

Alternative River Bank Protections

an appropriate approach to improve river banks
along waterways from an ecological point of view?

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- all large rivers have been severely modified by bank fixation



alternative
river
bank
protections



Neobiota

Diversity

- new concepts for bank protection which combine navigation issues as well as the improvement of habitat and species diversity
- supported by EU Water Framework Directive (WFD 2000)

- different approaches developed by the Federal Waterways Engineering and Research Institute (BAW) and the Federal Institute of Hydrology (BfG)
- tested along different waterways to gain practical experience with these measures under technical as well as ecological aspects

structural improvement of rip rap

technical-biological river bank protection

groyne modifications

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structural improvement of rip rap

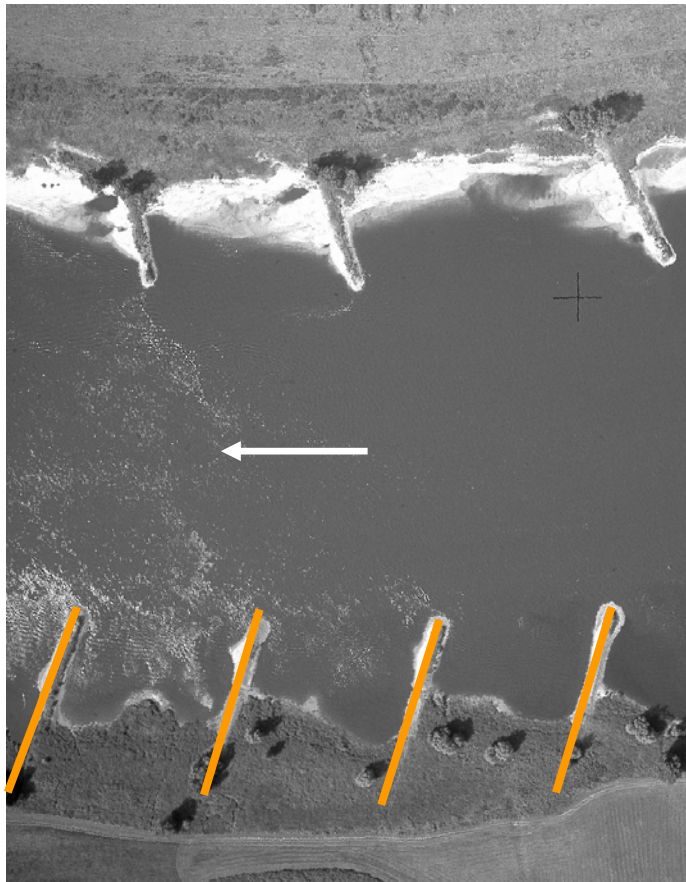
technical-biological river bank protection

Alternative Technical-Biological Bank Protection Measures applied on Inland Waterways - Test Reach along the River Rhine

