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Hannah RUSS &
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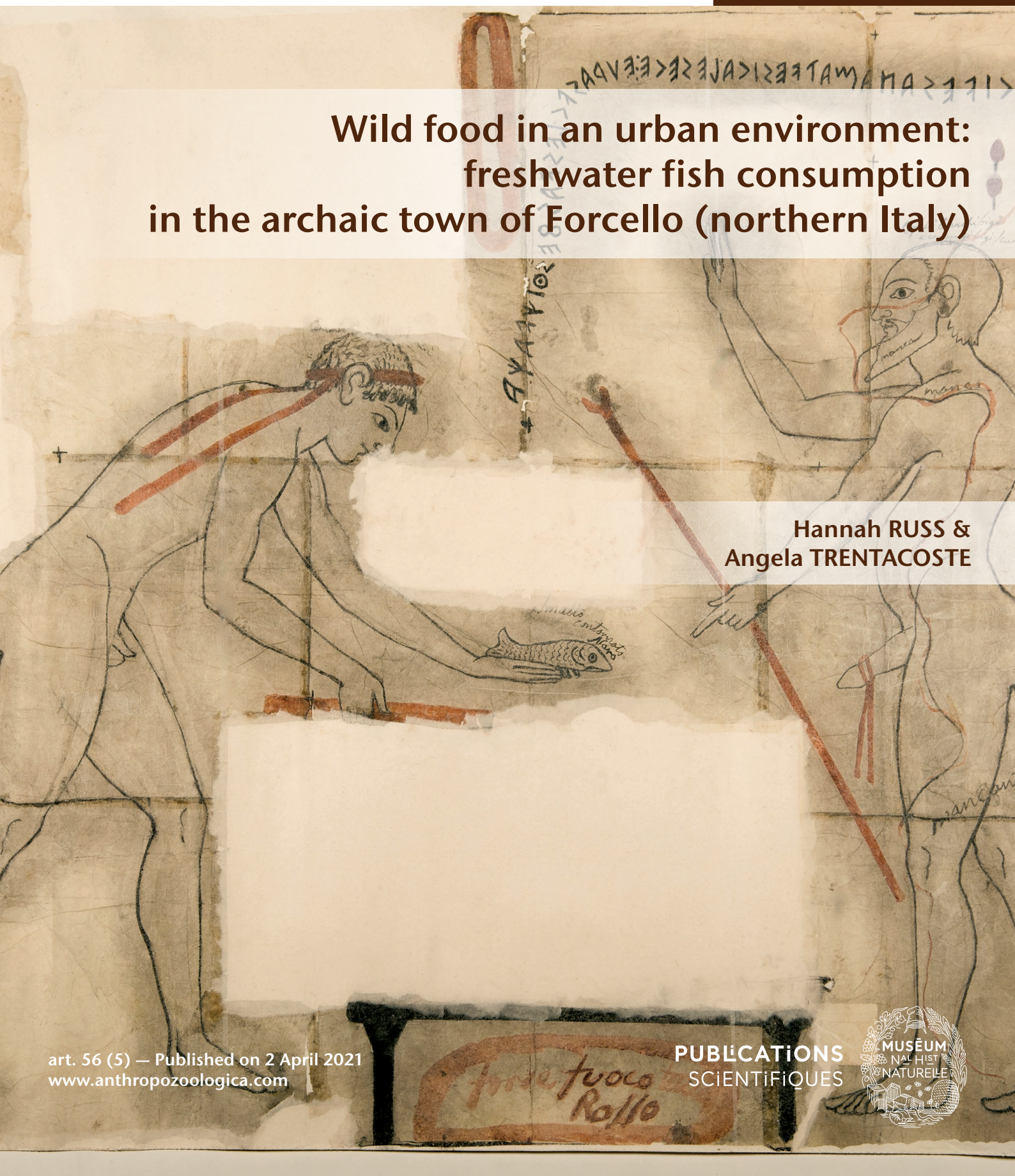

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Scène de la Tombe des Inscriptions, nécropole de Monterozzi, Tarquinia (*c*. 520 av. J.-C.). Tracé du XIXe siècle par C. Ruspi. Crédits : Deutsches Archäologisches Institut (DAI). Photo : H. Behrens (D-DAI-ROM 2018.1279) / *Scene from the Tomb of the Inscriptions, Monterozzi necropolis, Tarquinia (c. 520 BC). Nineteenth-century tracing by C. Ruspi. Credits: German Archaeological Institute (DAI). Photo: H. Behrens (D-DAI-ROM 2018.1279).*

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Wild food in an urban environment: freshwater fish consumption in the archaic town of Forcello (northern Italy)

Hannah RUSS
Angela TRENTACOSTE
Institute of Archaeology, University of Oxford,
36 Beaumont Street, Oxford, OX1 2PG (United Kingdom)
px@archaeology.biz (corresponding author)
angela.trentacoste@arch.ox.ac.uk

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ABSTRACT
In northern Italy's Po Plain, Etruscan cities flourished during the Archaic period (*c.* 6th-4th centuries BC), thanks to an organized and dynamic commercial network that linked these centres with Italy, Europe, and the Mediterranean. This new urban network had a significant impact on the territory it occupied, and zooarchaeological studies document the emergence of a new agricultural strategy and livestock improvement. While there is ample evidence for how these Etruscan communities shaped their urban environments and agricultural hinterland, their relationship with wild resources – outside of prestige hunting – is poorly understood. As a result of taphonomic and recovery biases, zooarchaeological assemblages representing small wild taxa like fish and birds are rare. In this context, the fish bone assemblage from the Archaic harbour town of Forcello offers an exceptional opportunity to investigate wild resource exploitation in an urban context. Here we present an initial analysis of the ichthyological assemblage and place results in their broader zooarchaeological and cultural context. Results suggest a fishing strategy that privileged large, line-caught fish, with a significant degree of continuity in species representation over pre- and proto-history. While the amount of food furnished by fishing was minimal compared to that from domestic livestock, wild foods including fish were the main source of diversity in the diet: a role which may have influenced their relatively greater visibility in Etruscan ritual practices.

KEY WORDS
Iron Age,
Etruscan,
subsistence,
palaeoeconomy,
biodiversity,
Po Plain,
fluvial environments.

