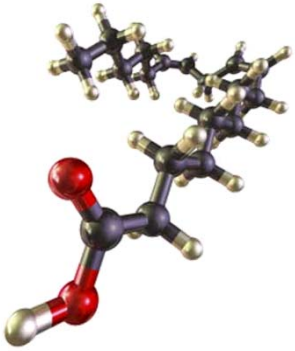
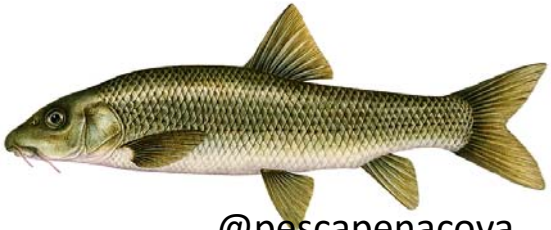
Sea Lamprey Webinar, 22 April 2021

Sea Lamprey migratory behaviour and population structure in Portugal

Inês C. Oliveira, Catarina S. Mateus, Bernardo R. Quintella, Maria J. Lança, Esmeralda Pereira, & Pedro R. Almeida



About me …



@pescapenacova

I am Inês Oliveira. Researcher at the MARE

Professor Pedro R. Almeida team

I started my research work with barbels (master's thesis)

"Impact of flow regulation for hydroelectric production in the movement patterns, growth and condition of a potamodromous fish species. **Oliveira *et al.* (2020), Ecohydrology**

Recently, in 2018, I started working in the **EVOLAMP project: "*Genomic footprints of the evolution of alternative life histories in lampreys*** PTDC/BIAEVL/30695/2017 **"**

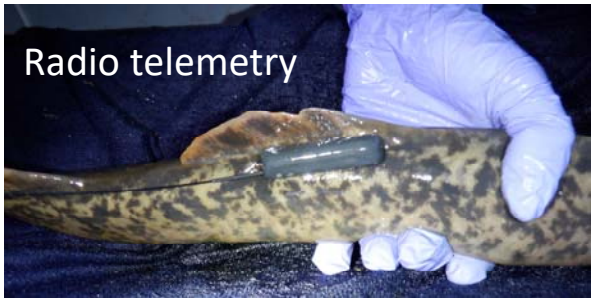
A short review of 2 scientific research team publications

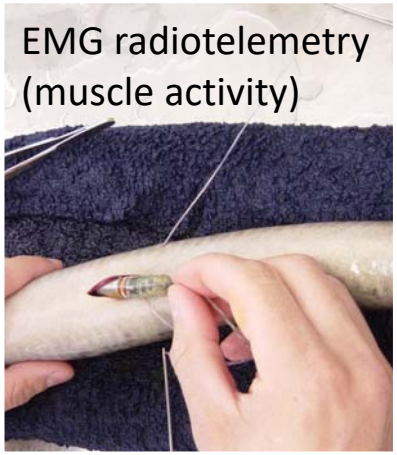
- **Pereira, E., Quintella, B.R., Mateus, C.S.**, Alexandre, C.M., Belo, A.F., Telhado, A., Quadrado, M.F. & **Almeida, P.R.** 2016. Performance of a vertical slot fish pass for the sea lamprey *Petromyzon marinus* L. and habitat recolonization. River Research and Applications, 33: 16–26.

- **Lança, M.J.,** Machado, M., **Mateus, C.S.**, Lourenço, M., Ferreira, A.F., Quintella, B.R., & **Almeida, P.R.** 2014. Investigating population structure of Sea Lamprey (Petromyzon marinus, L.) in Western Iberian Peninsula using morphological characters and heart fatty acid signature analyses. PloS one, *9*(9), e108110.

How we study sea lamprey migratory behaviour??

