

Innovative Floating Elver Trap

Increasing elver trapping efficiency and effectiveness through innovation and natural elver upstream migration behavior

Conventional elver traps/ladders

No major design changes have been applied relative to historical designs *(European perspective)*

Design Attributes:

- 15-20 inch wide wooden ramps
- 15-50 feet long
- Secured at waterway water's edge
- Attraction water by the entrance of the trap *(BCS)*

Conventional elver trap designs were likely sufficient to support elver migration when the run was about 90% larger than today's declining populations, but today innovation is needed to increase trap efficiencies and effectiveness.

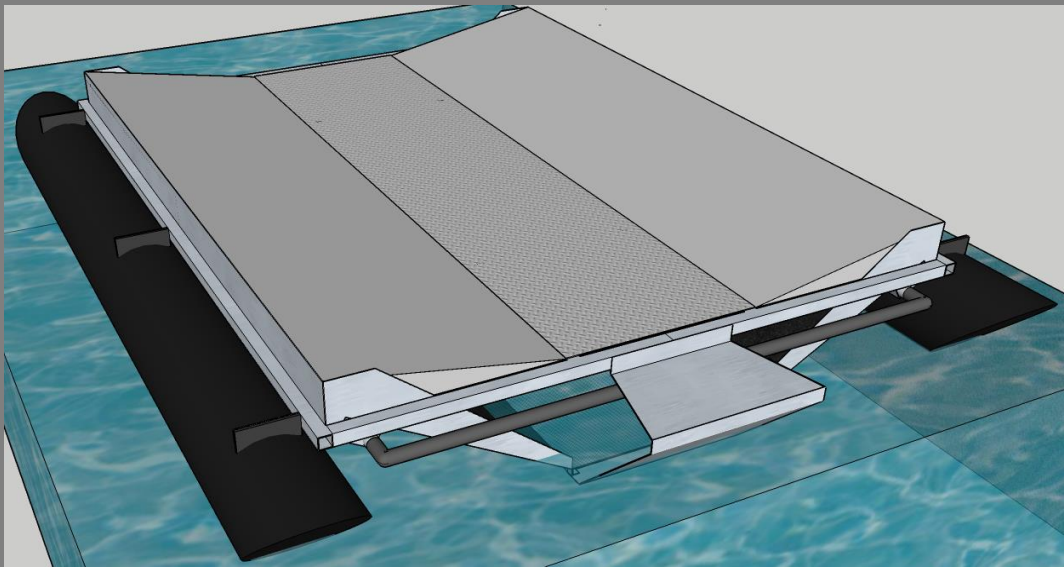
Conventional elver trap *Disadvantages*

- Installation and design dictated by local conditions rather than elver behavior
- Rodent and bird predation is a problem (open ramp design)
- Long climbs -> time and energy consumption
- Attraction flow not adjustable to river fluctuations
- Migration delays due to the design's ineffectiveness
- Delays result in increased numbers holding downstream
 - - *large schools collecting in warm waters elevates disease risk and decreases survival*



Floating Elver Trap *Advantages*

- Trap mobility enables elver behavior considerations (rather than local conditions)
- River fluctuations do not impact the trap's attraction flow
- Wider and shorter ramps provide climb savings: time and energy
- Design components reduce rodent and bird predation access
- Trap effectiveness has the potential to reduce migration delays
- Trap is easily moved to alternative sites and lifted out of the water during the off season

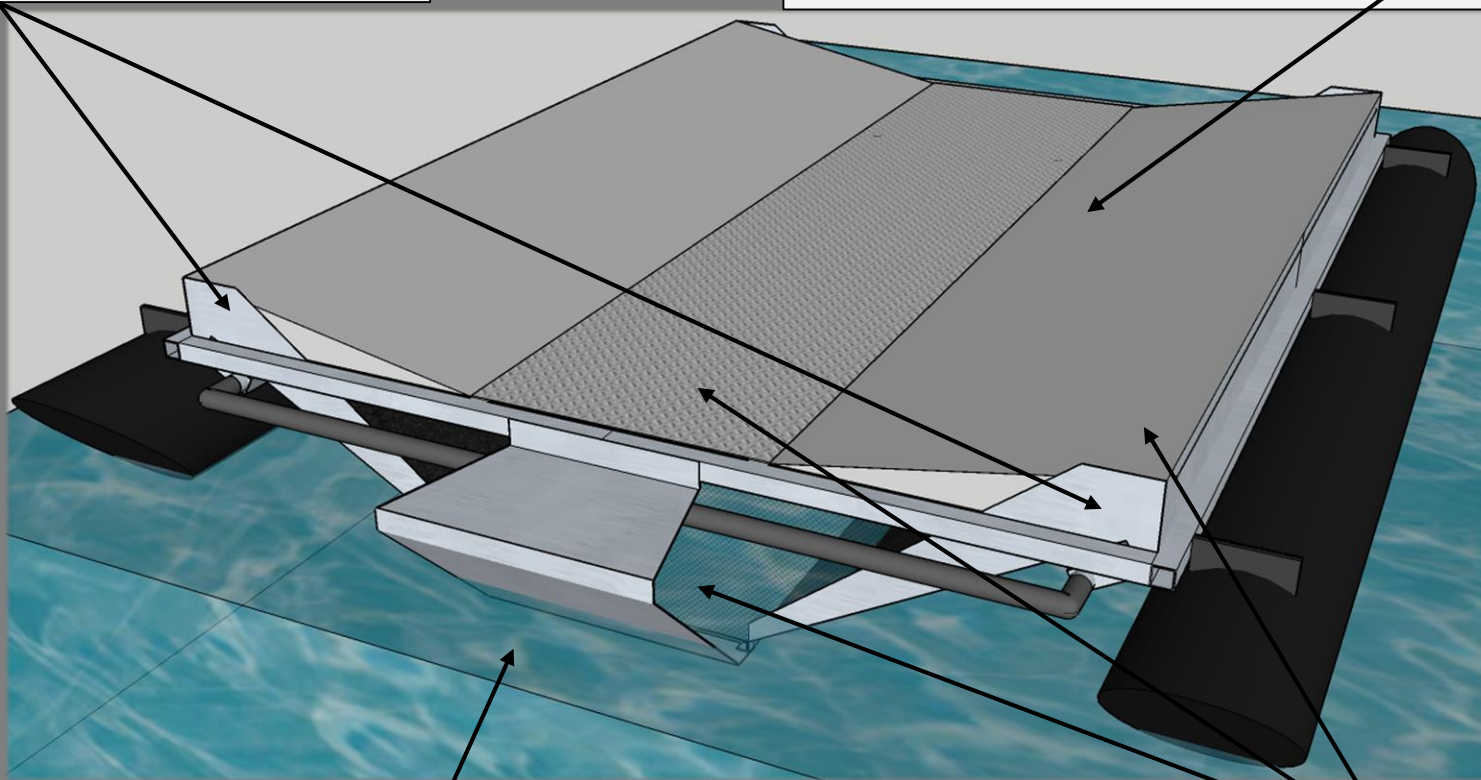


Floating Trap

Advantages

Two Ramps, dimensions: 10' wide, 3' long
Conventional designs: 1.25' wide, up to 50' long

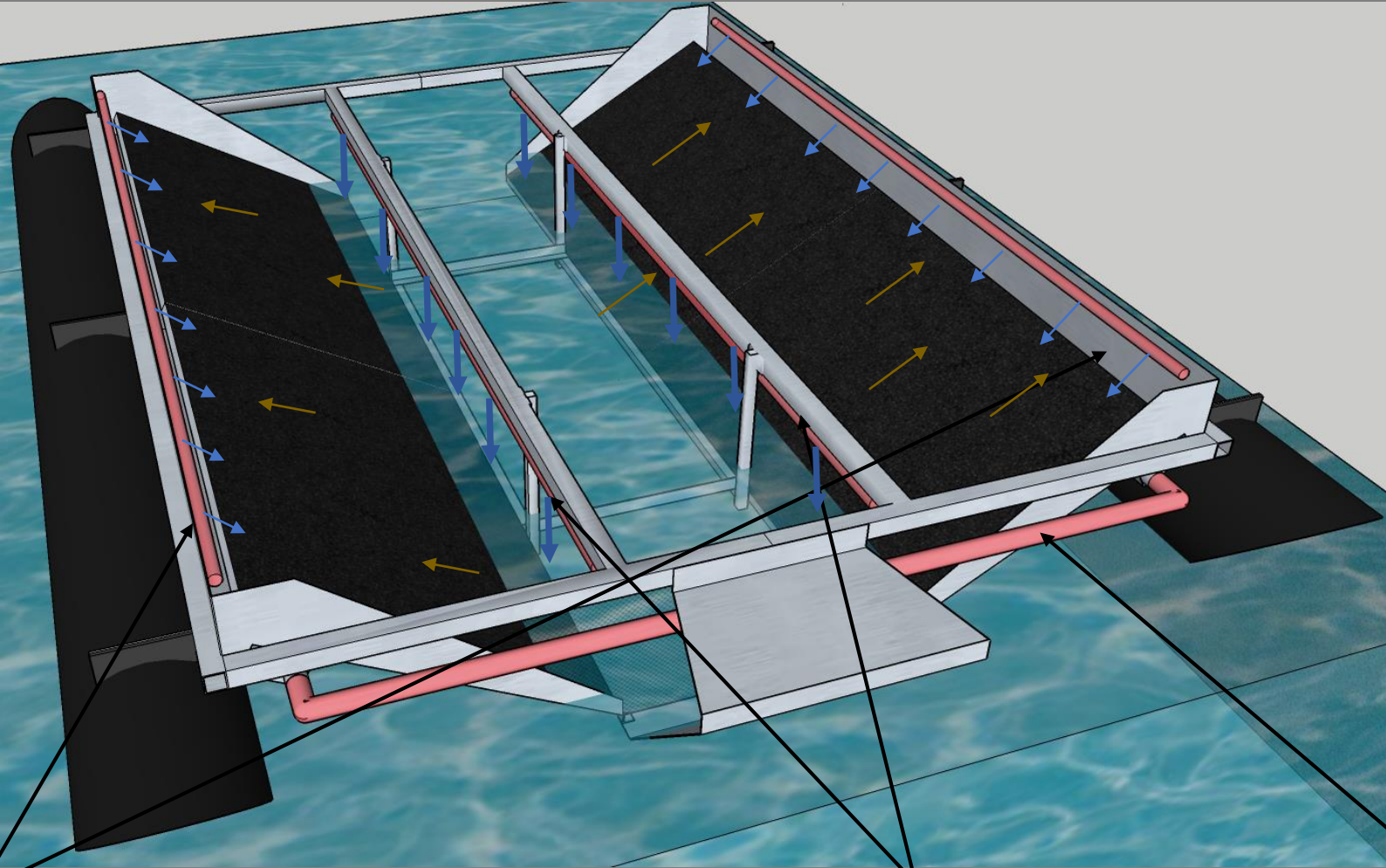
The trap itself creates a 138 sq ft. shadowed area attractant



