Migration of European eel in an anthropogenically impacted wetland area in Belgium

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Research Institute for Nature and Forest

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Wetenschappelijke instelling van de Vlaamse overheid

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Take me down
to the paradise city

where the eels are green
and their skin is slippy

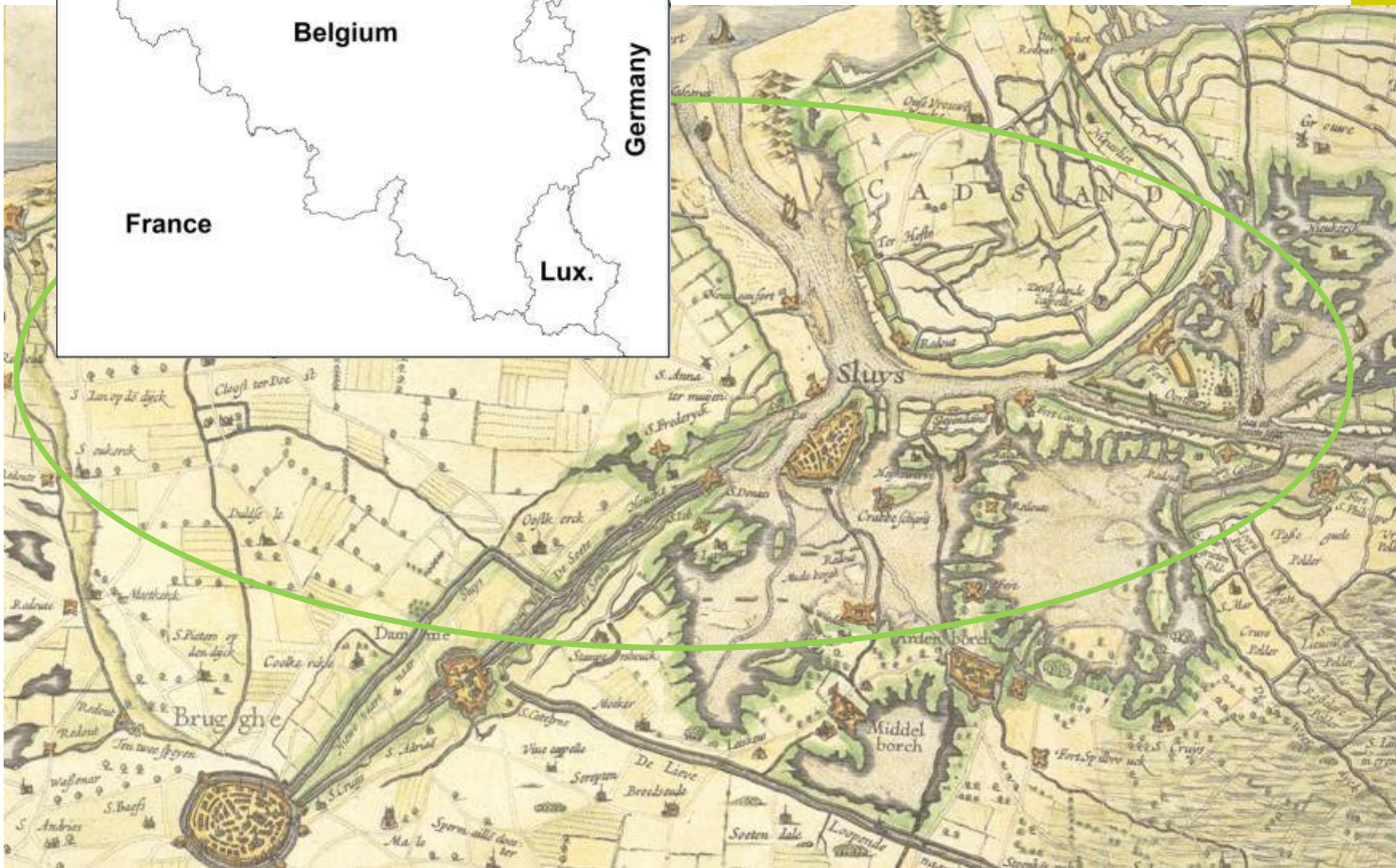
...

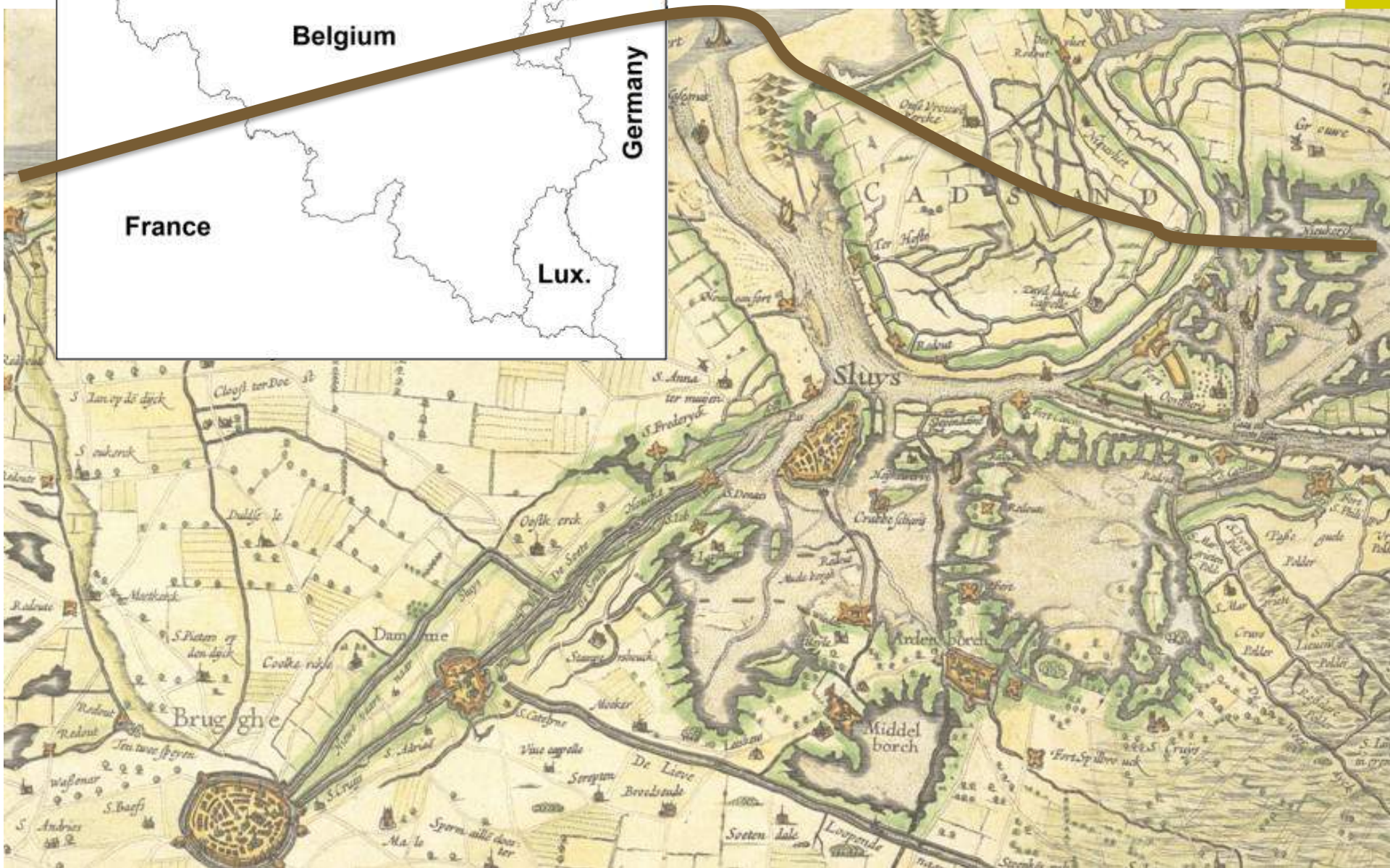
Valuable habitats

Valuable habitats

However, we do have problems

However, we do have problems


The Netherlands
Belgium
Germany
France
Lux.
C A D S A N D
Sluys
Brugghe
Middel borch


The Netherlands
Belgium
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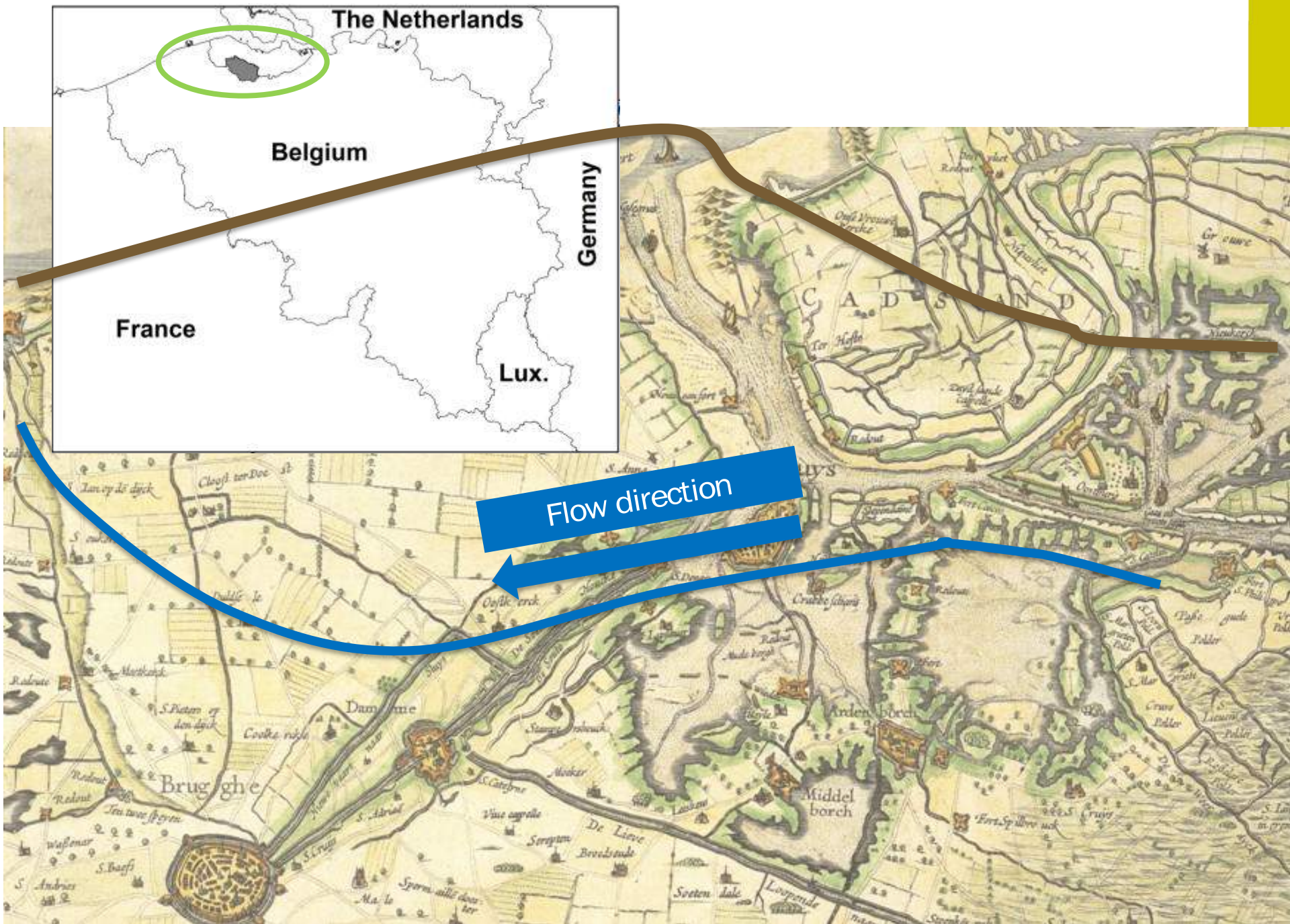
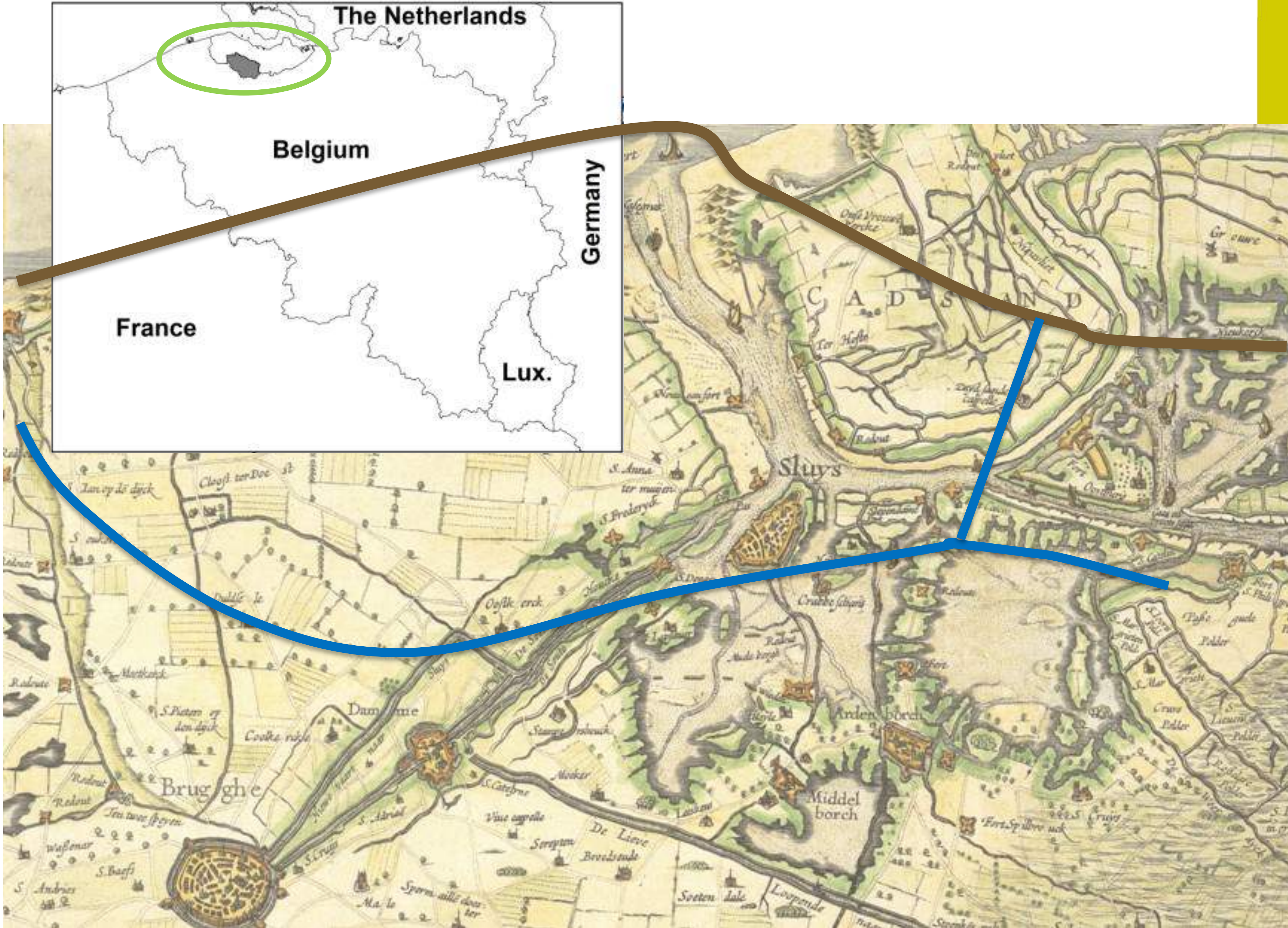
Sluys
Brugghe
Middelborch


