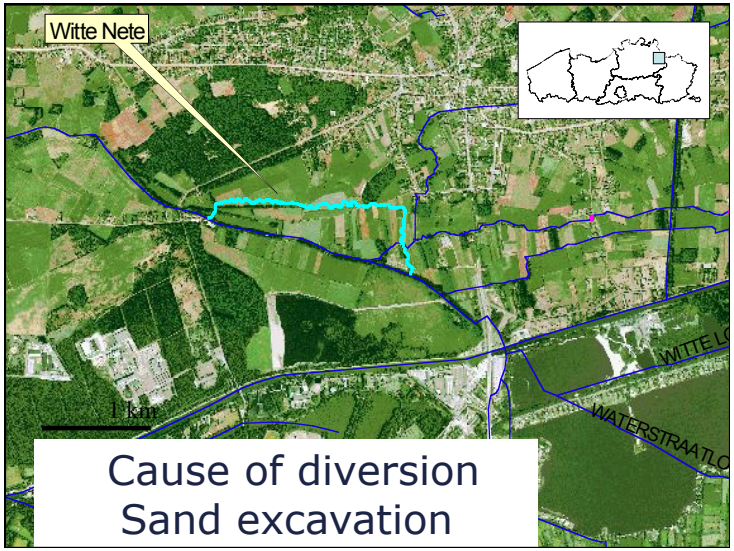
Remeandering and ecological restoration of a lowland stream in Belgium

Alain De Vocht
Centre for Environmental Sciences, Hasselt University,
Agoralaan, Build. D, 3590 Diepenbeek, Belgium
alain.devocht@uhasselt.be

RESTORE- Understanding River Restoration, De Bilt 25-26 juni-2013

Outline

- Introduction
- Realization
- Monitoring
- Conclusions



Original reach Witte Nete

Original reach	average		
Average width at waterlevel (m)	6.84	Average discharge (m^3/h)	1.826
Average width top levee (m)	9.29	Maximum discharge (m^3/h)	12.480
Average Water depth (m)	0.52	Slope	0.44
Average depth levee (m)	1.25	Sinuosity	1
Watervelocity (m/s)	0.2 – 2		

Introduction

- Original reach : channelized
- Presence of Endangered fish populations: Spined loach and Bullhead

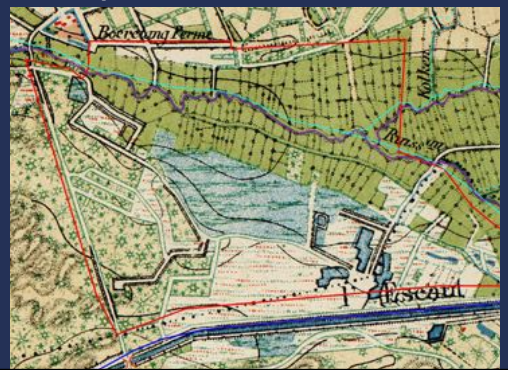
	Old	New
• Length	1.244 m	± 1.900 m
• Slope:	0.44m/km	0.29 m/km
• Sinuosity:	1.0	1.2

Goal diversion

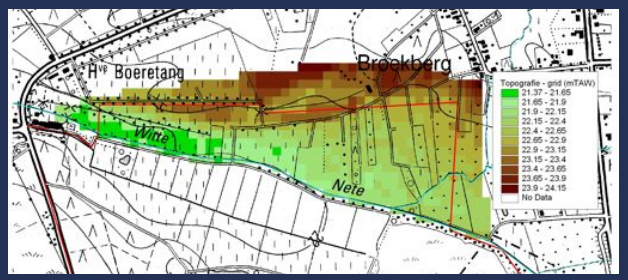
- Restore lowland stream with good structural and habitat quality where ecological processes can take place
- Create suitable habitat for Spined loach and Bullhead, in order to ensure stable populations

Design

Sinuosity based on historical maps

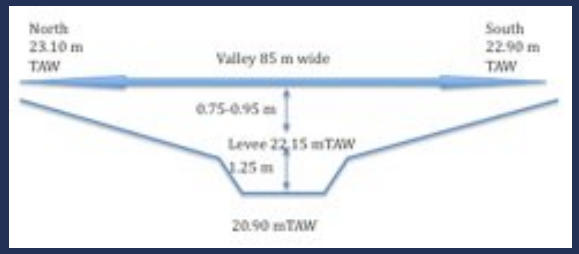


Local topography



- Valley within perimeter sand excavation
- New reach with same dimensions : digging out surrounding below ground level

Design



- System functioning : active meandering
- Width of meander belt within zone for nature development (new valley)

