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# Towards the development of fish based typologies in Flanders

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## The development of fish based typologies in Flanders.

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### Abstract

In the FIDES databank, Flanders has no references. We used two approaches using two sets of data.

The two sets of data we used were: a historical dataset (1840-1950; 18 rivers) and one with recent data (1980-2003; 84 rivers). Historical data are limited to presence absence, no information on biomass is available. It only covers rather large rivers.

Historical data were assessed using TWINSpan analysis (based on presence/absence data) in order to cluster watercourses with similar fish populations. 9 groups were identified. For each group indicator species could be defined.

Exploratory analysis of the recent data consisted of PCA, box plotting and cluster analysis (S-PLUS 2000). No significant differences were observed between the different rivers though some species were restricted to one basin. Using TWINSpan analysis results on presence absence data with all fishes or only the most abundant ones were compared. Results were different when the locations were assessed individually or grouped per river. Applying a canonical correspondence analysis on the recent data (462 plots, 30 species= main matrix) only the river Maas significantly differentiates from the other rivers. However a Detrended Correspondence analysis using presence absence analysis did not separate the River Maas while when using number of specimens it did separate the River Maas and some rivers from the IJzer basin. This separation is due to the following species: *Leusiscus cephalus*, *Alburnoides bipunctatus*, *Barbus barbus* and *Anguilla anguilla* for the Maas. The other locations formed one cloud on the biplots.

Apparently Flemish rivers all have a similar fish population or the differences are not significant to separate different typologies. We therefore think that the ichthyologic population presented in Huet's paper (1949) could be used for Flanders. Another possibility is to use a more refined typology developed by Wils (1998).

### The different steps of the analysis

#### Historical data

Historical data containing information of presence/absence in different rivers in Flanders from 1850 onwards were analysed using TWINSpan.

Results Historical data (Fig 1)

