Photo: Ingemar Alenäs

The Herting Project 2007-2015

- On the performance of a new upstream and downstream passage facility for diadromous fish species

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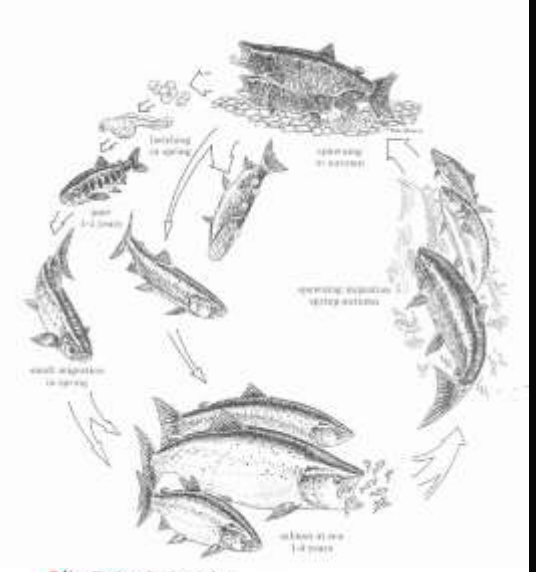
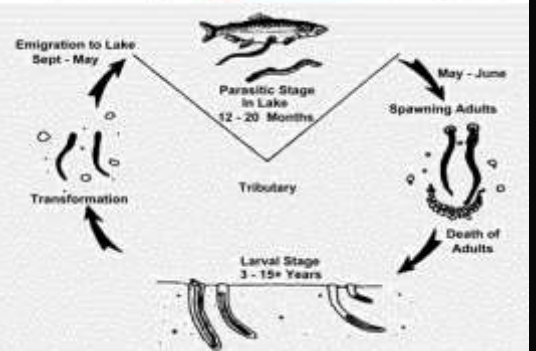
The project goals

- Strengthen diadromous fish populations:
  - Atlantic salmon (*Salmo salar*)
  - European eel (*Anguilla anguilla*)
  - Sea lamprey (*Petromyzon marinus*)





The project goals

- Strengthen diadromous fish populations:
  - Atlantic salmon (*Salmo salar*)
  - European eel (*Anguilla anguilla*)
  - Sea lamprey (*Petromyzon marinus*)

  …with contrasting life-cycles and behavior
- Evaluation of Fish Passage Solutions, before and after modifications, by quantifying:
  - Passage efficiency (rate)
  - Fish Guidance Efficiency (FGE)
  - Passage time (delay)

