

DISTRIBUTION OF CERTAIN MOLLUSCS IN THE LOWLAND CANALS OF SCOTLAND

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Abstract This survey describes the distribution of certain freshwater molluscs from the margins of the lowland canals of Scotland (Forth & Clyde Canal, Union Canal, and Monkland Canal). Fourteen species of gastropods and three species of freshwater mussels were recorded. Of these species, *Valvata cristata* Müller 1774, *Bithynia leachii* (Sheppard 1823), *Planorbis carinatus* Müller 1774, *Planorbarius corneus* (L., 1758), and *Acroloxus lacustris* (L., 1758) were found to be much more widely distributed than previously reported. Although inconspicuous species such as *A. lacustris* and *V. cristata* may have been under-recorded in the past, the possibility is discussed that other species might have been spread during the recent restoration of the canals for navigation, and the consequent increased traffic and movement of water and vegetation. Other species previously recorded from the canals which were not found in this survey, such as *Radix auricularia* (L., 1758) and *Dreissena polymorpha* (Pallas, 1771), may have become extinct in the Scottish lowland canals, but would probably have been missed by the sampling methods used in this study.

Key words Freshwater, gastropods, bivalves, canals, Scotland

INTRODUCTION

The publication of the *Atlas of the Land and Freshwater Molluscs of Britain and Ireland* (Kerney, 1999) was a landmark in mapping land and freshwater molluscs, providing a reasonably comprehensive overview of the distribution of these species in the British Isles. However, studies of the molluscan fauna of the Lothians in Scotland (vice-counties 84, West Lothian; 83, Midlothian; and 82, East Lothian) suggested that some freshwater species might be more widely distributed than shown in the *Atlas*. Indeed, Kerney (1999, p 23) specifically pointed out the paucity of up-to-date records of freshwater molluscs for south-east Scotland. When the operculate snail *Bithynia leachii* (Sheppard, 1823) was discovered in the Union Canal near Linlithgow, West Lothian, in 2002, it was decided to make a more thorough study of freshwater mollusc distribution in the lowland canals in Scotland. *B. leachii* had hitherto only been recorded from one site in the Forth & Clyde Canal (Waterston, 1934, quoted in Boycott, 1936), and from only two other sites in Scotland (Kerney, 1999, p 40). The present study shows that several species detailed below, including *B. leachii*, are much more widely distributed in the canals of lowland Scotland than has been reported before, and provides a baseline for studying possible future changes following the recent re-opening of the canals to navigation.

THE CANALS

Two canals, and parts of a third, remain in the Scottish lowlands today. The Forth & Clyde Canal ran from Bowling on the River Clyde to Grangemouth on the Firth of Forth (a distance of 35 miles or 56 km), with the Glasgow branch taking the canal to Port Dundas, close to the centre of Glasgow (Fig. 1) (Hutton, 2002). It is a relatively large canal, wide and deep enough to take small sea-going vessels (see the Scottish Waterways website, www.scottishcanals.co.uk/html/1_waterways/1-3_main.html for more details). The canal has over 30 locks, allowing it to climb from sea level at both ends to the summit level.

The Union Canal (in full, the Edinburgh and Glasgow Union Canal) was opened in 1822, and was smaller in width and depth than the Forth & Clyde Canal (see the Scottish Waterways website, www.scottishcanals.co.uk/html/1_waterways/1-3_main.html for more details). It ran from Edinburgh to Falkirk, a distance of 31 miles (approximately 50 km) (Fig. 1), and was a 'contour canal' with no locks, except at Falkirk, where a flight of eleven locks connected it to the Forth & Clyde Canal (Hutton, 2002).