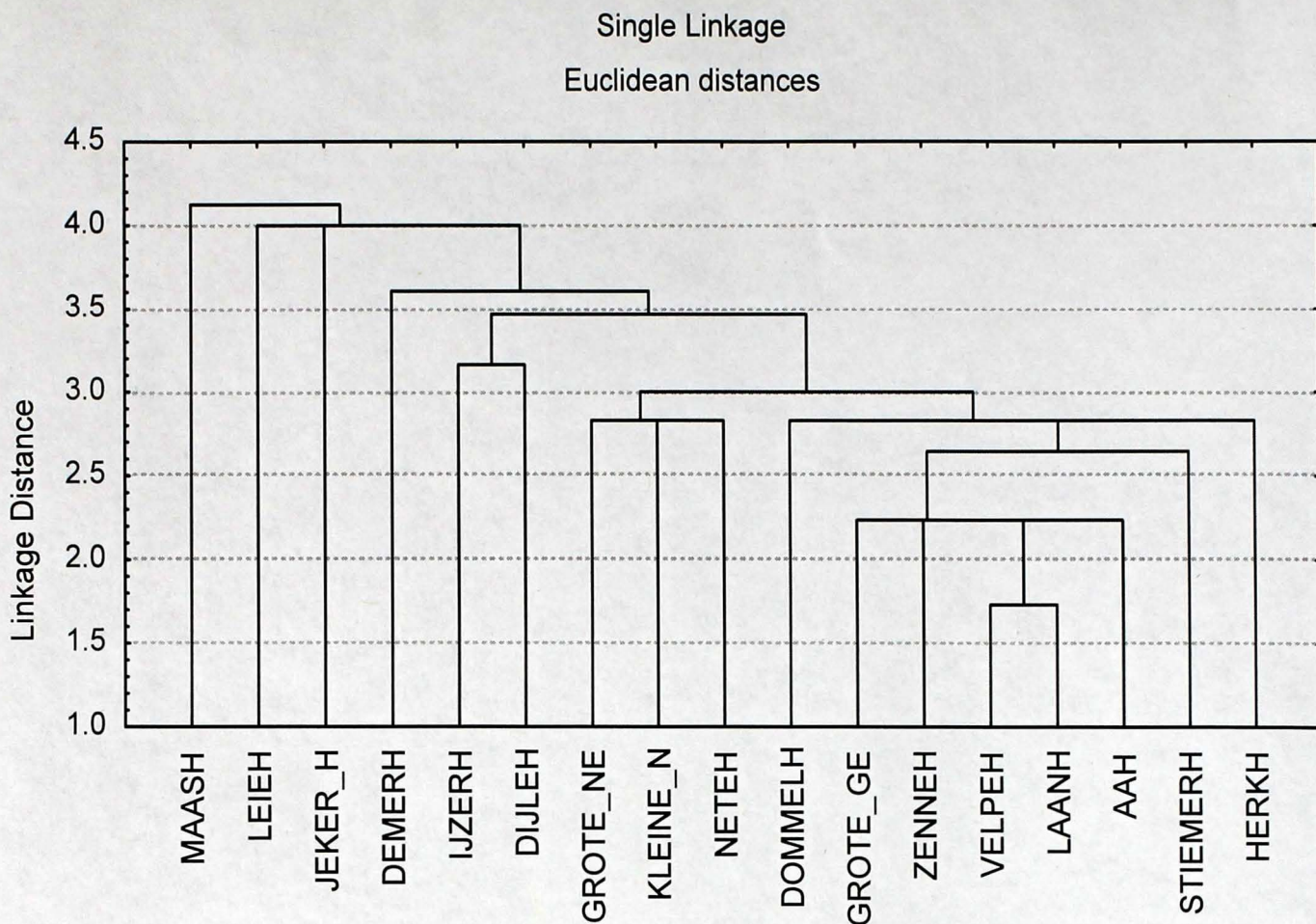


Fig 1: Dendrogram from a TWINSPLAN analysis using historical data grouped in basins and sub-basins

### Recent Data

#### PCA-analyses

We decided to use only data from locations with an IBI of at least 3.5 (on a scale ranging from 1 'bad' to 5 'pristine') and to consider only the most common fish species. This 111 locations scored also moderate to good for habitat structure (based on criteria such as presence of pool-riffle, natural state of banks and if the rivers do meander naturally).

In a PCA on presence/absence data with the 10 most common fish species (Fig 2) no groups can be distinguished.