The River Ätran

River Ätran Basics

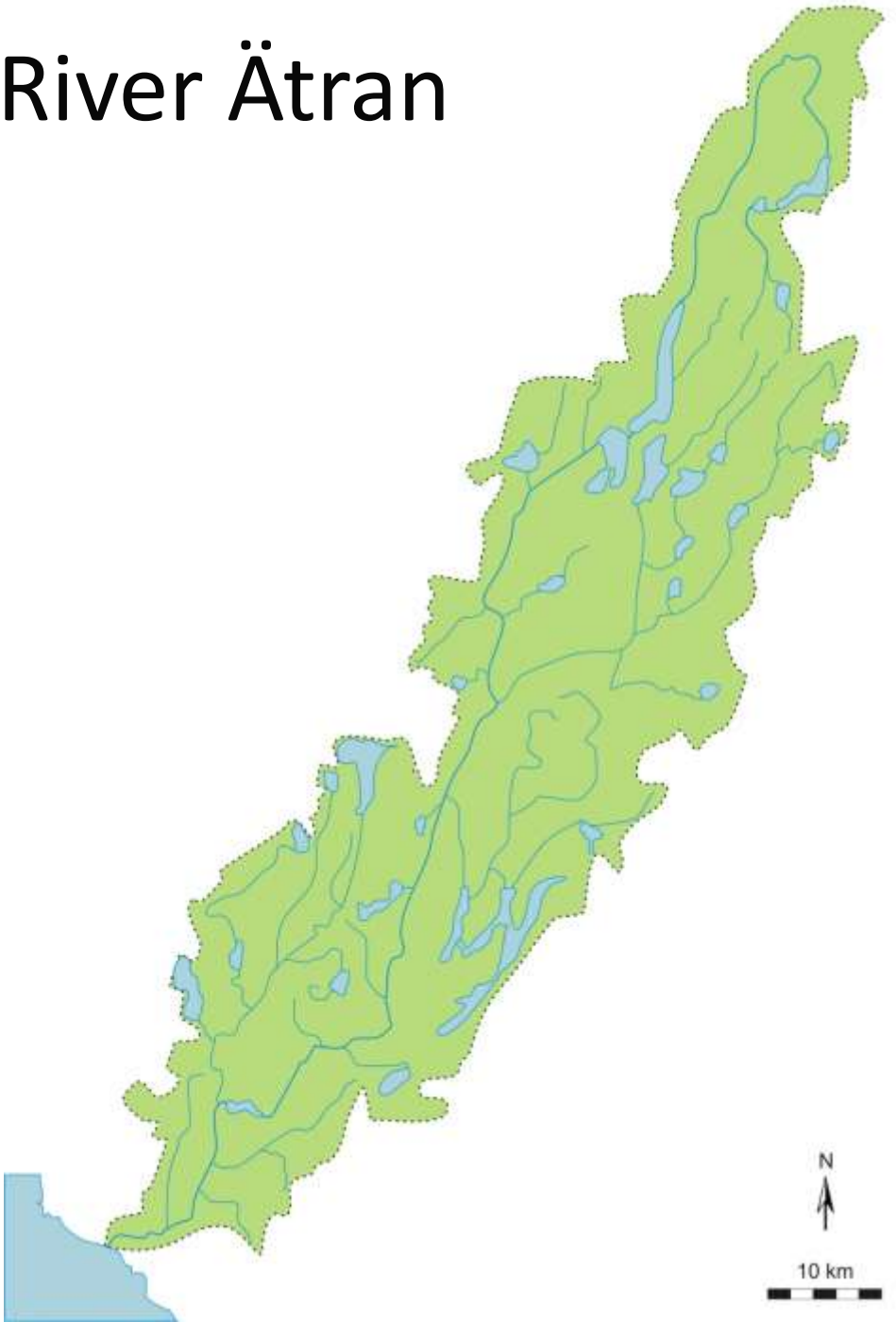
- ✓ Catchment: 3342 km^2
- ✓ Q range: 20-319 $m^3 s^{-1}$
- ✓ MQ: 60 $m^3 s^{-1}$

Connectivity in the River Ätran

Before 1906 (Pre-hydro)