During the twentieth century traffic on both canals declined and they became uneconomic, and were closed to navigation. Various sections were filled in or culverted. However, after many years of neglect the canals were reopened to navigation in 2001, under the title 'Millennium Link'. This involved not merely dredging and clearing out accumulated debris, but also rebuilding locks

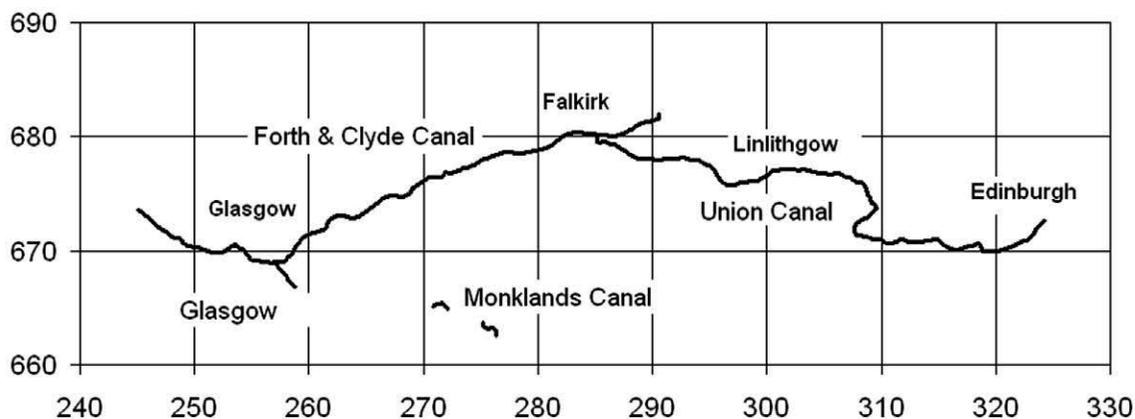


Fig. 1 Map of the canals in lowland Scotland, with the names of the principal towns. X and Y axes are labelled with British National Grid references according to the numerical system. In this system, the letters NS correspond to 26, and NT to 36, 2 and 3 being the eastings and 6 the northing. Thus the point $x = 250$, $y = 670$ corresponds to NS 250700 or 36/250700.



Fig. 2 The newly reconstructed stretch of the Union Canal at Wester Hailes, Edinburgh, showing the bare concrete banks and only very small patches of vegetation.



Fig. 3 The Falkirk Wheel. This structure, opened in 2002, is used to transfer boats, floating in sealed gondolas, from the upper level of the Union Canal to the lower level of the Forth & Clyde Canal. The Wheel is seen here in an intermediate position.

and bridges, and certain sections of canal had to be built anew (Hutton, 2002). These included a section of the Union Canal at Wester Hailes (British National Grid reference NT 195700–206702) (Fig. 2), and the easternmost section of the Forth & Clyde Canal (NS 904815–905822). At Falkirk the Union Canal was extended westwards (NS 865794–852796) to link with the Forth & Clyde Canal through the Falkirk Wheel (Fig. 3), opened in 2002.

Of the third canal, the Monkland Canal to the south-east of Glasgow (Fig. 1), much has been filled in, built over, or culverted, and only two short open sections remain (see the Scottish Waterways website, www.scottishcanals.co.uk/html/1_waterways/1-3_main.html; and Monkland Online, www.monklands.co.uk/monklandcanal/

for more information). The upper section, running north-west from Calderbank for approximately 2 km, is shallow, with extensive beds of vegetation at the sides, and is not navigable (Fig. 4); it has the character of a slow-flowing river rather than of a canal. The lower section (approximately 1.5 km long) at Drumpellier Country Park, Coatbridge, is wider.

All three canals are edged predominantly with the reed sweet-grass, *Glyceria maxima* (Fig. 5), except for reaches heavily overhung with trees, and the newly reconstructed sections of canal already referred to, which have bare concrete banks where a few small clumps of vegetation have been planted (Fig. 2). Other vegetation includes small patches of bur-reeds (*Sparganium* spp.), bulrushes (*Typha latifolia*), meadowsweet (*Filipendula ulmaria*), etc.

