THE MACRO-INVERTEBRATES OF THE RUBBLE BANKS OF THE ABCOUDERMEER

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ABSTRACT

In the Abcoudermeer, a small lake S.E. of Amsterdam, the rubble banks were investigated on macro-invertebrates. At least 46 species were encountered, insects and their larvae not included: 1 species of sponge, 1 species of hydrozoan, 6 species of free-living flatworms, 17 species of snails, at least 3 species of mussels, 8 species of leeches, 3 species of crustaceans and 7 species of bryozoans. Differences between two banks are discussed.

INTRODUCTION

The Abcoudermeer, a small lake, is situated at about 10 km S.E. of Amsterdam. Its surface area is about 18 ha. In its present form it is already to be found on 14th century maps. The lake forms part of the water circulation system of the former river Amstel. The banks are periodically strengthened with rubble, this being a general feature in this part of the country. The resulting "artificial rocky coast" consists predominantly of bricks and parts of masonry.

The lake has a scattered, but sometimes dense vegetation of mainly *Phragmites, Typha* and *Carex*. The open water lacks vegetation. Especially along the exposed northern and western banks vegetation is scarce.

HYDROGRAPHY

The lake (fig. 1) has on the western and south-eastern side connections with the rest of the system of canals and former rivers of which it forms part. This drainage system is separated by dikes from lower lying areas. Dependent on the needs of agriculture water is pumped up into this system, or water may be let in the lower lying area. Circulation in the lake depends on the water control of the surrounding area. The salinity of the lake water varies with the amount of rainwater or brackish drainage water from surrounding ditches (table I).

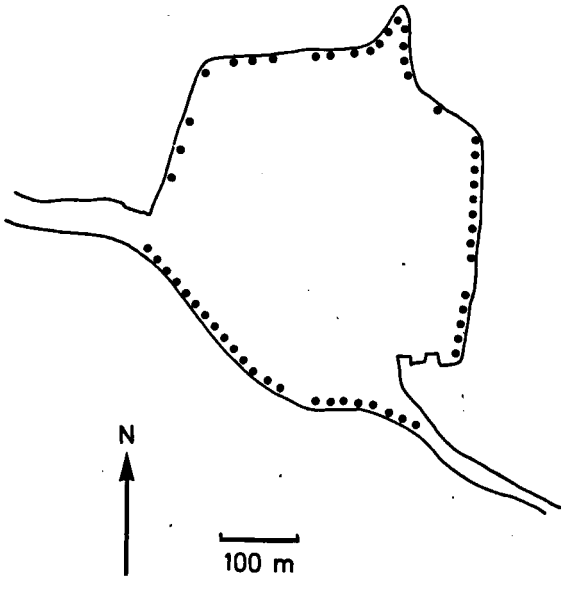

Fig. 1. Map of the Abcoudermeer. Dots representing vegetation.

Table I. Chlorinity of the Abcoudermeer water in mg/l from January 1973 to January 1974.

Jan.	1-555	July	17-369
Jan.	31-632	Aug.	1-266
Feb.	14-606	Aug.	15-250
Feb.	28-404	Aug.	29-330
Mar.	14-291	Sept.	12-470
Mar.	28-376	Sept.	26-535
Apr.	11-553	Oct.	17-675
May	1-486	Oct.	31-196
May	16-369	Nov.	14-392
May	30-335	Nov.	28-360
June	13-275	Dec.	12-252
June	27-637	Jan.	3-409

METHODS AND RESULTS

Bricks and pieces of masonry were, to a depth of 50 cm, taken from the water by hand or tongs. The stones were carefully searched for invertebrates. Differences in numbers of animals were so great, even between neighbouring bricks, that no attempt has been made to compare the samples quantitatively, except for the total number of snails and the total number of leeches from different banks.

A complete list of species is given in table II. In general terms the fauna is described as follows:

Within the snail population, *Bithynia tentaculata* dominates during the whole season. Other snails found regularly are *Theodoxus fluviatilis, Viviparus viviparus* and *Lymnaea peregra.* Regularly to be found too, but in much smaller numbers are *Valvata cristata, V. piscinalis, Bithynia leachii, Physa fontinalis, Viviparus contectus, Lymnaea palustris, L. auricularia, Acroloxus lacustris, Planorbis carinatus, P. crista, P. planorbis* and *Segmentina complanata. Potamopyrgus jenkinsi* was found only once.

The mussels *Pisidium* sp. and *Sphaerium* sp. are predominantly found in clusters on the underside of stones, in direct contact with the muddy bottom. *Dreissena polymorpha* is present as well, although scattered and mostly in deeper water.

The dominant free-living flatworms are *Dendrocoelum lacteum* and *Dugesia polychroa.* They occur amidst their egg cocoons, small dark-red to black spheres. Also to be found are *Polycelis* sp., *Dugesia lugubris* and *D. tigrina,* the latter prefering overgrown stones. In the summer the acoele *Oligochoerus limnophilus* is present.

The most common leech during the year appears to be *Glossiphonia complanata.* During spring *Herpobdella octoculata* and *Glossiphonia heteroclita* gradually appear in considerable numbers too. Other species, viz. *Hemiclepsis marginata, Piscicola geometra, Helobdella stagnalis, Theromyzon tessulatum* and *Herpobdella testacea,* occur only scattered and in smaller numbers.

The isopods *Asellus aquaticus,* and to a lesser extent *A. meridianus* are seen everywhere, scuttling about. Under every stone the amphipod *Gammarus tigrinus* is present, often in great numbers.

The most abundant insect larvae are those of the Chironomidae, but towards the summer the number of larvae of Trichoptera rises strikingly.