The Netherlands
Belgium
Germany
France
Lux.
Flow direction
Brugghe
Middelborch


The Netherlands
Belgium
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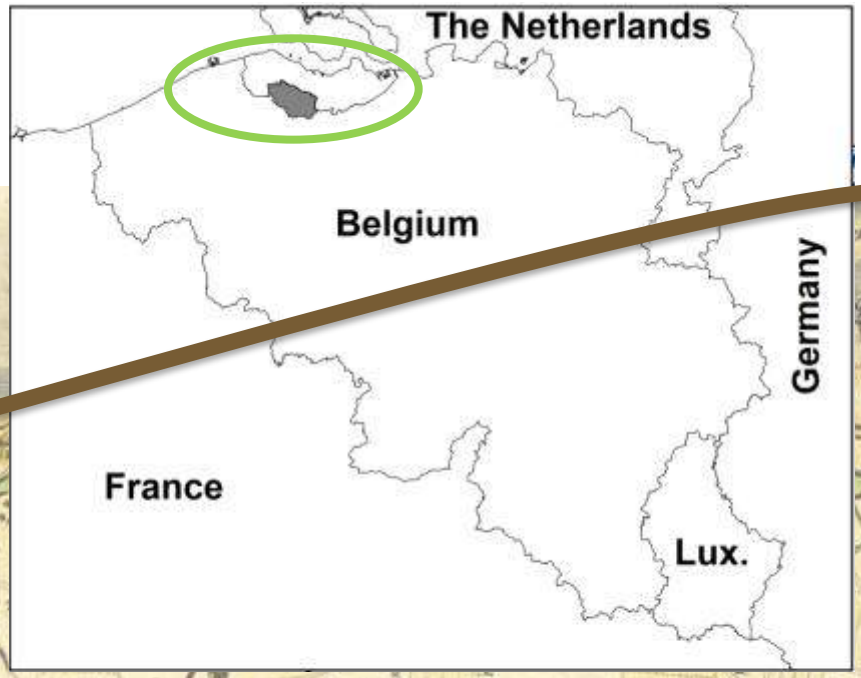
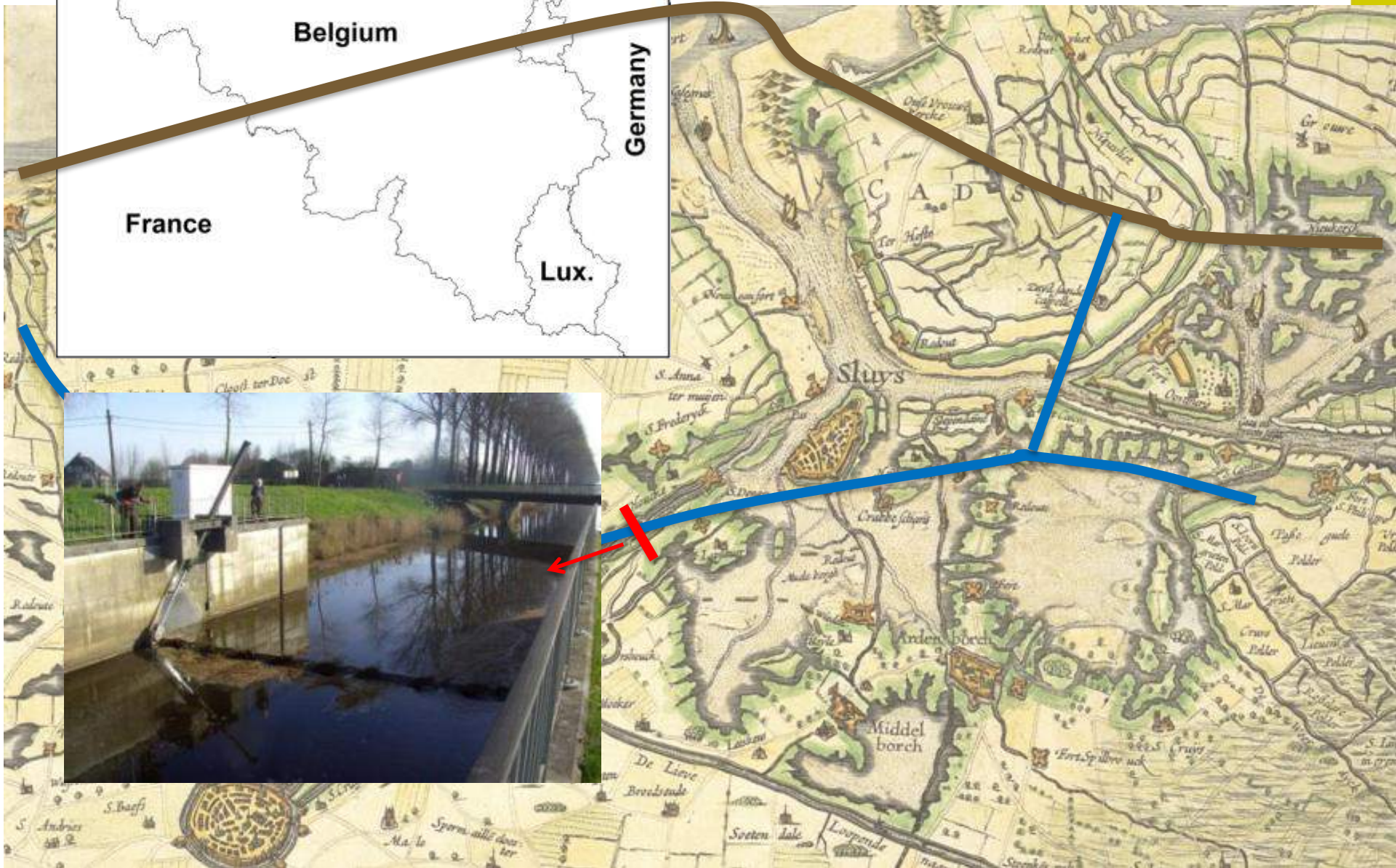
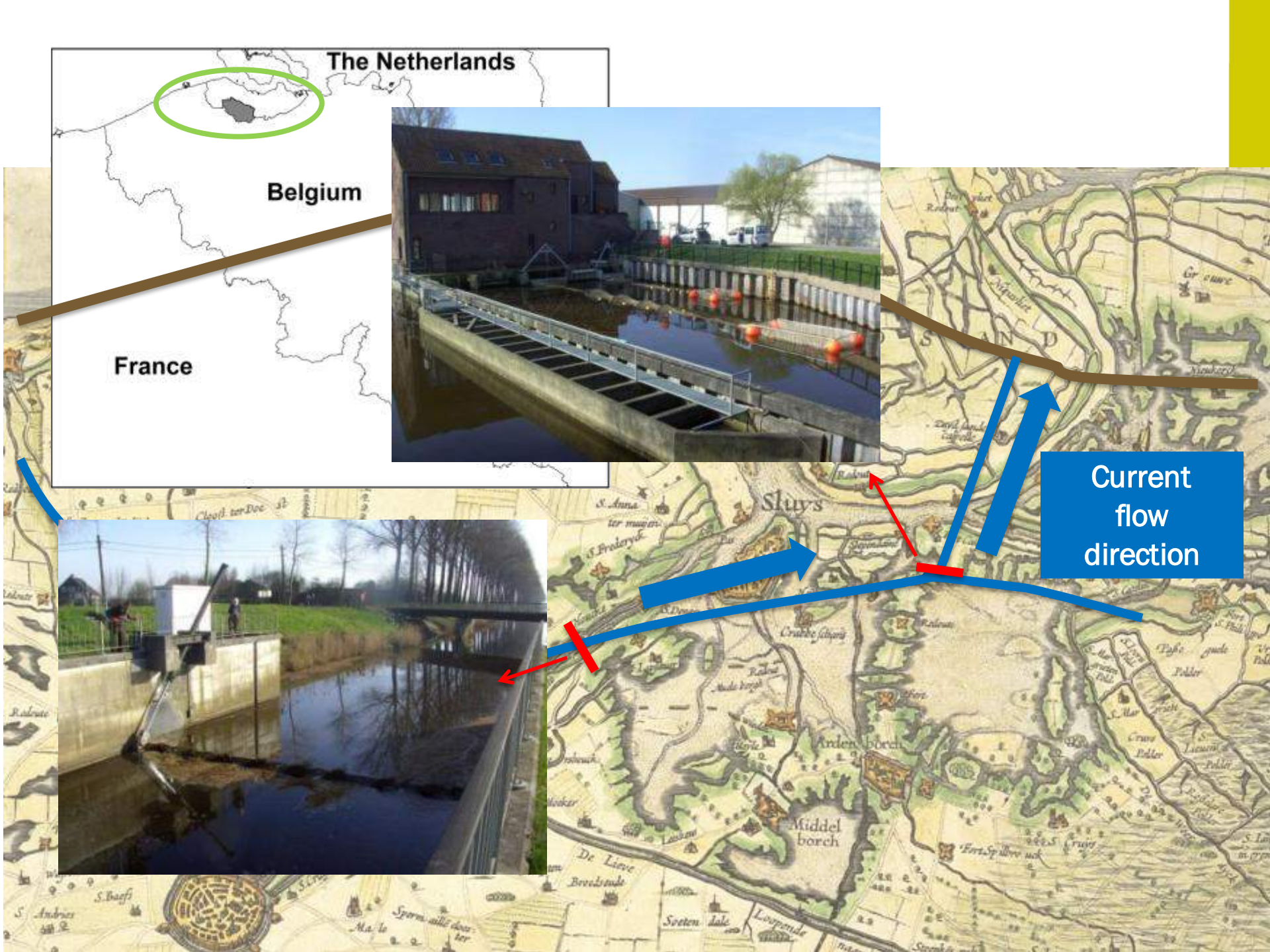
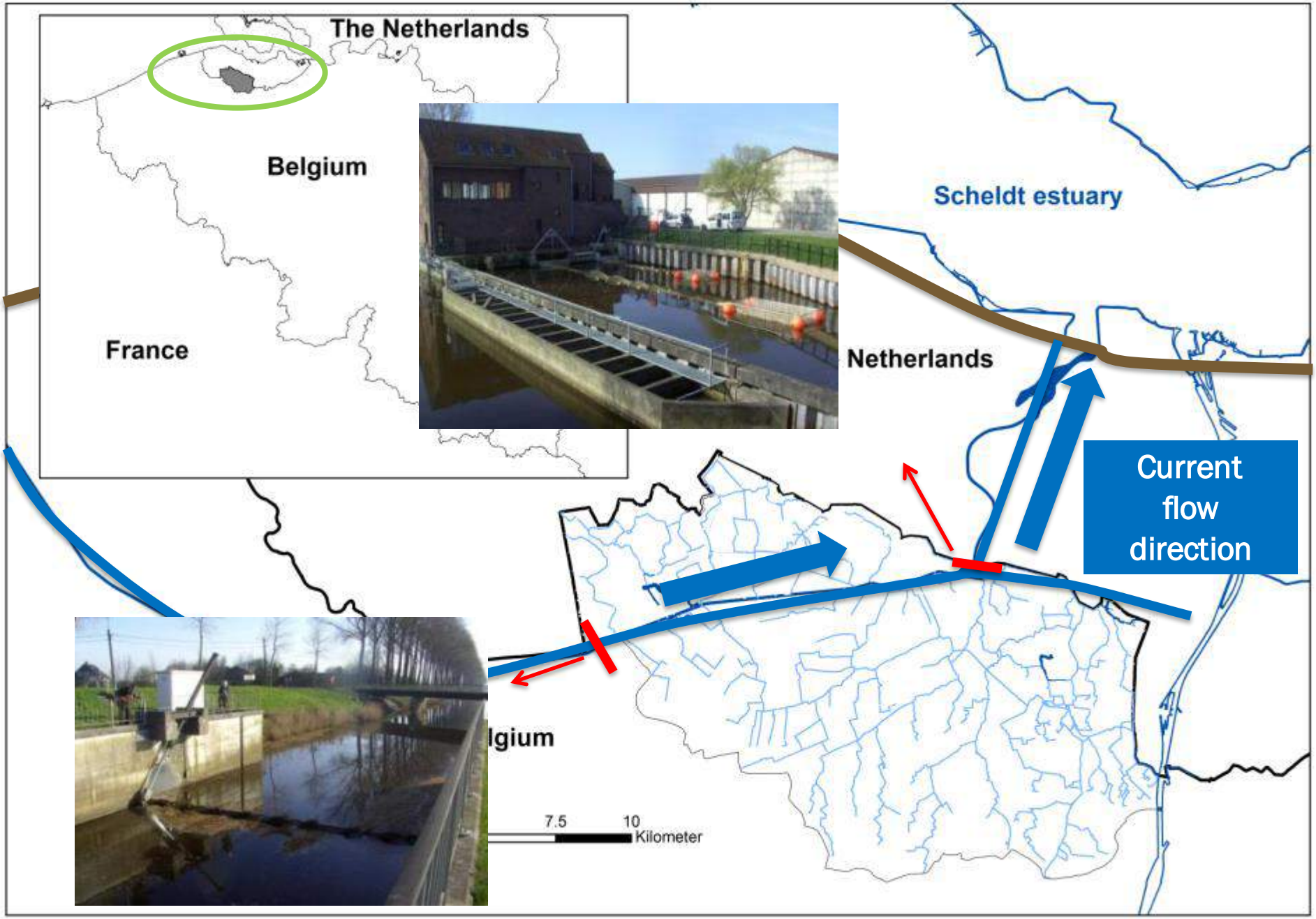
Lux.
Sluys
C A D S A N D
Middel
borch
Ardenborch
Brugghe


The Netherlands
Belgium
Germany
France
Lux.


