DERIVING AN EFFECT FACTOR FOR NITROGEN IN BRACKISH WATERS

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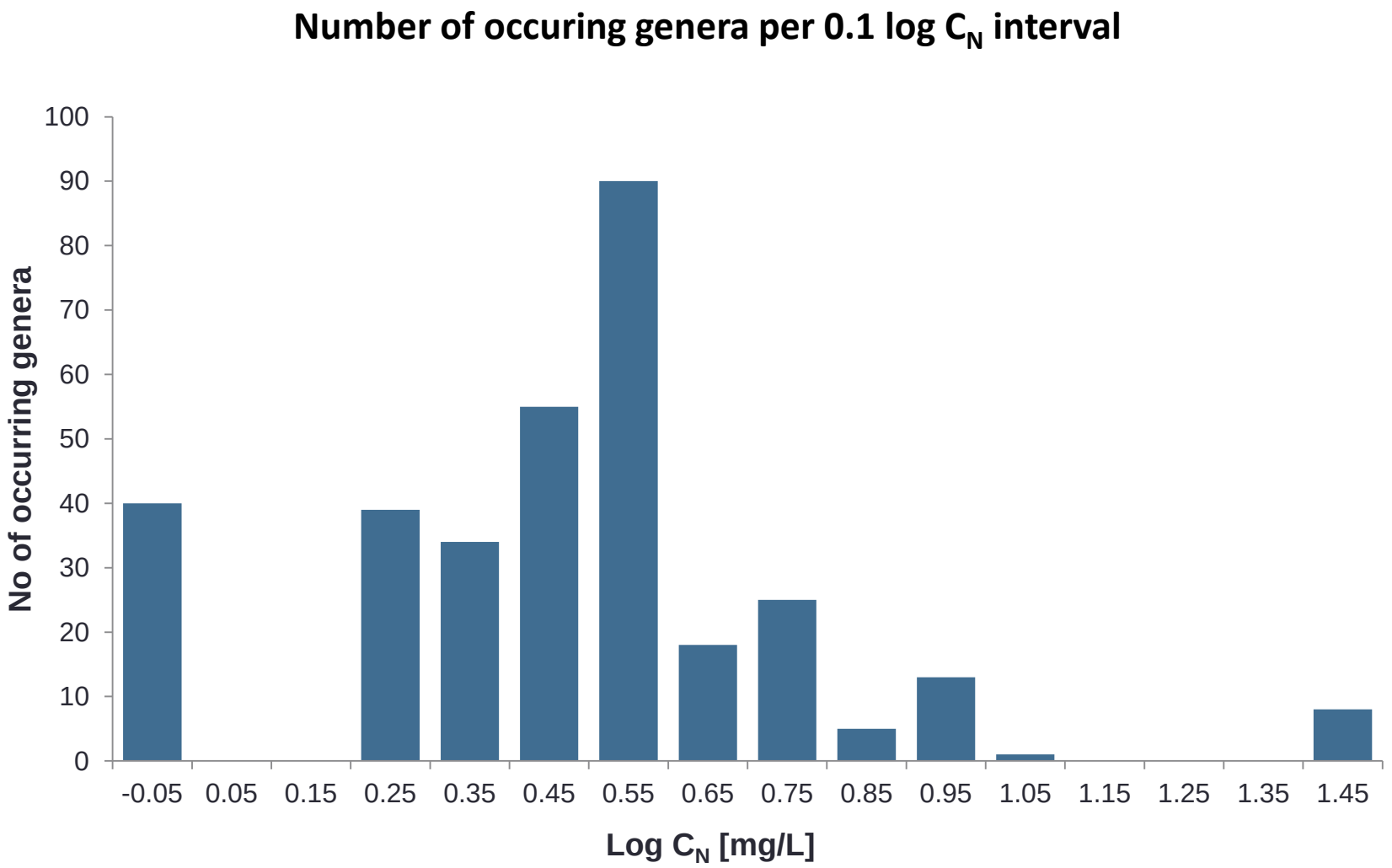
Introduction

- Two recently developed models for the assessment of P emissions in freshwater
- Brackish waters – usually adressed together with freshwater and assessed for P
- Is this really the way to go?

