Jun 22nd, 3:00 PM - 3:15 PM

Session B2: VisAdvies Protocol for Testing and Evaluating Pumping Station Pumps on Fish Survivability

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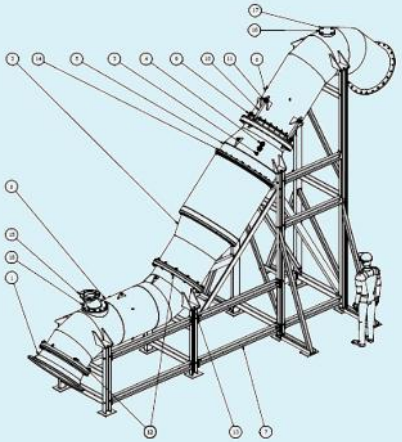
VisAdvies
Ecological consultancy & research

"VisAdvies protocol" for testing and evaluating pumping station pumps on fish survivability.



By

Jan H. Kemper

Author's:
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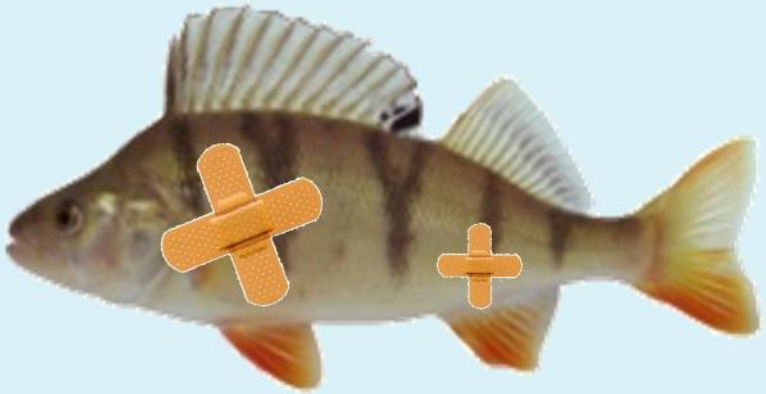
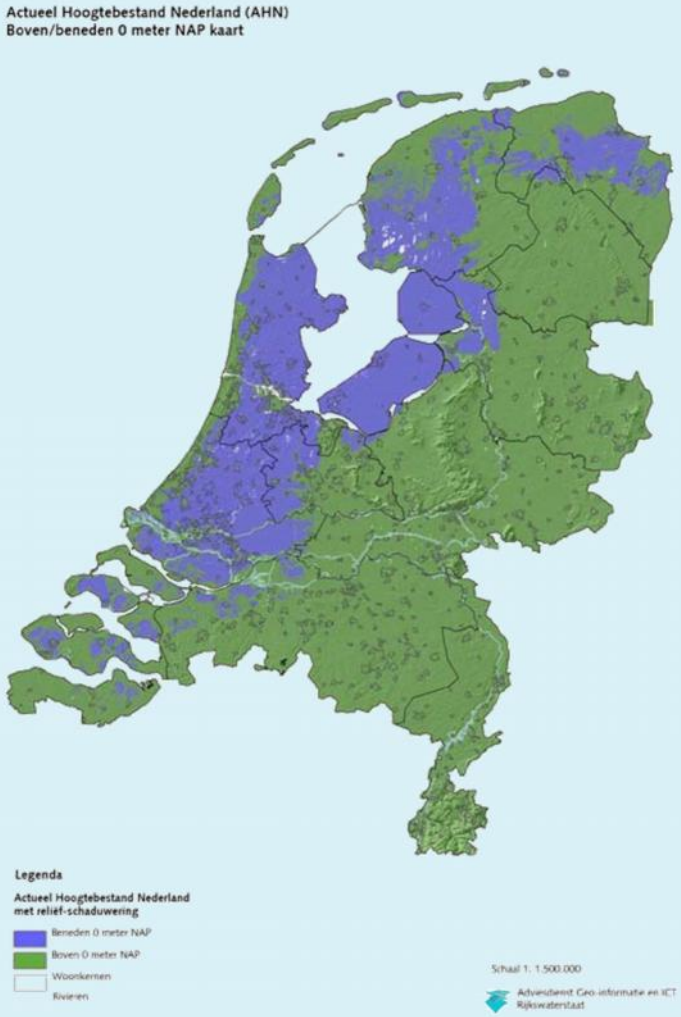
Jan H. Kemper (VisAdvies)

Background

- Much land below sea level
- All water must be drained by pumping stations.