Sluys
Middel borch


The Netherlands
Belgium
France
Current flow direction
Sluys
Middelborch


The Netherlands
Belgium
France
Scheldt estuary
Netherlands
Current flow direction
lgium
7.5
10
Kilometer

Archimedes screw pumping station

- **Previous research (Buysse et al. 2014)**

Archimedes screw pumping station

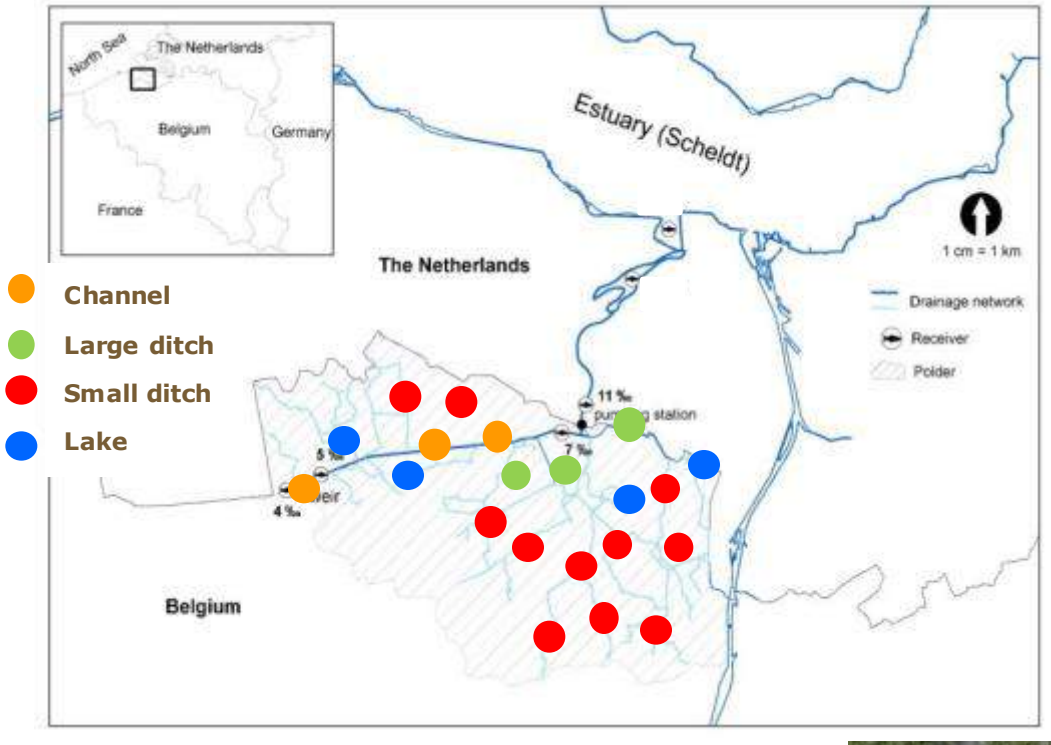
- **Previous research: min. 20% eel mortality at passage!**

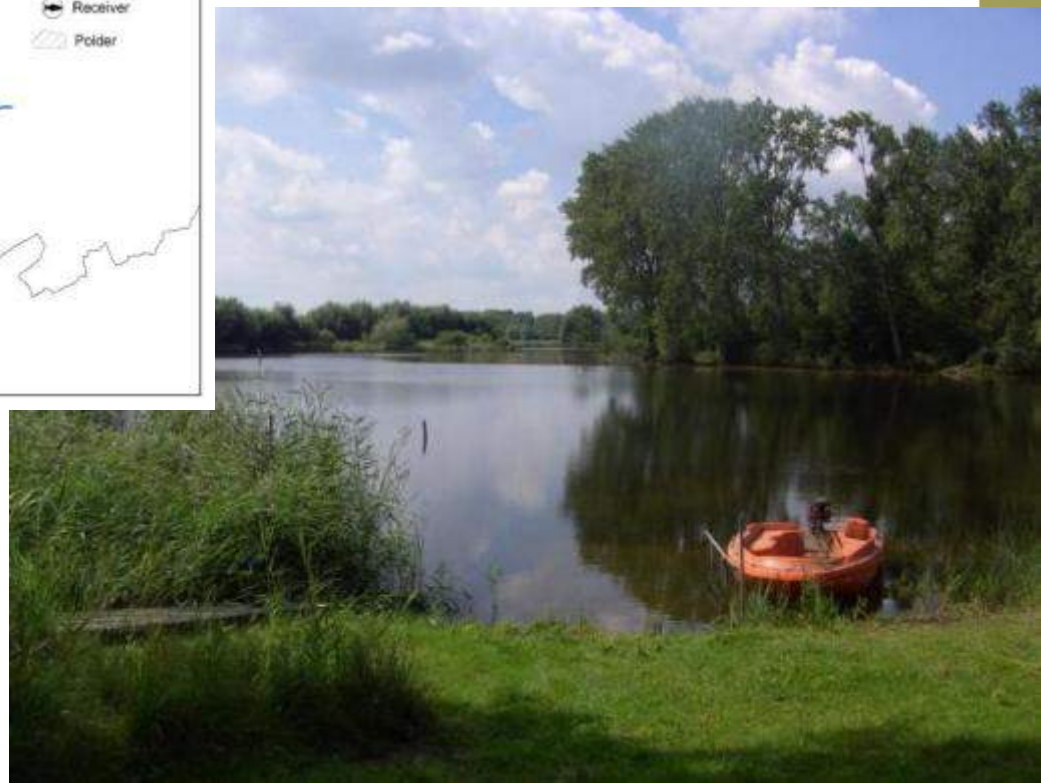
Objectives

- Impact of pumping station on eel behaviour?
  - Migration routes?
  - Search behaviour?
  - Delay?
- Potential solutions?

Methods

- **Fyke nets & electrofishing => 553 eel caught**





Methods

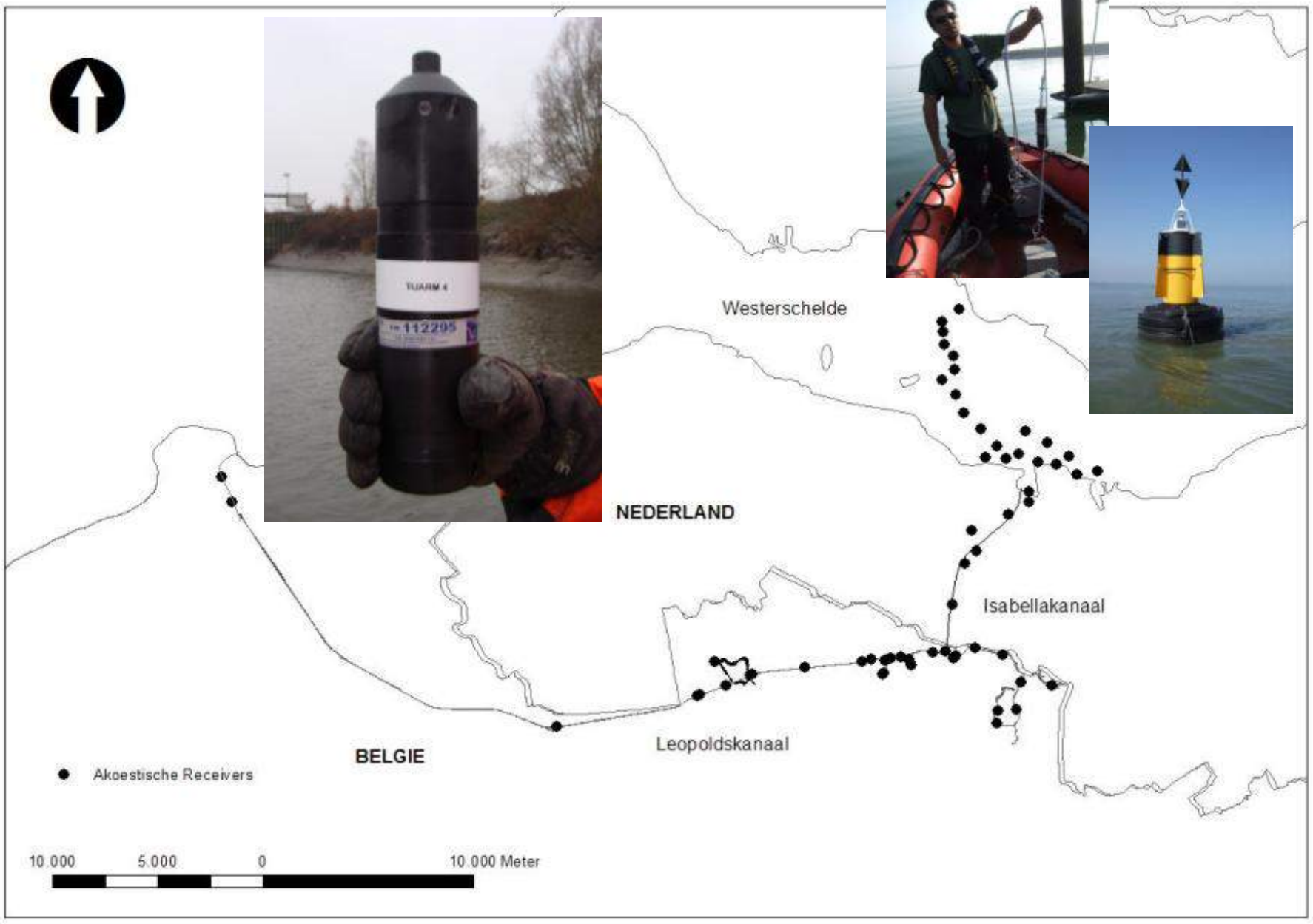
- **Fyke nets & electrofishing => 553 eel caught**
- **Silvering characteristics (Durif et al. 2005)**

Methods

- **Silvering characteristics (Durif et al. 2005)**

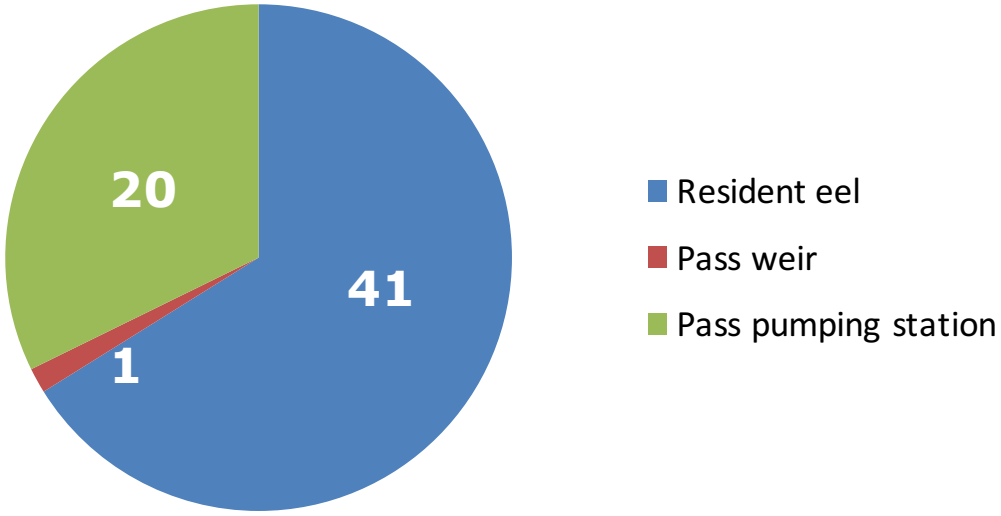
=> 69 eels tagged (V13-L, battery life = 3 years)
=> only female silver eels tagged

Methods



Results (May 2014, tagging summer 2012)