Tarp, steel panel and stainless steel net protect elvers from predation

Nose redirects river flow, facilitating attraction via slow moving backwater

Floating Trap Function



Elvers climb
up ramps

Pipes provide water to the climbing substrate
and the initial collection box

Pipes provide
attraction flow

Pipe leads elvers to
primary collection bag/box

Floating Elver Trap Piped Water Flows

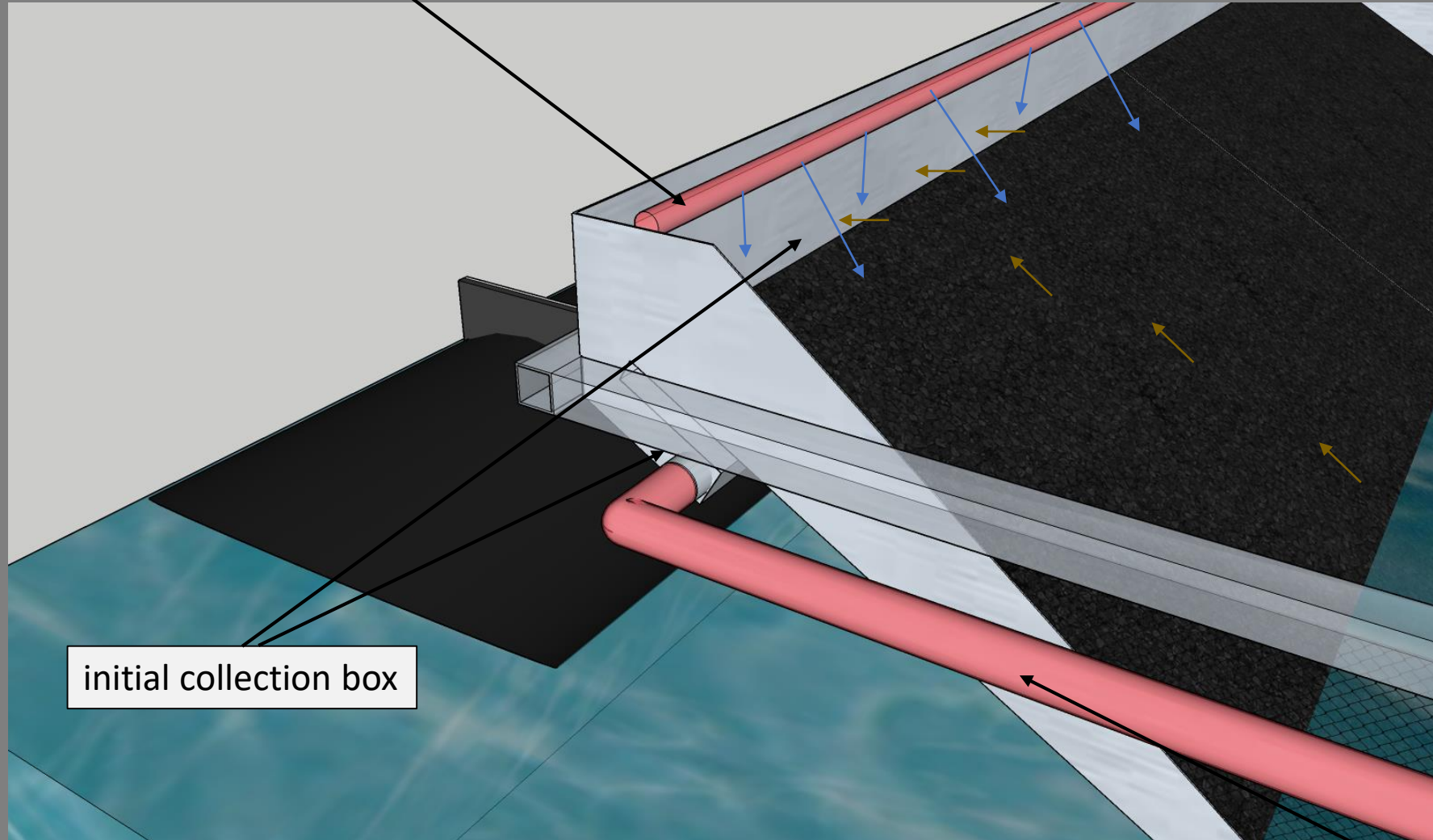


Climbing substrate *EF:16*



- Internally developed: designed by Elghagen Fiskevård
- Egg carton structure designed as a interfitting tile system
- Used in floating elver trap tests performed in 2016 and 2018