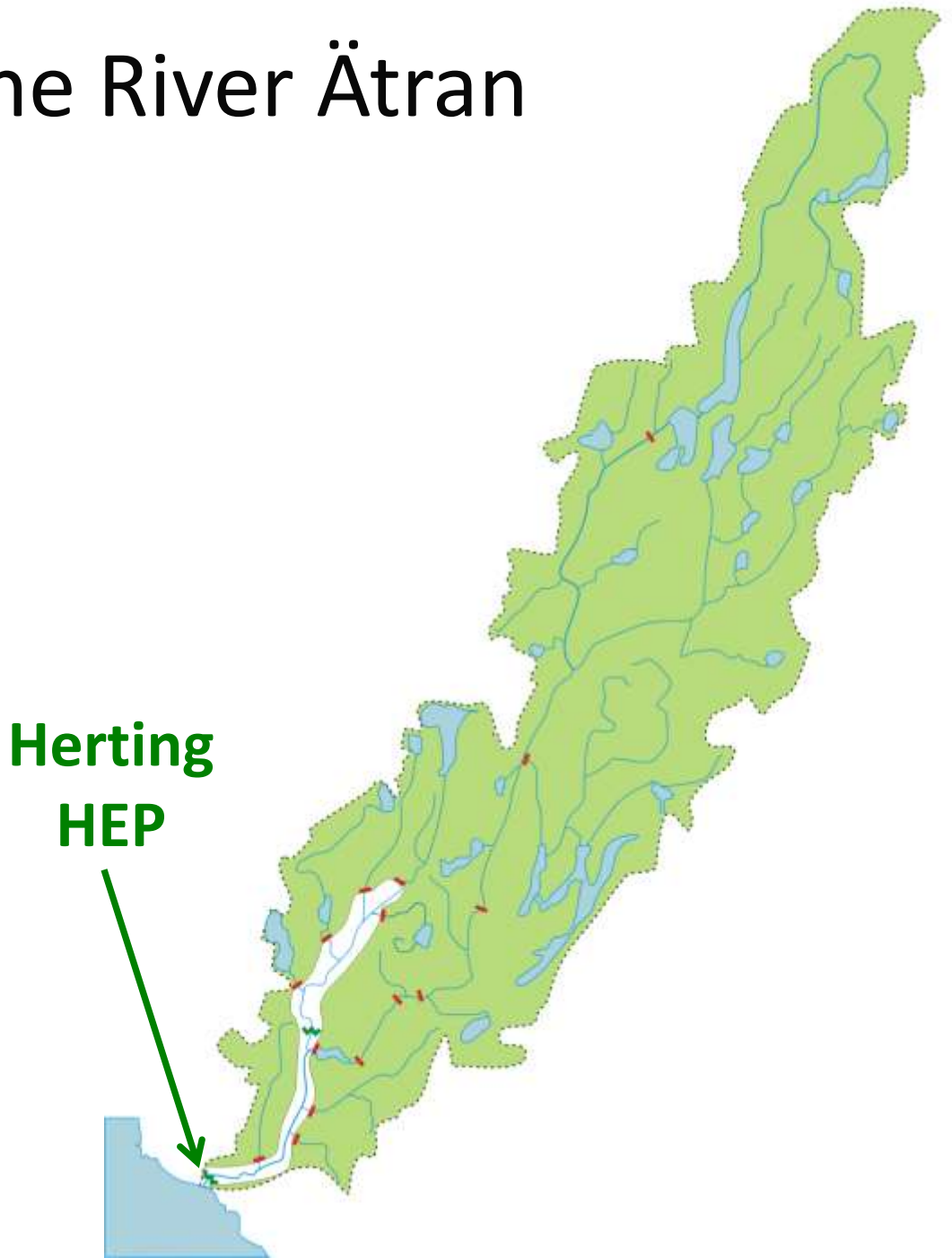
Connectivity in the River Ätran

Before 1906 (Pre-hydro)



Connectivity in the River Ätran

After 1906



Herting HEP
Before 2013

Herting HEP 2013

Herting HEP
After 2013

Before 2013

- Pre-study 2007-2010

Herting – the Gateway to River Ätran

After 2013

- Evaluation 2014-2015

Downstream passage solution

- Conventional rack → Low-sloping rack

Old conventional bar rack

1. Vertical bars - 90 mm
2. 60°
3. Surface bypass (2.0 cms)

New angled bar rack

1. Horizontal bars - 15 mm
2. 30°
3. Full-depth bypass (0.3-3.0 cms)

Methods

Various trapping techniques

Radio Telemetry

→ [1)] passage [2)] control

→ [3)] dead-drifters [4)] turbine releases

Video counters

Study groups before & after

1. Spawners [↑] N = 115
2. Post-spawners (kelt) [↓] N = 53
3. Smolt [↓] N = 98

4. Elvers [↑] N = 330
5. Silver eels [↓] N = 135

6. Spawners [↑] N = 35


Salmon spawners [↑] Before
66%
21 da


96%
4 days
Salmon
spawners
[↑] After

Salmon spawners [↑]

