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# Fishes as indicators of seasonality in Roman non-industrial fisheries: an overview from the southern NE Atlantic

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**Abstract**
From the standpoint of fish as markers of seasonality in archaeological sites, the paper surveys a selected series of Roman period deposits from three coastal sectors of SW Europe. These collections were compared with previous Iron Age fish assemblages from those same regions in an attempt to reveal fish taxa that would serve as proxies of fishing carried out at a local level. The aim is to allow scholars to set apart faunal collections representing artisanal fishing activities from those that characterize Roman industrial (commercial) fishing deposits such as fish factories and fish-salting installations. Not surprisingly, local fishing exhibits a level of idiosyncrasy that contrasts with the homogeneity documented in the industrial fishing deposits. A series of taxa have been identified as being of value to typify both seasonal (industrial) and year-round (local) fishing.
**Keywords:** Fishes, Artisanal Fishing, Roman, Aquitania, Galicia, Algarve, Seasonality, Sedentism.

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**Résumé**
Cette communication propose un aperçu des signatures, saisonnières et sédentaires, des poissons provenant de sites romains caractérisés par une pêche locale, ciblant trois secteurs côtiers de l'Europe du sud-ouest. Dans un deuxième temps, ces gisements sont confrontés à des échantillons datés de l'âge du Fer afin de mettre en évidence de possibles différences ou similitudes utiles pour définir au mieux les ressources caractéristiques de la pêche locale. L'objectif est de distinguer cette exploitation de celle liée à l'approvisionnement des ateliers à salaisons. Il n'est pas surprenant que la pêche locale se caractérise par un niveau d'idiosyncrasie qui contraste avec l'homogénéité connue pour les produits transformés dans les bassins à salaisons. Une série de taxons a été mise en évidence pour caractériser la pêche saisonnière et celle pratiquée toute l'année.
**Mots clés :** poissons, pêche artisanale, époque romaine, Aquitaine, Galice, Algarve, bio-indicateurs des cycles saisonniers et de sédentarisme.

> « […] Illic (Callaicum Oceanum) piscoso modo vix educta profundo/
> Inpedient lepores umida lina meos […] »
> (Martial, *Epigrams*, Book 10, XXXVII).

## Introduction

One major feature of the Roman fish productions in Western Europe was a geographical range centered upon the Iberian shores and those of neighbouring Atlantic France (*i.e.* the Roman province of *Aquitania*) and northern Morocco (*i.e. Mauretania Tingitania*). One second characteristic was their commercial ("industrial") character, meant to supply a large, transmediterranan and pan-european market with products such as fish sauces and *salsamenta* (*i.e.* processed fish meat) (Bekker-Nielsen, 2010 ; Marzano, 2013).

From the standpoint of the targeted fish species, one diagnostic trait of the Roman commercial fisheries was their focus on migratory taxa that were only available during a restricted time of the year (Morales-Muñiz, Roselló-Izquierdo, 2008 ; 2016). Such seasonal signature had apparently a lot to do with socio-economic contrivances, in particular the Roman agricultural calendar that allowed one to detract labour force from the fields at a time when many pelagic (*i.e.* offshore) fishes were approaching the coast to spawn (Bekker-Nielsen, 2010 ; Marzano, 2013). In this way, availability of both fish and fisherman during late spring/early summer fostered a virtuous "feedback loop" that lasted for ca. 700 years, even though shifts in terms of the main cropped groups have been recorded during the period lasting from 200 BC to AD 450 (Morales-Muñiz, Roselló-Izquierdo, 2008). The emphasis of historians on Roman commercial fisheries has had repercussions at all levels of the research agenda including decisions on where to carry out excavations.

Emphasis on the archaeological fish factories has implied that places where a subsistence type of fishing meant to feed the family or supply the local community has received far less attention than fish assemblages found, for example, in salting vats and amphorae. This is regrettable for we believe that it is precisely subsistence fishing that is likely to provide information on so-called background faunas (*i.e.* the appropriate baselines to monitor how, and in what ways the Roman

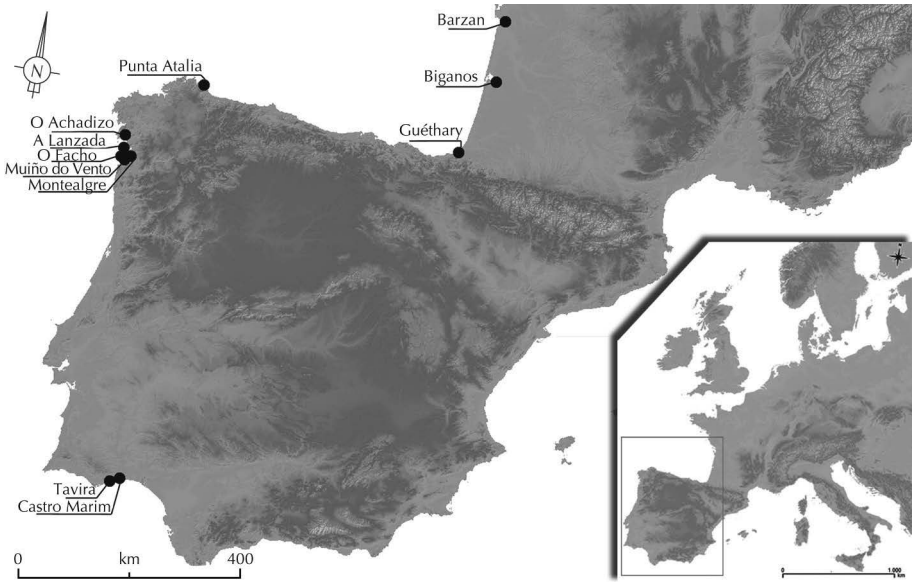


**Fig. 1.** *Location of the sites mentioned in the text.*

commercial enterprises differed from the fishing that had taken place up until that time). Throughout most of history, for example, fishing in European marine waters was difficult to carry out during the harshest months of the year. If only for that reason, one must concede that all kinds of fishing, whether commercial or artisanal, must have exhibited marked seasonal signatures in terms of species fished during spring and summer. Such fact alone would imply that any putative difference between traditional subsistence fishing and Roman commercial fisheries where spring/summer migrants monopolized fish assemblages, were more of a quantitative than a qualitative nature. This requires further analysis. Indeed, not being able to monitor to what extent subsistence and Roman commercial fisheries differed from each other hinders a reliable characterization of the fish assemblages generated by these alternative strategies. This situation hampers our ability to evaluate the factors that transformed local fishing activities into full-blown commercial enterprises.