Pipes provide water to the climbing substrate and initial collection box

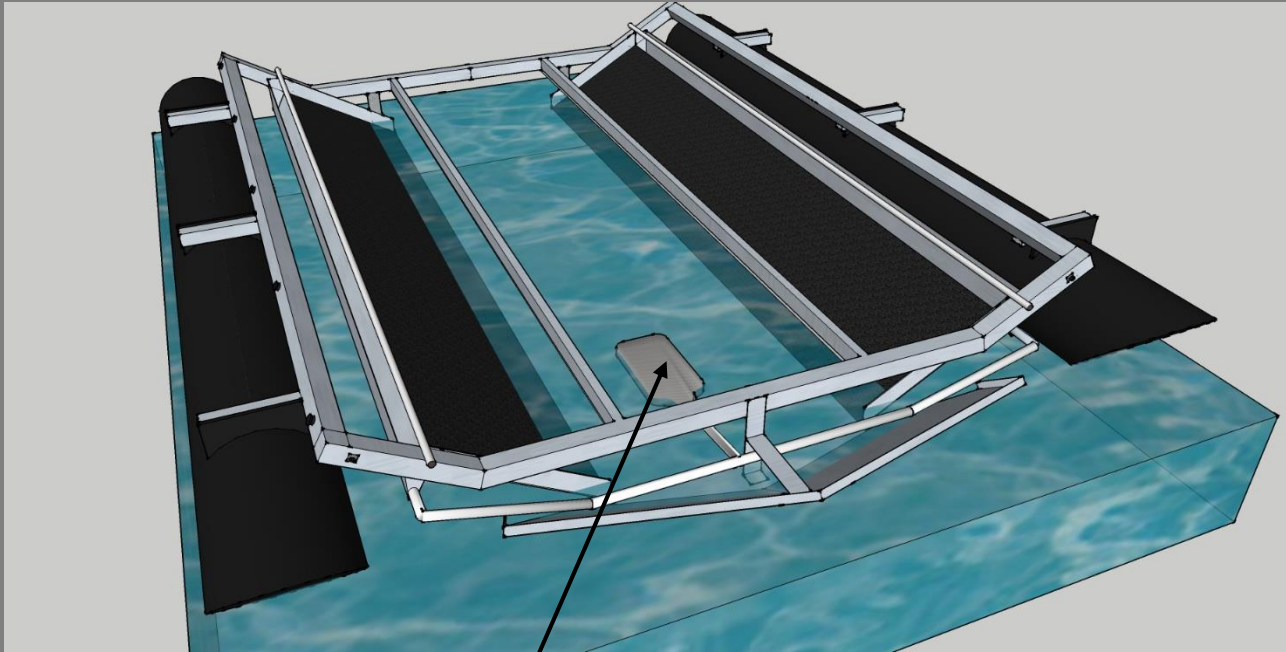


initial collection box

Elvers climb up ramp, over ramp crest and into the initial collection box

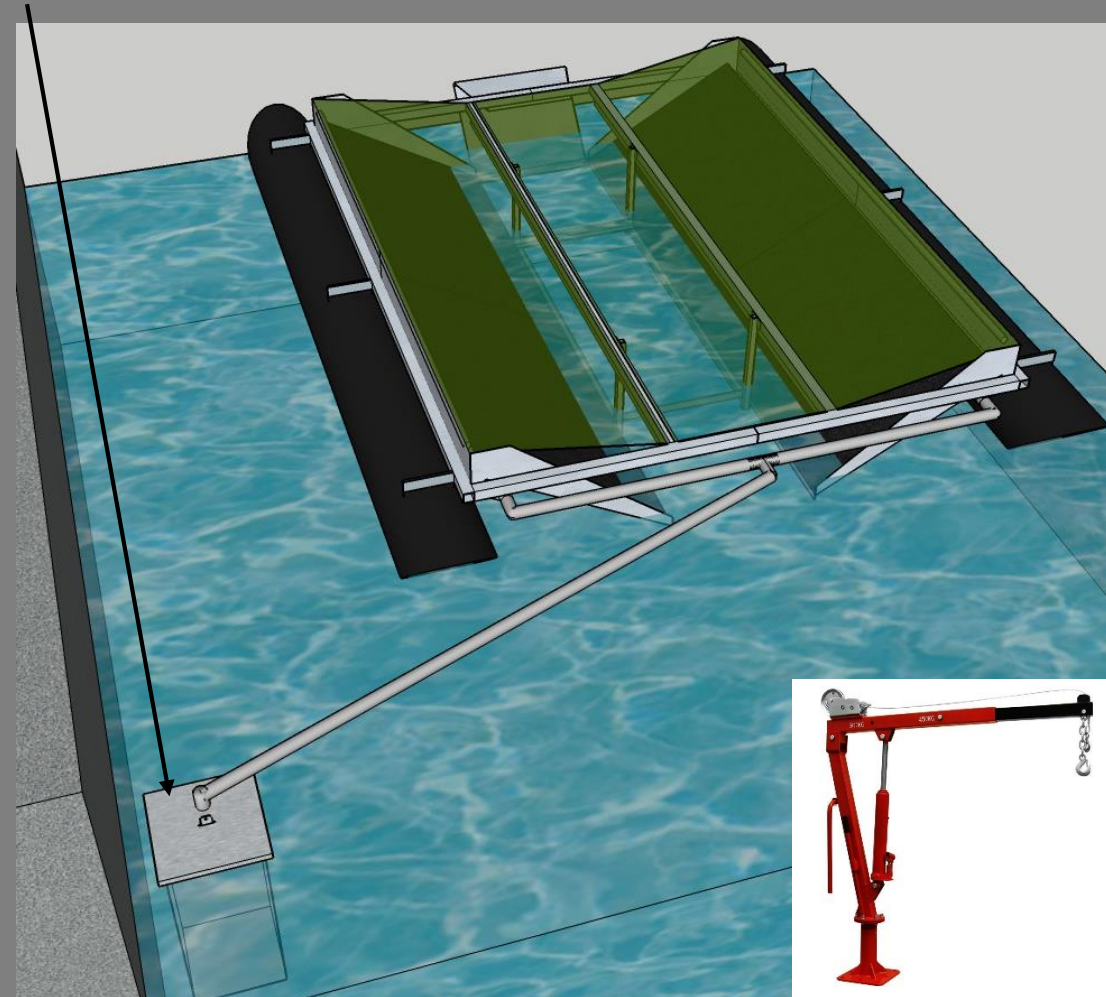
Pipe providing path to primary collection bag/box

Primary trap collection options



- **2016 study:** Trap accessed by boat
- Elvers collected in mesh bag

- **2018 study:** Trap accessed by a small crane
- Elvers collected in separated collection box



Elver Trap Comparative Studies: Floating trap vs. Conventional trap(s)



2016 River Lagan



2018 River Göta älv

Locations in Sweden where the comparative trap efficiency/effectiveness studies were conducted

River Lagan Elver Comparative Study 2016

floating trap vs. conventional trap (ladder)

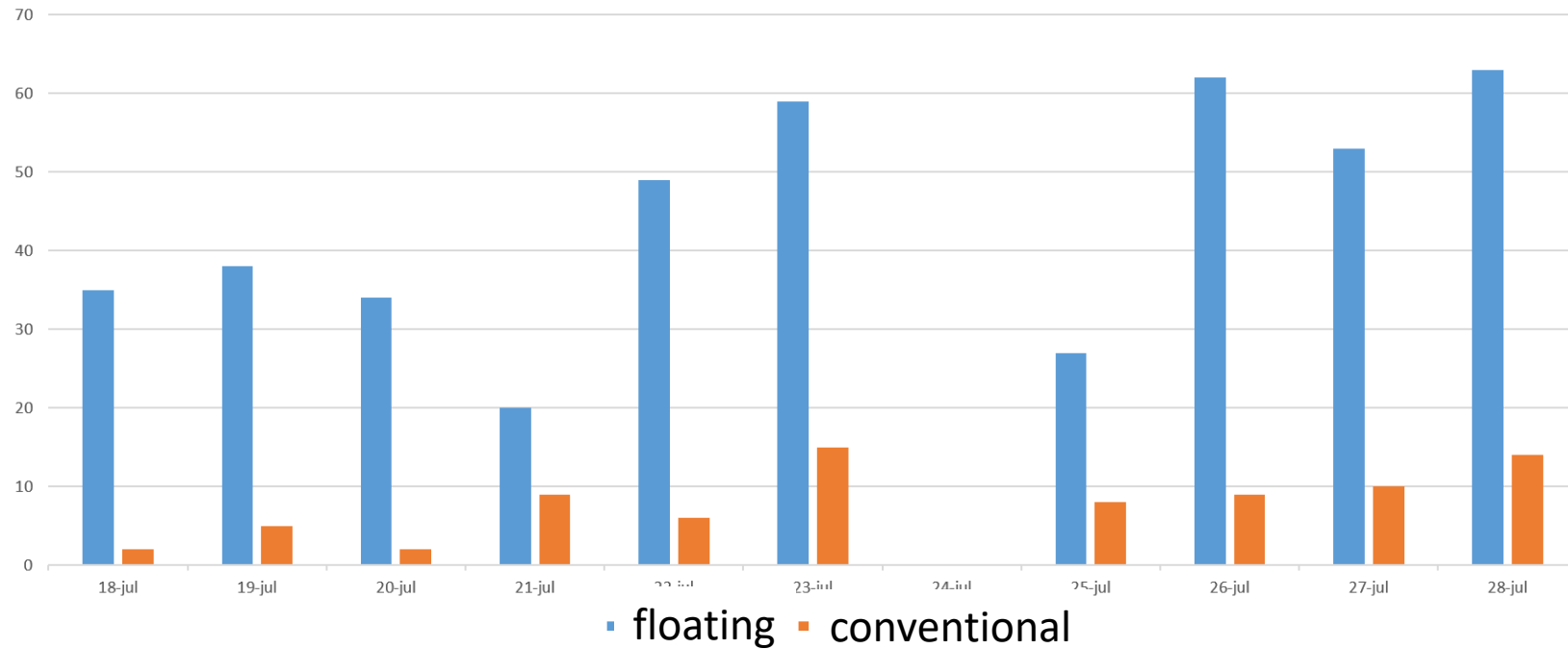
Evaluations under two distinct temporal test conditions

- Laholms hydro power station, Lagan, Sweden (Statkraft, average discharge: 2900 ft³s)
- Test 1. 08:00 pm – 08:00 am, Power station not running (night time)
- Test 2. 08:00 am – 02:00 pm, Power station running (day time)
- Floating trap and conventional trap under similar flow environments
- Study designed to maintain variables:
 - Attraction flow
 - Amount of water on climbing substrate
 - Ramp angle

A 3D architectural rendering of a building with a large, sloped roof and a prominent chimney, set against a light blue background. The building is shown from a low angle, emphasizing its height and the scale of the roof. The roof is a light beige color, and the chimney is a darker, brownish-grey. The building is situated on a light blue, textured surface that resembles water or a wet ground. The overall style is clean and modern, with a focus on geometric forms and light colors.

Results: River Lagan 2016

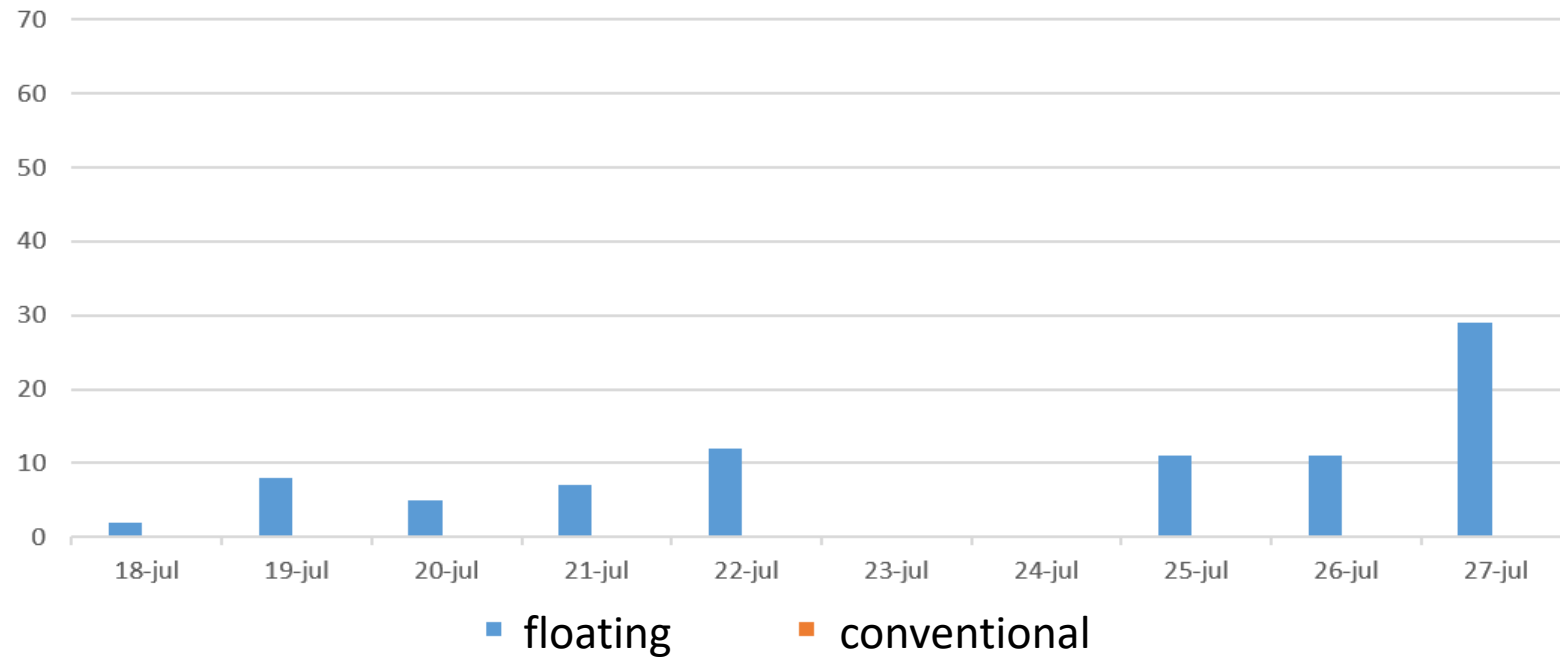
River Lagan Test 1: 08:00 pm – 08:00 am 10 nights