Methodology

- Correlation of nitrogen concentration (C_N) and occurence of macroinvertebrate genera in Dutch brackish lakes
- Following closely the method of Struijs et al. 2011 for comparability purposes
- Records for P limiting conditions (N:P>16) excluded

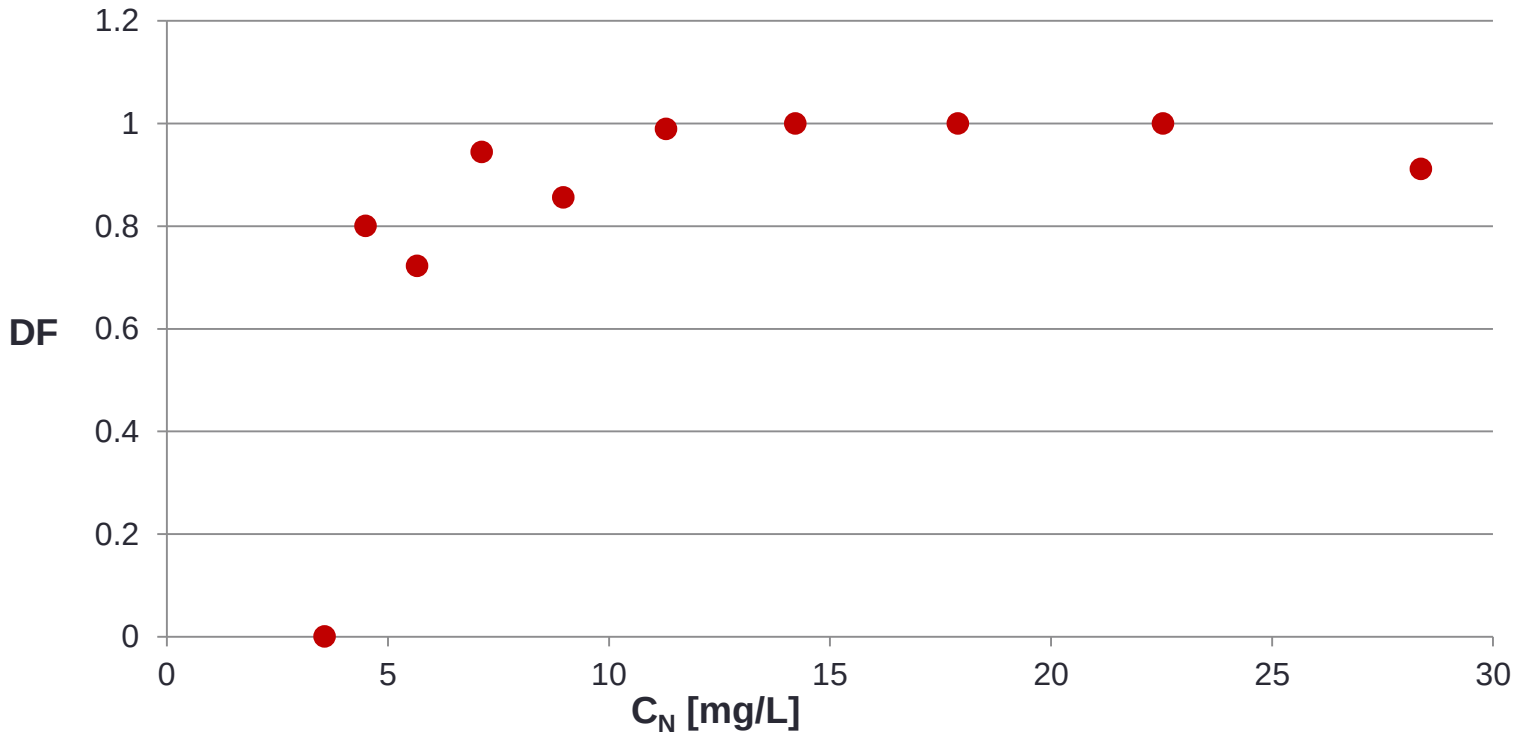
No of occuring genera per C_N interval



DF vs C_N

- Disappeared fraction : $DF = 1 - \frac{N(C_N)}{N_{max}}$

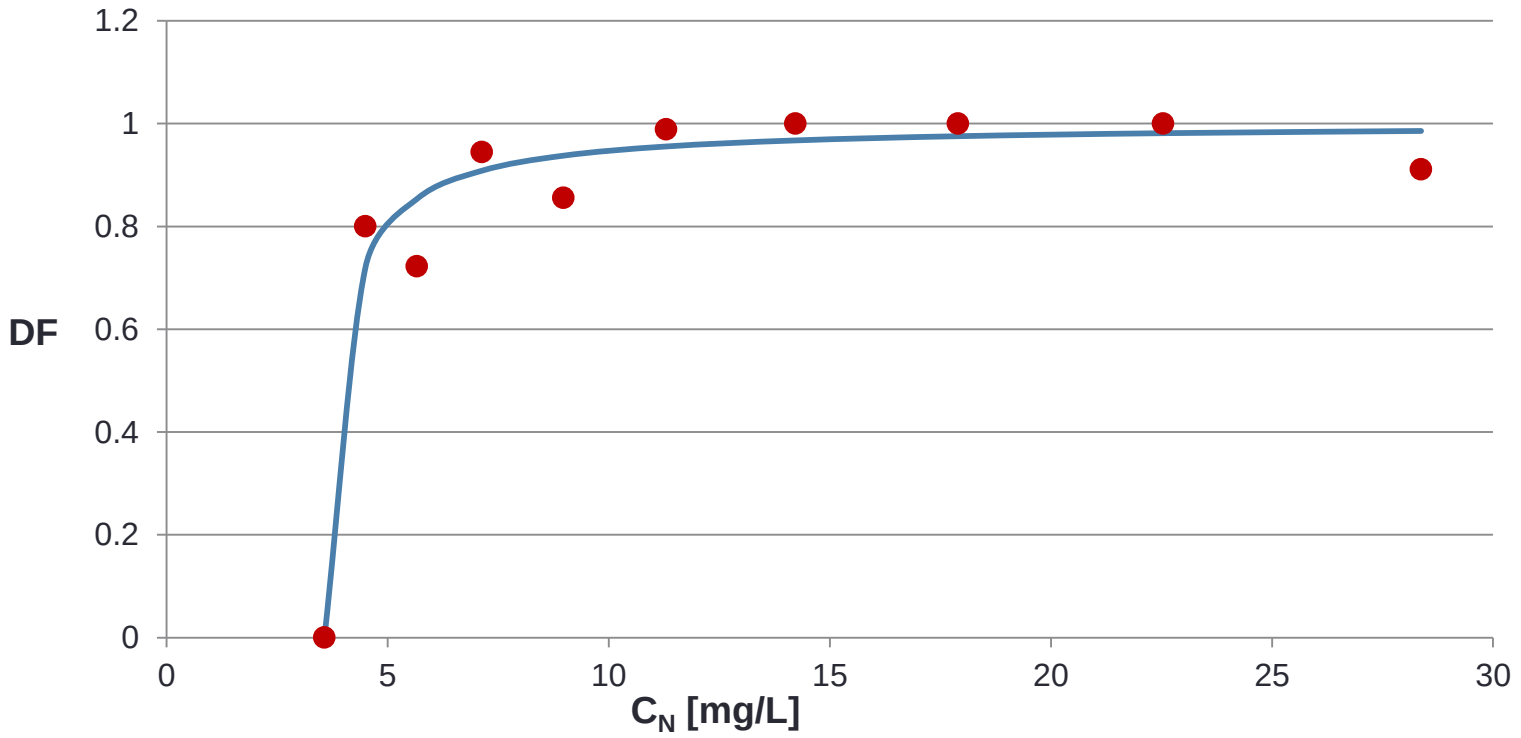
for $C_N > 3.57$ mg/L , $N_{max} = 90$ genera



