The evolution of the water quality in the west of Belgium: results of a ten year survey

by Annick DE WINTER & Robrecht PILLEN

Abstract

The use of the occurrence of macro-invertebrates in the biomonitoring of freshwater ecosystems is applied to a river basin in the extreme west of Flanders. Water quality was assessed by using the Belgian Biotic Index, a highly standardized method based on the presence of specific macro-invertebrates. During a ten year survey (1980-1990) 78 sites were followed in detail.
In 32 sites (41%) water quality improved considerably. It is shown that this is due to (i) the installation of several wastewater treatment plants from 1985 onwards and (ii) a better control on the discharge of all kinds of wastewater. In only 14 sites (18%) the Biotic Index decreased. We believe this is mainly due to the fact that a lot of riverbanks were reinforced with concrete. For 20 sites (26%) a status quo was noted.
Key-words: water quality, macro-invertebrates, Belgian Biotic Index, wastewater.

Samenvatting

Het gebruik van het voorkomen van macro-invertebraten in biomonitoring van zoetwaterecosystemen werd toegepast op een rivierbekken in het uiterste westen van Vlaanderen. De waterkwaliteit werd bepaald door middel van de Belgische Biotische Index, een gestandaardiseerde methode gebaseerd op de aanwezigheid van specifieke macro-invertebraten. 78 stations werden gedurende tien jaar continu gevolgd (1980-1990).
In 32 stations (41%) werd een aanzienlijke verbetering van de waterkwaliteit vastgesteld. Er wordt aangetoond dat dit voornamelijk te wijten is aan (i) het in werking stellen van verschillende rioolwaterzuiveringsinstallaties vanaf 1985 en (ii) een betere controle op het lozen van allerlei soorten afval. In slechts 14 stations (18%) bleek de Belgische Biotische Index te dalen. Dit is vermoedelijk een gevolg van normalisatiewerken aan de rivier- en beekoevers. Voor 20 stations (26%) werd een status quo vastgesteld.
Trefwoorden: waterkwaliteit, macro-invertebraten, Belgische Biotische Index, afvalwater.

Introduction

One of the tasks of the Flemish Environmental Company is the management of the water quality of all water bodies belonging to the public hydrographic network in Flanders. In order to be able to realise an efficient and structured management of the water quality in Flanders, a continuous investment in research is necessary. The researchers involved have to provide detailed data on the actual status of the water quality of the surface waters in Flanders. Moreover, it is necessary to follow the evolution of the water quality in the long term. Both biological and chemical methods are used in this kind of studies. The results finally supply a solid base which can be used for an efficient management of the water quality of Flemish surface waters.

On October, 21st 1987, the Flemish Government approved a resolution which divided the surface waters in Flanders into different categories: water intended to be used for swimming, fishing, mollusc rearing or for the production of drinking water. This resolution states that the basic water quality of

these different categories should be reached by 1995. This implies a minimal level of the Belgian Biotic Index of 7 (BBI, see Material and methods). Because water quality is one of the major factors influencing the environment, it is clear that this statement is of great importance for nature conservation.

Material, methods and study area

In this contribution we only report on results of the water quality obtained by biological methods. Water quality was measured by using a highly standardized method, namely the Belgian Biotic Index, BBI (DE PAUW & VANHOOREN, 1983). This index is based on the presence of aquatic macro-invertebrates which are relatively easy to identify (DE PAUW & VANNEVEL, 1991). For each measurement, a number ranging from 1 to 10 is assigned, indicating the degree of pollution (1 = highly polluted, 10 = not polluted). The index assesses water quality in an ecological way and this is why the method has certain advantages over a purely chemical measurement. For discussion on the method as well as on the sampling techniques used for the collecting of macro-invertebrates, we refer to ANONYMUS (1984), DE BRABANDER & DE SCHEPPER (1981), DE PAUW & VANHOOREN (1983), DE PAUW & VANNEVEL (1991), TACHET *et al.* (1980) and VANHOOREN (1982).

During ten years an area in the extreme west of Flanders was surveyed. The studied area, is limited by the river IJzer in the east and south, the North Sea and the French border in the west (Fig. 1). 78 sites were followed in detail.

The network investigated is made up of typical polder rivers. They are usually deep and wide with a thick mud layer on the bottom. Until recently, they were characterized by a well developed reed vegetation (*Phragmites australis*), but the area of this kind of effective river bank vegetation has shrinked considerably. The water level of most of these polder rivers is regulated in function of agricultural needs. This implies that the water level is kept low during winter. As a consequence, stream velocity increases.