TABLE 1. SUMMARY OF DISTRIBUTION OF CERTAIN FRESHWATER MOLLUSCS IN THE LOWLAND CANALS OF SCOTLAND

Species	Number of 1 km squares			Number of 10 km squares		
	Forth-Clyde Canal	Union Canal	Monkland Canal	This survey	Atlas post-1965*	Atlas pre-1965*
<i>Valvata cristata</i>	15	12	5	10	1	5
<i>Potamopyrgus antipodarum</i>	1	1	0	2	7	3
<i>Bithynia tentaculata</i>	58	53	0	12	4	7
<i>Bithynia leachii</i>	51	27	0	10	1	1
<i>Physa fontinalis</i>	50	46	4	13	7	4
<i>Lymnaea palustris</i>	0	0	1	1	4	3
<i>Lymnaea stagnalis</i>	33	20	4	13	5	4
<i>Radix auricularia</i>	0	0	0	0	1	6
<i>Radix balthica</i>	21	1	2	10	9	4
<i>Planorbis carinatus</i>	27	32	0	11	2	2
<i>Bathyomphalus contortus</i>	48	31	6	13	6	2
<i>Gyraulus albus</i>	6	0	0	3	7	5
<i>Planorbarius corneus</i>	27	6	0	9	3	2
<i>Acroloxus lacustris</i>	13	32	2	11	2	4
<i>Oxyloma elegans</i>	12	9	3	10	4	3
<i>Sphaerium corneum</i>	47	40	3	13	6	5
<i>Musculium lacustre</i>	0	0	1	1	1	5
<i>Pisidium subtruncatum</i>	1	0	0	1	3	6
<i>Dreissena polymorpha</i>	0	0	0	0	2	5
Total squares per canal	60	56	7	13	13	13

*Kerney (1999), respectively records from 1965 onwards, and pre-1965; these records cover areas in addition to the canals.



Fig. 4 The upper remaining section of the Monkland Canal near Calderbank, Lanarkshire.

METHODS

The margins throughout the whole length of the Forth & Clyde, Union, and Monkland Canals, except for the Falkirk Tunnel on the Union Canal, were sampled between August 2002 and October 2003 (mainly in 2003). It would have been impracticable in the time available to sample uniformly throughout the whole length of approximately 110 km, but at the very least a sample was taken every kilometre. In more accessible areas, sampling was more frequent, and the exigencies of the study meant that some reaches were sampled on two or three different occasions.

All sampling was done from the canal tow-paths, mainly using a net consisting of a metal domestic sieve (16 cm diameter, with approximately 1.4 mm mesh) attached to a stout wooden pole approximately 60 cm long. This was swept through the waterside vegetation. Molluscs were also searched for by visual inspection of vegetation, and of the canal bank in unvegetated areas.

Locations of sampling sites were determined using a Garmin GPS 12 Personal Navigator, and are given as British National Grid references. The maps were drawn using Microsoft Excel, based on data obtained in the same way; each symbol represents a sampling site at which the species in question was found.

Detailed records of the molluscs recorded in this study have been deposited with the appropriate biological records centres, i.e. Glasgow Museum Biological Records Centre for the Glasgow area, and the Lothian Wildlife Information Centre for the Lothians. Currently there is no biological records centre that covers the central area of this study in Stirlingshire.



Fig. 5 A section of the Forth & Clyde Canal showing the typical emergent vegetation of *Glyceria maxima* that lines these canals.

RESULTS

Fourteen species of gastropods and three species of bivalves were found. The distributions of these species are summarised in Table 1. Nomenclature used is according to Anderson (2005). Several species were found in abundance throughout almost the entire length of the Forth & Clyde and Union canals, with some exceptions to be described below. These were *Bithynia tentaculata* (L., 1758), *Physa fontinalis* (L., 1758), *Bathymomphalus contortus* (L., 1758), and *Sphaerium corneum* (L., 1758). Some other species – *Lymnaea stagnalis* (L., 1758), *Planorbis carinatus* Müller, 1774, *Acroloxus lacustris* (L., 1758), and *Oxyloma elegans* (Risso, 1826) – were more sparsely distributed, but were nevertheless found throughout the length of the canals.