In a recent paper, we presented the fish assemblages from a series of coastal Late Iron Age and non-commercial fishing Roman sites ranging from the mouth of the Garonne River in France to that of the Guadiana between Spain and Portugal (Roselló Izquierdo *et al.*, in press). In this contribution, we elaborate further on these assemblages, paying attention to their seasonal signatures by evaluating the phenological character and abundance of the fish taxa therein retrieved. Our attempt is to reveal spatio-temporal patterns that may help one define the appropriate faunal baselines to explore the intricacies of a socio-economic transformation that lead from a subsistence type of fishing to the first historical evidence the world knows of a fishing carried out at a large-scale, transregional, level.

## Migratory fishes: the problems of an adequate categorization

All fishes move. One refers to migratory species when displacements are not only appreciable in terms of distance but also regular in terms of time of the year and destination points (Morais, Daverat, 2016). Two major problems arise when attempting to classify migratory species. The first one has to do with the limitations of actualism as a heuristic tool since fish species may change behavior overnight, so to speak, so that one remains unsure whether what one records today as migratory, for example, was also so in the past (Morales, 1998). The problem is more pressing in the case of facultative migrants – whose migratory behaviour shifts with environmental circumstances – than in obligate migrants, whose behaviour is genetically fixed. The second problem has to do with the sheer variety of migratory patterns, some of them merely involving short displacements along the shore, others movements on the water column, etc. In practical terms, what is of concern for the archaeoichthyologist is, whether or not a particular species was available to fishermen stationed in a given coast at a given time of the year. In other words, more a problem of catchability, which involves availability, accessibility and fishing efficiency of the resource, than anything else. Such problems notwithstanding, although uncertainties abound, the quality of certain taxa as phenology (referring to life history traits) bioindicators of seasonality seems beyond question.

In the case of the temperate NE Atlantic, for example, both scombrids and clupeiforms are quality bioindicators. The former, including tunas (genus *Thunnus*) and mackerels (*Scomber scombrus* and *S. japonicus*), are offshore species that only reach close to the shore during their reproductive migrations taking place in the late spring and early summer. Hammerhead sharks (genus *Sphyrna*), along with other pelagic sharks, often follow tuna schools and constitute side catches of tuna fishing operations. This same pattern of summer migrants is seen in a wealth of pelagic taxa, as is the case of garfish (*Belone belone*) and jacks (Carangidae) such as the horse mackerels (genus *Trachurus*), although some members of this family, as is the case of amberjacks (genus *Seriola*), approach the Iberian shore mostly during late summer/early autumn. This same pattern is also seen, though with a marked temporal gradient that shifts with latitude, in species such as the meagre (*Argyrosomus regius*). Another species that is fished in the sea throughout the autumn months is the eel (*Anguilla anguilla*). In the case of clupeiforms, both sardines (*Sardina pilchardus*) and anchovies (*Engraulis encrasicolus*) undertake annual migrations that bring them close to the shore during spring/summer, and later into deeper water of the continental shelf. Other clupeiforms such as shads (genus *Alosa*) swim upstream during late winter when huge concentrations at the mouths of estuaries made them vulnerable to fishing operations in the past. In general, diadromous fishes that migrate regularly to and from fresh and marine waters such as sturgeons (Acipenseridae) and salmon (*Salmo salar*) are not reliable indicators of seasonality because some cohorts (*i.e.* age groups) within the same species may remain for prolonged periods on the shore.

Highly territorial fish, on the other hand, seldom move around. In the NE temperate Atlantic the four major sedentary groups of commercial interest that turn

up regularly in archaeological collections are members of the wrasse family (Labridae), the moray and conger eels (*Muraena helena* and *Conger conger*), groupers (family Serranidae, in particular some species of the genus *Epinephelus*) and certain non-territorial groups such as flatfishes like soles (genus *Solea*). Often moving a few meters around during their lifetime, wrasses are the best indicators of a local fishing. However, catchability has been reported to drastically shift along the year due to life-history traits and behavioral factors (Villegas-Ríos *et al.*, 2014). For such reasons they have been often taken to represent fishing carried out during winter (Leach, 2006).

In contrast with the aforementioned groups, most fish species in the NE temperate Atlantic that appear at one time or another on the shore qualify poorly as seasonal bioindicators despite the regular movements most of them embark upon. This is because those movements are either erratic, take place recurrently throughout the year, or else involve displacements of only some members from a given population. In this group of taxa set in-between marked migrants and hyper-sedentary/territorial species there exist a wealth of fish species in SW European waters that turn up in archaeological assemblages. This is the case of poor cod (genus *Trisopterus*), gilthead (*Sparus aurata*), blackspot seabream (*Pagellus bogaraveo*), white seabream (*Diplodus sargus*), seabass (*Dicentrarchus labrax*), hake (*Merluccius merluccius*), red and grey mullets (genus *Mullus* and family Mugilidae, respectively), gurnards (family Triglidae), turbot and brill (genus *Scophthalmus*) and, within the cartilaginous fishes, members of the family Rajidae (rays and skates).