In some areas, such as Nieuwpoort, the influence of the sea should not be neglected. Moreover, due to the artificial management of the water level, the direction in which the water runs can change temporarily for some rivers or brooks. All these factors have a considerable influence on the ecosystem and its faunal composition.

Results and discussion

General results

In order to be able to illustrate the evolution of the water quality of this part of the IJzer river basin, the results of the measurements effectuated at five year intervals are analysed. They are presented respectively in Fig. 1 for 1980, Fig. 2 for 1985 and Fig. 3 for 1990. The corresponding frequency distributions summarizing the number of samples within each water quality category (BBI) are shown in Fig. 4.

Of the 78 samples surveyed during the last decade, 41% showed a considerable improvement in water quality. For 18% the Biotic Index decreased and for 26% a status quo was noted. Table 1 provides more details on the evolution of the procentual frequencies within each BBI class.

Table 1. Percentual frequencies of the Belgian Biotic Index (BBI) for 1980, 1985 and 1990 respectively.

BBI	0	1	2	3	4	5	6	7	8	9	10
1980	-	5.0	10.0	-	20.0	20.0	35.0	10.0	-	-	-
1985	1.5	-	7.4	1.5	4.4	27.9	38.2	16.2	2.9	-	-
1990	1.4	-	1.4	2.8	12.5	19.4	25.0	34.7	-	-	-

The evolution of the water quality in some important parts of the area

All names used in this paragraph are situated in Fig. 1.

▸ *The Langeleed river bassin*

The Langeleed enters the Belgian territory in a polluted state (BBI 5). The presence of the recreation park 'De Meli' has an additional, negative influence on the water quality of this stream. At this point, only some Tubificidae and Chironomidae were present. Recently, there seems to be a slight improvement of the water quality. This is due to the installation of the wastewater treatment plant of Adinkerke (1986) and Wulpen (1987) both connected with 'De Meli', resulting in the occurrence of Asellidae and Hirudinea. Further east, in the direction of Nieuwpoort, the Langeleed recovers a lot and reaches a BBI of 7 to 8.

▸ *The channel of Duinkerke-Nieuwpoort*

Due to the installation of the Proostdijk-collector in 1982, the Channel of Duinkerke-Nieuwpoort received a high amount of additional wastewater previously discharged in the Proostdijkvaart. As a consequence its water quality decreased considerably (BBI 2). Afterwards, in the period 1985-1990, water quality of the channel improved. This is easily explained by the fact that the treated water of the wastewater treatment plant of Wulpen is discharged in the channel. This means a high input of purified water which stimulates natural recovery.

▸ *The Grote Beverdijk system*

At its origin, near Fintele, the Grote Beverdijk has a rather good water quality (BBI 6-7). At this point a lot of different Coleoptera and Mollusca which are relatively sensitive for pollution, can be found. Downstream, water quality decreases till a BBI of 5-6. This situation maintains till Nieuwpoort. During 1985 works were effectuated at the Grote Beverdijk in order to increase its

carrying off capacity of water. This resulted in a lower BBI in 1985 (BBI 5). An improvement was however noticed in 1990 probably due to natural recovery (BBI 7).

The most important tributary rivers of the Grote Beverdijk are Ramskapellegeleed, Kleine Beverdijk, Reigersvliet, Oostkerkevaart, Vlavaart, Zaadgracht, Duikervaart, Slopgatvaart (with the Oostwandelaarsgang and Sint-Machuitsbeek), Aardenvaart en Reepdijk. Most of these small rivers and brooks improved significantly during our ten year survey reaching a BBI of 7 in 1990. It is worth mentioning that the Vlavaart and Reepdijk are highly polluted at their origin (BBI 2), but that they recover very quickly (BBI 6).

▸ *The Koolhofvaart and Proostdijkvaart systems*

Both channels demonstrate a rather stable BBI of 5-6 indicating a mediocre water quality. The same is true for most of their tributary rivers and brooks. Identical results were also obtained for the Bergenvaart and the Ringsloot.

Conclusions

Generally, our results demonstrate a slight improvement of the water quality for the period 1980-1990. Actually, almost one third of the sampled sites shows a BBI of 7 or 8, which corresponds with the whishes expressed by the Flemish Government in its resolution of 21.10.1987.

The observed improvement is due to:

▸ the installation of several new wastewater treatment plants in the area,

▸ a better and more severe control on the discharge of all kinds of wastewater.

