

Fish and Fishing Strategies on the Southern Baltic Seacoast during the 5th to 4th Millennium B.C.: New Archaeoichthyological Data from the Settlement at Dąbki, Poland

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ABSTRACT: This article presents the results of the analysis of fish remains from the Stone Age site at Dąbki, situated on the western part of the coast of northern Poland. Most of the archaeoichthyological samples were excavated from an inshore refuse layer in a peat bog and some samples were from a protoneolithic¹ settlement on the former lake shore. A total of 18 ichthyological taxa were identified—16 freshwater and 2 migratory. The study showed that, despite the site's relatively close proximity to the seacoast, the fishing economy had a local character and probably concentrated on the freshwaters of the nearest lake.

KEYWORDS: ATLANTIC PERIOD, STONE AGE, PROTONEOLITHIC, BALTIC SEA, FISHERY

RESUMEN: Este artículo presenta un análisis de los restos de peces recuperados en el yacimiento paleolítico de Dąbki, localizado en la parte occidental de la costa septentrional polaca. La mayor parte de las muestras arqueoictiológicas fueron excavadas en una capa de desechos tierra adentro en un pantano en tanto que algunas muestras procedían de un asentamiento protoneolítico localizado en una antigua costa lacustre. Un total de 18 taxones ictiológicos fueron identificados; de éstos, 16 eran dulceacuícolas y 2 migradores. El estudio evidenció que, a pesar de la proximidad del asentamiento a la costa del mar, la economía piscícola en este yacimiento presentaba un carácter local concentrándose muy probablemente en las aguas dulces del lago más próximo.

PALABRAS CLAVE: PERIODO ATLÁNTICO, EDAD DE PIEDRA, PROTONEOLÍTICO, MAR BÁLTICO, PESQUERÍA

¹ The early stages in the adoption of characteristic Neolithic traits, primarily the manufacture of pottery and then animal and plant domestication.

INTRODUCTION

Dąbki is situated on the western part of the coast of northern Poland, on a headland surrounded by a peat bog, 800 m from Lake Bukowo and about 1.5 km from the present-day coastline of the Baltic Sea (Figure 1). Site 9 at Dąbki was discovered in 1977. The first excavations were conducted in 1978 to 1985, headed by J. Ilkiewicz (1985, 1989, 1997) of the former District Museum in Koszalin. Excavations at the site were renewed in 2004 and 2005 as an interdisciplinary Polish-German project to study the cultural development of

the areas on both sides of the Odra River during the Late Glacial and Early Holocene. This project was headed by J. Kabaciński from the Institute of Archaeology and Ethnology, Polish Academy of Science in Poznań, and by T. Terberger from the History and Prehistory Department, University of Greifswald.

Based on a series of radiocarbon dates, the chronology of the settlement was determined to the second half of the Atlantic period, ca. 5100-3600 cal B.C. (Ilkiewicz, 1997: 163; Kabaciński *et al.*, 2007: 47). According to the archaeological data, the site was in use by local protoneolithic

