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**Aquatic survey of the
Royal Canal at the 5th
Level, Phibsborough**

Aquatic survey of the Royal Canal at the 5th level, Phibsborough (MetroLink Project)



Prepared by Triturus Environmental Ltd. for Jacobs

July 2021

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1. Introduction

1.1 Background

Triturus Environmental Ltd. were commissioned by Scott Cawley on behalf of Jacobs to undertake aquatic survey of the Royal Canal, Phibsborough, Dublin 7. The survey area site was located within the Royal Canal pNHA (002103). As part of the MetroLink project, temporary dewatering of the Royal Canal basin located between locks no. 5 and 6 will be required to facilitate the installation and removal of a temporary working platform. Two dewatering events will be required in 2023 and late 2025, respectively.

In order to ensure that no rare macrophyte or invertebrate species were present, pre-construction surveys were required in the 300m section of canal located between locks no. 5 and 6, west of Cross Guns Bridge (**Figure 2.1**). Particular emphasis was required to detect the presence of the protected opposite-leaved pondweed (*Groenlandia densa*) and other macrophyte species of high conservation value such as the stonewort *Tolypella intricata*, in advance of dewatering works. In addition, the survey also examined macro-invertebrate samples to establish the presence of rare molluscan fauna such as *Myxas glutinosa* or other invertebrate species of high conservation value, including trichopteran and coleopteran species.

1.2 Opposite-leaved pondweed legislative status, ecology and distribution

Opposite-leaved pondweed has declined in Ireland (Preston et al., 2002; Preston, 2003) due to land drainage and reclamation, pollution, peat run-off and loss of habitat due to infilling of watercourses. Consequently, it is protected under the Wildlife Acts (1976-2018) and listed on Schedule A of the Flora (Protection) Order, 2015 (S.I. No. 356/2015). Due to a reduction in its area of occupancy, the plant is also classified as 'near threatened' and 'vulnerable' according to the Ireland Red List for vascular plants (Wyse Jackson et al., 2016).

Opposite-leaved pondweed is a calcicolous pondweed found in base-rich rivers, streams, canals, ditches and ponds (Preston & Croft, 2001; Preston, 2003) which shows a preference for mesotrophic to eutrophic conditions (Pujalon et al., 2008; Kohler & Schneider, 2003; Onaindia et al., 1996; Carbiener et al., 1990). Although it is sensitive to eutrophication (Preston, 2003; Haslam, 1987) several studies have shown *Groenlandia densa* is tolerant of low to moderate pollution levels (Kohler & Schneider, 2003; Preston et al., 2002). The species is restricted to shallow, often near-stagnant waters and although able to tolerate moderate flows, is one of the first species lost with increasing flow rate (Leuschner & Ellenberg, 2017; Haslam, 1987).

In Ireland, opposite-leaved pondweed is typically associated with tidal stretches of rivers and other periodically disturbed watercourses (e.g. canals and drains), where it ostensibly benefits from the reduction in competition with other macrophytes through disturbance (Reynolds et al., 2006). The species is found in the tidal reaches of large Irish rivers including the River Shannon and associated back drains, as well as the Slaney, Suir and Munster Blackwater (Preston, 2003). However, *Groenlandia densa* is also known from the Royal Canal in the vicinity of Dublin City, specifically the 1st to 4th levels, inclusive (BEC, 2011).

2. Methodology

2.1 Opposite-leaved pondweed survey

A SCUBA dive survey was carried out on the Royal Canal on Thursday 17th June 2021 to identify and map any extant stands of opposite-leaved pondweed within the survey area. The section of canal between locks no. 6 and 5 (i.e. 5th level) was divided equally into 8 no. transects across the width of the canal (approx. 15-20m average). Locks no. 6 and 5 were also surveyed between the lock gates, resulting in a total of 10 no. survey transects (**Table 2.1, Figure 2.2**). This comprehensive survey approach ensured that high coverage of the canal basin and lock structures was achieved, enabling a better overview of macrophyte and aquatic bryophyte species present whilst also increasing the likelihood of opposite-pondweed detection.

