DOI: 10.2478/cjf-2026-0014
Review paper

CODEN RIBAEG ISSN 1330-061X (print)
1848-0586 (online)

FISHPONDS AS INDICATORS OF FRESHWATER AQUACULTURE IN THE MEDIEVAL AND EARLY MODERN CROATIA: A PRELIMINARY HISTORICAL SURVEY

Matija Pofuk

Ministry of Agriculture, Forestry and Fisheries, Directorate of Fisheries, Ulica grada Vukovara 78, 10000 Zagreb, Croatia

*Corresponding Author: matija.pofuk@mps.hr

ARTICLE INFO

Received: 19 January 2026
Accepted: 11 May 2026

ABSTRACT

Freshwater aquaculture in Europe has a history spanning over 1,000 years, with its development primarily based on pond culture of common carp. During the Middle Ages, monastic orders and the aristocracy played a key role in the construction and operation of fishponds, as well as in the continuity and dissemination of pond management and husbandry practices. The history of freshwater aquaculture in the territory of present-day Croatia has not been systematically studied, and key aspects, including its origins, spatial distribution, social actors, purposes, management and husbandry practices, and cultured species, remain insufficiently explored. This paper draws on a broad range of historical sources, including archival, statistical, and normative materials, to identify the temporal and spatial distribution of fishponds. Fishponds are used as indicators and are analysed through an interdisciplinary approach incorporating archaeozoological evidence in order to reconstruct the development of freshwater aquaculture in Croatia during the medieval and early modern periods. The results indicate that fishponds can be traced back to at least the 11th century, with ecclesiastical institutions representing the earliest social groups involved in their construction and ownership, followed by the nobility. During the Middle Ages, fish production in fishponds primarily served to meet the dietary needs of the Church and the nobility, while in the early modern period, indications of market-oriented production began to emerge. Data on management and husbandry practices are scarce, but they allow for a partial reconstruction of production and organisational patterns. Information on cultured fish species is also limited; however, the most frequently mentioned species include common carp, northern pike, tench and crucian carp. The main limitation of this preliminary study lies in its reliance on general administrative and legal documents, and the lack of systematic analysis of archival materials related to noble families, monastic orders and other ecclesiastical institutions, highlighting the need for further research based on a wider range of sources.

Keywords:
Fishponds
Croatia
Medieval period
Early modern period
Fish culture
Common carp

How to Cite

Pofuk, M. (2026): Fishponds as indicators of freshwater aquaculture in the medieval and early modern Croatia: a preliminary historical survey. Croatian Journal of Fisheries, 84, 149-177. DOI: 10.2478/cjf-2026-0014.

© 2026 The Authors. Croatian Jounal of Fisheires by the University of Zagreb Faculty of Agriculture. This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

The history of freshwater aquaculture in Europe extends back over 1,000 years, with its development and expansion particularly associated with the pond-based culture of common carp *Cyprinus carpio* Linnaeus, 1758. Although carp culture is considered to have been well developed in the Roman Empire from approximately 100 BC to 500 AD (Beveridge and Little, 2002; Costa-Pierce, 2022), pond aquaculture became widespread across Europe during the Middle Ages (Balon, 1995a, b, 2004). The establishment of freshwater fishponds in Europe was closely linked to the activities of major landholders, such as ecclesiastical institutions and the nobility. From the 11th century onwards, monastic orders, the aristocracy and royalty played a central role in the construction and management of fishpond systems, driven largely by dietary requirements, particularly during fasting periods, as well as by broader ecological, economic and social factors (Hoffmann, 1995, 1996; Nash, 2011; Bond, 2016a). In many parts of Central and Western Europe, the development of pond aquaculture has been relatively well documented, with written records providing insights into fishpond construction, maintenance and management, husbandry practices, and the main and supplementary fish species used in production systems (Hoffmann, 1999, 2002; Beveridge and Little, 2002; Cios, 2016). In contrast, the history of freshwater pond aquaculture in the territory of present-day Croatia remains insufficiently researched and lacks a systematic synthesis of available historical sources. Existing publications have largely relied on fisheries literature from the late 19th and early 20th centuries (e.g. Bojčić, 1982; Bojčić and Bunjevac, 1982), which has proven insufficient for a comprehensive reconstruction of historical development due to fragmented data and a lack of interdisciplinary perspective. As a result, several fundamental questions remain unresolved, including the timing and spatial distribution of fishpond construction, the identity of key social actors, the purposes of fish production, the management measures and husbandry practices employed, and the cultivated fish species. In the absence of direct evidence on aquaculture practices, fishponds represent an important indirect indicator of the presence and development of freshwater aquaculture. Therefore, the aim of this paper is to survey historical evidence of fishponds and, on this basis, reconstruct the historical development of freshwater aquaculture in the territory of present-day Croatia during the Middle Ages and the early modern period. The paper is based on an interdisciplinary approach that combines the analysis of a broad range of historical and contemporary sources with the examination of historical terminology and contextual interpretation. Particular emphasis is placed on identifying the earliest evidence of fishponds, their distribution, development, ownership structures, functions and management.

HISTORIOGRAPHY AND METHODS

This study uses records of fishponds in historical sources as a proxy for reconstructing the presence and development of freshwater aquaculture in present-day Croatia. Relevant data on the existence of fishponds are dispersed across a wide range of historical materials, including archival, statistical, and normative sources, as well as within contemporary scientific disciplines such as archaeology and archaeozoology. This diversity of sources necessitates an interdisciplinary methodological framework that goes beyond traditional fisheries approaches and incorporates historical, philological, and contextual analysis. In this paper, these types of historical sources are examined primarily through edited and published collections of medieval and early modern material (e.g. Adamček, 1980; Laszowski, 1951; Lopašić, 1894a; Modrić, 1974; Smičiklas, 1905; Tkalčić, 1873). The material underlying the consulted editions includes urbariums (medieval and early modern legal and economic documents that served as an official register of feudal estates, recording landholdings, inventories, rents, and the obligations and dues of peasant serfs), statutes, diplomatic documents, charters, records of noble, ecclesiastical, and state archives, estate registers, inventories, and financial accounts, as well as other documents that provide indirect evidence for the presence of fishponds and freshwater aquaculture. Given that official documents from the medieval and early modern periods were predominantly written in Latin, particular attention was paid to the analysis of terminology related to fishponds and fish cultivation. For this purpose, the bilingual Latin–Croatian dictionary *Gazophylacium seu Latino-Illyricorum onomatum aerarium* by the Pauline priest Ivan Belostenec (1740), the Dictionary of Medieval Latin of Yugoslavia - *Lexicon Latinitatis medii aevi Iugoslaviae* (Kostrenčić et al., 1975; 1978), Materials for the financial and legal dictionary of the feudal era of Croatia (Herkov, 1956a, b) and reviews of Latin terminology related to aquaculture were consulted (Fašalić et al., 2014). Source searches were conducted using the keywords *piscinae, piscine, piscina, piscinam, piscinis, piscinella* and *piscium* (in sources relating to the southern, coastal cities and communes, fishing areas are referred to by the terms *piscacio, piscacionibus, piscationis* and *piscarie*, which generally denote fishing grounds or fishing rights), as well as the Croatian terms ribnjak and ribnjaci (fishpond/fishponds), and historical names of freshwater fish species potentially cultivated in fishponds (e.g. *carpio = krap, lucius = šćuka, tinca = lin, truta = bisztranga*) (Belostenec, 1740; Hirtz, 1956). Special attention was given to the contextual interpretation of the term *piscina*, due to its polysemous use in historical sources. In certain contexts, the term refers to baptismal fonts, bathing pools, or rainwater reservoirs, particularly in sacred and public architecture, which requires caution when interpreting its meaning in relation to aquaculture

© 2026 The Authors. Croatian Jounal of Fisheires by the University of Zagreb Faculty of Agriculture. This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

(Križaj, 2017). Where possible, the locations of fishponds were identified using modern toponyms (Dobronić, 1951, 1952; Dujmović, 2016), while other place names were retained in the form in which they appear in the original documents. Given that specific units of measurement for surface area and mass were used in the territory of present-day Croatia during the medieval and early modern periods, relevant literature on historical measurement systems was reviewed (Herkov, 1973, 1974). Fishpond surface areas in the historical material were recorded in units of *juger* (lat. jugerum) or *jutro*, defined as the area that could be ploughed in a single day. As the majority of identified medieval and early modern fishponds were located in the Kingdom of Slavonia, the *jugerum regale* was used, corresponding to approximately 0.77 ha (Herkov, 1974). The unit of mass was expressed using the Viennese apothecaries' pound. From the mid-16th to the late 17th century, the pound increased from 333.21 grams (up to 1569) to 353.68 grams (for the period 1569-1761) (Herkov, 1973). All collected data were converted into modern metric units of surface area (hectares) and mass (kilograms). In addition, historical currencies and their values were compiled (e.g. Kapustić, 1977) to facilitate the interpretation of available economic data and to support indirect estimates of fishpond production. Printed sources were collected at the National and University Library in Zagreb and the Zagreb City Libraries, while digital sources were obtained from the Digital Collections of the National and University Library in Zagreb (https://digitalna.nsk.hr/), the digital collections and catalogues of the Croatian Academy of Sciences and Arts (https://dizbi.hazu.hr/), the central portal of Croatian scientific and professional journals (https://hrcak.srce.hr/en), the Croatian scientific bibliography (https://www.croris.hr/crosbi/?lang=en), as well as the digital repositories Google Books and the Internet Archive.

FISHPONDS IN THE MEDIEVAL PERIOD

The analysis of archival and normative sources indicates a considerable presence of fishponds in the continental north-eastern part of present-day Croatia during the medieval period. The earliest known reference to a fishpond dates to 1093, when King Ladislaus donated land east of the church, including a fishpond, to the Zagreb Chapter (Tkalčić, 1889). In addition to the majority of fishponds recorded in the Kingdom of Slavonia, eight were identified in the Kingdom of Croatia. Three of these were situated in coastal areas, namely in the vicinity of Bakar near Rijeka, in Stinica near Solin, and in the vicinity of Obrovac (Table 1). The terminology recorded in the analysed documents includes various Latin forms related to fishponds and fishing activities. The most frequently occurring term is *piscina* and its variants (e.g. *piscine, piscinam, piscinis*). Other, less frequent terms include *clausuris piscature* (fishing enclosure), *piscium clausuras* (fish enclosures) and *clausuris aque* (enclosed water), as well as expressions such as *piscationibus piscatura, aquis et piscacionibus*, and *loca piscatera* (Table 1). Fishponds were most commonly situated along major watercourses, primarily the Sava (*Zawa*) and Drava (*Dravae*), and Danube (*Danubii*) rivers, as well as within their associated basins, including the Čazma (*Chazma*), and Petrinja (*Petrine*) rivers, and streams (e.g. Brežnica (*Bresniza*), Rakovica (*Rakythowycza*)) (Figure 1).

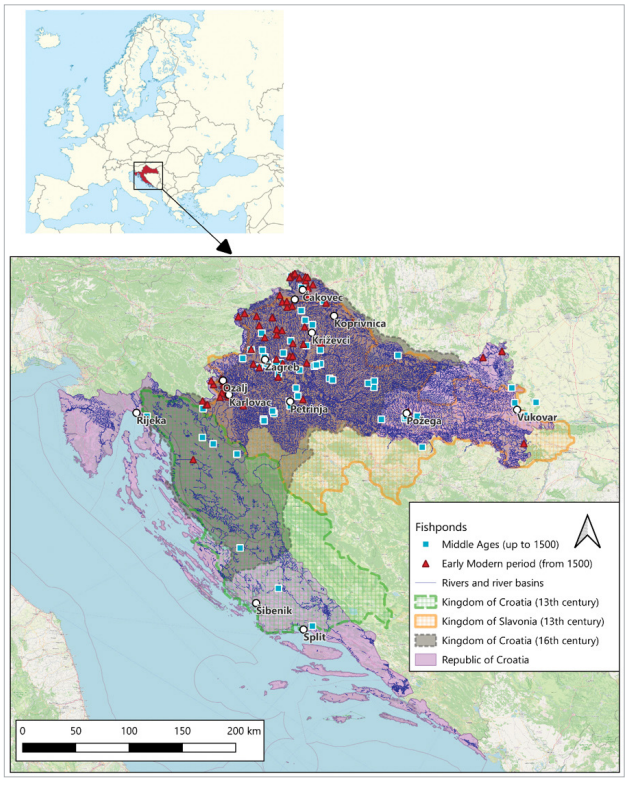


Fig 1. Distribution of documented medieval and early modern fishponds in the territory of present-day Croatia. Historical boundaries shown on the map represent an approximate cartographic reconstruction based on the maps *Croatian-Hungarian Kindgom in the second half of the 13th century* and *Croatia*, 1527-1538 published in the Croatian Historical Atlas (The Miroslav Krleža Institute of Lexicography). Where multiple fishponds are documented at the same locality, only a single symbol is shown. Therefore, the number of symbols shown is lower than the total number of fishponds listed in Table 1.

In written sources, fishponds most frequently appear as part of inventories of immovable property, estates, and agricultural assets belonging to both high and lesser nobility, and ecclesiastical institutions, including monastic orders. They are recorded in various types of documents, most notably charters of donation, wills, and estate inventories, but also in documents related to confiscations, legal disputes, pledges, financial accounts, and records of land sales, exchanges, or boundary delineations. Within the examined material, spanning the period from 743 to 1500, a total of 80 documents

© 2026 The Authors. Croatian Jounal of Fisheires by the University of Zagreb Faculty of Agriculture. This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

were identified that clearly mention individual fishponds or groups of fishponds. Based on these records, at least 98 fishpond objects were documented (Table 1). Certain ambiguities exist regarding the construction dates of two additional fishponds associated with the Zagreb Chapter. In the cartographic reconstruction by Kampuš and Karaman (1994), two fishponds located east of the Chapter are depicted as early as the 11th–12th centuries, while a third appears in the 15th century. In contrast, more recent reconstructions suggest that only a single fishpond existed in this area at the end of the 14th century, whereas three fishponds are recorded in the second half of the 16th century (Arbutina, 1996; Fabijanec, 2012; Vručina, 2021). No data on fishpond surface area, cultured fish species, or detailed husbandry practices and management measures were identified in the examined sources.

