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AN OUTLINE OF THE BIOLOGY, DISTRIBUTION AND CONSERVATION OF LAMPREYS IN IRELAND

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CONTENTS

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INTRODUCTION

The brief of this study was to review the information on lamprey species in Irish freshwaters, with particular reference to their spawning sites. It was recommended that the resulting report should have a particular regard to information relevant to the selection and designation of sites as Special Areas of Conservation under the Habitats Directive (92/43/EEC). To fulfil this remit, existing data on the distribution of lampreys in Ireland were collected from individual fisheries biologists and from the published literature. An introduction to the biology of the species and some recommendations for their conservation are also presented.

Three species of lamprey occur in Irish waters: the sea lamprey *Petromyzon marinus*, the river lamprey *Lampetra fluviatilis* and the brook lamprey *Lampetra planeri*. The brook lamprey is an entirely freshwater animal. The other two species spend most of their adult life in the sea, but migrate up rivers to spawn. Their resultant larvae live in river sediments. Throughout Europe, all three lamprey species are recognised as being in need of protection because their populations have decreased substantially.

In Ireland and most parts of Europe, lampreys are not commercially exploited. They have, therefore, largely been ignored by fisheries protection agencies. Indeed, they have received little attention at all and it is hoped that this short account will help to give them a place in the minds of more people and hence a better chance of survival. The lamprey populations in Ireland are, at present, still large enough that their successful protection, now, could play an important role in the conservation of these species in Europe.

BIOLOGY

Together with the marine hagfish, lampreys are the only survivors of the most primitive group of vertebrates, the Agnatha or jawless fish. With the help of fossil records, the appearance of the first agnathans can be dated back to the geological era known as Ordovician, which started about 500 million years ago. Jawed fish (Gnathostomata) arose approximately 70 million years later during the Silurian. They are assumed to have evolved from agnathan ancestors.

Apart from a study of *L. planeri* by Gibson (1953) which examined the size and fecundity of adults and the stomach contents of larvae, no work on the biology of lampreys has been carried out in Ireland. Lampreys have no jaws, scales or paired fins. Their mouth is a toothed sucking disc and their body is eel-shaped. They have distinct eyes, seven gill slits on each side of their body, a single nostril between the eyes and fins running along their back and surrounding their tail (see Figures 1-3). As mature adults, the three species can easily be distinguished by their size, colour, the shape of the dorsal fins and the shape and arrangement of their teeth (Table 1).

Table 1 Distinguishing features of adult sea, river and brook lampreys.

Species	Size	Colouration	Fins	Teeth
Sea Lamprey	50-100cm	Yellow-brown to brown-grey back with black mottling, whitish belly	2 distinct dorsal fins	Numerous, sharp
River Lamprey	30-40cm	Green-brown to dark grey back, whitish belly	2 distinct dorsal fins	Few, large, sharp
Brook Lamprey	12-18cm	Dark brown or grey back, whitish belly	Dorsal fins joined	Few, blunt

Brook lampreys remain in freshwater all their lives. After the transformation from larvae to adults in late summer or autumn, they continue living in the river or stream sediments. They are non-parasitic and, in fact, never feed as adults. When they

reach sexual maturity, they migrate short distances upstream and spawn at about the same temperature and time of year as the river lampreys.

Sea and river lampreys often spawn in the lower reaches of rivers but also migrate 50 miles and more upstream. They build nests (redds) and spawn in large and small rivers, usually at the downstream end of pools where there is a swift current. Sea lampreys like sediments made up of small cobbles and pebbles for spawning, whereas river lampreys prefer a sandy or gravely sediment. Both species spawn in pairs or small groups. The male often arrives first at a suitable spawning site and starts building a nest. He attracts a female and they complete the redd together. When building nests, the lampreys first remove stones by sucking onto them with their mouth. Then they attach themselves to a big stone and, by vibrating their bodies over the nest area, stir up small sediment particles which are washed away by the current. Once they have created an oval depression slightly longer than their bodies, spawning begins. The female attaches herself to a big stone at the upstream end of the nest, the male then sucks onto her body near the head and winds himself around her. They then release eggs and sperm, and the fertilised eggs fall into the nest. The sticky outer layer of the eggs, attaches them to sand particles. As the female is only able to release a small number of eggs at a time, the lampreys mate several times. The continuous disturbance of the fine sediment particles throughout the spawning activity ensures that the eggs get safely buried.

Brook lampreys also tend to spawn at the downstream end of pools, but often in smaller rivers and in slightly shallower and slower flowing water than their bigger relatives. Usually ten or even more individuals build a nest in sandy or gravely sediment and spawn in a group (Figure 5). All adult lampreys die after spawning.