Table 2.1 Location of $n=10$ opposite-leaved pondweed survey transects on the Royal Canal, Phibsborough, June 2021

Transect	Location		X (ITM)	Y (ITM)
A	Lock 6	Start	714749	736411
		Stop	714729	736419
B1	Between Lock 6 and 5	Start	714776	736398
		Stop	714780	736408
B2	Between Lock 6 and 5	Start	714796	736382
		Stop	714802	736400
B3	Between Lock 6 and 5	Start	714819	736373
		Stop	714825	736391
B4	Between Lock 6 and 5	Start	714848	736381
		Stop	714841	736364
B5	Between Lock 6 and 5	Start	714864	736354
		Stop	714871	736372
B6	Between Lock 6 and 5	Start	714887	736345
		Stop	714893	736362
B7	Between Lock 6 and 5	Start	714909	736336
		Stop	714916	736353
B8	Between Lock 6 and 5	Start	714932	736326
		Stop	714938	736342

Transect	Location		X (ITM)	Y (ITM)
C	Lock 5	Start	714981	736314
		Stop	714960	736323

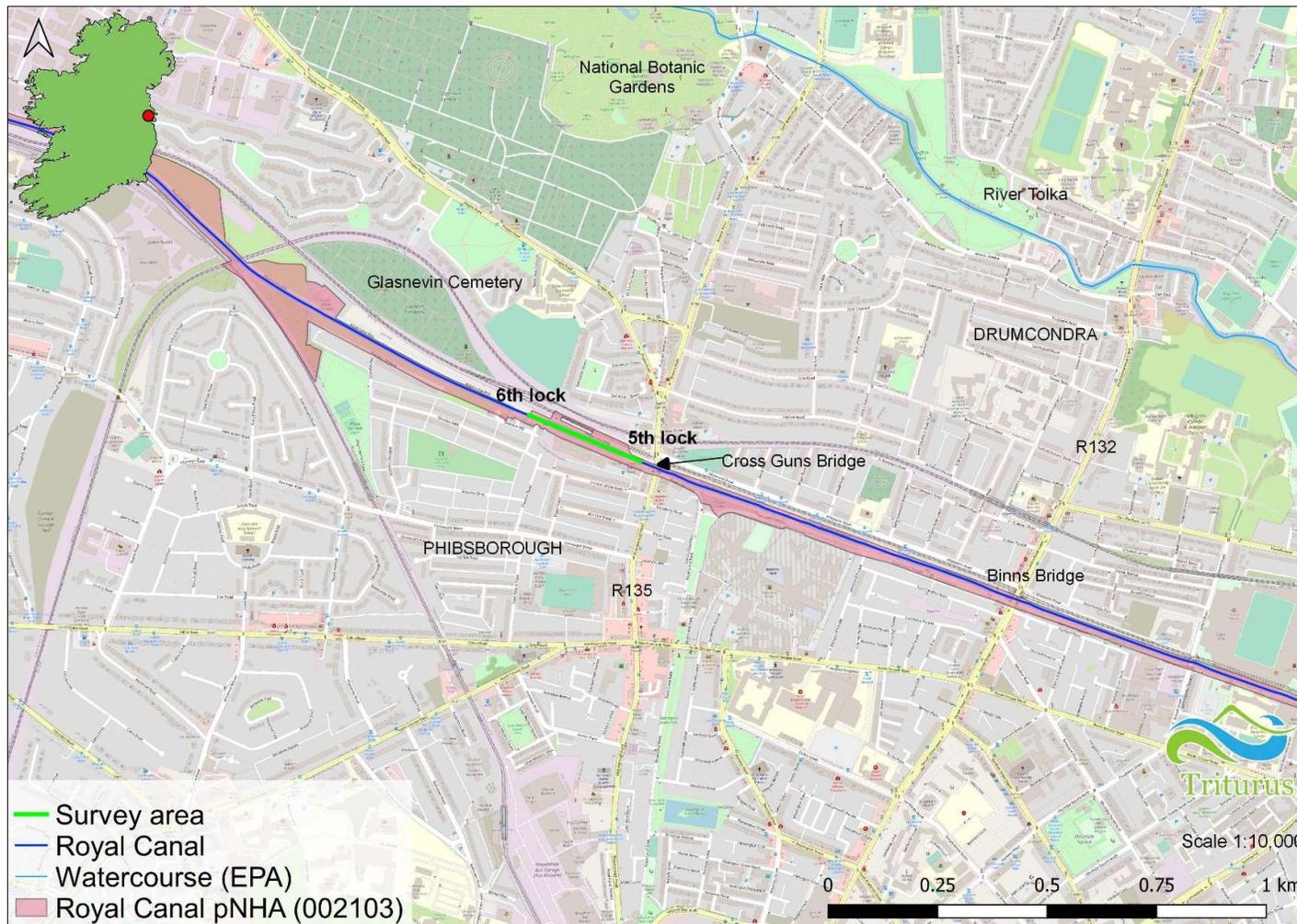


Figure 2.1 Location of the Royal Canal 5th level survey area near Cross Guns Bridge, Phibsborough, Dublin 7