Tagging Methodologies

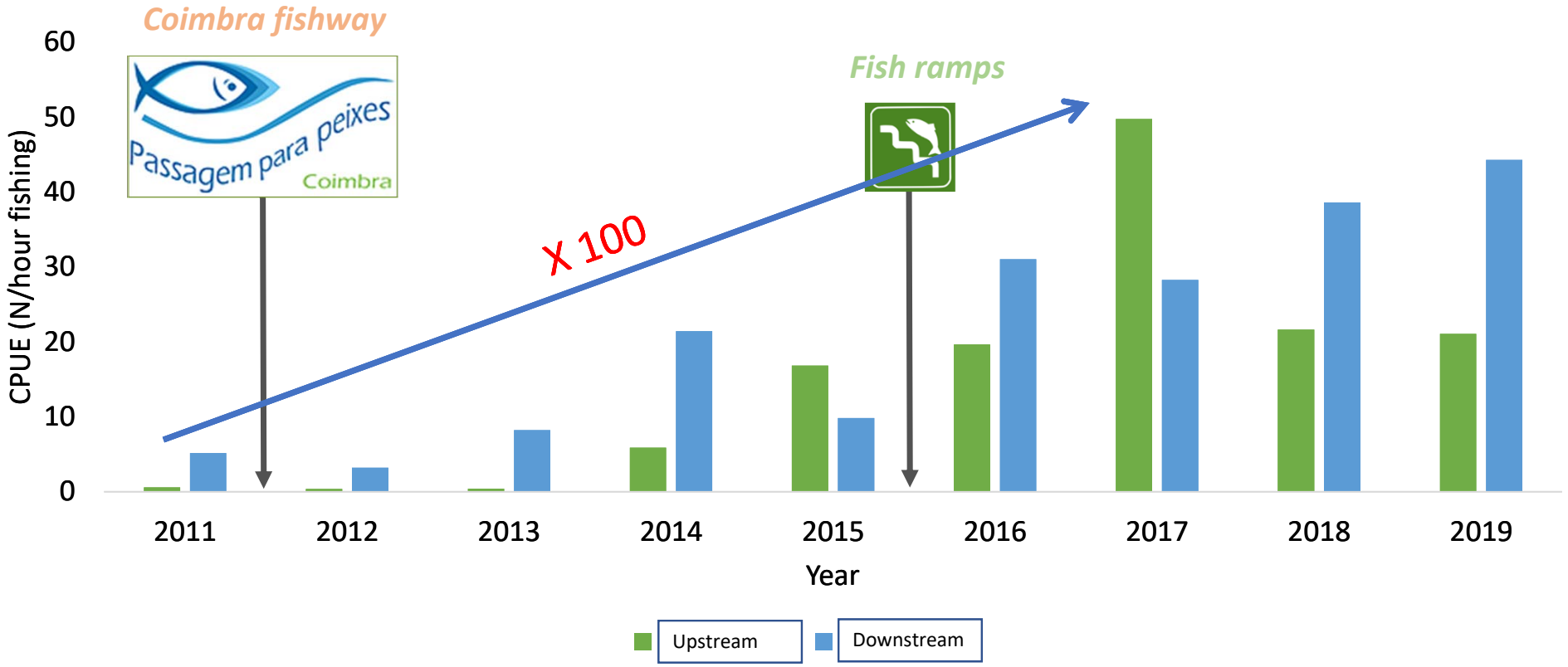




Others

Performance of a fish pass for sea lamprey – some results

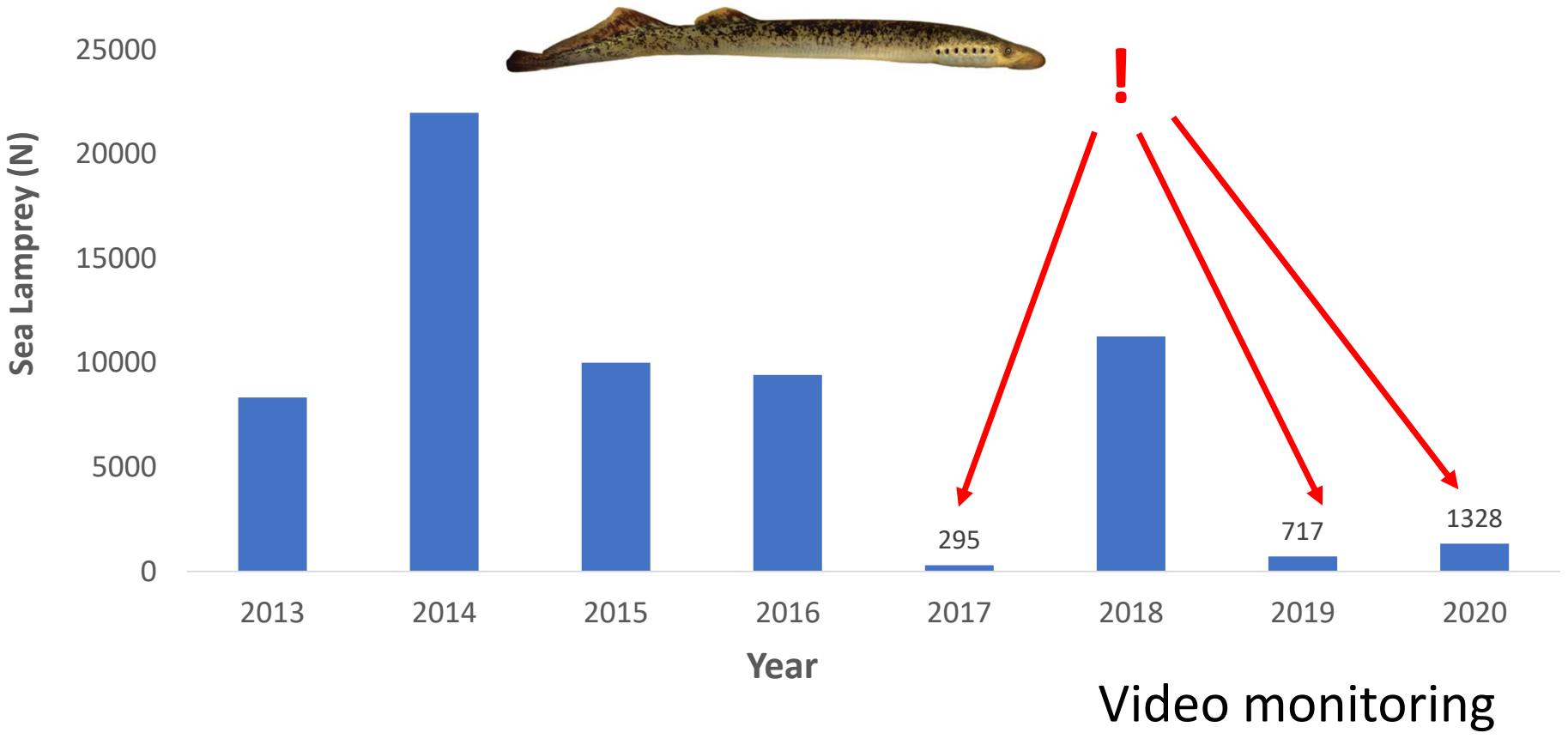
Abundance of larval sea lamprey population



