

Fish remains from the Late Neolithic site of Rzucewo (Baltic Coast, Poland)

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(Received 10 January 1996; accepted 26 February 1996)

ABSTRACT: A description is given of the abundant fish remains found in a single pit dated back to the initial phase of the Rzucewo culture. The material is quantified and body size reconstructions are made. Interpretation focusses on the place and season of capture, as well as on the possible fishing techniques practised.

KEYWORDS: ARCHAEO-ICHTHYOLOGY, LATE NEOLITHIC, POLAND, FISHING, FISH SIZE

RESUMEN: Se describen los abundantes restos de peces recuperados en un hoyo datado en la fase inicial de la cultura Rzucewo. El material es cuantificado y se llevan a cabo reconstrucciones de talla. La interpretación se concentra sobre el momento y lugar de captura así como en los posibles tipos de técnicas de pesca practicados.

PALABRAS CLAVE: ARQUEOICTIOLOGÍA, NEOLÍTICO FINAL, POLONIA, PESCA, ESTIMACIÓN DE TALLA

INTRODUCTION

Archaeological research along the Baltic coast of Poland has revealed the existence of a number of sites attributed to the Rzucewo culture. It is believed to be a syncretic culture that combines elements of the Corded Ware culture complex, the Globular Amphorae culture and the Pit and Comb culture (Tetzlaff, 1970: 361, 364). The settlements of the Rzucewo culture cover the coastal area of the southeastern Baltic from the Bay of Puck in the west to the Sambia coast in the east, including the Bay of Gdańsk, the Vistula Bar and the Kursk Bar (Figure 1). Its chronology is determined by radiocarbon dates from two settlements, namely Rzucewo itself which represents the earliest phase of the Rzucewo culture (3320-2930 BC cal; 3260-2920 BC cal and 3310-2890 BC cal) and Osłonino which corresponds to the turn of phase II and phase III of the Rzucewo culture (oldest date: 3020-2510 BC cal; youngest date: 2200-1960 BC cal) (Machnik, 1979; Król, 1991).

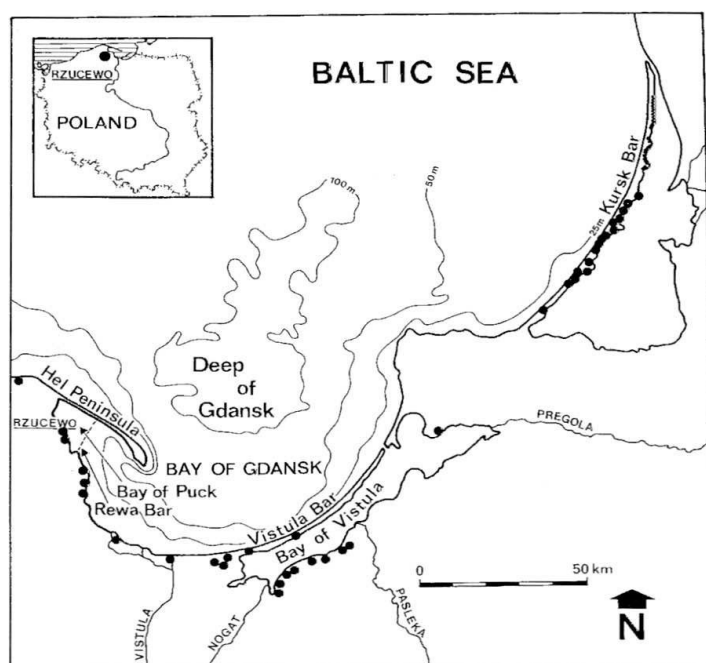


FIGURE 1
Location of settlements along the Baltic coast belonging to the Rzucewo Culture (dots).

Rzucewo is presently situated at the Bay of Puck which itself is part of the Bay of Gdańsk. However, during Late Neolithic times the area of the Bay of Puck was covered by pro-glacial stream valley deposits. Peat land and lakes extended eastward of the present-day shoreline as far as the Bar of Rewa (Rosa, 1984). This bar, which separated the Bay of Puck from the Bay of Gdańsk, was cut during the subatlantic transgression (Król, 1992).

