

Can we improve on current methods for Sea lamprey (*Petromyzon marinus*) population status assessment?

Preliminary results for discussion

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Lamprey population assessment in UK SACs

CSM Guidance current version (October 2015) .

Method of condition assessment for all species of lamprey relies heavily on larval stage, and electric fishing :

Targets for larval river and brook (*Lampetra spp*) abundance (5 m⁻²) but no target for sea lamprey (*Petromyzon marinus*)

“uncertainty about their habitat preferences”

Target for larval distribution

“Spatial extent should reflect distribution under near natural conditions”

Common Standards Monitoring Guidance

for

Freshwater fauna

Version October 2015

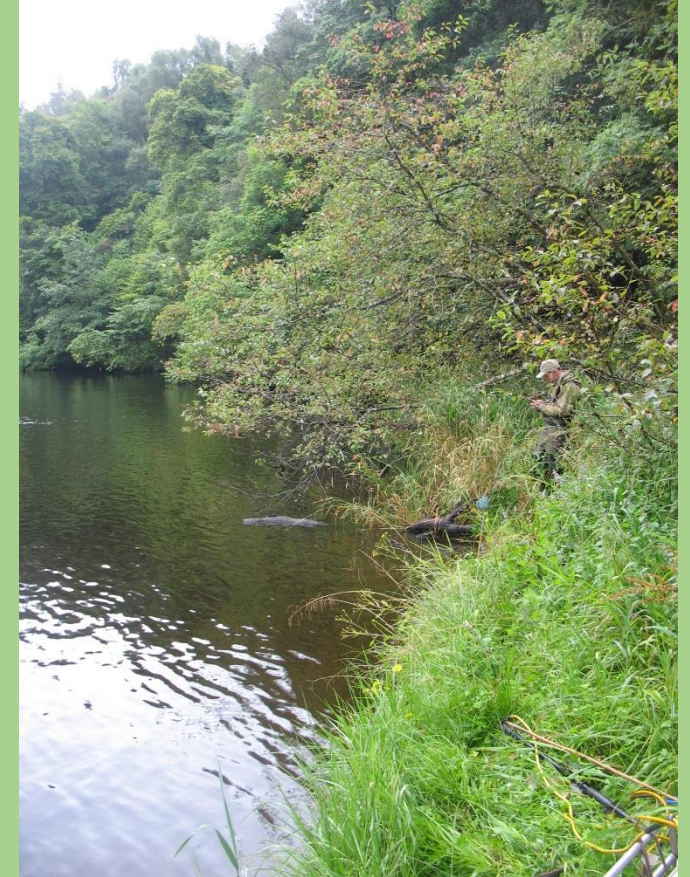
Updated from (August 2005)



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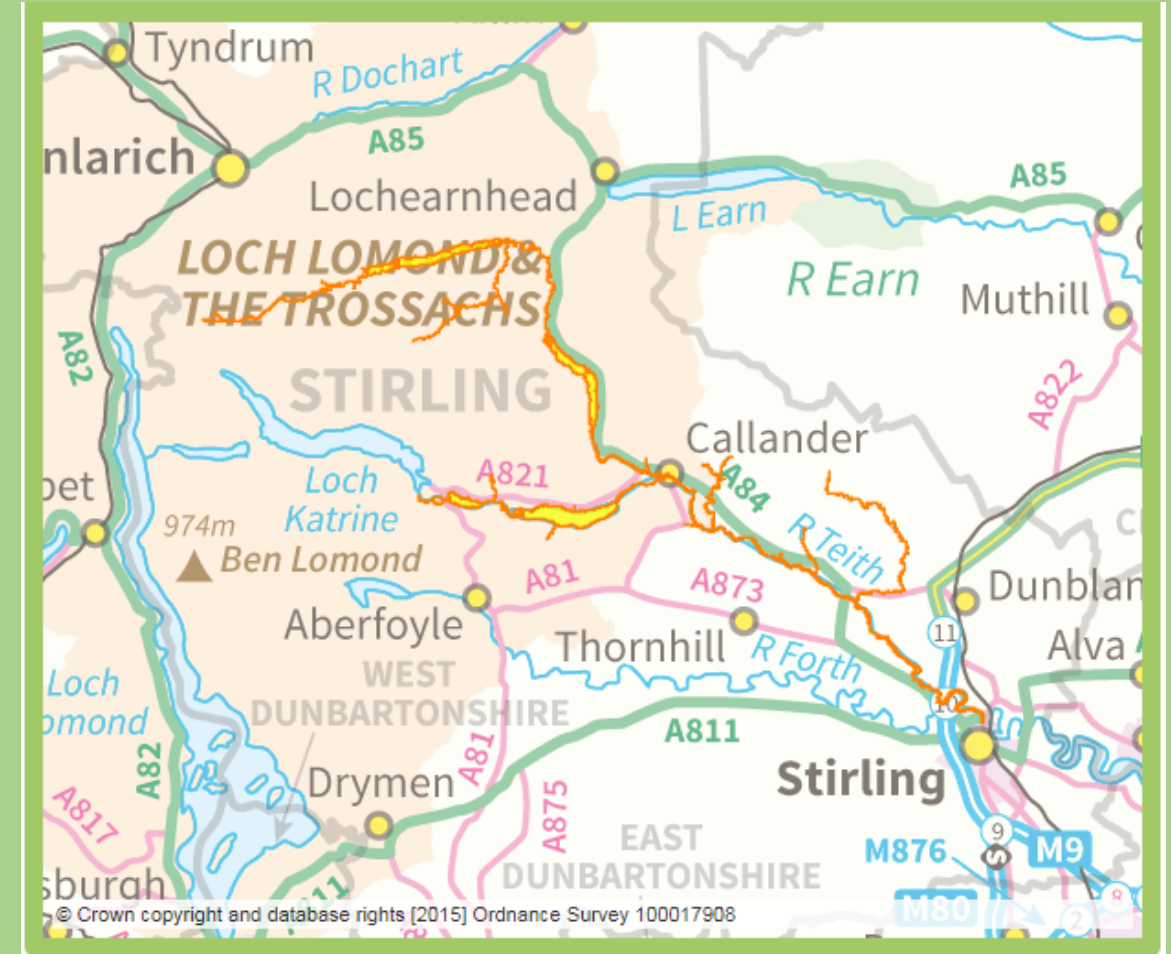
Typical electric fishing sites for larval lamprey assessment:
Water depth < 0.50m
Bank access for wading surveyors
Good visibility