Other species had more restricted distributions. *Valvata cristata* Müller, 1774 (Fig. 6) was found, usually in small numbers, in the Forth & Clyde Canal around Glasgow and to the west, the part of the Union Canal to the west of Edinburgh, in the Monkland Canal, and sporadically elsewhere. *Potamopyrgus antipodarum* (Gray, 1840) was found at only three sites: the Forth & Clyde Canal in Glasgow (grid reference NS 520699); the Union Canal at Falkirk (NS 867794); and in the new extension of the Union Canal at Falkirk (NS 866794).

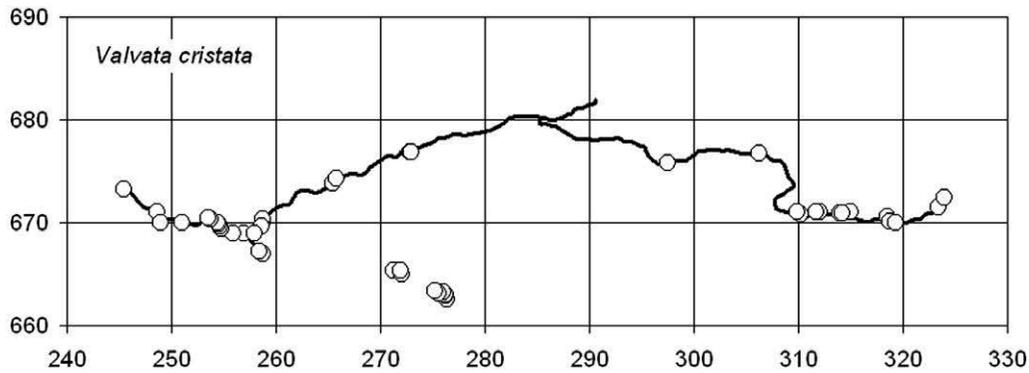


Fig. 6 The distribution of *Valvata cristata* along the Forth & Clyde, Union, and Monkland canals. See the legend to Fig. 1 for an explanation of the grid references.

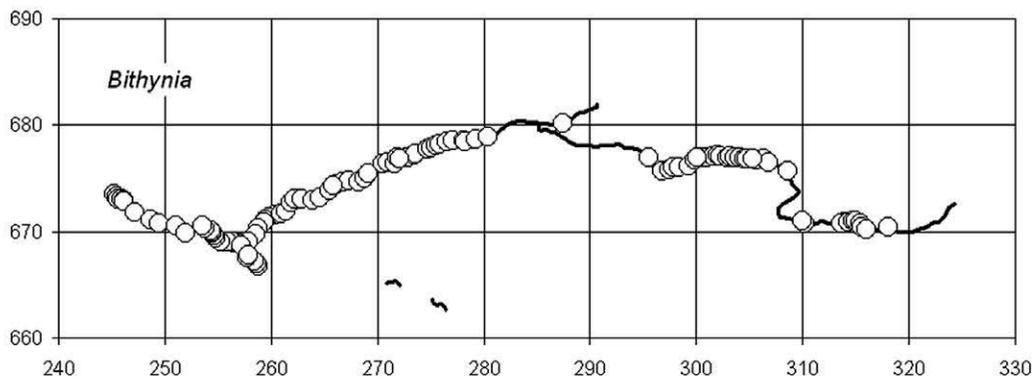


Fig. 7 The distribution of *Bithynia leachii* along the canals.

Bithynia leachii (Fig. 7), a smaller relative of *B. tentaculata*, was found throughout most of the Forth & Clyde Canal and in two extensive patches in the Union Canal, but not in the Monkland Canal. In places it is numerous, and its numbers may exceed those of *B. tentaculata*. At many sites a minority of the shells are decollate (Fig. 8).