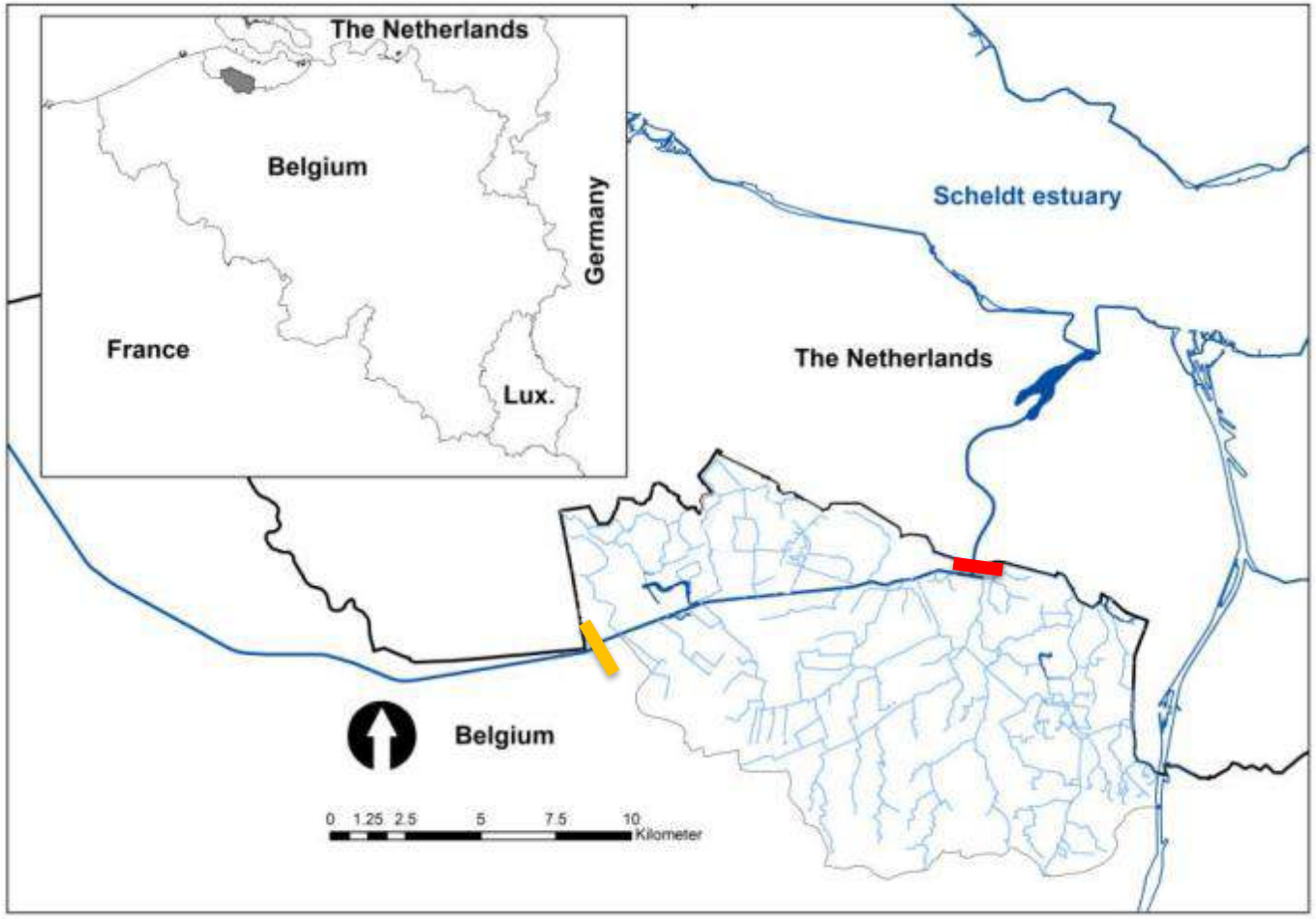
- **Number of eel tagged: 69**
  - **62 eel detected after release**

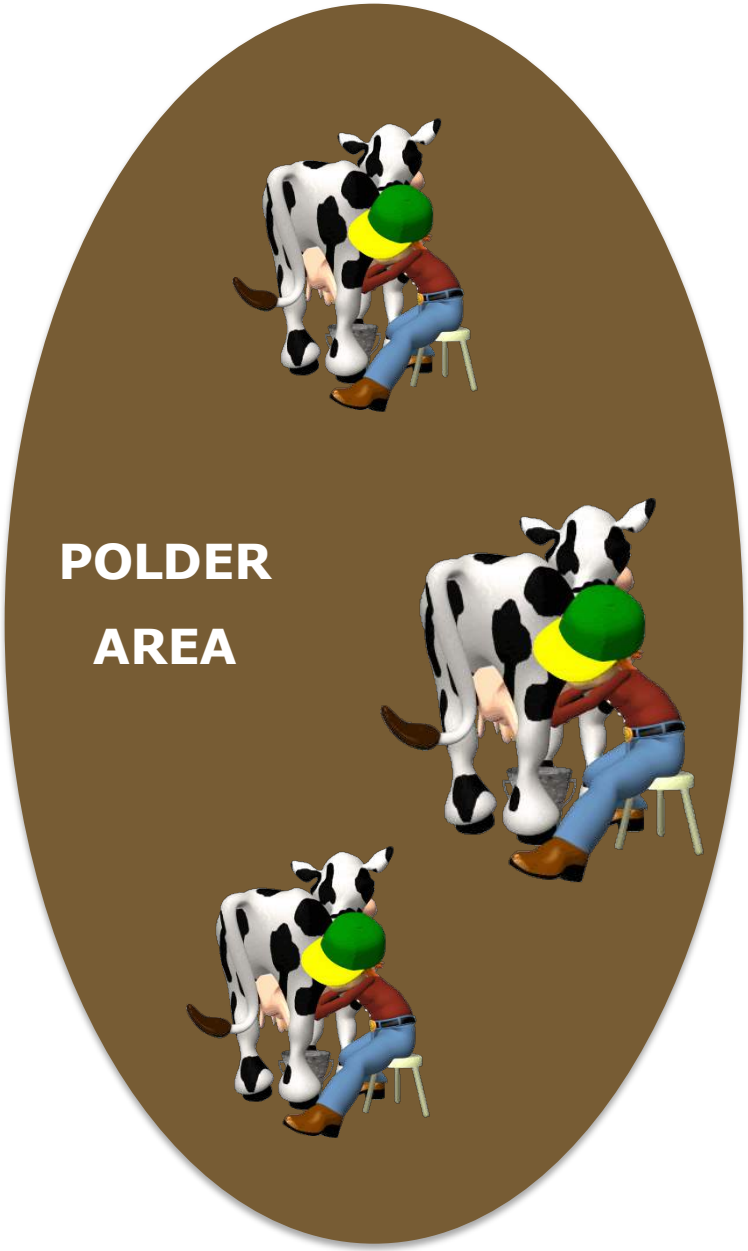


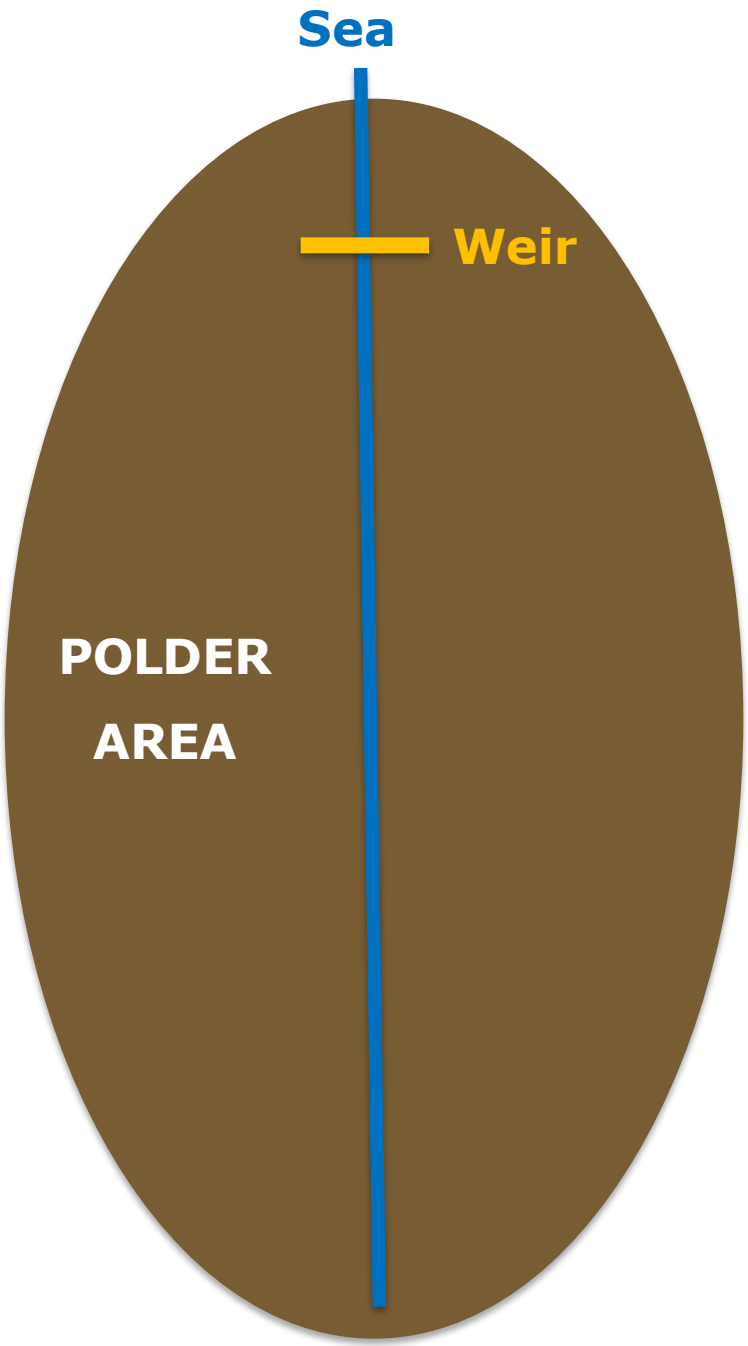
- Number of eel tagged: 66
  - 59 eel detected after release
    - 45 resident eel (stay in polder, min. 1 was fished)
    - 45 eel pass pumping station
      - 10 eel end up in zone between PS and tidal barrier
      - 35 eel pass tidal barrier and end up in estuary
    - 1 eel selects alternative migration route