## Materials: the sites

Eleven Iron Age and Roman sites taken to reflect artisanal fishing practices were found in three regions of the southern NE Atlantic: Aquitania (SW France), the Algarve (S Portugal) and Galicia (NW Spain) (fig. 1). All French assemblages were fine-sieved through 1.2 and 5 mm meshes (Ephrem, 2014). In Galicia, and except for *Facho de Donón* (4 and 2 mm meshes), samples went through a 0.8 mm mesh. The Portuguese samples were not sieved. Only a cursory description of the sites is provided. For additional details readers are addressed to the references.

1. The coastal town of *Barzan* (Charente-Maritime) is located on the right bank of the Gironde estuary (fig. 1). Fish samples were collected at the center of the urban area (Bouet, 2011). Ephrem (2014) evidenced that fish were caught both within the estuary (mudflats with marshes featuring soft bottoms) and on the oceanic coastline (sandy and rocky bottoms) (Clavé, 2001; Massé *et al.*, 2001).
2. *Biganos* is located on La Leyre, next to the bottom of the *Bassin d'Arcachon* lagoon (fig. 1). During Roman times the geomorphology of the area corresponded to a more open, estuarine-like environment (Pellegrin, 2010). The fish samples derive from Roman warehouses refurbished during Late Antiquity as a Christian cult building (Wozny, 2005; 2010). Fish were caught in the lagoon (soft bottoms) and on the open coast (sandy bottoms) (Ephrem, 2014).

3. *Guéthary* (Pyrénées-Atlantiques) (fig. 1) is the only salting installation documented in Roman Aquitania but the rocky coastline conforms best to that typifying the Cantabrian and Galician coasts of Iberia. Fishes were collected in the contents of salting vats, evidence of domestic consumption (Ephrem, 2010 and 2014).

Roman Period settlements from Galicia are located on the outer shore. Iron Age *Castros* (*i.e.* local hillforts), being of a more defensive nature, are located on strategic hilltops. Those found along the shores of the *Rias* (*i.e.* local fjords) will be considered "coastal".

4. The coastal *Castro* of *Punta Atalaia* was built on a small peninsula next to the town of San Cibrao (Cervo, Lugo). This is the only Galician site located on the Cantabrian shore. Fish samples were associated with a shell midden (1st to 2nd centuries AD) and with infilling operations that took place during 2nd to 3rd centuries AD and 3rd to 5th centuries AD (González Gómez de Agüero, 2014; González Gómez de Agüero *et al.*, 2011).
5. The coastal *Castro* of *O Achadizo* is located at the entrance of the *Ria* of Arousa (Boiro, A Coruña). The occupation ranged from the Iron Age (5th century BC) to Galaico-roman stages dated between 1st to 2nd centuries AD (Concheiro Coello, 2008) same as the fish middens where the samples were retrieved (Ferré Álvarez *et al.* 1996; González Gómez de Agüero, 2014).
6. The coastal village of *A Lanzada* occupies a promontory overlying the Atlantic Ocean next to the village of Noalla (Sanxenxo, Pontevedra). The occupation ranged from 4th century BC to 4th century AD but fish samples dated from an early Roman time (2nd to 1st BC) (González Gómez de Agüero *et al.,* 2013; González Gómez de Agüero, 2014).
7. The *Castro* of *Montealegre* is located on the *Ria* of Vigo (Moaña, Pontevedra), its occupation ranging from 8th century BC to 1st century AD (Aboal Fernández, Castro Hierro, 2006). Fish samples derived from a massive shellmidden dated 1st to 2nd centuries AD (González Gómez de Agüero, 2014).
8. The coastal *Castro* of *Punta do Muiño do Vento* is also located on the *Ria* of Vigo. Although the bulk of occupation ranged from 6th to 5th centuries BC, fish derived from a shell midden coinciding with the moment of abandonment (2nd BC) (González Ruibal, 2006-2007; González Gómez de Agüero, 2014).
9. The coastal *Castro Facho de Donón* is located on a cliff overlying the entrance to the *Ria* of Vigo (Cangas de Morrazo). The shell midden from where the fish samples derive was dated between 1st BC and 2nd AD (Ferré Álvarez, 2003; González Gómez de Agüero, 2014).

The two fish collections from the Algarve were found within eponymous coastal towns located on the easternmost sector of a shore typified by coastal lagoons, tidal sandflats and estuaries (*i.e.* soft bottoms) (fig. 1).

10. *Tavira* is a rescue excavation that revealed a Roman fish factory in the center of town. Fish deposits derived from two Iron Age stages respectively dated

to 7th century BC and 5th to 3rd centuries BC (Callejo-Gutiérrez, Roselló-Izquierdo, 2013).

11. *Castro Marim* is located on a hilltop overlying the estuary of the Guadiana. Its occupation ranged from the end of the Bronze Age (10th to 11th centuries BC) to Roman times (1st century AD) granting one the chance to track changes in fishing strategy throughout one full millennium (Arruda, Freitas, 2008).

## Methods

The basis of this analysis is an essentially comparative one in which fish assemblages from each of the sites were broken down into seasonal (migratory) and year-round indicators (*i.e.* strictly local fishes that stay in place for life). Both groups, together with fishes of low or no phenological value (*i.e.* neither clearly migratory nor clearly sedentary) referred in this paper as indifferent taxa, have been quantified for each assemblage by calculating their frequencies in terms of the percentage of their NISPs (number of identified specimens; Reitz, Wing, 1999).

