The Zoological Society of London's Citizen Science, European Eel Project Report 2013

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ZSL in partnership with Kingston University, The Wandle Trust, Medway Valley Countryside Partnership, North West Kent Countryside Partnership, Ham United, The Thames Rivers Trust, London Wildlife Trust, Friends of The River Crane Environment, Thames 21, The Wildfowl and Wetland Trust, The River Chess Association, Historic Royal Palaces, The Spelthorne Natural History Society and The Thames Anglers Conservancy.
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Contents

Executive Summary

- Over the past 30 years it has become apparent that European Eel (*Anguilla anguilla*) recruitment into European rivers has declined rapidly. Despite increased awareness of the situation and the development of action plans and legislation at local, national and European levels, numbers do not appear to be recovering on a large scale. In 2008 the International Union for Conservation of Nature (IUCN) classified the species as Critically Endangered.
- In 2005, ZSL set up its European eel monitoring programme to assess the presence of migrating juvenile eels, identify restrictions to their movements and gather long term data on trends in eel recruitment in the Thames catchment.
- In 2011, in order to expand this monitoring programme, ZSL began to enlist the help of volunteers and partnership organisations. ZSL now works with 14 partnership organisations and, to date, has trained 284 volunteers to become Citizen Scientists involved in the eel monitoring project. During the annual upstream juvenile eel migration period, April-October, Citizen Scientists check eel traps twice a week at eleven monitoring sites in the Thames catchment. The number and length of trapped eels are recorded before being released upstream of the trap. The recorded data are then uploaded to the ZSL database. At the end of the monitoring season, the data are fed into the Environment Agency's Eel Management Plan for the Thames River Basin District.
- ZSL's 15 monitoring sites, 11 citizen science sites plus 4 ZSL staff monitoring sites, represent the largest and most wide-ranging study on eel migration through a single catchment in the UK. The information from the study not only allows us to refine eel pass prioritisation by highlighting barriers to upstream eel migration, but it also provides a unique insight into eel recruitment into the Thames River Basin district, that has value at a national scale.
- In 2013, ZSL started working with our Citizen Science partners to make physical improvements to London's rivers to facilitate the upstream migration of eels. Two eel passes were installed, one on the River Darent and the other on the Hogsmill River. Our intention is to continue working with the Environment Agency to construct eel passes that will open up more habitat to eels.

1. Introduction

1.1. Background

The upstream freshwater migration of the European eel, *Anguilla anguilla*, starts in mid to late April each year on the River Thames. Elvers, juvenile eels, begin to migrate upstream when water temperatures warm to between 13°C and 14°C .There are plenty of historical accounts of the abundance of eels in the Thames; Londoners helped themselves as the 'river edges turned black with the countless bodies of wriggling elvers' during the migration. In 1832, Dr William Roots of Kingston upon Thames, perhaps the first eel citizen scientist, had a go at counting the number of elvers traveling upstream. He tied a length of string across the margin of the river and estimated 1600 elvers per minute passed over it (Wheeler, 1979). In recent years, more sophisticated monitoring programmes across Europe indicate that eel recruitment in rivers has declined dramatically when compared to pre-1980's levels. When comparing ZSL's own trapping data on the Rivers Darent between 2005 and 2010 to a study using the same methodology by Knights and Naismith (1988), a recruitment decline of over 99% is apparent (Gollock *et al.,* 2011).

The eel's life history is complex; it includes a 10,000km round trip migration from the Sargasso Sea to Europe and back (Schmidt 1922). Despite considerable amounts of research, the complexity behind its lifecycle makes it very difficult to determine the most significant reasons for the decline. Possible causes for the decline in recruitment, most likely acting synergistically, include anthropogenic factors such as overfishing, loss of freshwater habitat, pollution, the parasite *Anguillicoloides crassus ,* physical barriers to migration, poor condition of escaping silver eels, as well as natural changes in oceanic currents and climatic condition .In 2007, in recognition of worrying declines in recruitment across Europe, the European Union adopted Council Regulation No. 1100/2007, establishing measures for the recovery of European eel stocks. The regulation called on the UK and other member states to develop eel management plans. The European Commission approved the UK's Eel Management Plans in March 2010. In addition the European eel has been categorised as 'critically endangered' in the IUCN Red List of Threatened Species since 2008.

1.2. Eel populations in the Thames River catchment

Monitoring of the eel populations in the Thames catchment by the Environment Agency (EA) and its predecessors has been carried out using a variety of different methods. The most recent comprehensive review of monitoring data (Knights, 2005) concluded that the distribution of adult eels in the Thames catchment fits the pattern seen in other UK east coast rivers. Mean densities and biomass decline with distance from the Atlantic however mean body length increases. The limit of the Thames' eel population, appears to be at approximately 50-60 rkm upstream of the tidal limit in the main channel and the tributaries.