Total catch: 520 elvers

- Floating elver trap: 85 % N= 440
- Conventional elver trap: 15 % N= 80

River Lagan Test 1: 08:00 am – 02:00 pm 8 days

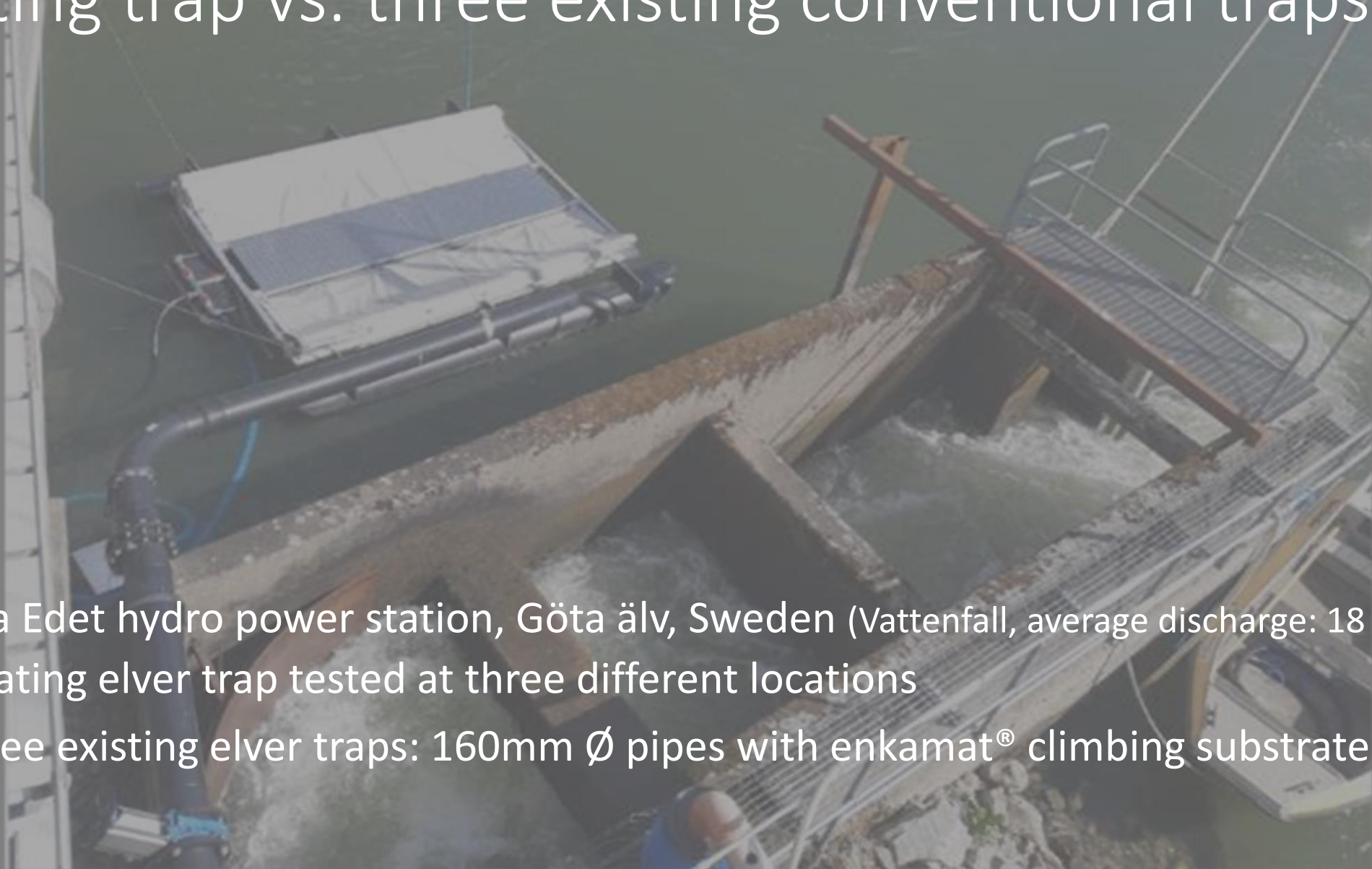


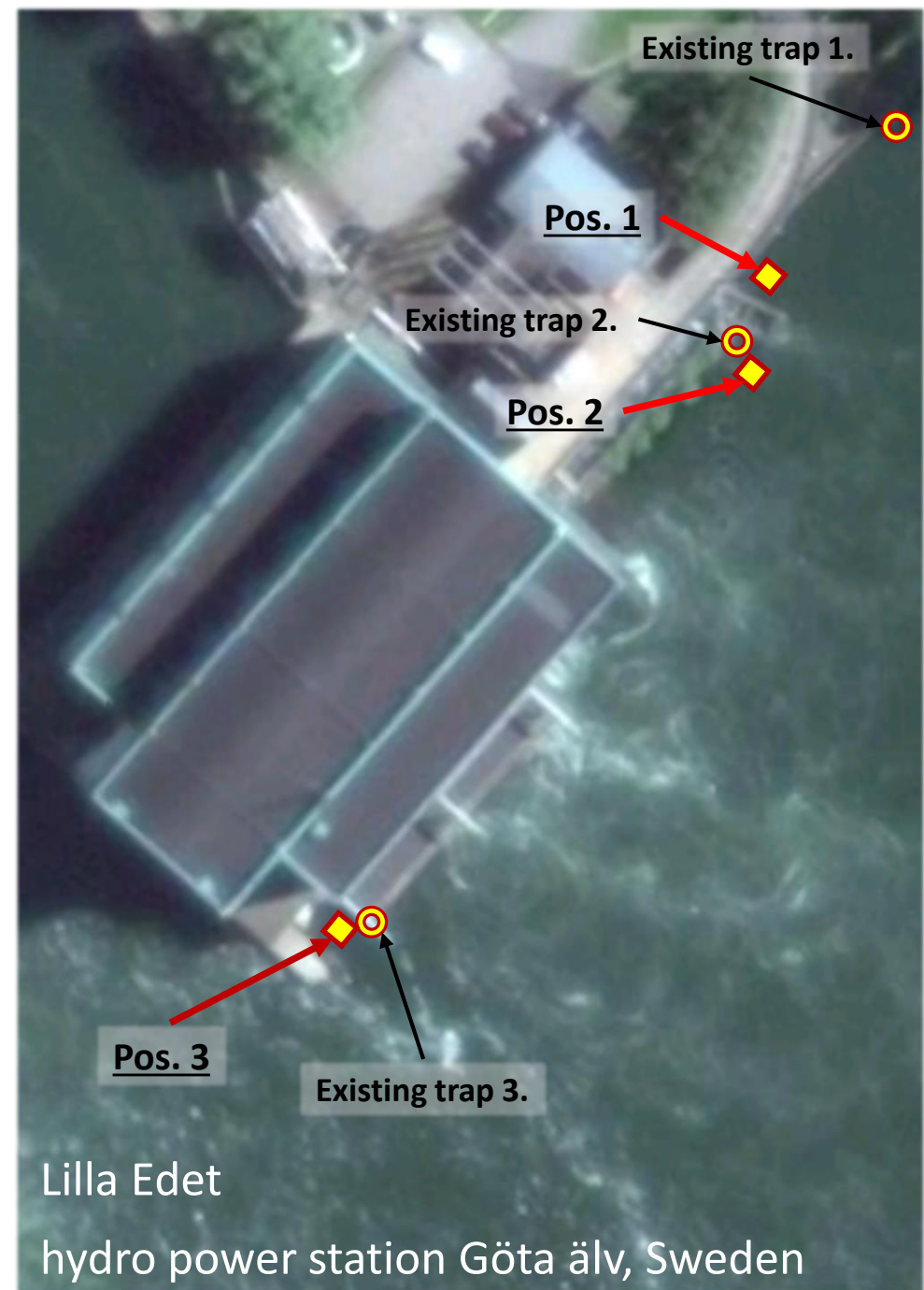
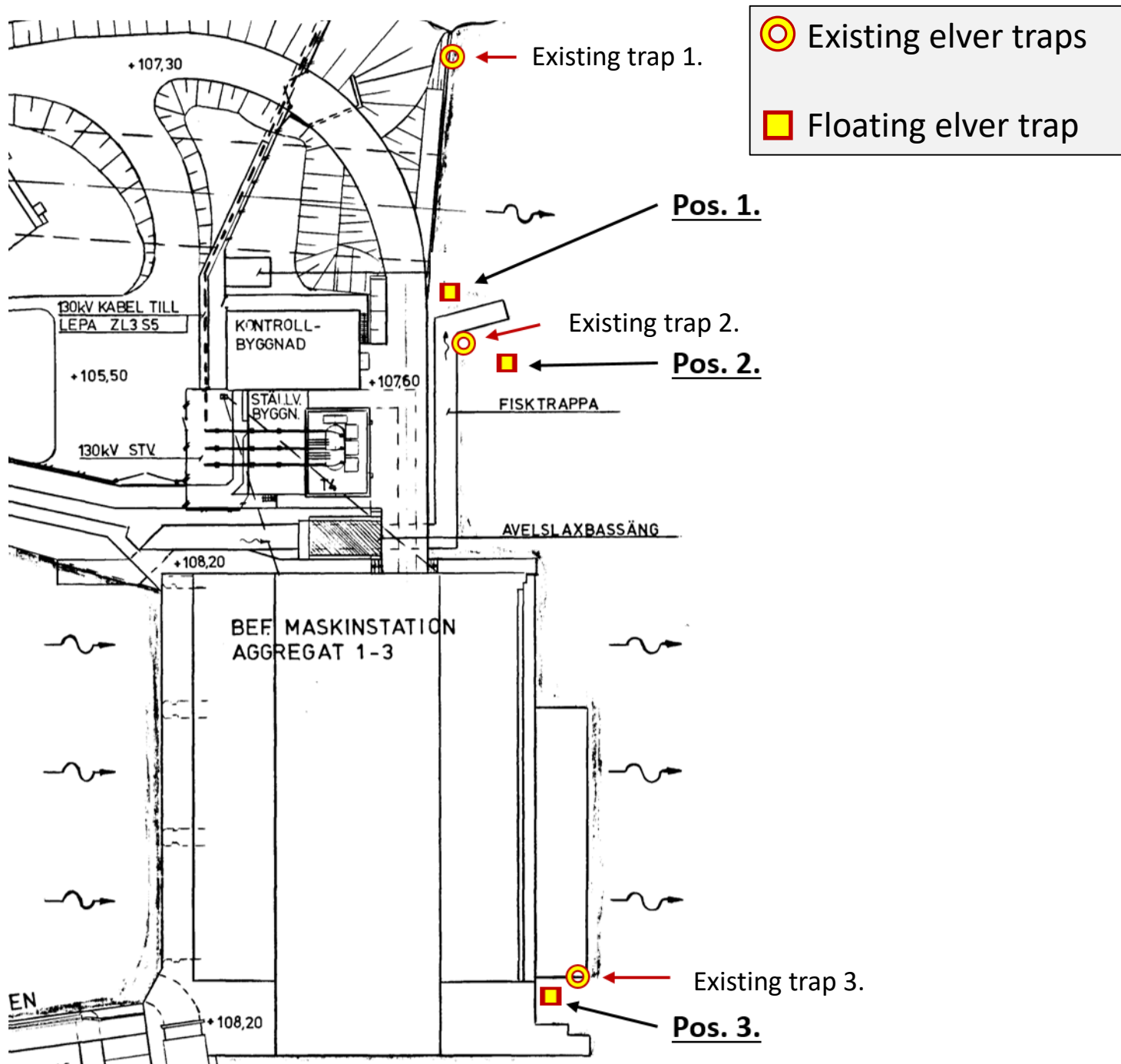
Total catch: 85 elvers