- More salmon spawners pass after improvements!
  - Passage not restricted by low temperatures
  - 66% vs. 96% **
  - Litterature: Median 60%, max 74% (Noonan et al., 2012)
- Faster passage today
  - 21 vs. 4 days **
  - Spawning migration occurs one month earlier
- 50 % increase in salmon spawners reaching the spawning grounds after modifications

Salmon kelts [↓]

- More kelts in the new downstream bypass:
  - Before: 99-335 st
  - After: 948 st
- No difference in passage timing:
  - Spring > Fall > Winter
  - Males earlier than females **

Salmon kelts [↓]

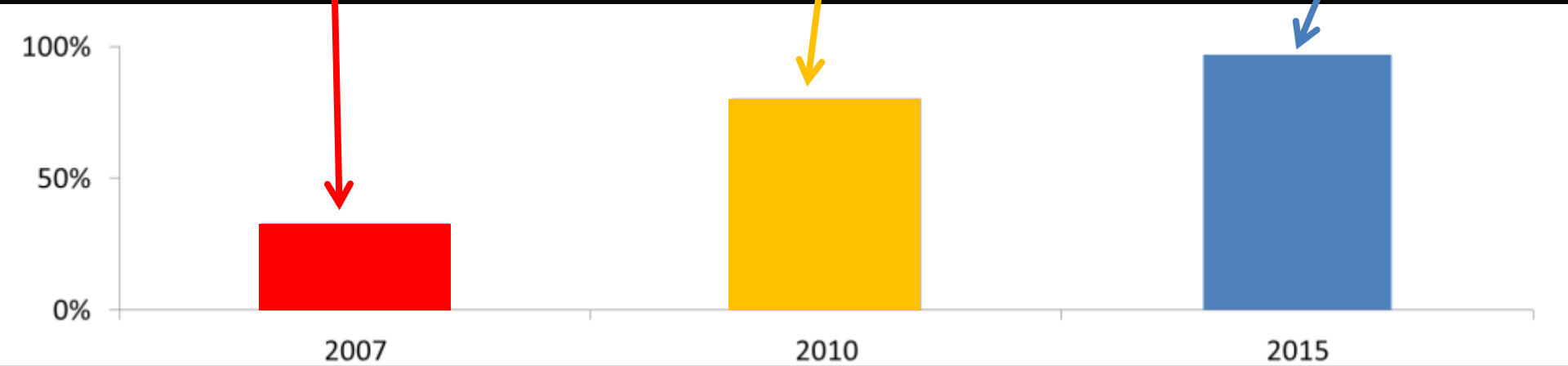
- More kelts in the new downstream bypass:
  - Before: 99-335 st
  - After: 948 st
- No difference in passage timing:
  - Spring > Fall > Winter
  - Males earlier than females **
- Higher kelt survival after modifications

Salmon kelt [↓]