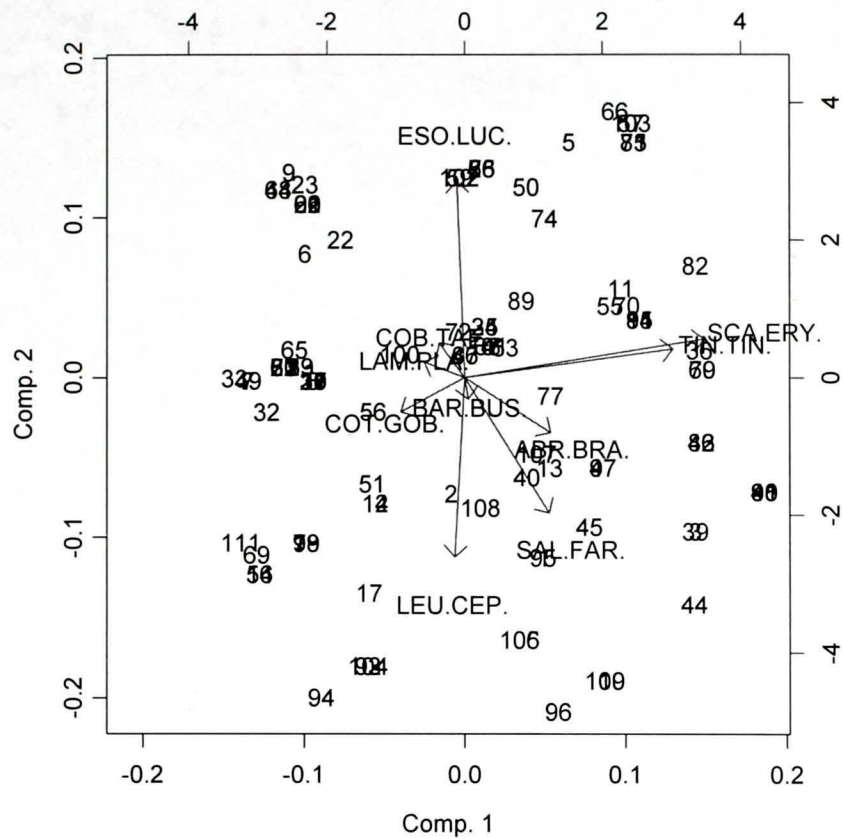


Fig 2: A PCA on presence/absence data with the 10 most common fish species in 111 locations with a IBI>3.5.

A PCA on number of specimen with the 10 most common fish species gives next plot: (Fig 3) The graph (Fig 3) shows that all 111 locations are spread. *Leuciscus cephalus* and *Barbatula barbatula* are distinct. *Leuciscus cephalus* can be attributed to the Maas basin but *Barbatula*

*barbatula* can not be appointed to one river basin nor river.

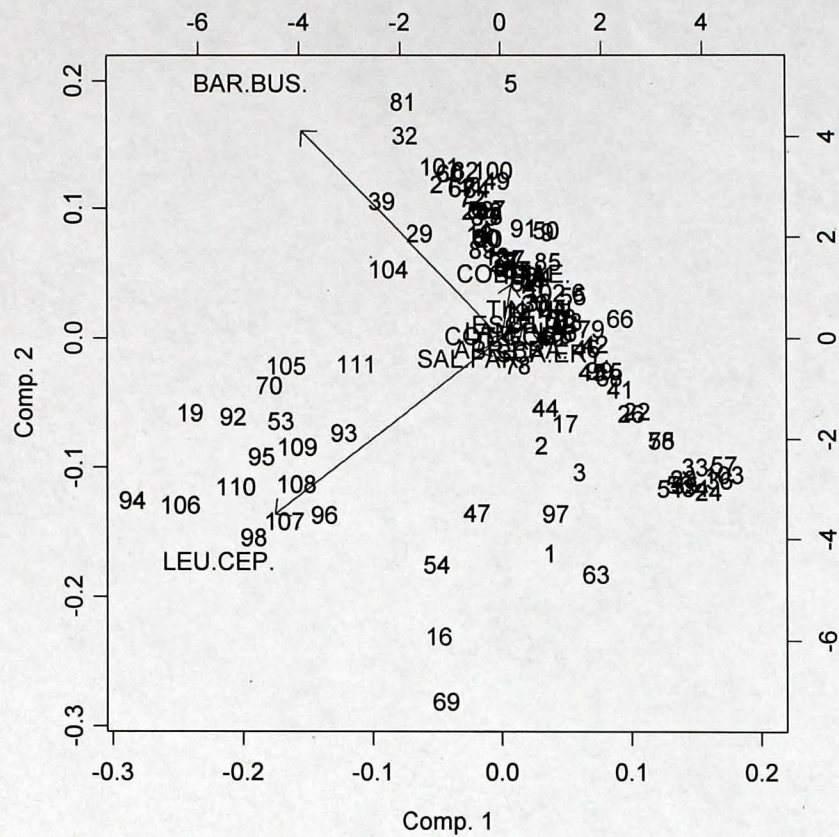


Fig 3 PCA with data from 111 locations with a good to moderate habitat quality and using only the 10 most common fish species

Removing this two species from the data and applying a PCA gives a plot (Fig 4) were all locations seem to gather in one cloud