One specimen of the snail *Lymnaea palustris* (Müller, 1774) s.l. was found in the Monkland Canal in Drumpellier Country Park (grid reference NS 718653). *Radix balthica* (L., 1758) (Fig. 9) was not a typical inhabitant of the canals, being found only locally in the Forth & Clyde Canal (see below) and at only one site in the Union Canal, while in the Monkland Canal it was found only in the upper section.

Gyraulus albus (Müller, 1774) (Fig. 10) had a very restricted distribution, being found, with one exception, only in the section of the Forth & Clyde Canal between Falkirk and the River Carron, where it is present in moderate numbers. *Planorbarius corneus* (L., 1758) (Fig. 11) was scattered throughout the Forth & Clyde Canal,

where it was occasionally common, and was also found at two sites at the Edinburgh end of the Union Canal.

Two species of bivalves were found at only a very small number of sites. Apparently fresh shells of *Musculium lacustre* (Müller, 1774) were found at two sites in the upper section of the Monkland Canal (grid references NS 763630 & NS 764626), while one specimen of *Pisidium subtruncatum* Malm, 1855, was found east of Kilsyth in the Forth & Clyde Canal (NS 7477). The scarcity of *Pisidium* spp. could be an artefact of the sampling method.

Newly restored or newly built sections of canal (Union Canal, Wester Hailes, Edinburgh, NT 195700–206702; Union Canal extension, Falkirk, NS 865794–852796; Forth & Clyde Canal, Clydebank, NS 5070) had bare concrete banks and only a few small clumps of vegetation growing in the water (Fig. 2). The number of individuals and variety of species were correspondingly small: *P. antipodarum*, *B. tentaculata*, *P. fontinalis*, and just above the Falkirk Wheel, two



Fig. 8 *Bithynia leachii* shells. Left: normal shells; right: decollate shells. Scale bars = 5 mm.

well grown specimens of *Lymnaea stagnalis*.

The stretch of the Forth & Clyde Canal running north-eastwards from Falkirk to the River Carron (NS 875802–905822) also had a characteristic fauna, in which otherwise common and widespread species such as *B. tentaculata* and *P. corneus* were not found, but *R. balthica* and *G. albus* were relatively common; indeed, *G. albus* was largely confined to this reach of the canal. The last sampling point on the new final stretch of the canal (NS 906820) had an impoverished fauna of only *Lymnaea stagnalis*, *R. balthica* and *B. contortus*.

DISCUSSION

The survey described in this paper has shown that five species of freshwater molluscs are much more widespread in lowland Scotland than previously reported (Kerney, 1999), being found throughout most of the length of the three remaining canals. A comparison of the results of this survey with the distributions shown in Kerney (1999) is given in Table 1. In particular, *Bithynia leachii* has been found, often in abundance, along most of the length of both the Forth & Clyde and Union Canals, instead of the single site in the Forth and Clyde Canal previously reported (Boycott, 1936; Kerney, 1999, p 40). The occurrence of decollate shells of *B. leachii* suggests that perhaps the calcium levels in the canal water are rather low for this species. Other species that show a greatly increased distribution are *Planorbis carinatus* and *Acroloxus lacustris*, while *Valvata cristata* and *Planorbarius corneus*

show more moderate increases in distribution compared with published records.

It could be that the freshwater molluscs reported here have been under-recorded in the past. Indeed, Kerney (1999, p 23) specifically remarked on the very limited recording of freshwater molluscs in south-east Scotland over the past 50 years or so. Changes in the canal fauna over this period would therefore have been missed. Small species such as *V. cristata* and *A. lacustris*, and the pea mussels *Pisidium* spp. are easily overlooked, and are probably more widespread and numerous than reported here.

Nevertheless, it seems likely that the restoration of the Forth & Clyde and Union Canals for navigation may have had an effect. The water quality has improved, and a variety of fish flourish, including trout (Personal communications from local anglers). Although much of the reconstruction and clearance work must have had a detrimental effect on the molluscs, as several reaches of the canals were drained for considerable periods, the subsequent free flow of water, vegetation and boats is likely to have facilitated the spread of molluscs. The construction of the Falkirk Wheel would have enabled transfer of species between the canals. Although the amount of water transferred by the Wheel is small, fish have been seen to transfer between the canals by using it. The presence of water snails close to the Wheel suggests that they too could move from one canal to the other by this means.