groyne modifications

Ecological Improvements of Groynes along the River Elbe

Groynes and Groyne Fields



River Elbe is fixed and regulated by
~6900 groynes

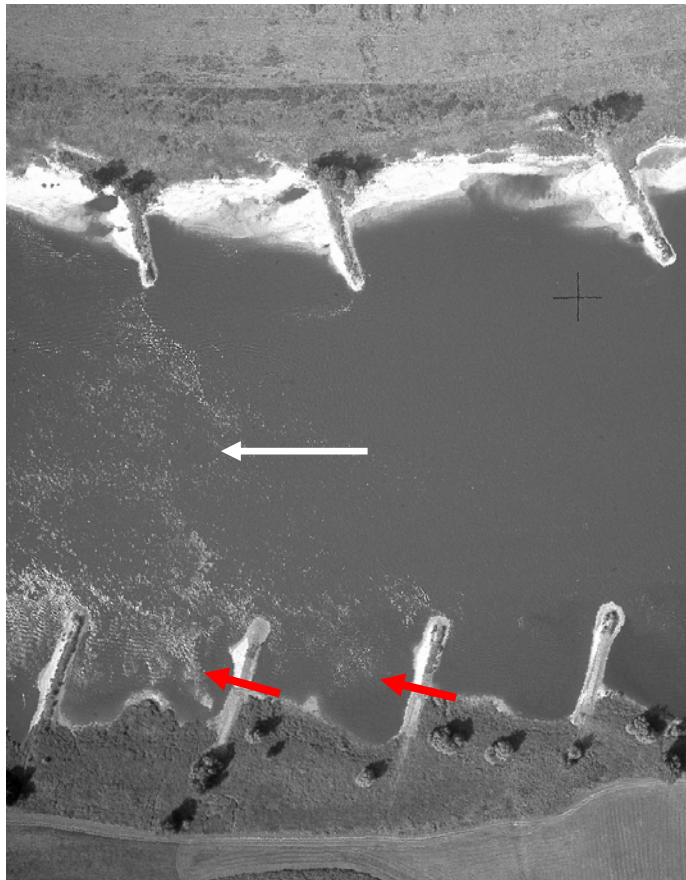
inclined form reduces the hydro-
morphological dynamic

long-term siltation process

BfG and BAW (1999): modification of
groynes

aim: increase of velocity and diversity

Groynes with Notches



River Elbe is fixed and regulated by
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inclined form reduces the hydro-
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BfG and BAW (1999): modification of
groynes

aim: increase of velocity and diversity

3 groynes were installed along the Middle
Elbe, km 443,4 – 444,1: 2001 – 2003

Pre- and Postmonitoring: 2000 – 2008

The ground beetle *Bembidion velox* L., 1761

stenotopic riparian

strongly endangered in Germany and
Saxony-Anhalt

main distribution at the Middle Elbe
River

key habitat factors determined by
habitat models:

- proximity to water
- sandy soil
- low vegetation cover



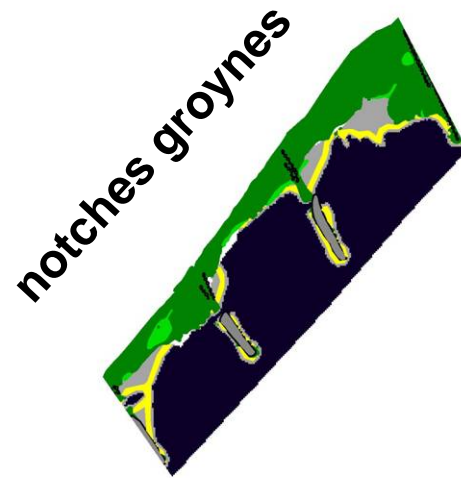
Habitat availability

optimal habitat quality

$p_{Bembidion\ velox} = 75\text{-}100\%$

WL 215 cm

2006, 26th June



78 m²

per 100 m
groyne field length

349 m²

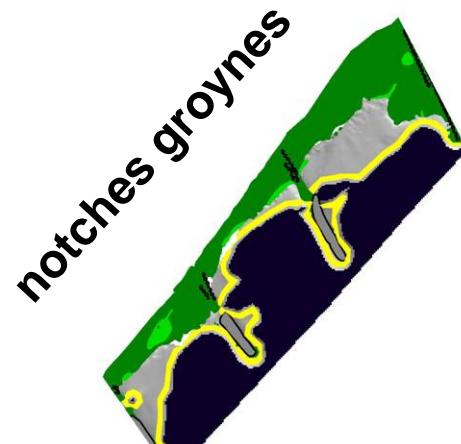
Habitat availability

optimal habitat quality

$p_{Bembidion\ velox} = 75-100\%$

WL 165 cm

2006, 25th July



465 m²

per 100 m
groyne field length

653 m²

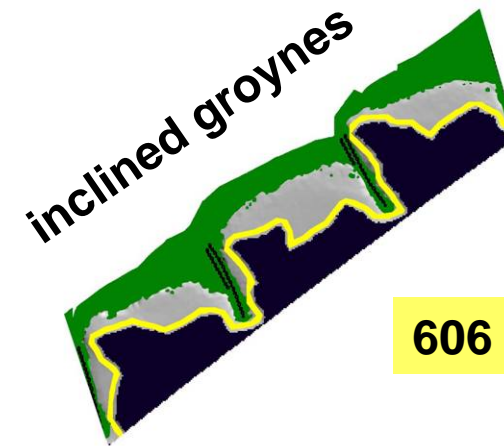
Habitat availability

optimal habitat quality

$p_{Bembidion\ velox} = 75-100\%$

WL 115 cm

2006, 3th August



606 m²

per 100 m
groyne field length

668 m²

Habitat availability

area (m ² per 100 m groyne field length)			
water level (cm)	215	165	115
inclined groynes	78	465	606
notched groynes	349	653	668

- ! in fields with notched groynes more area over a longer period of time is available for population development of *Bembidion velox* than in fields with inclined groynes
-

Test reach along the River Rhine

Upper Rhine km 440,6 - 441,6, near Worms

high traffic intensity - about 120 ships daily

measures installed from September to December 2011

- structural improvement of rip rap
- technical-biological river bank protections

Pre- and Postmonitoring until 2016

- bank stability
 - ecological potential
 - necessary maintenance
-

Technical-Biological River Bank Protections

willow brush mattresses



bank stability

prevent erosion

dense root
system



ecology

soft wood

native species



pre-cultivated plant mats



correct
installation

high plant vitality



natural plant
zonation

native species



Structural Improvement of Rip Rap

stone wall with shielded water zone
and dead wood trunks with roots



dead wood fascines

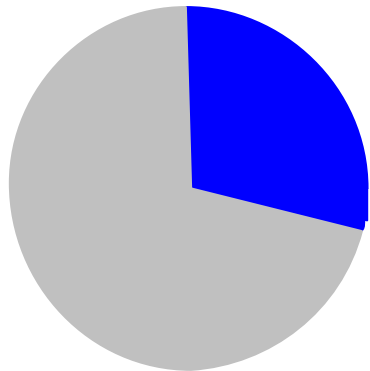


Fish assemblages

shielded water zone
with roots

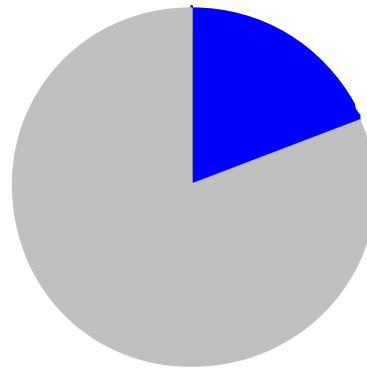
Individuals (%)

n = 199



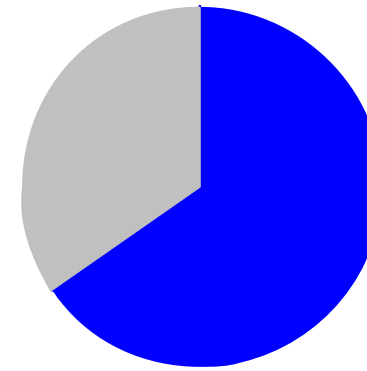
pure rip rap

n = 555



dead wood fascines

n = 214



■ reference species
according to WFD

■ non-native
species

Alternative bank protections can improve river banks along waterways from an ecological point of view

- habitat availability for the population development of *Bembidion velox* can be enhanced by notches in the groyne body
 - extension of the shore line with formation of scours and small sand banks
 - even under harsh conditions technical-biological river-bank protection can prevent bank erosion
 - woody debris along rip rap favor native fish species over non-native species
-

Many Thanks!



Ecological improvements of Groynes along the River Elbe

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Alternative Technical-Biological Bank Protection Measures Applied on Inland Waterways

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Riparian species