Young lampreys look very different to adults. Lamprey eggs hatch to produce little creatures with no sucking disc, no teeth, their eyes buried beneath a layer of skin and, in the case of river and sea lampreys, a life style entirely different from the adult.

The larvae, called ammocoetes (am-o-seats), hatch about two weeks after the eggs are laid. They then swim out of the nest and are washed downstream, where they accumulate in areas with slower water current, for example backwaters, current eddies or behind big stones on the river bed. There the ammocoetes burrow into stable sandy silt rich in organic matter, where they remain until they are transformed into adults (Hardisty and Potter, 1971a). They feed on micro-organisms and detritus which they suck up from the surface of the sediment surrounding their burrows. They are preyed on by other fish, such as minnow, stickleback, trout and eel, and by birds.

Ammocoetes of the three species look very similar and are often found at the same locations. However, *L. planeri*, due to its smaller size and purely freshwater life cycle, can additionally inhabit small streams and river sections above dams and weirs, which are not accessible to the other two species (Lelek, 1980), and consequently has a tendency to occur closer to the head-waters than the other species (Hardisty and Potter, 1971b).

Lamprey ammocoetes vary in length from 1- 16 cm. Some are nearly translucent whereas others have a grey-brown back and a whitish belly. Their mouth is covered by the hood-like upper lip and equipped with a filtering mechanism to separate the food from the water (Figure 4).

After 3 to 6 years, the ammocoetes have usually grown enough to change into small adults which are about 10 - 15 cm long, have eyes, teeth and a sucking disc. This transformation takes place between July and September and is completed within a few weeks. After the transformation into adults, *L. planeri* remain in freshwater, whereas *L. fluviatilis* and *P. marinus* usually migrate to the sea and only return to the rivers to spawn (Maitland and Campbell, 1992) (Figure 5).

Adult *L. planeri* do not feed, but adult *L. fluviatilis* and *P. marinus* are parasitic and feed on a variety of fish in the sea (Maitland and Campbell, 1992). They usually stop feeding when they re-enter the rivers to spawn (Hardisty and Potter, 1971b).

During the last few years, anglers and commercial netsmen have noticed lamprey numbers declining in the Blackwater, Slaney and Barrow catchments (A. Deppeler; W. Köpke; N. McCormack, pers. comm.). Water pollution and river barriers obstructing migration are probably at least partly responsible for this decline (Maitland, 1980). According, to observations made in the River Barrow catchment. the increased occurrence of flash floods as a result of land drainage schemes also has a major negative impact on lamprey populations (W. Köpke, pers. comm.). Such floods destabilise the river sediments and damage the ammocoete habitat.

DISTRIBUTION

Methods

For this review some 75 people were contacted and asked about their recent observations concerning the lamprey species in the Republic of Ireland. In the following section on distribution, the name of the person who reported the occurrence of lampreys at a particular location is added in brackets when this site is referred to in the text. The use of information from published literature is indicated in the usual way.

This report is mainly based on observations made between 1980 and 1995, but some information from the 1970s (15 sites), the 1960s (2 sites) and the 1950s (1 site) was included. There are a few conspicuous places where lampreys have been observed by several people (the Salmon Weir Bridge in Galway and the Municipal Waterworks in Cork for example), but generally the presence of lampreys is not obvious. When they are observed it is usually when work on other freshwater organisms is being carried out and the species of observed lampreys is often not determined. However, several people who encountered lampreys in the course of their work were interested in them and collected detailed and very valuable information on their occurrence.

Because no surveys aimed specifically at lampreys have been carried out, the information collected in this study does not reflect their true distribution. Consequently, this report indicates areas where lampreys do occur, but the absence of records from rivers does not mean that there are no lampreys present.

The freshwater sites at which lampreys are known to occur (Figure 6) are here presented according to the hydrometric areas used by the Environmental Research Unit (Clabby *et al.*, 1992) (Figure 7). This organisation of the data was chosen because of the overlapping habitats of the three species and because of the great number of unspecified lamprey records.

Hydrometric Area 1

P. marinus was observed spawning in the tidal reaches of the River Foyle and unspecified lampreys were reported to be common and relatively widespread in the Foyle catchment. They were noted in the Foyle, the Finn and the Mourne Beg (W. G. Crawford).

Hydrometric Area 6

Lampreys were found in the lower reaches of the River Castletown (D. Douglas) and in the upper and lower reaches of the River Fane (M. Byrne). The species were not determined. In the River Fane they were found in three consecutive years (1993, 1994 and 1995).

Hydrometric Area 7 - River Boyne Catchment

Unspecified lampreys were found in the River Yellow (L. Finnegan) and L. *planeri* in Lough Bane (C. O'Keeffe).

Hydrometric Area 8

In the lower reaches of the River Nanny, unspecified lampreys were caught during electrofishing surveys in the years 1993, 1994 and 1995 (M. Byrne).