When undertaking comparative analyses the main factor to control is whether the faunal samples are comparable or not. Fish remains are so often neglected in archaeological excavations in Iberia and difficult to identify that differences in their taxonomic frequencies may be caused by a variety of factors that may distort pristine taphocenoses beyond recognition (*i.e.* different excavation and retrieval procedures, size differences of the specimens, identification with inadequate reference collections, etc.). For such reasons, in the analyses that follow, all collections were identified by members of our group, following similar protocols, and, except for the sites of Tavira and Castro Marim, the authors either took part or else supervised the retrieval procedures in the excavations. In terms of retrieval biases it must be stressed that, except for Tavira, all samples were obtained after fine sieving of selected bulk samples (mesh sizes mostly 0.8 mm; see previous section). In the case of Castro Marim, results are partial since the analysis of the fine-screened samples has not been completed as of this writing (Roselló-Izquierdo, in prep.). Tavira, on the other hand, needs to be taken with caution and, in fact, is not strictly comparable to any of the remaining samples since this was a rescue excavation where only manual retrieval techniques were implemented. Analyses were restricted to coastal settlements where the fish accumulations reflect a less distorted picture of the original catch, and to sites where only a subsistence (local) kind of fishing was practiced (*i.e.* to places where no evidence of the activities and structures associated with Roman fish industrial complexes such as salting vats, ovens, amphorae, warehouses, etc. existed). Another important issue when making inter-site comparisons is the specific kind of deposit, in particular whether short or long-lived, each one represents. Indeed, in the absence of evidence to the contrary, one automatically assumes that from the standpoint of taphonomy, faunal deposits constitute time-averaged series (*i.e.* long-term accumulations) rather than episodic (short-lived) ones. This is, alas, far from a safe assumption.

Obviously there are other issues that may cause differences in the assemblages reaching the archaeozoologist's bench and these may produce both "pseudo-similarities" and "pseudo-differences" among samples one should keep in mind. Some of these limitations will be entertained in the following section.

For the purposes of contrasting potential differences of geographical interest, and also given the latitudinal range of the collections studied, sites were grouped into three zones, namely Aquitania (France), Galicia (Spain) and Algarve (Portugal).

The characterization of the seasonal nature of each fish species or taxon were taken from *http://www.fishbase.org/* and from the *Consejería de Agricultura y Pesca* handbook from the *Junta de Andalucía* (2004). The characterization of the identified taxa incorporates three categories of migrants (*i.e.* spring/early summer, late summer/autumn and winter) in addition to the sedentary taxa and taxa of low phenologic value. The list of species/taxa within each category is as follows:

1. Sedentary taxa: grouper (genus *Epinephelus*), wrasses (genera *Labrus* and *Symphodus*), conger eel (*Conger conger*), moray eel (*Muraena helena*) and sole (genus *Solea*).
2. Migratory taxa:
   - 2a. Spring/early summer migrants: tunas (genus *Thunnus*), mackerels (genus *Scombrus*), horse mackerel (genus *Trachurus*), sardine (*Sardina pilchardus*), anchovy (*Engraulis encrasicolus*) and hammerhead sharks (genus *Sphyrna*).
   - 2b. Late summer/autumn migrants: amberjack (*Seriola dumerili*), meagre (*Argyrosomus regius*) and eel (*Anguilla anguilla*).
   - 2c. Winter migrants: shads (genus *Alosa*).
3. Indifferent taxa: included here are all the remaining fishes from the archaeological assemblages that, due to their intermediate position between marked migratory species and highly sedentary/territorial ones, are more difficult to allocate from the standpoint of their phenology (see list of species at the end of Section 2).

## Results and discussion

Tables 1-4 refer to the taxonomical composition of the fish assemblages grouped according to geographical region. In the case of Galicia, the Iron Age collections (tab. 2) have been set apart from those of Roman times (tab. 3). As mentioned in our previous paper (Roselló-Izquierdo *et al.*, in press), the number of sites and deposits is restricted and so are the sample sizes for most assemblages. Any patterns that might emerge must of necessity remain preliminary thus in need of confirmation.

An equilibrium existed in the number of Roman and Iron Age sites (*i.e.* 5 *vs.* 4, in addition to Castro Marim and O Achadizo that featured levels from both moments) and deposits (9 Roman *vs.* 8 Iron Age). Still, fish NISPs from the Roman period outnumbered those from the Iron Age in a 2:1 ratio [*i.e.* Roman: 4773

(64.2 %); Iron Age: 2665 (35.8 %)]. Such figures are misleading given the huge size differences existing among samples. In this way, the NISP from the largest collection (Punta Atalaia's Late Roman level) outnumbers that from the smallest assemblage (Monte do Facho, also Roman) in a 300:1 ratio (tab. 3). Indeed, a mere three deposits (Barzan, Tavira and the aforementioned Punta Atalaia) qualify as statistically relevant whereas another four (Guéthary, Iron Age O Achadizo,

| | 1st century AD | 1st to 3rd centuries AD | Roman |
|---|---|---|---|
| | Guéthary | Barzan | Biganos |
| *Raja clavata* | | 19 | |
| Triakidae | | 10 | |
| *Acipenser sturio* | | 4 | |
| *Anguilla anguilla* | | 78 | 11 |
| *Conger conger* | | 2 | |
| *Sardina pilchardus* | 2 | 31 | |
| *Alosa* sp. | | 31 | |
| *Engraulis encrasicolus* | 1 | 1 | |
| *Cyprinidae* | | | 12 |
| *Salmo* sp. | | 3 | |
| Gadidae | | 2 | 2 |
| Mugilidae | | 229 | 16 |
| *Belone belone* | | | 1 |
| Triglidae | 10 | 4 | |
| *Dicentrarchus labrax* | 3 | 148 | 2 |
| *Trachurus trachurus* | | | 12 |
| *Trachurus* sp. | | 3 | |
| Sparidae | 4 | 35 | 26 |
| *Diplodus sargus* | | | 2 |
| *Spondyliosoma cantharus* | 1 | | 10 |
| *Sparus aurata* | | 13 | 27 |
| *Pagellus acarne* | | | 16 |
| *Pagrus pagrus* | | | 1 |
| *Pagellus erythrinus* | | | 16 |
| *Diplodus* sp. | 1 | | |
| *Pagellus* spp. | | 55 | 1 |
| *Argyrosomus regius* | | 17 | |
| *Mullus* sp. | | 55 | 5 |
| Labridae | 3 | | |
| *Scomber japonicus* | | | 4 |
| *Scomber* sp et spp. | 6 | 29 | |
| *Pleuronectidae* | | 253 | 3 |
| *Solea* sp. | | 672 | 5 |
| **NISP** | **31** | **1694** | **172** |