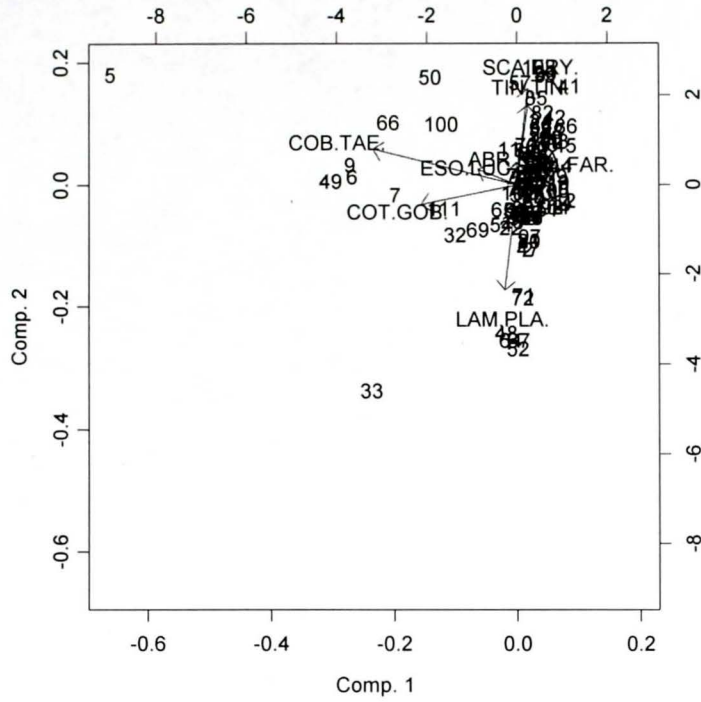


Fig 4: PCA with data from 111 locations with a good to moderate habitat quality and using only the 10 most common fish species minus *Leuciscus cephalus* and *Barbatula barbatula*

## TWINSpan

The same TWINSpan analysis, as used for the historical data, was applied on the recent dataset using all fish (presence/absence) and grouping those locations belonging to the same river. Rivers with a water quality (IBI<3) were omitted. The goals of these analysis was to see if similar groups of fish assemblages could be distinguished in the historical and recent dataset and to see if typical groups were to be found for certain types of rivers.

Rivers are grouped together belonging to different basins. The reasons are that they commonly do have some fish species or commonly do not have them.