Hydrometric Area 9

L. planeri were observed in the middle reaches of the rivers Dodder (M. Kennedy; E. Moorkens) and Liffey (J. Woodlock). Ammocoetes of the same species were found in the middle reaches of the Liffey (M. Kennedy). Unspecified lampreys were caught in three consecutive years (1993, 1994 and 1995) in the lower reaches of the Rye Water (F. Kelly), which is a tributary of the Liffey.

Hydrometric Area 10

Unspecified lampreys were found in the middle reaches of the River Dargle (M. Byrne) and in its tributary, the River Glencullen (M. Byrne; J. Bracken), in three consecutive years (1993, 1994 and 1995). *L. fluviatilis* were observed in the Aughrim River (C. Moriarty; D. Minchin).

Hydrometric Area 11

Unspecified lampreys were encountered in the lower reaches of the Ovenavorragh River (M. Byrne).

Hydrometric Area 12 - River Slaney Catchment

The two *Lampetra* species seem to be widespread in the River Slaney and in the lower reaches of some of its tributaries. They have been observed by several people over several years. *P. marinus* has occasionally been observed downstream of Enniscorthy (N. McCormack).

L. planeri has commonly been seen spawning in small streams in the Slaney catchment (A. McGurdy) and Lucey (in prep.) observed a group of *L. planeri* spawning in the Slaney main channel downstream of Baltinglass. Unspecified ammocoete larvae were found about 10 km downstream of that location (J. Reynolds).

Dead *L. fluviatilis* were observed downstream of Aghade Bridge (between Tullow and Bunclody) by McGurdy. As he saw them in May, they may have died there after spawning. This species is regularly encountered by fishermen in the Slaney. They catch them in eel traps as far up as they are allowed to fish, which is at Enniscorthy (B. Long; N. McCormack; T. Wilde). Unspecified lampreys were found to be particularly abundant near Bunclody (M. Matthews). They were also reported from the estuary (J. Hurley; D. Power) and from the lower reaches of the Slaney tributaries - Clody (Lucey, in prep.), Boro (M. Byrne; Lucey, in prep.), the Derry and the Urrin (Lucey, in prep.). Apart from the location near Hackettstown, unspecified ammocoetes were also found in the middle reaches of the Slaney (I. Kurz; Lucey, in prep.) and the lower reaches of the tributaries Clody and Boro (Lucey, in prep.).

Hydrometric Area 14 - River Barrow Catchment

Unspecified lampreys were found in the upper reaches of the Barrow, in the middle reaches of the tributary Triogue (Lucey, in prep.), in drainage streams of the fen area

near Robertstown (M. Kelly-Quinn) and in the Palatine Stream (Lucey, in prep.). Unspecified ammocoetes were found in the Barrow (Lucey, in prep.), in a small stream in Derries Woods (G. McCall), in the upstream reaches of the Barrow tributary Greese and the downstream reaches of the tributary Burren.

In the lower Barrow catchment downstream of Borris, all three lamprey species have been observed and unspecified ammocoetes were found in the lowest parts of the Barrow tributary Mountain (Lucey, in prep.).

P. marinus spawn regularly below the weir in Graiguenamangh, and below the Bahana and the lower Tinehinch weirs (W. Köpke). They also spawn below the weir in St. Mullins, but not every year (W. Köpke; J. Rogers). This species was also observed spawning in the lower reaches of the Barrow tributaries Aughavaud, Duiske and, up to 1993, in the Pollmounty (W. Köpke). *P. marinus* ammocoetes were noted as far upstream as Borris where they were found at the same location as *L. fluviatilis* ammocoetes (Lucey, in prep.). Adult *L. fluviatilis* were observed in a small tributary at Ballymurphy, and in the Pollmounty (W. Köpke).

Lampetra planeri occur throughout the Barrow catchment. They were for example observed in the Barrow at St. Mullins (R. Groot) and are known to spawn in the Aughavaud tributary (W. Köpke).

Hydrometric Area 15

P. marinus and *L. planeri* appear to be common in the River Nore catchment. *P. marinus* usually spawn in the lower reaches of the River Nore between Thomastown and Inistioge (W. Köpke), but sometimes as far up as Ballyragget (P. Fitzmaurice; W. Köpke). The Nore main channel is a good spawning area for *P. marinus* because it is fast flowing and has a gravely bottom. This species and *L. planeri* also spawn in the lower reaches of the River Arrigle (W. Köpke). Adult *L. planeri* were furthermore encountered in the Nore main channel between Abbeyleix and Ballyragget (E. Moorkens) and in the Erkina (W. O'Connor). Unspecified lampreys were observed in the upper reaches of the Nore, the Kings and the Munster and in

the lower reaches of the Dinin (Lucey, in prep.). Unspecified ammocoetes were reported from the upper and middle reaches of the Nore main channel, the upper reaches of the Owveg and the lower reaches of the Erkina and the Little Arrigle (Lucey, in prep.).