Compared with most freshwater bodies in Scotland, the lowland canals have a rich and diverse molluscan fauna. Other bodies of water in Scotland that I have sampled using similar

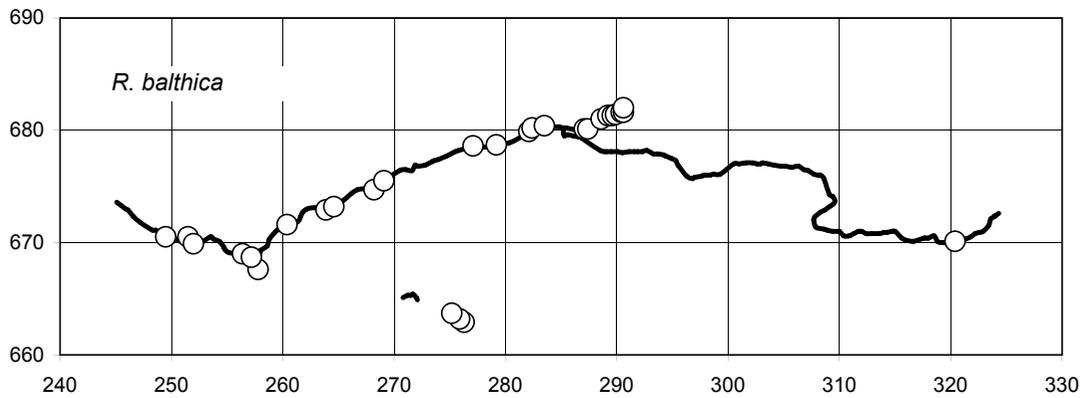


Fig. 9 The distribution of *R. balthica*.

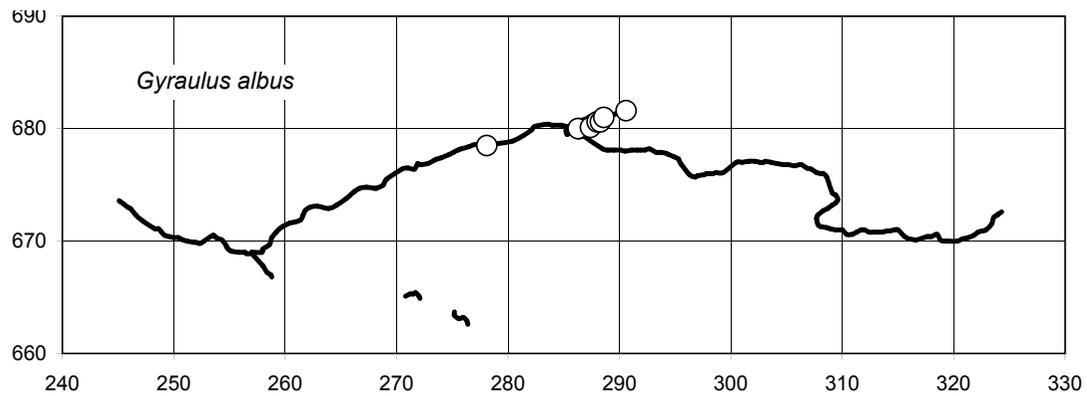


Fig. 10 The distribution of *Gyraulus albus*.