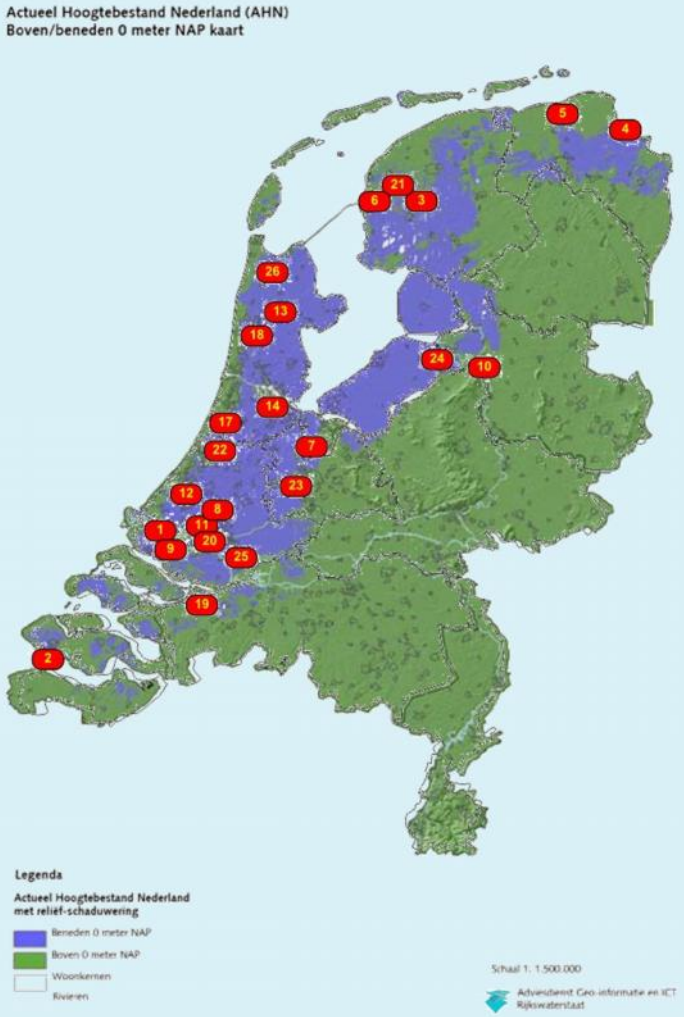


With all consequences for fish!!



Extend of the problem (???)