Hydrometric Area 16 - River Suir Catchment

Most information on lampreys in the Suir catchment are records of unspecified lampreys. They were found at several locations in the middle and lower reaches of the River Suir (Lucey, in prep; M. Matthews), also in the lower reaches of the rivers Multeen and Thonoge and in the middle reaches of the rivers Ara, Anner and Aherlow (Lucey, in prep.). Unspecified ammocoetes were caught in the middle reaches of the River Suir, the upper reaches of the River Lingaun, the middle reaches of the River Clodiagh and the lower reaches of the River Drish (Lucey, in prep.).

L. fluviatilis was reported from the middle reaches of the Suir (Lucey, in prep.) and *P. marinus* is said to occur in the lower reaches of the Suir up to about 5 miles upstream of Clonmel (Lucey, in prep.; J. Rogers).

Hydrometric Area 18 - River Blackwater Catchment

The sea lamprey is commonly seen in the River Blackwater as far upstream as Mallow (K. Clabby; A. Deppeler). This species was observed spawning at Mallow, at Ballyhooly, at Raspberryhill and near Ballyduff (A. Deppeler). It was also reported to spawn in the River Owentaraglin, which is an upstream tributary of the Blackwater (P. Fitzmaurice).

L. fluviatilis has also commonly been encountered in the River Blackwater and was observed spawning at Fermoy (A. Deppeler). *L. planeri* adults were caught in the upper reaches of the Blackwater. Unspecified lampreys were found in the rivers Funshion and Awbeg (Lucey, in prep.).

Hydrometric Area 19

P. marinus has commonly been observed spawning in the Lee near Inishcarra (T. Cross; P. Fitzmaurice; K. McCarthy). *L. planeri* was caught (M. O'Farrell) and seen spawning (P. Fitzmaurice) in the Lee tributaries Dripsey and Sullane. It was furthermore encountered in the Lee main channel near Inishcarra and in the tributaries Martin and Bride (M. O'Farrell). Unspecified lampreys were reported from the Bride and from two rivers which do not belong to the Lee catchment: the Owennacurra and the Dissour (Lucey, in prep.).

Hydrometric Area 20

Unspecified ammocoetes were observed in the middle reaches of the River Bandon in 1970 (T. Cross).

Hydrometric Area 22

In the Maine catchment, unspecified lampreys were found in the River Maine and unspecified ammocoetes in the Brown Flesk (Lucey, in prep.). Unspecified lampreys were also found in the middle reaches of the Flesk (Lucey, in prep.) and the lower reaches of the River Laune (M. Matthews).

All three lamprey species have been found in the Killarney National Park by Carruthers. He reported *L. planeri* to occur in the downstream reaches of the River Deenagh and to spawn in a small tributary of Muckross Lake. He also observed *P. marinus* in Muckross Lake and at Long Range between Muckross Lake and the Upper Lake, where *L. fluviatilis* is also said to be found.

Hydrometric Area 23

Unspecified lampreys were encountered in the middle (E. Fahy) and lower (Lucey, in prep.) reaches of the River Feale.

Hydrometric Area 24

Unspecified lampreys were noticed in the upper reaches of the River Maigue (Lucey, in prep.).

Hydrometric Area 25 - Lower Shannon Catchment

All three lamprey species were noted and observed spawning in the lower Shannon catchment. *P. marinus* and *L. fluviatilis* often share the same spawning and nursery areas. Both species commonly spawn in the Shannon and in several tributaries between Limerick and the Kilmastulla confluence. The main spawning areas for both species are located in the River Shannon at Plassey (W. O'Connor; M. O'Farrell) and at Castleconnell (P. Fitzmaurice; W. O'Connor; N. Roycroft) and in the River Mulkear at Annacotty (R. Geoghegan; M. Kennedy; W. O'Connor; M. O'Farrell; N. Roycroft). The silt beds downstream of these spawning areas are utilised by the ammocoetes of both species (W. O'Connor). Both species were also reported to spawn in the River behind the University of Limerick (N. Roycroft) and in the bottom reaches of the River Kilmastulla (M. Kelly-Quinn; N. Roycroft). *L. fluviatilis* was furthermore observed spawning in the Shannon at Parteen (P. Keane) and in the River Graney below Lough Graney (P. Keane). The existence of a landlocked *L. fluviatilis* population in Lough Derg is suspected by O'Connor.