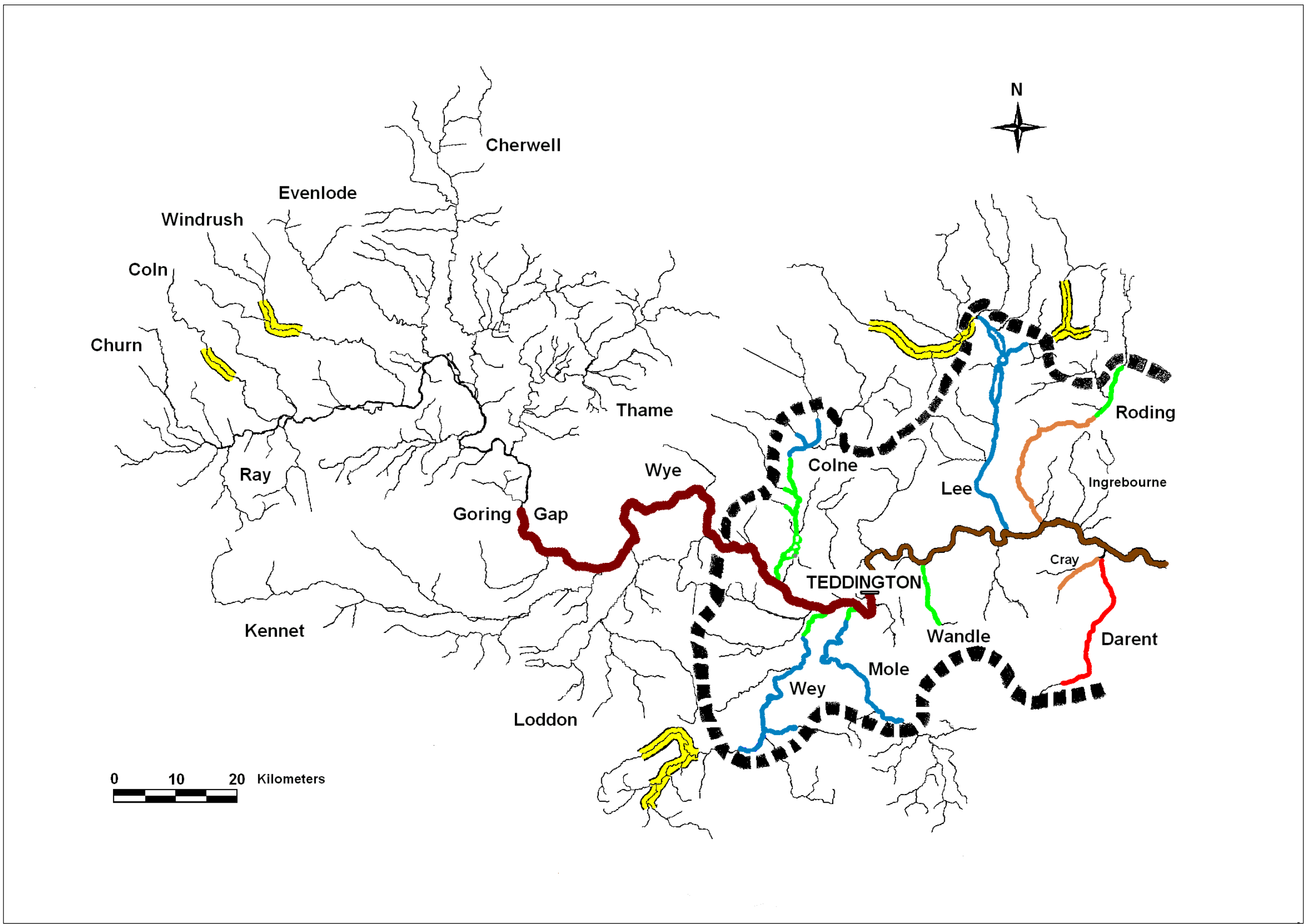


Figure 1: Distribution of eels in the Thames catchment in recent years. Core occupied area is delineated by heavy dotted line. River reach colours correspond to the Fisheries Classification System classes for eels (biomass g 100m-2, red > 572 (A); orange = 285-571 (B); green = 141-284 (C); light blue = 70-140 (D); dark blue > 69 (E); no colour = absent, F). Yellow coloured reaches are ones with evidence of stocking in 1993. Brown colours indicate distributions in the estuary and main river. (From Knights, 2005).

1.3. ZSL monitoring programme

ZSL's current European eel monitoring programme started in 2005. It aims to assess the status and trends of the number of migrating elvers (defined as eels less than 120 mm in length) and juvenile or 'yellow eels' in the tidal Thames and its tributaries, and to identify potential restrictions to their movements.

In year one, ZSL deployed simple eel traps, as shown in Figure 2, at barriers on the river Darent, Roding, Mole and Wandle. The trap is based on the Naismith & Knights (1988) design. It provides a gently sloping 'ladder' leading to a holding tank, with a flow of water running down the ladder to attract migrating eels. The ladder is made from a length of household guttering which is roughly lined with garden net to provide a suitable substrate for the eels to climb on. The ladder rests on the riverbed and the mesh left to trail in the water for approximately one metre. The traps are placed below weirs and water is gravity fed from the top of the weir, using a three centimetre diameter plastic water-pipe. The pipe supplies water into the holding tank and along the ladder. The holding tank is made from a 25 litre cold-water tank with windows in the sides to prevent it filling up and over-spilling, which are covered in a double layer of one millimetre mesh to prevent the eels from escaping. The tank lid is held in place by a metal brace which also supports the siphon pipe.

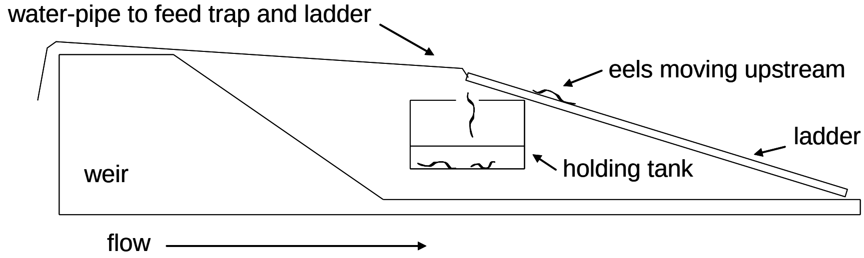


Figure 2: Elver trap schematic and an elver trap.

From 2005 to present, during the migration season, traps have been checked twice per week by ZSL field staff. Any eels found are measured and released upstream of the trap site. The programme is run in partnership with the EA and all data feeds into the Eel Management Plan for the Thames River Basin.

1.4. Citizen Science monitoring programme

A citizen scientist is defined as a volunteer who collects and/or processes data as part of a scientific enquiry. The citizen science approach has been adopted by a number of scientific fields however has arguably been put to best use by ecologists and conservation biologists. The UK has recently seen a proliferation in the number of citizen science projects. Some operate on a very large scale, for instance, almost 590,000 people took part in the RSPB's 2013 Big Garden Birdwatch. In his 2009 article, Silvertown cites three reasons for this explosion in citizen science; the internet now enables groups of people with a common interest to share data and communicate between themselves with ease, funding bodies often expect an element of education and outreach in research projects, both of which are inherent in a well-designed citizen science programme, and lastly, institutions like ZSL and many others have realized the value and benefits of working with citizen scientists.

In 2011, with thanks to generous funding from the Esmee Fairbairn Foundation, ZSL set about expanding the eel monitoring programme by working in partnership with a variety of other organisations and enlisting the help of volunteer citizen scientists. For the citizen science (CS) sites, ZSL and the EA provide the traps, monitoring equipment, training and some recruitment of volunteers whilst the partnership organisation coordinates trap checking and reports any faults with the trap.

2. Methods

2.1. CS and ZSL staff monitoring Sites.

The traps are sited at weirs or sluice gates ideally, on the tributaries, towards the confluence with the Thames. Other factors that have an influence on trap locations include the availability of local volunteers, accessibility, health and safety implications and freedom from theft and vandalism. In 2011, CS traps were located on four tributaries of the Thames; The River Crane at Crane Park, Hogsmill River at Middle Mill, River Cray at Hall Place and the River Wandle at Merton Abbey Mills and one site on the Thames itself at Teddington Lock. At the end of the third season of CS monitoring we have expanded the number of trap sites to twelve; eleven on the lower Thames tributaries, and one on the Thames at Molesey lock. Figure 3 shows the location of all but the River Chess Trap. CS trap National Grid References and their distance from the tidal limit are listed in Table 1.