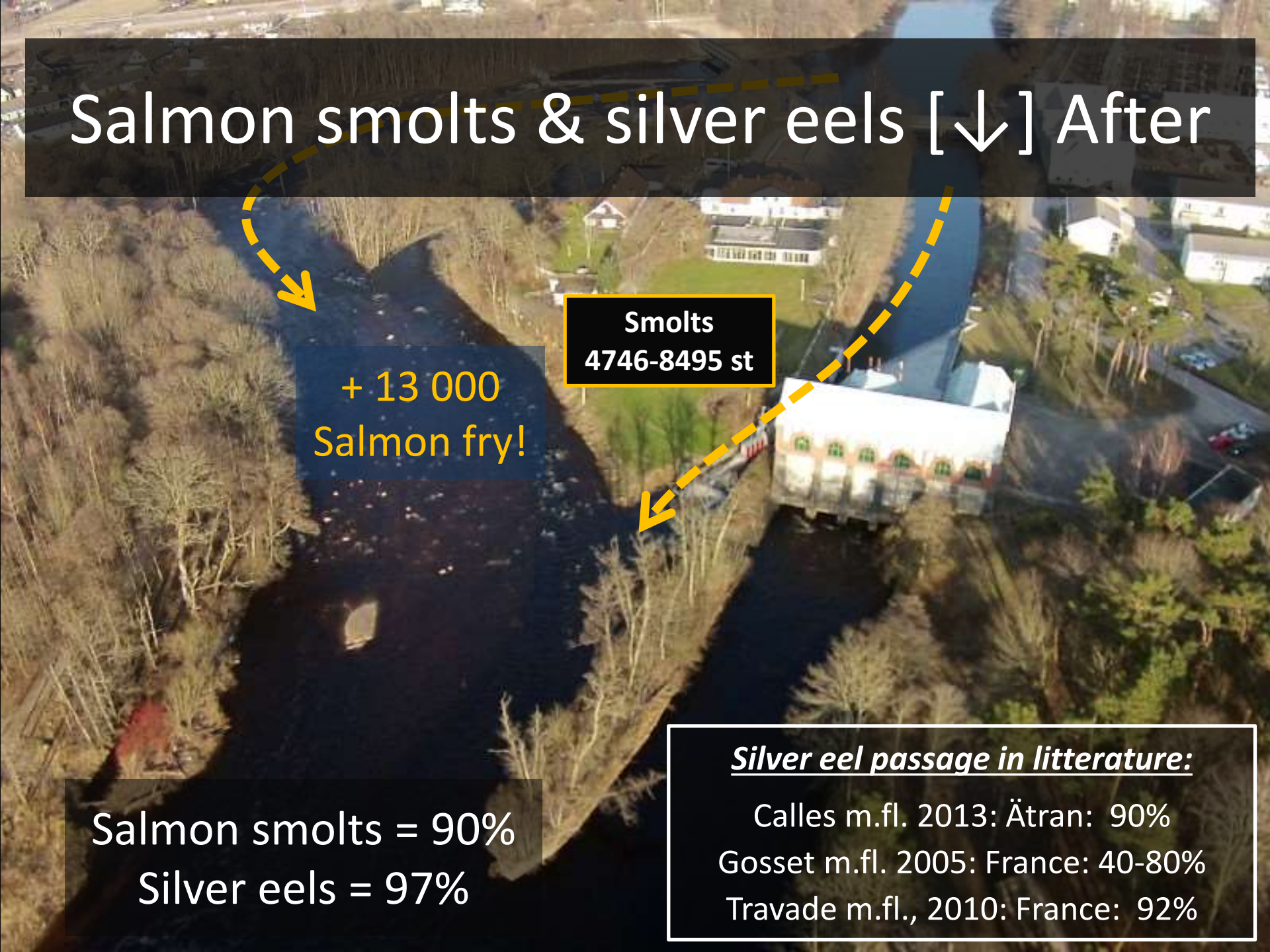
Before – Low discharge
Survival = 33 %

Before – High discharge