The rest of the sites under study have a medium (BBI 5-6) to low water quality (BBI 1-4). A large part of the pollution observed in these sites is caused by the import of different kinds of manure combined with an artificially low water level, especially during winter. This results in thorough eutrofication with extreme abundances of algae and considerable fluctuations in oxygen concentration. It is evident that this influences the aquatic animal community as well.

The highest pollution was encountered at Veurne, but due to the installation of the wastewater treatment plant of Wulpen (Koksijde) during 1987, an improvement of the water quality can already be noticed.

Another problem is the reinforcement of river banks with concrete at the cost of well established reed vegetations. This kind of reinforcements aims to increase the carrying off capacity of the river. It is thought that reed vegetation has a negative influence on the stream velocity.

Although much work remains to be done, it is clear that more improvement of the water quality in the IJzer area is to be expected. In this way an increase of the ecological value of the area could be established. This area has therefore considerable potentials in the frame of nature conservation. However, a continued survying of the water quality remains necessary in the future. Moreover, it is suggested that an important positive effect could be gained from a closer synchronisation of water quality management and water quantity management.

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Annick DE WINTER & Robrecht PILLEN
Vlaamse Milieumaatschappij, V.M.M.
Flemish Environmental Company
Dienst Meetnetten
Zandvoordestraat 375
B-8400 OOSTENDE