= Limitation on spatial distribution of sampling sites, and possible surveyor bias

Adding to the toolbox for sea lamprey assessment

- Only Scottish SAC with all three lamprey species the Priority Species
- Sea lamprey (*Petromyzon marinus*) main spawning locations are downstream from obstacle at Deanston (distillery offtake weir)
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- Sea lamprey larval distribution in electric fishing samples typically very patchy and abundance only 1% of total lamprey larvae encountered.



River Teith Special Area of Conservation





Sampling deeper water habitats for lamprey

Taverney et al., 2012

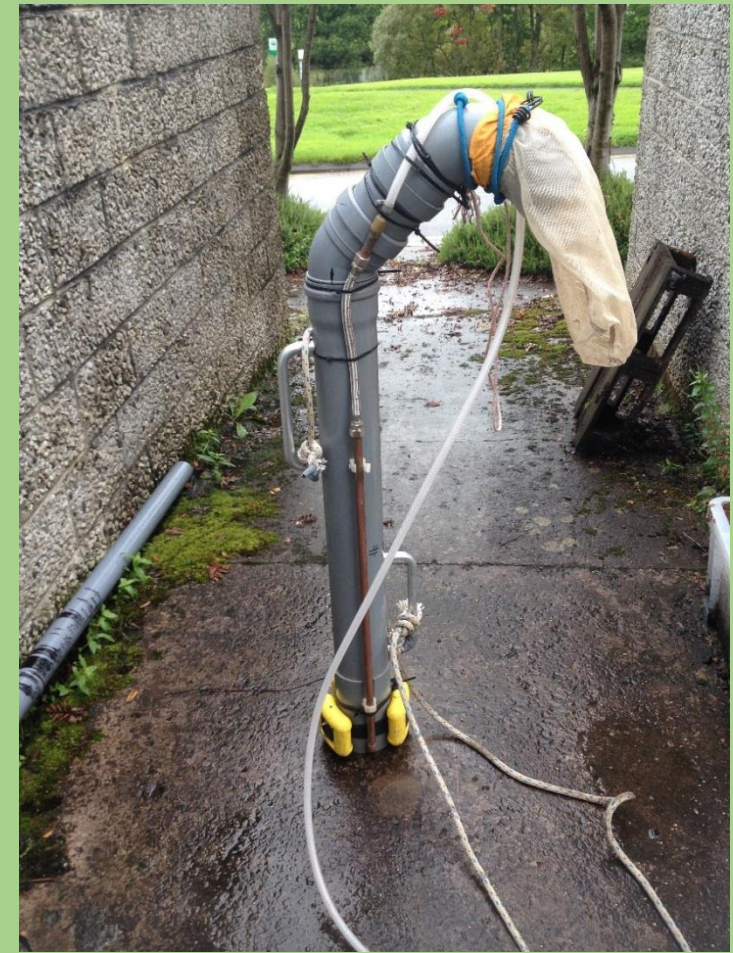
- Gironde-Dordogne using a water suction dredge.
- Sea lamprey more abundant in deeper water habitats(2m+)
- Occurred at 76% of sites with total of 74 larvae caught
- APEM 2013
- Welsh River Dee trial of airlifting in deep water
- 34% of samples contained larvae, up to 4.4m water depth
- Greater ratios of sea lamprey in airlift samples than in efished marginal habitat