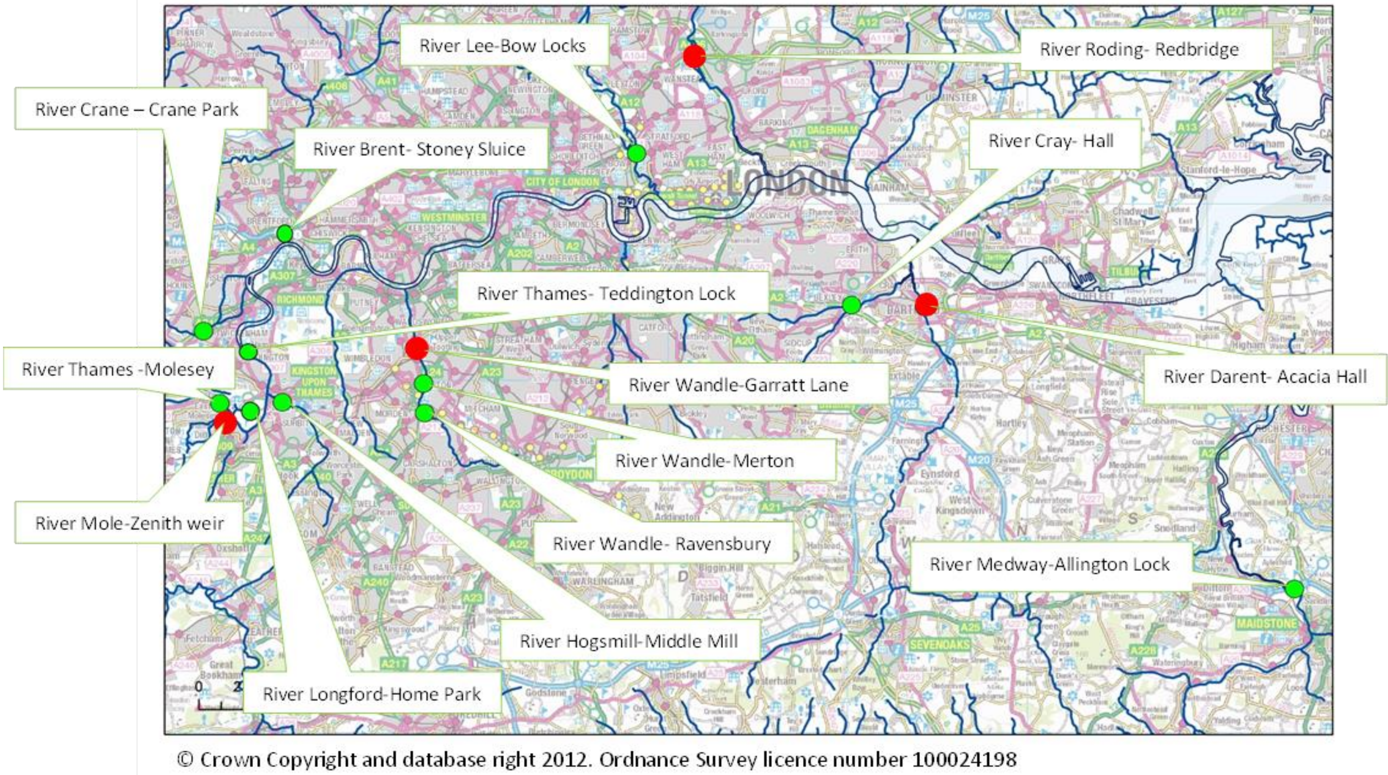


Figure 3: Map of the Thames catchment showing the 2013 eel trap sites. Red points represent traps monitored by ZSL staff and green points represent traps monitored through the CS project.

Table 1: National Grid references and distance from the tidal limit in river Kilometres (rKm) for the CS monitoring sites. A distance of 0 indicates that the trap is located within the tidal stretch of the river or at the tidal limit.

River	Site	Approximate Distance from tidal Limit (rKm)	National Grid Reference
Brent	Stoney Sluice	0	TQ 17443 77475
Chess	Chenies Bottom	>50	TQ 01437 98724
Crane	Crane Park Island	4.2	TQ 14155 72785
Cray	Hall Place	3.0	TQ 50209 74261
Hogsmill	Middle mill	3.8	TQ 1854268751
Lea	Bow Locks	0	TQ 38252 82860
Longford	Home Park	4.5	TQ 17497 68096
Medway	Allington Lock	0	TQ 74843 58171
Thames	Teddington Lock	0	TQ 16676 71548
Thames	Molesey weir	8.1	TQ 14712 69034
Wandle	Merton Abbey Mills	5	TQ 2639469823
Wandle	Ravensbury Park	8.3	TQ 26489 68100

2.2. CS Trap Design

The simple and easy deployment of the traps used since 2005 proved problematic when working with citizen scientists. In the first CS monitoring season of 2011, the light-weight traps (Figure 2) were prone to being damaged by high river water levels and spate flows at a number of sites. Volunteers can be discouraged from monitoring if traps break regularly, so from 2012 we developed more robust traps. Information on trap designs are included in the discussion section of this report.

2.3. Licensing

Licences were obtained from the EA for the trapping of eels under the Salmon and Freshwater Fisheries Act, 1975 and permissions obtained from landowners where appropriate.

2.4. Health and Safety and Volunteer Training

Risk Assessments are carried out for each site in compliance with the ZSL, EA and the partnership organisation's policies. The most important element of the programme is that all involved are working safely. To that end, all citizen scientists are obliged to attend a training session before they join the programme. Training principally consists of a health and safety briefing but also includes information on eel biology and instruction on how to collect the data and upload it to the ZSL website (Figure 4). Since the start of the CS monitoring, over 284 citizen scientists have attended a training session.

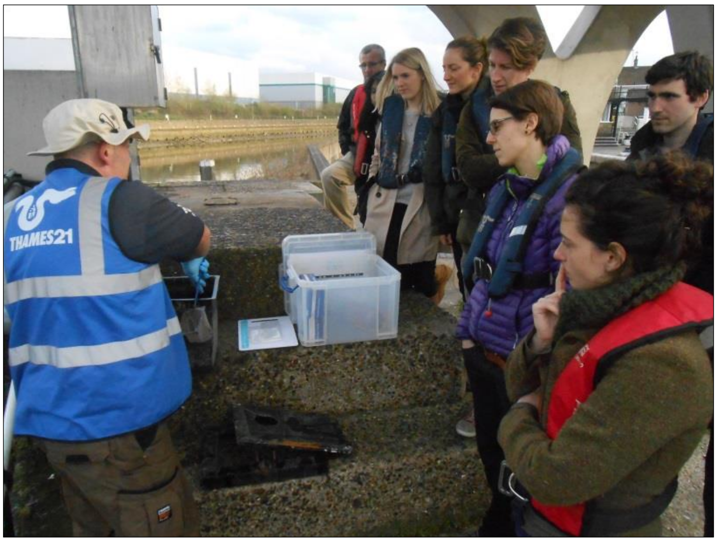


Figure 4: Training sessions on the River Lea and River Crane in 2013

2.5. Catch Handling

Trained CS volunteers check the traps twice per week during the monitoring period, from mid-April to the end of September. Eels are removed from the trap and held in a bucket of river water before being measured from the tip of the snout to the tail tip in mm. Eels of over 300mm in length are not measured and are recorded on the ZSL database at >300mm. On the occasions when more than fifty eels are present in a trap, a randomly selected sub-sample of 20% of the catch is measured, up to a total of fifty eels.

Once recorded, eels are returned to the river upstream of the trap as past studies show the majority will continue to swim upstream against the flow and therefore will not be recaptured.

2.6. Data Entry

Data are entered into the ZSL database by citizen scientists using a simple online form (MachForm). They enter the date of monitoring, their name, confirm if the trap was working or not during their visit, the number of eels and lengths in mm. There is also an optional section to add notes on other points of interest. All uploaded data are checked and standardized by the ZSL Project Officer. Any data anomalies or trap faults are followed up with a phone call to the site coordinator or a visit to fix the trap.

