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DOWNSTREAM FISH MIGRATION ALONG THE LOW MEUSE RIVER

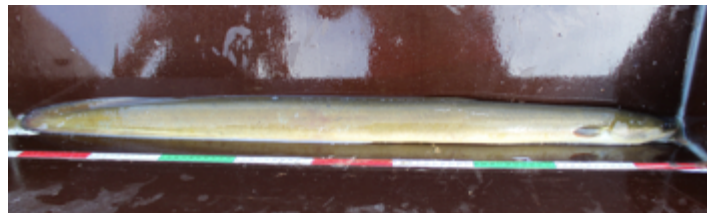


Action A2

Development of fishing capacities for stock constitution and characterization

In partnership with UNAMUR

Deliverable – Pilot Setup of a silver eel fishery at 1 site



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I. Introduction

The aim of this study is to test the feasibility and the success of a silver eel fishery on the Meuse River, by the mean of a network of 10 fyke nets. The results of this field pilot fishery are expected to give us the number of silver eels that we could catch with this method at 3 sites ongoing the future years of the project, and also the limit of operation of the technique mainly in terms of maximal hydraulic conditions.

This action has been managed by Profish and performed in collaboration with UNAMUR. For UNamur, the aim was also to collect biological samples on wild silver eels in order to characterize the stock of migrating eels, as described in the action D1.

II. Material and Methods

The applied fishery method tends to reproduce a proofed method performed since 20 years in the Mosel River, Germany in the Framework of the Eel Initiative (<https://wasser.rlp-umwelt.de/servlet/is/1153/>). Profish has visited the professional fisherman of this river on the 24th of October 2017. The protocol used below is directly inspired from the observed method in Germany.

II.1 Site localization

The fishery has been installed upstream the power station of Andenne (CHA). The fishery was located in the direct upstream of the CHA forebay, along the right bank of the river.



Figure 1 : View of the CHA and of the area used for the fishery (yellow circle), source: GoogleMap.

II.2 Fish catching system

Each fyke nets was composed by 3 catching sections separated by funnels, made with stainless steel rings and nylon mesh of 15 mm of diameter. The first ring had an opening diameter of 55 cm, the total length of a fyke net was 3.7 m (Figure 2).

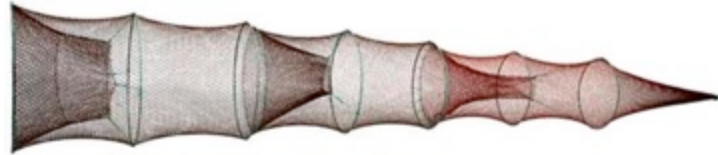


Figure 2 : Picture of the fyke net used (source : <https://engelnetze.com/fr/verveux-corps-de-verveux-80/7-maille-de-15mm-au-cul-de-chalut>)

5 fyke nets were attached along a line made by a rope of 8 mm of diameter. A distance of 2 m was kept between the tail of a fyke net and the head of the next fyke net. A steel weight (around 500 kg) was used to anchor each line of fyke net on the bottom of the river, with the tail of each fyke net pointing upstream, and the head pointing downstream. This way, eels will be caught when swimming back upstream after avoiding the screen of the power station. This disposition presents also an advantage concerning the debris as the debris of the river will be less clogging the net.

At the downstream end of the line, 5 m of chain were used as weight, and then a buoy was allowing the operator to lift the net-line from downstream to upstream. The Figure 3 presents the global installation of the nets.

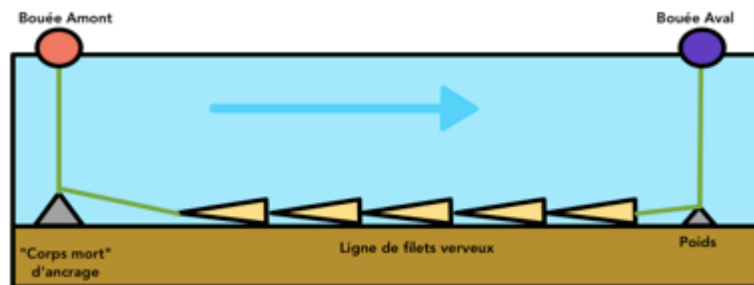


Figure 3 : Schemas of the 2 two lines of fyke nets used at Andenne in 2018.

The installation of the nets was made by boat with 2 two people on board. Each time, the nets were lifted from downstream to upstream to empty the net, and installed back in position after cleaning them by drifting the boat from upstream to downstream. The fish caught were stocked in basins poured with the river water. After catching, each fish was identified (species), measured (mm), and weighted (g).