Monitoring of 26 pumping stations *in situ*



Results and conclusions

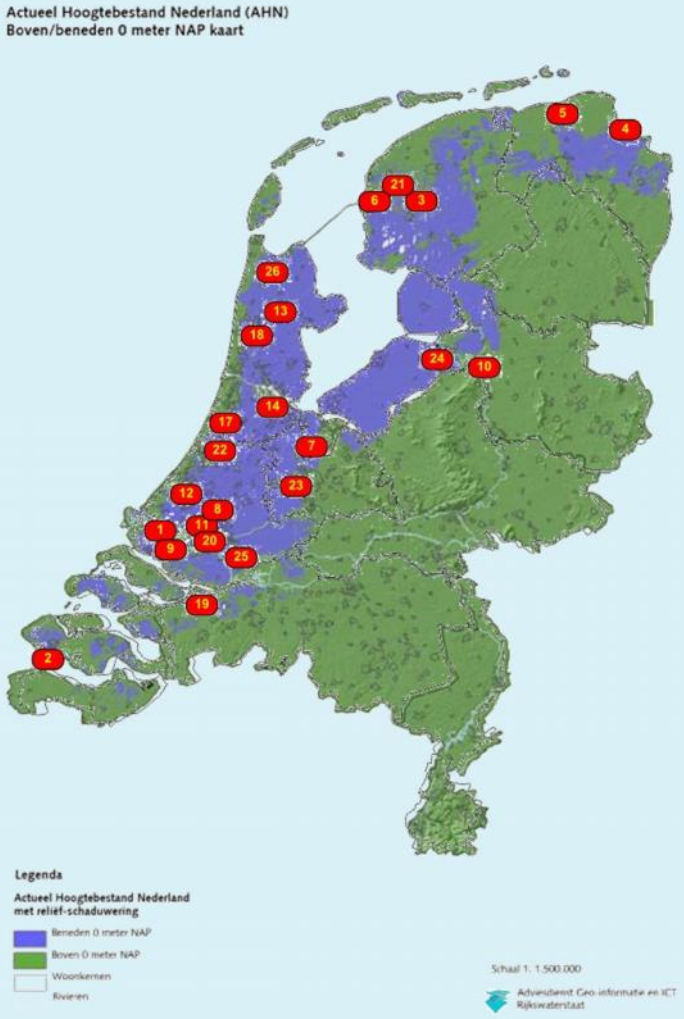
Results

- 11% for fish <15 cm
- 35% for fish >15 cm.
- 10 – 50% for eel (under-represented)

Conclusion:

- Pumping stations pumps must be fish friendly
- Supply of natural stock insufficient (silvereel)

  Alternative: ➔ Forced exposure of fish
- Need for universal approach (protocol)

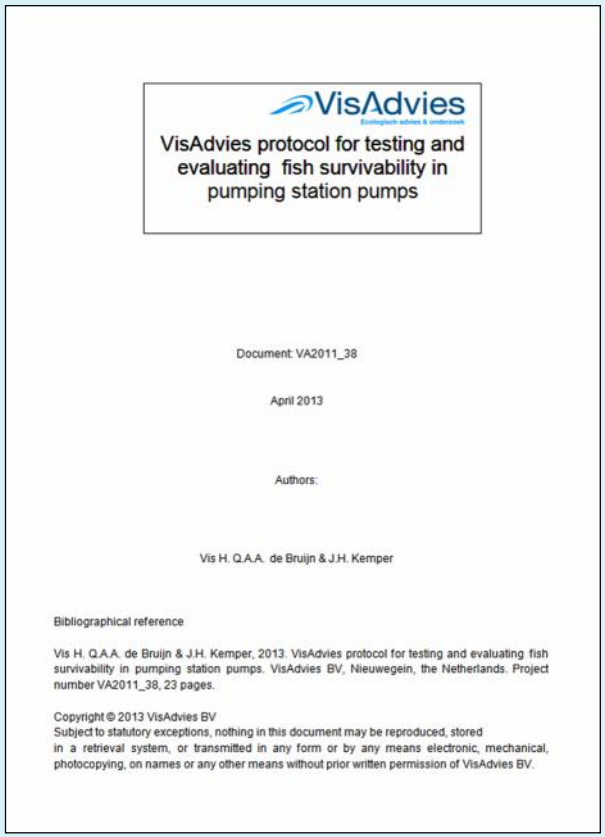


Protocol

Protocol

1. *Guideline for the field test*
2. *Survivability score*

Established with support of ecological technical specialists from many water authorities



VisAdvies
Ecologisch advies & onderzoek

VisAdvies protocol for testing and evaluating fish survivability in pumping station pumps

Document: VA2011_38

April 2013

Authors:

Vis H. Q.A.A. de Bruijn & J.H. Kemper

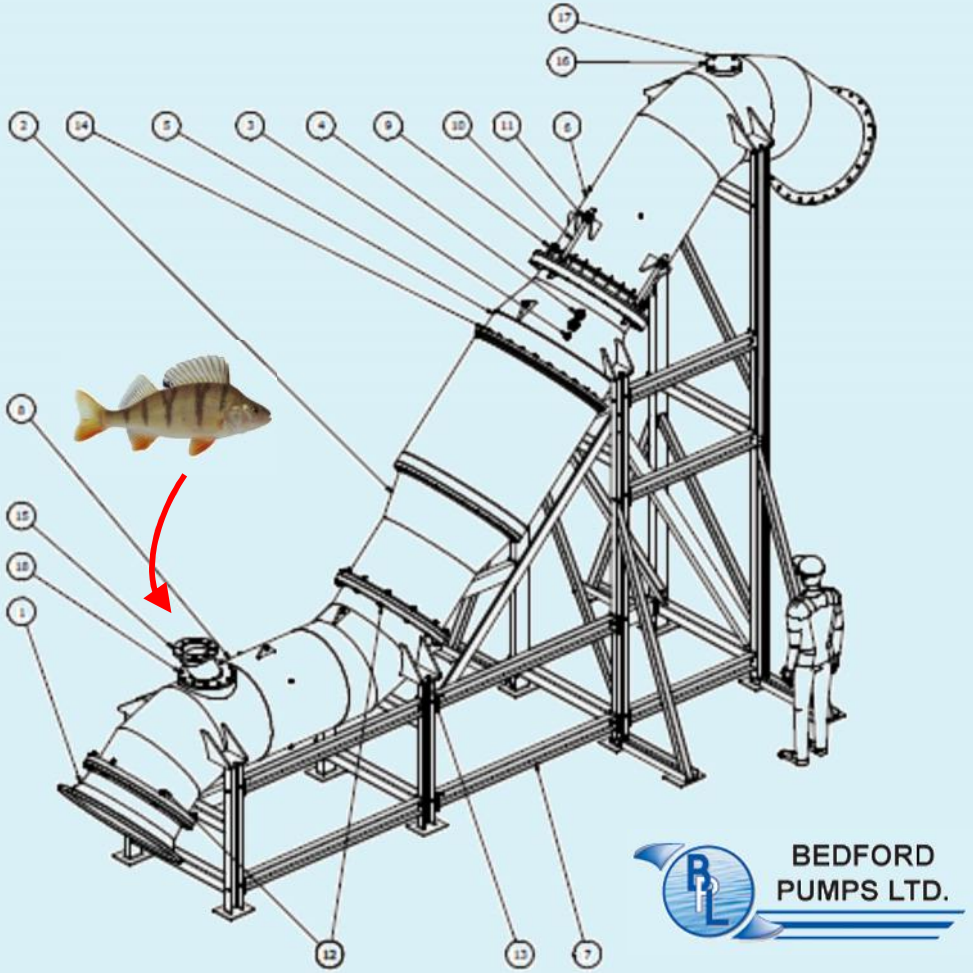
Bibliographical reference

Vis H. Q.A.A. de Bruijn & J.H. Kemper, 2013. VisAdvies protocol for testing and evaluating fish survivability in pumping station pumps. VisAdvies BV, Nieuwegein, the Netherlands. Project number VA2011_38, 23 pages.

Test protocol in lab setting

Test with the Bedford SAF.90.05.12 (**2012**)

Aspect	value
Running speed	330 rpm
Water elevating hight	2.9 m
Discharge	1.3 m3/s



Test protocol in lab setting

Dry dock

Pump and test rig

Fish species (room for other compositions)

- Anguillidae (eel-like) <= 45 cm
  > 45 cm (silvereel)