- Floating elver trap: 100 % N= 85
- Conventional elver trap: 0 % N= 0

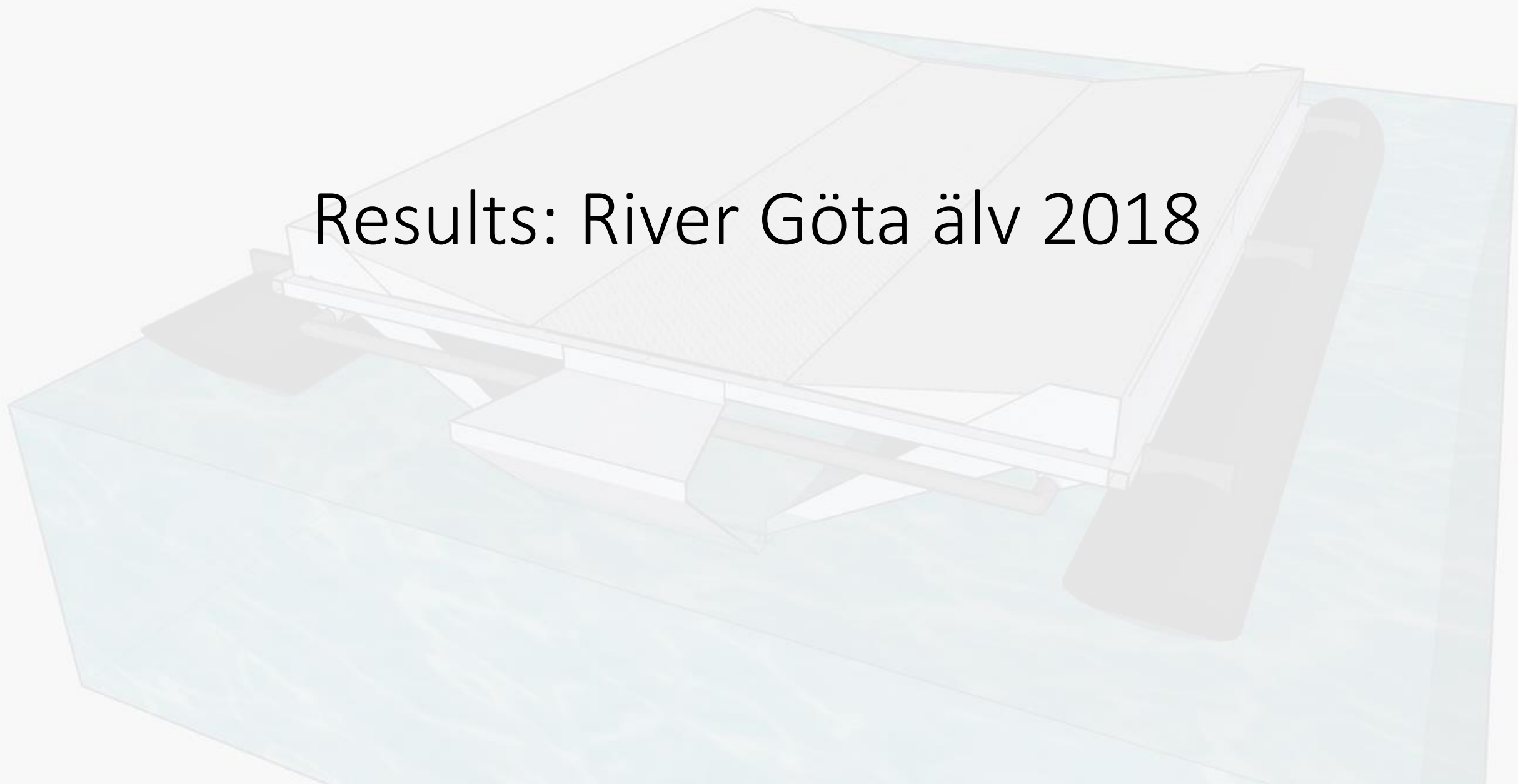
River Göta älv Comparative Study 2018: floating trap vs. three existing conventional traps

- Lilla Edet hydro power station, Göta älv, Sweden (Vattenfall, average discharge: 18 000 ft³s)
- Floating elver trap tested at three different locations
- Three existing elver traps: 160mm Ø pipes with enkamat® climbing substrate