DF vs C_N – fitting

a = 2.79
b = 3.57

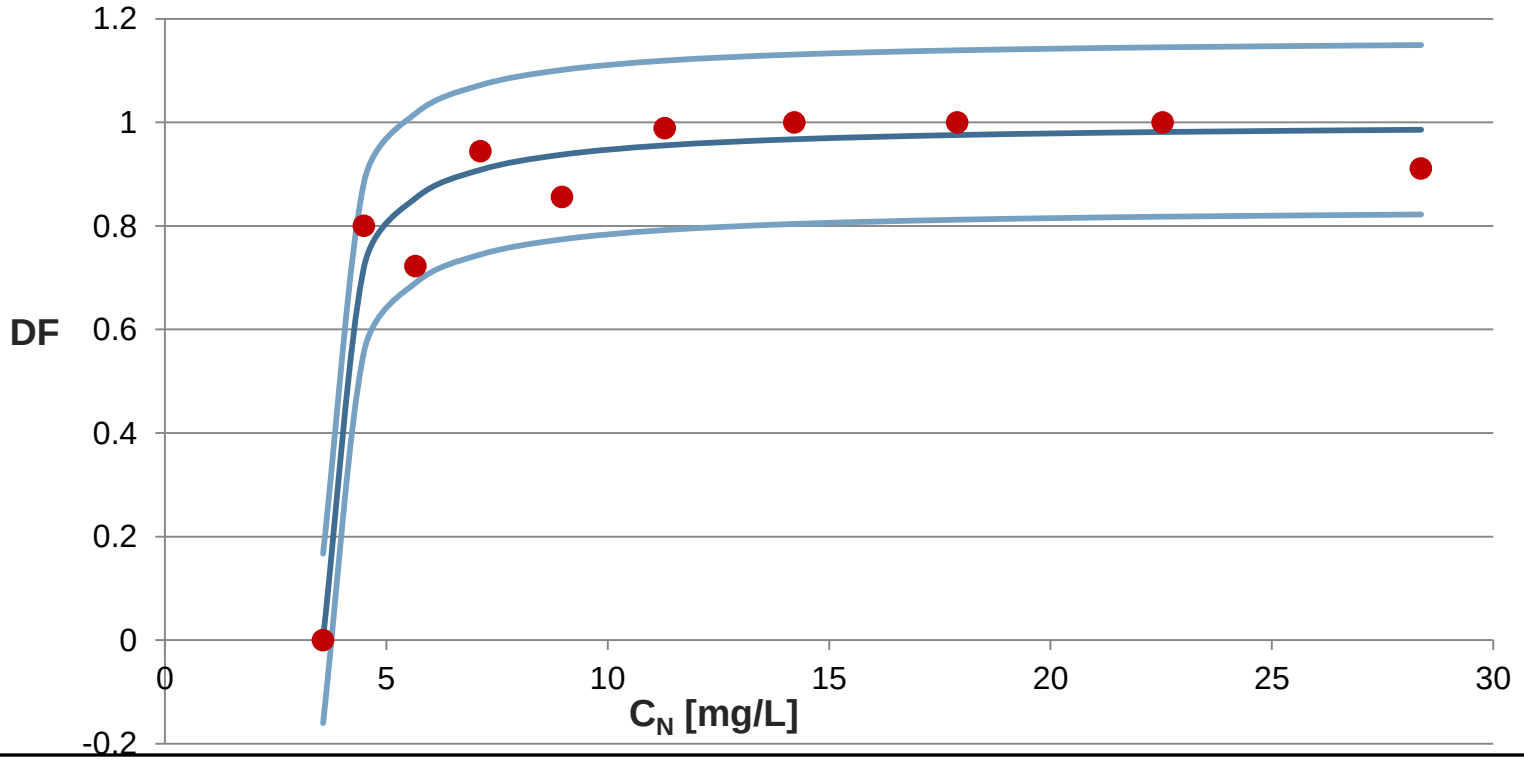
- Fitting : $DF = \frac{a \cdot (C_N - b)}{1 + a \cdot (C_N - b)}$ for $C_N > 3.57$ mg/L



DF vs C_N – fitting

a = 2.79
b = 3.57

- Fitting : $DF = \frac{a \cdot (C_N - b)}{1 + a \cdot (C_N - b)}$ (R^2 = 0.95)