Realization
Febr – April 2006

Realization

Realization

Project

- A priori assessment
- Design based on historical map (1850)
- Executed by private company in cont. consultation with gov. agencies
- Social aspects (waking, cycling path)
- Post evaluation

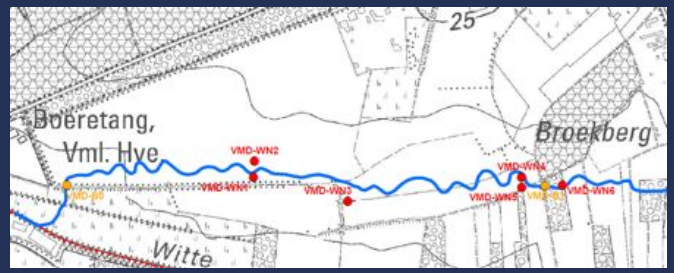
Monitoring

- Morphology
  - Depth, water velocity, substrate in cross sections
- Water en bank vegetation
- Water quality
- Macro-invertebrate fauna
- Fish fauna
- Groundwater

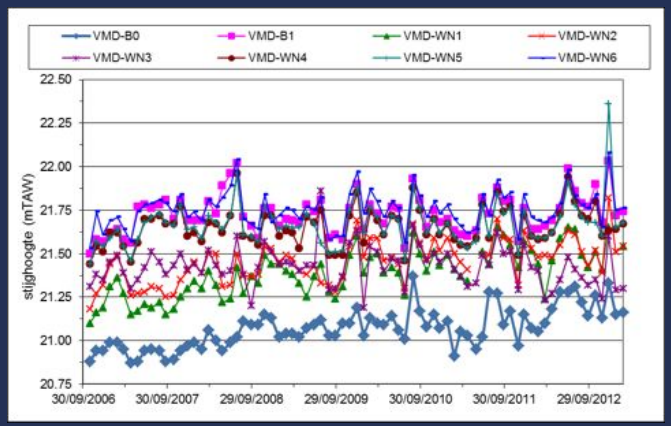
Goal monitoring

- Surveillance of restoration
  - –How will the system evolve?
- Is the diversion/remeandering an effective measure (EIA)
  - –Identical or richer communities
  - –Effect on Bullhead/Spined loach

Ground- and surface water



Ground- and surface water

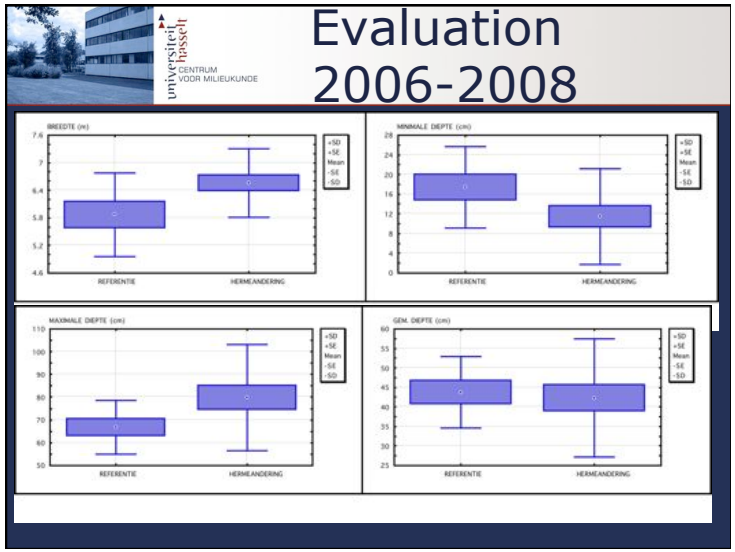


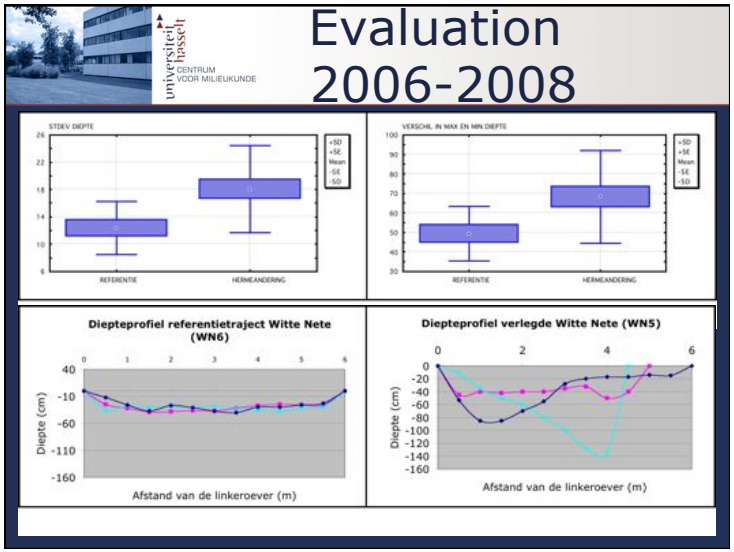
Evaluation morphology 2006-2008

- Changed depth profile
- Morphodynamic processes
- 8 point bars in April 2007
- More variation in depth and water velocity (not sign. after two year monitoring)