FISHPONDS IN THE EARLY MODERN PERIOD

A review of the literature on estate registers, inventories, and financial accounts of the nobility indicates an increased frequency of fishponds on agricultural land during the early modern period, particularly in the immediate vicinity of towns and castles (e.g. Božjakovina, Čakovec, Marjaševac, Novigrad na Dobri, Ozalj, Rakovec, Ribnik, Stubica) (Adamček, 1965, 1967, 1980; Laszowski, 1902, 1904a; Lopašić, 1894b; Modrić, 1974; Varga, 2016). Within the material analysed, covering the period from 1500 to 1700, a total of 68 records were identified that clearly mention the existence or construction of fishponds, resulting in the identification of at least 127 fishpond objects. Surface area data are available for 21 fishponds, with a combined area of 43.15 hectares (Table 1). No references to basic fishpond management measures and husbandry practices were found, except for a single source, which refers to the application of basic agrotechnical measures and the recording of cultured fish species. The majority of documents do not specify the fish species present and instead describe fishponds in general terms as “full of fish”, “full of various fish” or “full of small fish” (Adamček, 1980; Modrić, 1974; Varga, 2016; Table 1). However, in the one source where fish species are listed, the most frequently mentioned species include common carp, tench *Tinca tinca* (Linnaeus, 1758), northern pike *Esox lucius* Linnaeus, 1758, and crucian carp *Carassius carassius* (Linnaeus, 1758).

TERMINOLOGY, DISTRIBUTION AND HISTORICAL DEVELOPMENT OF FISHPONDS

Fishponds as indicators of freshwater aquaculture in the territory of present-day Croatia have received limited scholarly attention, and the available written historical sources have not yet been systematically and critically analysed. This paper provides new insights indicating the existence of freshwater fishponds in Croatia as early as the Middle Ages, with the earliest record dating back to 1093. Nearly all identified fishponds were located in the Kingdom of Slavonia (corresponding to the continental part of present-day Croatia), whereas only eight were recorded in the Kingdom of Croatia, three of which were located in the coastal area. This pattern is most likely related to hydrological and geological differences between the Danube (Black Sea) and Adriatic catchments, particularly in river network density and hydrological regimes (e.g. Riđanović, 1983). Additionally, in the coastal region, well-developed marine capture fisheries were of greater importance for subsistence and trade than freshwater fisheries, including pond aquaculture (e.g. Fabijanec, 2021). The analysis of Latin terminology in dictionaries, urbariums, charters and other official documents confirms their continuous presence from at least the 11th century onwards. The term *piscina* and its derivations are the most frequently occurring in the analysed documents, and the context in which they appear, together with their spatial distribution along watercourses, suggest their association with enclosed or managed water bodies, most likely corresponding to intentionally constructed or managed fishponds. In contrast, terms such as *piscatura* or *piscaria* generally refer to fishing grounds or fishing rights rather than constructed fishponds (e.g. Herkov, 1956b; Kostrenčić et al., 1975). The exact beginning of freshwater aquaculture in Croatia cannot be determined with complete certainty. The earliest fishpond is recorded on land belonging to church institutions, such as the Zagreb Diocese. However, it should be emphasized that the first mention of fishponds in written sources does not necessarily indicate the time of their construction, but rather their earliest recorded appearance in official documents. The possibility that some fishponds existed earlier is suggested by documents from 1280 (Smičiklas, 1908), 1307 (Smičiklas, 1910) and 1337 (Smičiklas, 1912), where fishponds are described as “ancient” (*ad antiquam piscinam*) (Table 1). The analysed historical material further indicates that fishponds were integral components of estates owned by ecclesiastical institutions, including monastic orders, as well as by both high and lesser nobility. Newly established ecclesiastical institutions, particularly monastic orders, were granted estates including agricultural land and associated fishponds. For example, Hungarian-Croatian kings and nobles donated such estates to the Zagreb Diocese (1217), the Cistercian Order (1237 and 1280), the Monastery of St. Giles (1334), the Pauline Order (1376), and the Monastery of St. Anne (1464), among others (Smičiklas, 1905; Smičiklas, 1906; Smičiklas, 1912; Smičiklas and Kostrenčić, 1934; Croatian State Archives, 2026a; Table 1).

© 2026 The Authors. Croatian Jounal of Fisheires by the University of Zagreb Faculty of Agriculture. This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Table 1. Historical records of freshwater fishponds in medieval and early modern Croatia

Date/Period	Location	Region	Number of fishponds	Type of record	Latin terminology	Bibliography	Notes
1093	(Cathedral Chapter) Kaptol	Zagreb	1	Royal charter of donation	Piscina	Tkalčić (1889) doc. 2, p. 2	Royal donation to the Zagreb Chapter
12th-16th century	Kaptol	Zagreb	2	Cartographic display		Kampuš and Karaman (1994); Arbutina (1996)	
1201/1202	Gaćište	Virovitica-Podravina county	1	Estate boundary delineation	piscinam, que dicitur Gasca; Piscina	Tkalčić (1873), doc. XIII, p. 15; Smičiklas (1905), CD III, doc. 8, p. 11	Estate boundary delineation of the Zagreb Diocese
1210	Lijesnica	Požega	1	Royal charter of donation	Piscinis	Smičiklas (1905), CD III, doc. 80, p. 98	Royal donation to the Knights Templar. The document mentions "fishponds"
1211	Topusko	Sisak-Moslavina County (near Hrastovina)	7	Royal donation to Cistercian	Piscationibus, Piscaturarum	Smićiklas (1905) CD III, doc. 84, p. 104	Royal donation of fishing rights to the Cistercian Order
1213	Topusko	Sisak-Moslavina County		Royal confirmation of the liberty of justice and right to the Topusko abbey	aquis et piscacionibus	Smićiklas (1905) CD III, doc. 95, p. 116	Royal confirmation of fishing rights to Topusko Abbey
1217	Burin (Beren)	?	1	Estate exchange	Piscinis Zele	Tkalčić (1873), doc. XXXV, p. 48; Smičiklas (1905), CD III, doc. 8, 11	Estate exchange between King Andrija II and the noblemen Paulin and Jakob
1217	Otok	Zagreb County	1	King's release from Ban's subjugation	Piscinam	Smičiklas (1905), CD III, doc. 132, p. 158	
1217	Glogovnica	Križevci	3+1	Royal charter of donation	tribus clausuris piscature + piscina cruciferorum	Smičiklas (1905), CD III, doc. 131, p. 151, p. 154	Donation to the Zagreb Diocese
1228	Saint-Martin convent	Pannonia	1	Royal confirmation of a trial sentence	piscina sita iuxta Knesa que vulgariter Miruht nominatur	Smičiklas (1905), CD III, doc. 264, p. 297	Legal dispute between the Convent of Saint-Martin and Srijem Abbey concerning the unauthorized harvesting of fish from fishponds

© 2026 The Authors. Croatian Journal of Fisheries by the University of Zagreb Faculty of Agriculture. This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Continued. Table 1

Date/Period	Location	Region	Number of fishponds	Type of record	Latin terminology	Bibliography	Notes
1231	Odransko polje + Vukovar county	Sisak-Moslavina County + Vukovar county	1+1+3	Royal charter of donation	Piscina nomine Sowala, Rybnicha in Odra + Timerena/Netusla/ Golina mlaca	Smičiklas (1905) CD III, doc, 305, p. 348	Royal donation to Tom Makarjev in recognition of loyal military service
1232	Čazma	Čazma	1	Charter of donation	quandam clausuram piscium	Smičiklas (1905) CD III, doc, 324, p. 373	Donation from the Zagreb Diocese to the Čazma Chapter
1237	Podgorje	Požega County	1	Estate exchange	ecclesie ex parte septemtrionis cum piscina iuxta eandem existente	Tkalčić (1873), doc. LXIV, p. 77	Estate exchange between King Stjepan II and the Zagreb Chapter
1237	Cathedral chapter	Zagreb	1+1	Return of possessions	Piscina	Tkalčić (1889) doc. 14, p. 12	Return of possessions to the Zagreb Chapter
1237	?	Petrovaradin	1	Royal charter of donation	villa Perben cum piscina bona; piscinis et insulis	Smičiklas (1906) CD IV, doc. 29, p. 28, 29	Establishment of the Abbey of Belakut for the Cistercian Order. The document mentions "fishponds".
1237	Toplice	Varaždin	1	Charter of donation	Piscina	Smičiklas (1906) CD IV, doc. 39, p. 43	Donation from the Zagreb Diocese to the Zagreb Chapter
1240	Petrinja	Petrinja	1	Royal charter of donation	Piscinam	Smičiklas (1906) CD IV, doc. 113, p. 124	Royal donation to the Royal Free City of Petrinja
1249	Raven	Križevci	1	Estate sale	ubi inferius est piscina, que piscina cadit in predictum fluuium Rakose; ubi descendit in, piscinam, que piscina cadit in fluuium Razisse	Smičiklas (1906) CD IV, doc. 351, p. 398; doc. 359, p. 414	Estate sale between Farkaš, son of Iso, and Petar, son of Ban Jakša
1260	Praputišće	Bakar	1	Royal charter of donation	murus in piscina ad Praputische	Smičiklas (1907) CD V, doc. 685, p. 180	Royal donation to the Counts of Krk
1260	?	Čazma	2	Estate division	est [una] piscina de novo	Smičiklas (1907) CD V, doc. 686, p. 181	Division of estates between Tomo and Marko

© 2026 The Authors. Croatian Journal of Fisheries by the University of Zagreb Faculty of Agriculture. This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Continued. Table 1

Date/Period	Location	Region	Number of fishponds	Type of record	Latin terminology	Bibliography	Notes
1264	Presnica	Kalnik	1	Charter of donation	piscinam Jone comitis; piscinam fillorum Jone comitis	Tkalčić (1873), doc. CXVI, p. 129; Smičiklas (1907) CD V, doc. 800, p. 304	Donation from Knez Nikola Kalnički to Leustak, son of Vid
1266	Vinodol na Kupi	Sisak-Moslavina County (near Hrastovina)	1	Legal dispute	Piscina; Truglou potoc ubi est piscina	Tkalčić (1873) doc. CXX, p. 133; Smičiklas (1907) CD V, doc. 884, p. 412	Ban Roland returns the estate to Topusko Abbey (Blinjani)
1266	Crkvenik	Požega	1	Royal charter of donation	de villa convicina ad caput piscine	Smičiklas (1907) CD V, doc. 878, p. 406	Donation to Župan Mika Hunipazman
1267	Končan	Turopolje	1	Legal dispute	piscinam quandam	Smičiklas (1907) CD V, doc. 895, p. 425	Legal dispute involving inhabitants of Turopolje
1272	Aljmaš	Erdut Municipality	1	Charter of donation	Piscinis	Smičiklas (1908) CD VI, doc. 20, p. 18	Donation from Petar Zovnuk to the Church of St. Mary de insula
1273	Aljmaš	Erdut Municipality	1	Royal charter of donation	Piscinis	Smičiklas (1908) CD VI, doc. 47, p. 52; Smičiklas and Kostrenčić (1916) CD XIV, doc. 435, p. 561	Donation to Dominik Petrov Čak. The document mentions "fishponds" (also recorded in a document from 1373)
1274	Petin	Bročino	1	Estate sale	Piscina	Smičiklas (1908) CD VI, doc. 85, p. 98	Estate sale from Petar Radolfov to Župan Perčin
1275	Cernik	Požega	1	Royal charter of donation	piscinam Chernuch vocatam	Smičiklas (1908) CD VI, doc. 124, p. 140	Donation to Otrok Grgur, son of Belučev, and the sons of Ševa
1280	Dubovac	Požega	1	Royal Charter of donation	loca piscatera, clausura in aqua Kenezicha	Smičiklas (1908) CD VI, doc. 289, p. 345	Donation to Nikola, son of Dominik Čak
1280	Brezovica	Zagreb	1	Charter of donation	antiquam piscinam	Smičiklas (1908) CD VI, doc. 317, p. 375	Donation from Ivan Okićki to the Cistercian Order. The document mentions an "ancient fishpond"
1284	Glina	Petrinja	1	Estate sale	Piscinis	Smičiklas (1908) CD VI, doc. 398, p. 479	Estate sale from Vuk of Bornovac to Knez Petar, Kojan and Ivan. The document mentions "fishponds"

© 2026 The Authors. Croatian Journal of Fisheries by the University of Zagreb Faculty of Agriculture. This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Continued. Table 1