2.7. Outreach, CS Recruitment and Feedback

As part of the recruitment drive for volunteers in 2013, the ZSL Project Officer has given a number of talks on the project at universities, colleges, friends of groups and fishing clubs. In 2013 the project featured in the Sir David Attenborough family lecture organised by the Environment Trust for Richmond upon Thames. Recent articles on the project have been written for 'Talk of the Thames' (www.thamesweb.com), DEFRA's Biodiversity News (http//jncc.defra.gov.uk/pdf/UKBAP_BiodiversityNews-62.pdf) and the Freshwater Biological Association. In addition, in 2013, ZSL have showcased the project at the Thames Festival, River Crane festival, London Springtime Safari, and the Thames Estuary Partnership 'Thames Forum'.

Once recruited, we try to maintain long term engagement in the project by regularly updating our CS volunteers. Good practice for any CS project includes providing feedback and two-way communication between scientists and volunteers as it serves to increase the sense of community ownership around a project. We send out regular bulletins to our trap coordinators via e-mail and utilise social media, such as twitter and Facebook, as platforms to communicate CS findings amongst the citizen science community. In addition, at the end of the migration season, all our CS volunteers have been invited to the 'Citizen Science Eel Forum' at ZSL London Zoo (Figure 5). The forum gives ZSL an opportunity to thank volunteers, provide feedback on the outputs of the project and also encourages a free-flow exchange of information and ideas between citizen scientists and the invited expert speakers. In 2013 the speakers were Prof. Jonathan Bailie, ZSL Director of Conservation Programmes, Darryl Clifton-Dey, manager of the Thames Eel Management Plan and Senior Technical Specialist for the EA and Andy Thomas, Conservation Officer for the Wild Trout Trust.

Figure 5: CS volunteers and site coordinators at the 2013 ZSL Citizen Science Eel forum.

3. Results

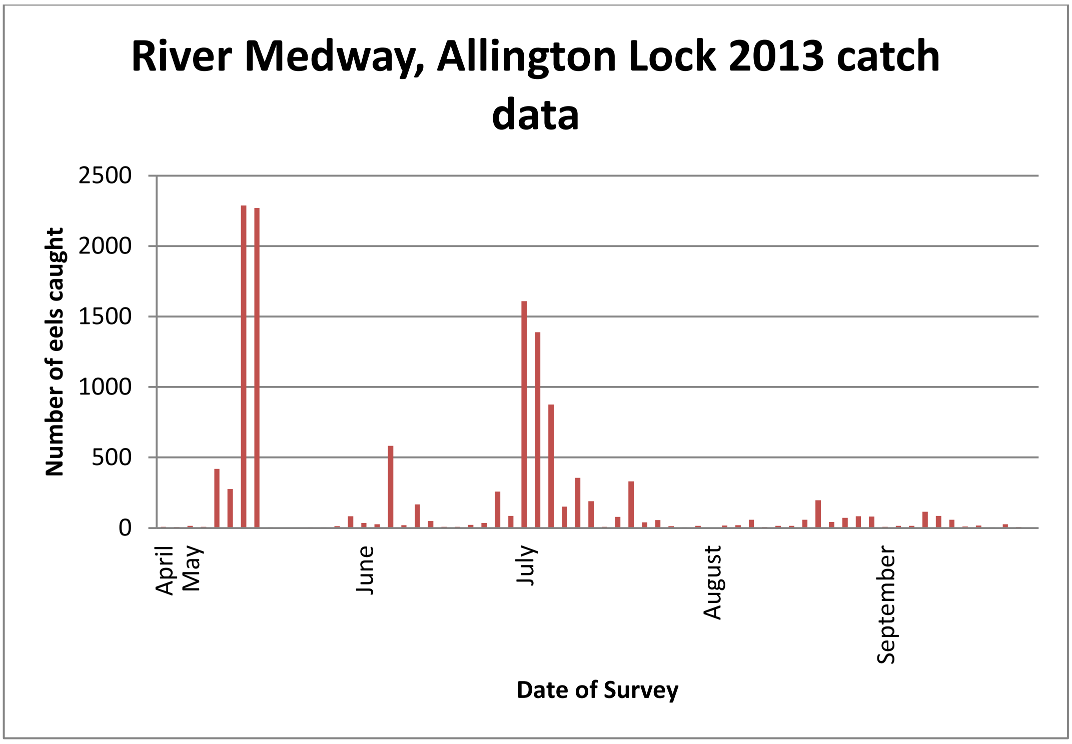
3.1 Catch totals

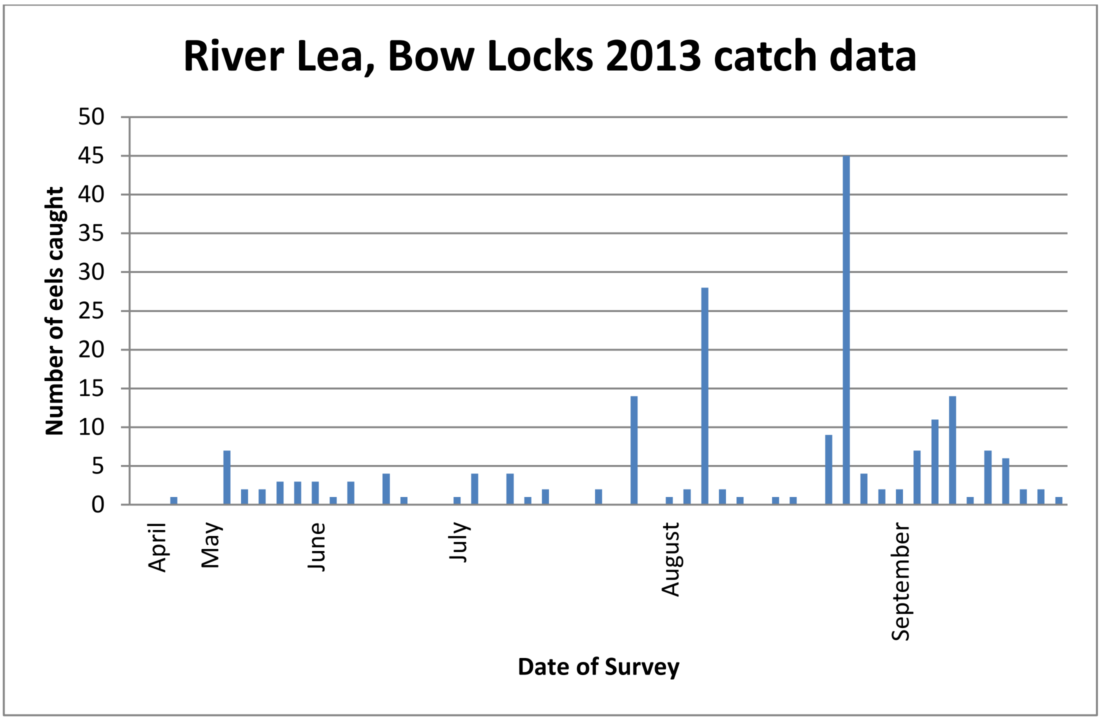
Table 2 shows the catch totals for the CS traps since 2011. During the first year of monitoring there were no eels caught in the traps on the Crane, Cray and Hogsmill. The Cray and Hogsmill sites have seen only minimal increases in total elver numbers between years. However, traps that joined the project in 2012 on the Thames at Molesey Weir, The lea at Bow Locks and the Medway at Allington Lock have seen large increases in total eel numbers between 2012 and 2013. The Wandle at Abbey MIlls is an exception to this, here the total numbers caught dropped from 139 in 2012 to 69 in 2013. The Medway caught the highest number of eels in 2013 with 12802.

