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Ichthyological note

Presence of larvae of lampreys, *Lampetra* sp. (Cephalaspidomorphi, Petromyzontiformes), in a French Catalan basin

by

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Résumé. – Présence d’ammocètes de lamproies *Lampetra* sp. (Cephalaspidomorphi, Petromyzontiformes) dans un bassin catalan français.

Des ammocètes de lampreies ont été récemment capturées pour la première fois dans un cours d’eau de Catalogne française, la Têt. Les identifications morphologique et moléculaire ont démontré que ces ammocètes appartiennent au complexe [*Lampetra fluviatilis* / *Lampetra planeri*]. Les lampreies et leurs frayères étant protégées en France, cette étude aura une incidence sur la gestion du cours d’eau de la Têt.

Key words. – Petromyzontidae – *Lampetra fluviatilis* / *Lampetra planeri* – France – Têt River – Ammocoete.

The Têt is a French Catalan coastal river starting at the foot of the Pic Carlit (altitude 2405 m) in the Pyrenees. It crosses the Pyrénées-Orientales department from West to East along 115 km, through Perpignan, and ends in the Mediterranean Sea at Canet-en-Roussillon (Fig. 1). It is characterized by a predominantly Mediterranean rainfall regime with two noticeable low periods in summer and in the middle of winter, and periods of high water during snowmelt as well as in autumn with possibilities of “Cévenol”-type violent floods (Curt and Davy, 1990). Two large dams structure its course and its hydrology, the Bouillouses Dam, a few kilometres from the source (hydropower) and the Vinça Dam at mid-course (flood control and low water support).

During an ichthyological inventory by the French national agency for water and aquatic environments (Office National de l’Eau et des Milieux Aquatiques, ONEMA) in the Têt River at Nefiach in 2012, a lamprey larva (or ammocoete) was caught. According to the ONEMA inventory networks, this catch was the first record in the Pyrénées-Orientales department since 1990, and the second one in a French Mediterranean basin with the specimen fished in the Fresquel stream (Aude basin) in 2003. No lamprey was recorded in the area in the last edition of *Les Poissons d’eau douce de France* (Keith et al., 2011). Eight other specimens were caught in 2015 and 2016 at Millas (1.6 km downstream from Nefiach), and six at Ille-sur-Têt (1.4 km upstream) (Arsento and Fonteneau, pers. com.; Richarte, unpubl. data).

The 7th September 2016, the ONEMA did an inventory at Nefiach, using electrofishing. The aim of this study was to confirm the presence of lampreys at this location, and to allow to identify which lamprey species is present.

**MATERIAL AND METHODS**

The fish inventory “Têt River at Nefiach” location is situated 30 km from the mouth, downstream of the two large dams. It is characterized by a succession of flat surfaces and currents on coarse substrates along 403 m, as well as a large deep hydraulic annex with a silt-silty substrate loaded with organic matter. Apart from the

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stable hydraulic annex and wooded banks, the course of this river is dynamic and its bed is changing.

Fish were caught by electrofishing with the punctual abundance sampling method (Nelva et al., 1979) and a particular effort for the prospection of the hydraulic annex according to the protocol of Harvey and Cowx (2003), more adapted for lamprey sampling.

Specimens were fixed and preserved in 95% EtOH for DNA identification using progressive concentration of EtOH in the span of a few hours. They were morphologically identified following the characters in Taverny and Elie (2010). Muscle samples were taken on each specimen for molecular identification [or DNA Barcoding sensu Hebert et al. (2003)] with the cytochrome oxidase subunit 1 marker (COI, 652 bp). DNA extraction, PCR products and sequencing were performed according to Dettai et al. (2011). COI sequences were deposited in the LPPPO (Lampetra planeri of the Pyrénées-Orientales) project folder in the Barcode of Life database (BOLD, www.boldsystems.org; Ratnasingham and Hebert, 2007) and GenBank (accession numbers MG574309 to MG574311).