Date/Period	Location	Region	Number of fishponds	Type of record	Latin terminology	Bibliography	Notes
13th-16th century	Abbey of the Blessed Virgin Mary (Garić)	Moslavačka Gora	1	Charter of donation/ Legal dispute		Pisk (2015)	The document mentions "fishponds"
13th-16th century	Abbey of St. Margaret (Bijela)	Papuk, Ravna gora	1	Toponym record		Janeš and Sekulić (2014)	Fishpond location south of the monastery site (Franciscan cadastre)
1304	Ponikve	Karlovac County		Templar's donation to a client	Piscationibus nostris	Smičiklas (1910) CD VIII, doc. 70, p. 74	Donation to Tomo Crni
1307	Moravče	Čazma	1	Estate sale	Mothica piscina antiqua	Smičiklas (1910) CD VIII, doc. 123, p. 136	Estate sale from Aleksander and Bank to Canon Stjepan. The document mentions an "ancient fishpond"
1322	Samobor, Zelingrad	Zagreb	1	Royal charter of donation	Piscinis	Smičiklas (1911) CD IX, doc. 39, p. 50	Donation to the Babonić noble family. The document mentions "fishponds"
1322	Dubočac	Brod-Posavina County	1	Charter of donation	piscinam de Dobolch vulgariter Gragya vocatam	Smičiklas (1911) CD IX, doc. 60, p. 72	Donation from Stjepan Cimba to the sons of Nikola Grgurov
1323	Dumbow	?	1	Royal charter of donation	Piscina	Smičiklas (1911) CD IX, doc. 129, p. 155	Donation to Petar and Nikola, sons of Fila
1334	Wyhel	Slavonija?	1	Charter of donation	piscyna Cossya(!)	Smičiklas (1912) CD X, doc. 117, p. 177	Donation from Ban Ivan Babonić to the Monastery of St. Giles
1335	?	Požega-Slavonia and Vukovar-Srijem County	1	Legal dispute	Piscinis	Smičiklas (1912) CD X, doc. 158, p. 220	Legal dispute between Petar Fila and Ivan Bota. The document mentions "fishponds"
1335	Trnovac	Zagreb	1	Estate sale	Piscinis	Smičiklas (1912) CD X, doc. 167, p. 235	Estate sale between Wydechech, son of Martina, and Juraj, Ilija, Tomo, and Petar. The document mentions "fishponds"
1337	Novi Dvori	Zagreb	1	Legal dispute	antiquam piscinam	Smičiklas (1912) CD X, doc. 235, p. 310	Legal dispute between Paris and Ivan Nabrad. The document mentions an "ancient fishpond"

© 2026 The Authors. Croatian Journal of Fisheries by the University of Zagreb Faculty of Agriculture. This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Continued. Table 1

Date/Period	Location	Region	Number of fishponds	Type of record	Latin terminology	Bibliography	Notes
1338	Borovo	Vukovar	1	Legal dispute	Piscinis, piscina Zawalya	Smičiklas (1912) CD X, doc. 295, p. 402, 404	Court ruling in favour of Petar, son of Fila. The document mentions "fishponds"
1339	Terdić	?	2	Estate sale	piscina Vnyhlew vocata iuxta piscinam seu stagnum Chernuch nuncupatum	Smičiklas (1912) CD X, doc. 324, p. 460	Estate sale between Župan Stepan and Stjepan, son of Petar
1343	?	Požega	1	Estate division	piscaturas seu piscium clausuras (Zege)	Smičiklas (1913) CD XI, doc. 65, p. 86	Division of estates between Levkusd and Kokas. The document mentions "fishponds"
1344	Gradec	Zagreb	1	Charter of donation	Piscina in Grech	Tkalčić (1889) doc. 194, p. 170 71, 62; Smičiklas (1913) CD XI, doc. 86, p. 116	Donation from Ban Nikola to the sons of Ban Mikić. Tkalić (1889) XXIX, questions whether this was a fishpond
1344	Medvedgrad (castri Medue)	Zagreb	1	Agreement between the ban and local nobles	Piscina	Tkalčić (1889) doc. 194, p. 170	Agreement between Ban Nikola and Stjepan and Akua, sons of Ban Mikić
1345	Brečevo	Drniš	1	?	Piscinis	Smičiklas (1913) CD XI, doc. 192, p. 250	The document mentions "fishponds"
1346	Glogovnica	Čazma	1	Charter of donation	Piscinis	Smičiklas (1913) CD XI, doc. 210, p. 275	Donation from Bishop Jakob to Magister Gerardu. The document mentions "fishponds"
1347	Obrezina (Prevlaka)	Zagreb	2	Estate sale	aqua piscaria Meruacha et alio nomine Zavicha vocate	Vručina (2021)	
1350	Strigova, Čakovec	Međimurje	1	Royal charter of donation	Piscinis	Smičiklas (1913) CD XI, doc. 477, p. 623	Donation to Stjepan Lacković. The document mentions "fishponds". Possibly identical to those recorded in the 17th century

© 2026 The Authors. Croatian Journal of Fisheries by the University of Zagreb Faculty of Agriculture. This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Continued. Table 1

Date/Period	Location	Region	Number of fishponds	Type of record	Latin terminology	Bibliography	Notes
1360	Zagrebačko polje?	Zagreb	1	Estate sale	piscine Skerche	Laszowski (1904b), doc. 73, p. 74; Smičiklas et al. (1915) CD XIII, doc. 24, p. 35	Estate sale between Taysa, son of Jakob de Moroucha, and the sons of Chernk
1364	Tyhothinawaz, Zryane, Pziwichyima, Malawazu, Kolosczy	?	1	Royal charter of donation	piscinis et locis piscaturiis	Smičiklas et al. (1915) CD XIII, doc. 247, p. 384	Donation to Mrmonja, son of Bachya de Dobowyk. The document mentions "fishponds"
1364	Bršljanovac	Moslavina	1	Estate exchange	Piscinis	Smičiklas et al. (1915) CD XIII, doc. 268, p. 364	Estate exchange between King Ljudevit and Knez Vlatko Vukoslavić. The document mentions "fishponds"
1365	Toplica	Daruvar	1	Estate sale	piscinis, locis piscaturarum	Smičiklas et al. (1915) CD XIII, doc. 319, p. 439	Estate sale between Ivan, son of Antun Toplički, and Ladislav, son of Petar Castellan. The document mentions "fishponds"
1373	Glogovac?	Čazma	5	Legal dispute	Piscinis	Smičiklas and Kostrenčić (1916) CD XIV, doc. 366, p. 590	Legal dispute between the Čazma Chapter and Valentino, son of Petar Glogowa
1376	Varhel	Čakovec	1	Charter of donation	Piscinis	Smičiklas and Kostrenčić (1934) CD XV, doc. 160, p. 228	Donation from Stjepan Lacković to the Pauline Order
1381	Gachalmezow	Požega	1	Financial pledge	clausuris aque, piscinis	Smičiklas et al (1976) CD XVI, doc. 181, p. 217	Financial pledge from Živko, son of Huholeov de Haraiowch, to Miska Pavla de Brestya.The document mentions "fishponds"
1381	Vidoševac	Glina?	1	Royal charter of donation	piscinis et piscaturis	Smičiklas et al (1976) CD XVI, doc. 193, p. 234	Donation to Palatine Nikola Gorjanski. The document mentions "fishponds"

© 2026 The Authors. Croatian Journal of Fisheries by the University of Zagreb Faculty of Agriculture. This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Continued. Table 1

Date/Period	Location	Region	Number of fishponds	Type of record	Latin terminology	Bibliography	Notes
1382/1384	Dubovica	Varaždin	4	Ownership change		Pavleš (2013)	Ownership change between landowners from Bednja and Ludbreg
1397	Stiniza	Solin	1	List of estates	U Piscine, U Duba longa	Smičiklas et al (1990) CD XVIII , doc. 170, p. 161.	List of estates of Prodana, widow of Zanin de Sloradis
1399	Zagorje	?	1	Royal charter of donation	Piscinis, Piscaturis	Smičiklas et al (1990) CD XVIII, doc. 292, p. 416	Donation to Count Herman Celjski. The document mentions "fishponds"
14th century	Sisak	Sisak	1	Estate inventory		Adamček (1980)	
1401/1461	Vrhrika	Plaški	2	Charter of donation		Lopašić (1894a); Bertović (2014)	Nikola IV Frankopan donates and Stjepan II Frankopan confirms the donation of fishponds and fishing rights to St. Nicholas monastery
1418	Gerec	Križevci	1	Estate inventory		Pálosfalvi (2014)	The document mentions "fishponds". Annual revenue from fishponds 400 florins
1451	?	?	1	Legal dispute		Croatian State Archives (2026b), doc. 330	Legal dispute concerning the unauthorized harvesting of fish from fishponds
1461	Bog, Rakythowycha, Cralychyna Brodyscha	Rivers Morkica and Rakovica	1	Legal dispute	piscinam Rybnayk	Laszowski (1904b), doc. 333, p. 409	Legal dispute between Fabijan Myxyka and Nikola, son of Elka
1464	Dobra Kuća	Daruvar	1	Royal charter of donation		Croatian State Archives (2026a)	Donation to the Monastery of St. Anne. The document mentions "fishponds"

© 2026 The Authors. Croatian Journal of Fisheries by the University of Zagreb Faculty of Agriculture. This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Continued. Table 1

Date/Period	Location	Region	Number of fishponds	Type of record	Latin terminology	Bibliography	Notes
1481	Ivanić-Grad	Zagreb	1	Financial account	Fossori piscine in Iwanich	Tkalčić (1905), p. 264, 266, 277; Stingl (2022)	Year construction began. Stocked with fish in 1482 (species not specified)
1486	Modruš	Lika	3	Estate inventory		Adamček (1980); Lopašić (1894a)	
1487	Brdare/Bahtići/ Konjšćica	Obrovac	1	Legal dispute	Piscinis	Klaić (1917), doc. XXV, p. 30	King Matthias Corvinus confirms the court ruling and donates estates to the Keglević family. The document mentions "fishponds"
?	?	?	1	Estate division		Croatian State Archives (2026d)	
1500	?	?	1	Legal dispute		Croatian State Archives (2026b), doc. 618	Legal dispute concerning the unauthorized harvesting of fish from fishponds
1503	Molve	Đurđevac	1	?		Pavleš (2013)	Part of the Đurđevac estate
1513	Vicinity of Zagreb Chapter	Zagreb	1	Estate inventory	Piscinam	Tkalčić (1905), doc. VIII, p. 195	Inventory of the Cistercian Order
1521	Podvršje	Požega	1	Financial pledge	Piscinis	Klaić (1917), doc. XLII, p. 52	Financial pledge from Ban Franjo Hedervar to Petar Keglević. The document mentions "fishponds"
1525	Krapina/Kostel	Krapina-Zagorje County	1	Official agreement	Piscinis	Klaić (1917), doc. LXVIII, p. 87	Official agreement between Petar Keglević and Mihajlo Imreković. The document mentions "fishponds"
1526	Bijela stijena/Lobor/ Blinja-Novigrad	Krapina-Zagorje County	1	Royal charter of donation	Piscinis	Klaić (1917), doc. II, p. 103	Donation from King Vladislaus II to Petar Keglević. The document mentions "fishponds"

© 2026 The Authors. Croatian Journal of Fisheries by the University of Zagreb Faculty of Agriculture. This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Continued. Table 1

Date/Period	Location	Region	Number of fishponds	Type of record	Latin terminology	Bibliography	Notes
1531	Radovac	Bosiljevo	1	Charter of donation		Laszowski (1951), doc. 2, p. 2	Donation from Count Bolf Frankopan to Knez Martin Lovinac. The document mentions "fishponds"
?	?	?	1	Estate sale		Croatian State Archives (2026e)	The document mentions "fishponds"
1558	Ribnik	Karlovac Pokuplje	1	Estate inventory	Piscinam	Laszowski (1902)	Estate inventory of Stjepan Frankopan Ozaljski. Fishpond near Ribnik castle
?	Stream Tržac and Starča (locality Utinja)	Karlovac	1	Estate inventory		Lopašić (1894b)	The document mentions "fishponds"
1558	Nowalkowo Selo	Varaždin	1	Legal dispute	Piscinae	Katušić (2013; 2014)	Legal dispute between Katarina Imreffy and Matija Keglević concerning the illegal construction of a fishpond
Middle 16th century	Cirkveno	Križevci	3	Estate inventory		Adamček (1980)	Three fishponds in Cirkveno (one large), and fishponds in Jetrovec and Orehovec
Middle 16th century	Jetrovec	Krapina-Zagorje County	1	Estate inventory		Adamček (1980)	
Middle 16th century	Orehovec	Koprivnica-Križevci County	1	Estate inventory		Adamček (1980)	
1559	Lovrečina	Vrbovac	2	Estate inventory		Adamček (1980)	
1560s	Brezovica	Zagreb	2	Estate inventory		Adamček (1980)	
1563-1574	Stupnik	Zagreb	1	Estate inventory		Adamček (1965; 1980)	Fishpond in Stupnik (Ztopnik) (medium size)

© 2026 The Authors. Croatian Journal of Fisheries by the University of Zagreb Faculty of Agriculture. This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Continued. Table 1

Date/Period	Location	Region	Number of fishponds	Type of record	Latin terminology	Bibliography	Notes
1566	Stubica	Krapina-Zagorje County	4	Estate inventory		Adamček (1965; 1980)	Fishponds in Stubica (Ztobyczensis), one constructed by Mr Henninght, one in the old town Stubica. Franjo Tahy seized a fishpond from a peasant serf.
1571	Turopolje	Turopolje	1	Estate inventory	Clausuram piscium communem	Laszowski (1908), p. 483	Peasant serfs permitted to catch fish in the presence of the count
1550-1573	Steničnjak	Karlovac Pokuplje	12	Estate inventory		Adamček (1980); Lopašić (1894b)	Annual income of approximately 1,000 forints from fish sales
1574	Slapno	Ozalj	1	Charter of donation		Laszowski (1951), doc. 9, p. 7	Donation from Juraj and Krsto Zrinski to Burgrave Ivan Karinčić. The document mentions "fishponds"
1575	Zakanje/Brihovo	Ribnik	1	Charter of donation		Laszowski (1951), doc. 11, p. 8	Donation from Counts Juraj and Nikola Zrinski to Knez Ivan Izačić. The document mentions "fishponds"
1579	Dubovac	Karlovac Pokuplje	2	Estate inventory		Adamček (1980)	
1579	Švarča	Karlovac Pokuplje	1	Estate inventory		Modrić (1974); Adamček (1980)	Estate inventory of confiscated properties of the Zrinski and Frankopan families. Fishpond near the manor house of Andrija Tadilović. Fishpond surface area 1.54 ha
1579	Veliki Tabor	Krapina-Zagorje County	3	Estate inventory		Adamček (1980)	