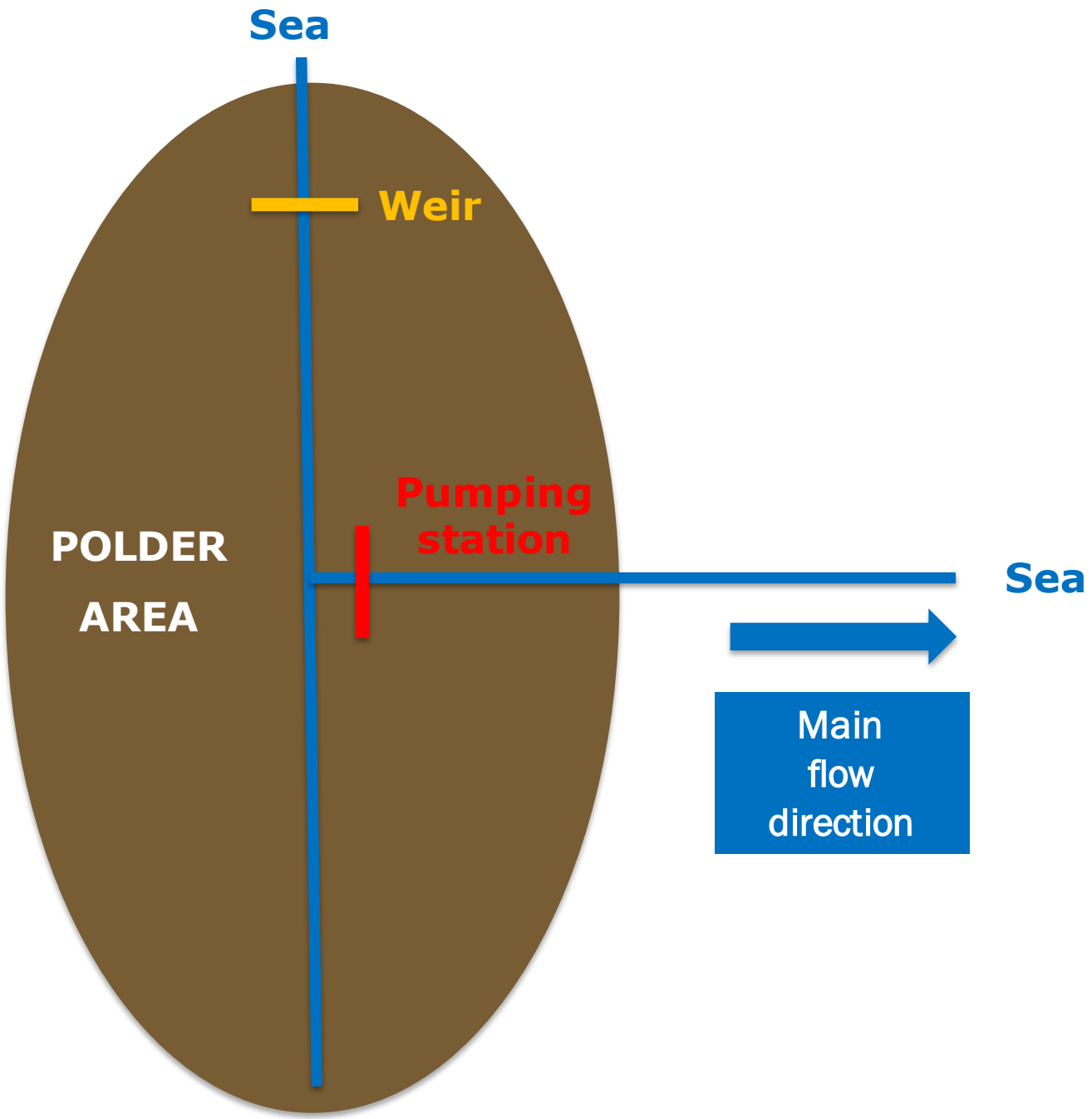
Results

- **Different types of behaviour**

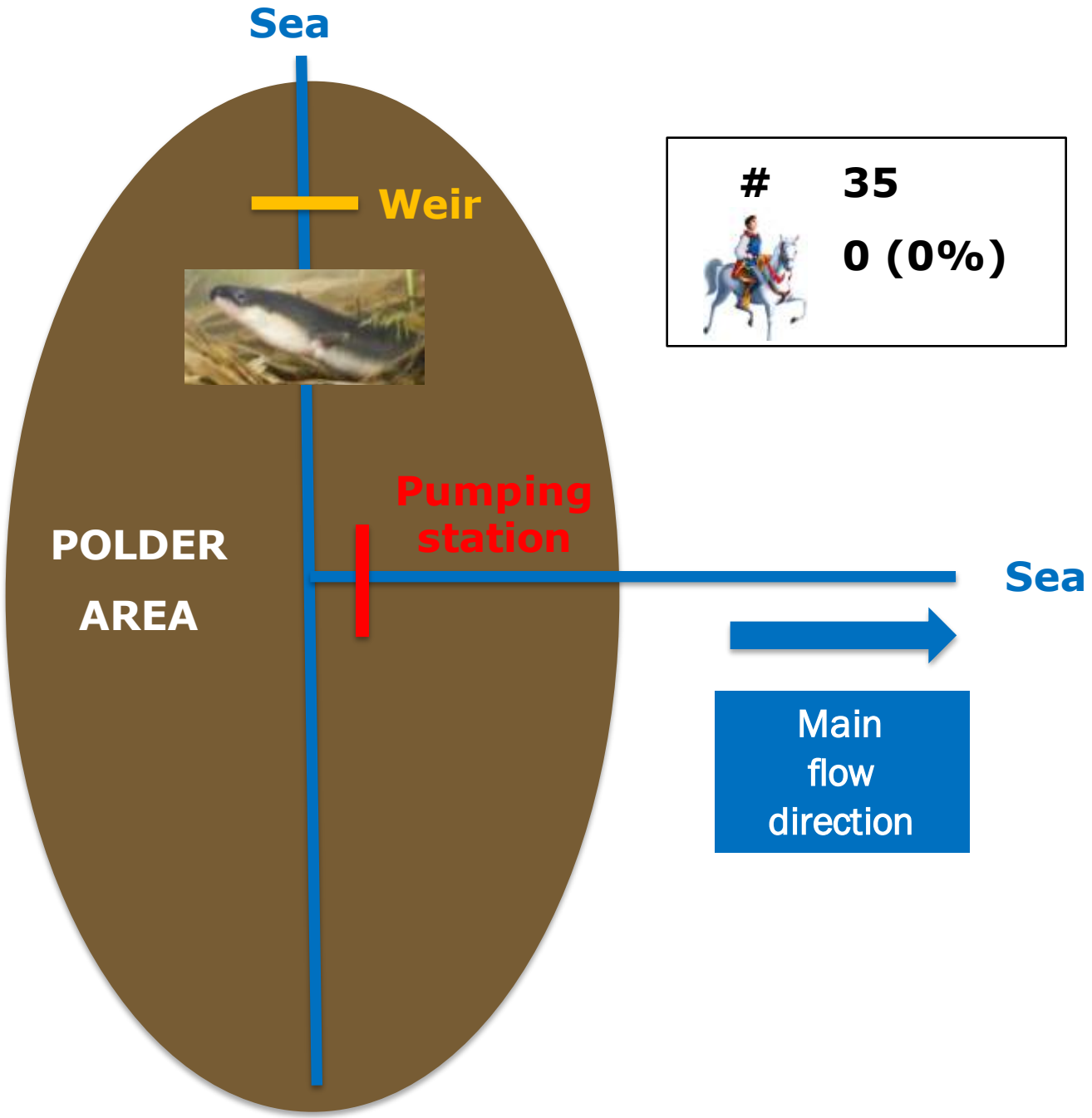







Sea
Weir
Pumping station
POLDER AREA
Sea
Main flow direction

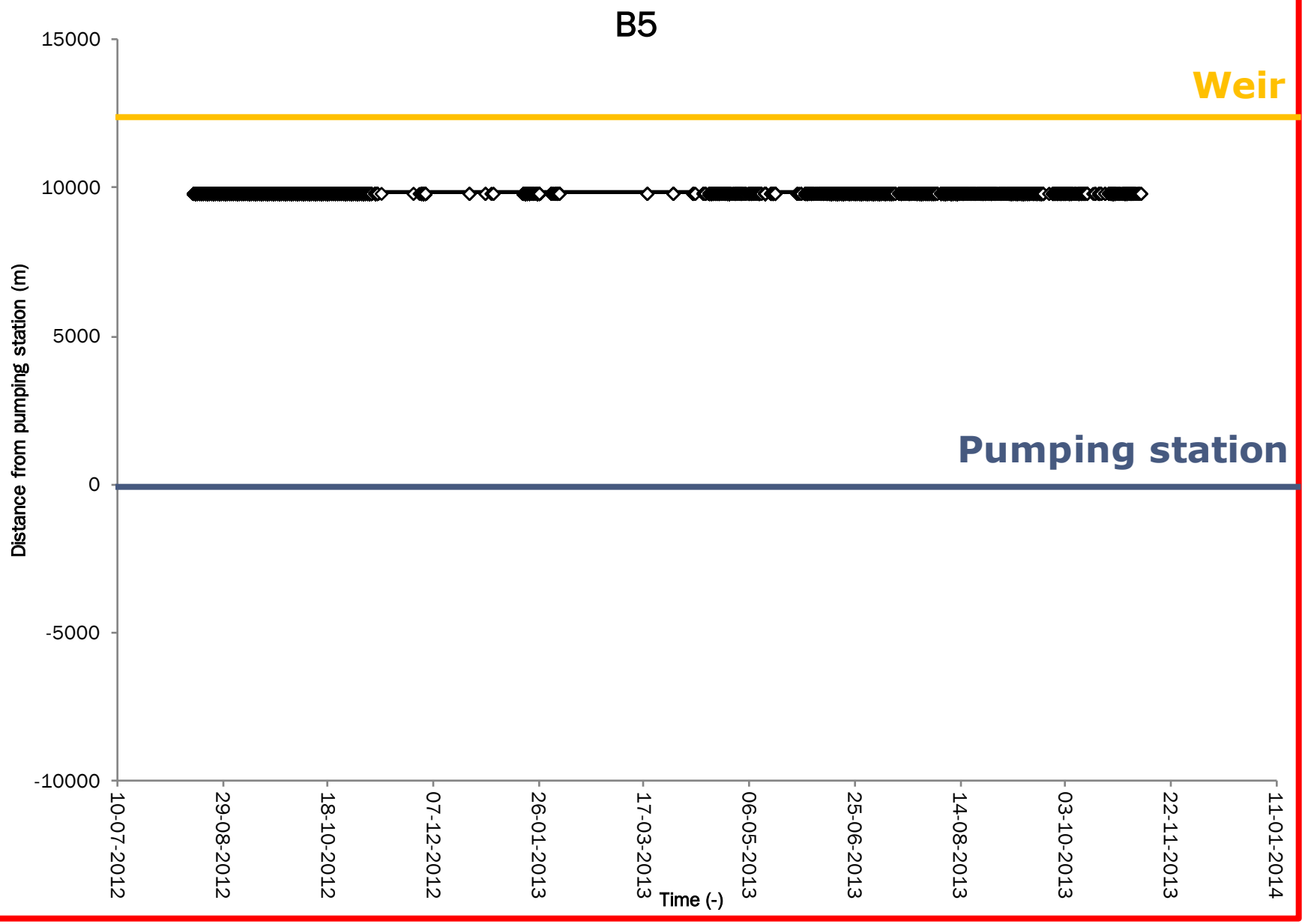
HOMING



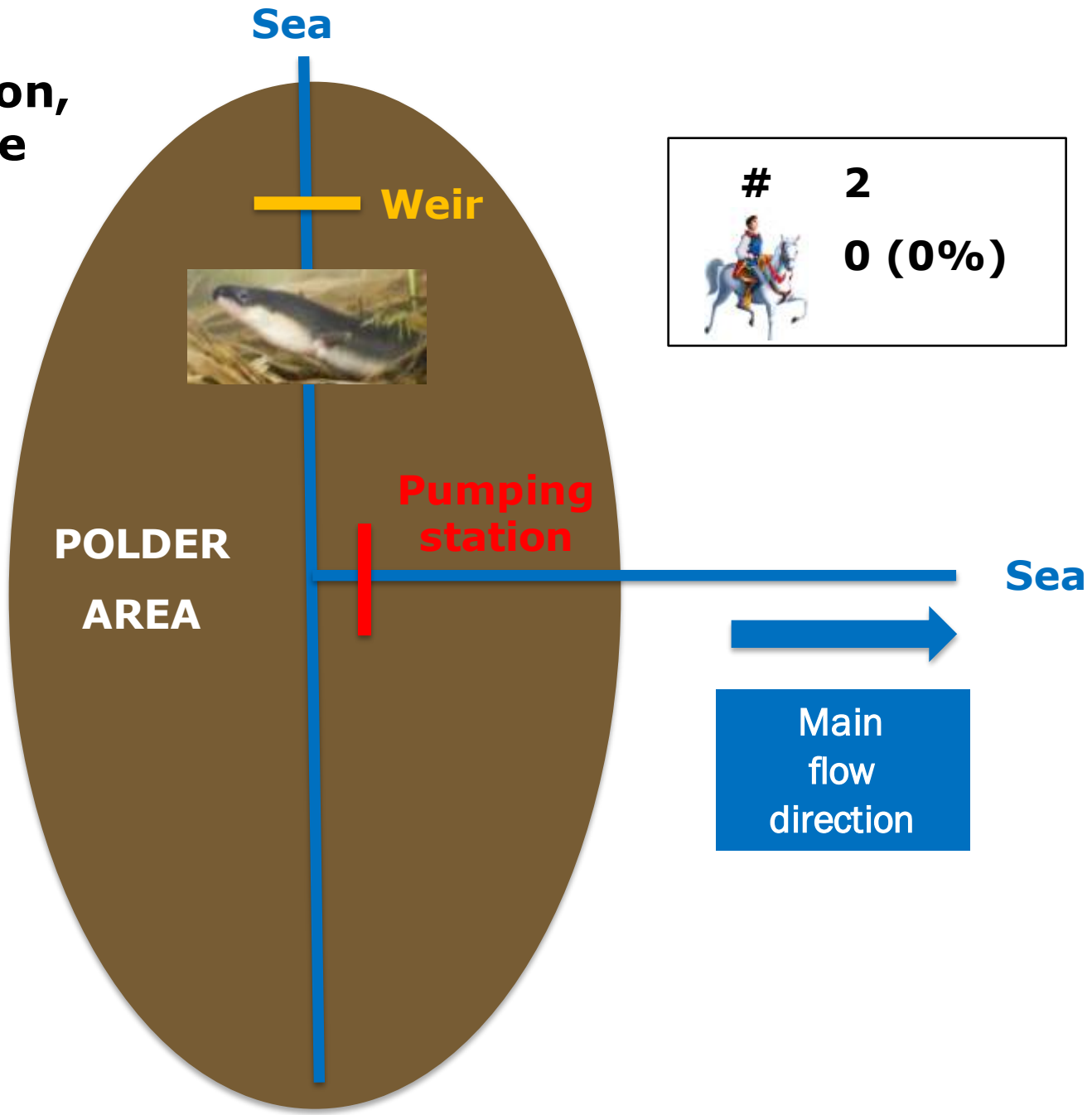
#	35
	0 (0%)