Trialled in 2015
with scaled down
kit.
Larvae caught
but mortalities
and practical
concerns

Taverny, C., Lassalle, G., Ortusi, I., Roqueplo, C., Lepage, M. and Lambert, P. (2012), From shallow to deep waters: habitats used by larval lampreys (genus *Petromyzon* and *Lampetra*) over a western European basin. Ecology of Freshwater Fish, 21: 87–99. doi:10.1111/j.1600-0633.2011.00526.x

Additional sampling method 1 : Airlift sampling

- Deep water methodology for invertebrate sampling (Davy-Bowker et al., 2014)
- Modified Yorkshire pattern airlift gear
- 50 sites sampled
- A site comprised 10 x samples– each sample used 5 second burst of air



John Davy-Bowker, John Iwan Jones, John Francis Murphy (2014) Standardisation of RIVPACS for deep rivers: Phase I - deriving a standard approach to deep river sampling. Environment Agency Science report





Strengths

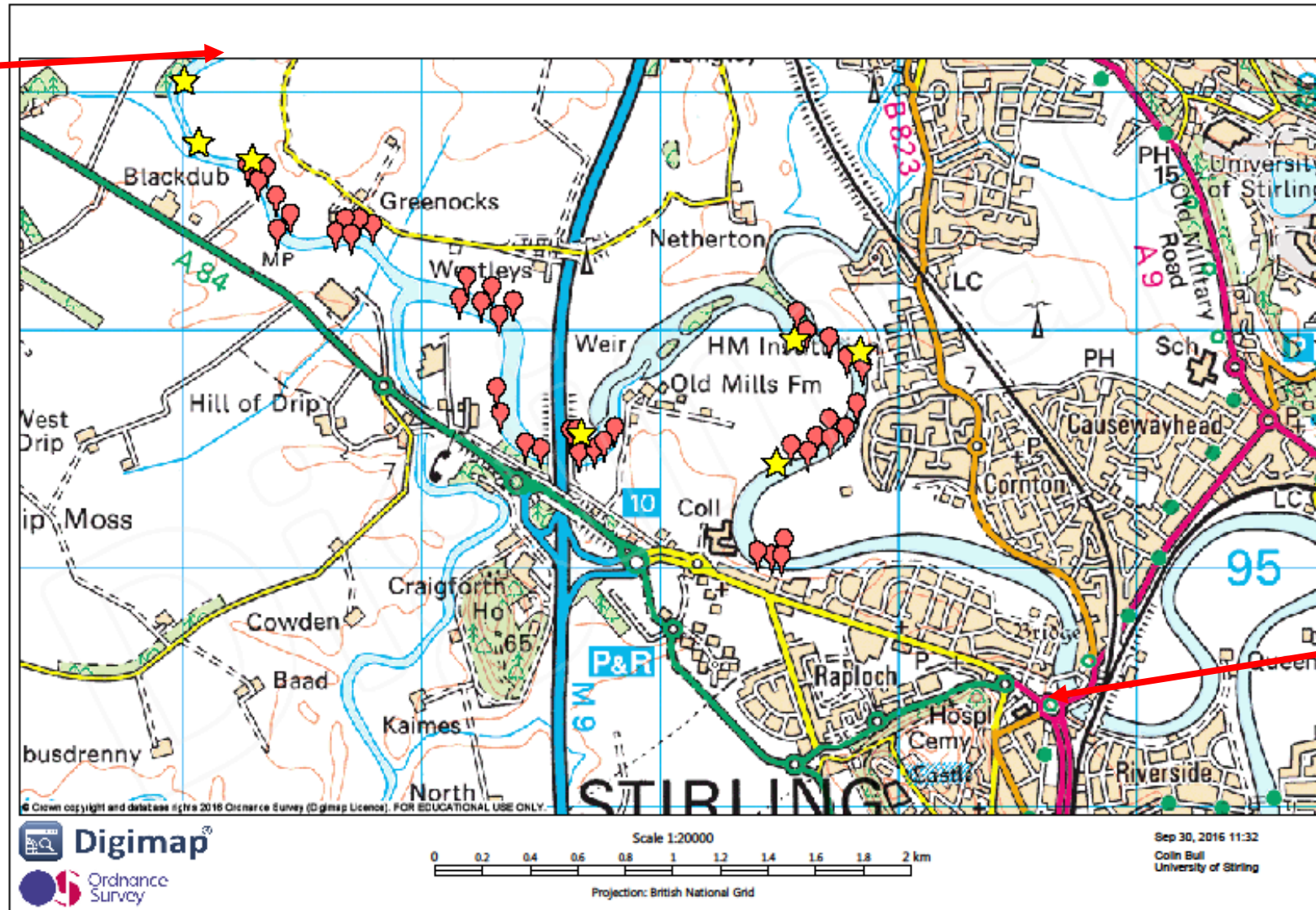
- Wide range of water depths
- Mesohabitat units can be selected prior to sampling
- Sampling efficiency is not so reliant on surveyor skills
- Non-destructive