RÉSUMÉ
Alimentation sauvage en milieu urbain : consommation de poissons d'eau douce dans la ville archaïque de Forcello (Italie du Nord).
Les villes étrusques de la plaine du Pô, au nord de l'Italie, ont prospéré pendant la période archaïque (*c.* VIe-IVe siècles av. J.-C.) grâce à un réseau commercial organisé et dynamique qui les reliait à l'Italie, l'Europe et la Méditerranée. Ce nouveau réseau urbain a eu une grande influence sur le territoire qu'il occupait et des études zooarchéologiques démontrent l'émergence d'une nouvelle stratégie agricole ainsi que l'amélioration de l'élevage. Bien qu'il existe de nombreuses preuves de la manière dont ces communautés étrusques ont façonné leur environnement urbain et leur arrière-pays agricole, leur relation avec les ressources sauvages – en dehors de la chasse de prestige – est mal comprise. En raison des biais taphonomiques et de collecte, les assemblages zooarchéologiques comprenant de petits taxons sauvages

MOTS CLÉS
Âge du fer,
Étrusques,
subsistance,
paléoéconomie,
biodiversité,
plaine du Pô,
milieux fluviaux.

comme les poissons et les oiseaux sont rares. Dans ce contexte, l'assemblage d'arêtes de poisson de la ville portuaire archaïque de Forcello offre une occasion exceptionnelle d'étudier l'exploitation des ressources sauvages dans un contexte urbain. Nous présentons ici une première analyse d'assemblage ichtyologique et situons les résultats dans leur contexte zooarchéologique et culturel plus large. Les résultats suggèrent une stratégie de pêche qui privilégie les gros poissons pêchés à la ligne, avec un degré significatif de continuité dans la représentation des espèces par rapport à la préhistoire et à la protohistoire. Si la quantité de nourriture fournie par la pêche était minime comparativement à celle du bétail domestique, les aliments sauvages, dont le poisson, étaient la principale source de diversité alimentaire, ce qui peut expliquer leur présence dans les pratiques rituelles étrusques.

FIG. 1. — Map of northern Italy with the location of Forcello and Bronze Age settlements discussed in text. Rivers are shown following their modern courses.

INTRODUCTION

The middle centuries of the 1st millennium BC marked an important moment of urbanism in northern Italy. Following a period of socio-economic development and the emergence of proto-urban centres between the 9th and 7th centuries BC, the 6th century saw a major reorganisation of Etruscan territory within the Po Valley, a process centred on commercial activity and inter-regional exchange (Sassatelli 2008, 2011). The ancient centre of Bologna was re-founded, and new cities placed on strategic communication routes: Marzabotto on the in-land road to Etruria, Spina on the Adriatic Sea, and Forcello on the waterway leading to the Alps (Fig. 1). These new centres contained many of the hallmarks of urban sites, including orthogonal urban layouts, paved roads, workshops, and monumental temples (De Marinis & Rapi 2007; Govi 2014), and territory surrounding them was systematically organised into an agricultural landscape through farms and hydrological works (Malnati 1989; Uggeri 1991; Quirino 2019).

Subsistence in these Etruscan communities was based on domestic plants and animals, as it had been for prehistoric communities in northern Italy since the Neolithic (Biagi *et al.* 1993; Fiorentino *et al.* 2004; Trentacoste 2016; Bosi *et al.* 2020). However, within the Etruscan urban network, a new and particular agricultural strategy emerged. Uniquely in the region, Etruscan cities focused on pork production and consumption, and pig bones often account for 50% or more of livestock remains recovered from Etruscan cities in northern Italy (Trentacoste 2016). These communities also improved their livestock, producing larger sheep and goats (Trentacoste *et al.* 2018).

In this increasingly anthropogenic landscape, wild resources took on a new role. In mammal bone assemblages, wild taxa become increasingly rare over later prehistory, illustrating a reduction in hunting and increasing reliance on domestic livestock (De Grossi Mazzorin 1989; Riedel 1994; Cattabriga & Curci 2007). The choice of prey also appears to have changed over this period, with a shift towards larger game like red deer (*Cervus elaphus* Linnaeus, 1758) and boar (*Sus scrofa* Linnaeus, 1758) and a reduction in exploitation of smaller wild species. Hunting increasingly became an aristocratic sport, richly depicted in Etruscan art (Camporeale 1984): an undertaking requiring equipment and man-power on a considerable scale, rather than an individual subsistence activity (De Grossi Mazzorin 1989; Cattabriga & Curci 2007). The array of wild animals recovered from the aristocratic homestead at Poggio Civitate illustrates this elite interest in hunting, and probably also their involvement in the production of luxury furs (Kansa & MacKinnon 2014).

Compared to the socio-economic role of large game, the importance of smaller wild taxa, especially fish and birds, is poorly understood. Due to preservation and recovery biases, these remains are rarely collected in any quantity, and, consequently, there are few opportunities to investigate the role of local wild resources in the increasingly urbanised landscape of proto-historic Italy. In this context, a fish-bone assemblage from the Etruscan port-town of Forcello offers an exceptional opportunity to evaluate the use of fish as a food source and the fishing strategies employed in the Archaic Po Plain (6th-4th century BC). This study presents a first systematic look at the fish assemblage from Forcello – the first significant fish-bone assemblage from any Etruscan site – and places results in context with prehistoric assemblages from the region. In this context, these fish bones provide far more than a record of the aquatic consumption habits of one site, and offer a rare

Fig. 2. — Fishing scene from the Tomb of Hunting and Fishing, Monterozzi necropolis, Tarquinia (*c.* 510 BC). **A**, view of the two chambers; **B**, detail of fishing scene, back wall. Nineteenth-century facsimile by G. Mariani (Ny Carlsberg Glyptotek HIN 0091). Credits: A, A. Trentacoste; B, Ny Carlsberg Glyptotek, Copenaghen.

and valuable look at human-environment relationships and the importance of wild resource exploitation at a moment of transition to an increasingly urban landscape.

