

Sampling eel populations in rivers

Audience:

- Environment Agency staff involved in sampling eel populations in rivers.
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What's this document about?

This document describes how to apply survey techniques for monitoring eel populations in rivers. It aims to ensure we are nationally consistent in all aspects of our sampling work.

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1. Electric fishing for yellow eel

Choice of method

The preferred method for yellow eel surveys is electric fishing by wading. This is the most efficient method for sampling smaller eel although large eels in deep water will still be underrepresented in the catch.

Where electric fishing by wading is not practical you can electric fish from a boat but the catch will be biased towards larger eels. Boom boat electric fishing is not suitable for eel specific surveys.

Survey timing and river conditions

Carry out eel surveys by electric fishing in the period June to October inclusive.

Only undertake an eel sampling survey when the water is particularly clear. Eel tend to be stunned on the river bed and are more difficult to see than other fish species.

River depth

Electric fishing by wading is suitable for rivers with mean depth < 0.8 metres. Where substrate is soft and easily disturbed, electric fishing by wading for eel may be inappropriate as turbidity will significantly reduce your catch efficiency.

Electric fishing by boat, using hand-held equipment, is suitable for rivers with mean depth > 0.8 and ≤ 1.5 metres. Note that this survey method is biased towards larger eels.

Electrical output

The electric fishing best practice manual recommends the use of 10-40 Hz and 10 % duty cycle as standard for eel surveys.

The following table gives guidance on voltages recommended depending on conductivity at the site.

Conductivity	Voltage
150 – 500 $\mu\text{s/cm}$	200-300 Volts
500 – 800 $\mu\text{s/cm}$	150-200 Volts
800 – 1000 $\mu\text{s/cm}$	120-180 Volts
>1000 $\mu\text{s/cm}$	100-150 Volts

You may need to consider reducing the voltage used where there is a risk of damage to sensitive species, however this is likely to reduce fishing efficiency.

Survey strategy

Eel index surveys must use quantitative catch-depletion sampling. Three runs will usually be required. If you do not have a good depletion after 3 runs, the value of doing 4 or more is limited unless you know you have been missing size ranges which you may catch on later runs.

If you need to change electrical output between runs (e.g. to remove sensitive species at a reduced power output during run 1), this data can not be used to derive Carle and Strub population estimates regardless of the number of runs or any apparent depletion. This survey strategy will, however, give you a minimum population estimate and population structure which is valuable data. You must put a comment on NFPD to describe the method used and that the data should not be used to derive population estimates using Carle and Strub.

In all cases, you must fish the full width of the river.

Anode operation

Keep anodes energised; eels affected by the electric field but not fully stunned will make a rapid recovery and escape.

Eels are often drawn from their refuges very slowly so operators should move through the channel slowly with a long dwell period near to likely eel haunts.

You must remove stunned fish of other species promptly. Capture and keep species other than eel throughout the survey to avoid repeated exposure to the electric field during successive runs.

Eel must remain your target species.

Nets

Stop nets should be used when electric fishing for eel. Recommended mesh sizes are:

- 3 mm micromesh for lower reaches where smaller eel are more prevalent, that is, up to 30 km upstream of the tidal limit;
- 5 mm mesh for sites further upstream.

Hand nets should have 3mm micromesh for lower reaches where smaller eel are more prevalent.

2. Fyke netting for yellow and silver eel

Survey window

Carry out eel surveys by fyke netting in the period June to December inclusive.

Preparation

For details of selecting equipment and the methods to use, refer to [25_07 Fyke netting for monitoring fish](#).

Fyke nets for eel should have 10mm mesh cod ends.

Fyke nets must be tagged and fitted with otter guards. Net tags and otter guards are available from the Fish Movements Team.

River depth

Fyke netting is suitable for rivers with mean depth > 1.5 metres and up to a maximum depth of 15 metres.

Survey strategy

You can use catch per unit effort (CPUE) fyke sampling to produce a basic assessment of eel populations, as described in the table below.