Weaknesses

- Limited to a minimum of 0.90m water depth
- Limited boat access (lower river)
- Qualitative
- Probably under-estimates larger larvae
- Labour intensive

Electric fishing sampling – standard SCM methods : 7 sites (0.10-0.50m water depth)
Each site : 4m² sampled, local calibrations using depletion method

Lowermost
known sea
lamprey
spawning
location



Downstream
extent of Teith
SAC

Nocturnal drift net sampling

- Passive trapping using off-the-shelf drift nets with modified collection bottle
- Intentions in 2016: set nets upstream and downstream from identified sea lamprey spawning pit locations



Sea lamprey spawning pit surveys on River Teith 2008-2013 : May 25- June 5



Nocturnal drift netting sampling

- Passive trapping using off-the-shelf drift nets with modified collection bottle
- Intentions in 2016: set nets upstream and downstream from sea lamprey spawning pit locations.....
- **No sea lamprey spawning pits found during surveys in 2015 or 2016**
- Adapted sampling : more intensive study at one location with subsequent genetic ID and examination of length and external characteristics
- Nets left out all night (10pm-6am) = considerably reduced capture rates compared to hourly collections at same location



- **Strengths**
- Quantitative
- Abundant dispersal stage
- Non - destructive
- Passive sampling
- Cheap sampling gear



- **Weaknesses**
- Limited sampling locations
- Surveyor safety
- Origin of larvae unknown

Drift netting preliminary results

Eight nights sampled between 11 July and 28 August

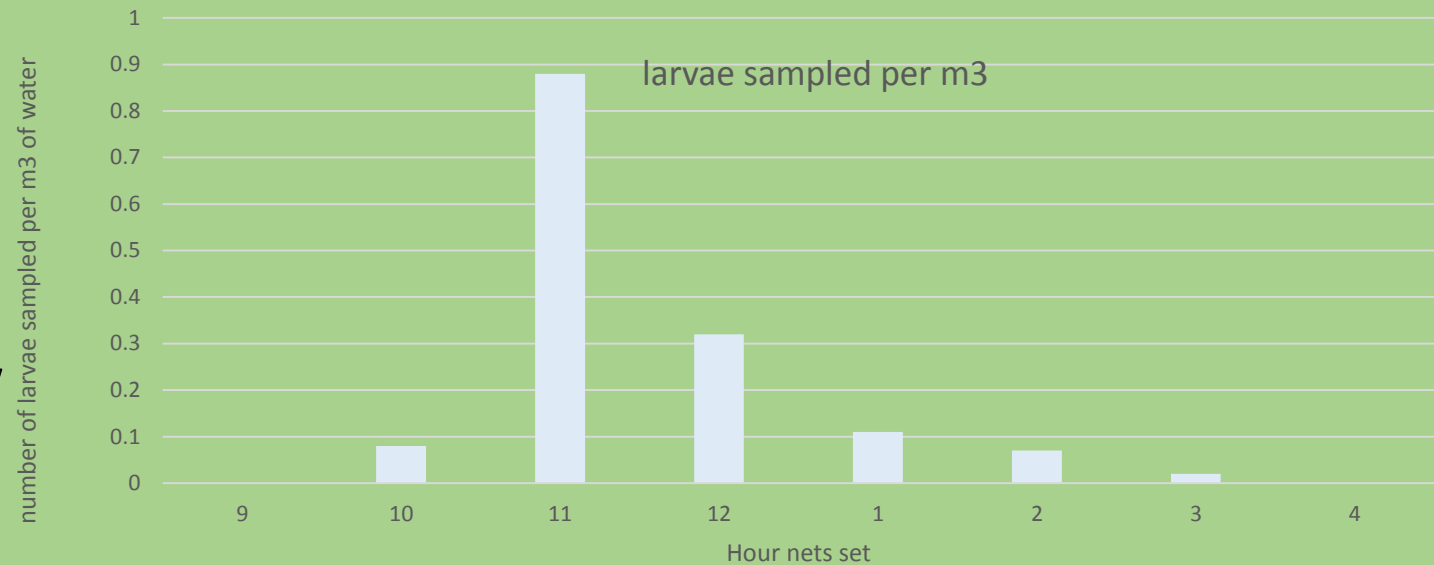
Only 2 nights produced no larvae (low water conditions)