Morphodynamics


Morphodynamics


universiteit hasselt
CENTRUM VOOR MILIEUKUNDE
Evaluation 2006-2008
REFERENTIE
HERMEANDERING


universiteit hasselt
CENTRUM VOOR MILIEUKUNDE
Evaluation 2006-2008
Diepteprofiel referentietraject Witte Nete (WN6)
Diepteprofiel verlegde Witte Nete (WN5)
Diepte (cm)
Afstand van de linkeroever (m)

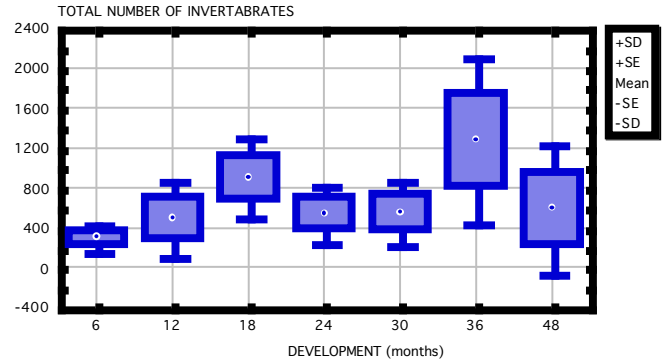
Effect of silt and rhizome introduction

Macro-invertebrates

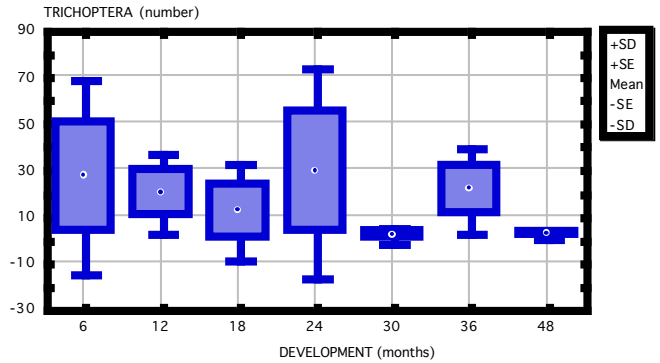
September 2006

remeandering	Silt and rhizome	BBI	#taxa	Staalnameplaats
yes	no	8	16	Downstream
yes	yes	8	32	↕
yes, pool-riffle	yes	8	32	
no, reference	no	8	26	upstream