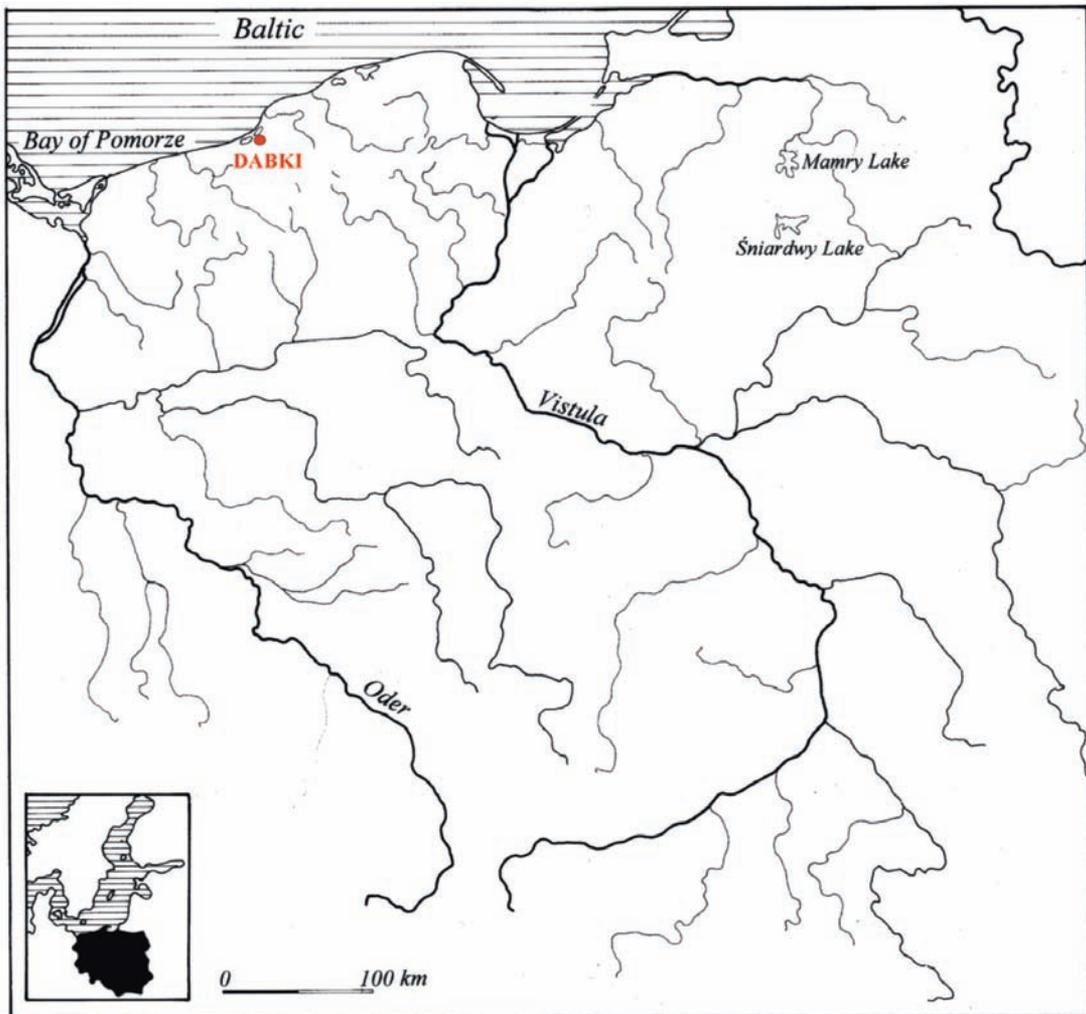


FIGURE 1

Location of Site 9 at Dąbki, Darłowo district, West Pomerania province, Poland.

groups related to the Late Ertebølle and the subsequent Funnel Beaker cultures.

One of the most numerous finds at the site was fish remains. The ichthyological material recovered during the first phase of excavation was identified by Iwaszkiewicz (1985) and Makowiecki (2003). Because of the detailed methodologies of excavation and documentation undertaken in the current project, broad-scale studies of the fish fauna, fishery, and fishing procurement strategies were possible. Therefore, the numerous fish remains excavated in the 2004 and 2005 field seasons were subjected to a detailed analysis.

During the Atlantic period, Lake Bukowo was larger and more ramified than today. The settlement was located on a former lake shore, probably near the place where the river, presently called Grabowa River, flowed into the currently overgrown part of the lake. Conditions for fishing must have been favorable there, because fish often concentrate at such places when passing from one basin to the other (e.g., Noe-Nygaard, 1995). Moreover because of the site's relatively close proximity to the coast (about 3-4 km at the time of the Littorina Sea), the possibility of a marine fishery cannot be dismissed. The fact, however, that most of the fish bones were recovered from the peat bog necessitated considering the possibility of

a natural deposition of the fish remains (Noe-Nygaard, 1987; Grudniewski, 1991: 147, 155). Two important objectives of the new research were to determine: a) whether the fish bone layer had arisen as a result of human activities or of natural causes; and b) whether the ichthyological material was related to the fishery, and if so, what was the fishing strategy used.

MATERIALS AND METHODS

As a part of the new research, several samples excavated from trenches 1/2004, 2/2004, 1/2005, and 2/2005 were chosen for detailed analysis. The samples were derived from three different parts of the site: the settlement, the former lake shore, and the peat bog (Figures 2 and 3). The recovery of the anthropogenic material was undertaken with detailed mapping. Trenches were divided into square meters which were subsequently divided into quarters: a, b, c, and d. The ichthyological material was recovered from each of the individual quarters by 10 cm arbitrary levels and was wet sieved using a 0.4-1 cm mesh.