Each eel caught was scanned by a Pit-tag reader, as some tagged silver eels are known to be present upstream (Action D1). Each untagged eel was tagged using Pit-Tag (12-mm HDX), by a surgery gun under anaesthesia (Clove Oil 10%, 0.2 ml/l). In addition to weight and length measures, the morphometric parameters (eye vertical and horizontal diameter and pectoral fin length) were recorded in order to determine the silver stage. The eels were also sampled for blood and mucus by UNamur in order to characterize their health status. This part will be presented by UNamur in the D1 action reports.

After recovering from anaesthesia, tagged eels were then restocked below the next dam upstream (under the Beez viaduc) since the recapture of a tagged eel among other eel allows population estimation by Capture-Mark-Recapture method (CMR) described in the fishing protocol (Action A2).

II.3 Study period and catching unit effort

A unit effort is described as the period from the moment the fyke nets are installed clean and empty into the river to the moment they are lifted back out of the water to recover the fish inside. Our protocol initially established a unit effort of 1 one week, with 2 two lines of 5 five fyke nets. This duration has been considered as safe for animals as it is commonly used by the German professional fisherman during low discharge conditions. In case of need, we could reduce the duration of the unit effort to reduce the time of stocking eels into the fyke nets, and, thus, avoiding damages on the fish.

The lines of fyke nets have been installed from 05/09/18 to 18/12/18. The Figure 4 below presents the sequences of unit efforts used.

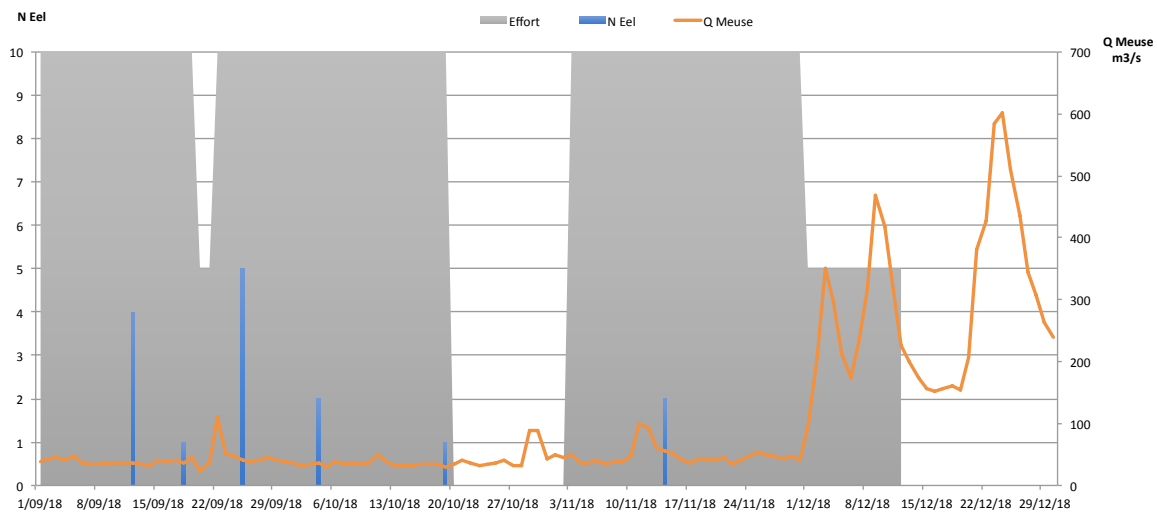


Figure 4 : Unit Effort (Y = number of fyke nets used, in grey) and Number of eels (Y axis, in blue) caught during the study period (X axis) in relation with the River Meuse discharge (YY axis, m3/s, in orange).

Between the 25th and the 28th of October, a line of fyke nets was loose in the river leading to the reduction of the number of fyke net. Thereafter, this line has been recovered. As we aimed to explore different hydraulic conditions during the study, and as the river discharge stayed low during the first 2 months, we decided to make a break of around 15 days in the fishery end of October. We continued to fish from early November, and had to stop in early December as the discharge did not allow us to operate with the nets.

III. Results

III.1 Main catching patterns

During this fishing campaign, a total of 358 fish from 6 different species has been caught (Figure 5).