Pereira *et al.*, 2016

Electrofishing surveys

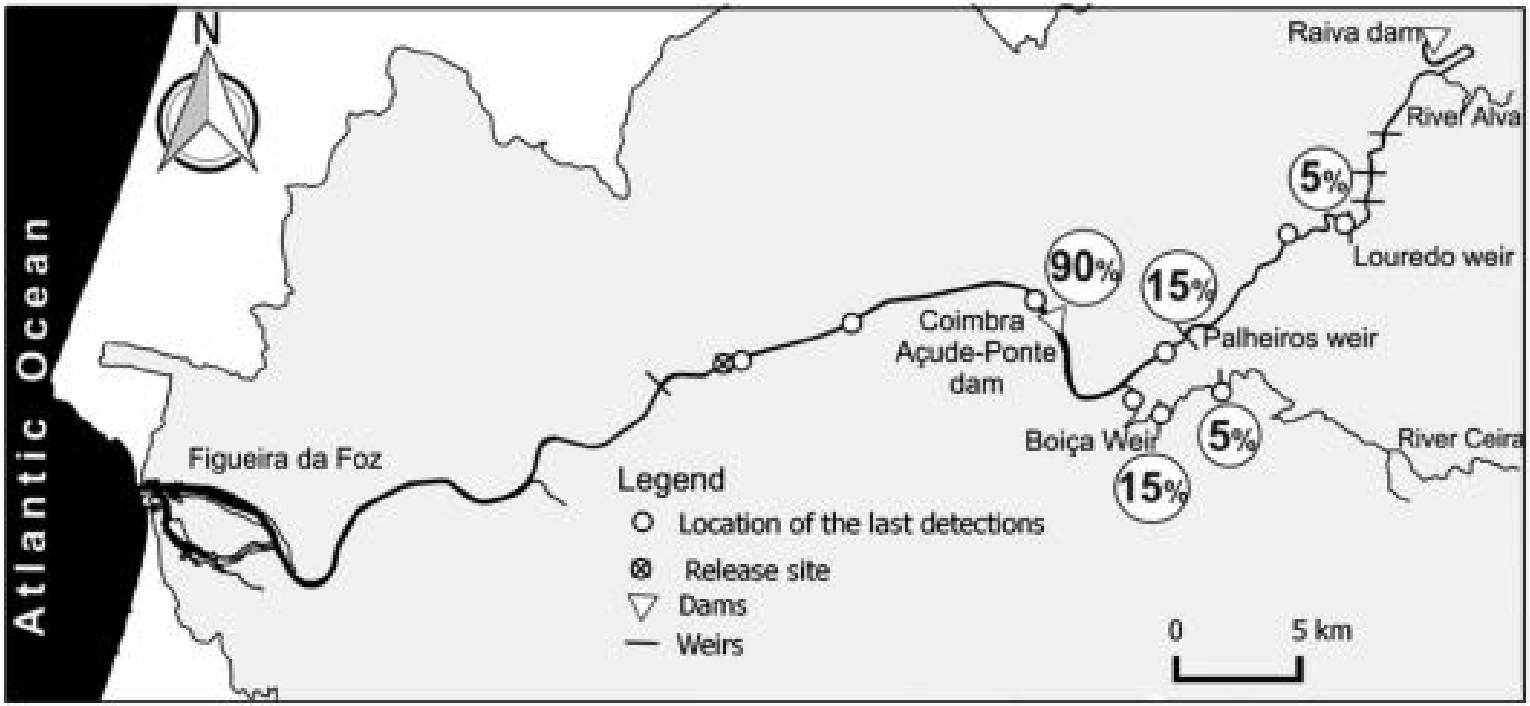
Visual counts data collected with the Coimbra fishway monitoring system during the spawning seasons of 2013–2020