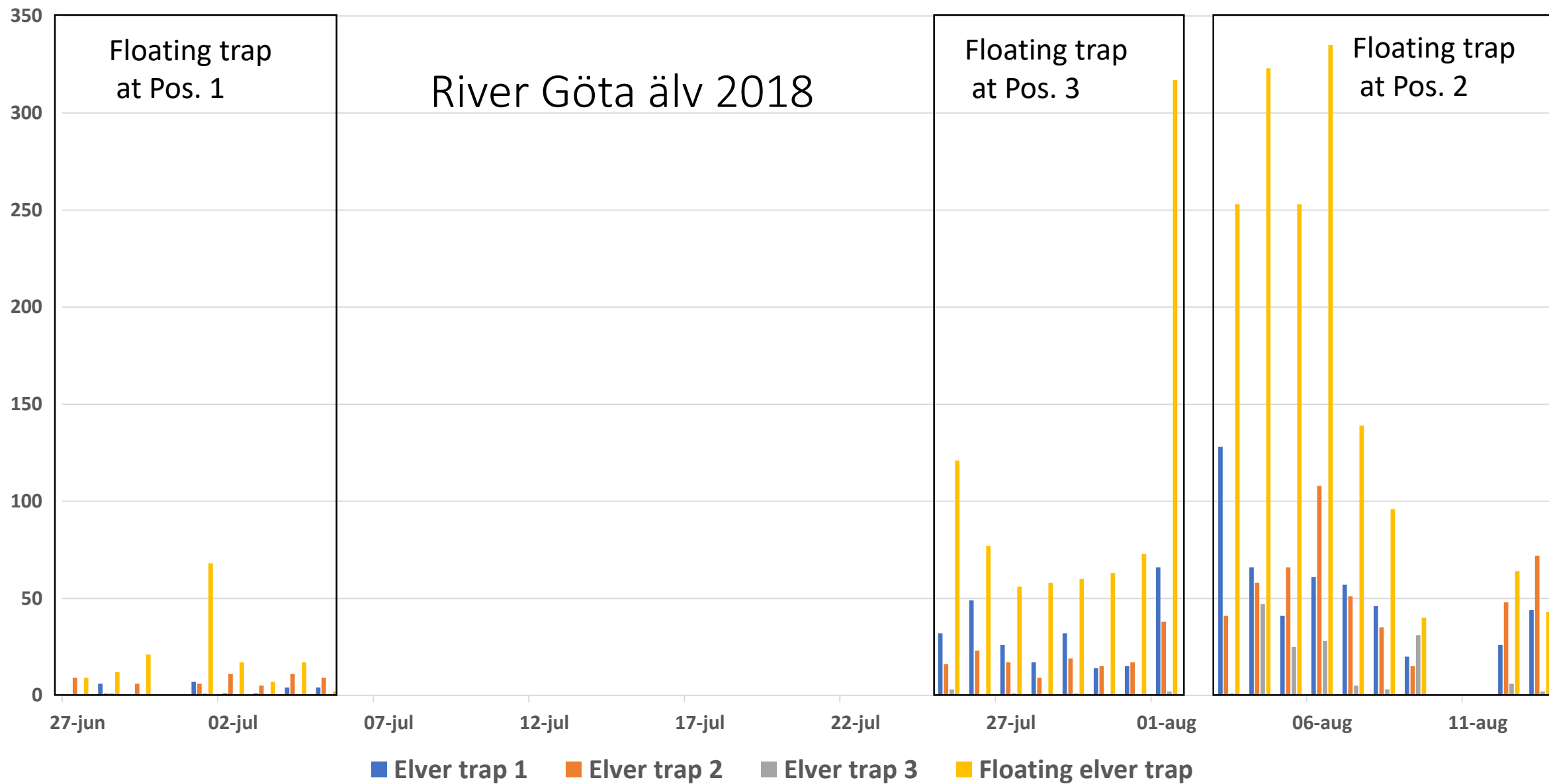




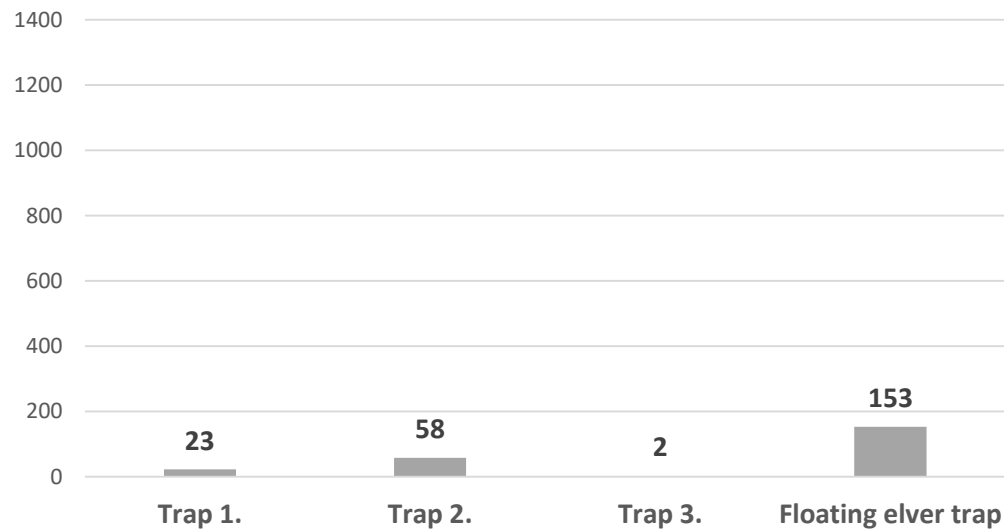
Results: River Göta älv 2018



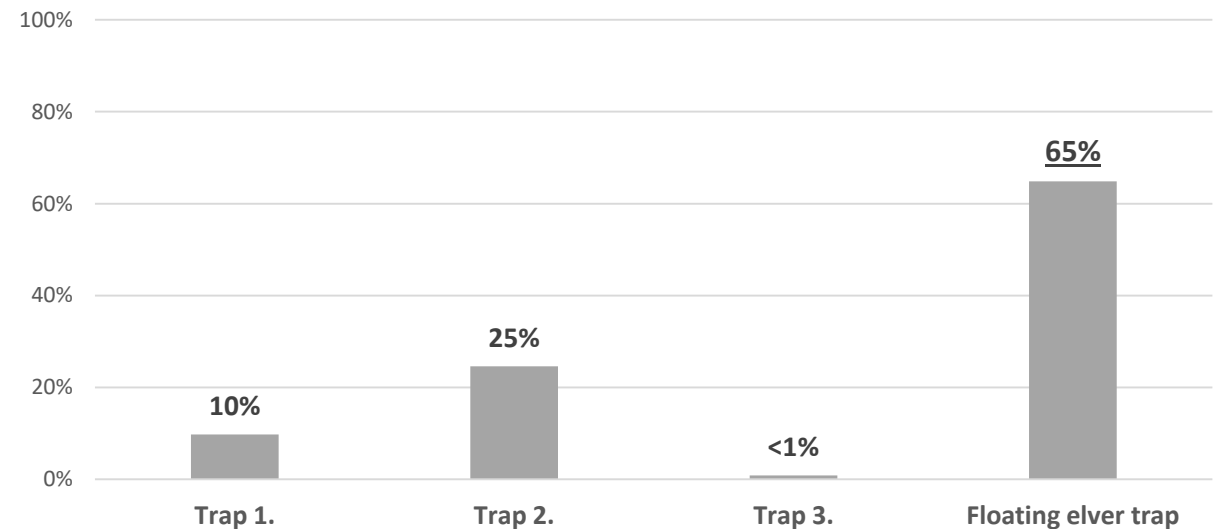
River Göta älv 2018



Floating elver trap located at Position 1



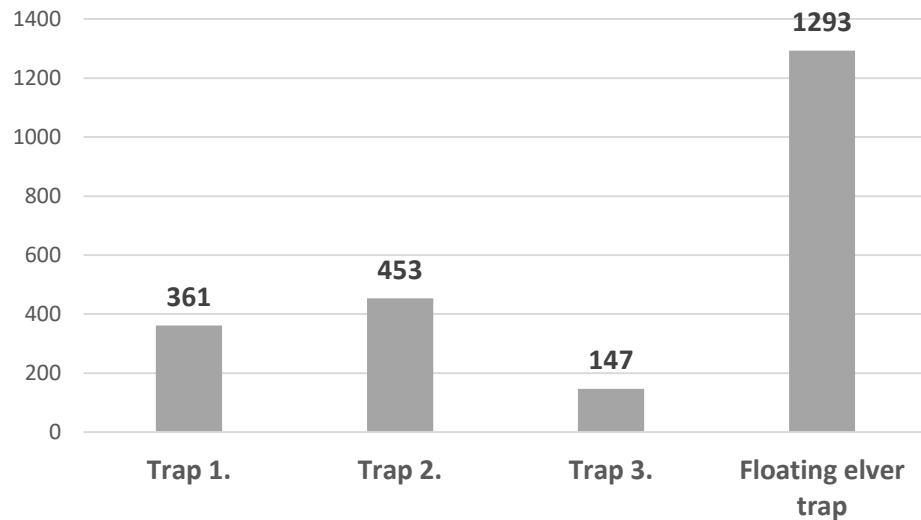
- Distribution of total catch: 8 days



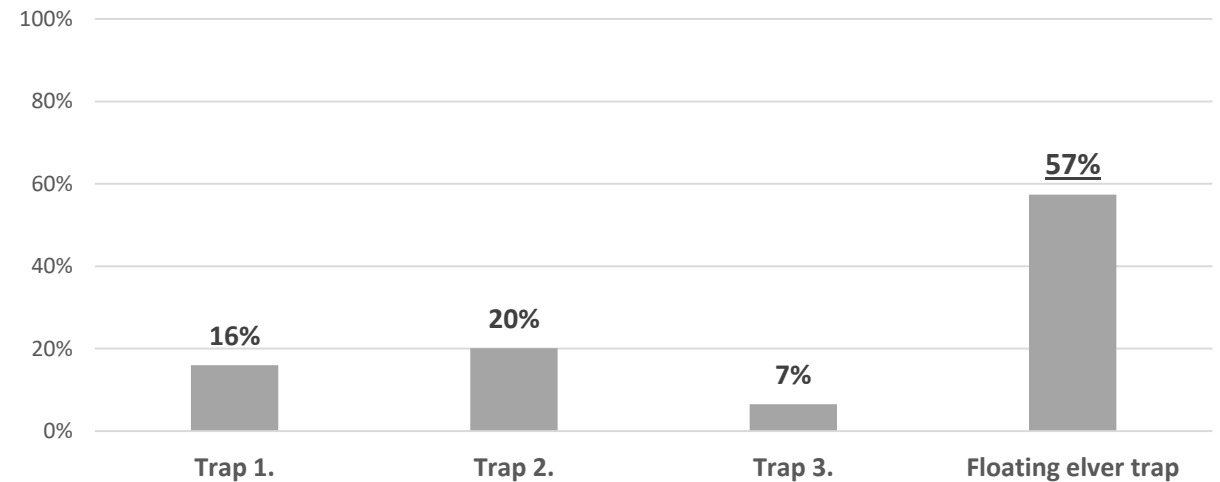
- Distribution of average catch/day: 8 days

