

COMPARISON OF TWO STANDARDISED METHODS FOR ASSESSING POND BIODIVERSITY (PLOCH-IBEM AND NPS)

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INTRODUCTION

Standardized tools for biological pond assessment are scarce. Consequently, pond managers often use poorly adapted methods that were developed for streams, rivers or lakes. In this context, standardized assessment methods have been developed specifically for ponds in England and in Switzerland :

In the UK, methods NPS and PSYM

Those methods have the same sampling protocol but different evaluation systems.

Taxonomic groups evaluated are : **aquatic plants and all macroinvertebrates groups except Diptera and Oligochaeta**

In Switzerland, PLOCH method (known as IBEM since 2008)

Taxonomic groups evaluated are : **aquatic plants, Gastropoda, Coleoptera, adult Odonata and Amphibia**



PLOCH and NPS methods have been applied on a pond located in the marshes of the Grande Caricaie (Lake of Neuchâtel, Switzerland) and data collected have been compared.

This study have been made in collaboration with the authors of the two methods, the University of Applied Sciences of Western Switzerland (PLOCH) and the Pond Conservation (NPS) and with the management and study group of the Grande Caricaie.

The objectives of this study are :

- To compare PLOCH and NPS taking into consideration :
 - (i) the biological quality assessments (aquatic plants and macroinvertebrates)
 - (ii) the specific richness,
 - (iii) the investment and competences required to apply the methods

To evaluate the compatibility of PLOCH, NPS and PSYM methods to determine if one sampling allow the calcul of the

MATERIAL AND METHODS

STUDY SITE

The pond studied (called Font) is located in the nature reserve of Cheyres-Châbles-Font (Fribourg) (Figure 1), one of the seven protected areas of the Grande Caricaie. This one constitutes the bigger marsh of Switzerland, and is situated on the southern shore of Neuchâtel Lake.

The pond is permanent. Banks are covered with different reed bed units, and are poor shaded. The immediate environment is constituted of wet grassland and reed beds.

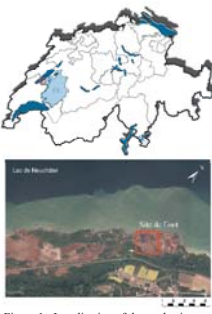


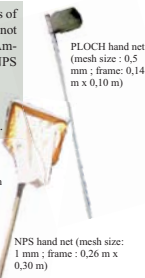
Figure 1 : Localisation of the study site

FIELD WORK

Field work has been conducted during months of June and July 2006. PLOCH sampling has not taken in consideration adult Odonata and Amphibia as these groups were not include in NPS protocol.

Tables 1 and 2 present some of the main characteristics of the methodologies applied.

Figure 2-2 : Quadrat used for vegetation sampling with PLOCH method



NPS hand net (mesh size: 1 mm; frame: 0,26 m x 0,30 m)

Table 1: Main characteristics of vegetation sampling protocols

VEGETATION	PLOCH	NPS
Number and date of sampling	One sampling the 05.07.06	One sampling the 12.07.06
Method used	Quadrats along transects	Exhaustive inventory
Description	Inventory of the species within the quadrats placed at equal distance along longitudinal transects positioned at regular intervals in order to cover the pond surface	Determination of all wetland species in the perimeter of the pond, including submerged areas.
Taxonomic level of determination	Species (IBEM: genus)	Species

Table 2: Main characteristics of macroinvertebrates sampling protocols

MACROINVERTEBRATES	PLOCH	NPS
Number and date of sampling	One sampling the 06.07.06	One sampling the 06.07.06
Method used	Numbers of samples determined in relation with pond surface	Fixed sampling time of 3 minutes independently of pond surface
Description	11 samples distributed in all habitats and then proportionally to the cover of each habitat, with one third in the interface habitats	3 minutes divided equally between the habitats presents
Taxonomic level of determination	Species (IBEM: genus)	Species

RÉSULTATS

BIOLOGICAL QUALITY OF FONT POND

Biological quality assessments of Font pond obtained with PLOCH and NPS methods assess the biodiversity of Font pond as «high» (Figure 2)

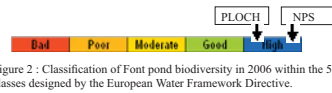


Figure 2 : Classification of Font pond biodiversity in 2006 within the 5 classes designed by the European Water Framework Directive.