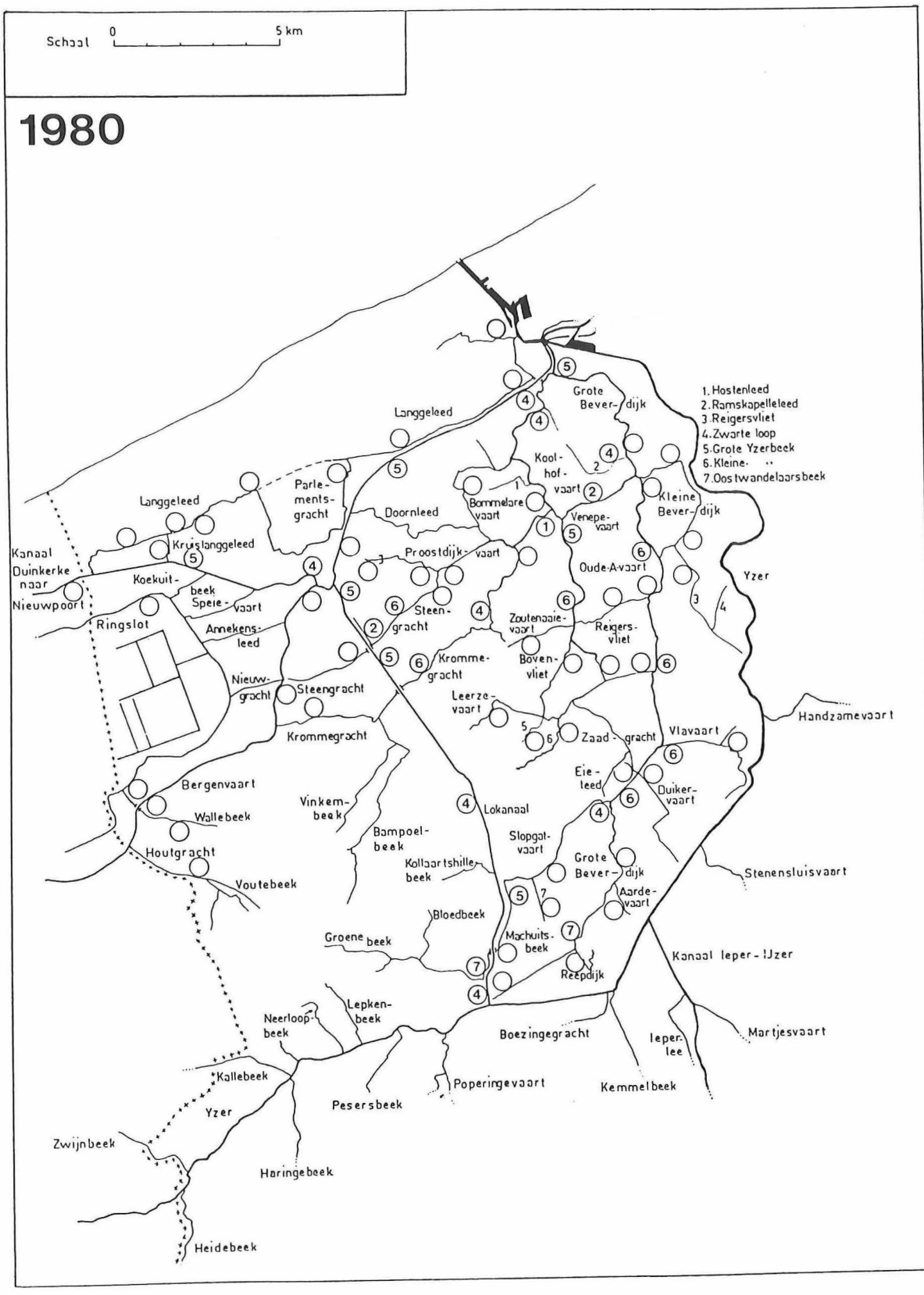

Fig. 1. Water quality in the western basin of the IJzer in 1980. Based on the Belgian Biotic Index: BBI 0-2 = extremely polluted, 3-4 = highly polluted, 5-6 = polluted, 7-8 = moderate water quality, 9-10 = good water quality.