Table 2: Total number of eels caught and, in brackets, the percentage of the catch that are elvers (<120mm) from all CS sites 2011 to 2013.

	Total eel catch 2011	Total eel catch 2012	Total eel catch 2013
Brent-Stoney sluice	-	-	1239 (75%)
Chess - Chenies Bottom	-	-	0
Crane - Crane Park	0	0	0
Cray - Hall Place	0	1 (100%)	3 (67%)
Hogsmill -Middle Mill	0	1 (0%)	7 (58%)
Lee - Bow Locks	-	13 (100%)	208 (71%)
Longford-Home Park	-	-	49 (98%)
Medway - Allington Lock	-	1079 (91%)	12802 (99%)
Thames-Teddington Lock	trap trial	-	trap trial
Thames - Molesey Weir	-	133 (23%)	2473 (99 %)
Wandle - Ravensbury Park	-	-	5 (0%)
Wandle - Merton Abbey	trap trial	139 (14%)	69 (32%)

In 2013, the first eels were caught at Allington Lock on the Medway on April 25th, on the Lea the first eels where caught only a day later on April 26th. Eels where not caught on the Thames at Molesey until May 11th (figure 6). The Medway continued trapping throughout the season with peaks of 2289 and 1610 in one monitoring session on May 8th and July 2nd respectively. On the lea the peak numbers arrived later in the season with the biggest single catch of 45 on August 26th. At Molesey the biggest single catch of 314 was on July 2nd.





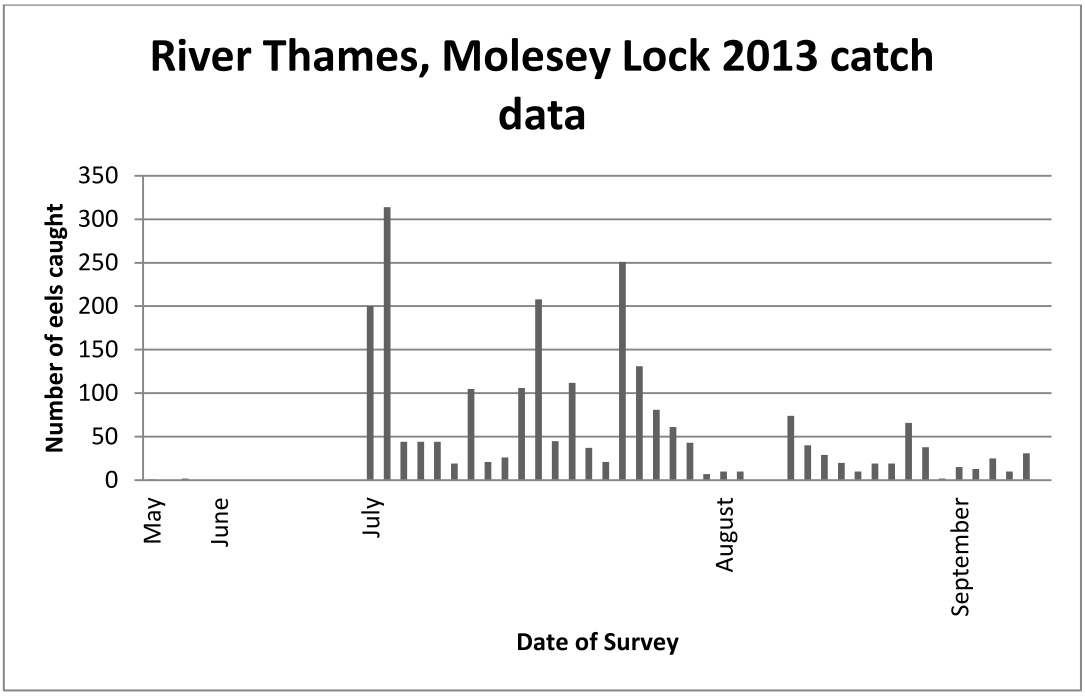


Figure 6. Total number of eels caught throughout the 2013 season On the Medway, Lea and Thames CS traps.

Catch per unit effort (CPUE), shown in Figure 7, was calculated based on the number of eels caught per day of active trapping. In 2013, CPUE greatly increased at Allington lock on the Medway from 10.9 to 133.35, at Molesey Weir on the Thames it increased from 0.8 to 14.6 and at Bow Locks on the River Lea it increased from 0.9 to 1.5. Only Abbey Mills on the Wandle saw a decline in CPUE which dropped from 0.97 in 2012 to 0.64 in 2013.

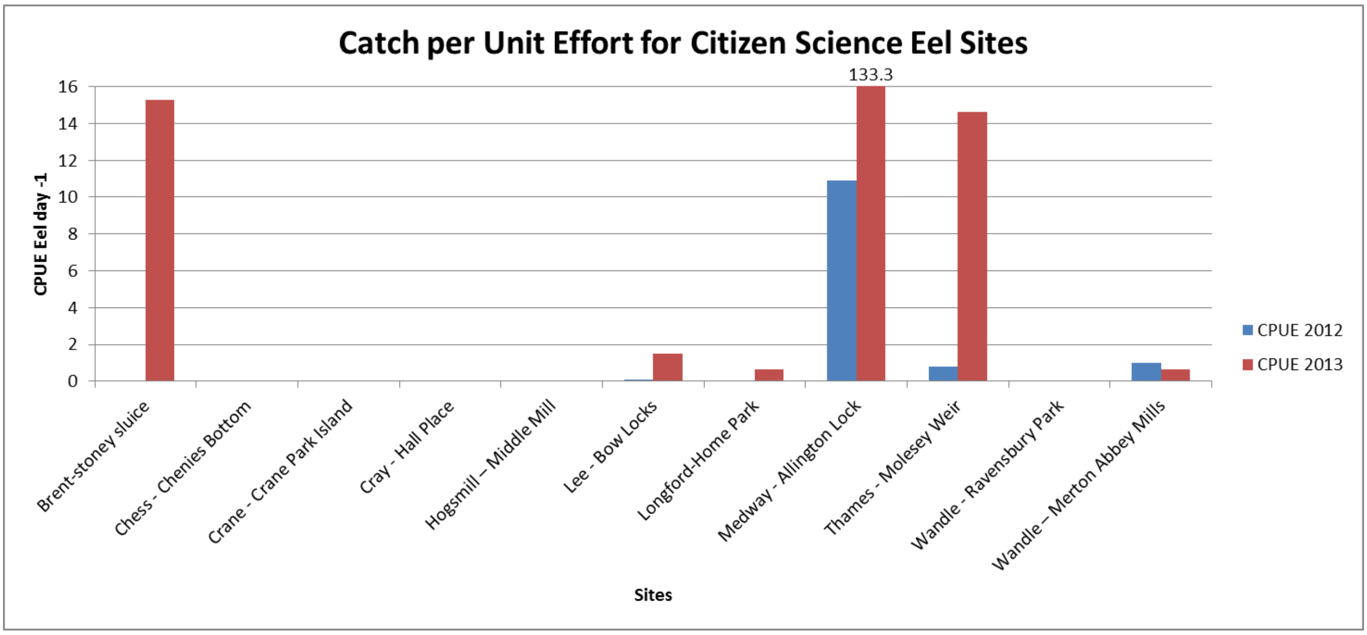


Figure 7: Catch Per Unit Effort (CPUE) for citizen science sites in 2012 and 2013.