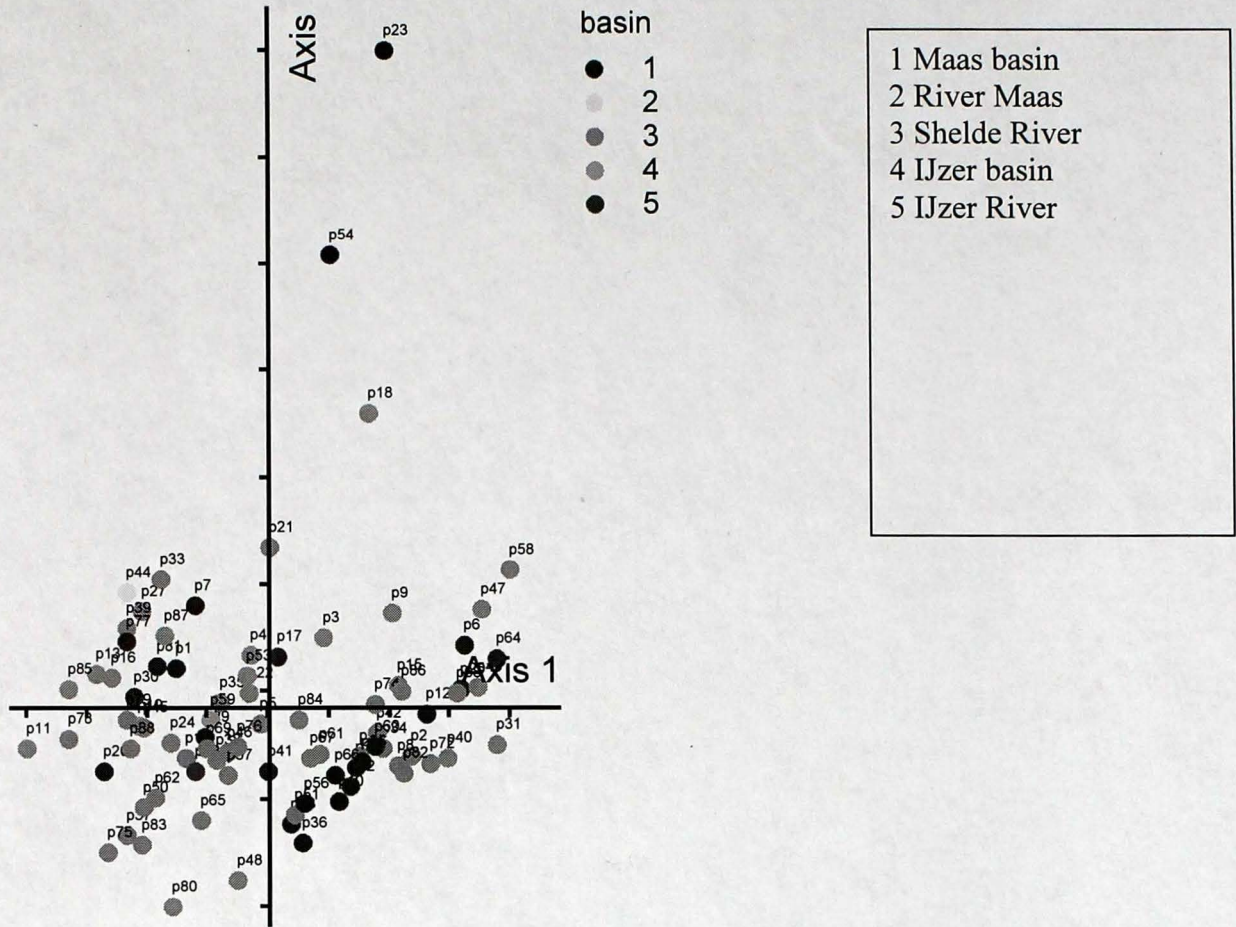


Fig 6 A Detrended Correspondence Analysis (DCA) using presence/absence data for the 30 species spread over the locations

Superposing the fish it appears as that the presence of barbell, stone loach, brook and brown trout could explain this separation (Fig 8)