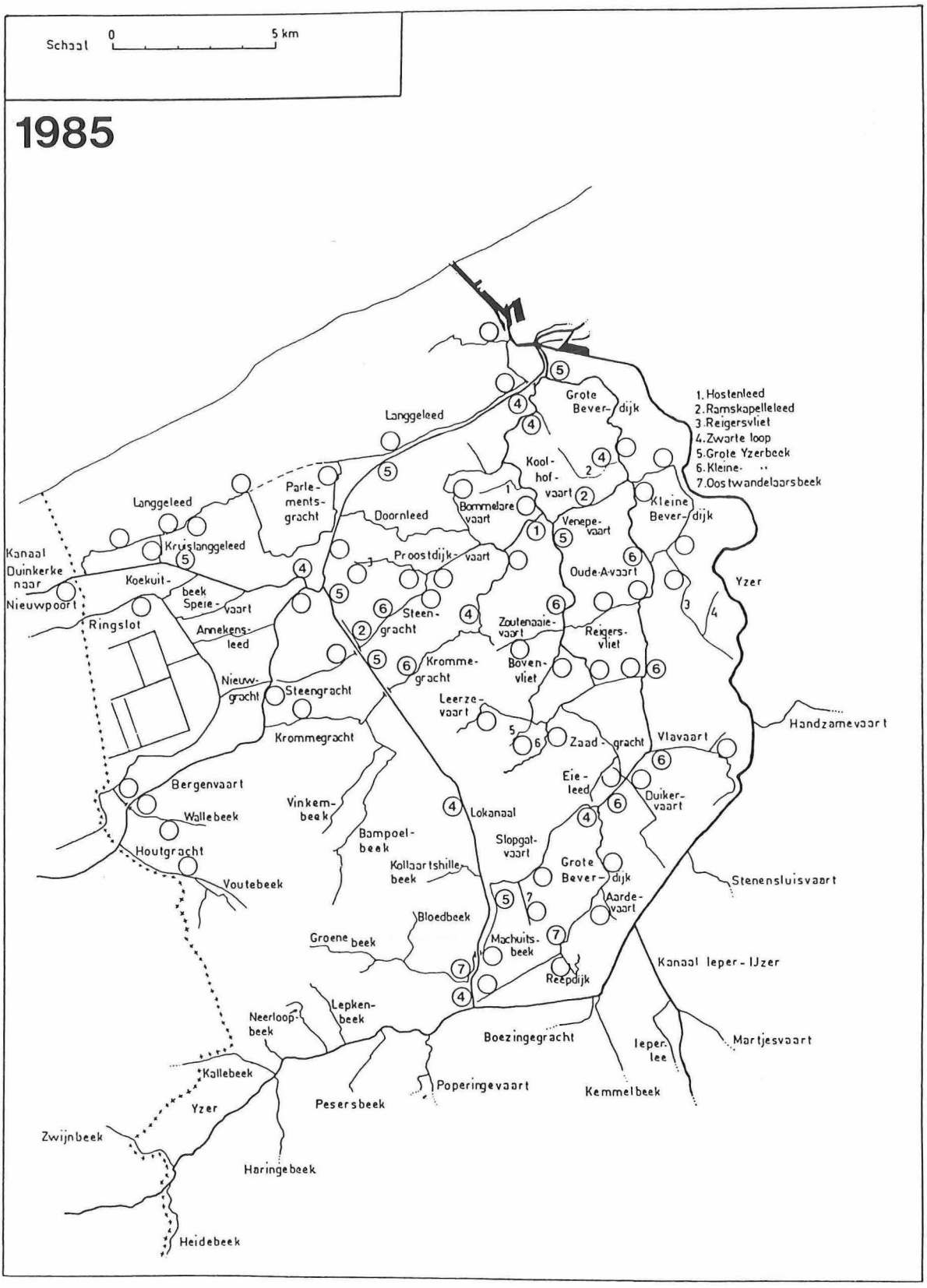

Fig. 2. Water quality in the western basin of the IJzer in 1985. BBI 1-10 = see legend Fig. 1.

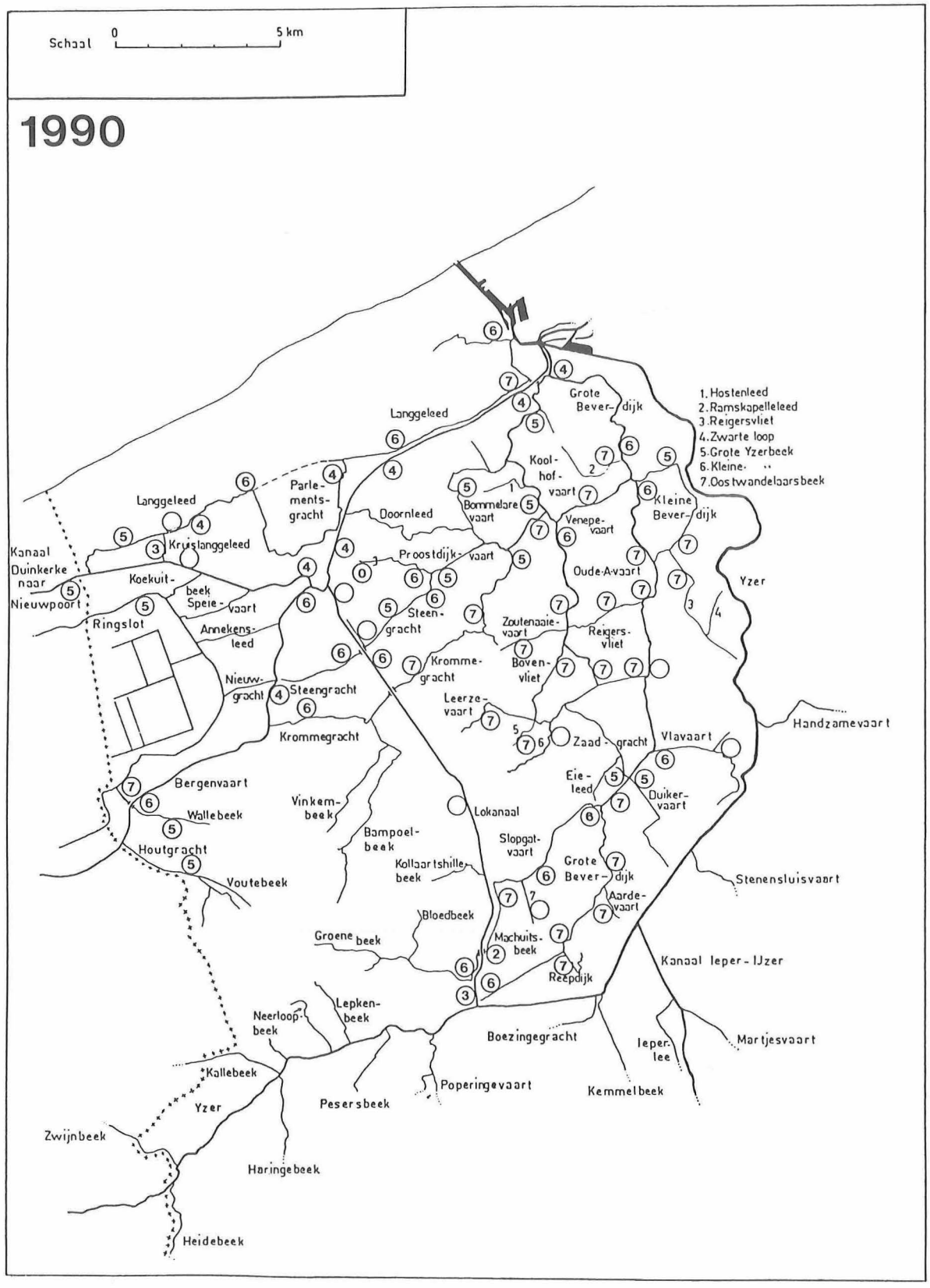

Fig. 3. Water quality in the western basin of the IJzer in 1990. BBI 1-10 = see legend Fig. 1.