Spawning areas of *P. marinus* were found in the lower reaches of the rivers Blackwater (M. O'Farrell) and Castleconnell (P. Fitzmaurice). *L. planeri* is known to be common in the lower Shannon catchment (W. O'Connor). It was encountered and observed spawning in the rivers flowing in and out of Lough Ennell (P. Fitzmaurice; A. Gibson; J. Reynolds), in the Blackwater near Limerick (P. Fitzmaurice; M. O'Farrell), in drainage channels near Roscrea (P. Fitzmaurice) and in the Little Brosna at Riverstown Bridge (Lucey, in prep.). *L. planeri* was also found in the rivers Black (small Shannon tributary below Lough Derg), Ballintotty, Derrainy, Graney, Killoran, Kilmastulla and Ollatrim (M. O'Farrell).

Unspecified lampreys were encountered in the Little Brosna, the Monaghanstown, the Pollagh Stream, the Tullamore (M. O'Farrell), the Tudenham Stream (P. Fitzmaurice) and the Camcor (Lucey, in prep.). Ammocoetes were reported in the Graney (M. McGarrigle).

Hydrometric Area 26 - Upper Shannon Catchment

L. planeri were observed spawning in a canal near Lough Owel (C. Moriarty) and in the Maughera Stream near Lough Sheelin (P. Fitzmaurice). Unspecified lampreys were noted in the Ballinure, the Kilconnell, the Ballycomoyle Stream near Lough Sheelin and the Ballynacarrig near Lough Owel (M. O'Farrell). Unspecified ammocoetes were found in the Rivers Diffagher, Lung, Francis, Scramoge and Ahascragh (M. McGarrigle).

Hydrometric Area 27

P. marinus was seen in the River Fergus at Ennis (P. Fitzmaurice; M. Kennedy). It was reported to spawn just downstream of Ennis in 1972 (P. Fitzmaurice).

Hydrometric Area 29

P. marinus has commonly been observed spawning in the River Corrib at the Salmon Weir Bridge in Galway (E. Ross; M. O'Farrell; E. Twomey; P. Fitzmaurice). There is also a record of unspecified lampreys near the riverine inflows in Lough Rea (K. McCarthy).

Hydrometric Area 30

P. marinus was reported to occur in Lough Corrib and Lough Mask (N. Roycroft) and to have spawned in the River in Oughterard in the 1970s (P. Fitzmaurice). *L. planeri* was observed spawning in the River Cross in the 1970s (P. Fitzmaurice).

Hydrometric Area 34

All lamprey records in this area are from the River Moy catchment. The only species identified is *P. marinus*. It spawned in the upper reaches of the River Deel in the 1970s (P. Fitzmaurice) and is known to occur in Lough Conn (P. Fitzmaurice; N. Roycroft), Lough Cullin (N. Roycroft) and in the Moy at Ballina (P. Fitzmaurice). Unspecified lampreys were found in the Lough Conn tributary Addergoole, in the River Castlebar tributary Manulla, in the upper reaches of the Moy, the upstream tributaries Mullaghanoe and Sonnagh, in the Moy tributary Strade and in the downstream Moy tributary Carrokeribly (J. Conneely).

Hydrometric Area 35

All three species were found in rivers around Lough Gill. *L. fluviatilis* and *L. planeri* occur in the River Bonet, especially in its lower reaches where also *L. planeri* ammocoetes were found (J. Conneely; D. Cotton). *L. planeri* were also noticed in a small stream running into Lough Gill at Slish Wood and *P. marinus* are known from the mouth of the River Garavogue. *L. planeri* ammocoetes were found downstream of Lough Arrow in a stream near Riverstown (D. Cotton).

Hydrometric Area 36

L. planeri occur in the Annalee catchment (P. Boylan) and *P. marinus* were observed in the River Erne at Ballyshannon (N. Roycroft).

Hydrometric Area 38

Unspecified lampreys were found in the River Clady (K. McCarthy).

Hydrometric Area 39

Unspecified lampreys were reported to occur in the River Leannan at Kilmacreanan (M. Matthews).

CONSERVATION

Legislation for the protection of lampreys has now been put into place by the European Union. The directive on the conservation of natural habitats and of wild fauna and flora (92/43/EEC) obliges Ireland to set aside special areas for the conservation of the three species of lampreys found here. The Special Areas of Conservation (SACs) proposed for lampreys must ensure 'the maintenance or restoration, at a favourable conservation status of the lamprey populations.

Freshwater sites intended to further the protection of present lamprey populations must therefore be characterised by good water quality, clean sediments at spawning grounds and the presence of stable sandy silt beds for the ammocoetes. For *P. marinus* and *L. fluviatilis*, access to spawning areas from the sea must furthermore be ensured. SACs for lampreys should be centred around the known spawning grounds and nursery areas of the different species. But even in the case of *L. planeri*. which only needs a 'small stretch of water' to complete its life cycle (Lelek, 1980), the protection of a river section alone is not enough. The requirements of good water quality and natural river sediments call for the conservation management of the catchment areas influencing the conditions in the relevant stretches of river. For the protection of *L. fluviatilis* and *P. marinus*, the river downstream of spawning grounds and nursery areas must also be managed so as to avoid pollution episodes, weirs, dams or other barriers disrupting migration. Furthermore, riparian vegetation, composed of scrub and tree species which grow naturally along rivers, will help retain both nitrogen and phosphorus and can thus reduce nutrient input from agricultural land to the rivers. This bankside vegetation will also reduce the erosion of river banks.