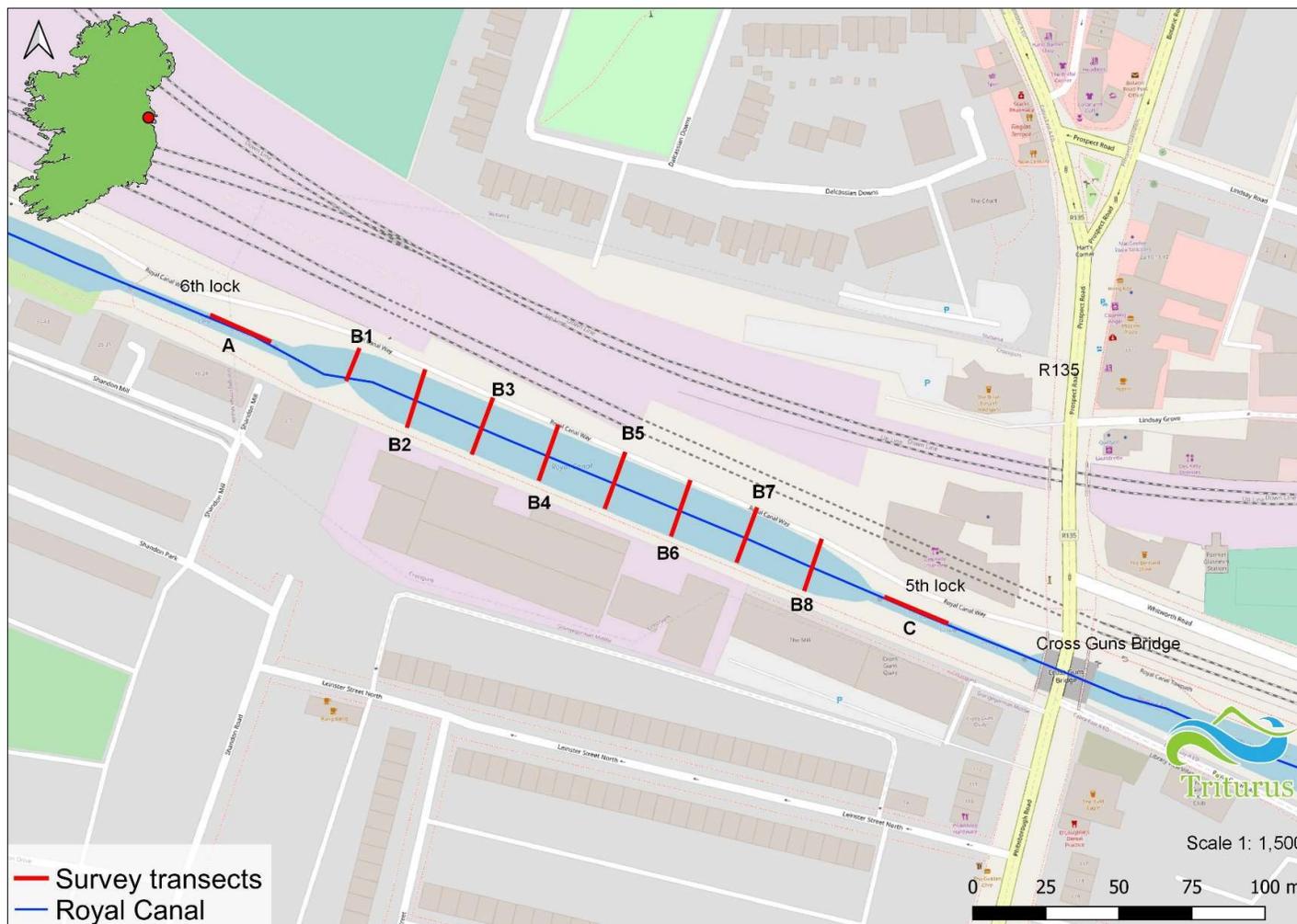


Figure 2.2 Royal Canal opposite-leaved pondweed survey transects, June 2021

2.2 Macro-invertebrate survey

To establish the macro-invertebrate community and presence of any rare or protected species, the Royal Canal was sampled in June 2021. A total of $n=5$ samples, along transects B2, B4, B6, B7 and B8 (**Table 2.1, Figure 2.2**) were collected from the canal basin. A standard pond net (250mm width, mesh size 500 μ m) was used to sweep macrophytes to capture macro-invertebrates. The canal bed was also swept to collect epibenthic and epiphytic invertebrates from the substratum (as per Cheal et al., 1993). In order to ensure appropriate habitat coverage, a 3-minute sampling period was divided amongst the range of meso-habitats present to obtain the most representative sample. The five composite samples were sorted live to improve cryptic prey detection and fixed in 70% ethanol for subsequent laboratory identification. Any rare invertebrate species were identified from the NPWS Red List publications for beetles (Foster et al., 2009), non-marine molluscs (Byrne et al., 2009) and odonata (Nelson et al. 2011). In the absence of a national red list for trichopteran records, the invertebrate samples were referenced against the National Grid Atlas of the Irish Caddisflies (O' Connor, 2020).

2.3 Biosecurity