© 2026 The Authors. Croatian Journal of Fisheries by the University of Zagreb Faculty of Agriculture. This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Continued. Table 1

Date/Period	Location	Region	Number of fishponds	Type of record	Latin terminology	Bibliography	Notes
1588	Marjaševac (Maruševec)	Varaždin	3	Charter of donation		Laszowski (1904a)	Donation to the Vragović Maruševački family. One functional fishpond and two drained. Fishpond near the town
1592	Čakovec	Međimurje	1	Estate inventory		Varga (2016)	Estate inventory of the Zrinski family. Castle moat used as a fishpond
1592	Bratinec	Varaždin	1	Estate inventory	Piscinae Brathyancz	Varga (2016)	Estate inventory of the Zrinski family.
1610	Vicinity of Ozalj	Karlovac Pokuplje	1	Financial pledge		Laszowski (1951), doc. 44, p. 33	Financial pledge from Count Nikola Zrinski to Knez Juraj Dovolić. The document mentions "fishponds"
1614	Ztrugh	Turopolje?	1	Estate inventory	Clausura piscium Ztrugh	Laszowski (1908), p. 505	Village community required to restore the fishpond
1615	Donji Lovrečani	Krapina-Zagorje County	1	Estate inventory		Adamček (1980)	
1618	Brlog	Vicinity of Ozalj	1	Financial pledge		Laszowski (1951), doc. 77, p. 58	Financial pledge from Count Nikola Zrinski to Knez Juraj Dovolić. The document mentions "fishponds"
1618	Vinica	Varaždin	5	Estate inventory	Piscina	Adamček (1980)	Three small fishponds located in the villages Korenjak, Lukavec and Slatinjak, one large (piscina maior) in Vinica, and one on the Plitvica River.
1618	Marča	Kloštar Ivanić?	1	Charter of donation	Piscinam, piscinis	Sladović (1856)	Bishop Domitrović of the Zagreb Diocese donates estates to Hegumen Vratanja
1622	Sv. Križ Začretje	Krapina-Zagorje County	1	Charter of donation		Klaić (1917), IV., LXVIII	Large fishpond near the town

© 2026 The Authors. Croatian Journal of Fisheries by the University of Zagreb Faculty of Agriculture. This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Continued. Table 1

Date/Period	Location	Region	Number of fishponds	Type of record	Latin terminology	Bibliography	Notes
1622-1672	Murščak, Peklenica, Zebanec, Gornji Kraljevec, Vidovec, Gardinovec, Jalšovec, Štrigova	Međimurje	8	Estate inventory	Piscina Zeboriczensis, Strigoniensis, piscina ad addlodium Kralyocz, piscina ad pagum Peklenycza	Modrić (1974); Adamček (1980); Gönczi (1995)	Estate inventory of confiscated properties of the Zrinski and Frankopan families. Total fishpond surface area 25,79 ha. Fishponds full of fish (species not specified). Fishponds called Zeboriczensis and Strigoniensis stocked with fish (species not specified) in 1671 and 1672, respectively. Fishpond near Peklenica "highly fertile". Possibly fishponds around Štrigova and Čakovec were mentioned in 1350 (Smičiklas, 1913 CD XI, doc. 477).
1624	Netulevi/Scičino	Zadobarje (Karlovac Pokuplje)	1	Estate sale/Charter of donation		Laszowski (1951), doc. 90, p. 70	Estate sale and Charter of donation from Count Nikola Zrinski to Knez Vicko Dešić. The document mentions "fishponds"
1638	Međimurje	Međimurje	4	Estate division	Terzteniakouzki et Gerhaueczky Ribnjaki piscinae, Brazanzky et Zebonzky Ribnjaky	Varga (2016)	Estate division between Nikola and Petar Zrinski
1650	Švarča	Karlovac	1	Estate inventory	Piscina	Modrić (1974); Adamček (1980)	Estate inventory of confiscated properties of the Zrinski and Frankopan families. Year of fishpond construction. Fishpond surface area 1.54 ha

© 2026 The Authors. Croatian Journal of Fisheries by the University of Zagreb Faculty of Agriculture. This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Continued. Table 1

Date/Period	Location	Region	Number of fishponds	Type of record	Latin terminology	Bibliography	Notes
1653	Hrnetići/Jelsa	Karlovac	1	Financial pledge		Laszowski (1951), doc. 147, p.113	Financial pledge from Count Petar Zrinski to Knez Petar Hranilović. The document mentions "fishponds"
1653	Stativa	Karlovac	1	Estate exchange		Laszowski (1951), doc. 152, p. 117	Estate exchange between Count Petar Zrinski and Knez Tomaž Mogorić. The document mentions "fishponds"
1654	?	?	1	Charter of donation		Croatian State Archives (2026f)	Charter of donation from Franjo Čikulin to Knight Nikola Malakoci
1658	Lobor	Krapina-Zagorje County	1	Estate inventory/ Fishpond inventory		Adamček (1980), Šišić (1918)	Fishpond containing northern pike, common carp, tench, crucian carp, and other cyprinids
1658	Topolovac	Sisak	1	Fishpond inventory		Šišić (1918)	Fishpond containing northern pike, common carp, tench, and crucian carp
1659	Politar	?	1	Fishpond inventory		Šišić (1918)	Fishpond containing common carp, tench, and crucian carp
1659	Batina	Baranja	3	Estate inventory		Adamček (1980)	
1660	Lipovac	Vukovar-Srijem County	1	Estate inventory/ Fishpond inventory		Adamček (1980), Šišić (1918)	Year of construction. Fishpond containing common carp and tench
1660	Bistrica	Krapina-Zagorje County	1	Estate inventory/ Fishpond inventory		Adamček (1980), Šišić (1918)	Fishpond containing common carp, northern pike, and tench

© 2026 The Authors. Croatian Journal of Fisheries by the University of Zagreb Faculty of Agriculture. This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Continued. Table 1

Date/Period	Location	Region	Number of fishponds	Type of record	Latin terminology	Bibliography	Notes
1660	Veleškovac	Krapina-Zagorje County	1	Estate inventory/ Fishpond inventory		Adamček (1980), Šišić (1918)	Fishpond containing common carp and northern pike
1661	sv. Martin	?	1	Fishpond inventory		Šišić (1918)	Fishpond containing tench and crucian carp
1672	Bratkovci	Međimurje	1	Estate inventory	Piscina Bratkoucz	Modrić (1974); Varga (2016)	Estate inventory of confiscated properties of the Zrinski and Frankopan families. Fishpond surface area 6.16 ha. Fishpond in good condition and full of fish (species not specified)
1672	Božjakovina	Zagreb	2	Estate inventory	Piscina magna penes ecclesiam sancti Brictii	Modrić (1974); Adamček (1980)	Estate inventory of confiscated properties of the Zrinski and Frankopan families. Total fishpond surface area 1.54 ha. Fishpond near the church full of "small fish" (species not specified)
1672	Vicinity of Ozalj	Karlovac Pokuplje	5	Estate inventory	Piscinae	Modrić (1974); Adamček (1980)	Estate inventory of confiscated properties of the Zrinski and Frankopan families. Total fishpond surface area 3.5 ha. Fishpond near a plot called Kerch full of various species of fish (species not specified). Two fishponds near Jaškovo "low-yielding"
1672	Slapno	Vicinity of Ozalj	1	Estate inventory	viuarium paruum pro piscibus conseruandis	Modrić (1974)	Estate inventory of confiscated properties of the Zrinski and Frankopan families

© 2026 The Authors. Croatian Journal of Fisheries by the University of Zagreb Faculty of Agriculture. This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Continued. Table 1

Date/Period	Location	Region	Number of fishponds	Type of record	Latin terminology	Bibliography	Notes
1672/1673	Novigrad na Dobri	Karlovac	3	Estate inventory	Piscinae	Modrić (1974)	Estate inventory of confiscated properties of the Zrinski and Frankopan families. Total fishpond surface area 3.08 ha. Fish spawning recorded in one of the fishponds. Two fishponds near the castle.
Second half of the 17th century	Ozalj	Karlovac Pokuplje	1	Estate inventory		Varga (2016)	Estate inventory of the Zrinski family. Fishpond near the castle
Second half of the 17th century	Božjakovina	Zagreb	1	Estate inventory		Adamček (1980)	
Second half of the 17th century	Rakovec	Zagreb	1	Estate inventory	Aqua piscibus impleta	Adamček (1980)	Fish cultured in a castle moat
1685	Božjakovina	Zagreb	1	Estate inventory	Conservatorium piscinum pro divenditione piscium	Varga (2016)	Estate inventory of the Zrinski family. Fishpond used for storage of live fish near the castle
1687	Branjin Vrh	Baranja	7	Estate inventory		Varga (2016)	Estate inventory of the Zrinski and Drašković families
1692	Krčić	Bosiljevo	1	Estate inventory		Adamček (1980); Lopašić (1894a)	
1692	Vicinity of Bosiljevo	Karlovac	1	Estate inventory		Adamček (1980)	
1692	Lapšina	Međimurje	4	Estate inventory		Varga (2016)	Estate inventory of the Zrinski family. Fishponds located below the castle
1692	Zamlach	Slavonija	1	Estate inventory		Varga (2016)	
Second half of the 17th century	Leskovec	Međimurje	2	Estate inventory		Adamček (1980)	Fishpond on the property of Stjepan Ivanović manor
1692	Novi Dvor	Zagreb	4	Estate inventory	Piscine sub castello	Varga (2016)	Estate inventory of the Zrinski family.
1692	Križovec	Međimurje	1	Estate inventory		Varga (2016)	Estate inventory of the Zrinski family.

© 2026 The Authors. Croatian Journal of Fisheires by the University of Zagreb Faculty of Agriculture. This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

However, fishpond ownership was not limited to the highest social strata. Evidence indicates that estates with fishponds were frequently sold, exchanged, or pledged as part of financial arrangements among different social ranks of the nobility and other landholders during the Middle Ages (Table 1). Additionally, members of the lesser nobility often acquired estates with fishponds through grants from more powerful noble families or royal donations in recognition of loyal military or other services. For instance, in the mid- to late 16th century, the Frankopan and Zrinski families donated estates, including fishponds, to noblemen Ivan Karinčić, Ivan Izačić, and Martin Lovinac (Laszowski, 1951). Among the nobility, ownership of fishponds was also a status symbol, often associated with substantial investments in their construction (Gönczi, 1995; Varga, 2016). Fishponds were present on most noble estates in the 15th and 16th centuries (Adamček, 1980), a pattern also observed elsewhere in Europe (Balon, 1995a; Beveridge and Little, 2002; Hoffmann, 1999). However, the reviewed material also contains a rare example suggesting that fishpond ownership was not exclusively confined to higher social groups. In 1566, the Hungarian-Croatian nobleman Franjo Tahy seized a fishpond from a peasant serf near Stubica (Adamček, 1980). While this case does not allow for broader generalisation, it indicates that, at least in some instances, fishponds could also be held by members of lower social strata. In the reviewed literature, a total of 98 individual fishponds or fishpond systems were recorded during the Middle Ages, while 127 are documented for the early modern period up to 1700. The total surface area of fishponds for which data are available for the early modern period amounts to 43.15 hectares. This figure represents a minimum value, as surface area data have not been preserved for a large number of fishponds. Comparison with other European regions shows that the development of pond aquaculture in Croatia followed a broader European pattern, albeit on a smaller spatial scale.

In Bohemia, fishponds appear in the 11th and 12th centuries, while by the late 14th century approximately 75,000 ha of pond surface area were recorded, and about 26,000 fishponds had been constructed by the end of the Middle Ages (Beveridge and Little, 2002; Hoffmann, 1995; Nash, 2011). By the end of the 16th century, fishponds in Moravia and Bohemia covered around 180,000 ha (Balon, 2004). In Poland, fishponds are recorded after the 11th century, with large pond systems constructed during the 12th and 13th centuries, and approximately 60,000 ha of fishpond surface area documented in Silesia in the second half of the 15th century (Taborska, 2019). In France, fishpond construction intensified from the 11th and early 12th centuries, with fishponds covering about 62,000 ha in northern and central France (Hoffmann, 2002). Fishponds were constructed at locations suitable for water retention and regulation, most commonly along rivers and streams. This indicates their planned integration into broader water management systems, including infrastructure such as water mills (Fabijanec, 2012). In some cases, fishponds were simple structures, such as dammed watercourses, water accumulations near mill dams, or ditches. For example, Tkalčić (1889) did not consider a fishpond mentioned in a document from 1344 to be a true fishpond due to the lack of a permanent water source, instead interpreting it as a marsh and questioning its suitability for fish culture. However, as demonstrated by the first Polish author on pond aquaculture Olbrycht Strumieński, in his 1573 treatise *O sprawie, sypaniu, wymierzaniu i rybnieniu stawów*, fishponds did not necessarily require a constant inflow of water. He distinguished between ponds filled by rainwater and wastewater and constructed within drainage ditch systems in marshlands, and those built in river valleys and former riverbeds supplied by rivers or streams (Taborska, 2019). Another example of a simpler type of fishpond is recorded in the late 16th and second half of the 17th centuries, when castle moats functioned as fishponds in which fish were cultivated (Adamček, 1980; Varga, 2016). In most cases, however, fishponds were technically demanding structures with associated inlet and outlet channels (e.g. Modrić, 1974) and substantial construction costs. The construction of a fishpond in Ivanić, initiated in 1481 for the purposes of the Zagreb Diocese, lasted approximately nine months and cost a total of 900 Hungarian denars (Stingl, 2022; Tkalčić, 1905). The value of fishponds and fishing gear owned by the Zrinski family in the 17th century amounted to 1,034 forints, a considerable sum for the period, clearly indicating the economic importance of pond aquaculture and fisheries (Gönczi, 1995; Modrić, 1974). While there are no measurements of the fishponds for the medieval and Renaissance periods, historical sources from the 17th century onwards classify fishponds by surface area into small, medium, and large categories, listing six typical sizes: 0.77 ha, 1.15 ha, 1.54 ha, 3.08 ha, 6.16 ha, and 9.24 ha (Adamček, 1965, 1980; Gönczi, 1995; Modrić, 1974). This classification also reflected the expected revenue from the sale of cultured fish (Modrić, 1974), a practice also observed in the Kingdom of Hungary (Ferenczi, 2018). In addition to larger production fishponds, smaller fishponds and live-fish storage facilities (*vivaria*) were used for temporarily storing fish prior to consumption or sale, most often located near manors or estate centres (Modrić, 1974; Varga, 2016; Table 1). Similar criteria for site selection, construction, and fishpond design have been documented across Europe. Fishponds were typically built in accordance with local topography, most often in river floodplains, valleys, former riverbeds, or by damming streams, and were situated in natural depressions or on less fertile agricultural land (Dubravius, 1599; Ferenczi, 2018; Hoffmann, 1996; Taborska, 2019; Zatykó, 2011). Fishpond surface areas ranged from several tens of square meters to as much as 400 ha, with depths of 6 to 8 m (Beveridge and Little, 2002;

© 2026 The Authors. Croatian Jounal of Fisheires by the University of Zagreb Faculty of Agriculture. This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Cios, 2016; Hoffmann, 2002). Whether fish were indeed cultured in fishponds can be inferred indirectly from legal disputes between religious orders and the nobility, which document cases of unauthorized harvesting of fish from privately owned fishponds. In the analysed material, at least four court cases were identified involving the illegal removal of fish from fishponds belonging to monasteries or noble estates (Croatian State Archives, 2026b, c; Smičiklas, 1905). Such disputes indicate clearly defined ownership of fishponds and fish stocks, as well as the economic value of the fish cultivated therein.