Archaeological work at Rzucewo started at the end of the 19th century and lasted until the late 1920s (Żurek, 1954). Work was resumed in the 1980s by Król (1984). Faunal analysis on the old (Lubicz-Niezabitowski, 1929: 64-81) and new material (Lasota-Moskalewska, 1988, *in press*) has shown that the subsistence of these Neolithic people was not exclusively based on domestic animals and large terrestrial game as in contemporaneous inland sites. Hunting of seals and fishing played an important role as well. Until recently information about the captured fish was mainly limited to a list of species identified from the first excavations of Rzucewo. The present study deals in more detail with an assemblage of fish remains discovered during the 1989 excavation season (Król, 1993).

MATERIAL AND METHODS

About one hundred thousand fish bones were discovered in a single pit structure of about 1 x 1.5 m diameter and 20 cm deep (Figure 2). The pit was situated outside a hut at its northeastern wall (Król,

1993). A preliminary study of the pottery associated with the fish bones dates the deposit to phase I of the Rzucewo culture (Krol, *pers. comm.*). Retrieval of the fish bones was done by screening on very fine sieves used for flour. The remains being so abundant, it was decided to study only about one fourth of the material. Identifications were based on comparison with the reference material stored at the Royal Museum of Central Africa. Measurements were taken according to Morales & Rosenlund (1979). Size reconstructions were based on direct comparison with modern specimens of known length and on the regression formulas provided by Brinkhuizen (1989) for pike and perch, and by Enghoff (1983) for cod and Pleuronectidae.

RESULTS

Table 1 gives an overview of the fish taxa identified from Rzucewo. Only one small scute fragment indicates the presence of sturgeon. Perch is the predominant species among the freshwater fish, followed by pike, eel and cyprinids. Among the latter family, roach and bream have been identified in equal proportions. Marine fish comprise more than 60% of the total number of identified remains, with cod as the dominant species. The few remains of Pleuronectidae that were identifiable at species level all belong to flounder, whereas the Clupeidae comprise mainly herring. Only one vertebra could be assigned to shad.

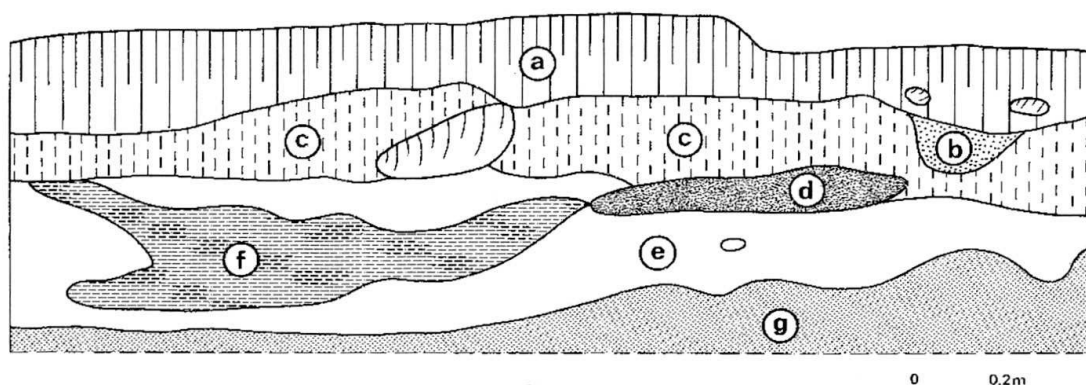


FIGURE 2

Stratigraphy of the central part of the western profile of the 19B excavation area from Rzucewo (by Danuta Krol, Archaeological Museum of Gdańsk). a, humus; b, mixed humus and sand; c, mixed brown and grey sand; d, brown sand with charcoal; e, cultural layer with charcoal; f, pit-like structure comprising abundant fish remains and some mammal bones; g, sterile layer of sand.

SPECIES	NISP	%
<i>Acipenser sturio</i> (sturgeon)	1	+
<i>Anguilla anguilla</i> (eel)	437	4.8
<i>Rutilus rutilus</i> (roach)	14	0.2
<i>Abramis brama</i> (bream)	14	0.2
Cyprinidae indet.	68	0.7
<i>Esox lucius</i> (pike)	621	6.8
<i>Perca fluviatilis</i> (perch)	2294	25.1
<i>Clupea harengus</i> (herring)	269	2.9
<i>Alosa</i> sp. (shad)	1	+
Clupeidae indet.	28	0.3
<i>Gadus morhua</i> (cod)	4952	54.2
<i>Platichthys flesus</i> (flounder)	13	0.2
Pleuronectidae indet.	431	4.6
Total identified	9143	100.0
Unidentified	13700	
Total	22843	

TABLE 1

List of fish species identified from a Late Neolithic pit at Rzucewo (NISP indicates number of identified specimens).