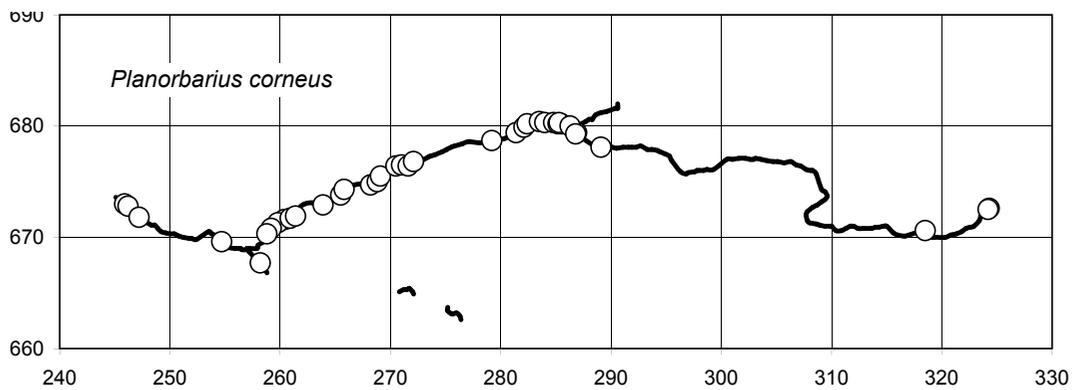


Fig. 11 The distribution of *Planorbarius corneus*.

methods to those used in the present survey usually yield between two and five species of molluscs, although a few more species may be found washed up along the shoreline or on the dried-up beds of reservoirs during drought. The richness of canal faunas and the favourability of canals as a habitat were noticed by Boycott many years ago (Boycott, 1936, pp 175–177). Nevertheless, certain species that are common elsewhere (*Potamopyrgus antipodarum*, *Radix balthica*) are scarce or local in the canals.

P. antipodarum is, in fact, mainly restricted to newly constructed or reconstructed sections of canal. It may be that these species do not find mature canals a suitable habitat, although both have previously been reported as inhabitants of canals (Boycott, 1936, pp 171, 175, 176; Kerney, 1999, pp 36, 56).

Two species previously reported from these canals were not found in the present study. *Radix auricularia* has previously been reported from the Forth & Clyde Canal (Sheldon, 1976). Although

it is possibly no longer present, it might live only in deeper water, and would therefore not be included in the samples obtained in this study. Moreover, it breeds early and dies off by June (Boycott, 1936, p 143), so that it would not be possible to find it for a large part of the year. The zebra mussel, *Dreissena polymorpha*, prefers water deeper than 2 m (Morton, 1969, pp 477–478), and would not have been obtained by the sampling method used in this study.

The canals studied appear to be a fairly uniform habitat. Indeed, most of the species found in this survey occur throughout the greater part of the length of these canals. Nevertheless, there are a few short reaches of canal that have quite distinct and impoverished faunas. Some (see section on The Canals) are newly constructed or reconstructed, and presumably have yet to be colonised by most species. At the time of the survey, vegetation was extremely sparse in these reaches (Fig. 2), and without vegetation at the sides of the canals there are usually no molluscs.

The easternmost section of the Forth & Clyde Canal, from Falkirk to the River Carron, also has an impoverished molluscan fauna, which however is notable for including *Gyraulus albus*, rarely found elsewhere in the canals. This section of canal underwent substantial reconstruction during the Millennium Link project. This makes it a habitat akin to a newly constructed reach of canal.

The third distinctive canal fauna is found in the two remaining sections of the disused, and hence atypical, Monkland Canal. This fauna lacks such widespread species as the two *Bithynia* species, *Planorbis carinatus* and *Planorbis corneus*, although it does contain other species – *Lymnaea palustris* s.l. and *Musculium lacustre* – that were not found in either the Forth & Clyde or Union Canals. The molluscan fauna of the Monkland Canal could be the result either of adaptation

to an atypical canal environment or, given the relatively small size of the remaining fragments, of chance colonisation or extinction, or both.

The Scottish lowland canals are here shown to be rich freshwater habitats for molluscs, with a number of species showing more extensive distributions than described hitherto. This survey, carried out shortly after the reopening of the Forth & Clyde and Union Canals, provides a “snapshot” at the beginning of a new era in the history of the canals. It will be interesting to see how the molluscan fauna develops in the future, particularly in the newly constructed parts of the canals.

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