EVIDENCE FOR FISHING AND FISH CONSUMPTION IN PROTO-HISTORIC ITALY

The most famous testament to fishing in pre-Roman Italy is perhaps the image from which the Tomb of Hunting and Fishing (*Tomba della Caccia e Pesca*) in the Monterozzi necropolis of Tarquinia derives its name (Fig. 2). The painting on the back wall of the inner chamber of this tomb, dated *c.* 510 BC, depicts a seascape with a boat and fisherman, alongside a man hunting birds with a sling (Steingräber 1986: n°50; Steingräber 2006). The scene continues on the right wall, where a similar seascape depicts a second fisherman with harpoon (Fig. 3). In terms of material remains of fishing equipment, hooks, weights, harpoons, and tridents recovered throughout Italy attest to a variety of fishing techniques (Gianfrotta 1987; Giulierini 2010). Certainly by the 4th century BC fishing had grown into an industry requiring significant installations for fish processing, at least in Sicily, and later in the 1st century BC fish factories expanded to the Tyrrhenian coast of peninsular Italy (Botte 2009, 2018).

In contrast to the abundant evidence for a fishing industry in the Roman period (Marzano 2013), evidence for fishing and fish consumption in proto-historic Italy is relatively sparse. Within central and northern Italy, the most significant ichthyological assemblages have been recovered from Bronze Age Canàr and Iron Age Frattesina in the Po Plain (De Grossi Mazzorin & Frezza 1998, 2000; De Grossi Mazzorin 2002). Fishing at these sites was based mainly on common freshwater taxa: northern pike (*Esox lucius* Linnaeus, 1758), tench (*Tinca tinca* (Linnaeus, 1758)), and rudd (*Scardinius erythrophthalmus* (Linnaeus, 1758)). European eel (*Anguilla anguilla* (Linnaeus, 1758)), European chub (*Squalius cephalus* (Linnaeus, 1758)), barbel (*Barbus barbus* (Linnaeus, 1758)), sturgeon (Acipenseridae), and carp family fishes (Cyprinidae) were also identified in small numbers. Pike increased in importance between the Early and Final Bronze Age, although the overall variety of fish remained stable between periods. Measurements taken from fish remains indicated that both tench and northern pike caught at Iron Age Frattesina were larger than those caught at Bronze Age Canàr (De Grossi Mazzorin 2002).

Fig. 3. — Tomb of Hunting and Fishing (detail, right wall), Monterozzi necropolis, Tarquinia. Nineteenth-century facsimile by G. Mariani (Ny Carlsberg Glyptotek HIN 0092). Credits: Ny Carlsberg Glyptotek, Copenaghen.

Knowledge of fishing in northern and central Italy outside of these two pre-Etruscan examples is comparatively limited. If present, fish are typically represented in pre- and proto-historic assemblages by only a handful of remains. In northern Italy, the most common species are pike and cyprinids. Pike fishing is attested during the Neolithic in the region (Jarman 1976), and pike and cyprinids have been identified in the assemblages of numerous Bronze Age sites (e.g., Riedel 1993; Farello 1995a; Di Martino 1997; Cavallo 2000; Curci 2013; De Grossi Mazzorin & Solinas 2013; De Grossi Mazzorin 2015), as well as at Iron Age Padova (Tagliacozzo & Cassoli 1990) and Oppeano (Minniti 2010). Small numbers of pike have also been recovered from northern Etruscan sites: Bologna (Castenaso; Farello 1994), Marzabotto (Farello 1995b), and Mirandola (Farello 1992; Calzolari 1993). Bologna (Castenaso) also produced cyprinid bones.

Central Italian sites, especially those on or near the coast, have produced a larger range of freshwater and marine species. A programme of sieving at the Late Bronze Age site of Monte Ignacio in central Italy led to the recovery of eels and cyprinids,

Fig. 4. — Scene from the Tomb of the Inscriptions, Monterozzi necropolis, Tarquinia (*c.* 520 BC). Nineteenth-century tracing by C. Ruspi. Credits: German Archaeological Institute (DAI). Photo: H. Behrens (D-DAI-ROM 2018.1279).

which are common inhabitants of freshwater lakes and streams (McVicar *et al.* 1994). At Ficana, several scutes from a European sea sturgeon (*Acipenser sturio* Linnaeus, 1758) have furnished evidence of these large fish in Tiber (Brandt 1981). Other finds of small numbers of marine fish bones from the city of Rome derive from l'Aqua Marcia, and proto-historic deposits at Cures Sabini (Ruffo 1987; De Grossi Mazzorin 2000). Recent excavation of a Republican house at Gabii, near Rome, produced only a handful of fish remains, despite the use of flotation on some samples. The only bones identified to taxonomic level were vertebrae from a shark of the Carcharhinidae family, an Atlantic chub mackerel (*Scomber colias* Gmelin, 1789), and a Mediterranean moray eel (*Muraena helena* Linnaeus, 1758) (Alhaique 2016).

Fish remains are sometimes recovered but not identified to any specific taxon, possibly due the preservation of the material or element(s) represented. Unidentified fish are documented in both northern (Jarman 1976; Riedel 1984; De Grossi Mazzorin 1988; Cassoli & Tagliacozzo 1990; Maini 2013a, b) and central areas (De Grossi Mazzorin 1985; Clark 1989; Van Kampen *et al.* 2005; Minniti 2012a). This very small body of material is, however, unlikely to transform understanding of fishing in this time period even if taxonomic attributions were made.

While the relative rarity of ichthyological remains in settlements and domestic debris suggests that fish made a minor contribution to human subsistence, fish remains recovered from tombs, ritual deposits, and sanctuaries suggest they had a more notable contribution to the symbolic sphere (Maras 2020). Their use in these contexts continued from the Iron Age across the 1st millennium BC. Two 8th century BC tombs in Rome produced remains of barbell and grey mullet (*Chelon labrosus* (Risso, 1827)) (Gjerstadt 1956), and tombs in the Iron Age necropoli of Villa Bruschi Falgari (Tarquinia) and Campidoglio Giardino Romano (Rome) yielded fresh water fish bones (Minniti 2012b). Pike, eel, ray, and European bass (*Dicentrarchus labrax* Linnaeus, 1758) were identified in Villanovan and Etruscan tombs in northern Italy (Bertani 1995; Farello 2002). Squalidae remains, probably from a dogfish (*Squalus acanthias* Linnaeus, 1758), have been found in a 3rd-to-2nd century BC tomb at Populonia (De Grossi Mazzorin & Minniti 2009).