Direct comparison of the eel remains with modern specimens of known length shows that the individuals captured near Rzucewo measured between 40 and 90 cm total length (TL). The cyprinids yielded few remains for size reconstruction, but most of the bones seemed to be from medium-sized animals of 20 to 30 cm TL. Total lengths of perch were calculated using the regression formulas of Brinkhuizen (1989: 101) for the basioccipital, parasphenoid, preopercular, supra-cleithrum and first vertebra (Figure 3). These size reconstructions show that perch were between 24 and 36 cm long with the majority of the specimens between 27 and 31 cm TL. The predominant size class of perch presently found in the Bay of Gdańsk is 15-20 cm SL (Kosmaczewski, 1947: 48), although specimens of up to 31.5 cm SL have been reported (Terlecki, 1986: 374-378). This would correspond to specimens of up to 37 cm TL. Size reconstructions for pike were done with the regression formulas of Brinkhuizen (1989: 92-94) established for the basioccipital, parasphenoid, quadrate, dentary and articular. The total length of

pike varies between about 40 cm and 1 metre, individuals between 45 and 65 cm being most abundant (Figure 3).

Herring remains are mainly from individuals measuring between 20 and 25 cm TL according to direct comparison with modern specimens of known size. Some slightly smaller and larger individuals have been found as well. The cod remains being so numerous, it was possible to apply the regression formula for the first vertebra (Enghoff, 1983: 89) on a large number of specimens. The size distribution (Figure 4) indicates specimens between 25 and 72 cm TL, with the majority of the individuals between 40 and 60 cm. Cod can attain sizes of 1 metre and more; in the Baltic Sea the maximum size is reported to be 60 cm. The present-day catches of cod from the Bay of Gdańsk comprise mainly fishes between 30 and 60 cm (Żurekmudziński, 1990: 144). We should, therefore, not consider this small average size as an indication of inshore fishing. Such practices yield fish of much smaller size as is indicated by data from