Video monitoring

Performance of a fish pass for sea lamprey – some results

Dispersal pattern of the 20 radio-tagged adult sea lamprey in the Mondego river

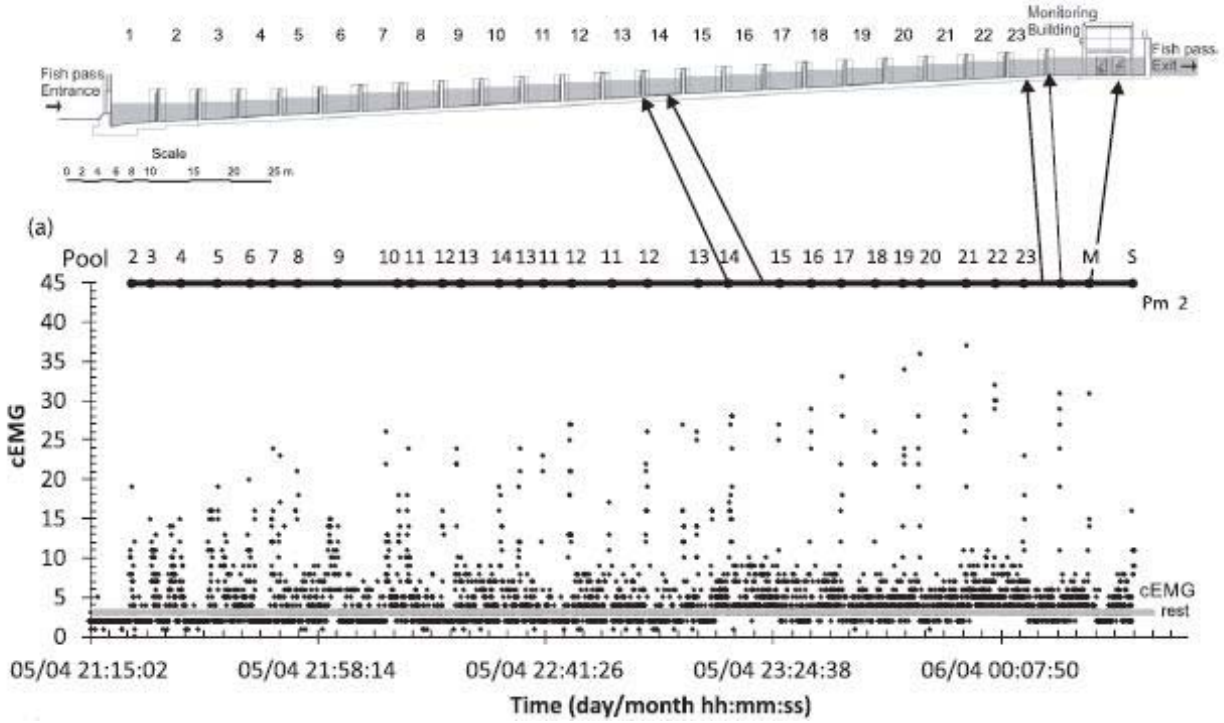


Captured between February-March

Pereira *et al.*, 2016

90 % (n=18) reached the Coimbra Açude-Ponte dam -> 33 % (n=6) successfully passed this obstacle
Upstream small weirs stopped migratory movement (≈ 11 days after) -> Percentages go down