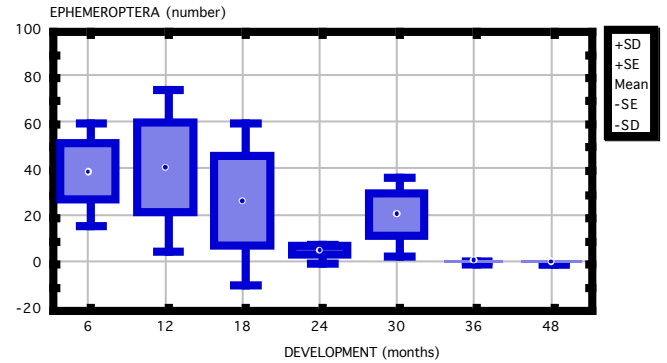
Macro-invertebrates



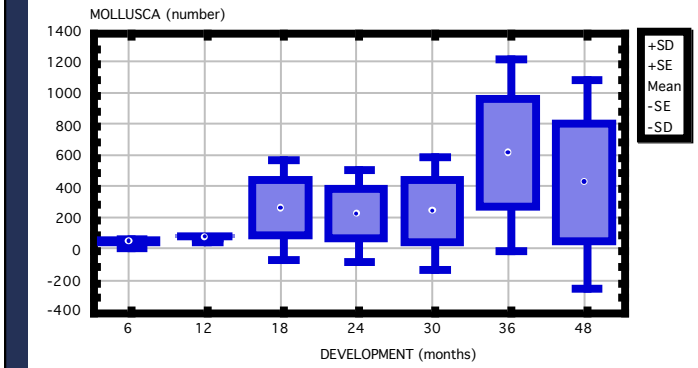
Macro-invertebrates



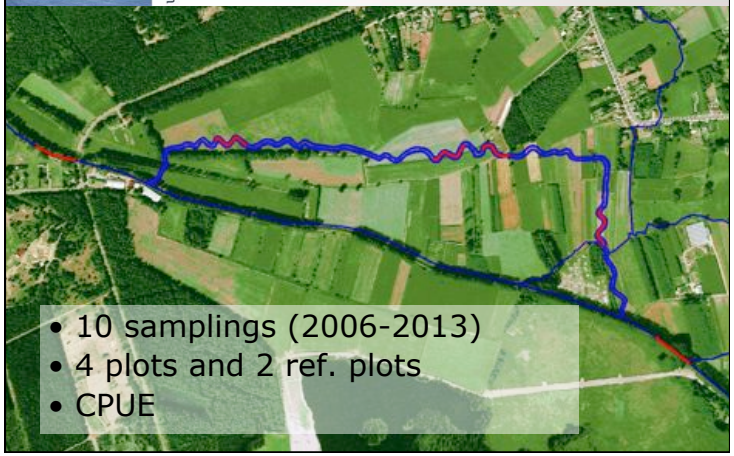
Macro-invertebrates



Macro-invertebrates



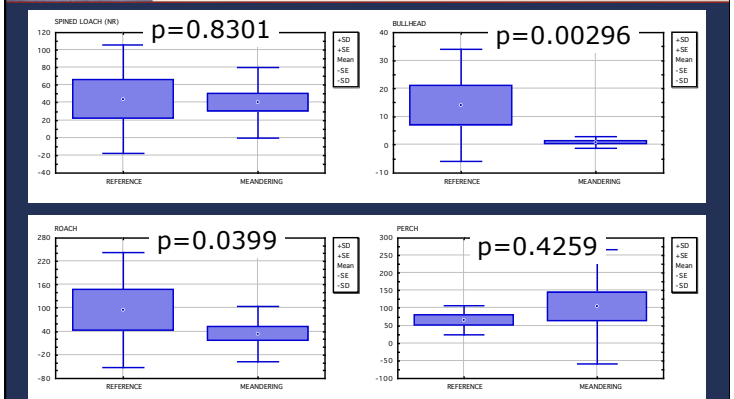
Fish fauna



Fish fauna

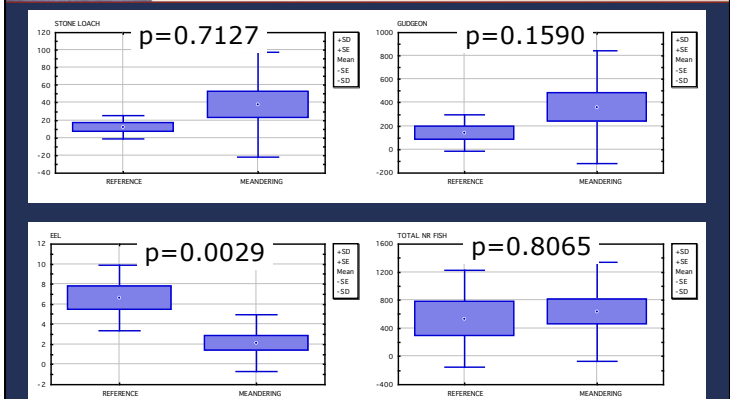
VIE marking – Radio telemetry

Fish fauna (2006-2010)



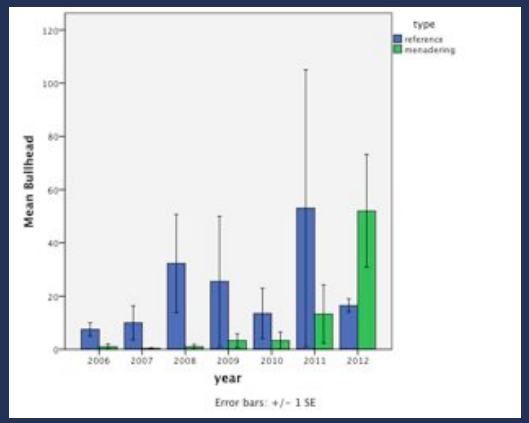
Mann-Whitney U test

Fish fauna (2006-2010)