Passage through PS

No passage



Failed migration, return to home site

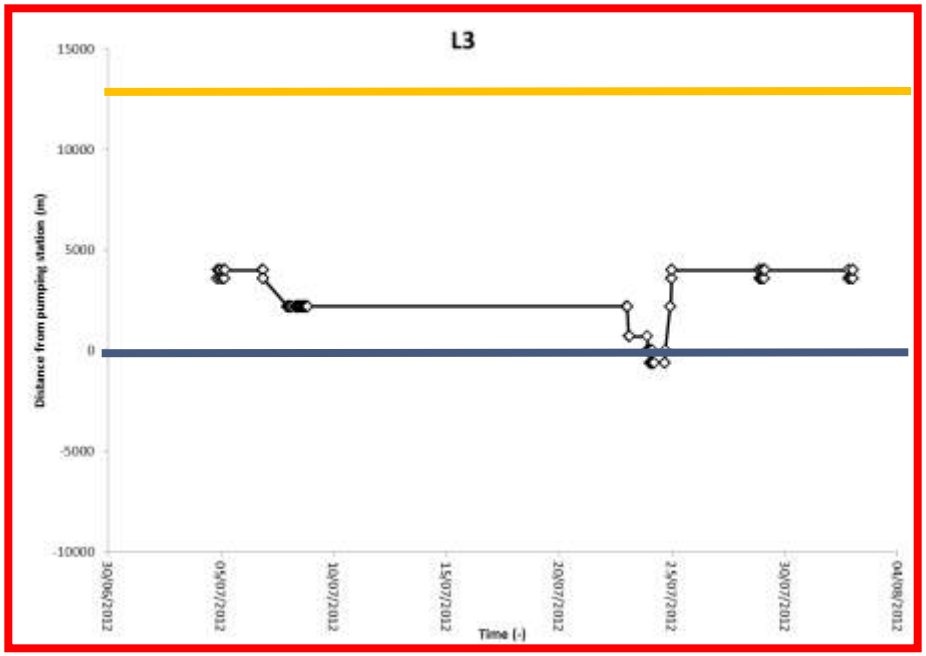


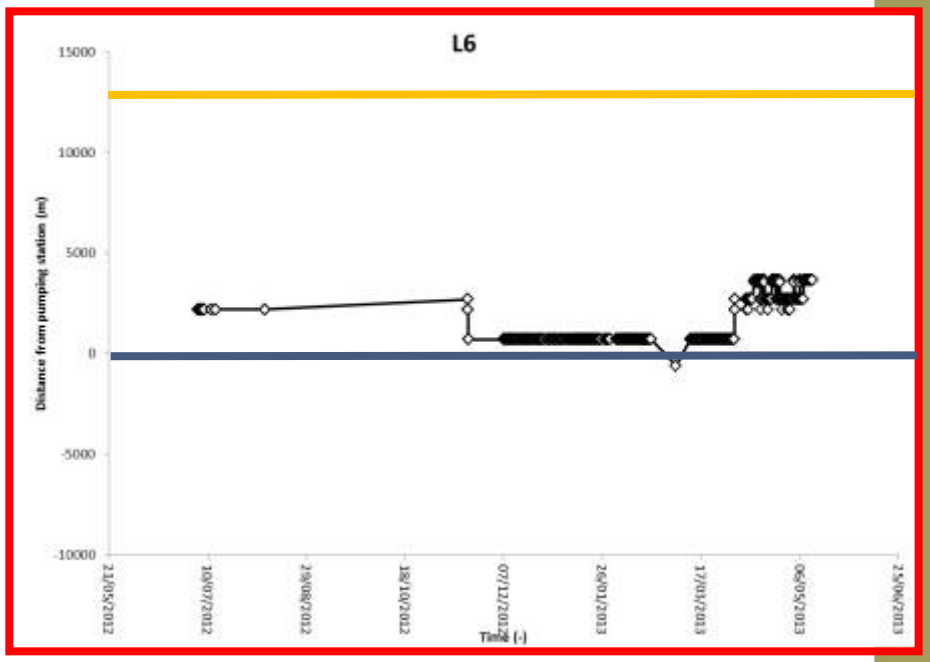
Results

No passage

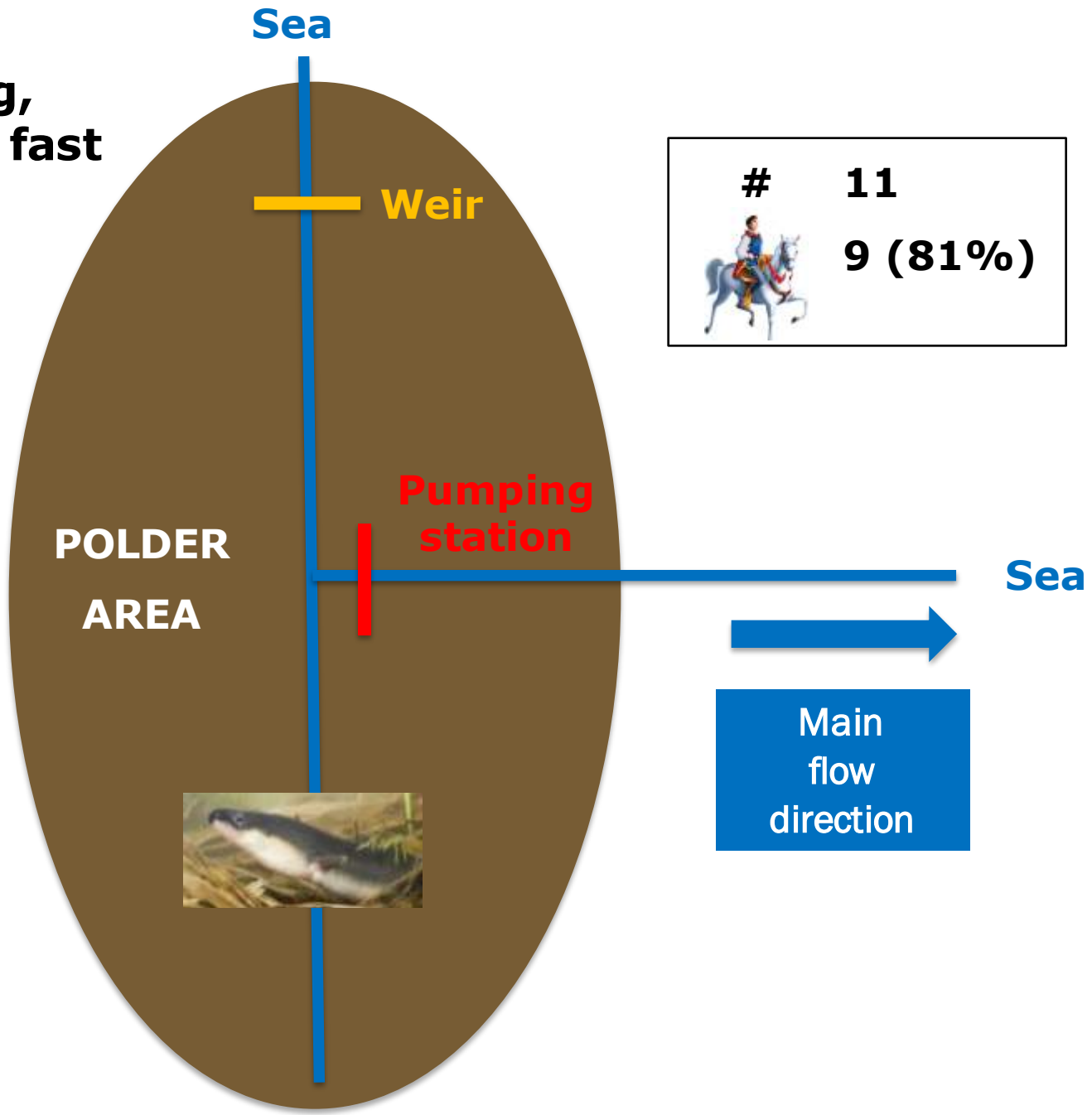
Passage

- Different types of behaviour





Long homing, Followed by fast migration

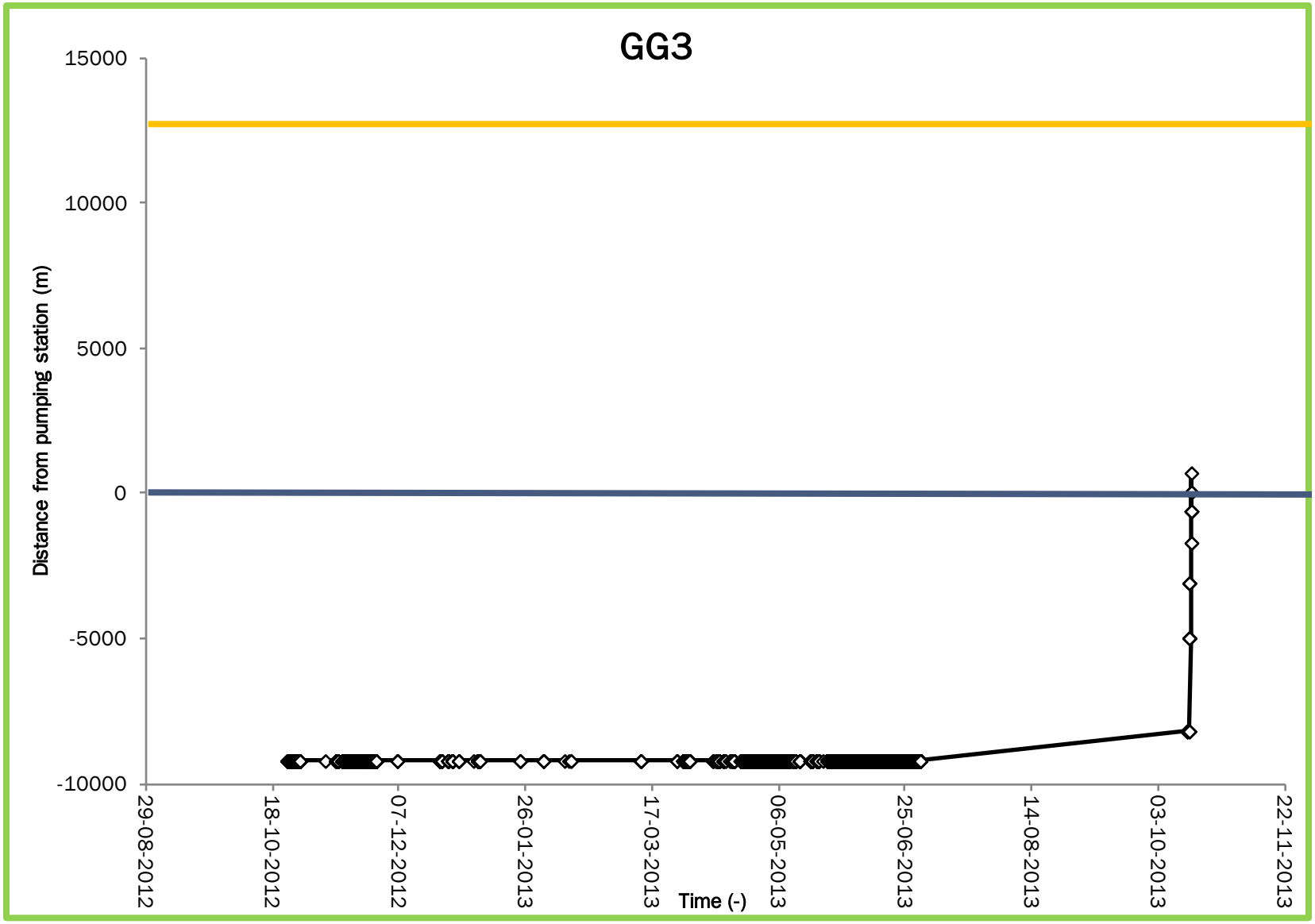


#	11
	9 (81%)

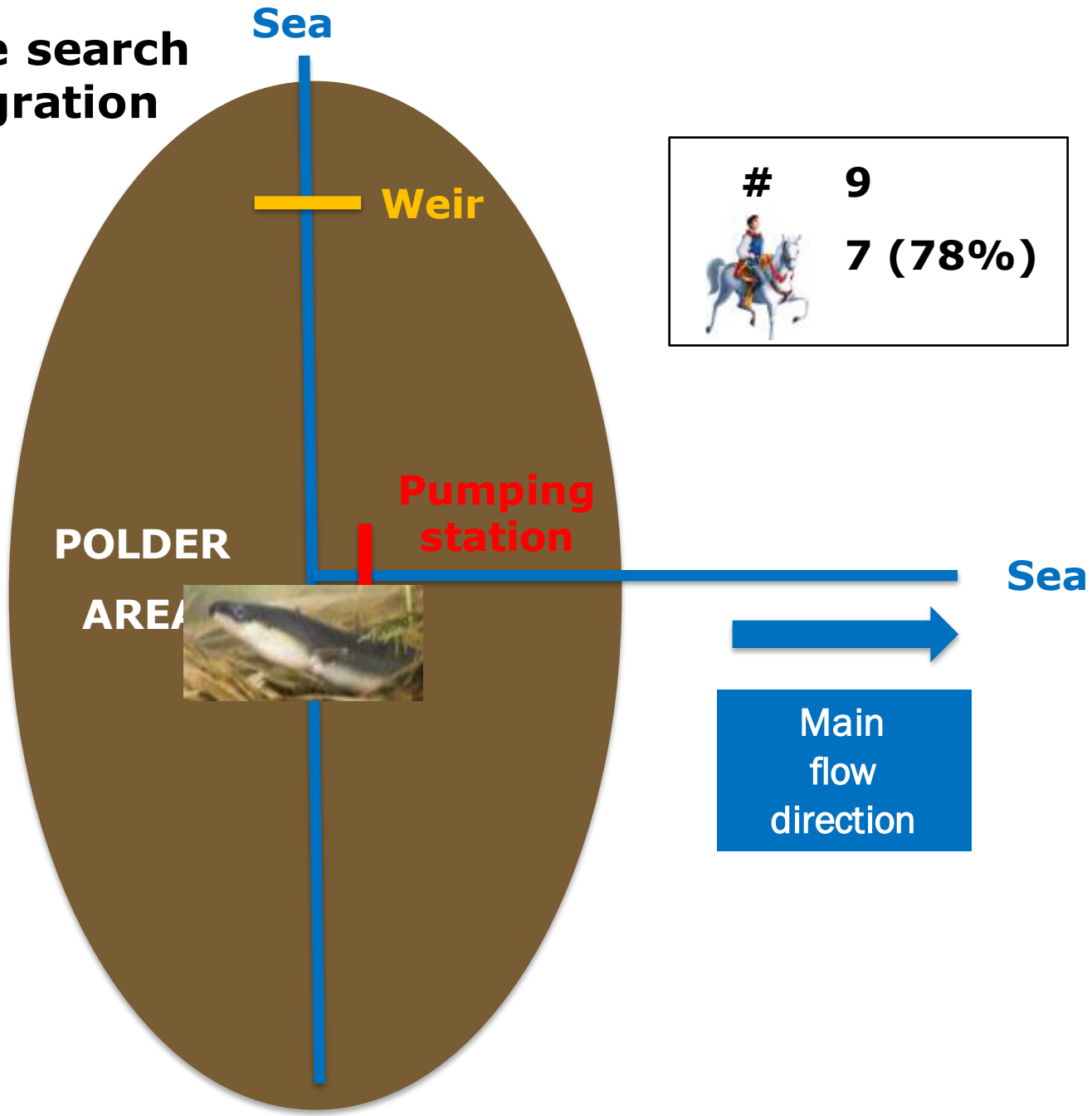
Results

Passage through PS

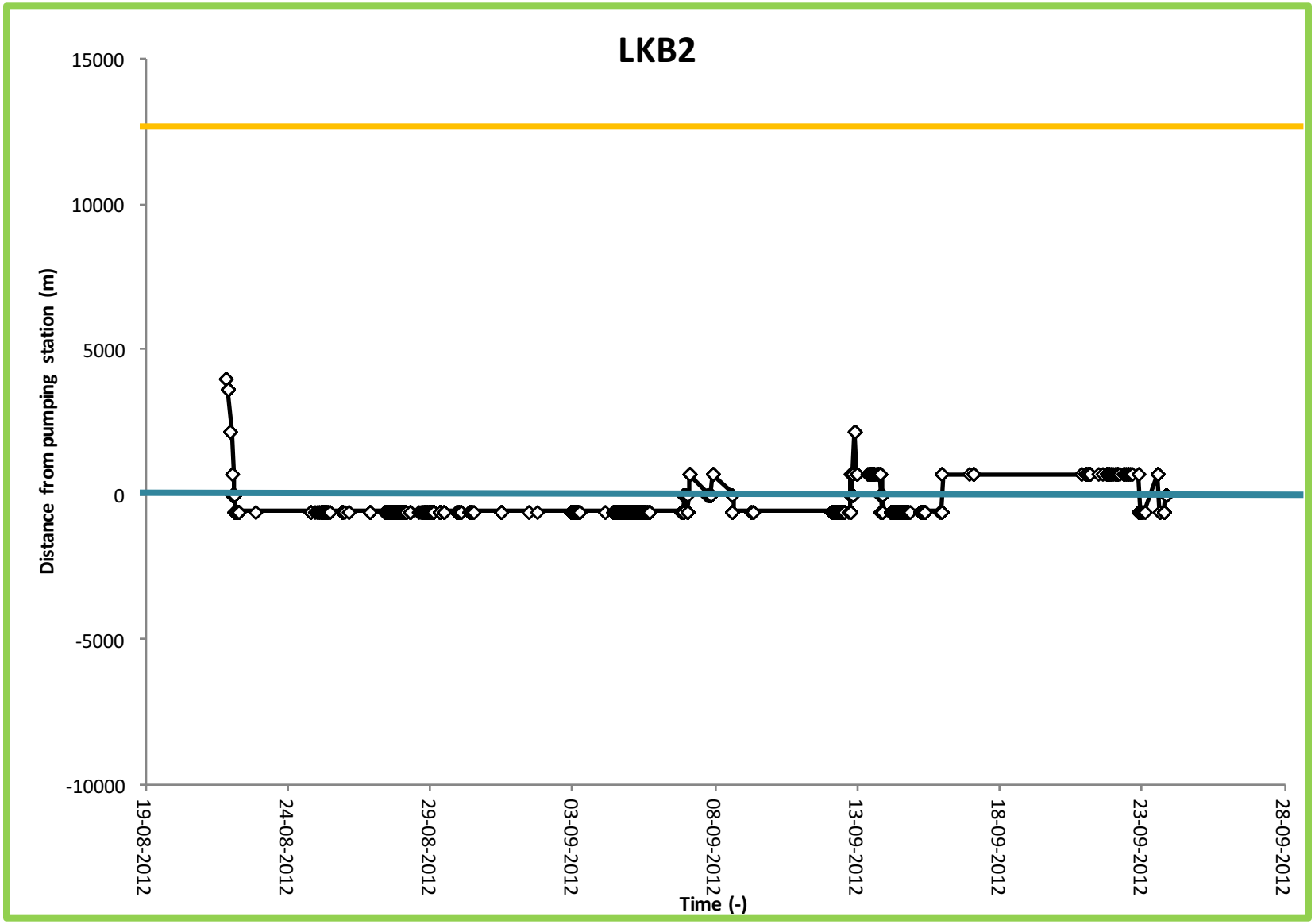