Due to the detailed methods of excavation and documentation, differences in the distribution of

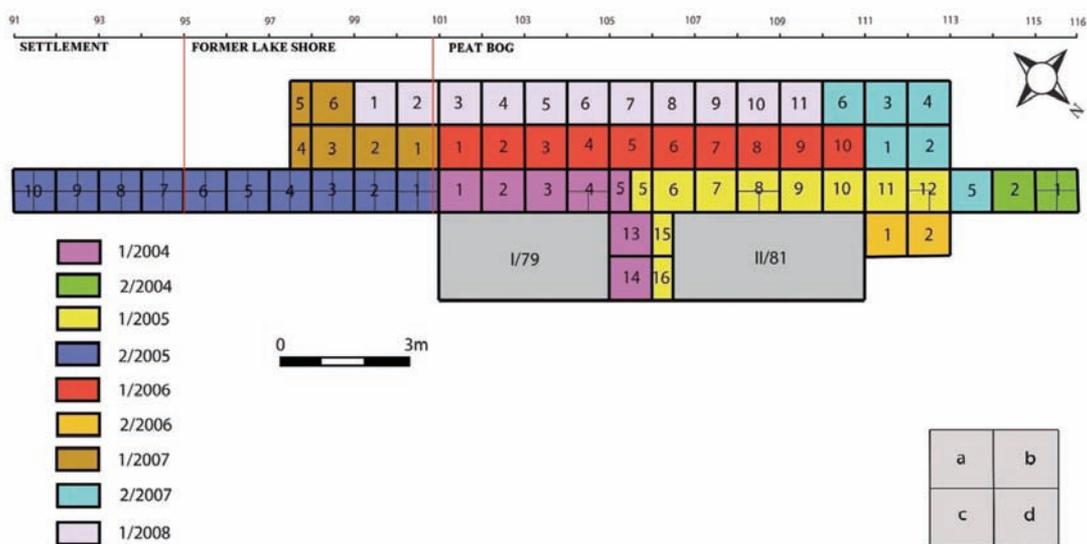


FIGURE 2

Dąbki, Site 9. Excavation plan with marked meters/quarters from which the fish remains were chosen for analysis (illustration after Kabaciński 2008, not published; modified by the author).

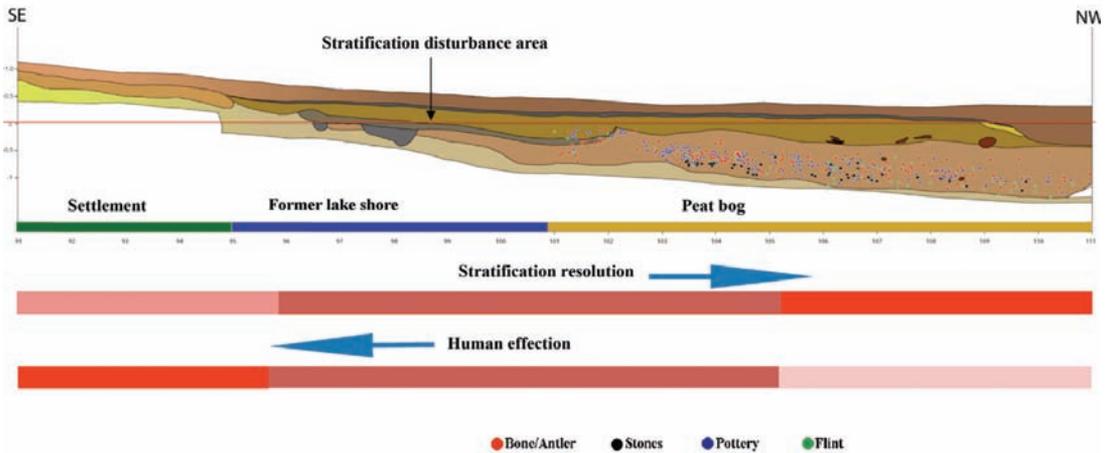


FIGURE 3

Dąbki, Site 9. NE profile of the site (illustration after Kabaciński 2008, not published; modified by the author).

species and of skeletal elements represented could be examined as well as distinctions between the terrestrial part of the site (i.e. the settlement and the former lake shore) and the peat bog. Such potential differences could be the result of fishing strategies or of preservation conditions in the mineral substratum and in the peat bog.

The ichthyological remains were subjected to macroscopic analysis according to the analytical procedures described in the works of Casteel (1976) and Wheeler & Jones (1989). The primary method for the identification of species and anatomical classification of bones was via a comparison of the archaeological remains with fish skeletons from the reference collections housed in the Laboratory for Environment Reconstruction, Institute of Archaeology, Nicolaus Copernicus University at Toruń and in the Zoological Museum, University of Copenhagen². One issue that was addressed was the skeletal representation of the fish remains; the nomenclature used was adopted from the following works: Urbanowicz (1956), Janec-Susłowska (1957), Lepiksaar (1981), Cannon (1987), Wheeler & Jones (1989),

² Laboratory research using this reference collection has been carried out under the project, Fish and Fishing in the Late Mesolithic site at Dąbki – south Baltic Sea (Poland), which had been completed thanks to the support of the SYNTHESYS Project <http://www.synthesys.info/> which is financed by the European Community Research Infrastructure Action under the FP7 «Capacities» Program.