Early portion of the migratory run 27 June -7 July 2018

Floating elver trap located at Position 2



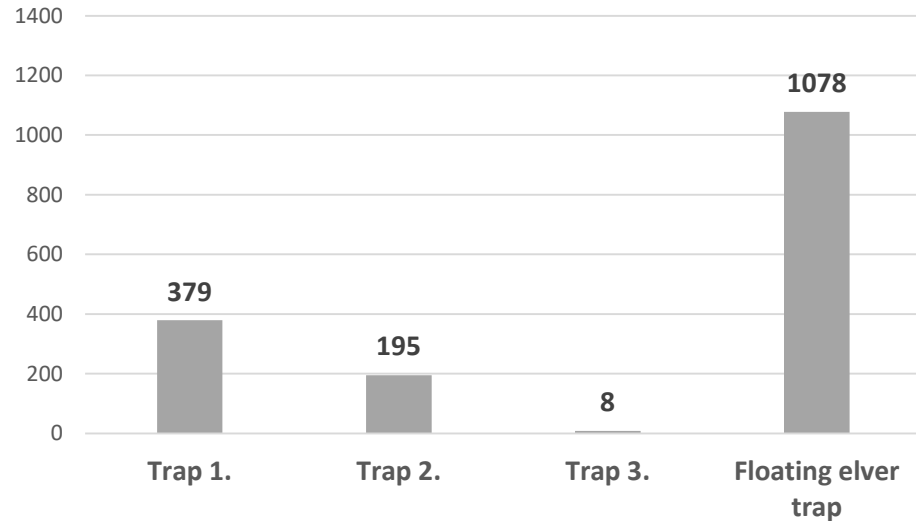
- Distribution of total catch: 8 days



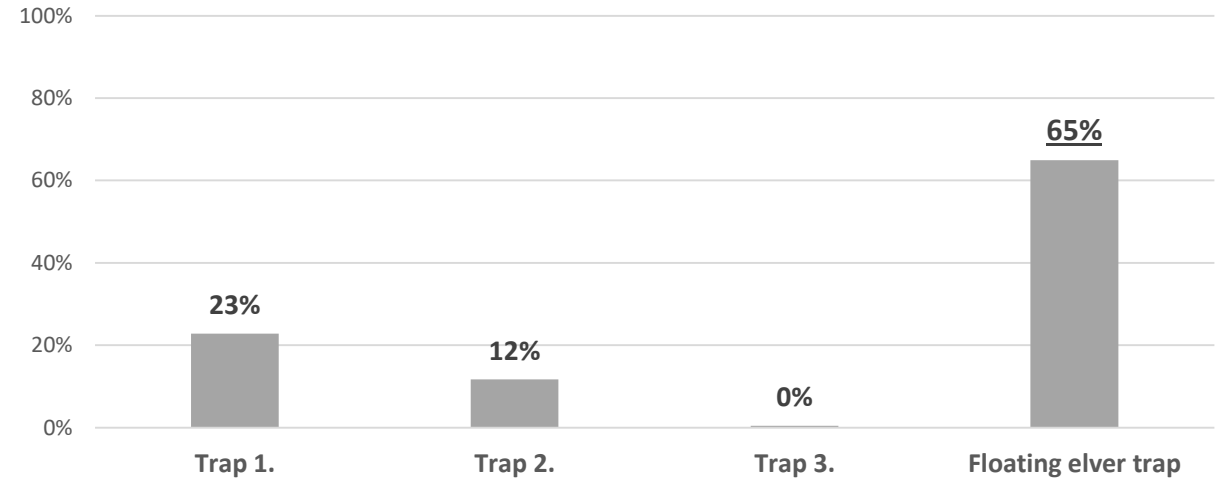
- Distribution of average catch/day: 8 days

Latter portion of the migratory run 4 Aug – 13 Aug 2018

Floating elver trap located at Position 3



- Distribution of total catch: 9 days

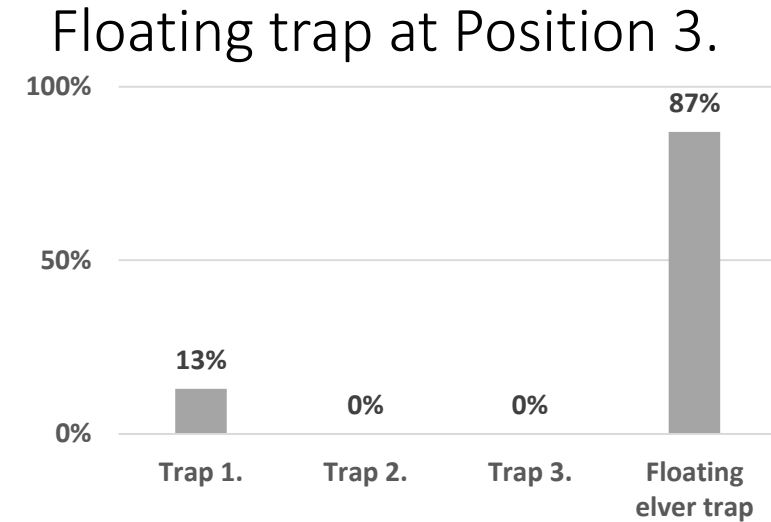
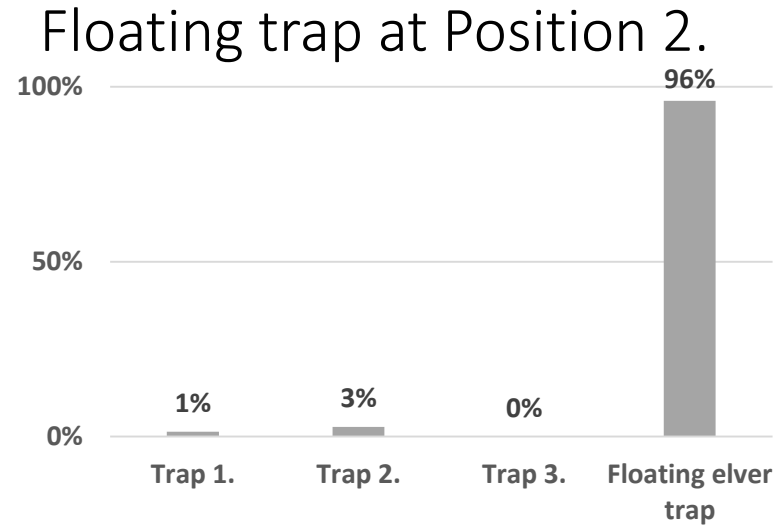
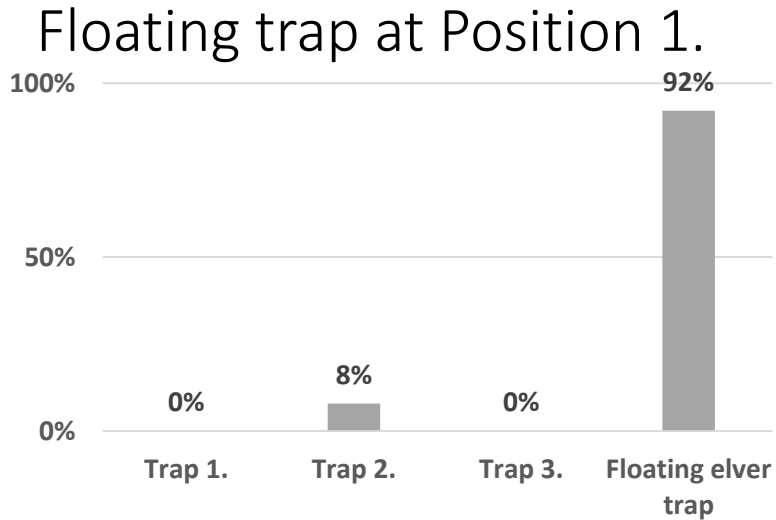