A strict biosecurity protocol, including the Check-Clean-Dry approach, was adhered to during surveys for all equipment and PPE used. Disinfection of all equipment and PPE before and after use with Virkon™ was conducted to prevent the transfer of pathogens or invasive propagules between survey sites. Particular cognisance was given towards preventing the spread or introduction of crayfish plague (*Aphanomyces astaci*) given the known distribution of white-clawed crayfish (*Austropotamobius pallipes*) in the Royal Canal (albeit significant distances upstream of Dublin City).

3. Results

3.1 Opposite-leaved pondweed survey

No opposite-leaved pondweed was recorded in the survey area in June 2021. SCUBA dive transect surveys recorded a total of $n=10$ macrophyte species (**Table 3.1**), namely whorled water-milfoil (*Myriophyllum verticillatum*), spiked-water milfoil (*Myriophyllum spicatum*), common stonewort (*Chara vulgaris*), small pondweed (*Potamogeton pusillus*), curled pondweed (*Potamogeton crispus*) in addition to ivy-leaved duckweed (*Lemna trisulca*). The macrophyte community also included the two non-native species Canadian pondweed (*Elodea canadensis*) and Nuttall's pondweed (*Elodea nuttallii*). These latter plants are both considered as high-risk impact species in Ireland (Kelly et al., 2013). Horned pondweed (*Zannichellia palustris*) and rigid hornwort (*Ceratophyllum demersum*) were recorded as rare in the canal basin. The macrophyte cover, when combined with filamentous green algae, covered up to 100% of the basin between transects B1 and B8 (i.e. total cover). The macrophyte and algal coverage was only lesser in the canal lock basins where turbulence, shading and depths were greater.