Passage behaviour – EMG radiotelemetry



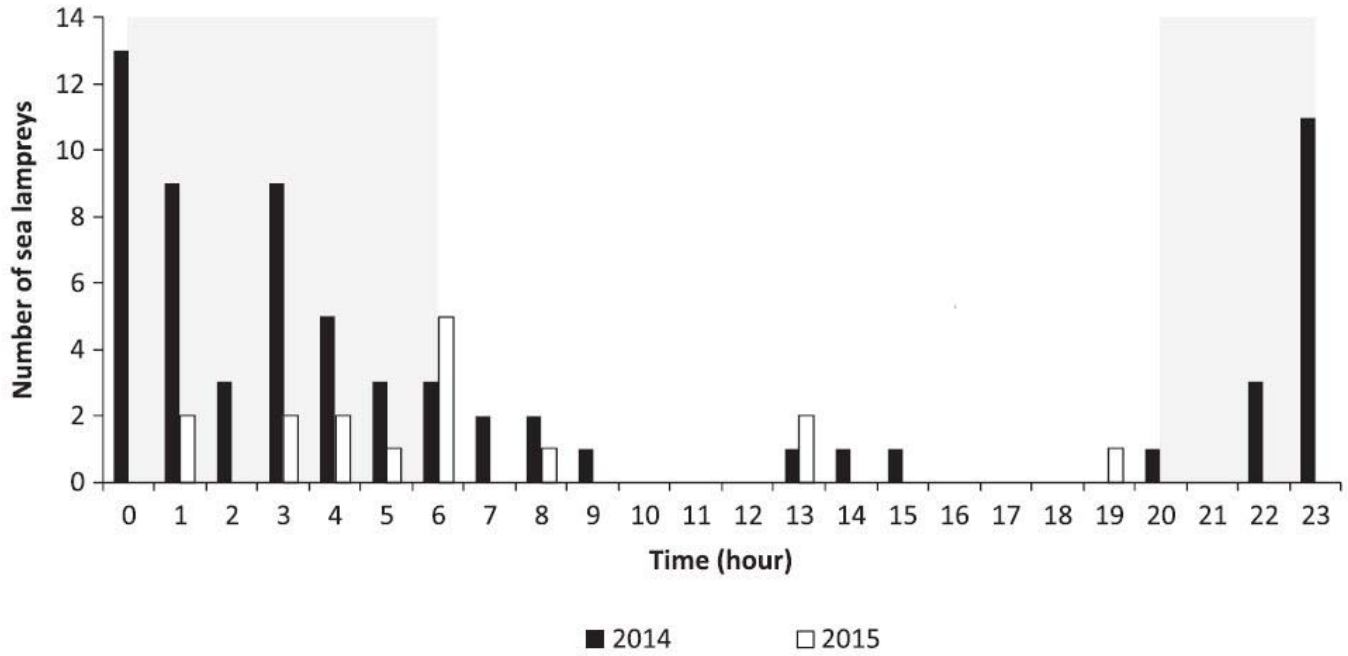
≈ 3h to complete the fish pass

High muscular effort was registered only between the pools of the vertical slots

Pereira *et al.*, 2016

Fish pass efficiency—PIT telemetry study to assess migratory season behaviour (e.g. circadian rhythm)

Pereira *et al.*, 2016



Similar overal passage efficiency in 2014 (31%), already observed with radio telemetry methodology in 2013

Animals High Detection Number:

Night periods
Low discharge (inferior to 50m3 s1)

225 Sea lamprey individuals PIT tagged; 2014 → Captured & released: migratory peak (April)

103 Sea lamprey individuals PIT tagged; 2015 → Captured & released: spawning season (January: 10%; February: 30%; March: 30% and April: 30%)

Discussion/Conclusion

- Fish pass built in 2011 allowed an increase in the abundance of larvae in upstream locations (around 100x more individuals)
- Some variability for sea lamprey Fish Pass Total counts
- Upstream weirs blocked the migratory movement of sea lampreys radio tagged (solution: fish ramps built in 2015)
- EMG telemetry, revealed sea lamprey swimming capacity inside of fish pass
- Similar Fish Pass Efficiency results were obtained with Radio telemetry and PIT tagging (30 %) – the higher proportion of individuals pass during migratory peak – maximum efficiency (21%)