CONSUMPTION OF FRESHWATER FISH

Evidence from medieval and early modern sources indicates that fish culture in fishponds primarily served to meet the dietary needs of ecclesiastical institutions, including religious orders, and the nobility (Adamček, 1967; 1980; Fabijanec, 2012; Gajer, 1978; Janeš and Sekulić, 2014; Stingl, 2022; 2025; Varga, 2016; Vručina, 2021). Ecclesiastical institutions appear to have consumed freshwater fish in considerable quantities, as indicated by financial accounts. For instance, Bishop Osvald Thúz of the Zagreb Diocese purchased fish on 95 occasions during 1481 and the first half of 1482, at a total value of 4,615.5 Hungarian denars, accounting for nearly one third of all foodstuffs acquired (Stingl, 2022). Stingl (2025) reports that fish were supplied by fishermen from the Sava River, while also noting the possibility that some may have originated from fishponds. Given that the Zagreb Diocese owned fishponds, it is reasonable to assume that at least a portion of the supply came from such sources (Table 1). There is also a recorded instance indicating that fish caught in fishponds were distributed among villages within an estate, suggesting that, at least in some cases, peasant serfs also consumed freshwater fish (Laszowski, 1908). The availability of fresh fish was particularly important during the Middle Ages due to strict dietary regulations prohibiting the consumption of meat from warm-blooded animals. Depending on the region of Europe, fasting days (Fridays, Lent, Advent, and other liturgical fasts) accounted for between 130 and 250 days per year (Balon, 2004; Cios, 2016; Costa-Pierce, 2022; Hoffmann, 1999; Nash, 2011; Taborska, 2019). The procurement of fresh fish from capture fisheries was irregular, as it depended on weather conditions, natural disasters, and wartime circumstances, which significantly stimulated the development of pond aquaculture as a stable source of fresh fish (Balon, 1995a). The importance of fish in the diet of the nobility is illustrated by the cookbook of the Zrinski family from Čakovec, dating back to the mid-17th century. Of the 394 recipes, 91 refer to fish and seafood (Puntijar and Puntijar, 2008). Freshwater species recorded in the recipes include common carp, crucian carp, two species of Acipenseridae, pikeperch *Sander lucioperca* (Linnaeus, 1758), wels catfish *Silurus glanis* Linnaeus, 1758, brown trout *Salmo trutta* Linnaeus, 1758, and others, with northern pike being the most frequently mentioned species. Additional evidence for fish consumption among the clergy and nobility is provided by archaeozoological studies conducted at several medieval monasteries and castle sites, which have identified fish remains in the diet of higher social strata (Janeš, 2014; Korpes et al., 2025; Tkalčec and Trbojević Vukičević, 2013; Tkalčec and Trbojević Vukičević, 2021; Trbojević Vukičević and Štilinović, 2008; Trbojević Vukičević et al., 2010). In contrast, no fish remains have been reported at other sites (Kolenc et al., 2024; Korpes et al., 2024; Trbojević Vukičević et al., 2023). For example, no fish remains were recorded at the site of the Abbey of St. Margaret (Korpes et al., 2024; Korpes et al., 2025), although a fishpond is documented south of the monastery in the historical Franciscan cadastre (Janeš and Sekulić, 2014). The recovery of archaeozoological evidence of fish is inherently challenging due to a range of biological, taphonomic, and methodological factors, including the small size and fragility of fish bones, their rapid decomposition, and the need for specialized recovery techniques such as fine sieving (e.g. Morales-Muñiz, 2014; Zohar et al., 2025). Therefore, the apparent discrepancy in the presence of fish remains is more likely attributable to taphonomic processes, recovery methods, or sampling strategies than to actual differences in dietary practices.

FUNCTIONS OF FISHPONDS

Based on available medieval and early modern sources, it can be inferred that the primary function of fishponds was the storage and production of fish for local consumption. In addition to production for household consumption by ecclesiastical institutions and the nobility, there is also evidence of market-oriented fish production (Adamček, 1980; Laszowski, 1908; Lopašić, 1894a, b; Pálosfalvi, 2014). For example, fishponds in Gerec near Križevci, recorded in 1418, generated an annual revenue of 400 florins (Pálosfalvi, 2014), while the Steničnjak fishpond complex near the Kupa River close to Karlovac, comprised 12 fishponds and generated an annual income of approximately 1,000 forints from fish sales between 1550 and 1573 (Adamček, 1980; Lopašić, 1894a, b). An approximate estimate of annual fish production at these sites can be derived from recorded prices of fresh fish from the early 17th century and the value of currencies in use (forints and denars) (e.g. Kapustić, 1977). Assuming that the principal cultured species was common carp, with an average price of 5 denars per pound of fresh fish (Filić, 1968), these revenues would correspond to an annual production of approximately 8,000 pounds (≈2,600 kg) and 20,000 pounds (≈7,000 kg) of fish, respectively. These estimates should be interpreted with caution, as they do not account for species composition, market size classes, product category (e.g. fresh or processed

© 2026 The Authors. Croatian Jounal of Fisheires by the University of Zagreb Faculty of Agriculture. This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

fish), seasonal price fluctuations, or the temporal gap between the sources used. Nevertheless, they indicate the production potential of certain fishpond systems in the medieval and early modern periods. The specific function of three fishponds in the area of the Zagreb Chapter remains unclear, as the available sources do not provide direct evidence of their purpose. Some authors interpret these fishponds primarily as defensive features in light of the Ottoman incursions (Arbutina, 1996; Stingl, 2022), while others suggest that they may have served an aquaculture role in response to the overexploitation of fish stocks in open waters, supplying fresh fish for the clergy and possibly the market (Vručina, 2021). A reliable assessment of their use would require a detailed analysis of the Chapter's accounts and cartularies (Fabijanec, 2012). Considering the spatial setting of the fishponds, favourable topography and hydrological conditions, and the documented mixed use of fishponds in some cases (Adamček, 1980; Varga, 2016; Table 1), it is reasonable to assume that these fishponds may have had a dual role, combining defensive and fish production purposes. Such multifunctionality of fishponds is also recorded in other parts of Europe and reflects their adaptive application under varying economic and socio-political conditions (e.g. Bunting and Little, 2005; Creighton, 2006; Hoffmann, 2023).

MANAGEMENT AND HUSBANDRY PRACTICES OF FISHPONDS

Precise and detailed information on management measures, husbandry practices and species composition is lacking for the medieval period. Nevertheless, available sources indicate that fishponds were stocked with live fish (e.g. Stingl, 2022) and were regarded as private property. Fish were most likely stored in fishponds until the time of consumption, with management practices that were limited and largely unsystematic. The operation of fishponds required a labour force responsible for activities essential to fish production. Medieval and early modern sources record specialised workers tasked with pond construction (*fossari piscine*), pond maintenance (*aggeres piscinarum reficere*), guarding services (*piscinarius – piscinae custos*) and fish harvesting (*piscationes deservire – servitutes piscationis praestare*) (Adamček, 1980; Fabijanec, 2012; Herkov, 1956b; Karbić and Škreblin, 2013; Kostrenčić et al., 1975; Lopašić, 1894a; Tkalčić, 1905), a practice also documented in other European regions. These workers, most commonly peasant serfs, were engaged in the maintenance of fishponds and inlet and outlet channels, guarding duties, fishing operations, sorting of fish, repair of nets, and other tasks associated with pond aquaculture (Dubravius, 1599; Hoffmann, 2002; Taborska, 2019). No direct evidence for specialised managerial roles responsible for overseeing fishpond operation and production was identified in the analysed sources, although "officials" employed at the Zrinski family fishpond in Čakovec are noted (Varga, 2016). In other parts of Europe, numerous records document the presence of lay specialists, often referred to as "pond-masters" or "fish masters", who were employed on both short- and long-term contracts and played a key role in fishpond management (Hoffmann, 2023). Information on fishpond yields and productivity in the medieval period is lacking, whereas such data for the early modern period remain scarce and appear only sporadically in historical sources. For example, two fishponds near Brlog are described as low-yielding, whereas a fishpond near Peklenica is described as highly fertile and self-sustaining for various fish species, although no quantitative data are provided (Modrić, 1974). In Poland, yields of extensive fishponds have been reported to range from 40 to 50 kg ha^{-1}, reaching up to 75 kg ha^{-1} in the most favourable cases (Cios, 2016). By the late 14th century, yields from approximately 75,000 ha of fishponds in Bohemia amounted to around 2,250 tons of fish (Beveridge and Little, 2002). According to other European sources, under extensive culture conditions, common carp reached a length of 40 to 60 cm and a body mass of approximately 1 kg by the fourth to sixth production year (Hoffmann, 2002). In order to increase productivity, fishponds were fertilised or, after drainage, sown with agricultural crops such as millet, wheat, barley, rye, oats or maize (Cios, 2016; Dubravius, 1599; Taborska, 2019). An important practice of medieval and early modern freshwater aquaculture in Europe was the organised harvesting and stocking of different age classes of fish into nursery, spawning, and grow-out ponds. Indirect evidence that stocking practices were also carried out in parts of the Kingdom of Slavonia (e.g. Brod na Kupi and Međimurje) during the early modern period is provided by inventories of fishery equipment belonging to the noble families Zrinski and Frankopan. These inventories list vessels and containers used for holding and transporting live fish (*lagena pro piscibus, lagenae pro portandis piscibus, magnae item lagenae pro piscibus*), suggesting the handling and possible transfer of live fish between water bodies (Modrić, 1974; Table 1). Additionally, at least two fishpond complexes appear to have been oriented towards fish production for the market, implying more advanced theoretical and practical knowledge of aquaculture practices. The most detailed information on fishpond management measures and husbandry practices is found in the chronicle of magnate Petar Keglević Bužinski (≈1476-1554), which mentions restoration, maintenance, drainage and systematic fish stocking, although without further details (Adamček, 1980; Šišić, 1918). Between 1658 and 1661, repeated harvests and stockings were recorded among seven fishponds under his ownership, during which a total of 407 carp (krap), 390 tench (linj), 282 northern pike (šćuka), six crucian carp (karas), and an unspecified quantity of small cyprinids (belka) were stocked (Šišić, 1918). These data indicate a certain degree of planned fishpond

© 2026 The Authors. Croatian Jounal of Fisheires by the University of Zagreb Faculty of Agriculture. This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

management measures and husbandry practices, as well as record keeping, with common carp as the principal cultured species, accompanied by polyculture with supplementary species, primarily northern pike and tench. Such methods and practices were widely reported in other parts of Europe and represent a typical example of extensive pond-based aquaculture in the medieval and early modern periods (Cios, 2016; Costa-Pierce, 2022; Dubravius, 1599; Hoffmann, 1996; Taborska, 2019). Among cultured species, common carp appears to have played a central role in medieval and early modern Europe (e.g. Balon, 1995a; Hoffmann, 1995). It was favoured due to several biological characteristics. In particular, it is well adapted to stagnant waters, can utilize a wide range of feed, including kitchen waste, and can be transported alive over long distances when kept in moist conditions (Zeuer, 1963). This combination of traits made common carp particularly suitable for pond-based aquaculture. Knowledge of freshwater fish species and awareness of the influence of environmental conditions on growth and production were present at least among segments of the nobility (Šišić, 1918). There are also indications that parts of the high nobility may have been familiar with contemporary theoretical and practical knowledge of pond aquaculture. One possible indirect indicator is the connection between Nikola VII Zrinski (1620-1664) and György Lippay (1600-1666), Archbishop of Esztergom, whose relative, Mauritius Knauer, authored the *Calendarium Oeconomicum perpetuum* (≈1650), a manual providing detailed instructions on fishpond management and common carp culture (Varga, 2016). Although there is no direct evidence that Zrinski owned or used this work, it is plausible that such knowledge circulated within the social and intellectual networks of the high nobility during the early modern period. This interpretation is supported by the close interconnections between ecclesiastical and noble elites in Europe, which facilitated the exchange of knowledge and practices (Hoffmann, 1995). Final confirmation of this proposition would require a detailed analysis of the Zrinski family library (*Bibliotheca Zriniana*).