4. Discussion

In order to draw any conclusions or apply any analysis of value on elver migration trends, we must first have three years of comparable trapping data collected using consistent methodology. At a number of sites, such as the River Thames at Molesey, for example, adjustments have been made to traps between monitoring seasons that will have implications on their trapping efficiency. In addition, direct comparisons between sites should not be made as a variety of trap designs are now in use on the project. An unsurprising pattern that is emerging is that those traps nearest the tidal limit (Brent, Lea and Medway) are catching larger numbers of eels than those further from the tidal limit (Crane, Cray, Chess, Wandle). The Thames at Molesey is an obvious exception to this pattern. The high eel abundance at this site is probably explained by its location on the main River Thames, where eels have entered the catchment via the estuary and the low number of barriers between the trap site and the tidal limit. Barriers such as weirs and sluices certainly appear to have an impact on the catch data, this is further discussed for each site below.

4.1. Site summaries

4.1.1. River Brent –Stoney Sluice

Partners: Thames Rivers Trust

2013 was the first year of monitoring on the River Brent with the Thames Rivers Trust (TRT). In 2011 TRT were awarded a grant from the DEFRA River Improvement Fund, administered by the Rivers Trust, to build three eel passes on the lower section of the River Brent; One pass at Osterley Weir, one at Boston Manor Weir and one at Stoney Sluice, Brentford. During the planning stages of the project, Stoney Sluice was selected as a suitable site for citizen science monitoring. The eel pass and trap shown in figure 8 operated between 8th May and 1st August and trapped 1,239 eels. A series of problems however including eels dying in the pipework of the pass resulted in it being turned off before the end of the migration season. A CPUE of 15.3 at this site is very positive. Given 2013 appears to have been a good year for eel recruitment into the Thames catchment and Stoney Sluice's position at the top of tidal section of the Brent, a good number of eels perhaps could have been expected. The good recruitment into the lower Brent highlights the need to aid eel passage further upstream. ZSL and TRT have produced a report on the barriers upstream of Stoney Sluice, up to Costons Lane Weir (available from ZSL); it highlights the need to aid eel passage over Osterley Weir (the pass installed by Aquatic Control Engineering is not currently working). The passage of eels over Osterley weir is crucial as there is 4.5 km of good eel habitat upstream between Osterley and the next major barrier on the River Brent, Costons Lane weir. In addition, the Grand Union Canal diverges from the river just upstream of Osterley through which eels could access a large proportion of the UK canal network.

Figure 8: The eel pass installed by Aquatic Control Engineering at Stoney Sluice.

4.1.2. River Chess- Chenies Bottom Weir

Partner: The River Chess Association

Members of the River Chess Association (RCA) contacted the project in January 2013, having read about the project in the GIGLer magazine (http://www.gigl.org.uk/GiGLer/?cat=130). Members of the RCA have recorded a small number of yellow eel in the River Chess in the vicinity of the monitoring site. Given the monitoring site is more than 50 rKm upstream of the tidal limit, we anticipated the zero catch at this site for the first year of monitoring. It is likely that the yellow eels found in the River Chess are a remnant of an EA (or its predecessor organisation) elver stocking in the 1980s. Large numbers of elvers where released into the Chess and other tributaries of the River Thames in this period although the records are hard to retrieve (personal communication, Tom Cousins).

Figure 9: River Chess Association Citizen Scientists

4.1.3. River Crane-Crane Park

Partners: The London Wildlife Trust (LWT) and Friends of River Crane Environment (FORCE)

At the end of the third year of monitoring at Crane Park on the River Crane, using a simple trap (figure 2), we are yet to record the presence of upstream migrating eels in the river. In response to the apparent lack of upstream migrating eels ZSL, LWT and FORCE undertook a survey of the barriers in the lower River Crane to elucidate the causes behind the absence of trapped eels. The report concludes that the issue of barriers to migration, in the downstream reach of the River Crane, is superseded by a more pressing need to restore and rehabilitate the general ecological health of this stretch of the river. Eel migration into the Crane, upstream of Mereway Weir, can be facilitated by adding passes onto two barriers on the Duke of Northumberland's River, a tributary of the River Crane that joins the River Thames at Isleworth. One at Kidds Mill Sluice very close to the confluence with the Thames and the other, a little further upstream, at the Mogden Sewage Treatment works. The full report can be obtained from ZSL.

4.1.4. River Cray- Hall Place

Partners: North West Kent Countryside Partnership

This is the third year of monitoring at Hall place on the River Cray. The trap design for this site is as shown in figure 2. In 2011, no eels were caught, in 2012 one elver was caught and in 2013, three eels were caught, two of which were elvers. Given that eels traveling upstream from the Thames estuary would have to pass Vitbe Sluice, a considerable barrier to the migration of all fish species, it is surprising that there is any recruitment at all into the River Cray. Removal of Vitbe Sluice is an Eel Management Plan and Water Framework Directive priority for the EA who are currently considering their options for the site following 2012's trial adjustments to the structure. North West Kent Countryside Partnership and ZSL are supportive of plans improve eel and other fish passage at the barrier.

4.1.5. Hogsmill River-Middle Mill

Partners: Kingston University

In 2011 we monitored at Middle Mill on the Hogsmill with a simple trap (figure 2). No eels were recorded in 2011. In 2012, with funding from the EA, we replaced the trap with the more robust trap shown in Figure 10. Eels move up the brush substrate lined lower section of the pass; halfway up the pass, they enter the trap chamber and pass through two funnel shaped restricted apertures. Once in the trap they are unable to locate the exit. These new trap designs were intended as pilots for review at the end of the first season of trapping. In the 2012 season we recorded one yellow eel at this site.

At the end of the 2012 migration season we viewed this site as the most interesting anomaly uncovered by the CS project. In two years of monitoring we had yet to record an elver at Middle Mill, but there appeared to be no obvious barriers downstream. Working with the South East Rivers Trust (SERT), we further inspected the structures downstream of Middle Mill and determined that Clattern Bridge, near the confluence with the Thames, was a barrier to eel passage. With thanks to funding from the Association of Rivers Trusts, SERT in partnership with ZSL and the Thames Anglers Conservancy attached a row of eel tile to the smooth concrete river bed underneath Clattern Bridge (Figure 11). This work was completed on 12th August 2013 and seven days later, on 19th August, we trapped the project's first elvers at Middle Mill. In total seven eels were caught in 2013 at Middle Mill, three yellow eel, before the eel tiles were positioned at Clattern Bridge and four elvers trapped after the work at Clattern Bridge was completed.