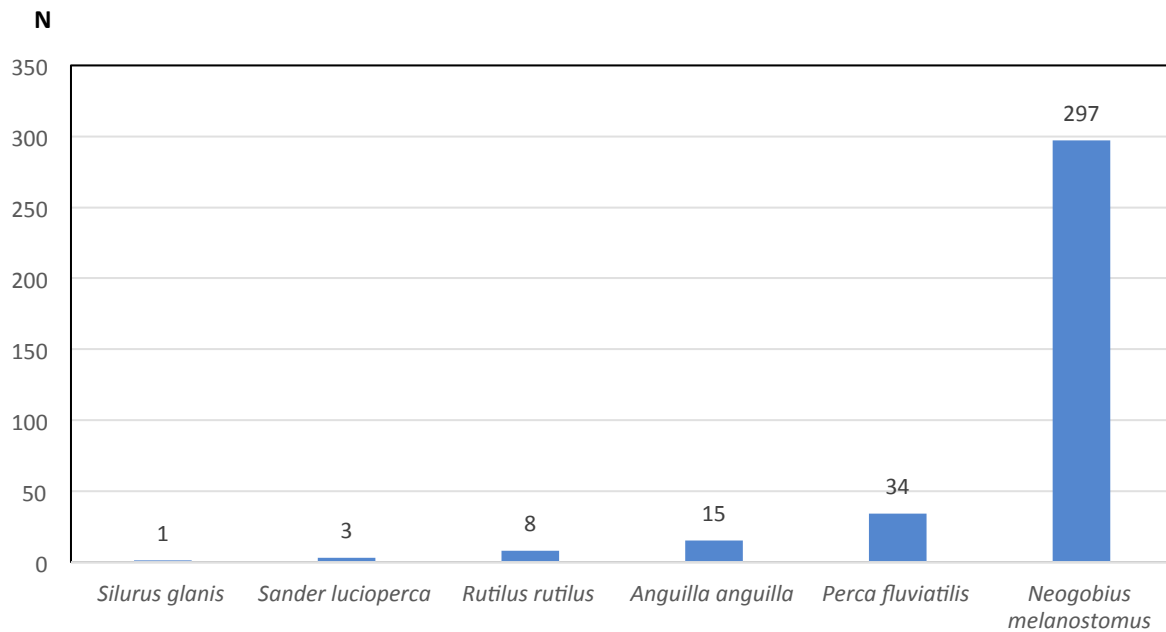


Figure 5 : Total fish caught during the study period.

The round goby, under invasive status in the River Meuse was the first species in terms of number of individuals caught. European eels was the third more important species after the Eurasian perch. A total of 15 eels have been caught during the study period, 11 in the line installed along the bank, and 4 in the second line of fyke nets.

III.2 Eel catch

The mean length of the eels was 883 mm (min 520 mm ; max 986 mm) for a mean weight of 1.345 kg. The distribution of these eels according to their length and silvering stage (determined by Durif et al., 2009 formula) are presented in Figure 6. As shown, 46% of eel were already in the silvering stage SFIV. The FIV stage is considered as pre-migratory stage. The individuals have already stopped to feed and are performing the first downstream movements, and will likely start their migration within the same year. During this period, 27% of eels were already in the silvering stage SFV which is considered as the migrating stage.

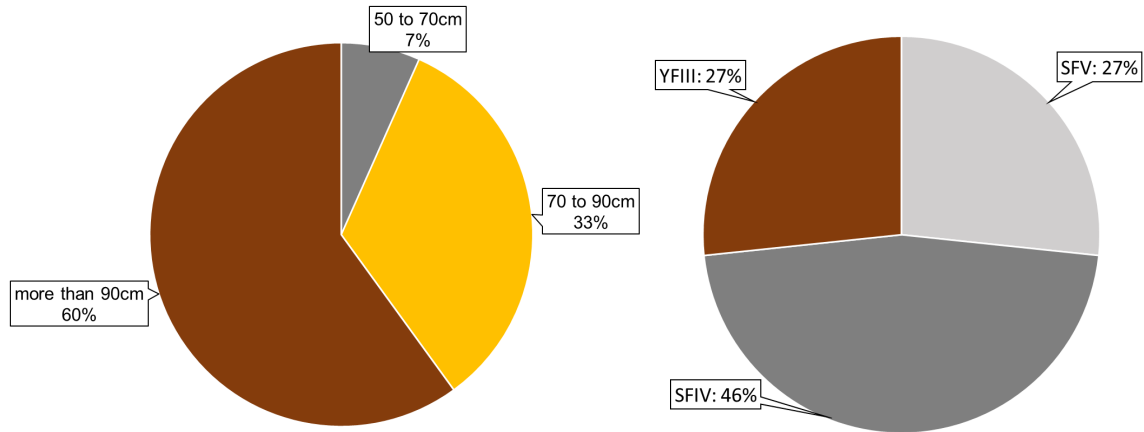


Figure 6: Distribution of the eels caught by size (left) and the silvering stage (right)

As 15 eels have been caught on a total of 15 unit efforts, the catching rate of the fishery is a mean of 1 eel/unit effort with 2 lines of 5 fykes.

As shown in Figure 7, the main catches have been made during the beginning of the study, under conditions of low discharge and decreasing temperature. Up to 5 eels have been caught in the same effort unit. No eels were caught during the increase of the discharge in the beginning of December (Figure 6).

