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Eels II: 15 Years of MIGROMAT®: An Early Warning System Protecting Migrant Eels

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Institute for Applied Ecology

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15 Years of MIGROMAT® - An Early Warning System Protecting Migrant Eels

Institute for Applied Ecology

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index of juvenile stocks (% of 1960s-1970s)

source: 2003 International Eel Symposium, Québec
Hydroelectric Power Stations (HPS)
Solution: An Early Warning System

Eels migrate
- collectively
- only few times a year
- nocturnally (from dusk till midnight)

Eels display
- pre-migratory restlessness before they commence migration

I will tell you when!
The MIGROMAT® System

- HPS
- Pipe
- Container
- Tanks
- Inflow
- Hose
- Outflow

Components of the system include: HPS, pipe, container, tanks, inflow, hose, and outflow.
The MIGROMAT® System
The MIGROMAT® System

“normal” activity vs. pre-migratory restlessness
Functional Components

bioindicator: eel

antennas and technical control devices

procedures for analyzing and evaluating data for behavioral patterns

sending alarm messages via email and USB

MIGROMAT® Alarm ➔ Eel Protective Mode (EPM)
Eel Protective Mode (EPM)

HPS Management Options

Goal: reduce risks during passage, and thus decrease corresponding injury and mortality rates

• open weirs to create additional migration corridors and reduce approach velocity < 0.5 m/s

• Kaplan turbines: maximize runner blade pitch angles

• shut down turbines altogether (also for other turbine types!)
HPS Mühlheim, Offenbach
Temporal Overlap EPM vs. Migration

HPS Mühlheim: 63%
HPS Offenbach: 77%
HPS Linne: 66%
HPS Alphen: 73%
ca. 70% on average
Migration Corridor Options
Migration Corridors Used

<table>
<thead>
<tr>
<th>% Proportion</th>
<th>HPS</th>
<th>Weir</th>
<th>Ship Lock</th>
<th>Sum</th>
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<td>63%</td>
<td>35%</td>
<td>3%</td>
<td>100%</td>
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<td>Offenbach</td>
<td>71%</td>
<td>28%</td>
<td>1%</td>
<td>100%</td>
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<td>31%</td>
<td>1%</td>
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N=209
turbines at 30 m³ s⁻¹
Reduction in Mortality: River Main

N = 35
Summary

- Temporal overlap of MIGROMAT® alarms and migration events is up to ca. 80%
- Most eels use the Hydroelectric Power Station (HPS) as migration corridor
- Mortality during passage can be reduced to 25% by implementing MIGROMAT®-generated Eel Protective Mode (EPM) when turbines are halted completely
- MIGROMAT®-based EPM is a powerful tool for protecting migrant eels, yet only if HPS are managed appropriately
- The MIGROMAT® system can be installed immediately, at relatively low cost, only requiring relatively little construction effort