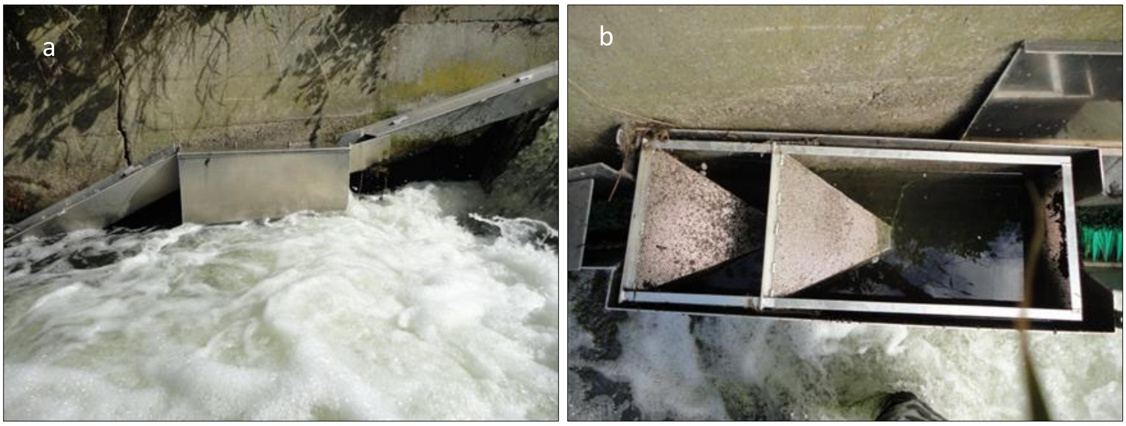


Figure 10: a, The eel pass with trap on the Hogsmill River at Middle Mill and, b, open lid aerial view of trap .

Figure 11: Attaching a row of eel tiles to the riverbed at Clattern Bridge

4.1.6. River Lea-Bow Locks

Partners: Thames 21

2013 was the second monitoring season at Bow Locks on the River Lea. In 2012, ZSL and Thames 21 worked with the Canal and Rivers Trust and the EA to integrate an eel trap into the exiting eel pass at the site. As shown in Figure 12, the trap is positioned on the 'out flow' pipe of the Bow Locks eel pass. Eels crawl up the bristle board ramp (not visible in figure 12) to the apex of the pass. Once at the top they drop down the pipe which had formerly guided them into the River Lee Navigation from the tidal section of the river.

In 2012, 13 eels were caught at this site and in 2013 this increased to 208. This represents a 16.6 fold increase in CPUE. In addition to gaining data on eel movement at the site, CS volunteers have routinely cleaned the pump screen in order to keep the pass operating properly. A plastic bag lodged in the impeller in 2013, meant that the Canal and Rivers Trust had to replace the pump and the pass was out of action for 15 days.

Now the project has demonstrated eel recruitment into the lower Lea. It is hoped that a monitoring site can be found further upstream on the river in order to assess if these elvers can make their way upstream of the lea's tidal barriers at Three Mills Lock and Three Mills River Sluice.

Figure 12: The modified eel pass with trap at Bow Locks on the River Lea

4.1.7. River Longford - Home Park

Partners: Historic Royal Palaces

This trap was set up by UCL masters Student, Amy Pryor as part of her investigations into the hydrological connectivity of the complicated network of managed, man-made ditches in Home Park. 48 elvers and 1 yellow eel trapped at this site in only 79 days of trapping in 2013 demonstrates recruitment onto the site and its potential as an important backwater habitat for eels on the lower non tidal Thames. Amy makes a number of recommendations to improve connectivity on the site which ZSL will work with others, such as Thames Landscape Strategy to achieve.

4.1.8. River Medway - Allington Lock

Partners: Medway Valley Countryside Partnership

Figure 13 shows the bespoke trap that was constructed to monitor eels using the eel pass around the Sluice gates at Allington Lock; the top of the tidal limit on the River Medway. 2013 was the second season of monitoring at this site and the catch increased from 1079 in 2012 to 12802 in 2013. This represents a 12.2 fold increase in CPUE.

In 2012, in addition to catching eels, the trap also caught 8119 Chinese mitten crab (CMC), *Eriocheir sinensis,* an invasive non-native species. The supply of live chinese mitten crab has allowed the project to form links with researchers at Royal Holloway University of London (RHUL). In 2013 the number of CMCs caught dropped to 134. Because of concerns about the numbers of crabs trapped and their possible effect on the trapped elvers, volunteers and staff at MVCP were more systematic about preventing CMS's accessing the trap this year. This was done by attaching a mesh across the trap opening on three out of every four days the trap was in position. However, this does not account for such a significant drop in the numbers of CMCs caught.

Also in 2012, 14 sea lamprey (*Petromyzon marinus*) were caught by the trap. The sea lamprey, a protected Annex II species, is a jawless fish resembling an eel; these trapped individuals appear to be the first reports from the Medway in recent history. It is an anadromous species, spending its adult life as a parasite in the ocean before entering rivers looking for clean gravel for spawning. Ammocoetes, larval sea lamprey, spend the first few years living in river silt or sand before migrating to the ocean. None were caught in 2013

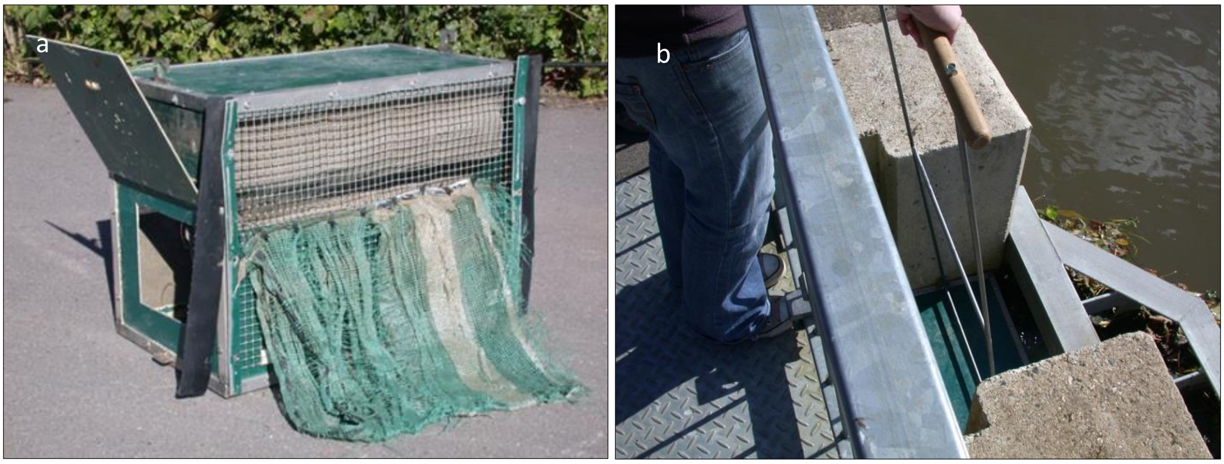


Figure 13: a,The bespoke eel trap and, b, the trap being lifted out of the top of the eel pass at Allington Lock.