All three species are known to spawn in various Irish rivers. This is indicated by observations of spawning lampreys and by the presence of ammocoetes. In the case of *L. planeri* the presence of adults suggests the existence of spawning grounds and nursery areas near by. Adults of this species retain the ammocoete life style and only migrate short distances upstream to spawn (Hardisty and Potter, 1971b).

However, to assess the need for conservation and to monitor the development of the populations, better information on the distribution of lampreys is essential. This can be achieved by a combination of special lamprey surveys and the central collection of information found during work carried out on other freshwater species.

Based on the presented information it appears that all three species spawn in the main channels and/or the lower reaches of the tributaries of the River Slaney, the River Barrow downstream of Borris, the River Suir, the River Blackwater downstream of Fermoy, the Shannon downstream of Lough Derg, and in the rivers and streams in the Killarney National Park and around Lough Gill. *L. fluviatilis* has not been identified from the River Nore, but is very likely to be there. The Nore main channel and the lower reaches of its tributaries below Abbeyleix sustain good lamprey populations. The River Slaney may be of particular importance for *L. fluviatilis*. The Shannon between Limerick and Lough Derg, and the lower reaches of its tributary Mulkear are distinguished by the availability of information on the exact locations of *P. marinus* and *L. fluviatilis* spawning grounds and nursery areas. The fact that the available information reflects the amount of survey work carried out in an area and the interest of the surveyors rather than the actual distribution of lampreys, cannot be emphasised enough.

Until recently, all lamprey species found in Ireland were widely distributed in rivers and occasionally lakes throughout much of Europe. However, a considerable decline in lamprey populations has been taking place in many European river systems. The most likely reasons for this decline are water pollution, the erection of barriers across rivers, changes to river and stream channels and alterations in the discharge patterns of rivers and streams, due to drainage schemes. Drainage schemes reduce the retention of water on the land and thus increase the occurrence of flash floods following heavy rainfall. Such floods tend to destabilise or wash away silt banks which constitute the habitat of ammocoetes.

A decline of lampreys has also been observed in Ireland over the last few years, although there is insufficient information for this decline to be quantified.

Nevertheless, populations fortunately still seem to be widespread. Ireland is therefore in a position to make an important contribution to the conservation of these survivors from the planet's remote past. To conserve lamprey populations, the *known spawning grounds* and ammocoete haunts need to be protected and maintained, and lampreys migrating upstream need unhindered access to spawning grounds. Significant alterations to the drainage patterns of the relevant river catchments thus require careful control and the generally good water quality of the river systems supporting lampreys must be ensured. Care must also he taken that the upstream and downstream migrations of sea and river lampreys are not impeded by weirs or dams. Unlike salmon, lampreys cannot jump big weirs. Such protection and management of freshwater habitats will also benefit salmon and trout and a variety of other freshwater life. Contrary to common belief, lampreys do not have a measurable negative impact on populations of other fish in Ireland. The two parasitic species generally do not feed in rivers, and the long coexistence of lampreys and their hosts in the sea suggests the existence of a balance between predator and host populations.

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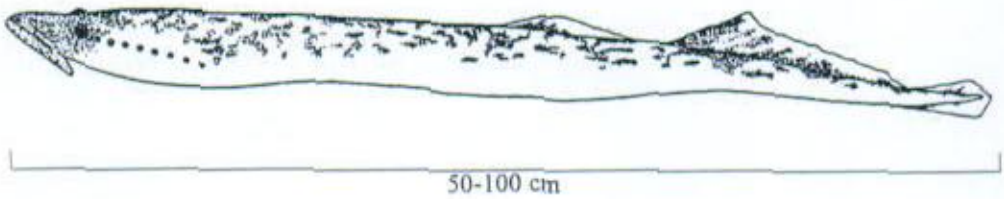