352 larvae sampled during 6 nights

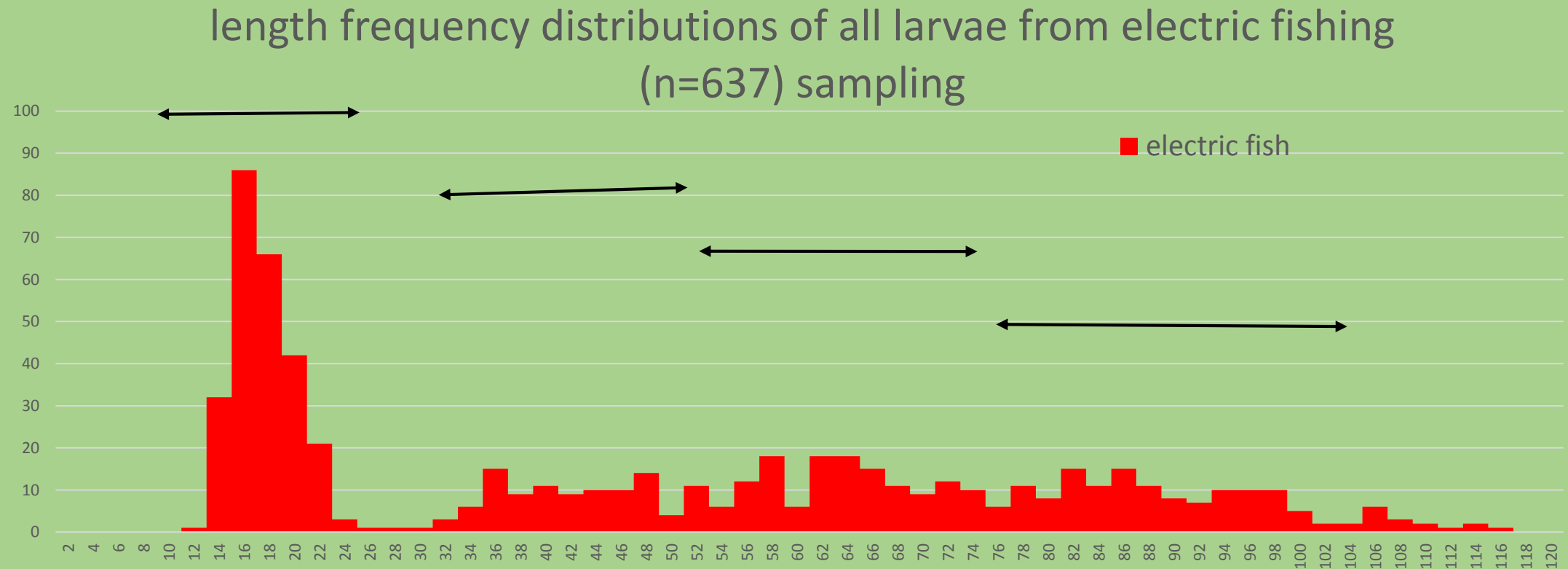
Typical pattern of peak abundance around midnight

No lamprey larvae drifting at twilight or towards sunrise

Environmental variables to be considered: Light level , water colour, water temperature , river stage change (Student project)