**Tab. 1.** *Comparison of the fish species recovered in the Roman Aquitanian sites.*

| | O Achadizo | A Lanzada | Montealegre | Muiño do Vento |
|---|---|---|---|---|
| *Sardina pilchardus* | | | 23 | 14 |
| *Salmo* sp. | 1 | | | |
| *Conger conger* | | 1 | | |
| *Merluccius merluccius* | 14 | | 2 | 1 |
| *Pollachius pollachius* | 1 | | | |
| *Trisopterus luscus* | 16 | 15 | 46 | 12 |
| *Dicentrarchus labrax* | | | 9 | 6 |
| *Trachurus trachurus* | 3 | 51 | | |
| *Sparus aurata* | 27 | | 4 | |
| *Pagrus pagrus* | 5 | 13 | | |
| *Diplodus* sp. | | 1 | | |
| *Diplodus sargus* | | 5 | 7 | 10 |
| *Diplodus vulgaris* | | | | 1 |
| *Pagellus* sp. | | 4 | | |
| *Pagellus acarne* | | 15 | | |
| *Pagellus bogaraveo* | 3 | 35 | 18 | 11 |
| *Labrus bergylta* | 1 | 68 | 3 | |
| *Symphodus melops* | 1 | 82 | | |
| Ammodytidae | | 2 | | |
| *Scomber* sp. | | | 2 | |
| *Scomber scombrus* | | 9 | 2 | 1 |
| *Scomber japonicus* | | 1 | | 1 |
| **NISP** | **72** | **302** | **116** | **57** |

**Tab. 2.** *Comparison of the fish species recovered in the Galician sites for the Iron Age period (2nd to 1st centuries BC).*

Punta do Muiño do Vento and Monte do Facho) are unreliable for comparative purposes (tab. 1-4).

Such limitations notwithstanding, some remarks seem pertinent. To better grasp patterns, Table 5 provides a breakdown of the assemblage from each deposit into late spring/early summer, late summer/autumn and winter migrants, and sedentary and phenologically non-informative groups. Table 6 pools these data for each geographic region, setting apart the Iron Age samples from those of the Roman Period, and rounding decimal values to facilitate comparison.

The data presented highlight some quite striking differences among regions in terms of migratory groups. In this way, Aquitanian sites are the only ones with a confirmed presence of winter migrants lending support to the idea that fishing there took place throughout the year. The substantial number of sedentary species in these three sites as well as the dominance of what we have here labelled as indifferent taxa (available, in principle, throughout the year), combined with the fact that migratory taxa never reach frequencies above 30 % of the NISP, lend weight to a year-round fishing in Roman Aquitania. One should remark that such results are coincident with sclerochronological analyses on the season of capture obtained from readings of the vertebrae annuli on some of Barzan's specimens

| | 1st to 2nd centuries AD | | | 2nd to 3rd centuries AD | 3rd to 5th centuries AD |
|---|---|---|---|---|---|
| | **Punta Atalaia** | **O Achadizo** | **Monte do Facho** | **Punta Atalaia** | **Punta Atalaia** |
| *Sardina pilchardus* | 3 | | | 18 | 1430 |
| *Engraulis encrasicolus* | | | | | 619 |
| *Salmo* sp. | 1 | | | | |
| *Merluccius merluccius* | 1 | | | | 6 |
| *Pollachius pollachius* | 15 | | | 1 | |
| *Trisopterus luscus* | 1 | 11 | 1 | | |
| *Zeus faber* | 1 | | | | 1 |
| *Dicentrarchus labrax* | 4 | 1 | | | 1 |
| *Polyprion americanus* | | 1 | | | |
| *Trachurus trachurus* | 8 | 1 | 1 | 299 | 36 |
| *Sparus aurata* | 4 | 91 | 2 | | |
| *Pagrus pagrus* | 19 | | 1 | | 2 |
| *Diplodus sargus* | 1 | | | | |
| *Dentex dentex* | | 1 | | | |
| *Pagellus* sp. | | | 1 | | 1 |
| *Pagellus acarne* | 5 | 2 | | 1 | 3 |
| *Pagellus bogaraveo* | 9 | 2 | | 3 | 1 |
| *Labrus bergylta* | 56 | 1 | 1 | 7 | 4 |
| *Scomber* sp. | 1 | | | 2 | 8 |
| *Scomber scombrus* | 1 | | | | |
| *Scomber japonicus* | 11 | | | 26 | 32 |
| **NISP** | **141** | **111** | **7** | **357** | **2144** |

**Tab. 3.** *Comparison of the fish species recovered in the Galician sites for the Roman period (1st to 5th centuries AD).*

(Ephrem, 2014: 99-100). For such reason, the Aquitanian fish evidence would be indicative of a local halieutic activity whose paradigmatic taxon would be the sole (if one were also to take Pleuronectids at large as evidence of local fishing, the values of the sedentary fishes would rise to 55 %, bringing the contribution of the seasonally indifferent taxa down to 34-79 %) (tab. 5).