The aquatic moss *Fontinalis antipyretica* was recorded on the quay walls and lock gates throughout the survey area (where it was locally abundant).

Table 3.1 Summary of macrophyte species recorded in Royal Canal survey transects

Transect	Physical Notes	Macrophytes (DAFOR)	Aquatic bryophytes (DAFOR) & filamentous algae	Opposite-leaved pondweed present/absent
A	Mixed sediment bottom with boulder, cobble, coarse gravel clay, sand and silt. Limited macrophytes due to turbulence and depth in canal lock (>3m). Limited to <i>Elodea</i> spp.	<i>Elodea nuttallii</i> (O) <i>Lemna trisulca</i> (R)	<i>Fontinalis antipyretica</i> (R) <i>Cladophora glomerata</i> (R)	No
B1	Deep soft silt central basin with harder littorals of clay, cobble, gravels and silt. Canal typically 2m to 2.5m deep	<i>Myriophyllum verticillatum</i> (R) <i>Myriophyllum spicatum</i> (R) <i>Chara vulgaris</i> (R) <i>Potamogeton crispus</i> (R) <i>Elodea nuttallii</i> (R) <i>Lemna trisulca</i> (R)	<i>Fontinalis antipyretica</i> (R) <i>Cladophora glomerata</i> (R)	No
B2	Deep soft silt central basin with harder littorals of clay, cobble, gravels and silt. Canal typically 2m to 2.5m deep	<i>Myriophyllum verticillatum</i> (R) <i>Myriophyllum spicatum</i> (R) <i>Chara vulgaris</i> (R) <i>Potamogeton pusillus</i> (R) <i>Potamogeton crispus</i> (O) <i>Elodea nuttallii</i> (R) <i>Elodea canadensis</i> (R) <i>Lemna trisulca</i> (R)	<i>Fontinalis antipyretica</i> (R) <i>Cladophora glomerata</i> (F)	No
B3	Deep soft silt central basin with harder littorals of clay, cobble, gravels and silt. Canal typically 1.6m to 1.8m deep	<i>Myriophyllum verticillatum</i> (R) <i>Myriophyllum spicatum</i> (R) <i>Chara vulgaris</i> (R) <i>Potamogeton pusillus</i> (O) <i>Potamogeton crispus</i> (O) <i>Zannichellia palustris</i> (R) <i>Elodea nuttallii</i> (O) <i>Elodea canadensis</i> (R) <i>Lemna trisulca</i> (R)	<i>Fontinalis antipyretica</i> (R) <i>Cladophora glomerata</i> (A)	No
B4	Deep soft silt central basin with harder littorals of clay, cobble, gravels and silt. Canal typically 1.6m to 1.8m deep	<i>Myriophyllum verticillatum</i> (F) <i>Myriophyllum spicatum</i> (R) <i>Chara vulgaris</i> (R) <i>Potamogeton pusillus</i> (O) <i>Potamogeton crispus</i> (O) <i>Ceratophyllum demersum</i> (R) <i>Zannichellia palustris</i> (R) <i>Elodea nuttallii</i> (O) <i>Elodea canadensis</i> (R) <i>Lemna trisulca</i> (R)	<i>Fontinalis antipyretica</i> (R) <i>Cladophora glomerata</i> (A)	No
B5	Deep soft silt central basin with harder littorals of clay, cobble, gravels and silt. Canal typically 1.6m to 1.8m deep	<i>Myriophyllum verticillatum</i> (A) <i>Myriophyllum spicatum</i> (R) <i>Chara vulgaris</i> (R) <i>Potamogeton pusillus</i> (O) <i>Potamogeton crispus</i> (O) <i>Ceratophyllum demersum</i> (R) <i>Zannichellia palustris</i> (R) <i>Elodea nuttallii</i> (O) <i>Elodea canadensis</i> (R)	<i>Fontinalis antipyretica</i> (R) <i>Cladophora glomerata</i> (A)	No

