Guidance of eels at Europe’s largest pumping station

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Introduction

- fish screening at pumping stations
- 40% of Netherlands below sea level
- pumping stations essential in Dutch water management
Introduction

• fish screening at pumping stations
• 40% of Netherlands below sea level
• pumping stations essential in Dutch water management
• major impact on eel migration
• Benelux fish migration directive (1996)
• EU eel management plan: reduction of number of barriers and mortality required
IJmuiden Lock Complex

Pumping station

Map of the Netherlands

30 maart 2011
IJmuiden Lock Complex

- Complex
  - 4 locks, volume >350,000 m³
  - 7 spill sluices, up to 500 m³/s
  - pumping station

- Pumping Station
  - 6 bulb pumps
  - rotor diameter 3.94 m
  - largest pumps 50 m³/s
  - total capacity 260 m³/s
Multiple passage routes
2010 research program

• Research in 2007-2010, aims:
  • investigate number of eels passing via IJmuiden lock complex
  • assess distribution of silver eels over complex

• 2010: Monitoring effectivity of measures to reduce passage via pumping station
  • investigate possibility of guidance from pumping station to spill sluices or locks
  • reduction of flow rate
  • application of strobe lights

• Research by IMARES, Witteveen+Bos and professional fishermen
Research set-up

1 - fyke nets
2 - netting
3 - strobe lights
4 - DIDSON camera
Research set-up

Downstream / North Sea
Research set-up

- strobe light screen
- 72 LED-units (8 x 15 m)
- flashing in random pattern
Multiple passage routes

- 1 - pumping station
- 2 - spill sluices
- 3 - northern lock (north bank)
- 4 - northern lock (south bank)
- 5 - middle lock
- 6 - southern lock
Mortality at route via pumping station

- yearly passage of 50,000-100,000 silver eels
- 7,500-15,000 via pumping station (15%)
- 27% of silver eels damaged (’07-’09 avg. 43%)
- 19% of damaged eels in pieces
- 78% of damaged eels internal fractures
Measure: reduction of flow rate

- Average catch per volume for eel, diadromous fish (excl. eel), freshwater fish, and sea fish.

Data points for flow rates of 25 m³/s and 50 m³/s.
Measure: strobe lights

90% of other diadromous fish are river lampreys
Measure: combined effect for eel

![Bar graph showing average eel catch per volume for different conditions and flow rates.](image)

- **Strobes on**
  - 25 m³/s: [20] ± [5]
  - 50 m³/s: [25] ± [5]
- **50/50**
  - 25 m³/s: [10] ± [5]
  - 50 m³/s: [15] ± [5]
- **Strobes off**
  - 25 m³/s: [5] ± [5]
  - 50 m³/s: [2] ± [5]
Measure: combined effect for river lamprey

- Strobes on
- 50/50
- Strobes off

Average lamprey catch per volume:

- 25 m3/s: 0
- 50 m3/s: 200

Bar chart shows the comparison of lamprey catch for different flow rates and strobe conditions.
Measure: strobe lights
Measure: strobe lights
Measure: strobe lights
Measure: strobe lights
Measure: strobe lights

lights 30 minutes on, 30 minutes off
Fish screening at pumping stations

Concluding

• preference: measures to eliminate mortality

• if not feasible: measures to reduce total mortality
  • precondition: presence of alternative route

• results show natural reluctance to pass pumping stations

• this provides the opportunity to use measures that enhance the natural behaviour

• major reduction in mortality can be achieved both through pump management and fish screening