Although Galicia exhibited the narrowest range of migratory groups, there is a *caveat* in the figures provided in Tables 5 and 6. This refers to the presence of the blackspot seabream which the artisanal Galician fishery harvests, coinciding with the coldest months of the year (late autumn-early spring) to this day. If this was also the case in the archaeological collections, the number of migratory groups present would expand, migratory species being particularly relevant in the Iron Age samples when blackspot seabream represented a substantial portion of the catch (*i.e.* 4-19 %; Table 2). Be that as it were, fact remains that there exist two marked situations in the migratory component of the Galician fish assemblages. During the Iron Age, for example, the frequency range of the late spring/early summer migrants mimics that reported for Roman Aquitania whereas that range expanded dramatically for Roman Galicia. As can be seen in Table 3, Punta Atalaia's occupation levels appear to be partly responsible for such expansion. Indeed, at Punta

| | IronAge | | | | Roman |
|---|---|---|---|---|---|
| | Tavira IronAge I | Tavira IronAge II | Castro Marim Iron Age I | Castro Marim Iron Age II | Castro Marim |
| Unid. Chondricthyan | | 2 | | 16 | 3 |
| Chondricthyan type 1 | | | 5 | 31 | 16 |
| Chondrictihan type 2 | | | 1 | 48 | 10 |
| Rajidae | 2 | | 1 | 11 | 10 |
| Rhinobatidae | 1 | 1 | | 3 | |
| *Myliobatis* sp./Myliobatidae | | | | 1 | 1 |
| *Sphyrna* sp. | 1 | | 1 | | |
| Lamnidae | | 2 | | 1 | 1 |
| cf. *"Mustelus»* | 2 | 5 | | 10 | 1 |
| cf. *"Galeorhinus»* | 1 | 1 | | 2 | 1 |
| *Squalus acanthias* | 2 | 8 | | 4 | 2 |
| *Squatina squatina* | 1 | 2 | 1 | 24 | 6 |
| *Eugomphodus taurus* | | | | 1 | |
| *Acipenser sturio* | | | 1 | 3 | 3 |
| *Barbus* sp. | | | 1 | | |
| *Muraena helena* | 1 | | | | |
| *Conger conger* | 2 | 4 | | | |
| *Merluccius merluccius* | 1 | | | | |
| *Zeus faber* | 1 | | | 2 | |
| *Halobatrachus didactylus* | | | | 9 | |
| *Dicentrarchus labrax* | | | | 1 | |
| *Dicentrarchus punctatus* | | | | 2 | |
| *Epinephelus* sp. | | 2 | | | |
| *Epinephelus* cf. *marginatus* | | | 1 | | 1 |
| *Seriola dumerilii* | | | | 1 | |
| *Trachurus trachurus* | | | | | 1 |
| *Plectorhincus mediterraneus* | | 1 | | | 3 |
| *Dentex* sp. | | | 2 | | 2 |
| *Dentex gibbosus* | 3 | 5 | 2 | 6 | 1 |
| *Diplodus* sp. | 1 | | | | |
| *Pagellus acarne* | 1 | | | | |
| *P. erythrinus/P. pagrus* | 3 | | 2 | 13 | 4 |
| *Pagellus erythrinus* | | 1 | 1 | 17 | 3 |
| *Pagrus* sp. | 2 | 2 | 2 | 2 | |
| *Pagrus auriga* | 1 | 6 | | 1 | |
| *Pagrus caeruleostictus* | 1 | | | | |
| *Pagrus pagrus* | 10 | 9 | | 4 | 8 |
| *Sparus aurata* | 106 | 69 | 8 | 55 | 17 |
| Sparidae | 32 | 50 | 2 | 18 | 3 |
| Sciaenidae | 1 | | 1 | | |
| *Argyrosomus regius* | 5 | 4 | 28 | 88 | 5 |
| *Sciaena* sp./*Umbrina* sp. | | | | 1 | |
| *Umbrina cirrosa* | 1 | 1 | | | |
| *Scomber japonicus* | | | | 3 | 1 |
| *Sarda sarda* | | 2 | | 1 | |
| Thunnidae/Scombridae* | | | 9 | 44 | 3 |
| *Thunnus* cf. *thynnus* | 432 | 744 | 3 | 138 | 10 |
| *Mugil* sp./*Liza* sp. | | | | 3 | |
| **NISP** | **614** | **921** | **72** | **564** | **116** |

**Tab. 4.** *Comparison of the fish species recovered at Castro Marim and Tavira sites (Gulf of Cadiz) in the Iron Age and Roman period.*

| ASSEMBLAGE (age) | NISP | LS-ES (NISP & %) | LS-AU (NISP & %) | WI (NISP & %) | SE (NISP & %) | IN (%) |
|---|---|---|---|---|---|---|
| **Barzan** (CE I-III) | 1694 | 81 (4.8%) | 78 (4.6%) | 31 (1.8%) | 674 (39.8%) | 49% |
| **Biganos** (Roman | 172 | 17 (9.9%) | 11 (6.4%) | - | 5 (2.9%) | 80.8% |
| **Guéthary** (CE I) | 31 | 9 (29%) | - | - | 3 (9.6%) | 61% |
| **O Achadizo** (II-I BC) | 72 | 3 (4.1%) | - | - | 2 (2.7%) | 93.2% |
| **A Lanzada** (II-I BC) | 302 | 61 (20%) | - | - | 151 (50%) | 50% |
| **Montealegre** (II-I BC) | 116 | 27 (23%) | - | - | 3 (2.6%) | 74.5% |
| **Muiño do Vento** (II-I BC) | 57 | 16 (28%) | - | - | - | 72% |
| **Monte do Facho** (I BC-CE I/III) | 7 | 1 (14%) | - | - | 1(14%) | 72% |
| **O Achadizo** (I BC-CE I/II) | 111 | 1 (0.9%) | - | - | 1 (0.9%) | 98.2% |
| **Punta Atalaia (shell midden)** (I BC-CE I/III) | 141 | 24 (17%) | - | - | 56 (39%) | 44% |
| **Punta Atalaia** (CE II-III) | 357 | 345 (96%) | - | - | 7 (1.9%) | 2% |
| **Punta Atalaia** (CE III-IV) | 2144 | 2125 (99.3%) | - | - | 4 (0.2%) | 0.5% |
| **Castro Marim** (1st Iron Age) | 72 | 13 (18%) | 28 (38.9%) | - | 1 (1.4%) | 41.7% |
| **Tavira** (1st Iron Age) | 614 | 433 (70.5%) | 5(0.8%) | - | 3 (0.2%) | 28.5% |
| **Tavira** (2nd Iron Age) | 921 | 744 (80.7%) | 4(0.4%) | - | 6 (0.6%) | 18.3% |
| **Castro Marim** (2nd Iron Age) | 567 | 182 (32%) | 89 (15.7%) | - | - | 52.3% |
| **Castro Marim** (Roman) | 116 | 14 (12%) | 5 (4.3%) | - | 1 (0.8%) | 83% |