Transect	Physical Notes	Macrophytes (DAFOR)	Aquatic bryophytes (DAFOR) & filamentous algae	Opposite-leaved pondweed present/absent
		<i>Lemna trisulca</i> (R)		
B6	Deep soft silt central basin with harder littorals of clay, cobble, gravels and silt. Canal typically 1.6m to 1.8m deep	<i>Myriophyllum verticillatum</i> (A) <i>Myriophyllum spicatum</i> (R) <i>Chara vulgaris</i> (R) <i>Potamogeton pusillus</i> (O) <i>Potamogeton crispus</i> (O) <i>Ceratophyllum demersum</i> (R) <i>Zannichellia palustris</i> (R) <i>Elodea nuttallii</i> (O) <i>Elodea canadensis</i> (R) <i>Lemna trisulca</i> (R)	<i>Fontinalis antipyretica</i> (R) <i>Cladophora glomerata</i> (O)	No
B7	Deep soft silt central basin with harder littorals of clay, cobble, gravels and silt. Canal typically 1.6m to 1.8m deep	<i>Myriophyllum verticillatum</i> (A) <i>Myriophyllum spicatum</i> (R) <i>Chara vulgaris</i> (R) <i>Potamogeton pusillus</i> (O) <i>Potamogeton crispus</i> (O) <i>Zannichellia palustris</i> (R) <i>Elodea nuttallii</i> (O) <i>Elodea canadensis</i> (R) <i>Lemna trisulca</i> (R)	<i>Fontinalis antipyretica</i> (R) <i>Cladophora glomerata</i> (O)	No
B8	Deep soft silt central basin with harder littorals of clay, cobble, gravels and silt. Canal typically 1.6m to 1.8m deep	<i>Myriophyllum verticillatum</i> (F) <i>Myriophyllum spicatum</i> (R) <i>Chara vulgaris</i> (R) <i>Potamogeton pusillus</i> (O) <i>Potamogeton crispus</i> (O) <i>Elodea nuttallii</i> (O) <i>Elodea canadensis</i> (R) <i>Lemna trisulca</i> (R)	<i>Fontinalis antipyretica</i> (R) <i>Cladophora glomerata</i> (O)	No
C	Mixed sediment bottom with boulder, cobble, coarse gravel clay, sand and silt. Limited macrophytes due to turbulence and depth in canal lock (>3m). Limited to <i>Elodea</i> spp.	<i>Elodea nuttallii</i> (O) <i>Elodea canadensis</i> (R) <i>Lemna trisulca</i> (R)	<i>Fontinalis antipyretica</i> (R) <i>Cladophora glomerata</i> (R)	No



Plate 3.1 Macro-invertebrate sweep sample from 5th level of the Royal Canal



Plate 3.2 Gates of the 6th Lock at lower extent of study area



Plate 3.2 Macrophyte and aquatic bryophyte assemblage from Royal Canal showing (top-left to bottom right) *Elodea nuttallii*, *Myriophyllum spicatum*, *Myriophyllum verticillatum*, *Potamogeton crispus* & *Fontinalis antipyretica*



Plate 3.3 Floating ivy-leaved duckweed (*Lemna trisulca*) and *Potamogeton* sp. (viewed from underneath the water's surface).



Plate 3.4 *Ceratophyllum demersum* and *Myriophyllum verticillatum* (centre foreground)



Plate 3.5 *Cladophora* sp. and *Chara* sp. recorded in the Royal Canal 5th level

3.2 Macro-invertebrate survey

A total of $\geq n=24$ macro-invertebrate species across ten taxa were recorded from the samples collected in June 2021. No species of conservation status greater than least concern (according to national red lists) were recorded.