No passage

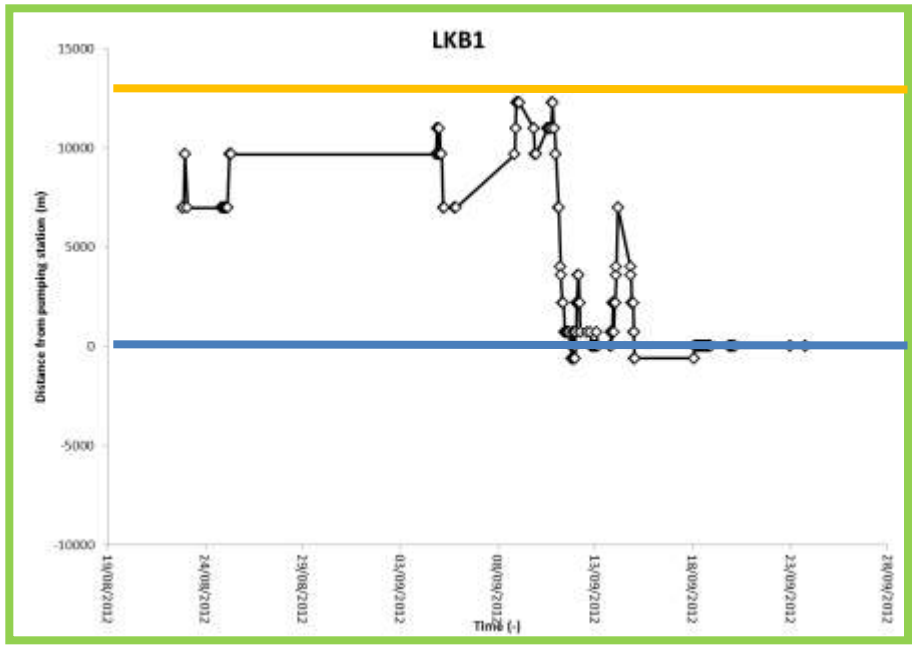


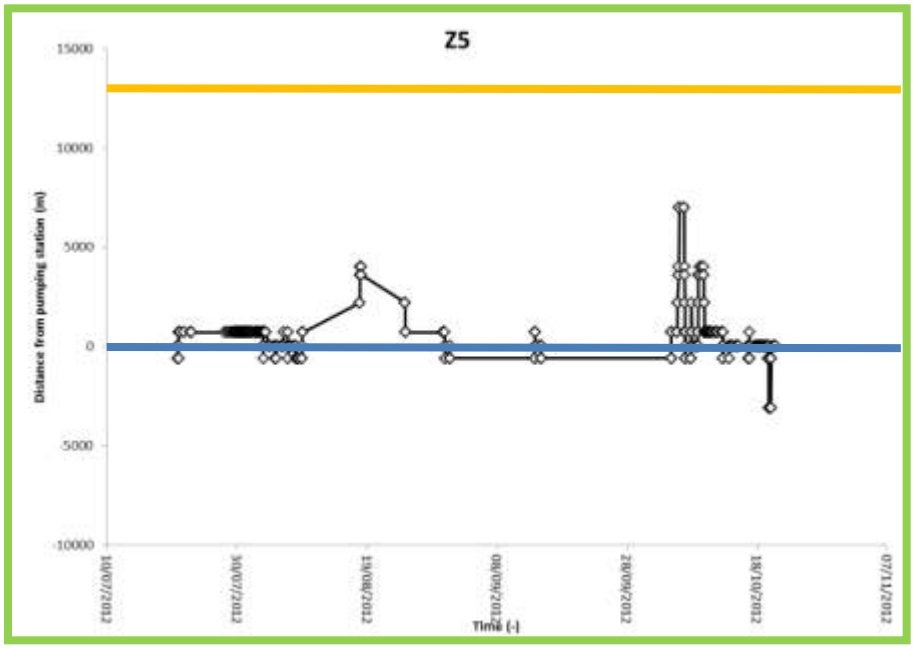
Short distance search + delay of migration



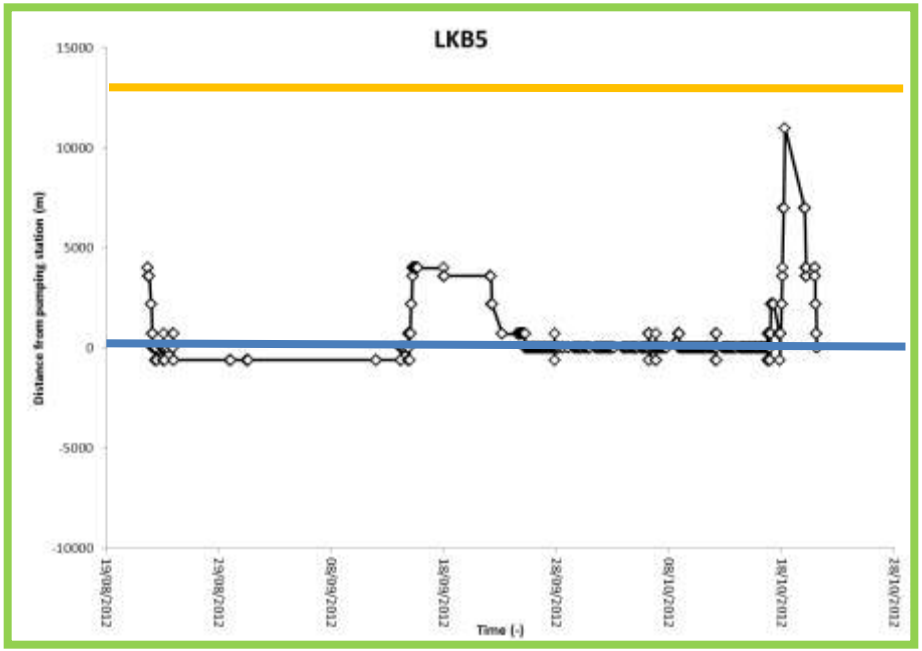
#	9
	7 (78%)


LKB2
15000
10000
5000
0
-5000
-10000
Distance from pumping station (m)
19-08-2012
24-08-2012
29-08-2012
03-09-2012
08-09-2012
13-09-2012
18-09-2012
23-09-2012
28-09-2012
Time (-)





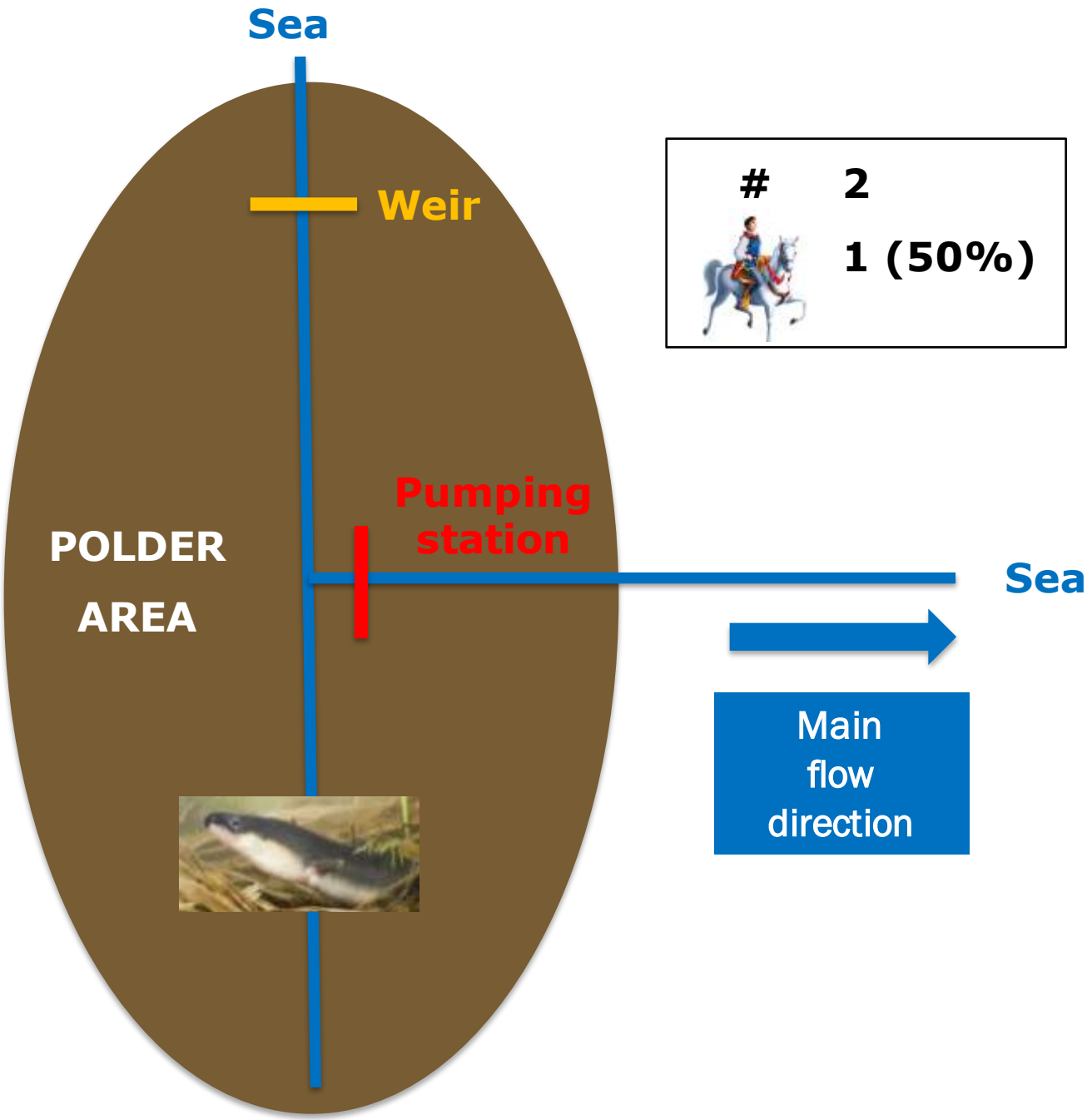
Long distance search



 # 3

3 (100%)