**Tab. 5.** *Breakdown of the selected Iron Age and Roman fish assemblages into phenologic (*i.e. *life cycle events) groups of sedentary (SE), phenologically indifferent (IN) and migratory species, the latter broken down into late spring/early summer (LS-ES), late summer/autumn (LS-AU) and winter (WI) migrants.*

Atalaia's shell midden, both the frequencies of the late spring/early summer migrants and those of the strictly sedentary taxa match not only those of the remaining Iron Age Galician sites, but also those from Aquitanian sites. Of the remaining Punta Atalaia levels, on the other hand, horse mackerels (2nd to 3th centuries AD collections) and clupeiforms (3rd to 5th centuries AD collections) monopolized fish samples (tab. 3). Given that horse mackerel was a neglected catch of the Roman fish industries (Morales-Muñiz & Roselló-Izquierdo, 2008), one may contend that horse mackerels at Punta Atalaia reflect a subsistence rather than a commercial type of fishing or, more unlikely, a fishing episode frozen in time. Likewise, sardines and anchovies, though certainly major targets of the Roman commercial fisheries, were surely items all artisanal fisheries would be keen to exploit (fishing sardines, in fact, does not require complex boats or technology and can be carried out successfully by a couple of people, even when stationed on the beach) (Bekker-Nielsen, 2010). The question on whether the 3rd to 5th centuries AD level at Punta Atalaia is indicative of local fishing or an instance of local fishermen being co-opted by the commercial enterprises is a question one could only answer with additional contextual evidence, in particular that relating to the nature, whether episodic or time-averaged, of the accumulation.

Galician assemblages are the only ones where one can carry out comparisons between Roman and Iron Age collections. Tables 2 and 3 hint that even though the list of species remained essentially unchanged through time, the frequencies

of many taxa shifted significantly. Excluding the skewed assemblage from Late Roman Punta Atalaia, species exhibiting a marked reduction through time include the corkwing wrasse (*Symphodus melops*; 16 % *vs.* 0 %), poor cod (*Trisopterus luscus*; 17 % to 5 %), horse mackerel (14 % *vs.* 4%) and the blackspot seabream (13 % *vs.* 4%). An opposite trend is seen in the gilthead (6 % *vs.* 38 %) and Ballan wrasse (14 % *vs.* 23 %). It so happens that, except for the Ballan wrasse, all of these species belong to the category of (seasonally) indifferent taxa. Although most of them undertake partial migrations along the shore or into deeper waters in winter, they do so in a restricted manner. Given that they are neither good seasonality markers nor present in large numbers in the places they inhabit, we believe all these fishes evidence a most local type of fishing carried out throughout the year. The differences recorded between the two periods should thus reflect differences in the local environments. A paradigmatic case in point would be the site of O Achadizo, where two local taxa, poor cod and gilthead, dominated both in the Late Iron Age and Roman assemblages (tab. 2, 3). Such pattern appears consistent with an activity that remained unchanged for a long time. Similar environments foster similar taxonomic spectra and similar abundances for a given species with independence of the period under consideration. As postulated in a previous paper, environmental idiosyncrasy, rather than technological or cultural developments, appears to constitute the most parsimonious way of explaining the faunal differences among our collections and regions (Roselló-Izquierdo *et al.*, in press). Such *take-away-message* appears to be particularly important for Galicia due to the shifting location of sites at different moments. Indeed, the location of the Iron Age *castros* on the inside of the *rias* and of Roman settlements on more exposed shores may explain the shifting abundance of certain taxa. Species such as poor cod and gilthead diminish from the inside to the outside of the *rias* (E. González Gómez de Agüero, pers. obs.) whereas species such as the horse mackerel and porgy (*Pagrus pagrus*) are only frequent on the open coast. Until compelling evidence on the contrary is found, environmental inertia seems to be the most parsimonious explanation to account for the fish spectra recorded in Galicia.

The Algarve assemblages, despite the substantial collections they exhibit, are the most unreliable of those taken into consideration here since those from Castro Marim do not include the fishes from the fine-screened samples and those from Tavira were collected by hand. Still, these collections exhibit coincidences and differences with those from the more northern sites. Within the latter, all of the Algarve deposits were characterized by ludicrously small frequencies of the truly sedentary fishes and, in the case of the Iron Age samples, by substantial numbers of late spring/early summer migrants, the values from Tavira undoubtedly reflecting an inflation of large sized specimens given the deficient retrieval (tab. 6). One major qualitative difference between the southern and northern sites is that whereas clupeiforms (in Aquitania also mackerels) constituted the bulk of the migratory species, in the Algarve the main taxon were the tunas (tab. 4). Likewise relevant at Castro Marim were autumn migrants, exemplified by the meagre (one should note that tunas may be occasionally caught on their return migration

| GROUP | LS-ES | LS-AU | WI | SE | IN |
|---|---|---|---|---|---|
| Aquitania (Roman) | 5 - 29 % | 4.5 - 6.5 % | 2 % | 3 - 40 % | 49 - 81 % |
| Galicia (Iron Age) | 4 - 28 % | - | - | 2.5 - 50 % | 50 -93 % |
| Galicia (Roman) | 1 - 99 % | - | - | 0.2 - 39 % | 0.5 - 98 % |
| Algarve (Iron Age) | 18 - 81 % | 0.5 - 39 % | - | 0.2 - 1.4 % | 18 - 52 % |
| Algarve (Roman) | 12 % | 4 % | - | 0.8 % | 83 % |