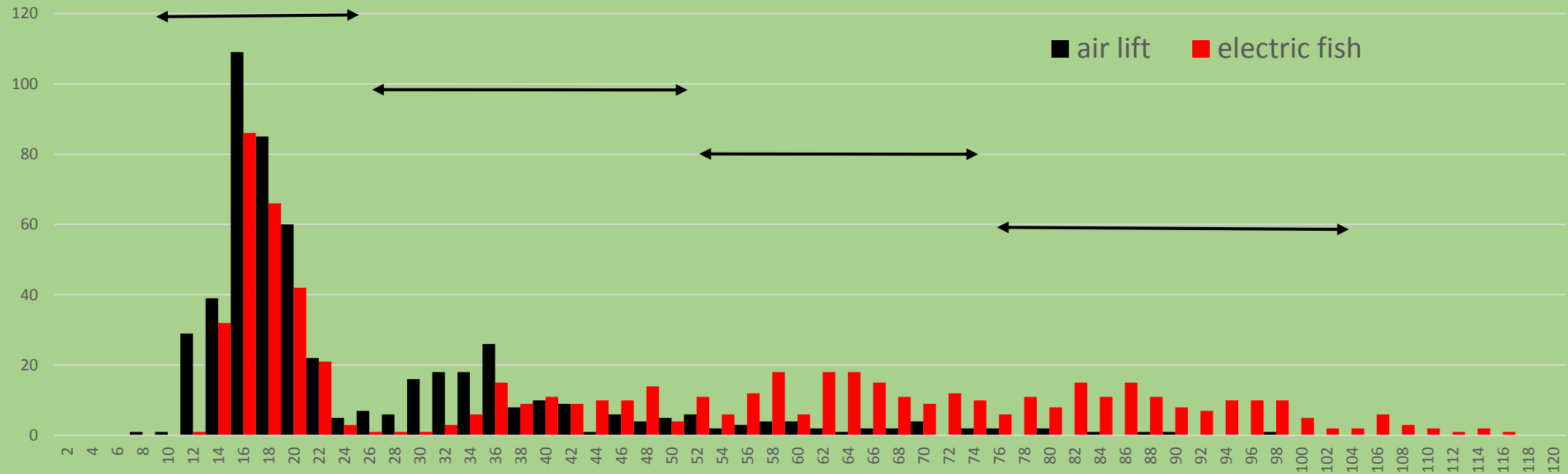
Electric fishing provides widest range of larval age classes (7 sites sampled)



Airlift under-sampling larger / older larvae

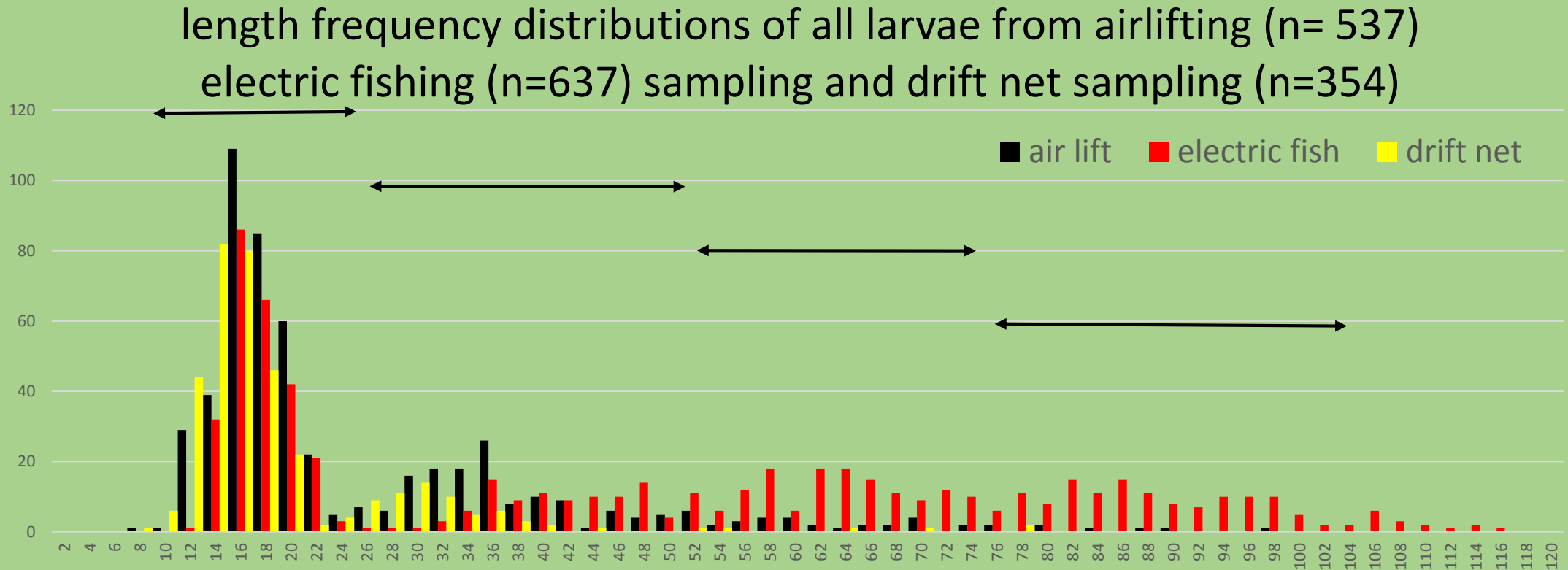
Abundant 0+ year class (50 sites)

length frequency distributions of all larvae from airlifting (n= 537) and electric fishing (n=637) sampling