Sea Lamprey Population Structure, Lança et al., 2014

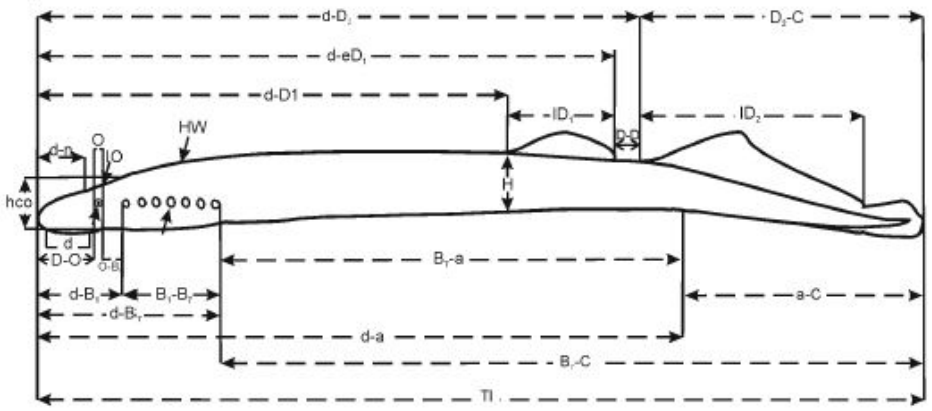
Hypothesis

- Existence of 3 groups:
  - 1: North/Central (includes Minho, Lima, Cávado, Douro and Vouga)
  - 2: Tagus
  - 3: Guadiana

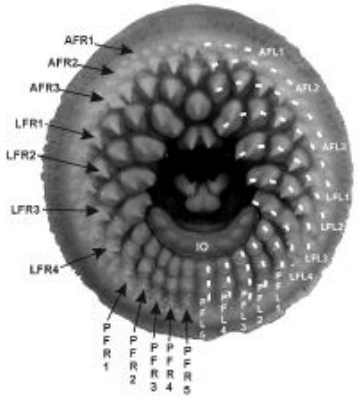
Why?? **Topography isolation**

Morphological Characters analysis

a)



b)



Total of **224 adult sea lampreys** were collected (**30 indviduals** from each river basin)

- 34 Morphological characters were used (a and b) :

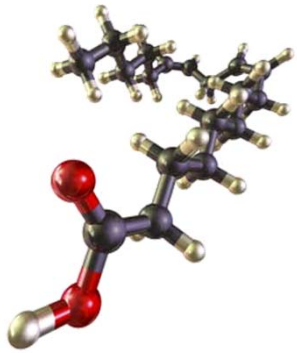
- 24 morphometric and 10 meristic

- Oral disc was photographed (b) to count the meristic characters (sub-sample n=201)

- Total mass (±0.01 g) of each individual

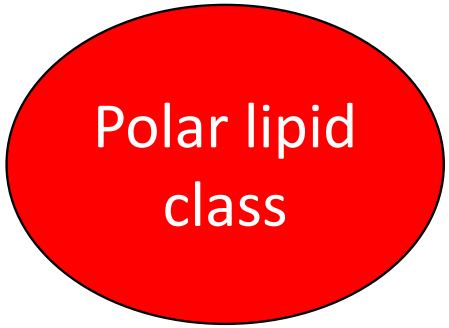
- Sexual dimorphism (gender)

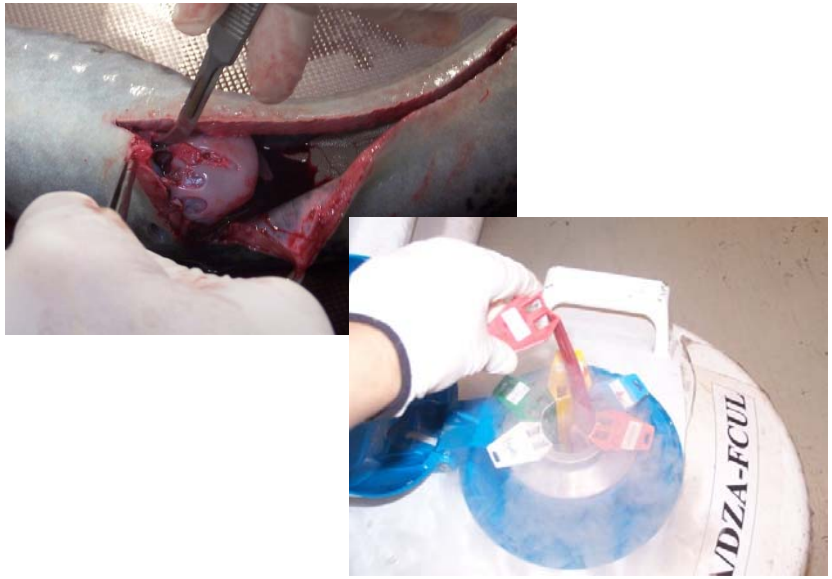
Heart tissue lipid extraction and fatty acid analysis