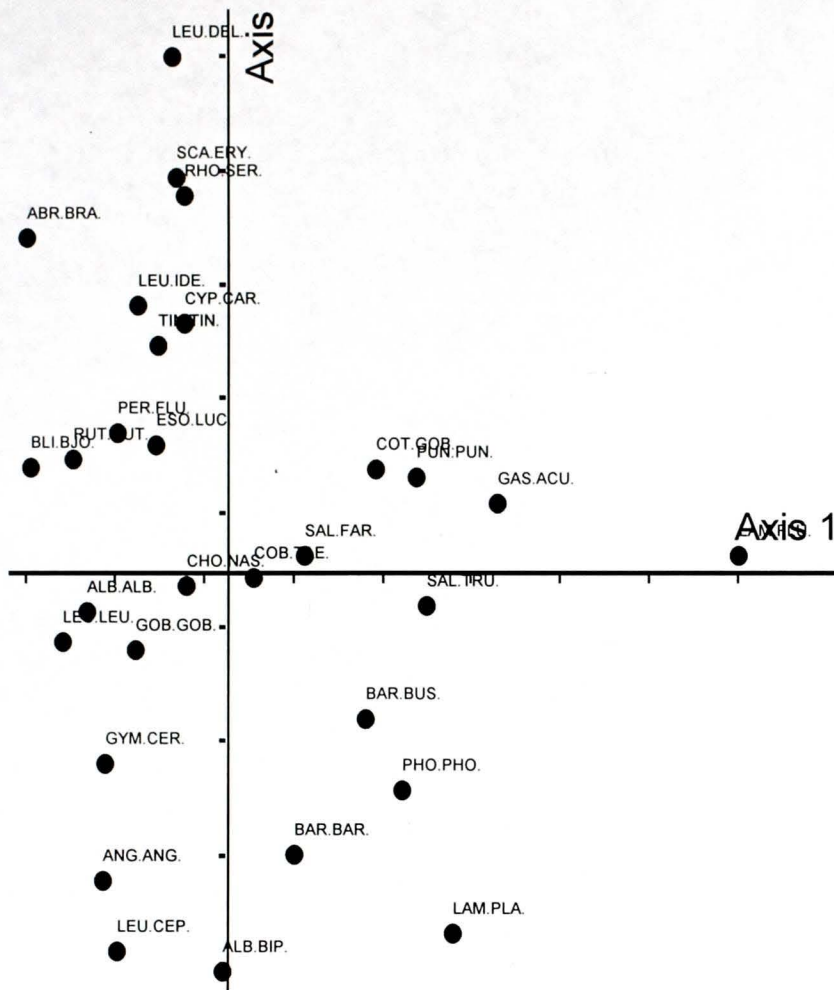


Fig 7 Superposing the fish on the results of the Detrended Correspondence Analysis (DCA) using presence/absence data for the 30 species spread over the locations

Using the same data a Canonical Correspondence Analysis (CCA) separated the river Maas (violet) nearly from the rest (Fig 8)

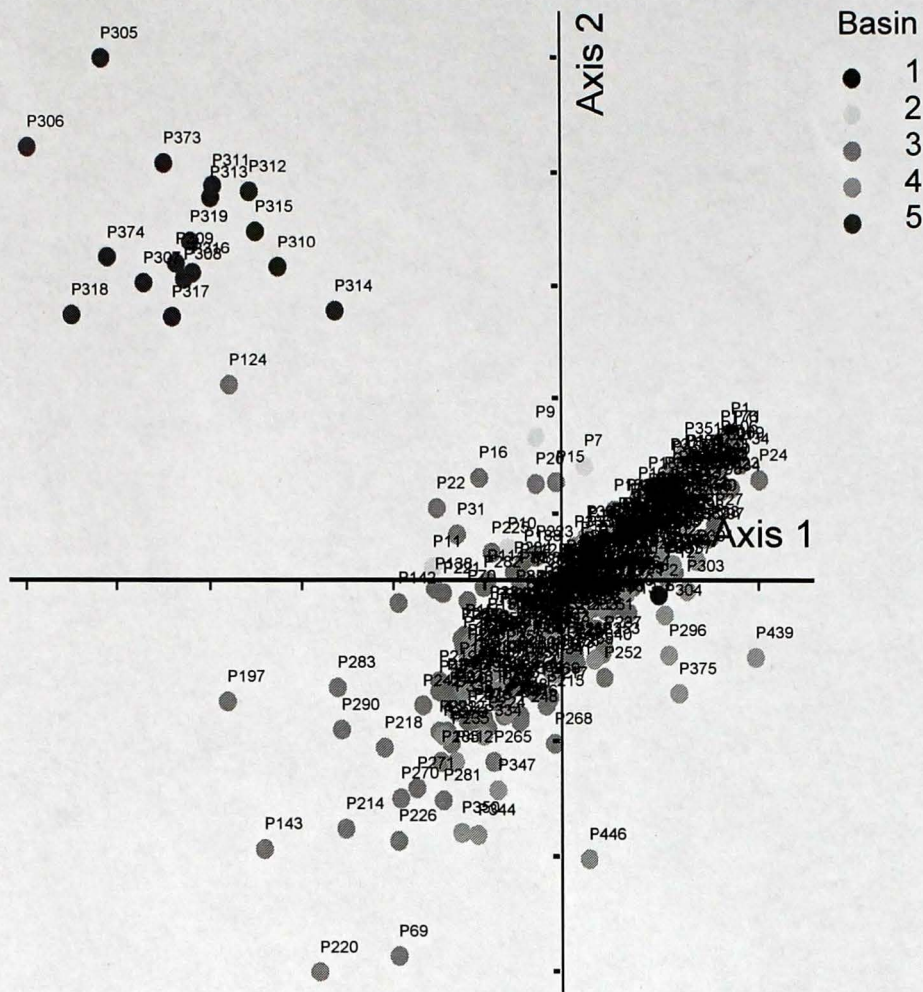


Fig 8: CCA using presence/absence data for the 30 species spread over the locations (Red is the River IJzer, blue Maas basin, green the Schelde basin and violet the River Maas, yellow the IJzer basin.)