Most bryozoan colonies found on stones near the bank, belong to the moss animal *Plumatella repens.* This species is mentioned in all observations on this lake since 1900 (Lacourt, 1949). There are at least two generations a year, the first in late spring (May-June), the second in autumn (September). In summer the colonies degenerate, probably because the temperatures in the shallow water are too high. The colonies develop from statoblasts, present in the plankton in quantities up to 2,000 per liter (December 1974), or sessoblasts which remain attached to the substrate. The latter are the only way in which *Fredericella sultana* survives. Colonies of this species are found along all banks, but much less abundant than *Plumatella repens.* Another bryozoan of which colonies were found is *Paludicella articulata,* also mentioned by Lacourt (1949). Of the moss animals *Cristatella mucedo, Plumatella emarginata, P. fruticosa* and *Lophopus crystallinus,* only statoblasts were seen. The latter three are new records for the lake, as are the colonies of *Fredericella sultana.*

The hydrozoan *Cordylophora caspia* occurs on the stones in small colonies. These are lower and less ramified in comparison with colonies on water-lily stalks in neighbouring waters.

The sponge *Spongilla lacustris* grows irregularly scattered, often in large colonies.

With the exception of *Plumatella,* which is absent during winter, and the larvae of Trichoptera, which appear in the second half of April, the animals are to be found all the year round.

Table II. Species composition of the banks of the Abcoudermeer (insects not included).

PORIFERA
Spongilla lacustris (Linnaeus)

CNIDARIA
Cordylophora caspia (Pallas)

TURBELLARIA
Dendrocoelum lacteum (Müller)
Dugesia polychroa (O. Schmidt)
Dugesia lugubris (O. Schmidt)
Dugesia tigrina (Girard)
Polycelis sp.
Oligochoerus limnophilus Ax & Dörjes

GASTROPODA
Theodoxus fluviatilis (Linnaeus)
Viviparus contectus (Millet)
Viviparus viviparus (Linnaeus)
Valvata cristata Müller
Valvata piscinalis (Müller)
Potamopyrgus jenkinsi (Smith)
Bithynia leachii (Sheppard)
Bithynia tentaculata (Linnaeus)
Physa fontinalis (Linnaeus)
Lymnaea auricularia (Linnaeus)
Lymnaea palustris (Müller)
Lymnaea peregra (Müller)
Planorbis carinatus Müller
Planorbis planorbis (Linnaeus)
Planorbis crista (Linnaeus)
Segmentina complanata (Linnaeus)
Acroloxus lacustris (Linnaeus)

PELECYPODA
Pisidium sp.
Sphaerium sp.
Dreissena polymorpha (Pallas)

HIRUDINEA
Glossiphonia complanata (Linnaeus)
Glossiphonia heteroclita (Linnaeus)
Helobdella stagnalis (Linnaeus)
Theromyzon tessulatum (Müller)
Hemiclepsis marginata (Müller)
Piscicola geometra (Linnaeus)
Herpobdella octoculata (Linnaeus)
Herpobdella testacea Savigny

CRUSTACEA
Asellus aquaticus (Linnaeus)
Asellus meridianus Racovitza
Gammarus tigrinus Sexton

BRYOZOA
Plumatella repens (Linnaeus)
Fredericella sultana (Blumenbach)
Paludicella articulata (Ehrenberg)
Cristatella mucedo Cuvier
Plumatella emarginata Allmann
Plumatella fruticosa Allmann
Lophopus crystallinus (Pallas)

DISCUSSION

No differences in species composition could be established between the different banks of the lake. All species found are common and have a wide distribution.

During the year however, there is a remarkable shift in appearance of the snail population. *Bithynia* is present all the year round. In early spring there are a great number of large, adult *Lymnaea* present, together with a great number of their eggs. These adults, being annual, disappear during spring and in the same period the number of *Bithynia* eggs grows steadily. In summer the young *Lymnaea* appear first, followed by the new generations of other snail species.

It appears that the total number of snails is significantly higher at the northwestern bank as compared with the eastern bank. On the contrary, the total number of leeches at the northwestern bank is lower than that of the eastern bank. These significant differences are proved by using Wilcoxon's two-sample test. No differences are to be shown between other banks or populations of other animals. The significant differences found between leeches and snails from different banks can be accounted for by exposition to prevailing wind directions, arrangement of stones and steepness of the bank.

The northwestern bank consists of heterogenous rubble and is relatively exposed by lack of reed growth over most of its length; the bottom slopes down steeply. This results in a diversity of habitats in clean, clear water. Organic decay is therefore transported to deeper water, many algae grow on the upper sides of the stones and algae-eating molluscs find food and shelter. The eastern bank is protected by vegetation, has a more uniform and densely packed stony bottom, which slopes very gently. Silt rests between the stones, inhabited by chironomids and oligochaetes. This less exposed area is apparently preferred by leeches and their prey.

The community found on the rubble stones along the banks of the Abcoudermeer is characteristic of this type of bank in various Dutch lakes. Den Hartog & Tulp (1960) found in general the same species composition in Frisian lakes. However, the distinct zonation observed there is not found in our lake, possibly because rubble disposal is too frequent, resulting in a mixture of fresh and older stones, thus disturbing any zonation.

Tulp (1967), describing another Frisian lake, states that in shallow water most animals prefer undersides of loose-lying stones. The same holds true for the Kagerplassen (Van Berge Henegouwen & Van der Velde, 1975) and the present investigation. Loose rubble along the banks may be unattractive to the eye, it forms, however, an old and enriching part of the Dutch lakes and canals.

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