The cased caddis species *Leptocerus tineiformis* was recorded from transects B4, B6 and B7 within the 5th level of the Royal Canal (Table 3.2). Whilst not rare, the species is regionally uncommon (O'Connor, 2020).

The bivalve species known as the horney orb mussel (*Sphaerium corneum*) was recorded as common in the samples. The species is widespread in Ireland, especially in hard water areas, and was previously recorded at this site in 2018 (Triturus, 2021) and throughout the Royal Canal (Moorkens & Killeen, 2003, 2005). Good numbers of *Pisidium* spp. were recorded from the samples but these were predominantly *Pisidium subtruncatum* and *Pisidium nitidum* species. None of the rarer, IUCN endangered *Pisidium* species were identified present, i.e. *Pisidium pseudosphaerium*, *Pisidium pulchellum* and *Pisidium moitessierianum*.

The IUCN Endangered glutinous snail (*Myxas glutinosa*), known from the Royal Canal in the vicinity of Dublin (INVAS, 2017; Moorkens & Killeen, 2003, 2005) was not recorded in the samples.

Table 3.2 Macro-invertebrate species composition for 5 no. Royal Canal survey transects

Group	Family	Species	B2	B4	B6	B7	B8	Conservation status
Trichoptera	Hydroptilidae	<i>Oxyethira flavicornis</i>			1			n/a
Trichoptera	Leptoceridae	<i>Athripsodes aterrimus</i>	3		3	4	3	n/a
Trichoptera	Leptoceridae	<i>Leptocerus tineiformis</i>		5	1	1		n/a (but regionally uncommon)
Trichoptera	Leptoceridae	<i>Mystacides longicornis</i>	1	1			4	n/a
Trichoptera	Limnephilidae	<i>Limnephilus lunatus</i>					1	n/a
Trichoptera	Phryganeidae	<i>Agrypnia obsoleta</i>					1	n/a
Amphipoda	Gammaridae	<i>Gammarus duebeni</i>		23	1	22	4	n/a
Arachnida	Hydrachnidiae	Unidentified species		5		1	12	n/a
Coleoptera	Halipliidae	<i>Haliplus flavicollis</i>		1		1		Least concern (Foster et al., 2009)
Coleoptera	Curculionidae	Unidentified species	1		6	13	7	n/a
Diptera	Ceratopogonidae	<i>Ceratopogonid</i> sp.			2			n/a
Diptera	Chironomidae	Unidentified larva	5		7	11	11	n/a
Hemiptera	Corixidae	<i>Corixidae</i> nymph			1	1		n/a
Mollusca	Bithyniidae	<i>Bithynia tentaculata</i>	80	80	84	74	72	Least concern (Byrne et al., 2009)
Mollusca	Bithyniidae	<i>Bithynia leachii</i>	20	20	21	18	9	Least concern (Byrne et al., 2009)
Mollusca	<u>Lymnaeidae</u>	<i>Galba truncatula</i>			1			Least concern (Byrne et al., 2009)
Mollusca	Neritidae	<i>Theodoxus fluviatilis</i>	1		4			Least concern (Byrne et al., 2009)
Mollusca	Planorbidae	<i>Planorbis planorbis</i>	3		2	2		Least concern (Byrne et al., 2009)
Mollusca	Sphaeriidae	<i>Pisidium</i> spp.	66	36	49	41	72	Least concern (Byrne et al., 2009)
Mollusca	Sphaeriidae	<i>Sphaerium corneum</i>	7	11	6	15	8	Least concern (Byrne et al., 2009)
Annelida	Erpobdellidae	<i>Erpobdella</i> sp.				1		n/a
Crustacea	Asellidae	<i>Asellus aquaticus</i>	9	39	39	59	48	n/a
Annelida	Naididae (Tubificidae)	Unidentified species				1		n/a
Annelidae	Lumbricidae	<i>Lumbriculus</i> sp.	1					n/a