- Pre-testing (random subsample of 8 individuals per river basin)
- Determination of heart total lipids, neutral lipids and polar lipids

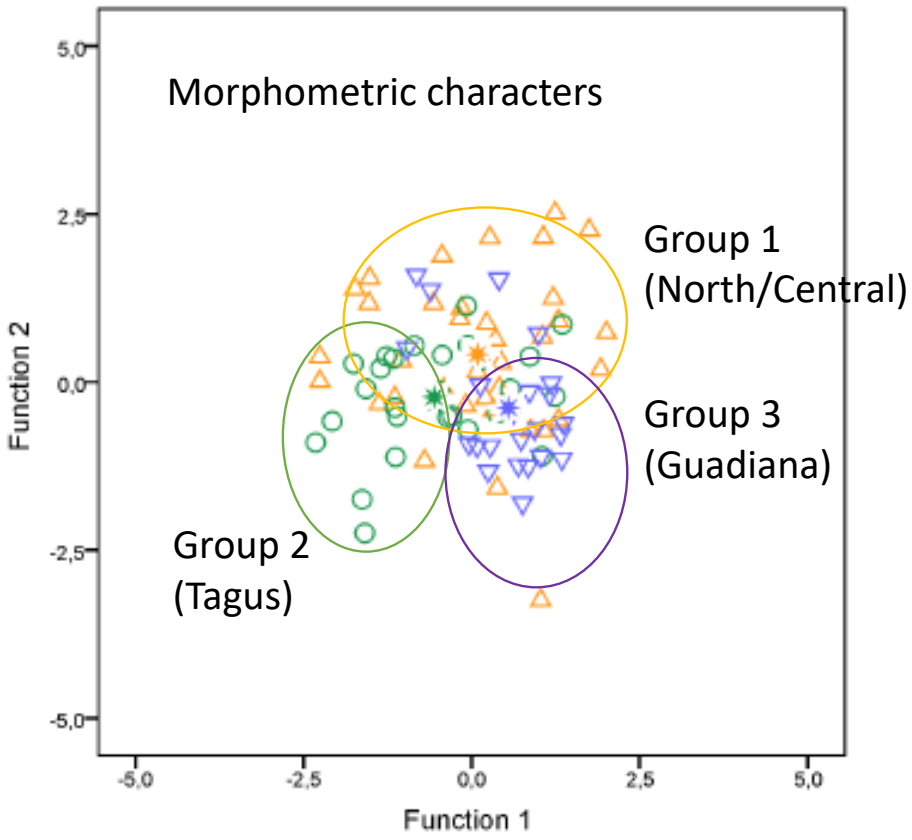
90 % - polar lipids



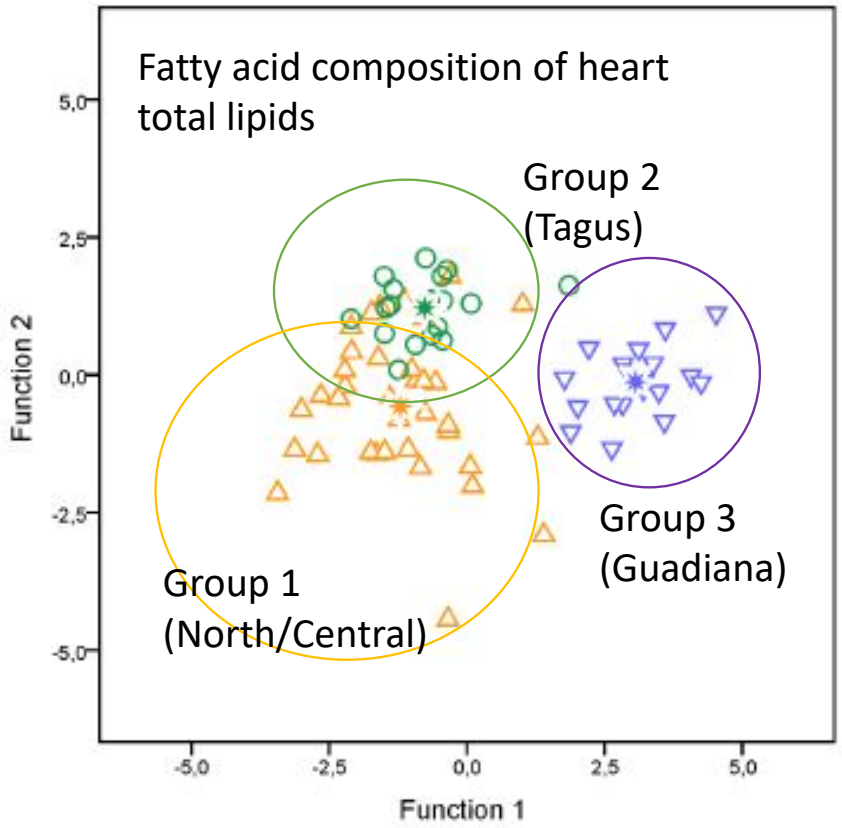


Results

a)



b)