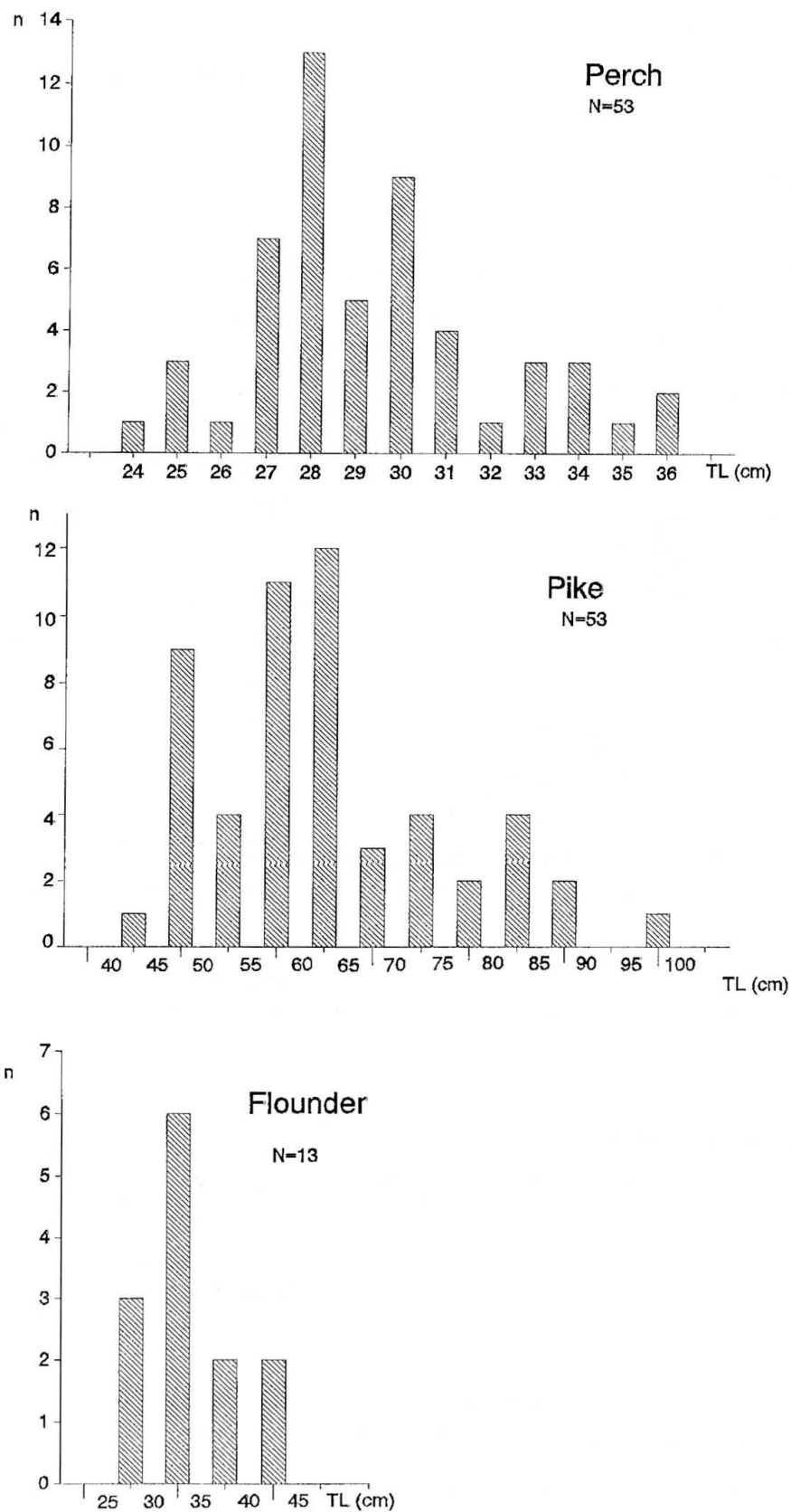


FIGURE 3

Size reconstructions for perch, pike and flounder based on individual specimens (TL = total length). The size classes for perch are only 1 cm, whereas they are 5 cm for pike and flounder.