Migration to weir



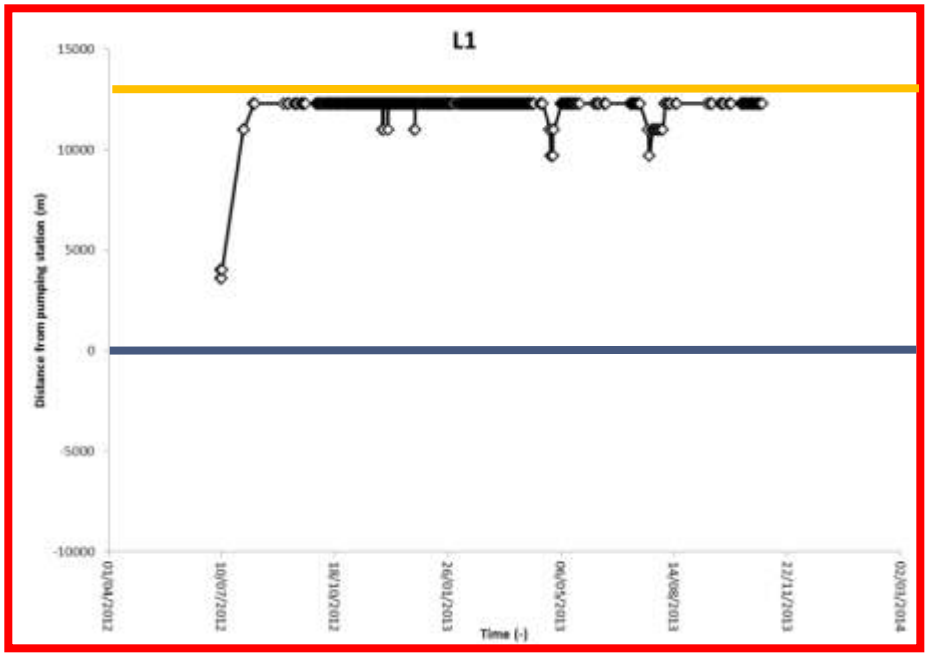
#	2
	1 (50%)

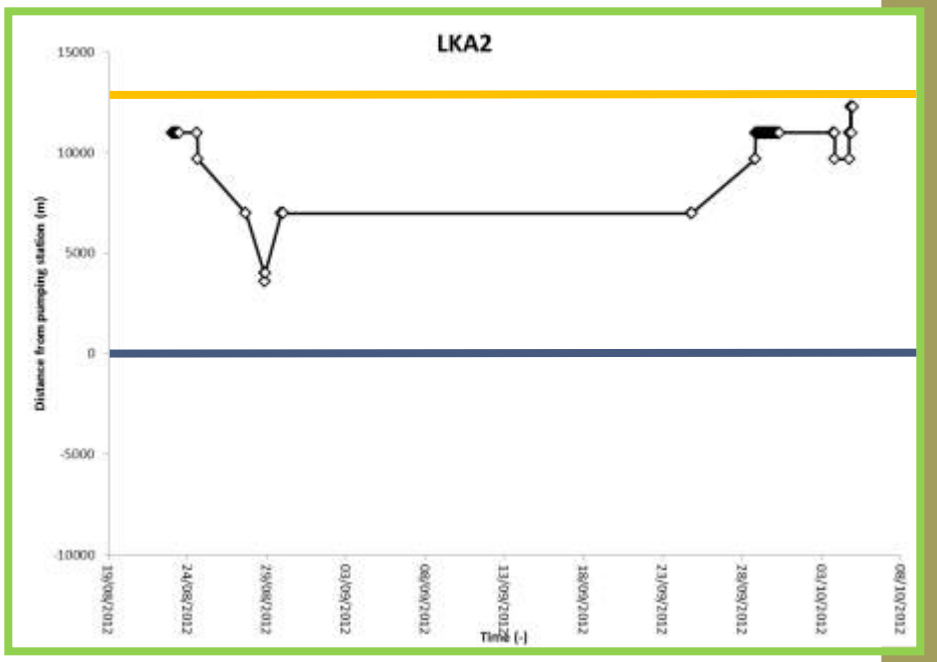
Results

- Different types of behaviour

No passage

Passage over weir





Results

- Different types of behaviour

Behaviour	Number of eel	Number of eel passing weir/pumping station
Homing	35	0 (0 %)
Failed migration, return to home site	2	0 (0 %)
Long homing, then fast migration	11	9 (81 %)
Short distance search + delay of migration	9	7 (78 %)
"Long distance" search	3	3 (100 %)
Migration to weir	2	1 (50 %)
Total	62	20 (32 %)

Conclusions

Conclusions

- Eel migration in study area seriously disrupted
  - Mortality after passage through pumping station
  - Impact on eel behaviour
    - Unsuccessful migration attempts
    - Desorientation – search behaviour
    - Delays
  - Significant individual differences!

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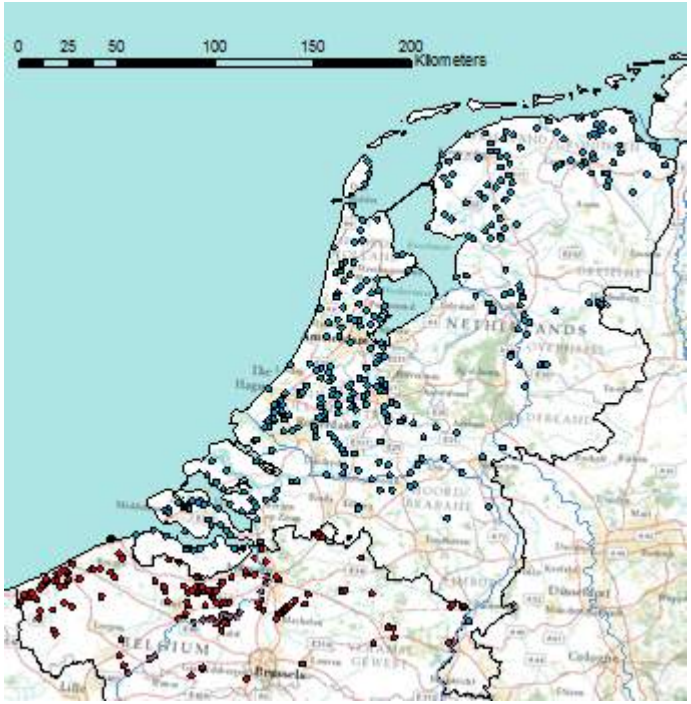
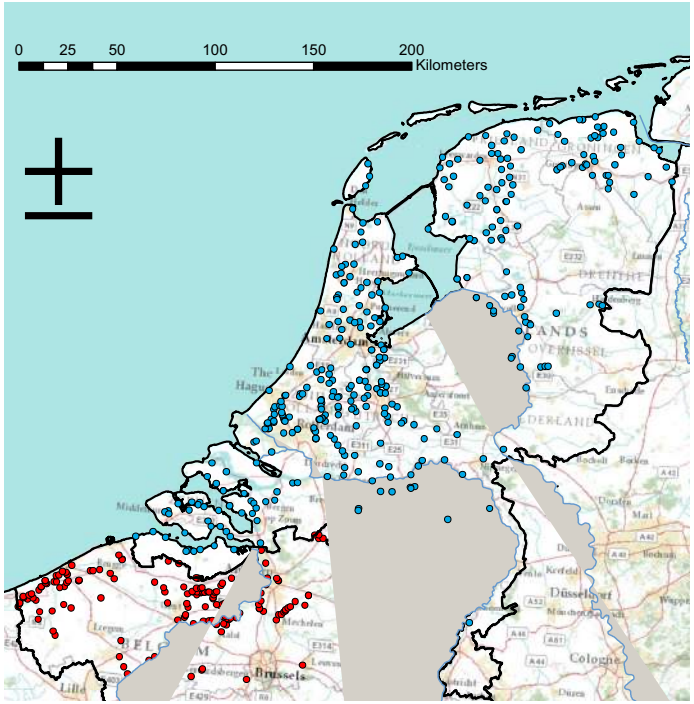
Conclusions

- **Extent of problem wider than study area**





Conclusions

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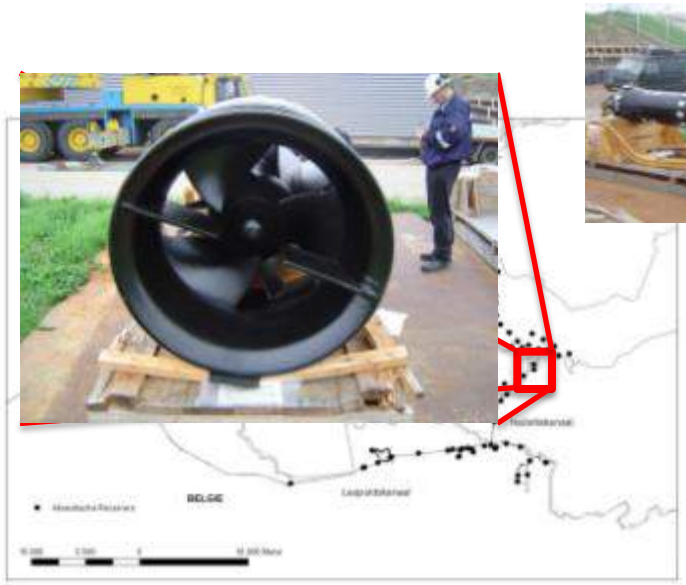

- **Cumulative effects!**

Conclusions

- Implications for management?
  - Fish-friendly pumping stations (turbines)?
  - Gain insight into eel response on flow alterations
  - Individual-based approach
    - Take into account realistic migration period
    - Optimise flow regime
    - Develop appropriate models

=> Much work to be done

Conclusions

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  - **Fish-friendly pumping stations (turbines)?**
  - **Gain insight into eel response on flow alterations**
  - **Individual-based approach**
    - **Take into account realistic migration period**
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    - **Develop appropriate models**

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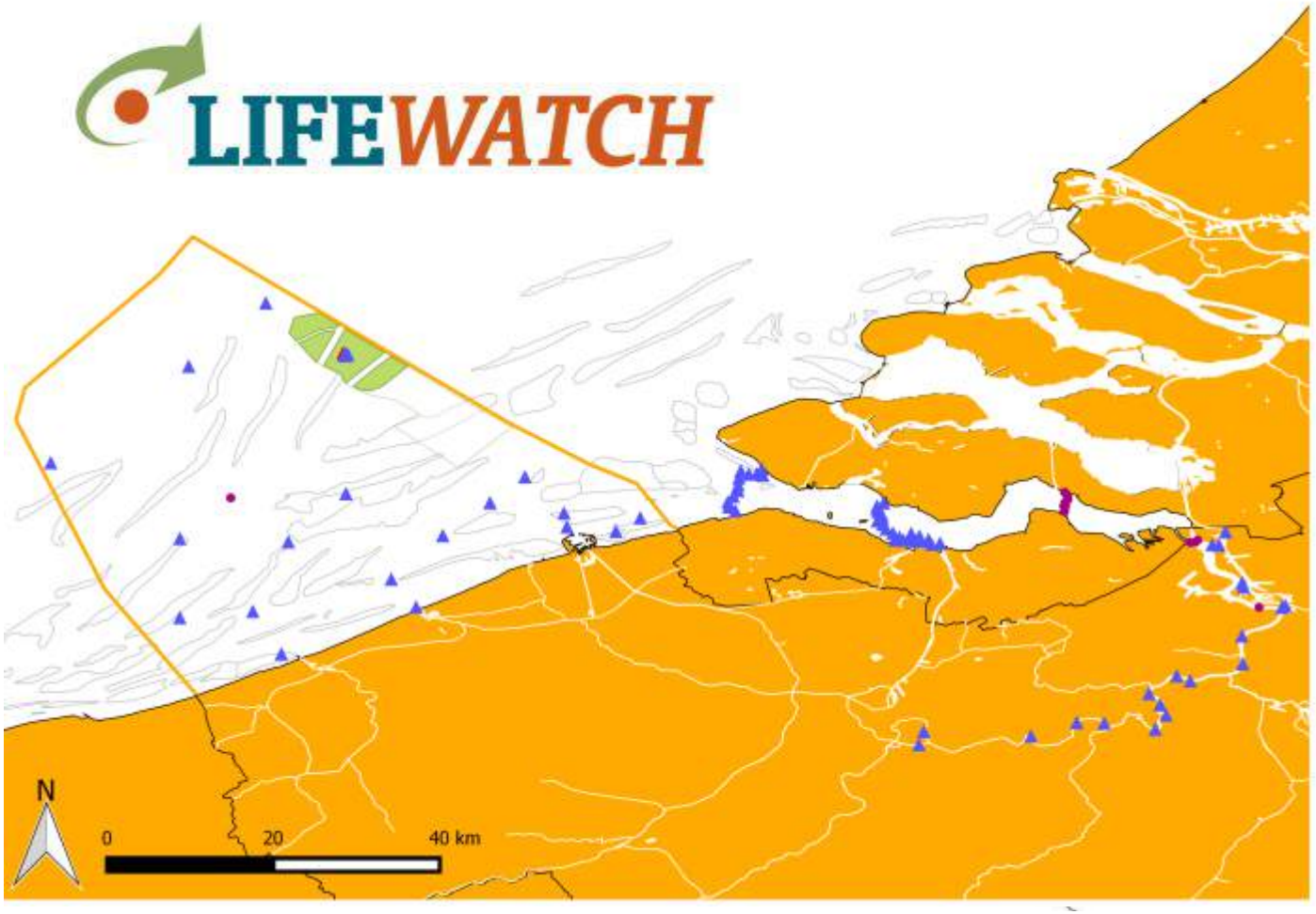
Further research

- **Permanent network of acoustic listening stations**
  - **Estuarine and marine migration behaviour**



Thank you!

Pieterjan.Verhelst@UGent.be

Questions?

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