Radue (1995), and Długosz & Demśka-Zakęś (1995, 1997).

Estimates of total lengths (TL) of the fish represented were mainly carried out on the basis of bone measurements according to Morales & Rosenlund (1979), Brinkhuizen (1989), Enghoff (1994), and comparisons of subfossil material with modern fish skeletons. Regression equations produced by Enghoff (1994) were used for estimating the total length of the European eel (*Anguilla anguilla*). For pike (*Esox lucius*), common bream (*Abramis brama*), perch (*Perca fluviatilis*), and pikeperch, or zander (*Sander lucioperca*), equations were derived by the author (Zabilska, in preparation). The results of the total length estimations were arranged into size classes, with 10 cm intervals for the larger species of fish, including pike, pikeperch, wels catfish (*Silurus glanis*), European eel, and salmon/trout (*Salmo* sp.); and 5 cm intervals for small and medium fishes, such as cyprinids (Cyprinidae), perch, and burbot (*Lota lota*).

RESULTS-TAXA AND SKELETAL ELEMENT REPRESENTATION

Due to favorable preservation conditions, 21,536 fish bones and 21,982 fish scales were identified. The collection contained 18 ichthyological taxa (Table 1).

FISHES	PISCES	NISP	%
FRESHWATER			
Pike	<i>Esox lucius</i> L.	1409	6,5
Common bream	<i>Abramis brama</i> (L.)	(610)	(2,8)
Tench	<i>Tinca tinca</i> (L.)	(35)	(0,2)
Roach	<i>Rutilus rutilus</i> L.	(25)	(0,1)
Rudd	<i>Scardinius erythrophthalmus</i> (L.)	(8)	(0,0)
Roach/Rudd	<i>Rutilus rutilus</i> L./ <i>Scardinius erythrophthalmus</i> (L.)	(13)	(0,1)
Asp	<i>Aspius aspius</i> (L.)	(1)	(0,0)
Crucian carp	<i>Carassius carassius</i> (L.)	(6)	(0,0)
Ide	<i>Leuciscus idus</i> (L.)	(1)	(0,0)
Vimba	<i>Vimba vimba</i> (L.)	(1)	(0,0)
Cyprinids unspecified	Cyprinidae	(15858)	(73,6)
Cyprinids Total	Cyprinidae Total	16558	76,9
Perch	<i>Perca fluviatilis</i> L.	(2045)	(9,5)
Pike perch	<i>Sander lucioperca</i> (L.)	(861)	(4,0)
Perches unspecified	Percidae	(527)	(2,4)
Perches Total	Percidae Total	3433	15,9
Wels catfish	<i>Silurus glanis</i> L.	14	0,1
Burbot	<i>Lota lota</i> (L.)	1	0,0
MIGRATORY			
Eel	<i>Anguilla anguilla</i> (L.)	32	0,1
Salmon/trout	<i>Salmo</i> sp.	89	0,4
IDENTIFIED fish		21536	100
UNIDENTIFIED fish		6208	
TOTAL (NISP)		27744	

TABLE 1

Dąbki, Site 9. List of fishes, number of their remains, and percentage in subfossil materials.

The majority of the identified fish remains, about 77%, came from cyprinids, which were mainly represented by common bream. Other species from this family were much less numerous. Skeletal elements identified of these fish included operculum, cleithrum, hyomandibular, atlas and axis vertebrae, basioccipital, and inferior pharyngeals. Estimated total lengths of the common bream represented were between 15-20 cm and 55-60 cm. It seems that the most frequently captured breams were between 35-40 cm and 40-45 cm in length.

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The remaining cyprinid bones were mostly vertebrae and fragmented cranium bones so that identification to species was difficult. The vertebrae, however, were assumed to derive mainly from common bream. Total length estimates showed that the cyprinids ranged in size classes from 10-15 cm and 65-70 cm, though the majority of the fish represented was about 35-40 cm in total length.

In addition to Cyprinidae, a significant number of Percidae remains were identified, represented

by perch and pikeperch. Bones of both latter species came from all anatomical components of the skeleton, though mostly from the vertebral column in the case of the perch remains, and from the anterior zonoskeleton and neurocranium for the pikeperch. Total length estimates of perch showed that the individuals represented ranged from 5-10 cm to 45-50 cm, but the most frequently identified bones were derived from fishes between 25-30 cm and 30-35 cm in length. Whereas the estimated total length for pikeperch was between 30-40 cm and 90-100 cm, the most numerous bones came from individuals 50-60 cm in length.

The next most frequent fish identified was pike which was represented by all anatomical components of the skeleton. The most commonly identified elements were vertebrae and some cranium bones, mostly from the mandibular arch and palatoquadrate. The pike specimens indicated that this fish ranged in length from 20-30 cm to 150-160 cm, though the majority represented was between 50-60 cm and 60-70 cm long.