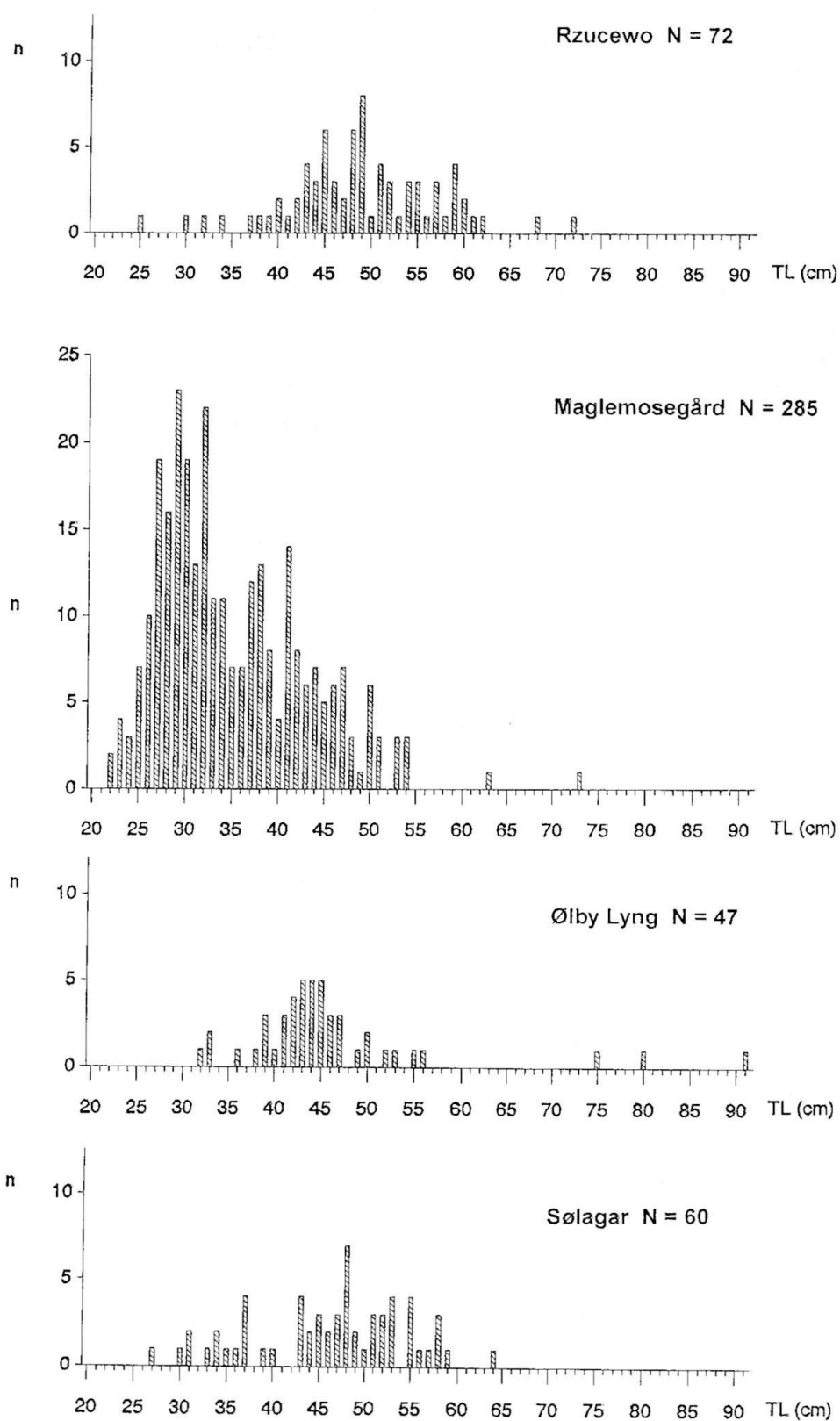


FIGURE 4

Size reconstructions for cod from Rzućewo, compared to data from Mesolithic Danish sites where coastal fishing of cod was practised. The material from Rzućewo and Maglemosegård was sieved, the two other assemblages were not.

Maglemosegård in Denmark (Enghoff, 1983). However, size distributions more or less comparable to the one seen at Rzućewo have also been found at some other Danish Mesolithic sites where coastal fishing is believed to have been practised. Those diagrams represent a distorted picture resulting from the fact that no sieving had been done. The Rzućewo material being carefully collected through sieves, it can be safely assumed that the size distribution observed at this Polish site is not typical of coastal fishing. Only four first vertebrae of *Pleuronectidae* were available that allowed the use of the regression formula of Enghoff (1994). Direct comparison of other skeletal elements with reference material of known size allowed an extension of the sample (Figure 3). The observed size range corresponds to the present-day catches of flounder in the region (Kosmaczewski, 1947: 47).

DISCUSSION

1. *Species diversity*

The number of species represented at Rzućewo is relatively low despite the large sample size and the application of fine sieving methods. Earlier work on fish remains (Lubicz-Niezabitowski, 1929: 64, 79), collected from different loci of the settlement, mentioned the presence of sturgeon, perch, pike, cyprinids and cod, which are species also found in the structure discussed here. Clupeids, flatfish and eel were not listed in that study although our data suggest that these fish were economically important. On the other hand, Lubicz-Niezabitowski (1929) also mentions the presence of pike perch (*Stizostedion lucioperca*), three-spined stickleback (*Gasterosteus aculeatus*) and stone loach (*Noemacheilus barbatulus*). Although it is impossible to verify these old identifications, we want to underline that, despite the abundance of Percidae material at Rzućewo and the existence of clear morphological criteria allowing the distinction of perch from pike perch, we could not attribute any bones to pike perch. The presence of three-spined stickleback and stone loach was not confirmed by our study but would indicate that, at least locally, sieve samples had been taken in the old excavations.

2. *Place and season of capture*

The reconstruction of the place of capture of the fish from Rzućewo has to take into account the dif-

ferent physical environment of the area during Late Neolithic times. It is likely that rivers and freshwater lakes were present in the peatland that extended over the present-day Bay of Puck as far as the Bar of Rewa. The freshwater species found in the Neolithic context may have been captured in such continental waterbodies. However, as a result of the low salinity of the Baltic Sea in this area, all the freshwater fish identified at Rzućewo presently also live in the Bay of Gdańsk. Salinity levels today are about 7‰ in the southern Baltic (Demel, 1947), an area which is, moreover, considered to be the most productive one for fisheries (Żmudziński, 1990: 7). The western coastline of the Bay of Gdańsk would also be the most nutrient rich of this part of the Baltic (Kosmaczewski, 1947: 26). These data on the present-day distribution of fishes cannot be simply transposed to the Late Neolithic. Salinity levels at that time were up to 3‰ higher than today, a situation which lasted until about 600 BC (Demel, 1947; Rosa, 1991). It is possible that the freshwater species migrated from the Baltic inshore region into estuaries and rivers when salinity levels approached or exceeded their physiological tolerance.