Step	Description
1	Single or double ended fyke nets may be used. Deploy a minimum of 10 cod ends. Each cod end (trap) should be numbered.
2	Fish for at least 24 hours. Nets must not be left unchecked for more than 24 hours. You should plan to check your nets every 12 hours. When checking the net you must: <ul style="list-style-type: none"> ● check that the otter guard is still securely in place; ● check that the net tag is still present; ● check for any damage to the net.
3	Recover the fyke nets.
4	Record the number of cod-ends (traps), and the number of hours and minutes fished.
5	You will need to record the number of the cod end (trap) each eel was caught in so keep catches separate until they have been measured.
6	Process all captured eel as described in Section 3.

To assess eel populations quantitatively by fyke sampling, use a mark release recapture (MRR) technique as described in the table below.

Step	Description
1	Deploy the fyke nets as for CPUE surveys.
2	Recover the fyke nets after a minimum of 24 hours fishing. Record the fishing period.
3	Process all captured eel as described in Section 3.
4	Mark all captured eel that have been measured individually on their ventral side, between the pectoral fins, using alcian blue via a Panjet or hypodermic needle. Use of anaesthetic when marking eels must be in accordance with guidance in 426 13 Use of anaesthetics in fish monitoring .
5	Return the marked eels to the site and leave them for at least 24 hours to disperse through the site.
6	Redeploy the fyke nets.

7	Recover the fyke nets after fishing for at least 24 hours. Record the fishing period.
8	You will need to record the number of the cod end (trap) each eel was caught in so keep catches separate until they have been measured
9	Process all captured eel as described in Section 3.

MRR fishing without stop nets

It is impractical to deploy stop nets in rivers for the long time periods needed for quantitative eel trapping.

As eel have a small home range, MRR fishing without stop nets produces the best practicable population estimate and we consider it quantitative for eel surveys.

3. Eel handling, storage and processing

Measuring eel

For each run or netting, measure each eel caught to the nearest 5 millimetres and record the length.

The use of eel specific measuring devices is recommended. Refer to [778_06_SD01 Eel measuring devices](#) for more information.

You can estimate weight from the lengths of eel by using the NFPD Sept 2006 Standard length weight relationship.

Avoid the use of anaesthetic when measuring and marking eels. If anaesthetic needs to be used you must follow the guidance on using anaesthetic in [Use of anaesthetics in fish monitoring](#).

Storing eel

Keep eel in a separate container to other fish. Stressed eel produce lots of mucus which can increase the viscosity of the water in the container to the point where fish are unable to respire satisfactorily.

Processing the eel

Process the eel as described in the table below.

Step	Description
1	Remove captured eel for processing.
2	Record the length (to nearest 5 mm) of yellow / silver eel and elvers. If very large numbers of eel or elver are found, a representative sample should be measured from the full size range in accordance with 149_03 Fish handling, storage and processing .
3	A count of any glass eel found must also be recorded.

Record site- and survey-specific variables

You must record supporting data according to requirements laid out in the Environmental Monitoring Manual and [149_03 Fish handling, storage and processing](#).

Non-target species

You should record all non-target species captured during an eel-specific.

4. Data entry

NFPD data entry

Enter data from eel specific surveys onto NFPD as described in the tables below.

The site purposes you should use are:

- Eel index (Biennial) for biennial surveys on Eel index rivers;
- Eel - Planned investigation for surveys done for local purposes.

Refer to [1109_08 NFPD site and survey purposes](#) for more detailed guidance.

Record data for non-target species on NFPD as for standard quantitative monitoring sites.

How to enter electric fishing data

Enter data from electric fishing surveys as described in the table below.

Step	Description
1	Record the length of yellow/silver eel (NFPD species 'European Eels>Elvers') and elvers (NFPD species 'European Elvers')
2	Record counts of glass eel (NFPD species 'European glass eels').
3	Enter multiple electric fishing run data for eel into NFPD as separate runs within one catch depletion survey, even where electrical output has been changed between runs.
4	<p>Where the method used is specifically targeting eels and can not produce accurate results for all species, you must select the 'Species selective survey' on the Survey Information form in NFPD.</p> <p>You should not select the Species Selective tab if varying electrical output between runs since survey data obtained from run 1 may still be suitable for WFD classification.</p> <p>If varying electrical output, you must put a comment on NFPD to describe the method used and that the data should not be used to derive population estimates using Carle and Strub.</p>
5	The end date for data entry onto NFPD is 15 December.