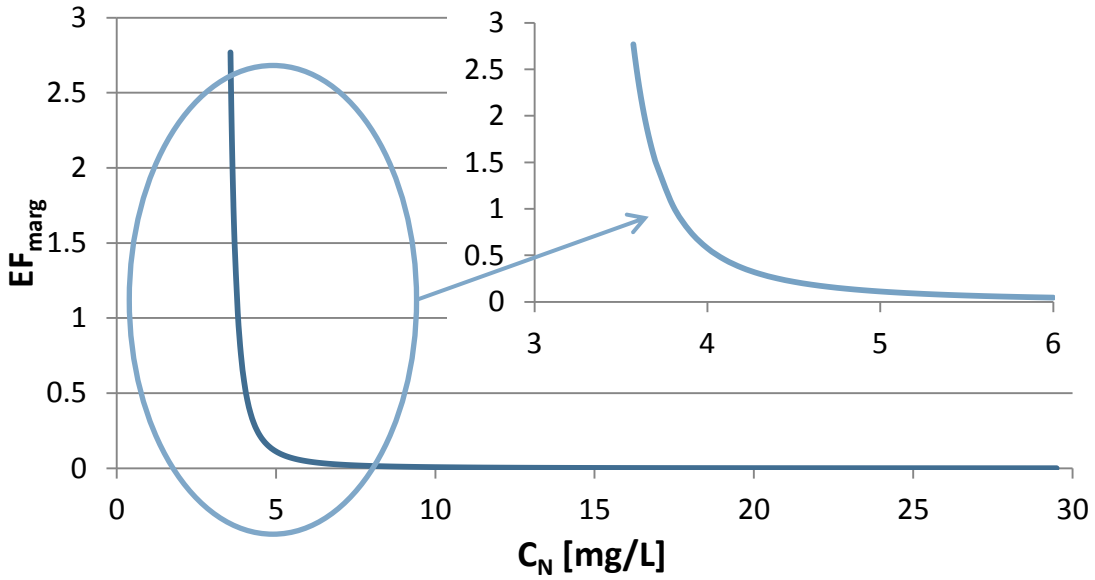
Effect Factors – marginal

a = 2.79
b = 3.57

$$DF = \frac{a \cdot (C_N - b)}{1 + a \cdot (C_N - b)}$$

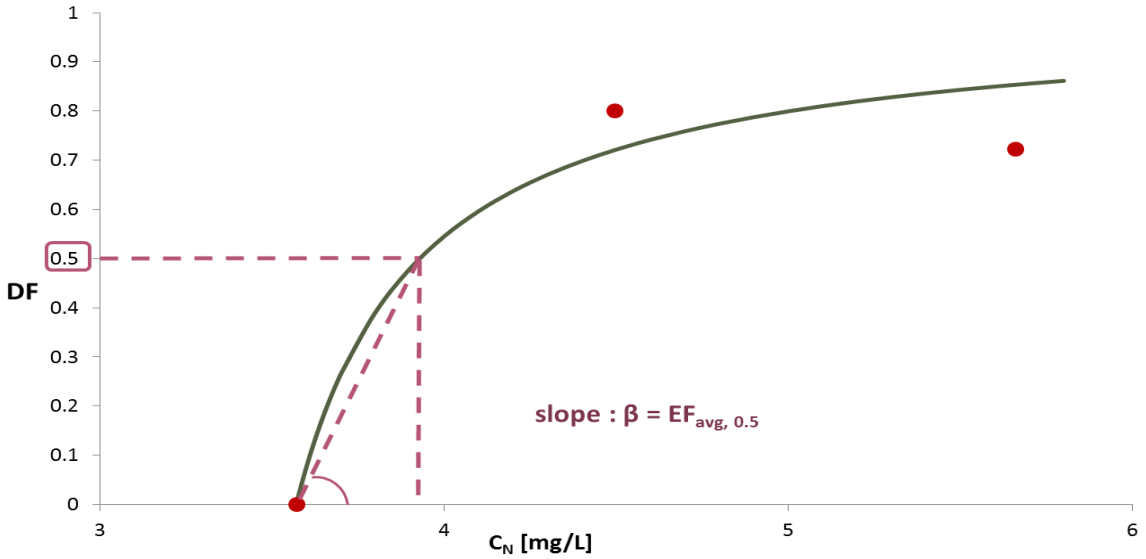
$$EF_{marg} = \frac{\partial DF}{\partial C_N} = \frac{a}{[1+a \cdot (C_N - b)]^2} \quad [L^3 \cdot M^{-1}]$$