Figure 1. Sea lamprey *Petromyzon marinus*

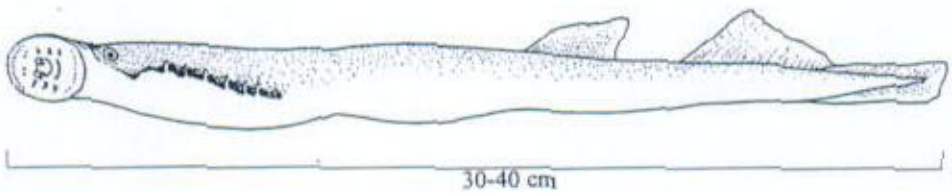

Figure 2. River lamprey *Lampetra fluviatilis*

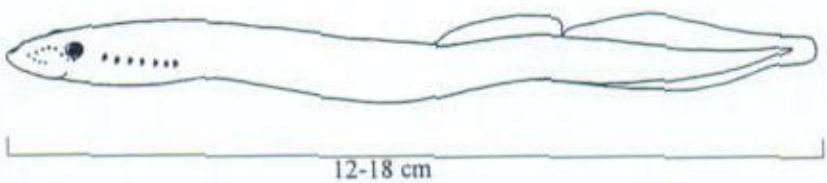

Figure 3. Brook lamprey *Lampetra planeri*

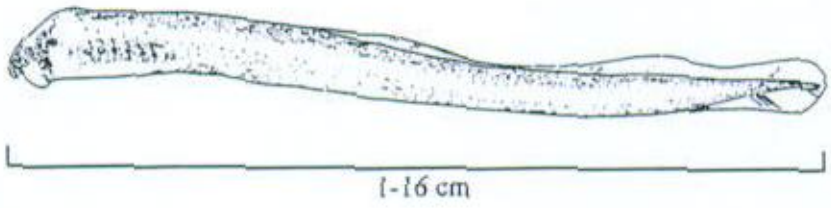

Figure 4. Ammocoete larva

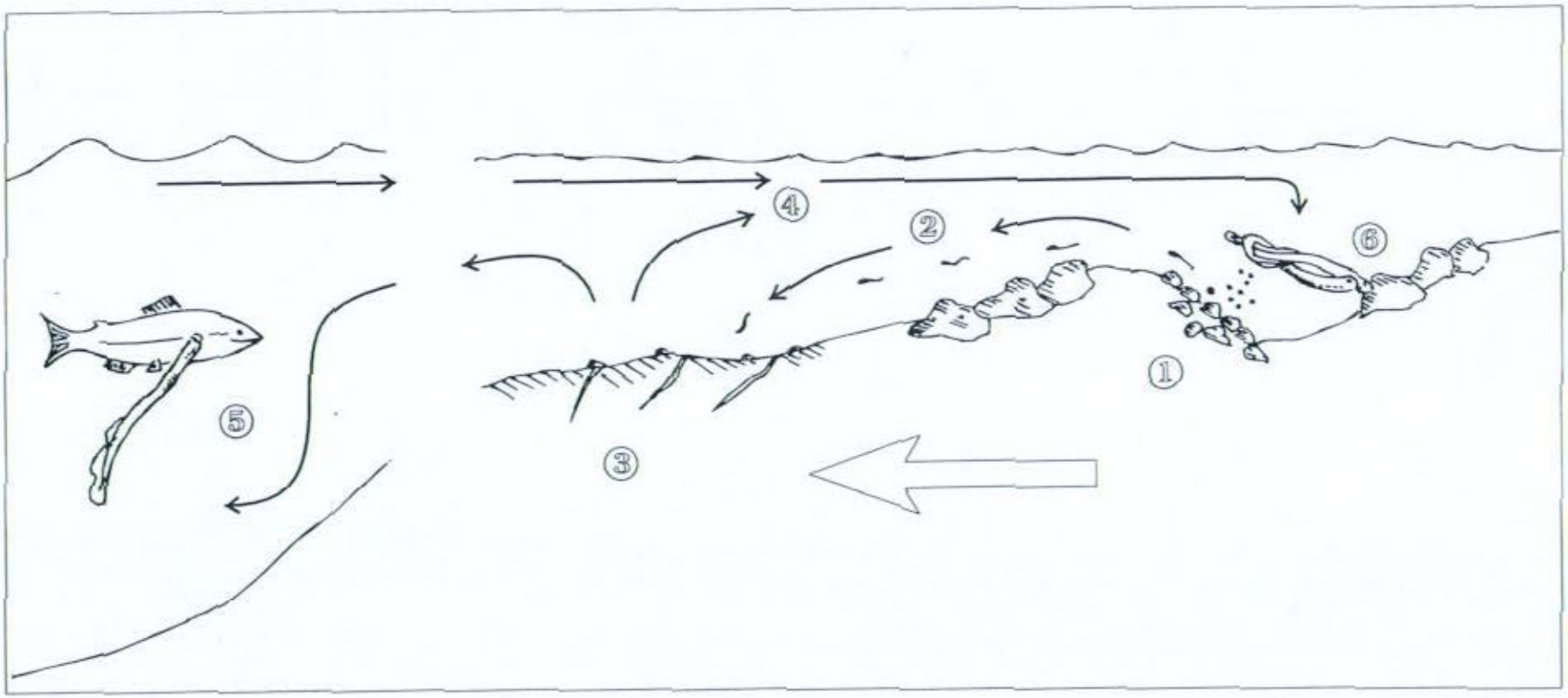

Figure 5. The life cycle of lampreys: (1) Larvae hatching in the nesting area; (2) Ammocoetes moving downstream to sandy silt sediments; (3) Ammocoetes live in nursery area for 3-6 years before they are transformed into