Sanctuaries also appear to have been places of fish consumption, or at least offerings of fish. Such a practice appears to be depicted on the entrance wall of Tarquinia's Tomb of the Inscriptions, *c.* 520 BC (*Tomba delle Iscrizioni*; Steingräber 1986: nº74): a young man holds out a fish over a missing part of the image (an altar or grill?) (Fig. 4). Opposite him is a fertility deity, with hand raised in a gesture of benediction. Living fish may also have had a ritual role: Torelli (2011) has interpreted a painted plaque from the Portonaccio temple at Veii (late 6th-early 5th century) as a scene of ichthyomancy (divination based on the movement of fishes). Returning to zooarchaeological remains, gilt-head bream (*Sparus aurata* Linnaeus, 1758) and brown meagre (*Sciaena umbra* Linnaeus, 1758) have been identified from the sacred area of San Omobono (Tagliacozzo 1989), and chub and rudd recovered from the sanctuary of Canicella at Orvieto (Wilkens 2008). Wells in the sanctuary at Pyrgi also produced fish remains (Caloi & Palombo 1989), as well as fishing hooks and net weights: offerings that may refer to the "first fruits" of a successful excursion (Donati & Rafanelli 2004: 154; Giulierini 2010). A final and particularly interesting example is provided by the repeated votive deposit from Tarquinia (Bagnasco Gianni 2005). Sometime between the 7th and 5th centuries BC, several sets of ceramics with organic remains (cereal, legume, fig, poppy, grape) were laid on atop each other in a natural depression. The uppermost deposit included four olle (ceramic jars) and a jug, all of which contained fish remains. Only one Sparidae bone was identified. An earlier iteration of the ritual, located below the aforementioned deposit, contained a further three olle, again with each containing fish remains.

Overall, fish recovered from pre- and proto-historic contexts in northern and central Italy generally represent common species accessible in rivers or coastal waters. Assemblages from northern Italian and Apennine sites concentrate on local freshwater species, while sites located closer to the Tyrrhenian coast record a greater presence of marine taxa. Strikingly, all sites other than Canàr and Frattesina produced very few fish bone finds. This phenomenon is certainly related to recovery strategies, as hand collection – the predominant mode of collection – is known to bias against small elements and taxa (Payne 1972, 1975). Nonetheless, despite the use of sieving at Celano, Rome (Campidoglio), and Sorgenti della Nova, no fish remains were recovered from these sites (Minniti 2012a). At Gabii, floatation did not produce more fish remains than hand picking (Motta 2016); however small rodents appeared to be under-represented in the hand-collected material, so fish may indeed be at least somewhat underrepresented. Although sparsely represented in domestic and habitation assemblages, the repeated recovery of fish as funerary and ritual offerings suggests that they had an important symbolic or ritual role, even if they were economically rather marginal. The character of mammalian remains found in tombs strongly suggests that they represent "food for the dead", rather than debris from a banquet (Maini 2010). Fish in funerary contexts may also

represent provisions for the afterlife, while their use in sanctuaries may reflect offerings or sacrifices, as is documented in the Greek world (see Mylona 2013; Carboni 2016). Whether the greater archaeological visibility of fish in ritual contexts relates to real social differences in their consumption or simply to their privileged conservation in and recovery from these contexts requires further work.

FORCELLO: AN ARCHAIC RIVER PORT IN NORTHERN ITALY

The Etruscan port-town at Forcello is located in the comune of Bagnolo San Vito, approximately seven kilometres southeast of the city of Mantua (Casini & De Marinis 2007). The site lies near the banks of the current course of the Mincio River (Fig. 1), a waterway that connects Lake Garda with the River Po approximately 12 km to the southeast of the site. Geomorphological and palynological research indicates that when the town was inhabited the surrounding area was occupied by a large fluvial lake (Ravazzi *et al.* 2013), much like Mantua is today. This body of water extended upriver from Mantua, past Forcello, and into an area of poorly drained lowlands, before meeting the River Po.

This location on the Mincio River shaped life in the Etruscan town. After its foundation in the 6th century BC, the site flourished as a trading post for 150-160 years, until its abandonment in the early 4th century BC (De Marinis 2016). Forcello, and neighbouring Mantua, were the northernmost Etruscan cities of the Po Valley, with an important role mediating trade with other Italic population of northern Italy, as well as trans-Alpine groups (Sassatelli 2011). A wide range of imported material culture attests to Forcello's far-reaching trade links. Amphorae, Greek pottery, glass paste objects, as well as a seal in the form of a scarab illustrate contacts with Greece and the wider Mediterranean basin (De Marinis & Rapi 2007; Consonni *et al.* 2010). Connections with Venetian, Rhaetian, Golasecca, and La Tène communities are evidenced by small finds, particularly fibulae, and pottery (De Marinis 1987, 2007c). The river also impacted the physical form of this twelve-hectare town. Forcello's orthogonally organised houses and work spaces were aligned with large drainage channels that ran across the settlement (De Marinis 2007b; Quirino 2012), and a large earth embankment surrounding the settlement served as a defence from flooding, as well as from any potentially hostile groups (De Marinis 1991; Casini & De Marinis 2007).

Like other towns of this period, the subsistence strategy at Forcello was based on the exploitation of domestic plants and animals. Castelletti & Rottoli (1988)'s examination of stored botanical remains from one of the houses identified a variety of crops consumed on site. Legumes were more common than grain, with broad beans (*Vicia faba* L., 1753) as the most prevalent species overall. Other crops include lentils (*Lens esculenta* Moench, 1794), peas (*Pisum* sp.), several types of wheat (*Triticum monococcum* L., 1899, *Triticum dicoccum* (Schrank) Thell., 1918, and a third unidentified naked type), and barley (*Hordeum* sp.).