Several catfish vertebrae, ribs, and cranial bones, such as quadrate, epihyal, and ceratohyal, were identified. The species, wels catfish (*Silurus glanis*), was the largest catfish identified, with total length estimates of all individuals represented over 100 cm and one even over 200 cm. Burbot was identified on the basis of one operculum which came from a small individual about 20-30 cm in total length.

In addition to freshwater species, two migratory fish taxa were identified: salmon/trout and European eel. Both taxa were mainly recognized on the basis of vertebrae and by single cranium elements. The majority of eel bones belonged to individuals measuring between 40-50 cm and 50-60 cm in total length. Salmon/trout was predominantly represented by individuals about 70-80 cm in total length.

Frequency of identified fish taxa differed in the terrestrial versus peat bog sections of the site (Figure 4). The majority of the fish bones identified in

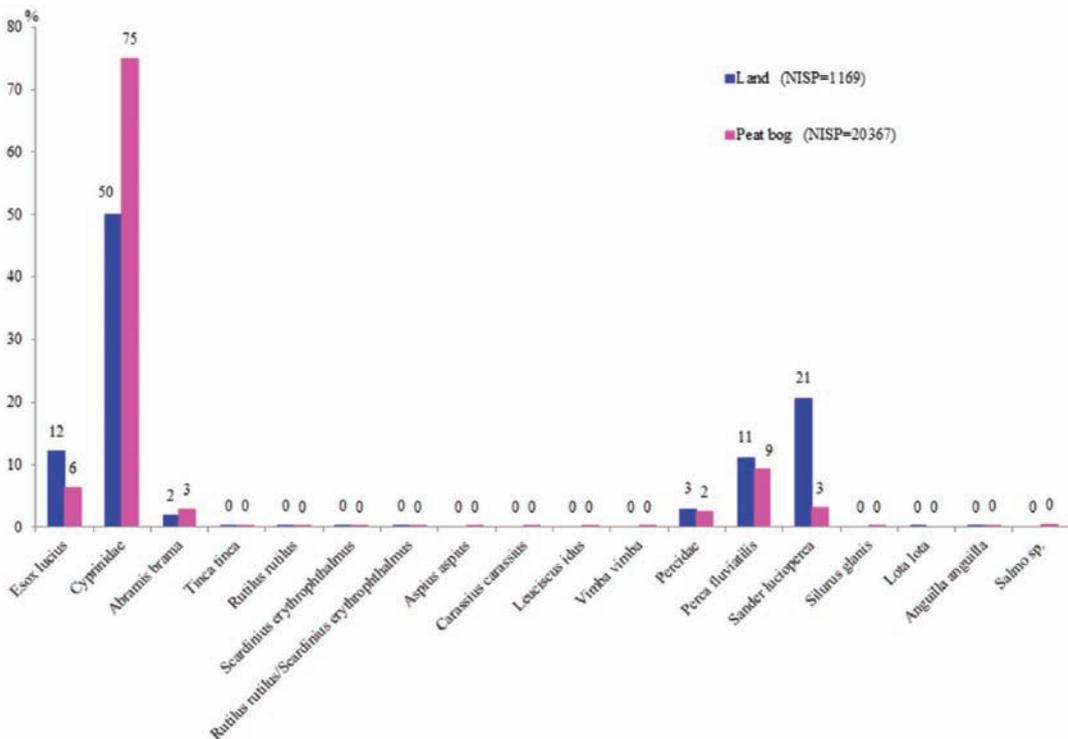


FIGURE 4

Dałki, Site 9. Land and peat bog zones. Percentage of fishes on the basis of bone remains.

both zones, 50% for the land component and 75% for the peat bog, were cyprinids. In both zones, the most frequently identified species of this family was common bream. The archaeoichthyological material from the land zone was characterized by a greater number of bones of the larger species of fish, such as pike and pikeperch. In the peat bog, on the other hand, there were more bones of smaller fishes, such as perch. Remains of catfish and salmon/trout were identified only in the samples from the peat bog. According to the anatomical composition of the remains, the majority of the bones excavated from the land component of the site were vertebrae (Figure 5), whereas a greater number of cranial elements were found in the peat bog (Figure 6). Finally, in the case of most species, the reconstruction of total lengths showed a predominance of larger-sized fish in the deposits from the land zone (Figures 7 and 8). The explanation for these phenomena is complicated. Both cultural behaviors, particularly fishing strategies, and the conditions of the deposition of the remains should be considered (see Discussion).