We have, thus far, not attempted any growth increment study in order to establish the season of capture. It is likely, however, that spring was the best fishing season for pike, perch and the cyprinids (Figure 5). That is when spawning takes place and fish occur in shallower waters. Today, eel is captured in the Bay of Gdańsk between March and November with the most successful catches from June to September (Kosmaczewski, 1947: 32-33).

Flounder is a very abundant marine species in the Bay of Gdańsk where it is caught in large quantities from May to October. The species then occurs inshore on shallow, sandy bottoms and prefers areas with low salinity (Kosmaczewski, 1947: 24). It is very likely that the flounders found at Rzućewo represent such specimens captured in shallow, inshore waters. Since this species also penetrates rivers, it cannot be excluded that some fishes were also captured in estuaries that may have existed near the site.

The herring also makes seasonal inshore movements. Spring herring is found today north of the Vistula Bar in April and May, whereas autumn herring spawns from September to mid-October near the Hel Peninsula in waters between 10 and 20 metres deep (Kosmaczewski, 1947: 20). Modern herring hence spawns in places with low salinity le-

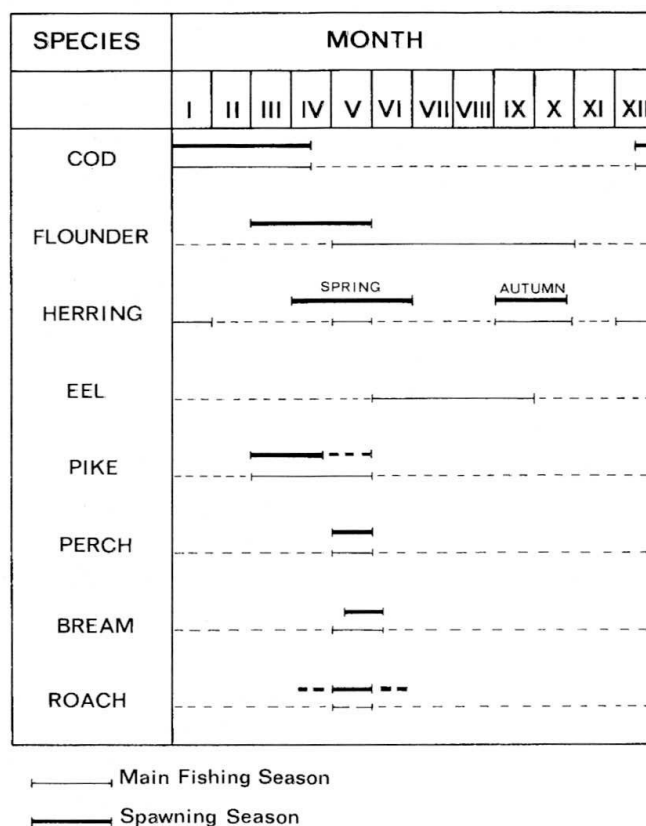


FIGURE 5

Present-day spawning seasons in the Baltic Sea of the species found at Rzucewo. Only cod and flounder spawn in offshore waters. The supposed major fishing season (cf. text for references) for each species is indicated as well.

vels (7‰). In Neolithic times comparable low salinity levels may have occurred near or in estuaries. It is therefore likely that Neolithic people were able to capture this species in inshore environments.

Cod was the most important fish species at Rzucewo both in number of identified specimens (NISP) and meat yield. Whereas flounder and herring may have been captured inshore, the presence of adult cod may indicate that fishing was also practised in a marine, offshore environment. This is shown by the size distribution which is atypical of coastal fishing (see above). Modern data on the distribution and spawning season of this marine species are available but, again, they have to be used with caution. Adult cod occur in great numbers in the Deep of Gdańsk where spawning takes place during spring (Kosmaczewski, 1947: 30, map 2). Fish from the Baltic Sea migrate to this area between January and April and are captured in large numbers throughout that period