- Cyprinidae (carp-like): <= 15 cm
  > 15 cm

- Percidae (perch-like): <= 15 cm
  > 15 cm

Law on Animal Experiments

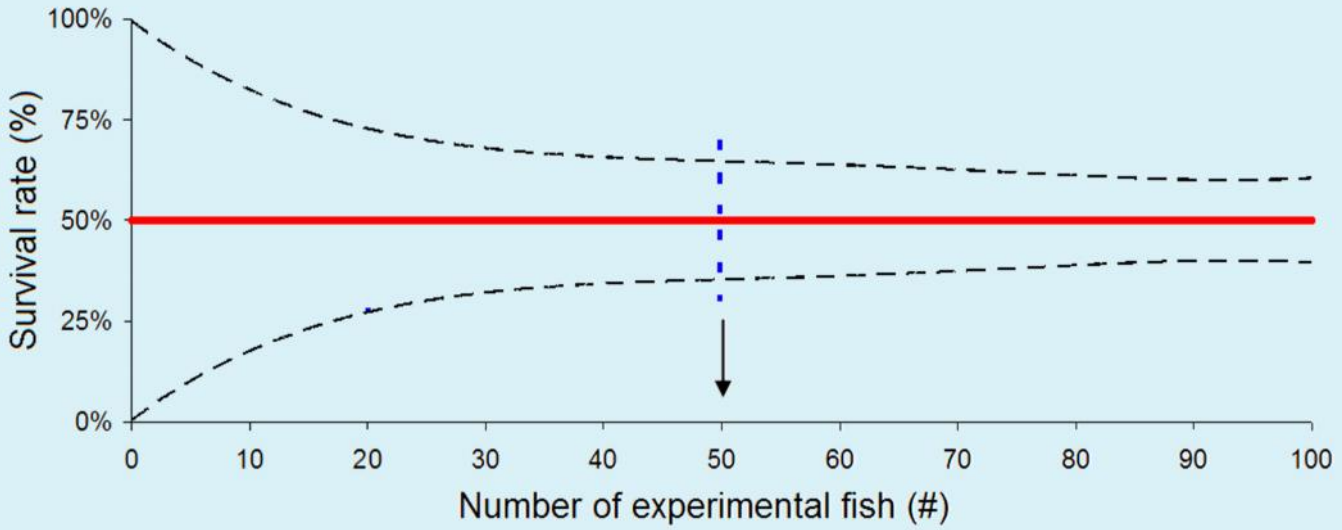
Statistical justification

$$CI = 1{,}96 * \sqrt{\frac{p * (100 - p)}{(n - 1)}} + \textbf{\textit{survivability}}\,(\%) - 1{,}96 * \sqrt{\frac{p * (100 - p)}{(n - 1)}}$$

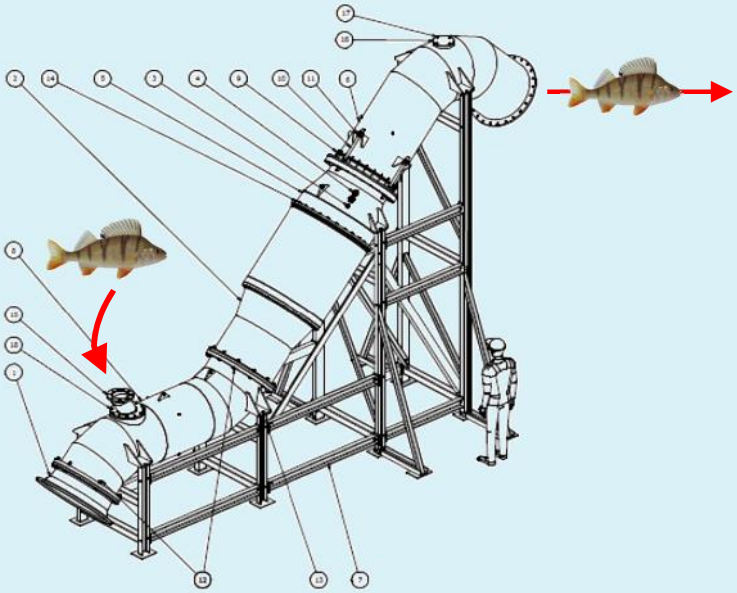
CI = ***Confidence interval***

p = ***the estimated probability of survivability (%)***

n = ***Sample size***



Exposure / Qualification



Qualification of fish injuries

Qualification of fish injuries

1. **No injury or mortality**
2. **Deviant swimming behaviour**
3. **External injuries** →