Survival = 80 %

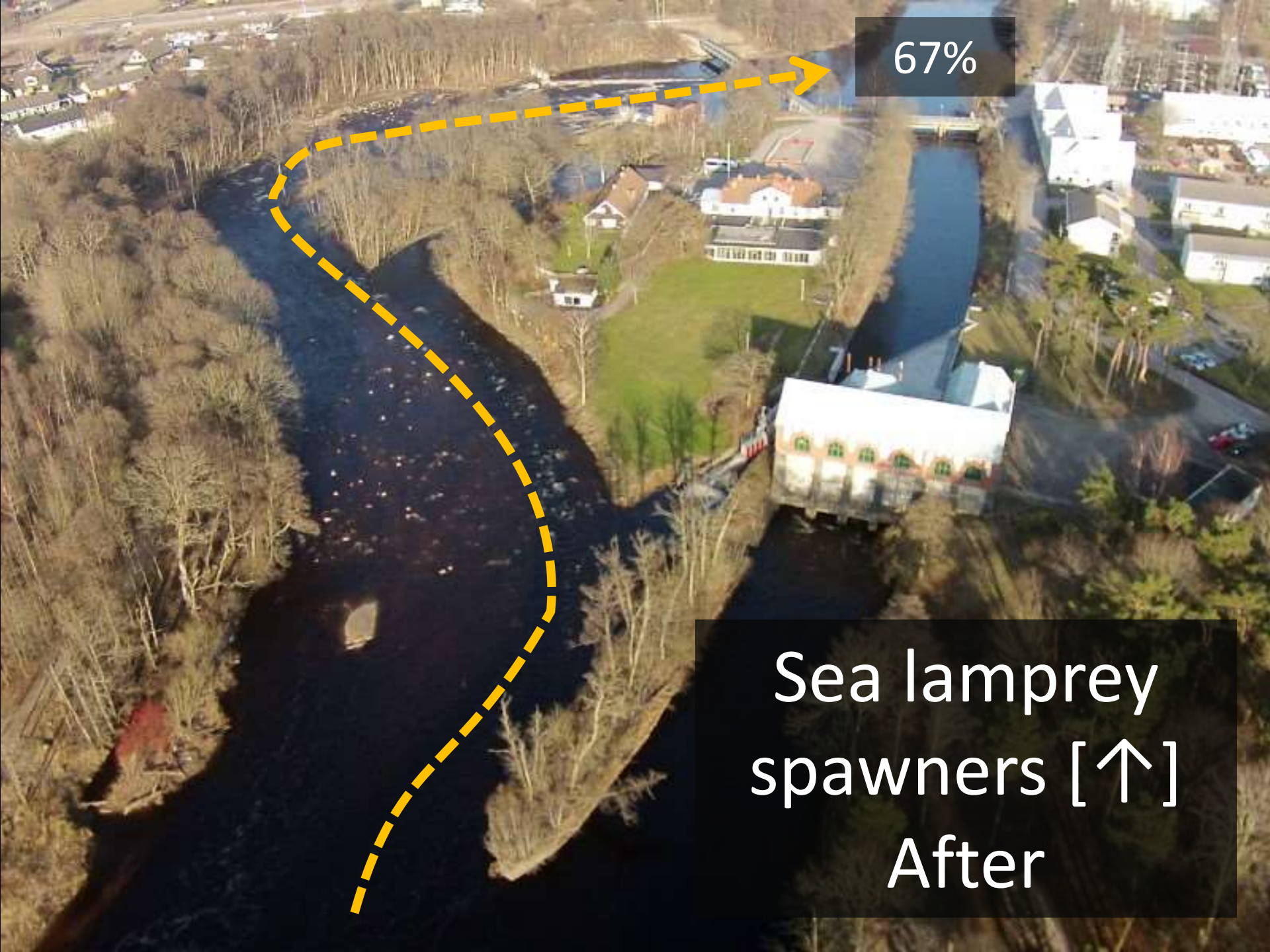
After – Always high discharge
Survival = 97 %