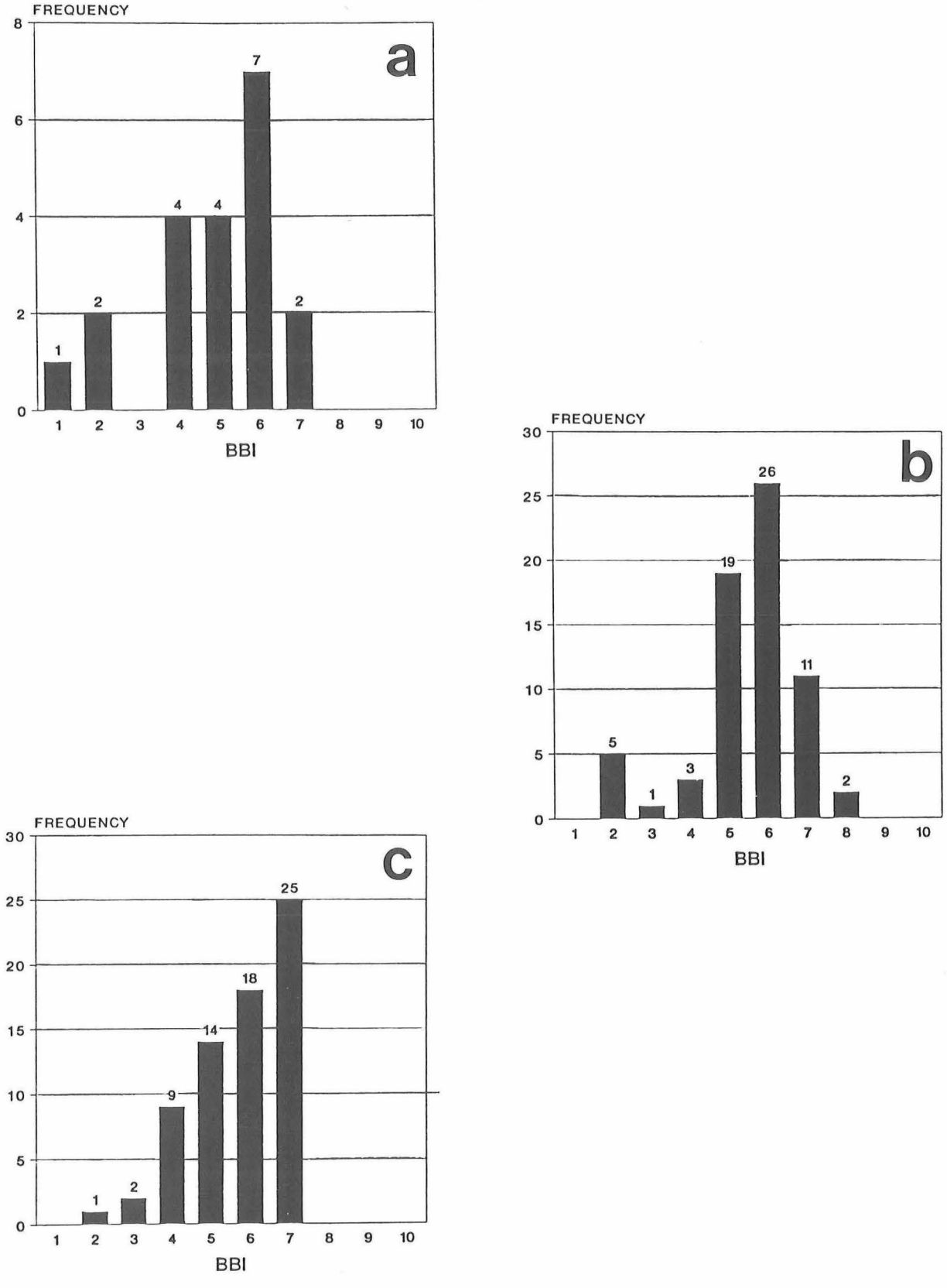

Fig. 4. Frequency distribution of the Belgian Biotic Index observed in the western basin of the IJzer during (a) 1980, (b) 1985, (c) 1990. BBI 1-10 = see legend Fig. 1.