LIMITATIONS AND FUTURE RESEARCH

A limitation of this preliminary study arises from the fact that only a portion of the available edited and published medieval and early modern sources was analysed, including material related to a limited number of noble families, primarily the Zrinski, Frankopan and Keglević families. This material consists predominantly of general administrative and legal documents, such as urbariums, statutes, charters and related records, and does not include noble family archives or dedicated archival collections of religious orders. This introduces a potential bias, as the analysed records are disproportionately associated with high-ranking social groups, particularly the high nobility and ecclesiastical institutions. Consequently, fishponds associated with urban populations or rural communities are systematically underrepresented in the available evidence. Written records from other parts of Europe indicate that, in addition to the high aristocracy, fishponds were also constructed, operated, or leased by lesser nobles, urban citizens, including wealthy merchants and fishmongers, wealthy peasants, as well as corporate entities (Bond, 2016b; Cios, 2016; Hoffmann, 2023). This suggests that the social distribution of fishpond ownership in medieval and early modern Croatia may have been broader than is currently reflected in the analysed written sources. Adamček (1980) notes that fishponds were present on almost all major noble estates in the 15th and 16th centuries, while in the 17th century pond aquaculture represented a highly developed branch of agricultural production, with estimates suggesting the existence of several hundred fishponds in the territory of present-day Croatia. A broader regional comparison further supports this estimation. Namely, in the Kingdom of Hungary, which was in a personal union with the Kingdom of Croatia, the number of fishponds during the Middle Ages has been estimated at between 3,000 and 4,000 (Zatykó, 2011). These observations support the likelihood that the currently identified number of fishponds represents only a fraction of their historical extent. Furthermore, this study did not systematically include archival material from specific monastic orders, such as the Cistercians, Pauline Fathers and Benedictines, which are known to have played an important role in the management of agricultural landscapes and water resources, including freshwater fishponds (Balon, 1995b; Beveridge and Little, 2002; Bond, 2016a; Hoffmann, 2023). The absence of such sources represents an additional limitation and may further contribute to the underrepresentation of the spatial extent of fishponds. Finally, the analysed material lacks precise descriptions of fishpond management and cultured species, which limits a comprehensive reconstruction of aquaculture practices. Therefore, a more systematic analysis of a wider range of historical sources, including noble and ecclesiastical archives, could significantly improve the identification of fishponds across a broader spatial scale, as well as provide additional insights into management and husbandry practices and cultivated species. This, in turn, would provide a sounder basis for a more precise and comprehensive reconstruction of the historical development of freshwater aquaculture in Croatia.

CONCLUSION

This paper provides the first systematic synthesis of fishponds as historical indicators of freshwater aquaculture in the territory of present-day Croatia during the medieval and early modern periods. The available evidence indicates that freshwater fishponds were an

© 2026 The Authors. Croatian Jounal of Fisheires by the University of Zagreb Faculty of Agriculture. This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

integral component of agricultural landscapes and estates owned by higher social groups, primarily ecclesiastical institutions and the nobility. Although detailed data on fishpond functions, management practices and husbandry techniques, as well as species composition, remain limited, the evidence suggests that these broadly followed patterns observed elsewhere in Europe, albeit on a smaller spatial scale. Despite the limitations of the available sources, this paper demonstrates that fishponds represent important indicators of freshwater aquaculture and provides a conservative reconstruction of their historical extent and significance in medieval and early modern Croatia. This paper also highlights the need for further systematic research based on a wider range of archival materials, particularly those of noble families and religious institutions.

RIBNJACI KAO POKAZATELJI SLATKOVODNE AKVAKULTURE U SREDNJOVJEKOVNOJ I RANONOVOVJEKOVNOJ HRVATSKOJ: PRELIMINARNI POVIJESNI PREGLED

SAŽETAK

Slatkovodna akvakultura u Europi ima tradiciju dulju od 1.000 godine, pri čemu se njezin razvoj prvenstveno temeljio na uzgoju šarana u ribnjacima. Tijekom srednjeg vijeka, crkveni redovi i aristokracija imali su ključnu ulogu u izgradnji i upravljanju ribnjacima, kao i u kontinuitetu i širenju uzgojnih i upravljačkih praksi. Povijest slatkovodne akvakulture na području današnje Hrvatske nije sustavno istražena, a ključni aspekti, uključujući njezine početke, prostornu rasprostranjenost, društvene aktere, svrhu, uzgojne i upravljačke prakse te uzgajane vrste, i dalje su nedovoljno poznati. Ovaj rad temelji se na analizi širokog sadržaja povijesnih izvora, uključujući arhivsko, statističko i normativno gradivo, s ciljem utvrđivanja vremenske i prostorne rasprostranjenosti ribnjaka. Ribnjaci se pritom koriste kao indikator slatkovodne akvakulture te se analiziraju interdisciplinarnim pristupom koji uključuje i arheozoološke dokaze, kako bi se rekonstruirao razvoj slatkovodne akvakulture u Hrvatskoj tijekom srednjeg i ranog novog vijeka. Rezultati upućuju na to da se postojanje ribnjaka može pratiti najranije od 11. stoljeća, pri čemu su crkvene institucije predstavljale najranije društvene skupine uključene u njihovu izgradnju i posjedovanje, nakon čega slijedi plemstvo. Tijekom srednjeg vijeka proizvodnja ribe u ribnjacima prvenstveno je služila zadovoljavanju prehrambenih potreba crkve i plemstva, dok se u ranom novom vijeku pojavljuju naznake tržišno usmjerene proizvodnje. Podaci o uzgojnim i upravljačkim praksama su oskudni, ali omogućuju djelomičnu rekonstrukciju proizvodnih i organizacijskih obrazaca. Podaci o uzgajanim vrstama riba također su ograničeni, no među najčešće spominjanim vrstama ističu se šaran, štuka, linjak i zlatni karas. Glavno ograničenje ovog preliminarnog istraživanja proizlazi iz oslanjanja na opće administrativne i pravne izvore te nedostatka sustavne analize arhivskog gradiva vezanog uz plemićke obitelji, crkvene redove i drugih crkvenih institucija, što upućuje na potrebu za daljnjim istraživanjima temeljenima na širem sadržaju izvora.

Ključne riječi: ribnjaci, Hrvatska, Srednji vijek, rani Novi vijek, uzgoj ribe, šaran

ACKNOWLEDGEMENTS

The author is grateful to Sabine Florence Fabijanec, PhD (Croatian Academy of Sciences and Arts) and Maja Hučić, mag. hist. (Croatian Institute of History) for drawing attention to relevant literature. The valuable suggestions of the anonymous reviewers are also gratefully acknowledged.

CREDIT AUTHORSHIP CONTRIBUTION STATEMENT

Author has read and agreed to the published version of the manuscript.

DECLARATION OF COMPETING INTEREST

The author declares no conflict of interest.

ETHICS AND PERMIT APPROVALS

The ethics statement has been revised to ensure full transparency regarding ethical approval, consent procedures, and compliance with relevant guidelines and regulations.

DATA AVAILABILITY STATEMENT

Data available on request to the author.

FUNDING STATEMENT

This research received no external funding.

AI USE STATEMENT

The author used ChatGPT (OpenAI) to improve language clarity. All scientific content, data interpretation, and conclusions were developed and critically evaluated by the author.

© 2026 The Authors. Croatian Jounal of Fisheires by the University of Zagreb Faculty of Agriculture. This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

REFERENCES

Adamček, J. (1965): Građa o susjedgradsko-stubičkom vlastelinstvu 1563-1574 (Materials on the Susjedgrad-Stubica Manor 1563-1573). Arhivski vjesnik. 7-8, 1, 7-340. (in Croatian)

Adamček, J. (1967): Susjedgradsko-stubičko vlastelinstvo uoči seljačke bune 1573. (The Susjedgrad-Stubica Manor on the eve of the peasant uprising of 1573). Historijski zbornik. 19-20, 1-4, 141-194.

Adamček, J. (1980): Agrarni odnosi u Hrvatskoj od sredine XV do kraja XVII stoljeća (Agrarian relations in Croatia from the mid-15th to the end of the 17th century). Odjel za hrvatsku povijest, Centar za povijesne znanosti Sveučilišta u Zagrebu, Sveučilišna naklada Liber. Zagreb. 853pp. (in Croatian)

Arbutina, D. (1996): Razvoj kaptolskog vrta Ribnjaka u Zagrebu i planovi za uređenje perivoja (Development of the Kaptol garden Ribnjak in Zagreb and plans for landscaping the park). Prostor: znanstveni časopis za arhitekturu i urbanizam, 4, 2, 12, 253-270. (in Croatian)

Balon, E. K. (1995a): The common carp, *Cyprinus carpio*: its wild origin, domestication in aquaculture, and selection as colored nishikigoi. Guelph ichthyology reviews, 3, 1-55.

Balon, E. K. (1995b): Origin and domestication of the wild carp, *Cyprinus carpio*: from Roman gourmets to the swimming flowers. Aquaculture, 129, 1-4, 3-48. https://doi.org/10.1016/0044-8486(94)00227-F

Balon, E. K. (2004): About the oldest domesticates among fishes. Journal of fish Biology, 65, 1-27. https://doi.org/10.1111/j.0022-1112.2004.00563.x

Belostenec, I. (1740): Gazophylacium seu Latino-Illyricorum onomatum aerarium. Typis Joannis Baptistae Writz, Inclyti Regni Croatiae Typographi, Zagrabiae. 650pp (in Latin and Croatian)

Bertović, K. (2014): Between the cross and the sword: Frankopan patronage over the Order of St. Paul the First Hermit. MA Thesis in Medieval Studies. Central European University, Budapest. 107pp.

Beveridge, M. C. M., Little, D. C. (2002): The history of aquaculture in traditional societies. pp. 1-29. In: Costa-Pierce, B. A. (ed.), Ecological aquacuture: The evolution of the Blue Revolution. Blackwell Science Ltd. 400pp.

Bojčić, C. (1982): Povijesni razvoj slatkovodnog ribarstva (Historical development of freshwater fisheries). pp. 7-54. In: Habeković, D. (ed.). Slatkovodno ribarstvo. Poslovna zajednica slatkovodnog ribarstva Jugoslavije, Zagreb, Jugoslavenska medicinska naklada, Zagreb. 605pp, (in Croatian)

Bojčić, C., Bunjevac, I. (1982) 100 godina ribogojstva na tlu Jugoslavije (100 years of aquaculture in Yugoslavia). Poslovna zajednica slatkovodnog ribarstva Jugoslavije, Ribozajednica Zagreb. 154pp. (in Croatian)

Bond, J. (2016a): Fishponds in the monastic economy in England. pp. 29-57. In: Bonow, M., Olsén, H., Svanberg, I. (eds.), Historical aquaculture in Northern Europe. Södertörn University, Stockholm. 204pp.

Bond, J. (2016b): The increase of those creatures that are bred and fed in the water – fishponds in England and Wales. pp. 157-199. In: Bonow, M., Olsén, H., Svanberg, I. (eds.), Historical aquaculture in Northern Europe. Södertörn University, Stockholm. 204pp.

Bunting, S. W., Little, D. C. (2005): The emergence of urban aquaculture in Europe. pp. 119-135. In: Costa-Pierc, B., Desbonnet, A., Edwards, P., Baker, D. (eds.), Urban aquaculture. CABI Publishing. 285pp.

Cios, S. (2016): The history of aquaculture in Poland. pp. 59-76. In: Bonow, M., Olsén, H., Svanberg, I. (eds.), Historical aquaculture in Northern Europe. Södertörn University, Stockholm. 204pp.

Costa-Pierce, B. A. (2022): The anthropology of aquaculture. Frontiers in Sustainable Food Systems, 6, 843743. https://doi.org/10.3389/fsufs.2022.843743

Creighton, O. (2006): Castles of communities: Medieval town defences in England, Wales and Gascony. Château Gaillard 22, p. 75-86, Publications du CRAHM.

Croatian State Archives (2026a): State Archive Zagreb (HR-HDA-646) Pavlinski samostan u Dobroj Kući (arhivski fond, 1275-1761) (in Latin)

Croatian State Archives (2026b): State Archive Zagreb (HR-HDA-877) Srednjovjekovne isprave, zbirka Hrvatskoga državnog arhiva (arhivski fond, 1111-1526), isprava broj 330; isprava broj 618. (in Croatian, Latin and German)

Croatian State Archives (2026c): State Archive Zagreb (HR-HDA-647) Pavlinski samostan na Gariću (arhivski fond, 1256-1796). (in Latin)

Croatian State Archives (2026d): State Archive Zagreb (HR-HDA-786) Razne obitelji, zbirka Hrvatskoga državnog arhiva (Obitelj Nagy) (arhivski fond, 1492-1940) (in Latin, Croatian, German, Italian and Hungarian)

Croatian State Archives (2026e): State Archive Zagreb (HR-HDA-730) Kiš Šaulovečki, obitelj (arhivski fond, 1534-1890) (in Croatian)

Croatian State Archives (2026f): State Archive Zagreb (HR-HDA-706) Čikulini-Sermage, obitelj (arhivski fond, 1272-1888) (in Croatian)

Dobronić, L. (1951): Topografija zemljišnih posjeda zagrebačkih biskupa prema ispravi kralja Emerika iz god. 1201. (Topography of the land holdings of the Zagreb bishops according to the charter of King Emeric from 1201). Jugoslavenska akademija znanosti i umjetnosti. Zagreb. 318pp. (in Croatian and Latin)

Dobronić, L. (1952): Topografija zemljišnih posjeda zagrebačkog kaptola prema izvorima XIII. i XIV. Stoljeća (Topography of the land holdings of the Zagreb Chapter according to sources from the 13th and 14th century). Rad Jugoslavenske akademije znanosti i umjetnosti. Knjiga 3, 286, 171-256. (in Croatian and Latin)

© 2026 The Authors. Croatian Jounal of Fisheires by the University of Zagreb Faculty of Agriculture. This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Dubravius, J. (1599): A new booke of good husbandry, very pleasaunt, and of great profite both for gentlemen and yomen; conteining, the order and maner of making of fish-pondes, with the breeding, preseruing, and multiplying of the carpe, tench, pike, and troute, and diverse kindes of other fresh-fish. pp 15-98. In: French, M. (ed.), Three books on fishing (1962). Scholars' fascimiles & reprints. Gainesville, Florida. 222pp.