(Żmudziński, 1990: 28, 144). The migration routes that are known today show that most cod from the southern Baltic Sea migrating towards the Deep of Gdańsk derive from the eastern part of the Bay of Gdańsk (area north of the Vistula Bar) (Żmudziński, 1990: 26, fig. 12). We can then accept that the inhabitants of Rzucewo went out in the open sea, at least for the larger cod. The preferential depth of cod is said to be below 20 metres, whereas spawning occurs below 10 metres (Poll, 1947: 196-197). Presently, the continental shelf reaches a depth of 10 m at a distance of 10-15 km from Rzucewo. Establishing where the fishing grounds of the adult cod were located precisely is impossible given the uncertainty about former distribution and migration patterns. It has recently been suggested that the modern distribution of gadids is affected by fishing pressure and that, in the past, cod and haddock may have occurred in more inshore waters (Beerenhout, 1994: 343). As we will demonstrate below, the inhabitants of Rzucewo, like the

Neolithic people elsewhere in the Baltic, were technically capable of seafaring. Offshore fishing need not be invoked, however, in the case of the smaller cod specimens, which may have been obtained by coastal fishing in waters less than 10 metres deep (Kowalska, 1973).

3. *Fishing techniques*

The archaeological material from Rzucewo comprises several artifacts that can be related to fishing. Some bone points are interpreted as fragments of fish gorges (Żurek, 1954, plate XI; Makowiecki, 1994), whereas two stone objects and a clay disc (Żurek, 1954: 22-23) probably represent net weights. It cannot be excluded, however, that these weights were used to keep fish traps in place. Moreover, some worked bone fragments are considered to be remnants of spears (Żurek, 1954: Plate IX; Makowiecki, 1994).

The larger cod found at Rzucewo were probably captured with hook and line in deeper, offshore waters. Tools used for hollowing wood represent indirect evidence for the possible availability of dug-out boats (Żurek, 1954: 19, 23) that would have been needed to reach the fishing grounds. The majority of the fish found at Rzucewo may, however, have been captured in the shallower inshore parts of the Bay of Gdańsk. In such places, nets may have been used as well as different kinds of stationary traps and fish fences. Evidence for the latter type of perishable fishing gear was not found at Rzucewo. This is not surprising given the limited chances of preservation of such material and the distance of the site to the coast. Nevertheless, Mesolithic and Neolithic finds outside Poland indicate that these techniques were already well established in the region (Enghoff, 1994: 84-85). This type of fishing gear would have allowed the capture of all major fish species found at the site, including the smaller cod. The spears that were found at Rzucewo may have been used for fishing in shallow, marginal waters. Spearing may have been a suitable method for the capture of spawning freshwater fish, especially pike. Large individuals of this species enter waters of 20-50 cm deep during spawning (Bryliński, 1986: 178).

CONCLUSIONS

The fish remains from the Late Neolithic site of Rzucewo comprise a relatively low number of species. Cod was the main food species both in number of specimens and in meat yield. Perch, pike and eel were the major freshwater species followed by the cyprinids, comprising roach and bream. Flounder and herring were also frequently captured, whereas sturgeon and shad were rarely fished. The determination of the place of capture is hampered by the changes in the coastal landscape and salinity that have taken place in the area since the Late Neolithic. The freshwater fishes may have been captured near the site in lakes and rivers of the peatland area that extended as far as the present-day Bar of Rewa. Alternatively, those species may as well have been taken from the coastal waters of the Bay of Gdańsk if the 5‰ increase in salinity did not cause a substantially different distribution of freshwater species from that observed today. Flounder and herring are likely to have been taken from those inshore waters of the Bay of Gdańsk or from the estuaries in the peatland. Smaller cod were probably also captured near the coast. For the larger cod, however, it seems necessary to invoke fishing further away from the coast if the present-day ecological preference of this species for waters deeper than 10 metres is accepted to hold also for the Late Neolithic. Fishing for large cod might have been practised from dug-out boats, using hook and line. There is also material evidence for the use of nets and spears which were probably used in shallower waters. Moreover, it is likely that other types of fishing gear such as stationary traps and weirs were available. This kind of equipment was not found at the site but is documented from older and contemporaneous sites around the Baltic.

ACKNOWLEDGEMENTS

This paper presents research results of the Belgian Programme on Interuniversity Poles of Attraction, initiated by the Belgian Office for Scientific, Technical and Cultural Affairs. The first author received a research fellowship from the same institution. We thank Alain Reygel (Tervuren) for the drawings.