- Distribution of average catch/day: 9 days

Mid portion of the migratory run 25 July - 3 Aug 2018

Larger elvers prefer the Floating trap

- Larger elvers measure 6-12 inches
 - Tot. size range: 3-12 inches



- Distribution of trapped larger elvers at trap locations

Conclusions

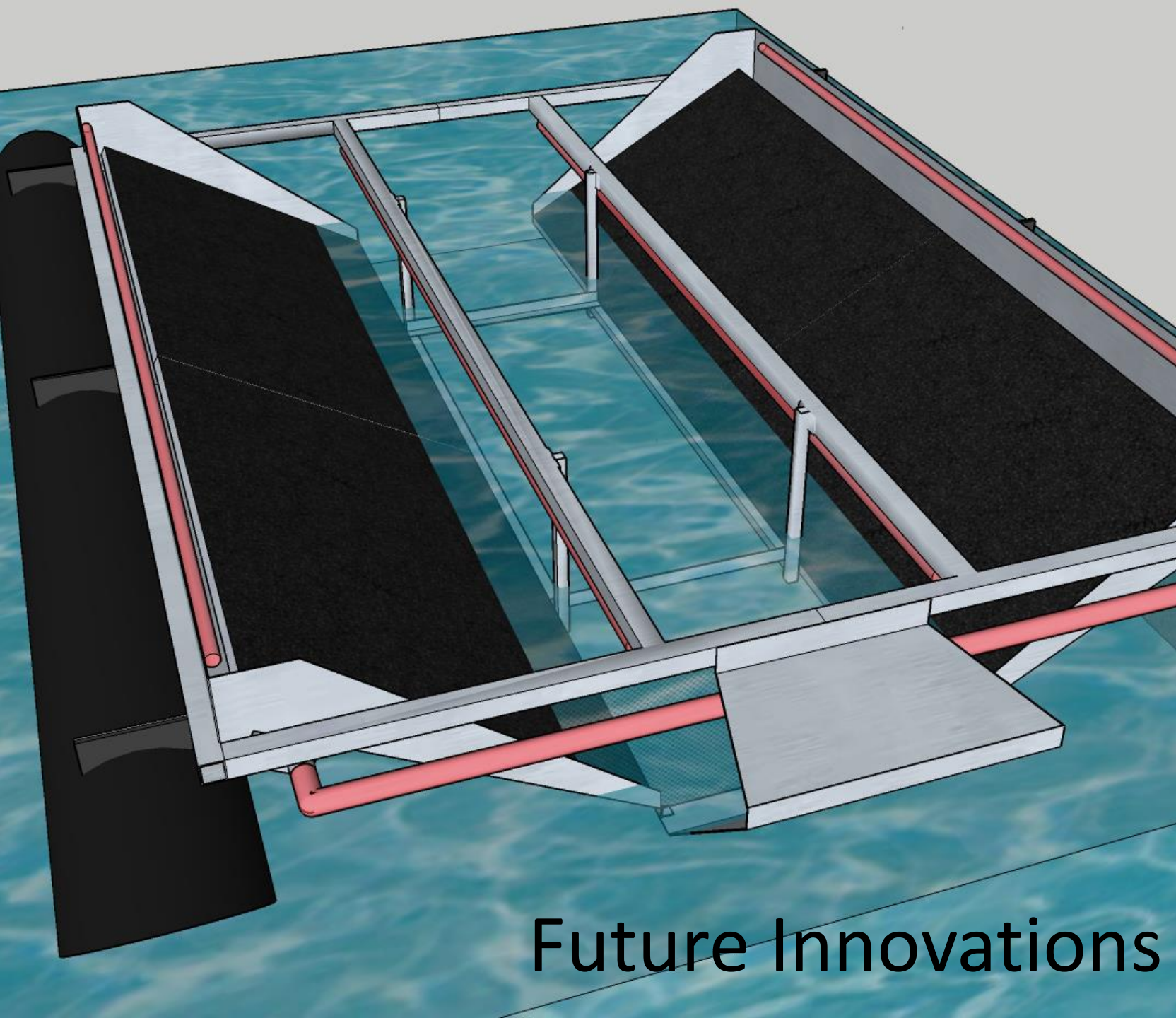
- Floating elver trap caught significantly more elver than the conventional trap under both night time and day time conditions (*Wilcoxon signed-rank test $P=0.005$ and $P=0.012$ respectively*)
- Floating elver trap provides greater localization versatility
- Floating elver trap supports usage by a great elver size range
- Floating elver trap design reduces predation
- Tests show, increased elver collection efficiency and effectiveness

A 3D perspective rendering of a floating elver trap. The structure is a rectangular frame with a dark grey mesh netting on the sides and bottom. It is supported by several vertical white poles. A red line, likely a rope or cable, runs along the top edge of the frame. The trap is floating on a blue, wavy surface representing the ocean. The text is overlaid in the center of the image.

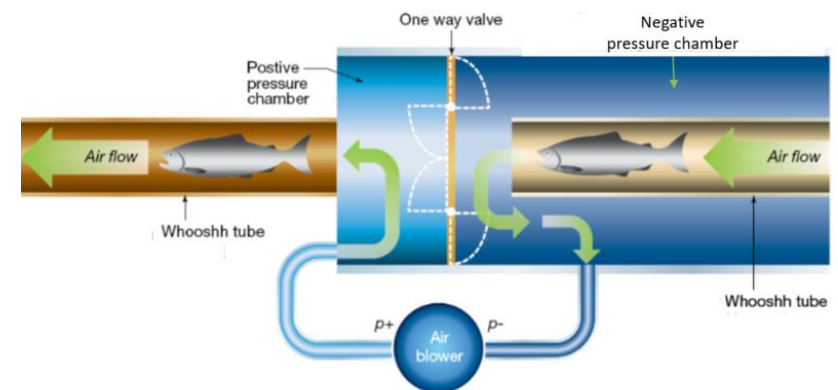
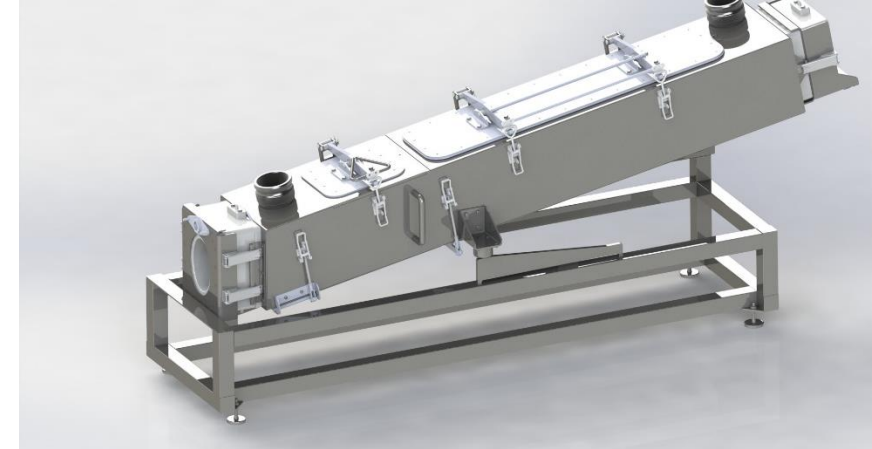
Floating Elver Trap

Commercial Availability
through Whooshh Innovation

begins Q1 2019



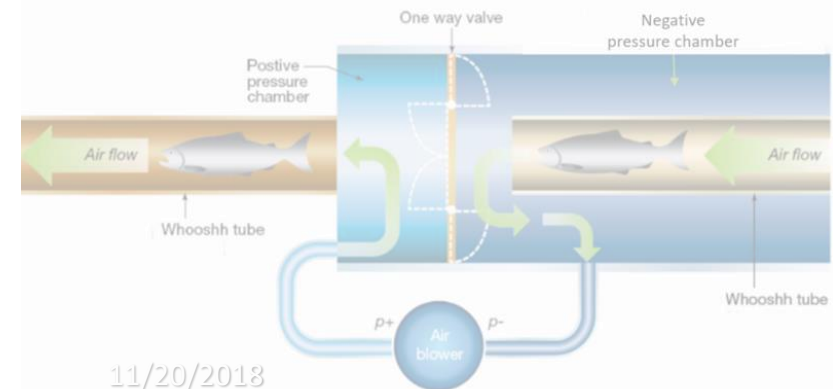
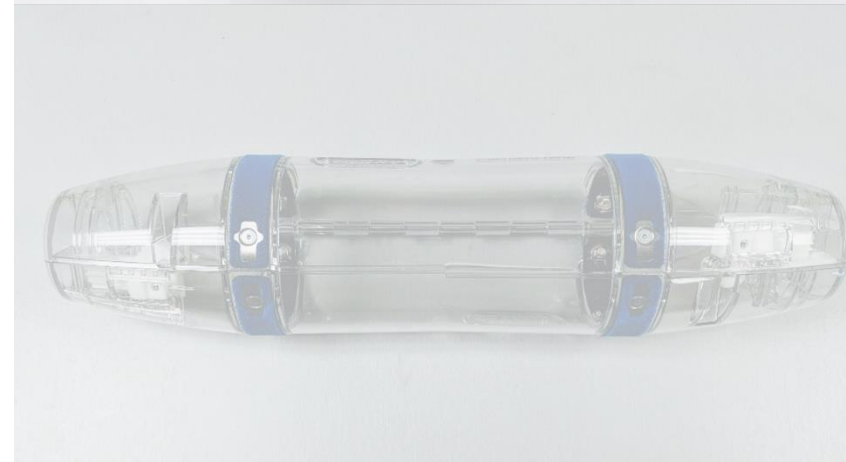
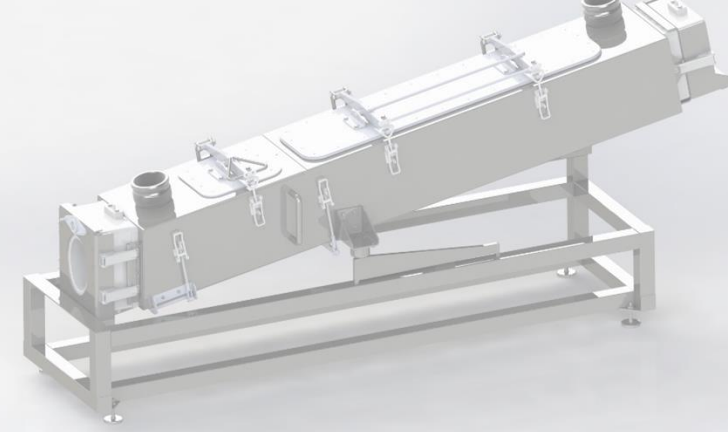
Future Innovations



Floating elver trap integration with Whooshh systems for passage over the dam

Pictured are transport test prototypes.
Final designs not shown.

Future Innovations



11/20/2018

Zits By Jerry Scott and Jim Borgman



An underwater photograph showing a dense field of dark, leafy seaweed or kelp. Sunlight filters down from the surface, creating bright, shimmering patches and rays of light that illuminate the scene. The water appears slightly turbulent, with small ripples and bubbles visible.

Thank you!

Questions?