COI sequences were integrated with 91 sequences of Lampetra spp. and Petromyzon marinus Linnaeus, 1758 (Appendix 1). Aligning and NJ barcoding tree were performed under MEGA 7 (Kumar et al., 2016) with the Kimura 2 parameter model (K2P; Kimura, 1980) and bootstrap values (1000 replicates; Felsenstein, 1985).

RESULTS

Six ammocoetes were caught among other species: gobio occitaniae Kottelat & Persat, 2005, Phoxinus septimanias Kottelat, 2007, Barbus meridionalis Risso, 1827, Barbatula barbatula (Linnaeus, 1758), Squalius laietanus Doadrio et al., 2007, Salmo trutta Linnaeus, 1758, Leuciscus budrigalensis Valenciennes, 1844, Anguilla anguilla Linnaeus, 1758, Gasterosteus aculeatus Linnaeus, 1758 and Rutilus rutilus (Linnaeus, 1758). Three ammocoetes (catalog number MNHN 2016-0363; Fig. 2A) were fixed and preserved for morphological and molecular identification.

According to the diagnostic criterions for ammocoetes given by taverny and elie (2010), we identified morphologically these lampreys. Each specimen has a depigmented zone on both side of the snout (Fig. 2B), and their caudal fins do not present any pigmentation (Fig. 2C). Thus, these larvae belong to the genus Lampetra. Ammocoetes do not yet display characters allowing the distinction between L. fluviatilis Linnaeus, 1758 and L. planeri Bloch, 1784.

The barcoding analysis tree confirms this identification as the complex [Lampetra fluviatilis + Lampetra planeri] without precis- ing to which species they belong (Fig. 3).

DISCUSSION

The presence of lampreys Lampera sp. is attested on the Têt River, downstream of the Vinça Dam. Morphological and molecular determinations are in agreement to identify them as belonging to the complex [Lampetra fluviatilis + Lampetra planeri]. However, there are twelve transverse structures that are impassable for most of the year and only two others are equipped with fish passes between the sea and the location at Nefiach. L. fluviatilis, a supposed amphihaline species, is not able to cross these kinds of barriers without a fish pass (Taverny and Elie, 2010). Without adult specimens, we could assume these larvae are L. planeri (a freshwater species) ammocoetes. Nevertheless, some authors are doubtful about the distinction between these two species, with L. planeri as a neither non-parasitic nor amphihaline form of L. fluviatilis (e.g., Taverny and Elie, 2010; Knebelberger et al., 2015; Tutman et al., 2017). A taxonomic revision of this complex will be necessary in the future.

The Têt River is in a severe deficit of solid transport due to the presence of the Vinça Dam, blocking all inputs from the upstream and the intensive exploitation of gravel pits in the minor river until the 1980s. So, the favourable habitats for the ammocoetes growth are largely disrupted. About ten kilometres downstream of Millas, the Têt flows directly on the bedrock, offering no habitat for this taxon.

Lampreys Lampetra spp. belong to the list of species protected by the annex III of the Bern Convention (19th Sep. 1979) as well as in France since the 8th of December 1988, thus protecting their biotope. The spawning beds and their granulometry are also protected since the 27th of July 1990 and the 23rd of April 2008, respectively (Taverny and Elie, 2010). Prospection efforts on all the Têt basin

Figure 2. – A: Three of the six lamprey lar-vae, or ammocoetes, belonging to the genus Lampetra caught in the Têt River at Nefiach (MNHN 2016-0363). B, C: Enlargement of the head and tail showing the absence of pigmentation respectively on the snout and on the extremity of the caudal fin (arrows). Scale bars = 1 cm.
and adjacent catchments must be done in order to map lamprey occurrences, protect their habitats and manage their populations.

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REFERENCES


Appendix 1. – GenBank accession numbers of COI sequences by lamprey species used for DNA Barcoding analysis.

Lampetra sp.: France (Têt River): MG573409 to MG574311.

Lampetra alavariensis Mateus et al., 2013: Portugal KJ553926.


Petromyzon marinus Linnaeus, 1758: Germany: KM286795, KM286797 to KM286802; Portugal: KJ554404; Sweden: KJ128572, KJ128573.