4.1.9. River Thames-Molesey Weir

Partners: Thames Anglers Conservancy

133 eels were trapped in 2012, the first monitoring season at this site. The trap design at Molesey (Figure 14) is similar in design to the trap on the Hogsmill, but the mesh size on this trap was constructed at 6mm and small elvers were seen escaping from the trap. In the winter of 2012 the trap was fitted with 2mm mesh, ready for the 2013 migration season. In 2013 the CPUE rose from 0.82 to 14.63. The fact that the percentage of elvers trapped also increased from 23% to 99.4% suggests that the large increase in numbers of eels trapped is, to some extent, a result of the modifications made to the trap between the migration seasons. However, given the catch sizes at other sites, it is unlikely that the increase can be solely determined by modifications to the trap. We lost 17 days of trapping in June 2013 due to adjustments in the upstream river level made to allow work to proceed on the new Sluice gates at Molesey weir.

Data from this site is critical as it illustrates recruitment is occurring upstream of tributaries where we have been recording zeros or near zeros such as the Crane, Cray and Hosgmill.

Figure 14: The eel pass and trap on the River Thames at Molesey Weir with members of the Thames Anglers Conservancy.

4.1.10. River Thames – Teddington Lock

Partners: Ham United

In 2011, ZSL and the EA trialled a solar powered eel trap at Teddington Lock which was beset by a number of technical faults. In 2013 the EA commissioned a new solar powered eel pass and trap at the Teddington Lock boat rollers. The pass and trap were running for a trial period between the 6th and 27th August, and were monitored by ZSL staff, one elver was caught. The main purpose of this trial was to ensure that the new eel pass and trap were working and operating protocols could be developed ready for the trap to be monitored by citizen scientists from the Ham United community group in 2014.

4.1.11. River Wandle-Abbey Mills

Partners: The Wandle Trust and the Wandle Heritage Trust

In 2011, ZSL ran a pilot study at this site using two traps as shown in figure 2; the traps proved unsuitable for the site. In September 2011, The Wandle Trust built the permanent eel pass and trap, with integrated CCTV (Figure 15), over the weir at Abbey Mills. 139 eels used the pass during the 2012 monitoring period of which 14% were elvers. The CCTV proved invaluable in studying the behaviour of the eels using the pass and informed important modifications to the pass to improve its efficiency. The Wandle Trust worked with Jiamin Xu, a masters student from Kings College, University of London, who concluded that minor design changes in pass design can lead to large changes in eel behaviour in the pass. Her report is available through the Wandle Trust (www.wandletrust.org).

In 2013, 69 eels were caught at the site, the majority of which (55) where caught after some minor flow adjustments were made to the pass on 24th August. This may account for the drop in CPUE from 0.97 in 2012 to 0.64 in 2013.

Figure 15: a) the eel pass and, b) trap at Merton Abbey Mills on the River Wandle.

4.1.12. River Wandle – Ravensbury Park

Partner: The Wandle Trust

2013 was the first full year of monitoring at Ravensbury Park, five yellow eels were trapped recorded and released. No elvers were found at this site, given the distance from the tidal limit, this is not unsurprising. The EA conducted one of their biennial, triple pass, electric fishing eel surveys at six sites on the River Wandle in 2013. At Morden Hall Park, just downstream of Ravensbury Park, 21 eels were recorded all measuring in excess of 200mm. The Wandle Trust is continuing to aid eel passage in the River Wandle. A project to make the Ravensbury Park 'by-pass channel' passable was completed in 2013.

5. Eel Passes

During the first two years of the project, 2011-12, the emphasis was on identifying volunteer groups, establishing monitoring sites, gathering data and education. In 2013 the project has shifted to emphasising the role of our volunteers as stewards of London's rivers and work with our CS partners to aid upstream eel migration in the Thames catchment. This work started with the construction of two eel passes in 2013; the first under the A225 Road Bridge on the River Darent, with the North West Kent Countryside partnership (see Figure 16), and the second at Clattern Bridge on the River Hogsmill (Figure 11), with South East Rivers Trust and The Thames Anglers Conservancy. River barriers such as weirs prevent or hinder upstream migration and reduce the amount of available habitat to eels. The EA has identified 2,393 barriers within the Thames catchment. To provide passes to all these barriers is a monumental task, but the CS programme will add much needed capacity to tackle the problem. With our partners and under guidance from the EA, we will work to build more eel passes by raising funds to engage pass construction companies or, where appropriate, support volunteer groups to do the work necessary to aid upstream eel passage.

Figure16: A 'bristle board' eel pass being installed on the River Darent with the North West Kent Countryside Partnership.

The project continues to work to fill gaps in knowledge of where principle barriers are located on the Thames, Medway and their tributaries. To date the project has produced river barrier survey reports on the rivers Crane, Brent and Darent. These rivers (or sections of river) have been chosen for survey as their barriers have not been assessed in EA commissioned reports, such as Solomon (2011) and Solomon (2010), nor are they covered in the 2010 report by Solomon and Clifton-Dey on the 'passage of elvers and small eels in the Lower Thames Tributaries'.

The sites, in the Thames Catchment highlighted by the EA and ZSL as high priority for improved eel passage are listed in Table 3.

Table 3: Thames Catchment Barriers prioritised by ZSL and the EA for the provision of eel passes.

River	Site	National Grid reference	Source
Brent	Osterley Weir	TQ 15810 78955	ZSL/EA
Ingrebourne	Frog Island Sluice	TQ 5097681021	Solomon, Clifton Dey 2010
Mar Dyke	Tidal Sluice	TQ 5482878737	Solomon, Clifton Dey 2010
Cray	Vitbe Sluice	TQ 52798 75400	Thames eel management plan
Crane	Kidds Mill	TQ 1658875952	ZSL
Crane	Mogden STW	TQ 1541775192	ZSL

6: Future of the Project

In 2014 we hope to add new monitoring sites to the project on the River Ash, with the Spelthorne Natural History, Teddington Lock with Ham United and potentially a pass and trap on the River Wey with Surrey Wildlife Trust. In addition, as mentioned above, now the project has demonstrated evidence of elver recruitment into the Lea and Brent at 0 rKm from the tidal limit it is important we find suitable monitoring sites further upstream on these catchments. This will allow us to see if elvers can pass the barriers on the lower reaches of these rivers.

The project will not continue monitoring on the River Crane at Crane Park or on the River Cray at Hall Place until barriers downstream of these sites have been made passable. Three years of recording zero or a near zero catch is enough to demonstrate problems exist to eel recruitment into these rivers.

From February 2014, the generous funding from the Esmee Fairbairn Foundation comes to an end. ZSL is working hard to secure funding for the future of this programme.

7: Conclusion

In contrast to many terrestrial citizen science projects such as the Big Garden Birdwatch, monitoring fish migrations is inherently more complex and more demanding on citizen scientist's time. The ZSL eel project however has demonstrated that a significant number of volunteers are motivated enough to support such projects. Working with citizen scientists over three eel migration seasons has allowed us to increase the number of eel trapping sites to fifteen in a very cost efficient manner.

The project now represents the largest and most wide-ranging study on eel migration through a single catchment in the UK. The information from the study not only allows us to refine our eel pass prioritisation by highlighting barriers to upstream eel migration. It also provides a unique insight into eel recruitment into the Thames River Basin district that has value at a national scale.

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Photo Credits

All photos are ZSL other than figure 13 a,(Paul Clark, NHM) and figure 15 a and b, (Tim Longstaff, Wandle Trust).

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