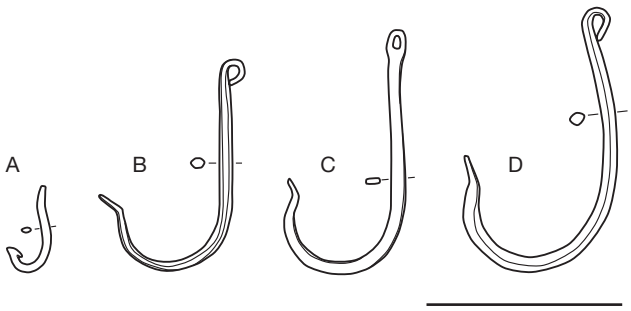

Fig. 5. — Bronze fishing hooks from Forcello. Credits: M. Rapi, Forcello excavations, Università degli Studi di Milano. Scale bar: 5 cm.

Grapes, either cultivated or wild (*Vitis* sp.), and hazelnut (*Corylus avellana* L., 1753) were also recovered from the house. Palynological analyses suggest a predominantly forested landscape, with clearings for agriculture and grazing (Ravazzi *et al.* 2013). The house that produced this archaeobotanical assemblage only had modest stores of plant remains, suggesting that crop processing occurred on a modest, household scale.

ANIMAL REMAINS AND FISHING EVIDENCE FROM FORCELLO

Animal remains from Forcello have been examined by Scarpa (1988), Trentacoste (2014), and Depellegrin & Tecchiati (2016). Molluscs, primarily freshwater, but some marine, were identified by Franchini (1988). These zooarchaeological studies demonstrated that subsistence at Forcello was based on the four most common species of domestic livestock: cattle, sheep, goat and pig. Amongst these taxa, pigs were the most common by a significant margin (68%), followed by sheep/goats (24%), and finally cattle (8%). Mortality profiles demonstrated an organised system of exploitation, with pigs reared for meat, sheep for tender meat, milk and wool, and cattle primarily for traction (Trentacoste 2014). The assemblage was almost entirely hand-collected, only a few contexts were subject to sieving. Wild mammals made only small contributions to the quantified assemblages (<3%). These mammal remains derived predominantly from red deer and wild boar, but bones from beaver (*Castor fiber* Linnaeus, 1758) and otter (*Lutra lutra* (Linnaeus, 1758)) provide further evidence of hunting or trapping in riverine environments. The majority of avian fauna derived from Anseriformes (waterfowl) and other aquatic birds (Trentacoste 2014; Corbino & Trentacoste in prep.). The remains of carp and pike were noted (De Marinis 1988; Depellegrin & Tecchiati 2016).

In addition to the fish bones, number of small finds from Forcello help inform understanding of fishing practices. More than twenty fishing hooks or hook fragments have been recovered from the site (Fig. 5) (De Marinis 2007a). The 12 complete examples are large, and range from approximately 5-6.7 cm in length (Amato in prep.). These present different strategies for forming the eye at the top of the hook, where the line is attached. There are also a few

TABLE 1. — Linear regression formula for estimating northern pike length from dentary measurements. Abbreviations: **c**, dentary measurement value in millimeters; **R^2**, coefficient of determination; **TL**, total length.

Source	Measurement	Formula	R^2
De Grossi Mazzorin & Frezza (2000)	Measurement n°4 *in* Morales & Rosenlund (1979)	TL (mm) = 69.129c + 117.95	0.9367

smaller hooks (e.g., Fig. 5A), some with inverted points resembling modern fishing hooks. Several fragments of cuttlefish bone were also recovered from the site (Trentacoste 2014). As cuttlefish are a marine fauna, they must have been transported or traded from the coast to Forcello. Transport or trade of whole cuttlefish may have occurred, perhaps representing a dietary resource; however, since cuttlefish spoil quickly, these elements may have been collected and travelled as cuttlebones. While the specimens from Forcello are not obviously worked, pieces of cuttlebone could be used as floats for fishing.

MATERIALS AND METHODS

Fish remains from site phases C and D (490-450 BC) were assessed for this study. These derived from an area of the town characterised by houses with workspace and storage. This sample represented approximately 30% of the fish remains recovered during the excavations conducted between 1990 and 2010 (the same excavation years considered in Trentacoste 2014). Materials from the early excavations corresponding to the previous study (Scarpa 1988) were not available for analysis. All materials were hand collected, with the exception of two bones from US 476, which were retrieved from a sieved sample. Fish remains were identified to element, side and taxon using modern comparative material at University of Sheffield and Oxford Brookes University, the online Archaeological Fish Resource (http://fishbone.nottingham.ac.uk, last consultation on 4 March 2021), and published identification guides (Maitland 1972; Rosello Izquierdo 1986; Lepiksaar 1994). Fragmentation was recorded using the York System (Harland *et al.* 2003) where possible, with any elements not covered by the system (e.g., vertebrae) recorded on a percentage presence basis. Vertebrae with complete centrum but absent spines were considered complete. Remains were measured in millimetres to one decimal place, where possible, using guidelines provided by Morales & Rosenlund (1979) and Enghoff (1994). The total length of northern pike (TL as described by Wheeler [1969]) was calculated using a linear regression equation (Table 1; De Grossi Mazzorin & Frezza 2000), and dentary measurement n°4 as described by Morales & Rosenlund (1979: 22; anterior height of the dentary). The length of other fish taxa were estimated based on comparison with comparative reference specimens.

The use of linear regression equations has been an established method for estimating the length of fish in the study of their ancient remains (e.g., Grouard *et al.* 2019). However, some recent research on Nile perch (*Lates niloticus* (Linnaeus, 1758)) has indicated that this approach can lead to the overestimation of length for larger specimens, and that logarithmic regression models should instead be used (Lernau & Ben-Horin 2016). Here linear regression formulae were used for several reasons. Firstly, fish lengths at other sites in the region were calculated using linear regression formulae and this method allowed length data from Forcello to be compared with those from these other sites; data compatibility would have been an issue if different methods of length calculation were used. Secondly, other research considering a much wider range of fish species has indicated minimal difference between the results achieved using the two methods (Grouard *et al.* 2019: 456). Finally, no research specific to the use of logarithmic regression models for the reconstruction of northern pike length has been undertaken. Northern pike lengths at Forcello were compared to those from the Bronze Age site of Canàr (De Grossi Mazzorin & Frezza 2000), located on the River Po approximately 36 km southeast of Forcello (Fig. 1). Taphonomic assessment was carried out on all remains, with any evidence for cut-marks, burning, pathology, and any other notable modification observed during analysis.