**Tab. 6.** *Phenologic* (i.e. *life cycle event) groups from selected Iron Age and Roman fish assemblages pooled into regions broken down into Iron Age and Roman times [sedentary (SE), phenologically indifferent (IN) and migratory species, the latter broken down into late spring/ early summer (LS-ES), late summer/autumn (LS-AU) and winter (WI) migrants].*

during late summer/early autumn) but the contrast with Tavira here is striking for meagre is also a large sized fish. Matters at Castro Marim will change qualitatively and quantitatively once the study of the clupeiforms from the fine-sieved samples is completed (Roselló-Izquierdo, in prep.). Such fact notwithstanding, it seems clear that well before the onset of the Roman fish industries people in the Algarve were targeting migratory fishes, the hallmark of the Roman commercial fisheries, both on a regular basis and perhaps also in substantial numbers. What this implies for the origin and development of those Roman fisheries remains open to question. The origin of the fish processing industries has been taken to represent not a Roman development but instead an eastern Mediterranean invention in which the Greeks with their Black Sea fish imports apparently played an instrumental role (Etienne, Mayet, 2002; Morales *et al.*, 2007). Given that Greeks, and before them the Phoenicians, reached southern Iberia in the first half of the 1st millennium BC, and opened the region to the Mediterranean world, it should come as no surprise that they might have also set in motion the shift for the local fishing communities to focus on tunas (Morales-Muñiz, Roselló-Izquierdo, 2008). For such reasons, the Iron Age from the Gulf of Cadiz may not be the best place to look for evidences of "pristine" subsistence/artisanal fishing prior to the arrival of the Romans.

In connection with this last line of argument, the single Roman collection from the Algarve (Castro Marim) is striking in that it evidences an inverted pattern to that documented in the Iron Age samples (tab. 5). Migrant fishes at that time constituted a secondary item (16.3 %) within a singular assemblage for the Algarve dominated by indifferent taxa as are most of the cartilaginous sharks and rays (43% excluding the pelagic Lamnidae) and the seabreams (Sparidae : 32 %). This seemingly paradoxical case may be accounted for by the fact that all fish assemblages from Castro Marim were retrieved in the habitational contexts on the top of the hill where the settlement is located. It so happens that Roman fish processing installations were all located at sea level (*i.e.* around the harbor) (Ana Arruda, com. verb.) thus most tunas probably never made it uphill at that time. In other words, two separate areas reflecting two different fishing strategies. If this were the case, one may contend that the fish assemblages from the habitational

contexts reflect the fish spectra of the presumably secular artisanal fishery from this area, with perhaps the single exception of tunas that were now detracted in larger numbers to keep the fish processing installations going. Alternatively, and more unlikely, one may surmise that the lower proportions of tunas in the Roman level from Castro Marim reflects the truly pristine situation of the Algarve artisanal fisheries prior to the arrival of the trans-Mediterranean colonizers. If that were the case, the proportions of migratory species from all of the previous Iron Age levels – also at Tavira – would be "inflated" in the sense of reflecting mixed deposits of artisanal fishing as well as of fishing carried out on a commercial basis to supply the needs of the Phoenicians, Greek and Punic. Far-fetched, perhaps, but certainly a hypothesis meriting further exploration.

## Conclusions

In NE Atlantic waters Roman fishery studies have prompted an ample research agenda focusing on the so-called industrial/commercial/large-scale component of the phenomenon. As a result, local fishing activities have been paid less attention to despite these complementing the industrial fisheries' data and also data on the local economy of coastal societies outside of the industrial fishing season. Not to mention issues relating to the biogeography and behaviour of fish species that could shape the availability and accessibility of halieutic resources and provide an operative baseline for future diachronic analyses, including those focusing on human and climatic impacts on former environments.

In this paper the information of fish taxa reported for Iron Age and Roman sites from the Atlantic shores of SW Europe have revealed a series of spatiotemporal trends. In particular:

1. The sites from the three Atlantic regions that have been analysed hint at year-round fishing during both the Iron Age and Roman times, the Aquitanian region being the one providing the strongest evidence given the presence of winter migrants in the assemblages.
2. Fishing recorded in Iron Age Iberia (*i.e.* Galicia and the Algarve), though arguably concordant with a year-round fishing activity, already featured a potent seasonal signature in terms of spring/early summer migrants that, in the Algarve hints at a gradual development of the features that will later characterize Roman commercial fisheries. This has not been the case in Roman Aquitania which not only exhibited low frequencies of spring/early summer migrants in its fish samples, but also a focus on strictly sedentary species as are the soleid flatfishes. To what extent this regional difference constitutes the persistence of fishing practices from the Aquitanian Iron Age or a yet unrecorded specialisation of the commercial fishing strategies of the Romans can only be resolved once pre-roman fishing assemblages from this region become available for analysis.

The evolution of the Roman commercial fisheries was marked by three stages on account of the targeted taxa. These included (i) a "tuna stage" lasting from

the end of the 2nd century BC to the first half of 1st century AD, (ii) a "mackerel stage" (1st to 3rd centuries AD), and (iii) a "clupeiform (sardine) stage" lasting from the 3rd century AD to the middle of 5th century AD (Morales-Muñiz, Roselló-Izquierdo, 2008). These stages have been associated with socio-economic changes taking place within Roman society, yet neither environmental phenomena (*e.g.*, changes in the marine currents, freshwater outflows affecting the routes of migratory fish, etc.) nor bio-cultural ones, as would be the *fishing-down-the-food-web* proposal, have been explored as causal agents of such shifts as of this writing. The data that emerges from our analysis evidence that whereas clupeiforms were fished in both Galicia and the Algarve (*Castro Marin*, Roselló-Izquierdo, in preparation) on at least a recurrent basis previous to the arrival of the Romans, and so were tunas in the Algarve, mackerels were an essentially novel item of the Roman fishing enterprises. That feature, combined with a lack of interest for local fishes, weakened the idiosyncratic (local environment) signal of artisanal fisheries beyond recognition, conferring Roman fishing enterprises a faunal homogeneity not to be seen in the ensuing five hundred years that followed the collapse of the Roman Empire.

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