C_N : most recent records for lakes (2007/8) ⇨ EF_{marg} = 101 PDF·m^{3}kg^{-1}



Effect Factors – average

a = 2.79
b = 3.57



$$EF_{avg} = \frac{DF(C_{N,i}) - 0}{C_{N,i} - 3.57} \Rightarrow$$

EF_{avg} = 532 PDF·m^{3}kg^{-1}

$$EF_{avg,0.5} = \frac{0.5}{C_N(0.5) - C_N(0)} = \frac{0.5}{3.93 - 3.57} \Rightarrow$$

$EF_{avg, 0.5}$ = 1'399 PDF·m^{3}kg^{-1}

Effect Factors – comparison

a = 2.79
b = 3.57

$$DF = \frac{a \cdot (C_N - b)}{1 + a \cdot (C_N - b)}$$

$$EF_{marg} = \frac{\partial DF}{\partial C_N} = \frac{a}{[1+a\cdot(C_N-b)]^2} \; [L^3 \cdot M^{-1}]$$

C_N : most recent records for lakes (2007/8) ⇨ EF_{marg} = 101 PDF·m^{3}kg^{-1}

$$EF_{avg} = \frac{DF(C_{N,i})-0}{C_{N,i}-3.57}$$ ⇨ EF_{avg} = 532 PDF·m^{3}kg^{-1}

$$EF_{avg,0.5} = \frac{0.5}{C_N\,(0.5)-C_N\,(0)} = \frac{0.5}{3.93-3.57}$$ ⇨ $EF_{avg,\,0.5}$ = 1'399 PDF·m^{3}kg^{-1}

Effect Factors – comparison

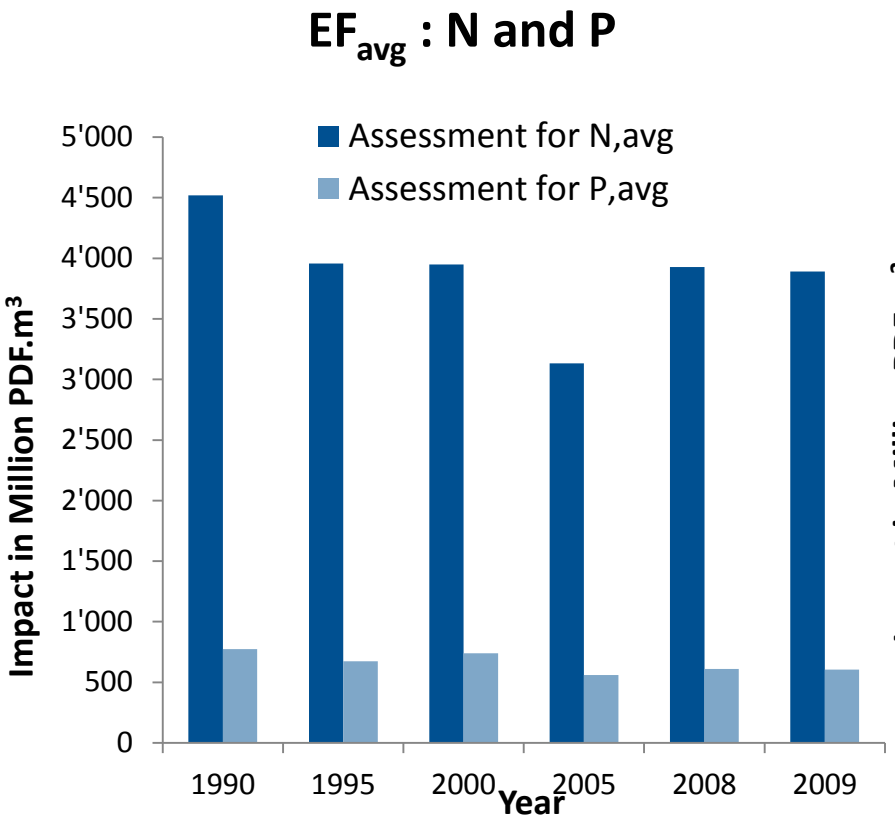
	This study (N)	Struijs et al. 2011 (P)
EF_{marg} [$DF.m^3kg^{-1}$]	101 (2.5)	167 (1.2)
EF_{avg} [$DF.m^3kg^{-1}$]	532 (6.1)	230 (1.3)
$EF_{avg,0.5}$ [$DF.m^3kg^{-1}$]	1’399	4’523