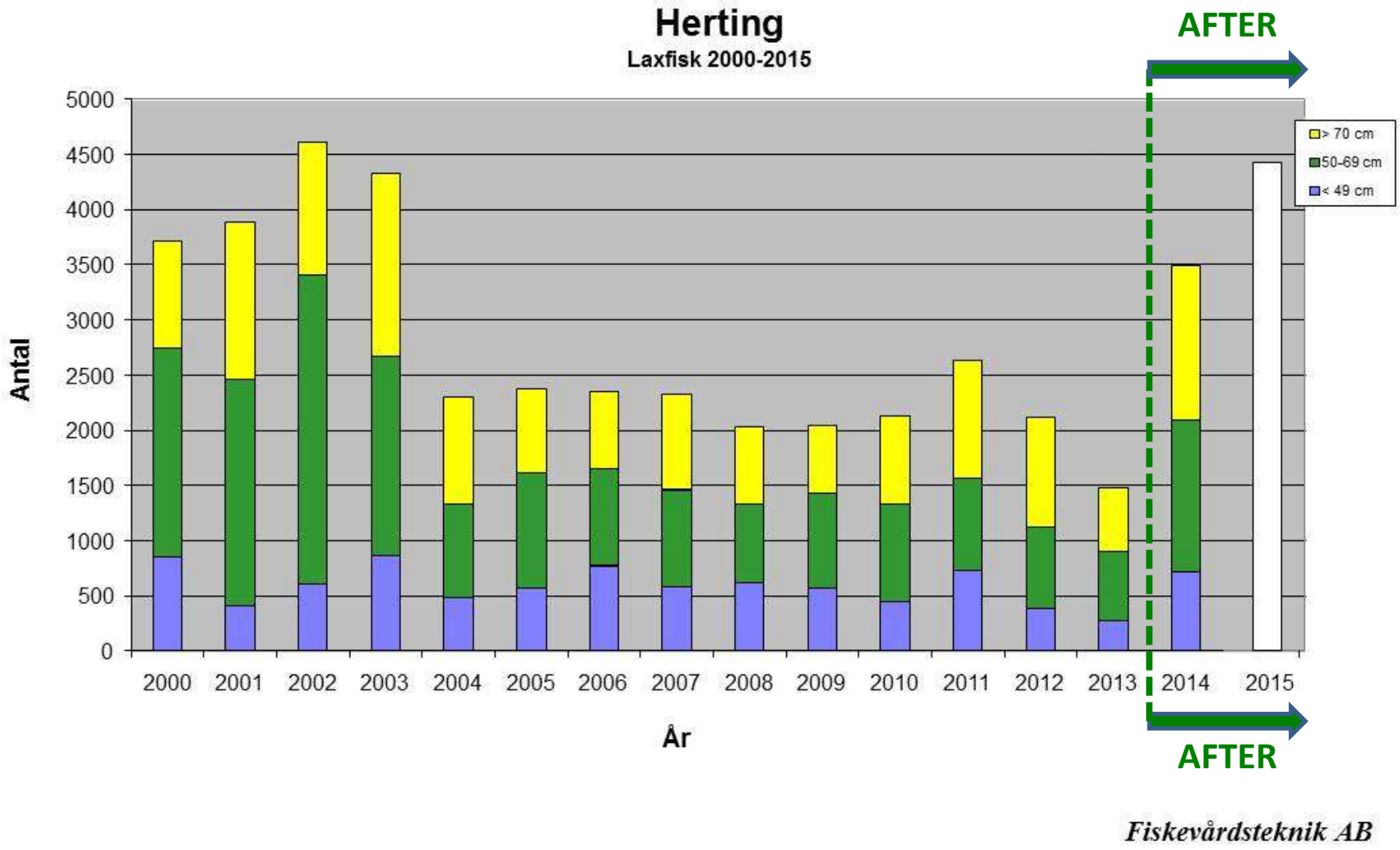

Salmon smolts & silver eels [↓] Before
Smolts
668 st
Smolts = 90%
Silver eels = 70%


Salmon smolts & silver eels [↓] After
Smolts
4746-8495 st
+ 13 000
Salmon fry!
Salmon smolts = 90%
Silver eels = 97%
Silver eel passage in litterature:
Calles m.fl. 2013: Ätran: 90%
Gosset m.fl. 2005: France: 40-80%
Travade m.fl., 2010: France: 92%

Sea lamprey spawners [↑] Before


67%
Sea lamprey spawners [↑] After

Long-term effects?



Herting Project Conclusions

The new Herting fish passage facility:

- Follows the guidelines in the Swedish BAT-report, i.e.:
  - A large nature-like fishway providing habitat and passage
  - A low-sloping fish-friendly rack with a full-depth bypass
- Has high passage success for several species and life-stages migrating both upstream and downstream
- Causes limited delay

= Illustrates the potential of Best Available Technique at sites where fish are prioritized higher than hydro

Thanks for listening!