DISCUSSION

According to the stratigraphy of the site (see Figure 3), most of the fish remains was found in

the inshore refuse layer. This layer was about 50-100 cm thick and consisted of anthropogenic materials, including plant and animal remains, charcoal, pottery, flint, and organic artifacts. On the basis of the stratigraphy of the site, displacement of finds by sediment erosion to the lake can be dismissed. It appears that the nearest water body to the site was used for deposition of the settlement refuse. This kind of behavior is also known from other Stone Age sites, such as Ringkloster in Jutland, Denmark (Enghoff, 1994), and from several sites in the Åmose basin in Zealand, Denmark (Noe-Nygaard, 1995).

On the basis of the documented examples, as in Tłokowo (Makowiecki, 2003: 54-55), a fish bone layer resulting from natural deposition would have contained more complete skeletons. The research undertaken here, however, has shown that the bone material from Dąbki contained various elements of different fish skeletons. Furthermore, some of the fish bones excavated from the peat bog were burnt, and so there is no doubt that they were derived from settlement refuse, probably the result of remains from meals consumed by the residents of the settlement. Nevertheless, the possibility of the inclusion of fish that had died from natural causes cannot be completely rejected.

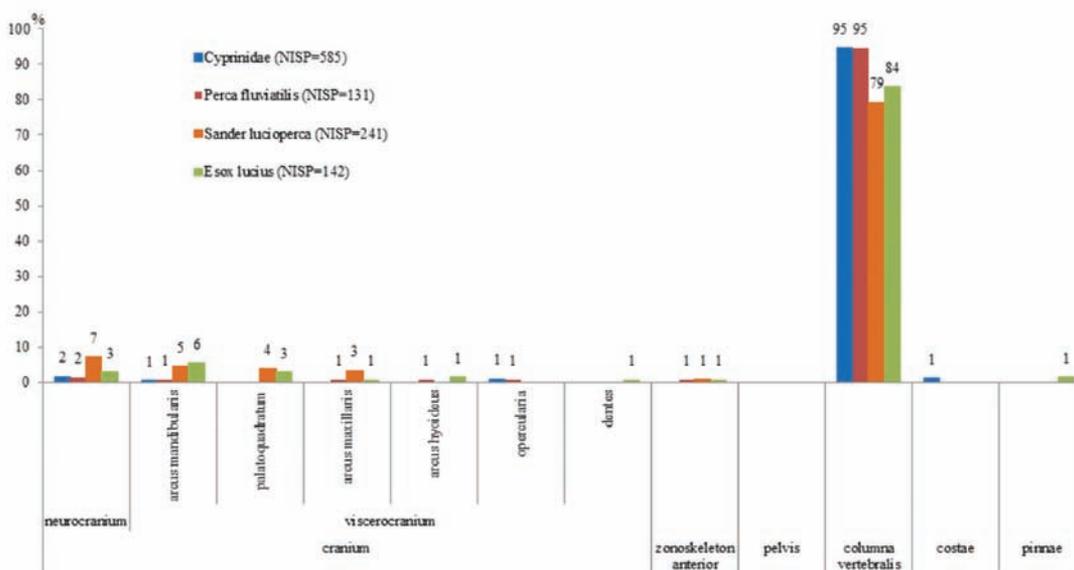


FIGURE 5

Dąbki, Site 9. Land zone. Percentage of bone distribution of cyprinids, perch, pikeperch, and pike according to bone groups.

