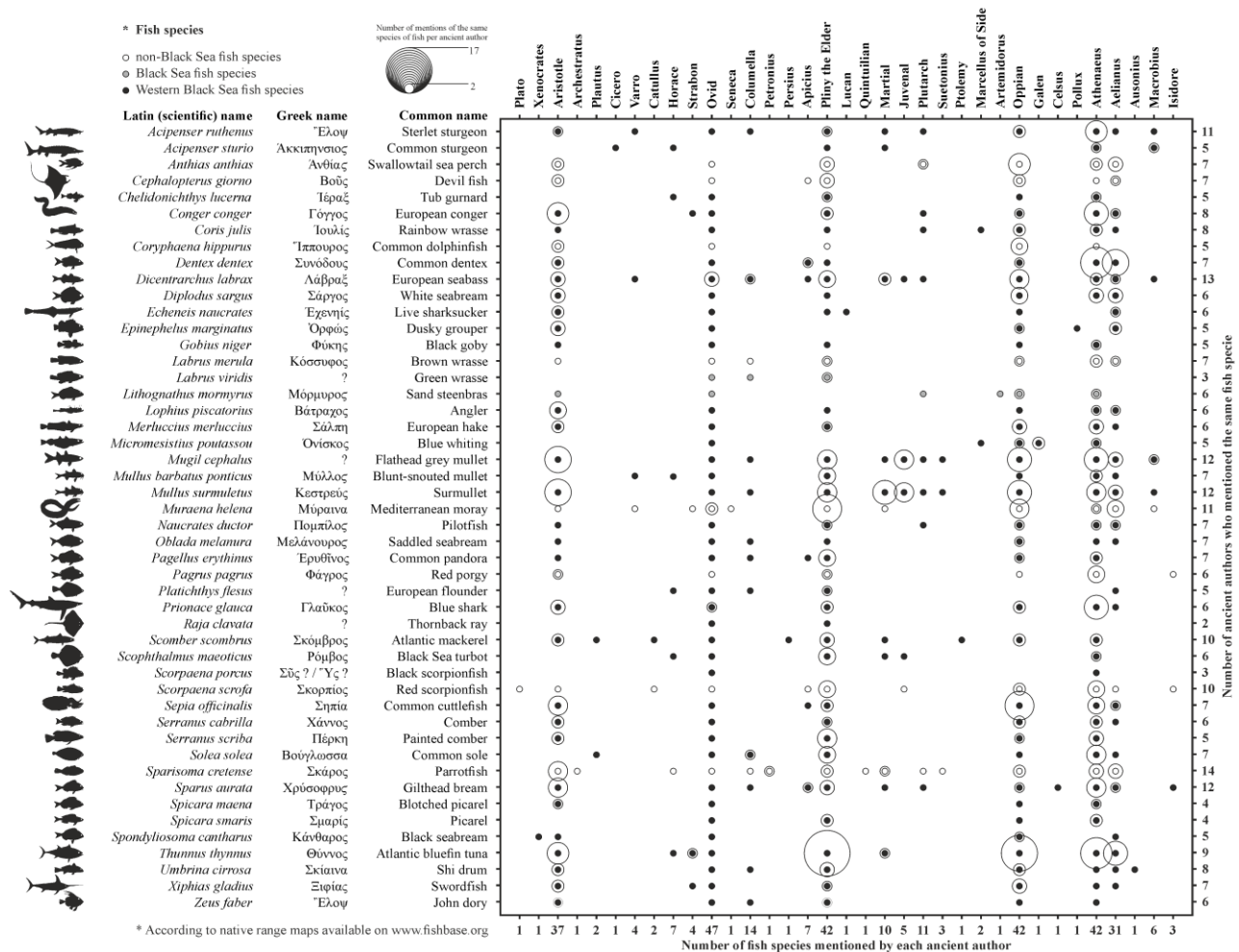
The majority of literary sources offer comprehensive descriptions of fish in the Black Sea, detailing aspects such as their biological characteristics, behavior, and migration patterns. All this information, along with the names and their correspondence with today's fish taxonomy, helps us identify a total of 48 fish species. Therefore, as preliminary results of our investigations, in Figure 4, we present the native range distribution maps (indicated in red) of all fish species described by ancient authors across a variety of literary sources (see Table 1). The occurrence of each fish species along the *Scythia Minor* coastline is marked with a black square in each map. The Roman Empire, at its greatest extent in 117 AD, is highlighted in gray. These species encompass: *Acipenser ruthenus* (Sterlet sturgeon), *Acipenser sturio* (Common sturgeon), *Chelidonichthys lucerna* (Tub gurnard), *Conger conger* (European conger), *Coris julis* (Mediterranean rainbow wrasse), *Dentex dentex* (Common dentex), *Dicentrarchus labrax* (European seabass), *Diplodus sargus* (White seabream), *Echeneis naucrates* (Live sharksucker), *Epinephelus marginatus* (Dusky grouper), *Gobius niger* (Black goby), *Lophius piscatorius* (Angler), *Merluccius merluccius* (European hake), *Micromesistius poutassou* (Blue whiting), *Mugil cephalus* (Flathead grey mullet), *Mullus barbatus ponticus* (Blunt-snouted mullet), *Mullus surmuletus* (Surmullet), *Naucrates ductor* (Pilotfish), *Oblada melanura* (Saddled seabream), *Pagellus erythrinus* (Common pandora), *Platichthys flesus* (European flounder), *Prionace glauca* (Blue shark), *Raja clavata* (Thornback ray), *Scomber scombrus* (Atlantic mackerel), *Scophthalmus maeoticus* (Black Sea turbot), *Scorpaena porcus* (Black scorpion fish), *Sepia officinalis* (Common cuttlefish), *Serranus cabrilla* (Comber), *Serranus scriba* (Painted comber), *Solea solea* (Common sole), *Sparus aurata* (Gilthead bream), *Spicara maena* (Blotched picarel), *Spicara smaris* (Picarel), *Spondyliosoma cantharus* (Black seabream), *Thunnus thynnus* (Atlantic bluefin tuna), *Umbrina cirrosa* (Shi drum), *Xiphias gladius* (Swordfish), and *Zeus faber* (John dory).