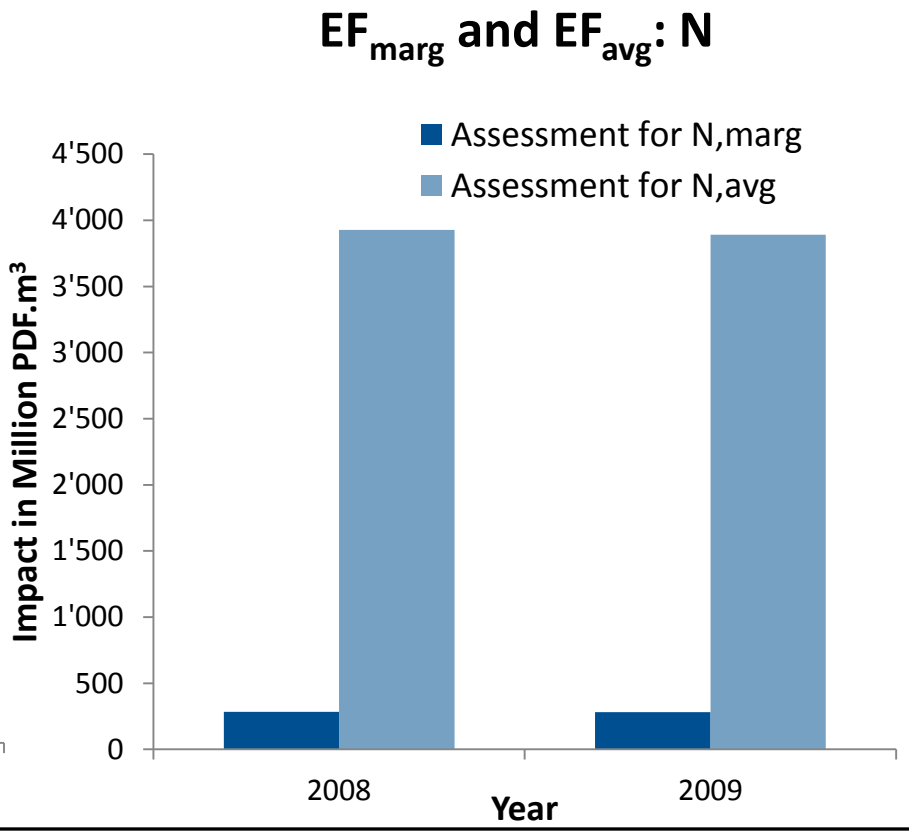
Effect Factors – comparison

	This study (N)	Struijs et al. 2011 (P)
EF_{marg} [DF.m³kg⁻¹]	**101 (6.1)**	**167 (1.2)**
EF_{avg} [DF.m³kg⁻¹]	532 (2.5)	230 (1.3)
$EF_{avg,0.5}$ [DF.m³kg⁻¹]	**1'399**	**4'523**

Assessment of brackish lakes

Assessment of all Dutch brackish lakes for N and P emissions, using the average and marginal effect factors





Conclusions - Discussion points

- How to treat brackish waters? Is it meaningful to account for N and assess separately?
- Model is site specific and data demanding – scaling up?
- Marginal or average effect factors?
- Data handling is critical!

Thank you for your attention.

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