This time the River Maas is separated from the rest. Clearly the River Maas is different from the rest. This is due to the presence of some species that are not or really found in the other basins as can be observed in the Fig 7.

Since these analyses didn't bring us closer to a typology, we proposed to continue with the existing typologies.

## The two existing typologies

Table 1 is based on the results presented in Huet's paper (1949)

Table 1 The different zones and fish occurring in these zones

	zone			
	Trout salmonids	Grayling Mixture with salmonids dominant	Barbel Mixture with cyprinids dominant	Bream cyprinids
<b>T species</b>	<b>Trout</b>	<b>Trout (grayling)</b>	<b>Barbel</b>	<b>Rudd</b>
			<b>Chub</b>	<b>Roach</b>
		<u>Barbel</u>	<b>Nose carp</b>	
		<u>Chub</u>		<b>Pike</b>
		<u>Nose carp</u>	Trout (grayling)	<b>Perch</b>
<u>Acc species</u>	<u>Bullhead</u>	Rudd		<b>Eel</b>
	<u>Minnow</u>	Roach	<u>Rudd</u>	
			<u>Roach</u>	<b>Carp</b>
				<b>Tench</b>
Acc pis spec.		Pike	<u>Pike</u>	<b>Bream</b>
		Perch	<u>Perch</u>	
		Eel	<u>Eel</u>	Barbel
				Chub
			Carp	Nose carp
			Tench	
			Bream	

In bold: typical species

Underlined accompanying species

Plain accompanying piscivorous species

Table 2 gives the distribution of the fish species present in the different zone's according to the recent data.

Table 2 Species occurring in the different zones (recent data). Here data are limited to the 11 most common species.

trout (23)	species	grayling (31)	species	Barbel (51)	species	Bream (38)	species
10,8 4	Gasterosteus aculeatus	8,97	Gasterosteus aculeatus	9,35	Gobio gobio	8,40	Rutilus rutilus*
7,83	Gobio gobio	8,97	Gobio gobio	9,13	Gasterosteus aculeatus	8,14	Gasterosteus aculeatus
7,23	Barbus barbus	7,93	Rutilus rutilus	8,26	Barbus barbus*	7,89	Gobio gobio *
7,23	Rutilus rutilus	7,59	Barbus barbus	7,83	Perca fluviatilis	7,89	Perca fluviatilis*
6,02	Anguilla anguilla	6,90	Perca fluviatilis	7,83	Rutilus rutilus	7,12	Pungitius pungitius
5,42	Perca fluviatilis	6,21	Pungitius pungitius	7,39	Anguilla anguilla	6,87	Barbus barbus*
5,42	Salmo trutta fario *	5,86	Scardinius erythropthalmu s	6,74	Scardinius erythropthalmus	6,62	Anguilla anguilla*
4,82	Scardinius erythropthal mus	5,17	Anguilla anguilla	6,30	Pungitius pungitius	6,36	Scardinius erythropthalmus*
4,22	Cottus gobio	4,83	Tinca tinca	5,87	Esox lucius	4,83	Esox lucius *
4,22	Leuciscus idus	4,14	Esox lucius	5,22	Tinca tinca	4,58	Tinca tinca*
0,60	Salmo trutta trutta	0,34	Lampetra fluviatilis	0,22	Phoxinus phoxinus	0,25	Chondrostoma nasmus*
0,00	Alburnus alburnus	0,34		0,00	Alburnoides bipunctatus	0,00	Lampetra fluviatilis
	Lampetra fluviatilis	0,34	Salmo trutta trutta	0,00	Lampetra fluviatilis	0,00	Salmo trutta trutta
	Absent species		Thymallus thymallus		Leuciscus cephalus		Cyprinus carpio
			Salmo trutta fario		Chondrostoma nasmus		Abramis brama