**Figure 4.** The native distribution of 48 sea fish species (red colour) in the eastern Mediterranean basin and Black Sea, determined using native range maps available on FishBase (<https://www.fishbase.se/search.php>). The black squares indicate the location of *Scythia Minor* and the ancient shoreline (study area) along the western coast of the *Pontus Euxinus* (Black Sea).



The outcomes suggest that over 16.6% of the fish species (8 fish species) described by ancient authors are not native to the Black Sea basin, and over 20.8% of them (10 fish species) cannot be found on the *Scythia Minor* coastline. These species encompass: *Anthias anthias* (Swallowtail sea perch), *Cephalopterus giorno* (Devil fish), *Coryphaena hippurus* (Common dolphinfish), *Labrus merula* (Brown wrasse), *Labrus viridis* (Green wrasse), *Lithognathus mormyrus* (Sand steenbras), *Muraena helena* (Mediterranean moray), *Pagrus pagrus* (Red porgy), *Scorpaena scrofa* (Red scorpionfish) and *Sparisoma cretense* (Parrotfish). Although the results are based solely on fish species mentioned by ancient authors, they still provide valuable information (85% accuracy) about the fishery resources that were exploited in the Pontic basin, along the *Scythia Minor* coast and at the mouth of the Danube (currently the Danube Delta) (Figure 5).



**Figure 5.** Descriptive statistics of 48 fish species mentioned by 35 ancient authors in various sources. The native range in the Black Sea region for each fish species is indicated.

#### 4.2. Fishing activity along the western Black Sea coast

From the geographical perspective of the ancient authors, the Black Sea was nothing more than an extension of the Mediterranean Sea, constricted in the Marmara region, as asserted by Pomponius Mela (Dumitrache, 2015). Consequently, at present, it is challenging to distinguish between the Pontic and Mediterranean fish resources, as well as between the specific fish species of the brackish Black Sea (17.3 %) basin and those of other significantly saltier seas like Mediterranean Sea (36 %) (Curca & Mihiu-Pintilie, 2023). However, certain ancient literary sources have provided relatively precise information about the available fish resources along the coast of *Scythia Minor*. Moreover, numerous indications exist regarding fishing activities in the study area, primarily in texts that describe various fishing techniques, adapted to different categories of fish (pelagic, benthic, migratory), and within different aquatic environments (coastal, shallow waters, deep waters, straits) (Dumitrache & Mihiu-Pintilie, 2023).