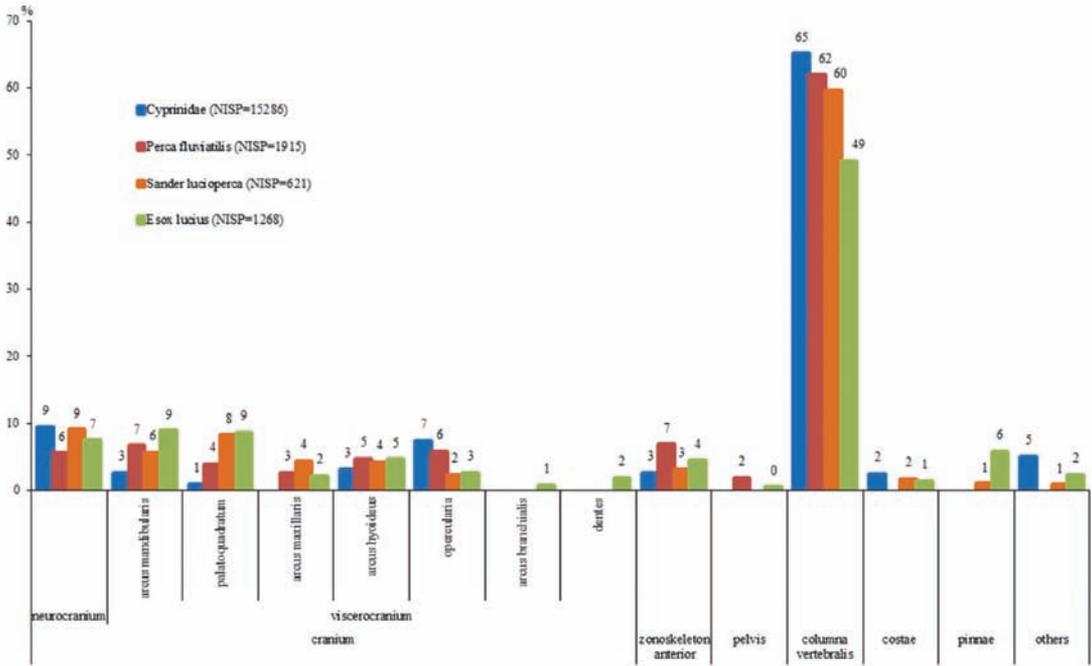


FIGURE 6

Dąbki, Site 9. Peat bog. Percentage of bone distribution of cyprinids, perch, pikeperch, and pike according to bone groups.

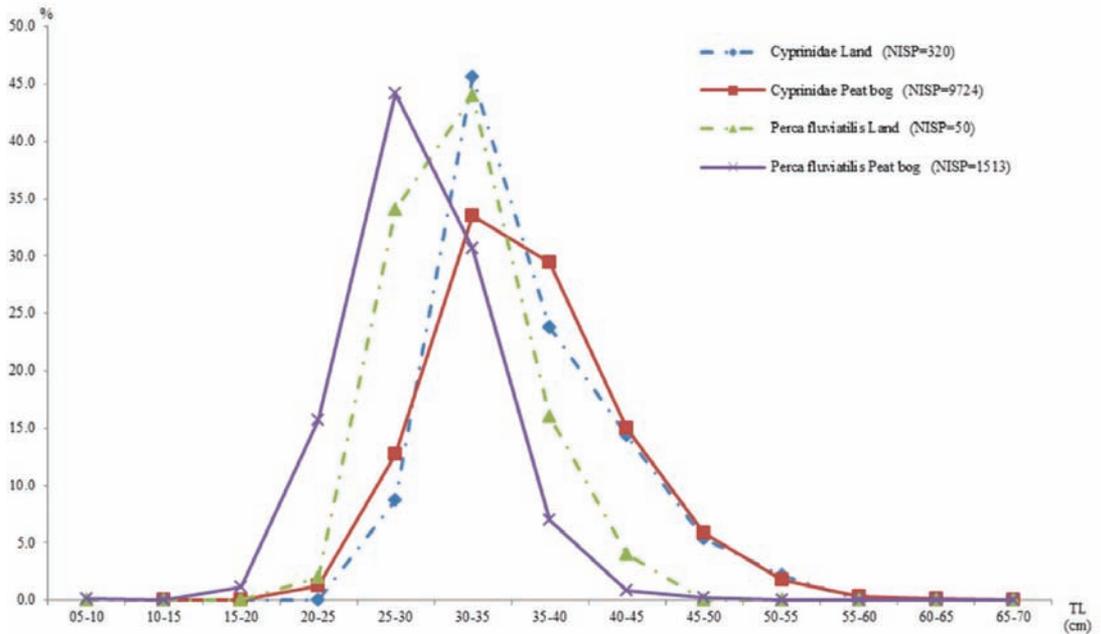


FIGURE 7

Dąbki, Site 9. Total length (TL) of cyprinids and perch.