METHODS COMPARISON

COMPARISON OF THE PLOCH BIODIVERSITY ASSESSMENT OBTAINED WITH PLOCH AND NPS SAMPLING METHODS

Figure 3 highlights differences between Coleoptera and Gastropoda biodiversity assessments when using PLOCH and NPS sampling protocols.

Those differences haven't however significant effect on the global pond quality assessment, since the same result is obtained when using or PLOCH, or NPS sampling protocol.

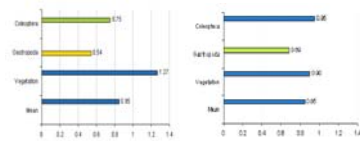


Figure 3 : PLOCH biodiversity assessment obtained with PLOCH and NPS sampling methods for each taxonomic group

COMPARISON OF SPECIES RICHNESS

Overall, NPS method inventories a higher species number than PLOCH method (Figure 4).

True species richness computed with Chao 1 estimator from PLOCH and NPS samples shows no significant difference (Figure 5).

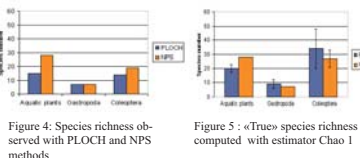


Figure 4: Species richness observed with PLOCH and NPS methods

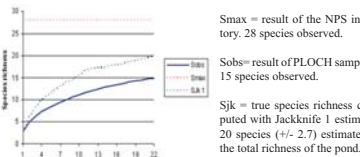


Figure 5 : «True» species richness computed with estimator Chao 1

COMPARISON OF VEGETATION SAMPLING PROTOCOLS

Sampling effort

The species accumulation curve of aquatic plants (Figure 6) shows that 22 quadrats are not sufficient to give a correct assessment of species richness (Sobs, 15 species). Indeed, Jackknife 1 estimator continues to grow after 22 quadrats, without reaching an asymptote.

Prospection effort of NPS inventory allowed to count an higher species number than the one estimated by Jackknife 1.

Sampling strategy

Precedent results show that PLOCH protocol sampling of vegetation (quadrats along transects) isn't appropriate regarding Font pond characteristics :

- High heterogeneity of vegetation units ;
- High number of rare species for which the probability of being present in the quadrats are weak.

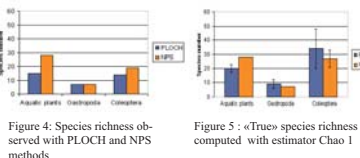


Figure 6 : Aquatic plants species accumulation curve drawn with PLOCH samples

Smax = result of the NPS inventory, 28 species observed.
Sobs = result of PLOCH sampling, 15 species observed.
Sjk = true species richness computed with Jackknife 1 estimator, 20 species (+/- 2.7) estimated as the total richness of the pond.

COMPARISON OF MACROINVERTEBRATES SAMPLING PROTOCOLS

Sampling effort

Sampling effort has been more important with PLOCH than with NPS, as related by Table 3.

The fact NPS method inventoried a higher percentage of Coleoptera total richness than PLOCH method, and a similar number of Gastropoda species, despite a sampling effort less important, seems to show that other parameters could have wrong PLOCH sampling efficiency.

The lake of efficacy of PLOCH sampling is illustrated by the Coleoptera species accumulation curve (Figure 7b), that shows a linear growth of Chao and Jackknife estimators after 11 samples.