Hot to enter fyke net data

Enter data from fyke netting surveys as described in the table below.

Step	Description
1	Enter fyke net data using Fyke netting as the survey method
2	<p>Enter the Start time, End time and Time taken.</p> <p>The Event date must be the same as the Start date not the End date.</p>
3	<p>Use the 'No. of units' field to record the number of cod ends (traps).</p> <p>When recording the survey on NFPD the 'number of units' is the number of cod ends (traps), not the number of fyke nets.</p>
4	If you have used MRR techniques, record each set of the fyke nets as a separate survey in NFPD and flag marked eels, and marked eels

	<p>which were recaptured, using the 'Individual fish characteristics' tab on the 'Supplementary data edit' form.</p> <p>Use the characteristics:</p> <ul style="list-style-type: none"> • "Marked (& released for MRR purposes)"; • "Recaptured (previously marked for MRR purposes)" <p>Marked eel which are recaptured must be re-measured and re-recorded, as part of the 'second set' survey data.</p>
5	The number of the cod end (trap) in which each fish was caught must be recorded on the 'Individual measurements' form.

5. Sampling glass eel

Site selection

The most effective sites for monitoring glass eel and elver are at weirs or barriers where there are elver passes in place.

Choose sites where you have good access and can set traps safely. Avoid areas where commercial elver fishing take place.

Where possible you should select sites where the majority of elvers and glass eels will use the pass and be captured in the trap.

Some sites will be suitable for remote monitoring using cameras.

Trap design

Trap design is highly dependent upon site-specific considerations but some general considerations apply. These include:

- The trap must be large enough to hold all elvers and eels that could build up between operator visits. This may involve some level of trial and error as magnitude and timing of peaks of activity may be difficult to predict.
- The trap should provide safe refuges for the glass eel/elvers collecting there to prevent them from continuously trying to escape and exhausting themselves. This is particularly important where the periods between emptying the trap are protracted, or where numbers of migrating eels are large.

- Sacking bags and brightly-lit boxes without refuges, from which the animals are constantly trying to escape, are not satisfactory.
- The design should allow for the easy and safe removal and transfer of the trapped animals (in this context “safe” refers to both the eels and the operator).
- The trap should be protected from excessive temperatures caused by direct sunlight by placing it in natural shade or providing shading.

Ref: [Solomon and Beech 2004](#).

Data requirements

You need to record:

- date and time of trapping;
 - length of fishing period;
 - water temperature;
 - count of glass eel and elver caught.
 - date and time of trapping;
 - an estimate of the proportion of the migrating population captured.
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Large catches

Where you catch very large numbers, it is acceptable to estimate the total numbers from an accurate count and weight of a representative subsample, and from the weight of the rest of the catch. The equation to use is:

$$N = ((\text{Weight of rest}/\text{weight of subsample}) \times \text{count of subsample}) + \text{count of subsample}$$

If you use this technique, record both the total (estimated) number and total weight of the catch.

6. Sampling silver eel

Methods

Available silver eel monitoring methods include:

- commercial eel traps;
- fyke netting, quantitative estimates can be made using MRR;
- resistivity fish counters;
- hydroacoustic imaging (Didson).

We recommend you use more than one method at a site where possible. The suitability of different methods is site specific. Contact your National eel group member or [Helpdesk Services](#) for advice.

Related documents

Guidance

- [149_03 Fish handling, storage and processing](#)
 - [426_13 Use of anaesthetics in fish monitoring](#)
 - [97_04 Using stop nets for fishery survey work](#)
 - [25_07 Fyke netting for monitoring fish](#)
 - [993_08 Electric fishing operations: equipment and working practices](#)
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