Qualification of fish injuries

1. **No injury or mortality**
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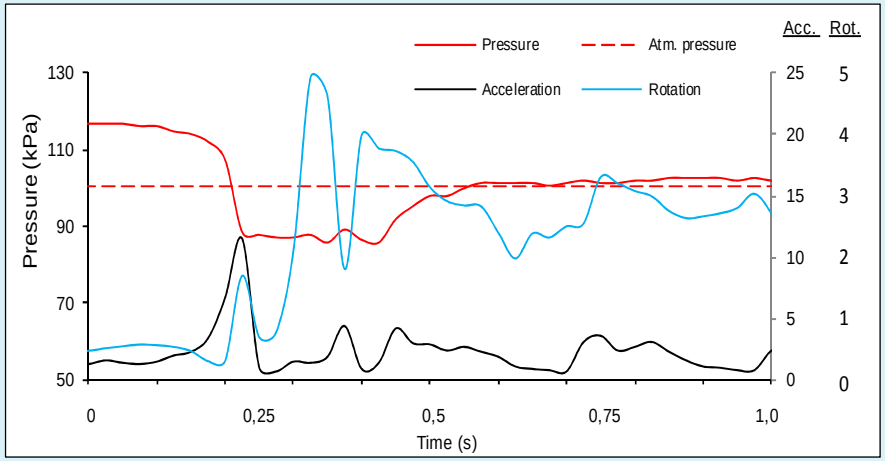
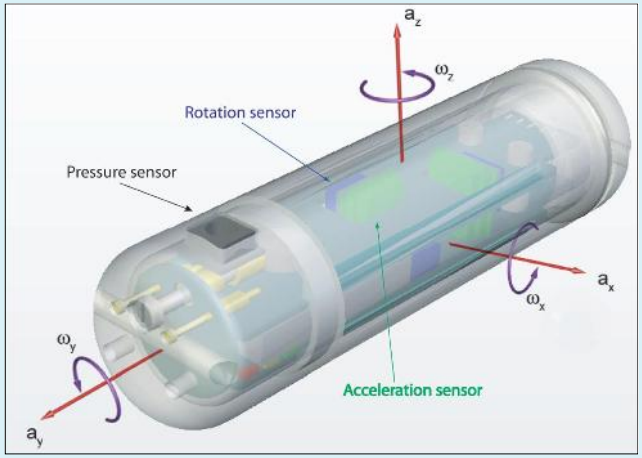
4. **Delayed mortality**

Qualification of fish injuries

1. **No injury or mortality**
2. **Deviant swimming behaviour**
3. **External injuries**
4. **Delayed mortality**
5. **Internal injuries (swimm bladder, broken spines)**

Qualification of fish injuries





5. Internal injuries (swimm bladder, broken spines)

Survivability score

$$\text{Final score } (0-1) = \sum_{n=1}^{6} (\text{Group survival(n)percentage} * \text{weighting factor})$$

	Group	Length class (cm)	Weigthing factor
1	Eel	0-45	0.15
2		>45	0.25
3	Cyprinids	0-15	0.1
4		>15	0.2
5	Percids	0-15	0.1
6		>15	0.2

Survivability score

Aspect	value
Running speed	330 rpm
Water elevating hight	2.9 m
Discharge	1.3 m3/s

Rating	Score
Outstanding	1
Excellent	0.75-0.99
Good	0.50-0.75
Insufficiënt	0.25-0.50
Bad	0.00-0.25

Alternative approach

Theoretical approach (Jacob van Berkel)

- Unique guidelines to the design of fish friendly pumps and turbines
- However: *“The proof of the pudding is in the eating”.* (methods complementary)

“*VisAdvies protocol*” for

testing and evaluating

pumping station pumps on fish survivability.

Thank you for your attention.

Questions?

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