PLOCH sampling has been more efficient for Gastropoda. Figure 7a shows that despite both estimators of species richness continue to grow after 11 samples, an inflexion of the curve is visible, highlighting that total richness is not far to be reached.

Table 3 : Comparison of sampling effort of PLOCH and NPS methods on Font pond

	PLOCH	NPS
Total length	5 minutes 30	3 minutes
Length / sample	30 seconds	30 seconds
Number of samples	11	7

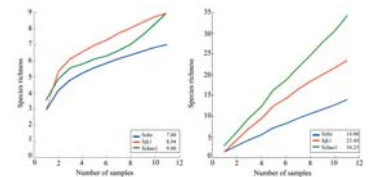


Figure 7 : Gastropoda (a) and Coleoptera (b) species accumulation curves drawn on PLOCH samples

Sampling effort partition

NPS spatial samples partition (2/3 of the samples in the interfaces) has been more efficient than PLOCH one (1/3 of the samples in the interfaces) for Coleoptera sampling.

Indeed, the analysis of species distribution in the different habitats sampled by PLOCH method, illustrated in Figure 8, shows that all species are located in interface habitats.

Both PLOCH and NPS spatial samples partition have been efficient for Gastropoda sampling. This can be explained by the fact that species distribution in the different habitats sampled by PLOCH is more or less similar in aquatic habitats than in the interfaces (Figure 9).



Figure 8: Mean Coleoptera species richness by sample in the five meso habitats sampled with PLOCH method

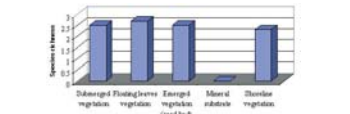


Figure 9: Mean Gastropoda species richness by sample in the five meso habitats sampled with PLOCH method

COMPARISON OF TIME REQUIRED TO REALISE A BIOLOGICAL QUALITY ASSESSMENT

Comparison of the number of days necessary to realise a biological assessment with the three methods shows that PSYM method requests the less investment (4 days), followed by PLOCH-IBEM (6 days), and NPS (9 days for non taxonomic specialists and 6 days for specialists). PLOCH method including a determination to the species level for all groups needs 14,5 days.

Advantages of protocols considering family or genus taxonomic level rather than species level for organisms determination have been clearly demonstrated.

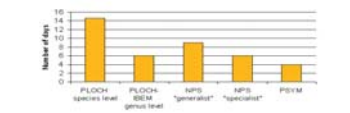


Figure 10 : Mean time (in days) of realisation of PLOCH/IBEM, NPS and PSYM assessments

DISCUSSION

Methods compatibility

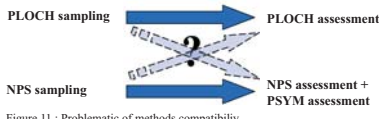


Figure 11 : Problematic of methods compatibility

The investigations leaded on potential compatibility between the studied methods, as schematized in Figure 11, resulted in the following conclusions :

PLOCH isn't directly compatible with NPS and PSYM (and conversely). Indeed, referentials systems are specific to the geographical area in which data used to the methods development have been collected ;

In consequence, to be used elsewhere, these would need local adaptation through expert knowledge or mathematical modelling.

CONCLUSION

In conclusion, three kinds of applications are suggested for the studied methods :

- PLOCH and PSYM as **monitoring methods**, for example within the scope of the implementation of legislation as the WFD
- PLOCH, NPS et PSYM as **management tools**. The complementarity of the three methods for this purpose have been highlighted ;
- PLOCH et PSYM as **planning tools**, for example for pre-selection of sites of particular interest within the scope of regional/national monitoring schemes.

However, some restrictions are imposed by :

- **Site characteristics** : pond surface seems to be a restrictive factor for NPS application (better on small ponds), whereas high heterogeneity of vegetation stands is limiting PLOCH efficiency ;
- **Investment and skills** required limit a routinely application of NPS method by non-expert users