RESULTS

SPECIES AND ELEMENT REPRESENTATION

Table 2 presents the quantified results, referring to number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI). A total of 297 fish bones and fish bone fragments were considered in this study (Table 2; Suppl. 1, 2), of which 57 (19% of NISP) could only be identified generically as fish (Pisces). Recognition at family level was possible for 240 (81% of NISP) of the remains; 189 of these (64% of NISP) provided identification at species level. The small variation in NISP and MNE values, as well as the relatively low number of unidentified fish remains (< 20% of NISP), indicate that the recovered assemblage is well preserved with limited fragmentation.

All the fish remains from Forcello represent freshwater species. These include northern pike, tench, rudd, European chub, European eel, great sturgeon, Cyprinidae, and an undetermined species of salmonid (Salmonidae). Northern pike was by far the most common taxon in the studied assemblage (56% of the NISP), represented predominantly by cranial remains. Only 12 fragments (8% of the NISP for northern pike) represented post-cranial regions (Table 3).

TABLE 2. — Fish remains from Forcello by taxa and skeletal element. See Supplement 1 for details.

	Cranial																Post-cranial				
Taxon	Dentary	Articular	Quadrate	Ectopterygoid	Palatine	Vomer	Frontal	Preopercular	Opercular	Ceratohyal	Cleithrum	Pharyngeal	Urohyal	Parasphenoid	Basioccipital	Cranial fragment	Abdominal vertebra	Spine from abdominal vertebrae	Caudal vertebra	Vertebra	Total
Northern pike *Esox lucius* Linnaeus, 1758	71	10	2	3	19	1	4	4	1	1	21	–	–	2	1	1	8	–	2	2	153
Cyprinidae	–	1	–	–	–	–	–	4	14	–	1	3	1	–	–	–	1	1	4	1	31
Tench *Tinca tinca* (Linnaeus, 1758)	–	–	–	–	–	–	–	–	–	–	–	14	–	–	–	–	–	–	–	–	14
Rudd *Scardinius erythrophthalmus* (Linnaeus, 1758)	–	–	–	–	–	–	–	–	–	–	–	3	–	–	–	–	–	–	–	–	3
European chub *Squalius cephalus* (Linnaeus, 1758)	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	2
European eel *Anguilla anguilla* (Linnaeus, 1758)	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Great sturgeon *Huso huso* (Linnaeus, 1758)	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	1
Total	72	11	2	3	19	1	4	8	15	1	22	22	1	3	1	1	9	1	6	3	205

TABLE 3. — Summary of fish taxa represented at Forcello. Abbreviations: **MNE**, minimum number of elements; **MNI**, minimum number of individuals; **NISP**, number of identified specimens. See Supplement 1 for details.

Taxon	**NISP**	**MNE**	**MNI**
Northern Pike *Esox lucius* Linnaeus, 1758	167	153	35
Carp family – Cyprinidae	50	31	–
Tench *Tinca tinca* (Linnaeus, 1758)	15	14	7
Rudd *Scardinius erythrophthalmus* (Linnaeus, 1758)	3	3	2
European chub *Squalius cephalus* (Linnaeus, 1758)	2	2	2
Salmon/trout family – Salmonidae	1	1	1
European eel *Anguilla anguilla* (Linnaeus, 1758)	1	1	1
Great sturgeon *Huso huso* (Linnaeus, 1758)	1	1	1
Unidentified fish – Pisces	57	–	–
Total	297	206	49

FIG. 6. — Great sturgeon (*Huso huso* (Linnaeus, 1758)) parasphenoid from Forcello (context 2305). Scale bar: 5 cm.

Northern pike was also the most abundant taxon when MNI is considered, with the left dentary providing a MNI of 35 for this species.

Cyprinids were the second most abundant taxa at Forcello, with 70 identified fish bones and fish bone fragments. Species level identification was possible for 20 of these specimens, all of which were pharyngeal arches representing at least seven tenches, two rudds and two European chubs. Opercular bones (providing a MNI of 8) were common within the cyprinid assemblage, but these were not identified to species level, and all may be accounted for by the individuals identified to a more specific level. As was the case for pike remains, cranial elements dominated the cyprinid assemblage; only seven (10% of NISP for cyprinids) of the 70 fish bones and fish bone fragments identified to this family represented post-cranial regions.

In addition to the northern pike and cyprinid remains, a single left articular of an unidentified salmonid fish and a left dentary of a European eel were identified. A fragment of a parasphenoid from a great sturgeon represents an especially large fish (Fig. 6). Fifty-seven bones including a cleithrum, a parasphenoid, ribs, spines and unidentified skeletal elements could be identified as fish but not any lower taxonomic group; these remains formed 19% of the studied assemblage by count.

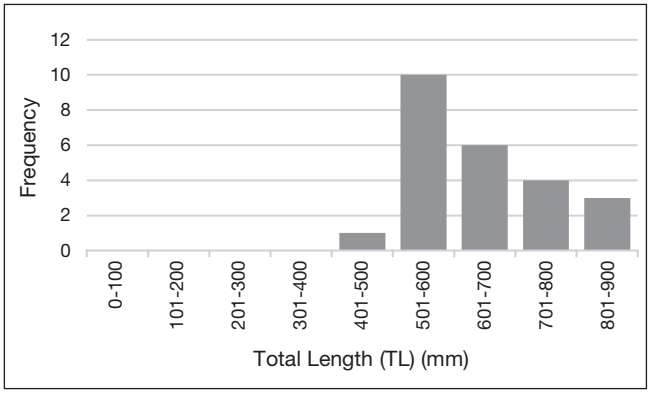

Fig. 7. — Reconstructed total lengths for northern pike at Forcello.

Estimating fish length

The total length (TL) of northern pike was reconstructed using dentary measurements using the equation in Table 3. Figure 7 presents the results of size reconstruction for northern pike at Forcello using the equation from De Grossi Mazzorin (2000) and dentary measurement n°4 from Morales & Rosenlund (1979). Table 4 provides a comparison for reconstructed northern pike lengths from remains recovered from Canàr, Frattesina and Forcello. The pike remains from Forcello represent large specimens, ranging in size from *c.* 46-85 cm in total length, comparing most closely with those recovered in Late Bronze Age deposits at Frattesina.