4. Discussion

4.1 Macrophyte community

No opposite-leaved pondweed was recorded from the 5th level of the Royal Canal in June 2021. The plant is known from the 1st, 2nd, 3rd and 4th levels of the Royal Canal (BEC, 2011; INVAS, 2017; NBDC data). The nearest location of the *Groenlandia densa* is the 4th level (i.e. immediately downstream of the current survey area, east of Cross Gun's Bridge). The species occurs quite frequently from below the 5th lock in the Royal Canal as far as Croke Park (above the 1st lock, at the canal's confluence with the River Liffey). The absence of opposite-leaved pondweed from the 5th level is possibly due to depth constraints or the high cover of species such as *Myriophyllum verticillatum*. Previous surveys of the 5th level in 2018 (Triturus, 2021) also failed to record opposite-leaved pondweed.

The rare stonewort species, tassel stonewort (*Tolypella intricata*) has been recorded historically from the Royal Canal between Granard Bridge and Cross Gun's Bridge with records from 1992 - the species was recorded typically within 1m metre from the bank growing in silt in 0.5m water depth (Nash & King, 1993). The species was not recorded during the current survey between the 6th and 5th locks of the Royal Canal. The survey area typically featured water between 1.5m and 2m deep with typically steeply-sloping margins and, thus, may be unsuitable for the species.

4.2 Macro-invertebrate community

No macro-invertebrate species of conservation status greater than least concern (according to national red lists) were recorded during the current survey. This included an assessment of trichopteran, molluscan and coleopteran fauna.

The cased caddis species *Leptocerus tineiformis*, a species associated with macrophytes in standing water only, was recorded at low densities within the 5th level of the Royal Canal. The species is known from 6 no. national 10km grid squares but has not previously been recorded from the Royal Canal (NBDC records; O' Connor, 2020).

In the Royal Canal the ICUN endangered glutinous snail (*Myxas glutinosa*) was found living at a line of five sites towards the eastern end between Maynooth and Leixlip (Moorkens & Killeen 2003, 2005), approx. 15km west of the current survey area. Favouring a diverse community of macrophytes, this species requires high water quality and has declined geographically in both the Royal and Grand Canals, increasing the vulnerability of these populations (Moorkens & Killeen 2003). The Irish population of *M. glutinosa* is considered globally important (up to 50% of the global population; Byrne et al., 2009).

Though not recorded in the current survey, other rare and or declining aquatic molluscan fauna have been previously recorded in the Royal Canal, including the whirlpool ramshorn snail (*Anisus vortex*), an IUCN vulnerable species, and the pygmy pea shell (*Pisidium moitessierianum*), an IUCN endangered species (Byrne et al., 2009). The closest whirlpool ramshorn snail and pygmy pea shell records were in the Moyvalley area east of Dublin City (NBDC data). The Irish distribution of the false-orb pea mussel (*Pisidium pseudosphaerium*) is centred in the Royal and Grand Canals and is thought to be at risk from dredging activities (Byrne et al., 2009). The nearest record for *Pisidium pseudosphaerium* is in the vicinity of Leixlip (Moorkens & Killeen

2003, 2005). A third IUCN endangered *Pisidium* species, the iridescent pea mussel (*Pisidium pulchellum*), is known from the Royal Canal albeit at the western extent near the River Shannon. As above for *Myxas glutinosa*, populations of these species in the Royal Canal are considered vulnerable given their restricted distribution (Moorkens & Killeen 2003). Whilst good numbers of *Pisidium* spp. were recorded from the samples in the current survey, these were predominantly the short-ended pea mussel (*Pisidium subtruncatum*) and shing pea clam (*Pisidium nitidum*) species (both of least concern).

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Triturus Environmental Ltd.

42 Norwood Court,

Rochestown,

Co. Cork,

T12 ECF3.