Dujmović, D. (2016): Otok svetog Jakova: Prilog poznavanju srednjovjekovnoga kulturnoga krajolika Zagreba (St. James' Island: A contribution to the knowledge of the Medieval cultural landscape of Zagreb. Croatica Christina Periodica 40, 78, 39–48. (in Croatian)

Fabijanec, S. F. (2012): Uloga vode u svakodnevnom životu srednjovjekovne Hrvatske (The role of water in everyday life in medieval Croatia). Gazophylacium, 17,1-2, 9-43. (in Croatian)

Fabijanec, S. F. (2021): Fishing, consumption, and processing of fish and shellfish in the Eastern Adriatic through the long Middle Ages. Imago temporis: medium Aevum, XV, 167-191. DOI 10.21001/itma.2021.15.05

Fašalić, K., Gomerčić, H., Adámek, Z., Gomerčić, T. (2014): Multilingual dictionary for the fisheries profession. Veterinarski fakultet, Sveučilište u Zagrebu. 732pp. (in Croatian, Latin, English and Czech)

Ferenczi, L. (2018): Water management in medieval Hungary. pp. 238-252. In: Laszlovszky, J., Nagy, B., Szabó, P., Vadas, A. (eds.), The Economy of Medieval Hungary. East Central and Eastern Europe in the Middle Ages, 450-1450. Vol. 49. Brill. 640pp.

Filić, K. (1968): Varaždinski mesarski ceh: zapisnici ceha od godine 1589. do uključivo godine 1708 (Varaždin butchers' guild: guild records from 1589 to 1708). Povijesni spomenici grada Varaždina: Cehovski spisi. Knjiga I. Novinsko izdavačko i štamparsko poduzeće Varaždin. 431pp. (in Croatian and Latin)

Gajer, R. (1978): Posjedi zagrebačkog kaptola oko Zagreba u prvoj polovici 14. st. (The Zagreb Chapter's estates around Zagreb in the first half of the 14th century). Radovi Zavoda za hrvatsku povijest Filozofskoga fakulteta Sveučilišta u Zagrebu. 11,1, 5-102. (in Croatian)

Gönczi, F. (1995): Međimurje: ljudi, vjerovanja, običaji (Međimurje: people, beliefs, customs). Chak Čakovec. Tiz Zrinski Čakovec. 166pp. (in Croatian)

Herkov, Z. (1956a): Građa za financijsko-pravi rječnik feudalne epohe Hrvatske (Materials for a financial and legal dictionary of the feudal era of Croatia). Prvi svezak. Jugoslavenska akademija znanosti i umjetnosti. Zagreb. 535pp. (in Croatian and Latin)

Herkov, Z. (1956b): Građa za financijsko-pravi rječnik feudalne epohe Hrvatske (Materials for a financial and legal dictionary of the feudal era of Croatia). Drugi svezak. Jugoslavenska akademija znanosti i umjetnosti. Zagreb. 620pp. (in Croatian and Latin)

Herkov, Z. (1973): Naše stare mjere i utezi – Uvod u teoriju povijesne metrologije i njezin praktična primjena pri proučavanju naše gospodarske povijesti (Our old measures and weights – An introduction to the theory of historical metrology and its practical application in the study of our economic history). Školska knjiga, Zagreb. 132pp. (in Croatian)

Herkov, Z. (1974): Prinosi za upoznavanje naših starih mjera za dužinu i površinu (Contribution to the understanding of our old measures for length and area). Zbornik Odsjeka za povijesna znanosti Zavoda za povijesne i društvene znanosti Hrvatske akademije znanosti i umjetnosti. 1, 61-151. (in Croatian with a German abstract)

Hirtz, M. (1956): Rječnik narodnih zooloških naziva. Knjiga treća – Ribe (Pisces) (Dictionary of national zoological names. Book Three – Fish (Pisces)). Jugoslavenska akademija znanosti i umjetnosti. 478pp. (in Croatian)

Hoffmann, R. C. (1995): Environmental change and the culture of common carp in medieval Europe. Guelph Ichthyol. Rev. 3, 57-85.

Hoffmann, R. C. (1996): Economic development and aquatic ecosystems in Medieval Europe. The American Historical Review. 101,3, 631-669.

Hoffmann, R. C. (1999): Fish and Man: Changing Relations in Medieval Central Europe. Beiträge zur Mittelalterarchäologie in Österreich. 15, 187-197.

Hoffmann, R. C. (2002): Carp, cods, connections – new fisheries in the medieval European economy and environment. pp.3-56. In: Henninger-Voss, M. J. (ed.), Animals in Human Histories: The Mirror of Nature and Culture. 475 pp

Hoffmann, R. C. (2023): The catch: environmental history of medieval European fisheries. Cambridge University Press 556 pp

Janeš, A. (2014): Burg Cesargrad: povijesno-arheološka analiza (Burg Cesargrad: historical and archaeological analysis). Portal: godišnjak Hrvatskoga restauratorskog zavoda, 5, 35-47. (in Croatian) https://doi.org/10.17018/portal.2014.3

Janeš, A., Sekulić, P. (2014): Rudina i Bijela: benediktinski samostani kasnosrednjovjekovne Slavonije (Rudina and Bijela: Benedictine monasteries of late medieval Slavonia). Starohrvatska prosvjeta, 3,41, 185-203. (in Croatian)

Kampuš, I., Karaman, I. (1994): Tisućljetni Zagreb: od davnih naselja do suvremenog velegrada (A thousand year old Zagreb: from ancient settlements to a modern metropolis). Školska knjiga, Zagreb. 499pp. (in Croatian)

Kapustić, S. (1977): Prilog istraživanju gospodarske povijesti Varaždina (Contribution to the research of the economic history of Varaždin). Journal of Information and Organizational Sciences, 1, 45-69. (in Croatian)

Karbić, M., Škreblin, B. (2013): Grad na rijeci ili pored nje: srednjovjekovni Zagreb i rijeka Sava (A city on or next to a river: medieval Zagreb and the Sava River). In: Ostajmer, B., editor, Rijeka Sava u povijesti: Zbornik radova znanstvenog skupa održanog u Slavonskom brodu 18.-19. listopada 2013. Hrvatski institut za

© 2026 The Authors. Croatian Jounal of Fisheires by the University of Zagreb Faculty of Agriculture. This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

povijest–Podružnica za povijest Slavonije, Srijema i Baranje, p. 163-179. (in Croatian)

Katušić, M. (2013): Regesti isprava 16. stoljeća iz arhiva Hrvatske akademije znanosti i umjetnosti. Sedmi dio: Isprave iz razdoblja 1558.-1559 (Abstracts of 16th century documents from the archives of the Croatian Academy of Sciences and Arts. Part Seven: Documents from the period 1558-1559). Papers and Proceesings of the Department of Historical Research of the Institute of Historical and Social Research of Croatian Academy of Sciences and Arts. 13, 313-333. (in Latin and Croatian)

Katušić, M. (2014): Regesti isprava 16. stoljeća iz Arhiva Hrvatske akademije znanosti i umjetnosti. Osmi dio: isprave iz razdoblja 1560.-1562. (Abstracts of 16th century documents from the Archives of the Croatian Academy of Sciences and Arts. Part Eight: Documents from the Period 1560-1562). Papers and Proceesings of the Department of Historical Research of the Institute of Historical and Social Research of Croatian Academy of Sciences and Arts. 32, 263-290. (in Latin and Croatian)

Klaić, V. (1917): Acta Keglevichiana, annorum 1322-1527: najstarije isprave porodice Keglevića do boja na Muhačkom polju (the oldest documents of the Keglević family until the battle on Muhačko polje). Monumenta spectantia historiam Slavorum meridionalium. Knjiga 42. Zagreb. 129pp. (in Latin and Croatian)

Kolenc, M., Piplica, A., Čelhar, M., Trbojević Vukičević, T., Đuras, M., Vrbanac, Z., Korpes, K. (2024): Bird Exploitation and Chicken Size in the Late Medieval and Early Modern Periods in Continental Croatia. Quaternary, 7, 3, 30. https://doi.org/10.3390/quat7030030

Korpes, K., Piplica, A., Đuras, M., Trbojević Vukičević, T., Kolenc, M. (2024): Exploitation of pigs during the Late Medieval and Early Modern Period in Croatia. Heritage, 7, 2, 1014-1027. https://doi.org/10.3390/heritage7020049

Korpes, K., Trbojević Vukičević, T., Đuras, M., Kolenc, M., Piplica, A. (2025): Archaeozoological insights into the husbandry of domestic ruminants at monastic and noble sites in medieval Croatia. Quaternary, 8, 3, 51. https://doi.org/10.3390/quat8030051

Kostrenčić, M., Deanović, M., Gortan, V., Herkov, Z., Novak, V., Tadić, J., Kos, M., Grošelj, M., Blaznik, P., Marinović, A., Modrić, R., Otorepec, B., Stipišić, J., Šamšalović, M. (1975): *Lexicon Latinitatis medii aevi Iugoslaviae* (Dictionary of Medieval Latin of Yugoslavia). Fasciculus V (O-P). Consilium Academiarum Scientiarum et Artium SFR Iugoslaviae. Editio Academiae scientiarum et artium Slavorum meridionalium. Zagrabiae. 771-945pp. (in Latin and Croatian)

Kostrenčić, M., Deanović, M., Gortan, V., Herkov, Z., Novak, V., Tadić, J., Kos, M., Grošelj, M., Blaznik, P., Marinović, A., Modrić, R., Otorepec, B., Stipišić, J., Šamšalović, M. (1978): *Lexicon Latinitatis medii aevi Iugoslaviae* (Dictionary of Medieval Latin of Yugoslavia). Fasciculus VII (Subarrare – Z et Indices). Consilium Academiarum Scientiarum et Artium SFR Iugoslaviae. Editio Academiae scientiarum et artium Slavorum meridionalium. Zagrabiae. 1135-1362pp. (in Latin and Croatian)

Križaj, L (2017): Tezaurus spomeničkih vrsta: podatkovni standard u inventarima graditeljske baštine (Thesaurus of Monument Types: Data Standard in Inventories of Built Heritage). Mala biblioteka Godišnjaka zaštite spomenika kulture Hrvatske, Svezak 18. Ministarstvo kulture RH, Uprava za zaštitu kulturne baštine. Printera grupa d.o.o. 155pp. (in Croatian)

Laszowski, E. (1902): Popis i procjena dobara kneza Stjepana Frankopana-Ozaljskoga god. 1558 (Inventory and valuation of the estates of Duke Stjepan Frankopan-Ozaljski in 1558). Starine. Knj. 30. 177-211. (in Latin and Croatian)

Laszowski, E. (1904a): Povjesni podaci o obitelji Vragovića Maruševačkih (Historical data about the Vragović Maruševački family). Vjesnik Arheološkog muzeja u Zagrebu. 7,1, 203-206. (in Croatian)

Laszowski, E. (1904b): Povjesni spomenici Plem. Općine Turopolja. Svezak I. God. 1225.-1466. (Historical monuments of the Noble Municipality of Turopolje. Volume I. Year 1225-1466). Monumenta historica nobilis communitatis Turopolje. Tisak Antuna Scholza. 699pp. (in Latin and Croatian)

Laszowski, E. (1908): Povjesni spomenici Plem. Općine Turopolja. Svezak IV. God. 1560.-1895. (Historical monuments of the Noble Municipality of Turopolje. Volume IV. Year 1560-1895). Monumenta historica nobilis communitatis Turopolje. Tisak Antuna Scholza. 699pp. (in Latin and Croatian)

Laszowski, E. (1951): Građa za gospodarsku povijest Hrvatske u XVI. I XVII. stoljeću - Izbor isprava velikih feuda Zrinskih i Frankopana (Materials for the economic history of Croatia in the 16th and 17thcenturies - A selection of documents from the large fiefs of the Zrinski and Frankopan families). Građa za gospodarsku povijest Hrvatske. Knjiga 1 (urednik Mirković, M.). Jugoslavenska akademija znanosti i umjetnosti. Zagreb. 189pp. (in Croatian and Latin)

Lopašić, R. (1894a): Urbaria lingua croatica conscripta: Hrvatski urbari. Svezak I. Monumenta Historico-Juridica Slavorum Meridionalium (Croatian urbariums. Volume I. Monumenta Historico-Juridica Slavorum Meridionalium). Vol. V. Jugoslavenska Akademija. Tisak dioničke tiskare. 484pp. (in Latin and Croatian)

Lopašić, R. (1894b): Oko Kupe i Korane – mjestopisne i povjestne crtice (Around the Kupa and Korana Rivers – Topographical and Historical Sketches). Naklada Matice Hrvatske. Tisak Karla Albrechta. 324pp. (in Croatian)

Modrić, R. (1974): Povijesni spomenici obitelji Zrinskih i Frankopan – Vol. 1: Popisi i procjena dobara (1672-1673) (Historical Monuments of the Zrinski and

© 2026 The Authors. Croatian Jounal of Fisheires by the University of Zagreb Faculty of Agriculture. This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Frankopan Families – Vol. 1: Inventory and Valuation of Property (1672-1673)). Djela Jugoslavenske akademije znanosti i umjetnosti, Knjiga 55 (Ur. Kostrenčić, M.). Izdavački zavod Jugoslavenske akademije, Zagreb. 410pp. (in Latin)

Morales-Muñiz, A. (2014): Ichthyoarchaeology. pp. 3648-3659. In: Smith, C. (ed) Encyclopedia of Global Archaeology. Springer, New York, NY. https://doi.org/10.1007/978-1-4419-0465-2_2124. 8013pp.