REFERENCES

- BEERENHOUT, B. 1994: What conclusions can be drawn from mature haddock bones in a neolithic site in the Netherlands? *Offa* 51: 341-347.
- BRINKHUIZEN, D. C. 1989: *Ichthyo-archeologisch onderzoek: methoden en toepassing aan de hand van romeins vismateriaal uit Velsen (Nederland)*. Doctoral thesis, Rijksuniversiteit Groningen.
- BRYLIŃSKI, E. 1986: Szczupak. In: Brylińska, M. (ed.): *Ryby słodkowodne Polski*: 176-182. Warszawa.
- DEMEL, K. 1947: *Biologia ryb Bałtyku*. Gdynia.
- ENGHOFF, I.B. 1983: Size distribution of cod (*Gadus morhua* L.) and whiting [*Merlangus merlangus* (L.)] (Pisces, Gadidae) from a Mesolithic settlement at Vedbæk, North Zealand, Denmark. *Meddelelser fra dansk naturhistorisk Forening* 144: 83-97.
- ENGHOFF, I.B. 1994: Fishing in Denmark during the Ertebølle Period. *International Journal of Osteoarchaeology* 4: 65-96.
- KOSMACZEWSKI, J. 1947: *Rybołówstwo morskie na wodach Północnej Europy*. Gdynia.
- KOWALSKA, K. 1973: Dorsz. In: Chrzanowski, Z. (ed.): *Mały słownik zoologiczny. Ryby*: 49-50. Warszawa.
- KRÓL, D. 1984: Rzucewo. *Informator Archeologiczny. Badania* 1983: 49-50.
- KRÓL, D. 1991: Absolute chronology of the settlements of the Rzucewo culture in Poland. *Internationales Symposium 1990 in Praha-Stirín. Die kontinentaleuropäischen Gruppen der Kultur mit Schnurkeramik*. Praha: 75-77.
- KRÓL, D. 1992: The elements of settlements in Rzucewo. *Praehistorica, Praha* 19: 291-299.
- KRÓL, D. 1993: Rzucewo. *Informator Archeologiczny. Badania* 1989: 19.
- LASOTA-MOSKALEWSKA, A. 1988: *Rzucewo gm. Puck woj. Gdańskie. Opracowanie szczątków zwierzęcych z neolitycznego stanowiska (Materiały z wykopalisk w latach 1984-1987)*. Manuscript in Archaeological Museum of Gdańsk.
- LASOTA-MOSKALEWSKA, A. IN PRESS: *Animal remains from the Neolithic settlement in Rzucewo*. Proceedings of the International Symposium «The Baltic Coast Landscapes», 4th-9th October 1994, Gdańsk.
- LUBICZ-NIEZABITOWSKI, E. 1929: Szczatki zwierzęce z osady neolitycznej w Rzucewie na polskim wybrzeżu Bałtyku. *Przegląd Archeologiczny* 3: 64-81.
- MACHNIK, J. 1979: Kultura rzucewska. In: Hensel, W. & T. Wiślański (ed.): *Prahistoria Ziem Polskich*, vol. 2: 366-379. Wrocław.
- MAKOWIECKI, D. 1994: *Ekspertyza archeozoologiczna przedmiotów kościanych z wykopalisk ludności kultury rzucewskiej (sezon 1929)*. Manuscript in Archaeological Museum of Gdańsk.
- MORALES, A. & ROSENLUND, K. 1979: *Fish bone measurements*. Steenstrupia, Copenhagen.
- POLL, M. 1947: *Poissons marins*. Faune de Belgique. Musée Royal d'Histoire Naturelle de Belgique. Bruxelles.
- ROSA, B. 1984: *Rozwój brzegu i jego odcinki akumulacyjne, Pobrzeże Pomorskie*. Gdańsk.
- ROSA, B. 1991: *Zagadnienie zmian Bałtyku południowego-dotychczasowe rozpoznania i perspektywy dalszych poszukiwań*. Peribalticum V, GTN. Gdańsk.
- TETZLAFF, W. 1970: The Rzucewo culture. In: Wiślański, T. (ed.): *The Neolithic in Poland*: 356-365. Wrocław.
- TERLECKI, J. 1986: Okoń. In: Brylińska, M. (ed.): *Ryby słodkowodne Polski*: 371-378. Warszawa.
- ŻMUDZIŃSKI, L. 1990. *Świat Zwierzęcy Bałtyku. Atlas makrofauny*. Warszawa.
- ŻUREK, J. 1954. Osada z mdszej epoki kamiennej w Rzucewie, pow. wejherowski i kultura rzucewska. Le village néolithique de Rzucewo, distr. de Wejherowo. *Fontes Archaeologici Posnanienses* 4: 1-40.