In the case of cyprinids, size reconstruction by linear regression methods was not possible due to damage to the pharyngeal arches preventing reliable measurements from being taken (dorsal and/or ventral tips missing). To establish an idea of fish size archaeological specimens were compared visually with modern comparative specimens of known length. The size of the 20 pharyngeal arches indicated that the archaeological specimens would have all been in the region of 40-50 cm in length. Consideration of other cyprinid remains in the assemblage corroborated this conclusion.

Taphonomic assessment

As previously discussed, fragmentation in the Forcello fish bone assemblage was relatively low, though, as is the case for cyprinid pharyngeals, some element damage was observed. No evidence for butchery in the form of cut or chop marks was observed. Evidence for exposure to fire was also not present in the assemblage. No other modifications of note appeared to be present.

Chronological observations

Study of the mammal assemblage was divided into earlier (E-H) and later (A-D) phases activity (Trentacoste 2014). The fish remains considered in this study derive mainly from the beginning of the later period (phases C, D, E), spanning approximately 495-450 BC (Table 5). About 80% of the phased fish bones (n = 139) were recovered from the *c.* 45 years of activity within these site phases. Northern pike were by far the dominant species during this period, with exploitation of cyprinids, especially tench, but also European chub and rudd clearly evidenced. Fish remains from activity in later site phases include only northern pike (n = 18), tench (n = 2) and unidentified cyprinid (n = 2), while before 495 BC there is extremely limited evidence for fish exploitation, with only pike (n = 8), and two unidentified cyprinid bones recovered.

DISCUSSION

Although modest in size, the fish bone assemblage from Forcello offers a unique opportunity to investigate fishing and local resource exploitation in the Etruscan world. However, challenges also come with this potential. All but a few specimens considered here were hand collected. This recovery regime will have impacted species representation and the size of fish represented in the assemblage, no doubt contributing to the large values found in length estimates. The remains represented fish around 40 cm in length or larger; northern pike were at least 46 cm in length. This suggests that large pike and cyprinids formed an important part of the diet and/or economy at the site. The significance of smaller fish of the same and other taxa still needs to be established through the study of remains recovered by sieving and from bulk environmental samples. Fish remains that were recovered by hand-collection during excavations at Forcello, and studied here, nonetheless provide a useful insight into the fishing and fish consumption practices of the people of Etruscan Forcello.

The taxa represented in the assemblage were comparable with those recovered from late prehistoric and Etruscan sites in northern Italy, where pike and carp family fishes are the most common finds. Remains of salmonids are not reported from any other northern Etruscan sites, although salmonid taxa are likely to have been available in the same freshwater riverine environments exploited for northern pike, carps, and eels. Differential preservation of salmonid remains compared to those of other fish has been raised as a potential factor in the representation of salmonid taxa at archaeological sites (Wheeler 1978: 74; Colley 1990: 285). However, the specimen from Forcello is well preserved, suggesting that if salmonids had been widely exploited at the site, their remains should be present in the assemblage. Also notable in the Forcello assemblage is a fragment from a great sturgeon (*Huso huso* (Linnaeus, 1758)), which has also been identified in the Po Valley in Iron Age levels at Frattesina (De Grossi Mazzorin 2002, 2015). These anadromous fishes (migrating from the marine environment to freshwater to spawn) do have edible flesh, though in modern Europe they are exploited for their eggs, which are sold as caviar for extremely high prices (Bronzi *et al.* 2011b). Great sturgeon were recorded in the waters of the River Po until the later 20th century (Bronzi *et al.* 2011a).

All the taxa identified at Forcello are native to Italy and, with the exception of great sturgeon, still are found in the region today (Kottelat & Freyhof 2007). Northern pike occur in clear vegetated lakes, quiet pools and backwaters of creeks, and small to large rivers. They are usually solitary and highly territorial. Adults feed mainly on fishes (including smaller

TABLE 4. — Summary of estimated northern pike lengths from Canàr, Frattesina, and Forcello using the equation published *in* De Grossi Mazzorin & Frezza (2000) and dentary measurement nº4 *in* Morales & Rosenlund (1979).

	Length (cm)		
Northern pike	Min	Median	Max
Canàr (Early Bronze Age)	22,4	41,8	106,2
Frattesina (Late Bronze Age)	47,1	59,1	71,9
Frattesina (Iron Age)	39,8	70,7	106,7
Forcello (Etruscan)	46,4	62,3	85,1

pike), but at times feed heavily on frogs and crayfish. Northern pike spawn late winter to spring; during this time spawners move inshore or upstream to marshy areas since vegetation is required for spawning (Pecl 1995; Kottelat & Freyhof 2007: 84, 85). The behaviour of the northern pike and the size of the individuals at Forcello suggest that pike were likely caught individually using hook and line, as net or trap fishing would be unlikely to catch this species due to their solitary nature. It is likely that northern pike would have been easier to catch during the spawning season. If pike fishing focused on the late winter and early spring, it would have provided a valuable wild food source during the lean months of the agricultural year.

The cyprinid species found at Forcello exploit a variety of aquatic habitats (Kottelat & Freyhof 2007). The tench is typically found in shallow, densely vegetated lakes and backwaters and often overwinters buried in mud. Larvae and juveniles stay confined to dense vegetation. Adults inhabit warm lakes and pools with weed and mud bottoms. Tench feed on detritus, benthic animals and plant materials, although adults often prey mainly on molluscs. Rudd occurs mainly in nutrient-rich, well vegetated lowland rivers, backwaters, oxbows, ponds and lakes. They feed mainly on plankton, terrestrial insects and plant material. European chub are most abundant in small rivers and large streams with riffles and pools. They are found along shores of slow-flowing lowland rivers, even in very small mountain streams, and in large lakes, undertaking spawning migration to inflowing streams. Large individuals prey predominantly on fishes.

As for northern pike, the large size of the cyprinids at Forcello and the solitary nature of adult specimens of these cyprinid taxa suggest that these fish were caught individually, likely by hook and line. Fish of this size are also consistent with the dimensions of the fishing hooks recovered from Forcello. At approximately 5.5-6.5 cm in length (De Marinis 2007a), these hooks would be capable of landing the large pike and carp family fishes represented in the assemblage. The ecological data for northern pike and the three species of cyprinid identified suggest that a variety of aquatic habitats were present in the Forcello locality, most likely found within the adjacent Mincio River. Specifically, Etruscan fisherman must have exploited bodies of freshwater with both vegetated and gravel bottoms.