Nash, C. E. (2011): The history of aquaculture. Wiley-Blackwell. 227pp.

Pálosfalvi, T. (2014): The Noble Elite in the County of Körös (Križevci) 1400-1526. MTA Bölcsészettudományi Kutatóközpont, Történettudományi Intézet. Budapest. 526pp.

Pavleš, R. (2013): Ljudi i rijeka Drava u srednjem vijeku na sjeverozapadu Križevačke županije (People and the Drava River in the Middle Ages in the Northwest of Križevci County). Podravina: časopis za multidisciplinarna istraživanja, 12, 24, 46-56. (in Croatian)

Pisk, S. (2015): Plemstvo Križevačke županije i pavlini samostana Blažene Djevice Marije na Gariću: izabrani primjeri (The nobility of Križevci County and the Pauline monks of the Monastery of the Blessed Virgin Mary on Garić: selected examples). Cris: Časopis Povijesnog društve Križevci. XVII, 1, 108-115. (in Croatian)

Puntijar, M., Puntijar, Z. (2008): Kuharska knjiga Čakovećkog dvora obitelji Zrinski iz vremena Nikola Zrinskog - ban hrvatski 1646.-1664. (Cookbook of the Čakovec court of the Zrinski family from the time of Nikola Zrinski - Croatian Ban 1646-1664). U. O. Stari Puntijar. LKDL-dizajn, Zagreb. 77p. (in Croatian and English)

Riđanović, J. (1983). Hidrogeografski značajke SR Hrvatske (Hydrogeographical characteristic of SR Croatia). Hrvatski geografski glasnik. 45, 1, 33-41. (in Croatian)

Sladović, M. (1856): Povĕsti biskupijah senjske i modruške ili krbavske (History of the dioceses of Senj and Modruška or Krbava). Tisak austrianskoga lloyda, Trst. 452pp. (in Croatian and Latin)

Smičiklas, T. (1905): *Codex diplomaticus Regni Croatiae, Dalmatiae et Slavoniae* (Diplomatic Proceedings of the Kingdom of Croatia, Dalmatia and Slavonia). Volume III: Charters from the years 1201-1235. Jugoslavenska akademija znanosti i umjetnosti. Tisak dioničke tiskare, Zagreb. 538pp. (in Latin and Croatian)

Smičiklas, T. (1906): *Codex diplomaticus regni Croatiae, Dalmatiae et Slavoniae* (Diplomatic Proceedings of the Kingdom of Croatia, Dalmatia and Slavonia). Volume IV: Charters from the years 1236-1255. Jugoslavenska akademija znanosti i umjetnosti. Tisak dioničke tiskare, Zagreb. 647pp. (in Latin and Croatian)

Smičiklas, T. (1907): *Codex diplomaticus regni Croatiae, Dalmatiae et Slavoniae* (Diplomatic Proceedings of the Kingdom of Croatia, Dalmatia and Slavonia). Volume V: Charters from the years 1256-1272. Jugoslavenska akademija znanosti i umjetnosti. Tisak dioničke tiskare, Zagreb. 770pp. (in Latin and Croatian)

Smičiklas, T. (1908): *Codex diplomaticus regni Croatiae, Dalmatiae et Slavoniae* (Diplomatic Proceedings of the Kingdom of Croatia, Dalmatia and Slavonia). Volume VI: Charters from the Years 1272-1290. Jugoslavenska akademija znanosti i umjetnosti. Tisak dioničke tiskare, Zagreb. 815pp. (in Latin and Croatian)

Smičiklas, T. (1910): *Codex diplomaticus regni Croatiae, Dalmatiae et Slavoniae* (Diplomatic Proceedings of the Kingdom of Croatia, Dalmatia and Slavonia). Volume VIII: Charters from the years 1301-1320. Jugoslavenska akademija znanosti i umjetnosti. Tisak dioničke tiskare, Zagreb. 496pp. (in Latin and Croatian)

Smičiklas, T. (1911): *Codex diplomaticus regni Croatiae, Dalmatiae et Slavoniae* (Diplomatic Proceedings of the Kingdom of Croatia, Dalmatia and Slavonia). Volume IX: Charters from the years 1321-1331. Jugoslavenska akademija znanosti i umjetnosti. Tisak dioničke tiskare, Zagreb. 678pp. (in Latin and Croatian)

Smičiklas, T. (1912): *Codex diplomaticus regni Croatiae, Dalmatiae et Slavoniae* (Diplomatic Proceedings of the Kingdom of Croatia, Dalmatia and Slavonia). Volume X: Charters from the Years 1332-1342. Jugoslavenska akademija znanosti i umjetnosti. Tisak dioničke tiskare, Zagreb. 777pp. (in Latin and Croatian)

Smičiklas, T. (1913): *Codex diplomaticus regni Croatiae, Dalmatiae et Slavoniae* (Diplomatic Proceedings of the Kingdom of Croatia, Dalmatia and Slavonia). Volume XI: Charters from the years 1342-1350. Jugoslavenska akademija znanosti i umjetnosti. Tisak dioničke tiskare, Zagreb. 734pp. (in Latin and Croatian)

Smičiklas, T., Kostrenčić, M., Laszowski, E. (1915): *Codex diplomaticus regni Croatiae, Dalmatiae et Slavoniae* (Diplomatic Proceedings of the Kingdom of Croatia, Dalmatia and Slavonia). Volume XIII: Charters from the years 1360-1366. Jugoslavenska akademija znanosti i umjetnosti. Tisak dioničke tiskare, Zagreb. 764pp. (in Latin and Croatian)

Smičiklas, T., Kostrenčić, M. (1916): *Codex diplomaticus regni Croatiae, Dalmatiae et Slavoniae* (Diplomatic Proceedings of the Kingdom of Croatia, Dalmatia and Slavonia). Volume XIV: Charters from the Years 1367-1373. Jugoslavenska akademija znanosti i umjetnosti. Tisak dioničke tiskare, Zagreb. 608pp. (in Latin and Croatian)

Smičiklas, T., Kostrenčić, M. (1934): *Codex diplomaticus regni Croatiae, Dalmatiae et Slavoniae* (Diplomatic Proceedings of the Kingdom of Croatia, Dalmatia and Slavonia). Volume XV: Charters from the Years 1374-1378. Jugoslavenska akademija znanosti i umjetnosti. Tisak dioničke tiskare, Zagreb. 556pp. (in Latin and Croatian)

Smičiklas, T., Kostrenčić, M., Stipišić, J., Šamšalović, M. (1976): *Codex diplomaticus regni Croatiae, Dalmatiae et Slavoniae* (Diplomatic Proceedings of the Kingdom of Croatia, Dalmatia and Slavonia). Volume XVI:

© 2026 The Authors. Croatian Jounal of Fisheires by the University of Zagreb Faculty of Agriculture. This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Charters from the Years 1379-1385. Jugoslavenska akademija znanosti i umjetnosti. Zagreb. 655pp. (in Latin and Croatian)

Smičiklas, T., Rendić-Miočević, D., Samsalović, M. (1990): *Codex diplomaticus regni Croatiae*, *Dalmatiae et Slavoniae* (Diplomatic Proceedings of the Kingdom of Croatia, Dalmatia and Slavonia). Volume XVIII: Charters from the Years 1385-1399. Jugoslavenska akademija znanosti i umjetnosti. Zagreb. 643pp. (in Latin and Croatian)

Stingl, S. (2022): Prehrana kasnosrednjovjekovnih elita na primjeru troškovnika zagrebačkog biskupa Osvalda Thúza iz 1481. i 1482. godine (The diet of late medieval elites based on the example of the expense account of Zagreb bishop Osvald Thúz from 1481 and 1482). Zbornik Odsjeka za Povijesne Znanosti. Zavoda za Povijesne i Društvene Znanosti, 40, 39-73. (in Croatian)

Stingl, S. (2025): Fish on the Bishop's table. The analysis of dana regarding the procurement and cosumption of fish by Oswald Túz, Bishop of Zagreb. pp. 126-135. In: Ožanić Roguljić, I., Bedić, Ž, Raičković Savić, A. (eds.), Eating and Drinking along Ancient Roads and Rivers: Study Opportunities, Archaeological Sources and Open Issues about Diet Habits, Roads and rivers 3. Archaeopress archaeology. 152pp.

Šišić, F. (1918): Dva ljetopisa XVII. vijeka (Two 17th century chronicles). pp. 352-389. In: Šišić, F. (ed.), Starina, Knjiga XXXVI. Jugoslavenska akademija znanosti i umjetnosti. Tisak nadbiskupske tiskare u Zagrebu. 429pp. (in Croatian and Latin)

Taborska, M. (2019): Treatise by Olbrycht Strumieński (1573)—The First Polish Book on Hydraulic Engineering. Journal of Physical Science and Application, 9, 2, 30-38.

Tkalčec, T., Trbojević Vukičević, T. (2013): Diatery habits at Vrbovec Castle in NW Croatia: archaeozoological evidence. pp. 362-x. In: Turek, J. (ed.), Book of Abstracts: 19th Annual Meeting of European Association of Archaeologists, 2013, Pilsen. Plzeň: University of Bohemia in Pilsen.

Tkalčec, T., Trbojević Vukičević, T. (2021): Archaeozoological evidence of dietary habits of small castle inhabitants in the medieval Slavonia. pp. 124-152. In: Pisk, S. (ed.), Castrum Bene 16, Castle and Economy: Proceedings of the 16th International Castellological Conference, Conference Kutina – Sisak, Sisak-Moslavina County, Croatia May 21st – 25th 2019, 152pp.

Tkalčić, I. K. (1873): *Monumenta historica episcopatus Zagrabiensis* (Historical monuments of the Zagreb Diocese in the 12th and 13th centuries). Book one. Tisak Karla Albrechta, Zagreb. 280pp. (in Latin and Croatian)

Tkalčić, I. K. (1889): *Monumenta historica liberae regiae civitatis Zagrabiae metropolis regni Dalmatiae, Croatiae et Slavoniae* (Historical monuments of the free royal city of Zagreb, the capital of the Kingdom of Dalmatia-Croatia-Slavonia). Volume one (documents: 1093-1399). Brzotisak K. Albrechta, Zagreb. 519pp. (in Latin and Croatian)

Tkalčić, I. K. (1905): *Monumenta historica liberae regiae civitatis Zagrabiae metropolis regni Dalmatiae, Croatiae et Slavoniae* (Historical monuments of the free royal city of Zagreb, the capital of the Kingdom of Dalmatia-Croatia-Slavonia). Volume Eleven (Estate Books: 1471-1526; Property Lists and Accounts: 1368-1521). Brzotisak K. Albrechta (Maravić i Dečak), Zagreb. 352pp. (in Latin and Croatian)

Trbojević Vukičević, T., Frančić, S., Kužir, S. (2010): Analiza životinjskih kostiju iz srednjovjekovnog burga Vrbovca u Klenovcu Humskome. pp. 234-246. In: Burg Vrbovec u Klenovcu Humskome: deset sezona arheoloških istraživanja. Zagreb: Muzeji Hrvatskog zagorja, Institut za arheologiju, 2010. (in Croatian with English abstract).

Trbojević Vukičević, T., Korpes, K., Đuras, M., Vrbanac, Z., Javor, A., Kolenc, M. (2023): Paleopathological changes in animal bones from Croatian archaeological sites from Prehistory to New Modern Period. Veterinary Sciences, 10, 5, 361.

Trbojević Vukičević, T., Štilinović, A. (2008): Arheozoološka analiza kostiju s utvrde Čanjevo. Utvrda Čanjevo - istraživanja 2003-2007. pp. 253-259. In: Visoko, Zagreb: Općina Visoko, Hrvatski restauratorski zavod Vlade Republike Hrvatske, 2008. (in Croatian with English abstract)

Varga, D. (2016): Hrana, kuhinja i blagovanje u doba Zrinskih: život na zrinskim dvorovima, utvrdama i vlastelinstvima u 16. i 17. stoljeću, s knjigama recepata (Food, cuisine and dining in the time of the Zrinskis: life at the Zrinski courts, fortresses and manors in the 16thand 17th centuries, with recipe books). Izdavačka kuća MERIDIJANI. 495pp. (in Croatian)

Vručina, P. (2021): Kako gospodariti vodam u srednjem vrijeku? Primjer Zagrebačkog kaptola i njegovih vlastelinstava u 14. i 15. stoljeću (How to manage water in the Middle Ages? The example of the Zagreb Chapter and its estates in the 14th and 15th centuries). Miscellanea Hadriatica et Mediterranea. 8, 33-64. (in Croatian)

Zatykó, C. (2011): Aspects of fishing in medieval Hungary. pp. 399-408. In: Klápšte, J., Sommer, P. (eds.), Food in the Medieval Rural Environment: Processing, Storage, Distribution of Food. Ruralia VIII, 7th-12th September 2009 Lorca, Spain, 433pp.

Zeuner, F. E. (1963): A history of domesticated animals. Hutchinson & Co. Ltd. 560pp.

Zohar, I., Morales-Muñiz, A., Roselló-Izquierdo, E., Fernández-Jalvo, Y., Frontini, R. (2025): Taphonomy through fisheyes: an historical and methodological overview. Archaeological and Anthropological Sciences, 17, 6, 128.

© 2026 The Authors. Croatian Jounal of Fisheires by the University of Zagreb Faculty of Agriculture. This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.