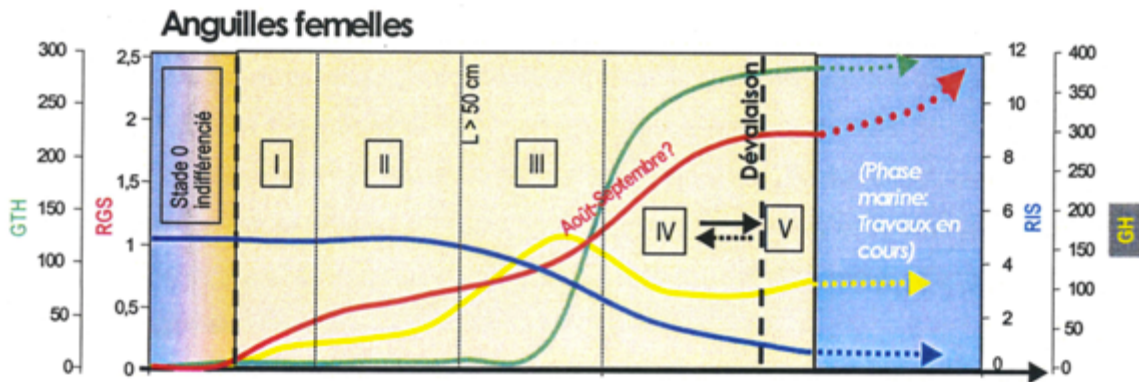


Figure 7 : Silvering evolution of female eels in relation with hormonal influence, and silver stage. Reprint from Durif 2003.

IV. Feedback from the pilot fishery

IV.1 Fishing equipment and position of the lines of fyke nets

The lines of fyke nets revealed to be easy to handle as long as they are not clogged with debris and not exposed, once clogged, to high water velocity. As our lines were ending quite close to the screens of the CHA (around 20 m upstream), we noticed that it was more difficult to lift the first downstream fykes than the last upstream ones, mainly because of the higher water velocity in the area close to the intake. For the next silver eel fisheries, we recommend that the lines should be installed a bit more upstream, with a distance of 50 m between the screens and the end of the line.



In the Mosel River, German fishermen place the lines at a distance up to 300-500 m, so we are in a range that should not affect the efficiency of the method.

The total length of a line of 5 fyke nets (3.2 m long each) was around 20 m long. When the lines were lifted up to empty the fykes, we observed that the water current was exerting a strong lateral force and the operation then became tricky for operators. Consequently, we plan to use smaller nets (2 m long with 2 funnels, 45 cm opening, fine mesh with 15 mm of diameter) and to install 5 lines of 3 nets in place of 3 lines of 5 nets to improve operator's safety. This should improve the flexibility and allow us to lift up the fyke nets in more rough conditions without reducing significantly the fishing efficiency. Moreover, we plan to use ploughs anchors in place of steel weight to attach the lines of fyke. This allows us also to potentially look for the best fishing position of each line, and to make the whole fishing equipment more easy to install and remove.

IV.2 Catch per unit effort and expected sample caught on 3 sites in 2019.

In a total of 15 catching effort units with 2 fishing lines, we succeeded to catch 15 eels that were mostly in the pre-migrating stage FIV or in the migrating stage FV. These individuals should be good candidates for the telemetry study. In the Mosel River, the same technique allows more important catches from June to August. During this summer period, pre-migrant eels could display some movements to prepare the main peak of migration concomitant with the autumn-winter flood.


As foreseen in our project, the fishing period in 2020 will be spread between June and December, and extended to three sites : CH Andenne, CH Ampsin-Neuville and CH Lixhe. These sites have been selected because: i) the fishery should not interfere with the telemetry equipment's installed at CH Grands-Malades et CH Ramet ; ii) CH Monsin is in derivation from the main river so the technique might be inefficient.

A total of 75 units effort x 3 sites was schedule in the initial planning. We spent for the pilot test a total of 15 units effort x 1 site. This means that we still have a total of 70 unit efforts x 3 sites left to perform over the year 2019, 2020 and 2021, i.e. 23 unit efforts per year.

In CH Andenne, the mean catching rate is 1 eel/unit effort with a total of 10 fykes. By adding 5 additional fykes, and considering that these fykes would have the same fishing capacity, the expected fishing rate could be 1.5 eel/unit effort, meaning an expected number of 23 eels caught in 2019 in Andenne.

At CH Ampsin-Neuville and CH Lixhe, as the fishing equipment used will be the same, we could expect a similar catching rate. However, it is established that the density of eel increases as the distance to the sea decreases. In total, we could expect a minimum number of 69 eels over the fishing period for the 3 sites.

As this number is less than our objective that corresponds to 150 silver eels, we will prepare a complementary source of silver eels, as already used in the past, from the Rhine River in Germany.

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