Preliminary results

Airlift and drift net size distributions similar
0+ year class numerically dominant



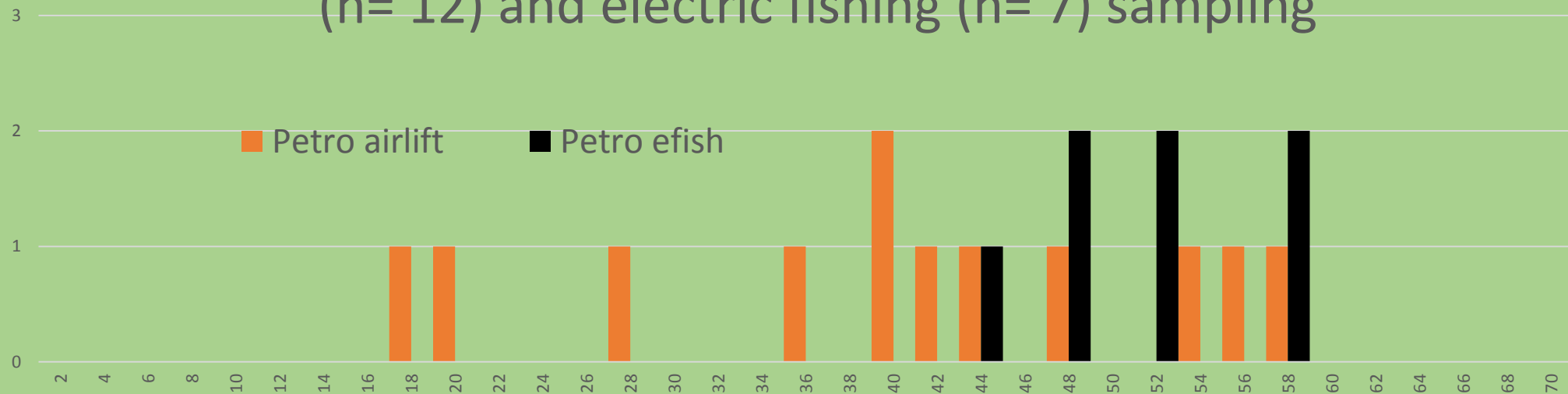
Preliminary results

Can we be sure we are able to adequately identify the smallest larvae ?
Are we missing sea lampreys in our samples

Sampling sea lamprey larvae in airlift and electric fishing: presence important, as no abundance target

Airlift sampling provides higher proportion of sea lamprey larvae than electric fishing (2% of sample as opposed to 1%) and also more smaller sea lamprey larvae

Sea lamprey length frequency distribution from airlift (n= 12) and electric fishing (n= 7) sampling



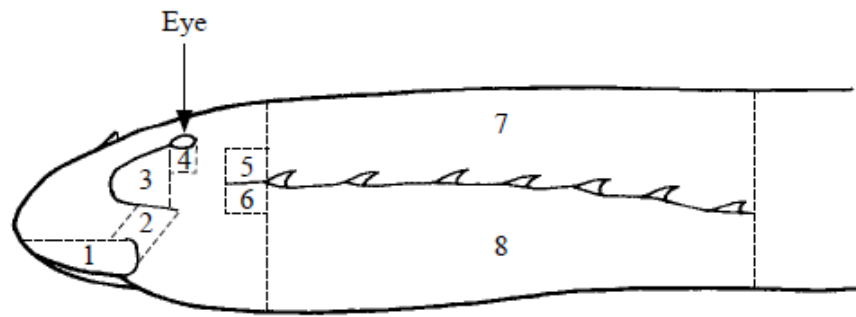


Fig. 10. Side view of the head and branchial regions of a larval lamprey showing various pigmentary areas: 1– upper lip, 2– between upper lip and cheek, 3– cheek, 4– subocular, 5– upper prebranchial, 6– lower prebranchial, 7– upper branchial, 8– lower branchial. After Renaud (1982a).



	1 Upper Lip	4 Subocular	5 Upper prebranchial	6 Lower prebranchial	caudal fin	caudal fin shape	trunk myomeres
<i>L. Planeri</i>	0	0		0	0	spade like	67-71
<i>L. fluviatilis</i>	0	25-75%	1-5%	0	0	rounded	58-64
<i>P. marinus</i>	25-75%	> 75%	25-75%	1-25%	25-75%	rounded	58-64

Renaud, C.B., 2011. Lampreys of the world. An annotated and illustrated catalogue of lamprey species known to date. FAO Species Catalogue for Fishery Purposes. No. 5. Rome, FAO. 109 pp.