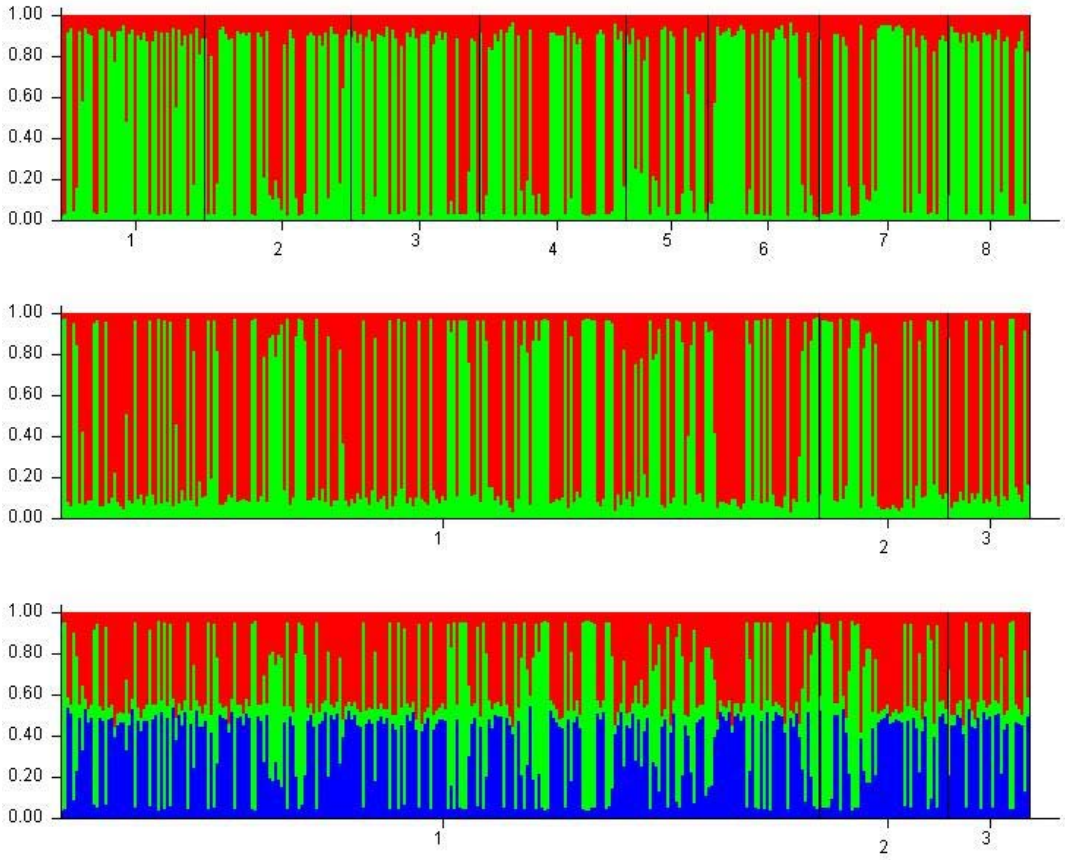
Sig. Differences in 3 morphometric characters eye length, second dorsal fin length and branchial length.
E.g. Eye length - diferences between group 2 and 3

100 % of individulas correctly classified in the group 3

89.5% and 72.2%, correctly classified in the group 2 and 1, respectively

Results – genetic analysis

STRUCTURE plots



8 populations
K=2

- Minho
- Lima
- Cávado
- Douro
- Vouga
- Mondego
- Tagus
- Guadiana

3 stocks
K=2

- North/Central
- Tagus
- Guadiana

3 stocks
K=3

- North/Central
- Tagus
- Guadiana

Discussion/Conclusion

- Similar morphological characteristics inside of Group 2 and 3, Group 1 more diverse

- Differences in the heart tissue fatty acid profile may result from environmental factors and geographical isolation, rather than derived from a genetic basis.

- Population structure (recognition of 3 stocks) – Management and conservation importance


Thank you
for your
attention!!