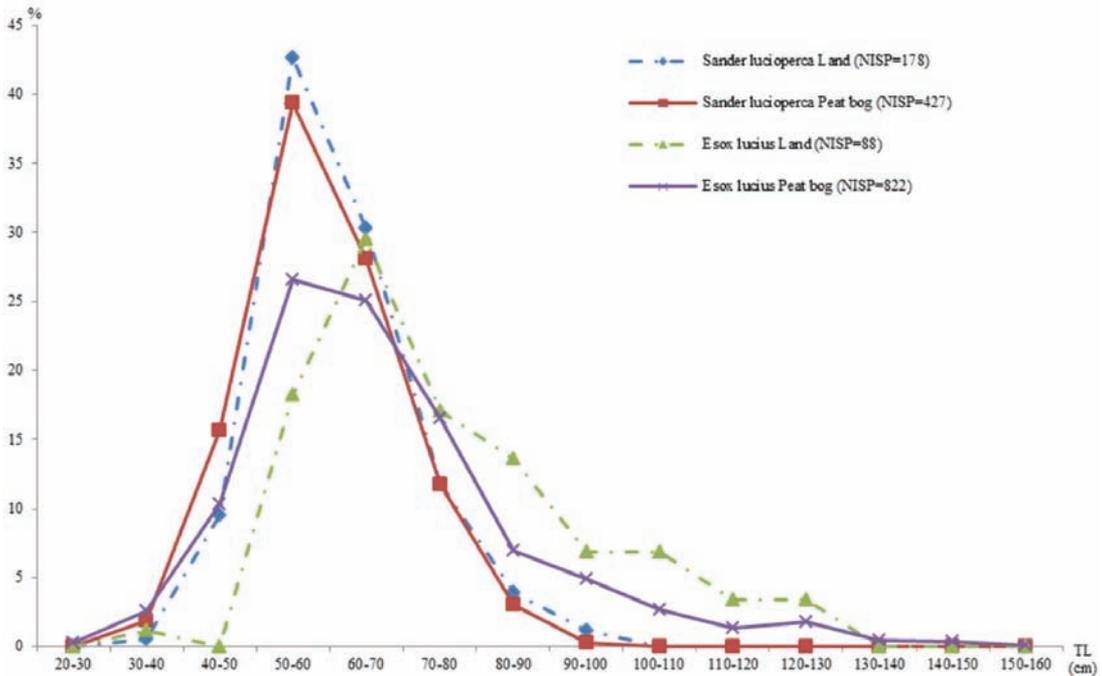


FIGURE 8

Dąbki, Site 9. Total length (TL) of pikeperch and pike.

Analysis of the fish material from Dąbki showed that the fishing economy during the 5th to 4th millennium B.C. was probably concentrated on freshwaters. Considering the location of the site with its close proximity to the sea, the absence of marine fish is puzzling. An explanation for this phenomenon is not simple. Perhaps the protoneolithic communities at Dąbki preferred to fish in the nearest lake, because of the richness of the lake and the apparently larger specimens that may have been more easily procured (not that selected catch may have been a factor). Probably due to the favorable environmental conditions and the site inhabitants' knowledge of the life cycle of these fish, especially their spawning season, these communities could have successfully used simple fishing techniques, e.g., fish traps. Migrations of marine species are more complicated than those of freshwater fishes. The majority of the latter fishes (e.g., pike and most of the Cyprinidae) usually migrate in the quest for food and for a place to spawn in the same water body. A marine fishery, even in inshore areas, generally would be more difficult. That is why it cannot be completely dismissed that these communities did not know the

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appropriate techniques and did not have the necessary equipment. Based on the fact that only one marine mammal (seal) bone was identified and that the majority of the mammal bones were beaver (e.g., Sobociński, 1984, 1986), a freshwater species, the richness of the local ecosystem and the lack of interest in exploiting marine resources may possibly be reasonable explanations.

The protoneolithic communities fished throughout most of the year. The most favorable conditions for fishing, however, were during the spring and summer seasons. They probably fished for pike at the end of March and for perch, roach (*Rutilus rutilus*), common bream, tench (*Tinca tinca*), pikeperch, and catfish over the following few months. This highly effective fishing strategy was based on the knowledge that, during the spawning season, fishes concentrate in shallow waters, close to the shore. The most intensive fishing probably ended in June, during the spawning time of pikeperch and subsequently catfish. Based on the remains of salmon/trout and burbot, fishing continued during the autumn and even during the winter, though to a lesser extent. Eel fishing took

place probably from April to the first autumn frosts, after which eels begin to hibernate. According to the ethnographic data (e.g., Znamierowska-Prüfferowa, 1988), however, eel also could have been fished during the winter.

The research has shown that, in the terrestrial portion of the site, the most common skeletal elements were vertebrae derived from mainly large-sized fish. Vertebrae are more robust and have more compact structures than do cranial bones, and therefore they are usually better preserved in archaeological deposits. The peat bog deposit, however, provided better preservation conditions for the thin and brittle cranial elements. This repetitive pattern at the site indicates human impact.

No cut marks were found on the bones. Based on the distribution of anatomical elements at the site, however, it can be surmised that the majority of fishes, especially the larger individuals, were gutted and decapitated directly after capture. Most of the remains (i.e. entrails, heads, and perhaps fins) were thrown out into the lake. Thus, only fish carcasses and probably some whole specimens of small fishes were taken to the settlement.

CONCLUSIONS

The analysis of the ichthyological material from Dąbki showed that at least most of the fish bones examined were the remains of specimens fished and consumed by the residents of the settlement. It seems that the protoneolithic fishery had a local character and probably concentrated on the freshwaters of Lake Bukowo, especially its numerous bays and other water bodies of the area. These findings are also in accordance with the results of previous research in the region.

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