In dark green are those species occurring in all zones. Species with an asterisk (\*) are typical for the zone. Red are those species occurring in nearly one zone only. In light green are those species missing in a particular zone. Blue are species that do occur in nearly all zones and pink only in one zone. We observe that all zones have species belonging to the bream zone. The trout zone does have its typical species but too many other species occur in that zone. Or recently due to human activities the differences in fish composition among the zones are no longer that clear. We can therefore conclude that Huet 's typology and the species attributed to the zones can be considered as a reference.

A second more recent developed typology by Wils (1998) is also based on Huet. The table below (Table 3) gives an overview of the different zones and associated fish species.

Table 3 Indicator fish in different zones according to Wils (1998)

Brooks				Brooks in Kempen		Rivers	
Spring brook	Small brook	Large brook	Large river	Small brook	Large brook	Large river	Grindriver (Maas)
<i>Lampetra planeri</i> , <i>Salmo trutta</i> and <i>Cottus gobio</i>	<i>Salmo trutta</i> and <i>Cottus gobio</i>	<i>Barbatula barbatula</i> , <i>Barbus barbus</i> , <i>Tinca tinca</i> , and <i>Abramis brama</i>	( <i>Scardinius erythrophthalmus</i> , <i>Rutilus rutilus</i> and <i>Abramis brama</i> )	<i>Cobitis taenia</i>	<i>Perca fluviatilis</i> ( <i>Rutilus rutilus</i> and <i>Scardinius erythrophthalmus</i> )	<i>Scardinius erythrophthalmus</i> , <i>Rutilus rutilus</i> and <i>Abramis brama</i>	<i>Barbus barbus</i> , and <i>Leuciscus cephalus</i>

Table 4 gives the species captured recently for each river-type.

Table 4 Fish species found recently in the different typologies (considering only the most common species in analogy with previous exercise with the Huet typology i.e. using the same colour symbols)

spring brook	small brook	small brook (Kempen)	large river	large river (Kempen)	river (<20m)	Maas	large river (>20m)
Stickleback	Stickleback	Stickleback (10)	Stickleback	Roach	Gudgeon	Eel	Roach
Barbel	Stickleback (10)	Stickleback	Bream	Gudgeon	Stickleback	Roach	Gibel carp
Stickleback (10)	Gibel carp	Gudgeon	Gudgeon	Gibel carp	Roach	Gudgeon	Stickleback
Roach	Roach	Barbel	Roach	Pearch	P. parva	Chub	Eel
Brook lamprey	Gudgeon	Roach	Gibel carp	P. parva	Gibel carp	Pearch	Rudd
	P. parva	Pumpkinseed	P. parva	Pumpkinseed	Rudd	Ruffe	Pearch
	Barbel	Eel	Stickleback (10)	Ide	Pearch	Barbel	White bream
	Eel	Rudd	Rudd	Eel	Ide	Bleak	Carp
	Rudd	Striped mudminnow	Ide	Brown bullhead	Tench	Bullhead	Pike
	Pearch	Gibel carp	Pearch	Stickleback (10)	Minnow	White bream	Gudgeon
				Pike			
				Carp			
				Stickleback			

We can see that some typical species do occur in the designated typology. But again different species occur randomly in different typologies. Therefore the typology and the attributed species can be considered as a reference.

### Conclusion

Due to the absence of references in Flanders it is extremely difficult to develop fish based typologies. Using previously developed typologies could be a solution.

## References

Huet M., 1949. Aperçu des relations entre la pente et les populations piscicoles des eaux courantes. Separatum Revue Suisse d'Hydrologie Vol XI Fasc. 3/4 p 332-351

Wils C., 1998. Opmaak van een systematiek natuurtypen in Vlaanderen: 1. waterlopen. UIA dep Biologie in opdracht van het ministerie van de Vlaamse Gemeenschap, AMINAL. MINA/102/98/02.