In this context, the subject of fishing activity along the coast of *Scythia Minor* in ancient writings, referring here to the texts of Ovid and Oppian, proves to be the most abundant source of corroborated information, aligned with the list of fish species described in the previous section (Dumitrache, 2015; 2022; Dumitrache & Mihiu-Pintilie, 2023). Thus, in his poems, Ovid points out several aspects related to techniques



used in ancient pisciculture, making reference to the fishing rod, net, and basket. The bait used by ancient fishermen is called *esca*, and *hamus* is the Latin term used for a hook, also being the most commonly encountered tool as archaeological remains for fishing activities (Dumitrache, 2015; 2022). On the other hand, Oppian indicates that fishing with a fishing rod was not only practised occasionally but seasonally as well, especially for large-scale catches. This method appears to have been quite effective when multiple hooks were used on a single line, or when fishermen targeted larger fish species, such as sturgeons caught at the river mouths of the Danube into the Black Sea (Curca & Miħu-Pintilie, 2023; Romanescu et al., 2018). However, the use of fishing seemed to aim at capturing deep-sea fish species.

Two main questions stay in the discussion: the small number of marine fish bones identified through archaeological investigation, and the lack of processing vats from the study area. The presence of freshwater fish might be explained, in the case of the sites located on the shore of the Danube or in the proximity of a lake or a river by the facilities offered by the environment (Curca & Miħu-Pintilie, 2023). Sea fishing supposed different skills and different infrastructures, while freshwater fishing was affordable for everyone, especially for small-scale exploitation. The same situation is revealed for the Delatic area of the Don River (Marepa, 2017). The migration of the sturgeons facilitates their easy capture in the bays. But one of the main issues remains the poor preservation and sampling of the ichthyological remains.

As for large-scale processing, there have not yet been discovered salting vats on the western shore of the Black Sea. Given the situation in the Crimean area (Čechová, 2014) or the Bosphorus region (Dumitrache, 2022), one might expect the archaeological confirmation of the fish salting industry in *Scythia Minor*. The epigraphical evidence indicates extended halieutic activities, at least within the *regio Histriae* (Bivolaru et al., 2021), as shown in the inscribed correspondence between the *praefectus* Laberius Maximus and the people of Histria from the beginning of the second century AD (ISM I, 68) (Dumitrache, 2022). The document states that the city's financial situation was close linked to the fish-salting industry, and the state guaranteed, as a consequence, fiscal immunity for the fishing at the Peuce Mouth (Dumitrache, 2022; Romanescu et al., 2015; 2018). Therefore, written sources confirm that officially organised and managed fishing was conducted in the Histrian territory. Shore changes, processing methods and/or archaeological approaches have not brought up to light yet satisfactory results.

## 5. CONCLUSIONS

In conclusion, the research discussed in this paper sheds light on the intricate relationship between fishing, resource utilization, and economic strategies in antiquity. The project "Halieutica Scythiae Minoris: Fishing and Fish Industry at the Mouth of the Danube in Roman and Early Byzantine Times (FinDaRT)" presents its initial discoveries and their implications for understanding ancient halieutic practices along the western Black Sea coastline. Employing a multifaceted approach, this research aimed to investigate fish resources in the Pontus Euxinus (Black Sea) region, integrating classical and geoarchaeological methods alongside GIS-based data integration.

A comprehensive analysis of data from 48 fish species documented by 35 ancient authors enabled the creation of spatial datasets for each species, mapping their distribution and presence across the Pontic basin and the fishing domain of *Scythia Minor*. Overlaying these distributions with historical information regarding processing centres, fishing associations, and export destinations, the study elucidated the complexity of ancient fishing networks. The findings reveal that 16.6% of the fish species mentioned by ancient authors (8 fish species) are not native to the Black Sea basin, and 20.8% (10 fish species) cannot be found along the Scythia Minor coast.

Notably, the results highlighted that a considerable proportion of fish species documented by ancient sources were either non-indigenous to the Black Sea basin or absent along the Scythia Minor coast. While confined to species noted by historical authors, these findings offer valuable glimpses into the exploitation of fishery resources within the Pontic basin, the Scythia Minor coastal region, and the Danube mouth, excluding species specific to other maritime basins (Mediterranean Sea). Through its interdisciplinary approach, this study contributes significantly to our comprehension of ancient fishing practices and their socioeconomic implications in the wider context of the Black Sea's maritime history.

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