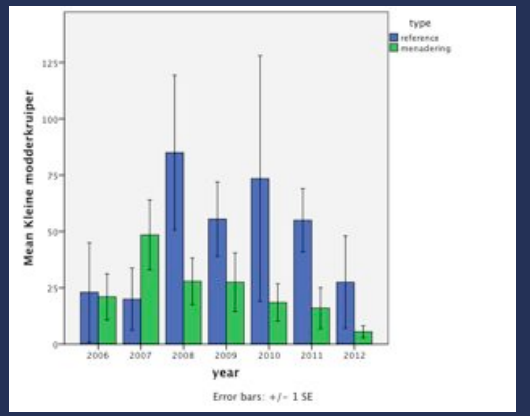


Mann-Whitney U test

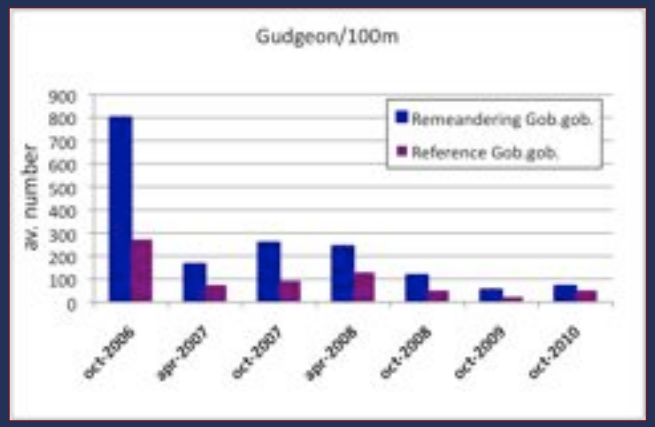
Bullhead



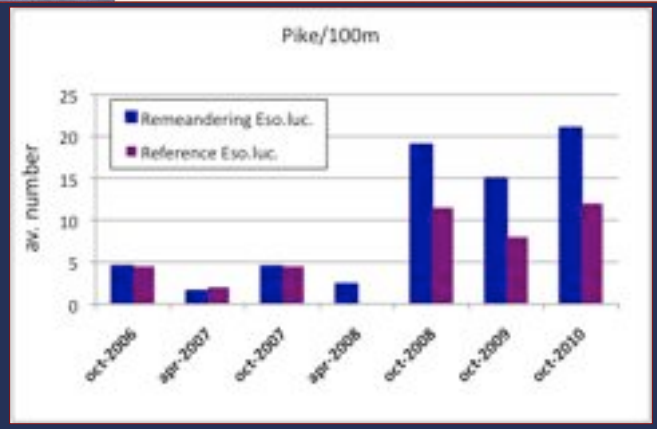
Spined loach



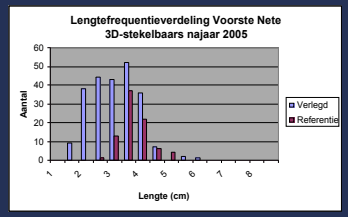
Gudgeon

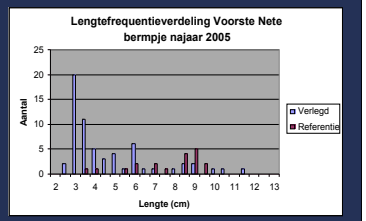


Pike



Population structure





- More juveniles in meandering reach
  - More shallow zones

Conclusions

- Morphology
  - Sandy banks were sensitive to erosion during first year
  - Short distance erosion/sedimentation processes
- Overall impact of eutrophication
- First two years: effects of disturbance

Conclusions

- Trends are visible, only few statistical significant differences
- Variability in population density:
  - Seasons
  - Natural fluctuations
  - Ageing ecosystem
  - Higher variability in restored reach
  - Period of monitoring

Conclusions Fish fauna

- Rapid colonization
- Similar fish population
- Spined loach
  - Reduced suitable habitat
  - lower population density
- Bullhead
  - Initially lower population density
  - Colonized by juveniles
  - Increased suitable microhabitats in time

Remember

- Ecological restoration by private company
  - Importance of good cooperation between parties in the process
- Ecosystem functioning versus population density of Annex II-species of HD
  - Meandering: less suitable habitat for Spined loach
  - Population density of Bullhead affected by man
- Long term monitoring
  - Variability
  - Ageing of ecosystem

Q & A

Alain De Vocht & Sarah Descamps
Centre for Environmental Sciences, Hasselt University,
Agoralaan, Build. D, 3590 Diepenbeek, Belgium
alain.devocht@uhasselt.be

Bart Aubroeck, Paul Hendig
Arcadis-Belgium nv,
Vaartkom 31 bus 8, 3000 Leuven, Belgium

Monitoring financed by
the Flemish Government Dept. LNE
and SCR-Sibelco NV