While the size of the fish recovered and the presence of fishing hooks at the site supports the interpretation of a fishing economy based on hook and line fishing for larger specimens of northern pike and various cyprinids, evidence for the exploitation of smaller fish of these species and smaller

TABLE 5. — Number of identified fish remains from Forcello by phase.

	Site phase / Date			
Taxon	H-F / 530-495 BC	E-C / 495-450 BC	B-A / 450-380 BC	**Total**
Anguilla anguilla (Linnaeus, 1758)	–	1	–	1
Cyprinidae	1	20	2	23
Scardinius erythrophthalmus (Linnaeus, 1758)	–	1	–	1
Squalius cephalus (Linnaeus, 1758)	–	1	–	1
Tinca tinca (Linnaeus, 1758)	–	7	2	9
Esox lucius Linnaeus, 1758	8	95	18	121
Huso huso (Linnaeus, 1758)	–	1	–	1
Salmonidae	–	1	–	1
Unidentified	2	12	3	17
Total	11	139	25	175

fish taxa have been lost due to preservation and recovery biases (for further discussion of recovery bias in the Forcello assemblage see Trentacoste 2014: 83-85). Although the most visible strategy in this study, both in terms of archaeological remains and zooarchaeological evidence, hook and line fishing may have been one strategy undertaken alongside other fishing practices (e.g., net fishing for smaller taxa) for which no evidence was recovered.

The fish remains from Forcello display element representation patterns that are suggestive of fish processing. In both the northern pike and cyprinid assemblage cranial elements were significantly more abundant than those from post-cranial regions of the body. As such, the remains appear to represent the butchery waste after removing the head from a whole fish. Presumably the flesh, along with the post-cranial skeletal elements (mainly vertebrae), would have been moved elsewhere for consumption (either locally at Forcello, or perhaps further afield). While the assemblage was subject to some degree of collection bias, hand recovery was unlikely to have created this pattern. Vertebrae are usually well represented, if not dominant, in assemblages interpreted as resulting from the discard of whole fish. As the most recognisable skeletal element in fish, vertebrae are also typically amongst the best recovered elements in hand-collected assemblages; cranial elements are more frequently recovered through sieving and sampling. Taphonomic studies also indicate that cranial elements are preferentially lost over post-cranial vertebrae (see Russ 2010: 72-93 and references within).

CONCLUSIONS

Between the 6th and 4th centuries BC, Etruscan cities – including the port-town of Forcello – flourished in the southern Po Valley. The subsistence economies that supported the towns, farms, and cities of the region were based on domestic plants and animals; however, fish and other

wild resources supplemented farmed foods. The faunal assemblage from Forcello offers a rare opportunity to investigate fishing and fish consumption in proto-historic Italy. Though there is potential for smaller specimens and smaller species of fish to be underrepresented (or not represented at all), it is clear from the fish remains studied here that large specimens of northern pike (46-85 cm TL) and medium sized carp family fishes (40-50 cm TL) were exploited and represented a regular dietary resource for people at Forcello. The size of the specimens and the behaviour of the fish taxa represented suggest that fishing methods targeted large individual specimens, likely by hook and line fishing – an activity documented by small finds. The large size of the fish and the amount of flesh provided by specimens this size indicates that fish was a common supplement to a diverse diet that also included a range of mainly domestic, but also some wild, animals and plants. Though the evidence from local sites of earlier periods is sparse, the similarity in taxa perhaps indicates a continuation in fish exploitation behaviour, particularly a preference for pike, throughout the life of the town and over late pre- and proto-history in the region. This continuity in fluvial resource exploitation sits in stark contrast to Etruscan livestock management strategies, which completely break from Bronze Age patterns (Trentacoste 2016; Trentacoste *et al.* 2018). Fish exploitation at Forcello thus forms part of a long regional tradition of local resource exploitation and pike fishing. In some form this tradition continues today: after thousands of years, *luccio in salsa* (pike in sauce) remains part of the cucina mantova.

Fish remains from Forcello demonstrate an Etruscan exploitation strategy focused on the Mincio River and the fish that would have been available locally within it. Bird remains from the site, which are predominately from aquatic taxa (Trentacoste 2014; Corbino & Trentacoste in prep.), reinforce the importance of local riverine habitats as hunting and trapping grounds. This conclusion is echoed by the remains of edible freshwater molluscs. Forcello's location on the banks of the Mincio River allowed it preferential access to trade routes, but also to ecologically rich environments with a range of wild foods. Considering the tens of thousands of bones from domestic mammals, wild fish, birds, and shellfish may have made a relatively minor contribution to the non-plant component of the diet in terms of volume or calories; however, wild foods were the main source of dietary diversity. Other contemporaneous sites also capitalised on locally available wild resources, which varied with the habitats in their vicinity (e.g., George *et al.* 2017). It is unclear the extent to which such wild resources were purposefully managed, although botanical evidence suggests a forest management and conscious selection in tree-felling in northern Italy during later prehistory (Ravazzi & Pini 2013). This very local focus on wild resource exploitation may go some way to explaining the relative lack of fish remains on sites outside of northern Italy, in locations where communities did not have similar immediate access to large meandering rivers, although a greater number of freshwater fish would be still expected on sites along the Tiber (Lorenzoni *et al.* 2006). Exploitation of wetland, forests, and other biologically diverse environments offered communities a rich resource both in terms of subsistence (especially during lean months) and symbolic potential. If relatively rare on the dinner table, fish are found in numerous funerary and ritual deposits. In an age of new urban settlements and their networks, the data presented here point to continuity in local resource exploitation over the *longue durée*. These traditions continued at least until the Roman conquest, when deforestation, land reclamation, and centuriation dramatically changed the Italian landscape (e.g., de Haas 2017).

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ADDITIONAL MATERIAL

SUPPLEMENT 1. — Fish remains from Forcello, available here (https://doi.org/10.5852/anthropozoologica2021v56a5_s1).
SUPPLEMENT 2. — Recording details for fish remains from Forcello, available here (https://doi.org/10.5852/anthropozoologica2021v56a5_s2).