adults; (4) Adult brook lamprey stay in nursery areas until they become sexually mature. *Then they migrate short distances upstream to spawn;* (5) Adult river and sea lampreys migrate to sea, feed on a variety of fish and migrate back upstream to spawning areas when they are sexually mature; (6) Nest building and spawning takes place at the downstream end of pools.

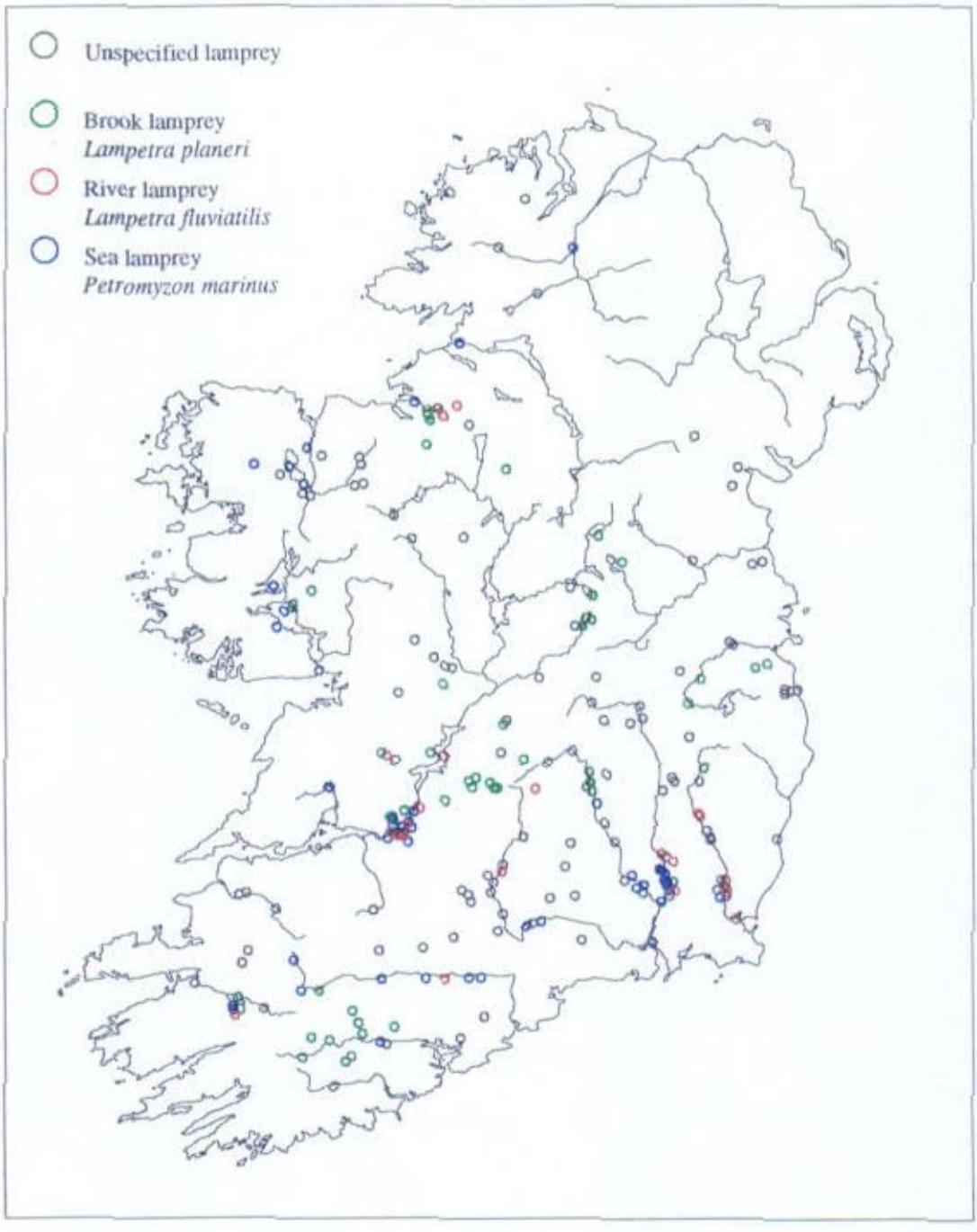

Figure 6. The known distribution of lampreys in the Republic of Ireland

Figure 7. Hydrometric areas of Ireland (Clabby *et al.*, 1992)