Field ID realities

- Poor light
- Cold fingers
- Detritus
- Limited time window as larvae under anaesthetic
- Hundreds of larvae per site
- Personal experience : reduced confidence in ID for any larvae under 20mm length



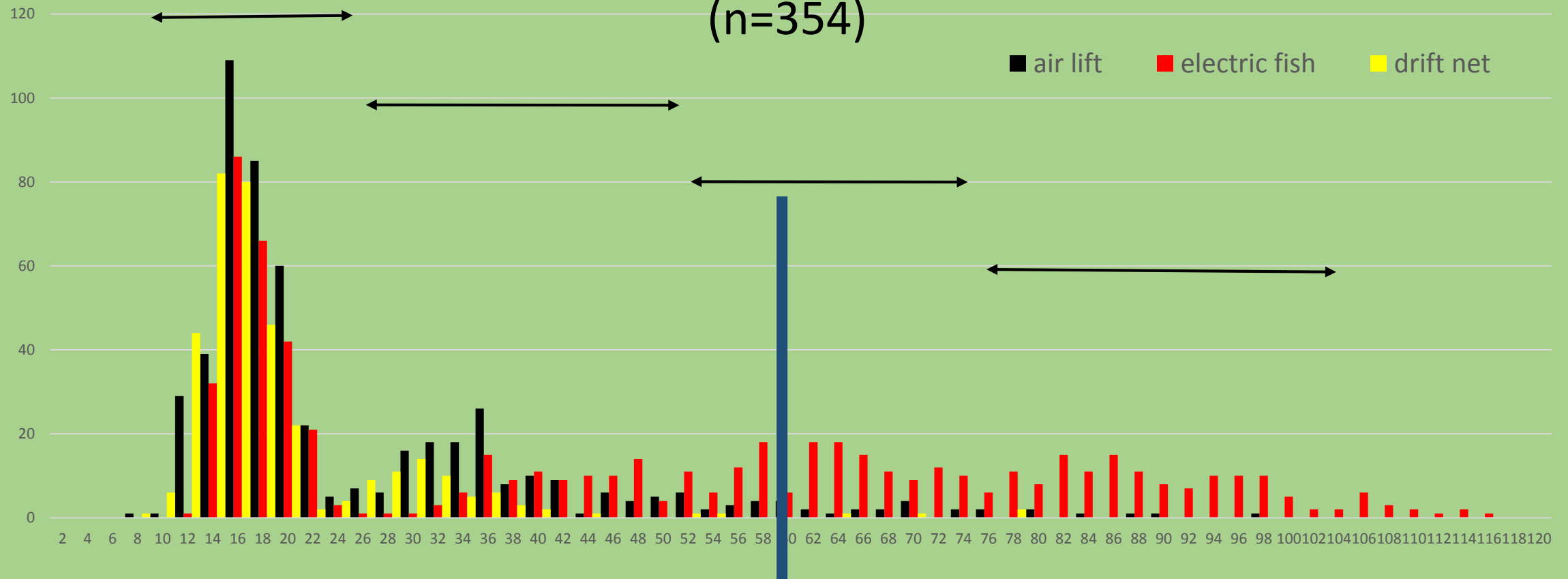


Gardiner R (2003). *Identifying Lamprey. A Field Key for Sea, River and Brook Lamprey*. Conserving Natura 2000 Rivers Conservation Techniques Series No. 4. English Nature, Peterborough.

60mm length appears in literature as smallest size to confidently use external features to identify genus (Taverny et al., 2005 Renault et al., 2011), but Gardiner (2003) suggests use on smaller larvae

Taverny, C., Urdaci, M., Elie, A.-M., Beaulaton, L., Ortusi, I., Daverat, F. & Elie, P. 2005. Biologie, écologie et pêche des lamproies migratrices (Agnathes amphihalins). Rapport no. 99. Groupement de Bordeaux: Cemagref.

length frequency distributions of all larvae from airlifting (n=537) electric fishing (n=637) sampling and drift net sampling (n=354)



Drift netted larvae – images of head and caudal regions taken



Tail morphology and
pigmentation patterns

Lower prebranchial
region as well as upper
lip and tail
pigmentation

- Still awaiting DNA results for drift netted larvae – identify if sea lamprey present and then examine morphology and pigmentation

How practical will this
be in the field?

Increased population monitoring capacity, or just muddying the waters further?

- Airlift method may enable greater numbers of sea lamprey to be sampled and wider range of habitats. May be useful spatial monitoring tool.
- Drift netting may allow non-selective means of sampling larval dispersal stage, and may assist detecting upstream limit of sea lamprey distribution.
- Both methods provide good samples of 0+ larvae but non-destructive field method for differentiating these small individuals as sea lamprey or river/ brook needs attention

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