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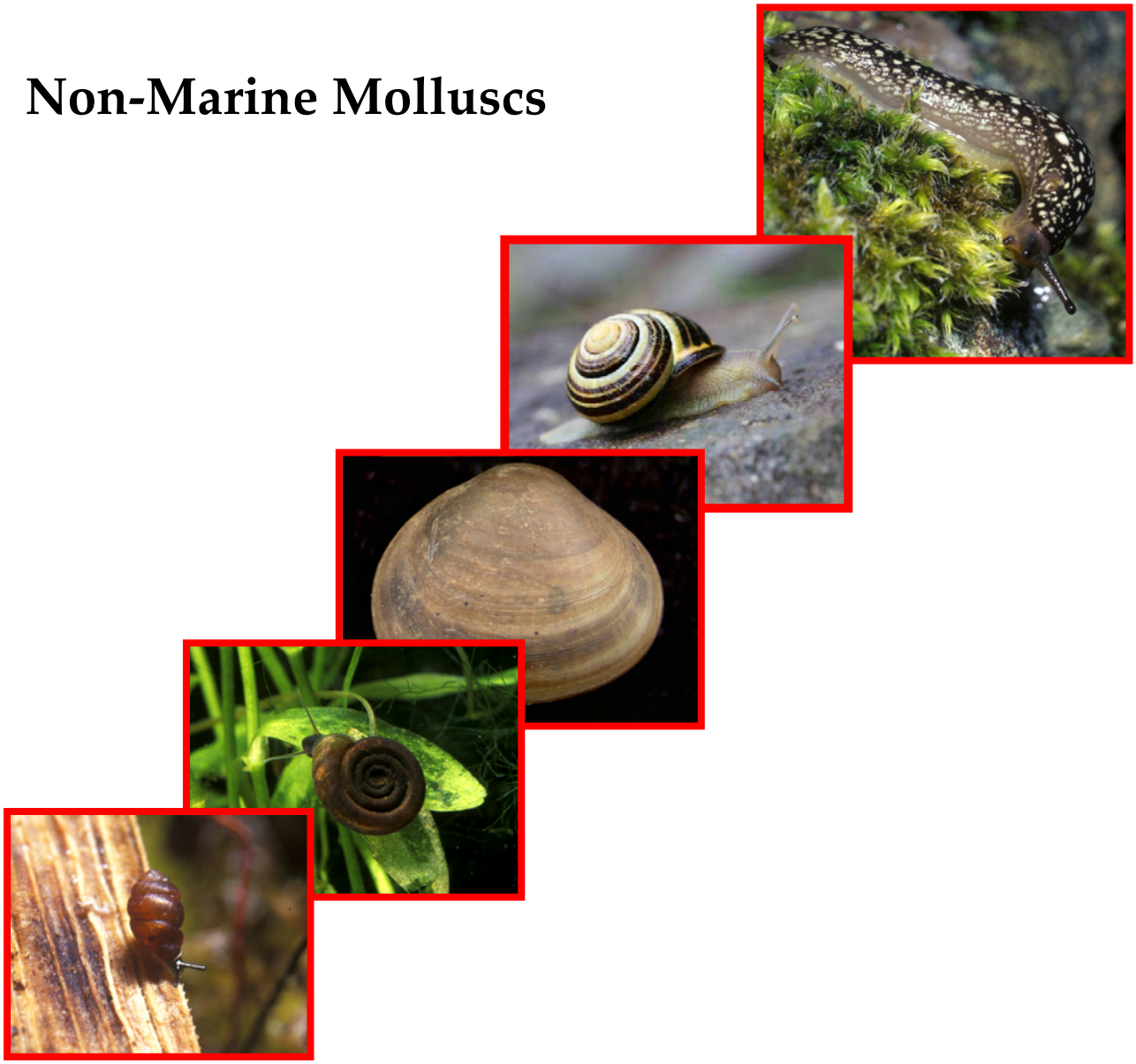
Ireland

Red List No. 2

THE IUCN RED LIST OF THREATENED SPECIES™

Non-Marine Molluscs



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NATIONAL BIODIVERSITY DATA CENTRE

Comhshaol, Oidhreacht agus Rialtas Áitiúil
Environment, Heritage and Local Government

Ireland Red List No. 2:

Non-Marine Molluscs

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CONTENTS

ACKNOWLEDGEMENTS 1

EXECUTIVE SUMMARY 2

INTRODUCTION 3

NOMENCLATURE 3

COVERAGE AND DATABASE STRUCTURE 3

SUMMARY OF EVALUATIONS 5

THE MAPS 8

CLASS GASTROPODA 9

CLASS BIVALVIA 26

REFERENCES 31

APPENDIX 1: CHECKLIST OF IRISH NON-MARINE MOLLUSCS 34

APPENDIX 2: NOTES ON NON-MARINE MOLLUSCAN RED LISTS IN EUROPE 39

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The species maps were created using the distribution mapping software DMAP © Alan Morton (www.dmap.co.uk).

EXECUTIVE SUMMARY

Based on almost 80,000 records for Ireland, 150 native species of non-marine mollusc are evaluated for their conservation status using International Union for the Conservation of Nature (IUCN) criteria (IUCN, 2001, 2003). Two are considered to be regionally extinct, five critically endangered, fourteen endangered, twenty-six vulnerable, six near threatened, and the rest of least concern, or data deficient.

Ireland's non-marine molluscan fauna is of international importance. Ten species have populations of significant international worth, having large proportions of their global population in Ireland. *Ashfordia granulata* and *Leisotyla anglica* are two examples of such species; both are near endemics to Britain and Ireland, with Ireland having at least a fifth of their global populations. Seven species have been listed on the global IUCN red list, for example *Myxas glutinosa* and *Quickella arenaria*, both of which are endangered species in Ireland. Six species are legally protected under European legislation. Of these legally protected species, only the Kerry slug, *Geomalacus maculosus*, is not considered threatened in Ireland. However, the Irish population of this species is of particular international importance as the species is restricted to south-west Ireland and northern Iberia, and the Iberian populations are severely threatened.

Some species are rare in Ireland as they are at the edge of their range or climatic tolerances (e.g. *Pomatias elegans*). For species that are declining in Ireland there are multiple drivers of population loss. Species declines are primarily driven by habitat loss (e.g. loss of marginal agricultural wetlands through drainage impacting species such as *Vertigo antivertigo*), habitat change (e.g. reduced water quality impacting species such as *Pisidium pseudosphaerium* and *Margaritifera margaritifera*) and habitat management (e.g. woodland management practices impacting species such as *Spermodea lamellata*). To a lesser extent species may be declining due to climate change (e.g. *Pisidium conventus*, a cold, deep water, montane species) and the impact of invasive species (*Anodonta cygnea* and *A. anatina*, the swan and duck mussels, are being severely impacted by the invasive species *Dreissena polymorpha*, the zebra mussel).

The importance of water quality and the reduction of habitat loss and change across a spectrum of habitats are identified as important components in conserving the non-marine molluscan fauna on the island of Ireland.

INTRODUCTION

There has been a long history of recording non-marine molluscs in Britain and Ireland with some of the oldest reliable records dating to the 1830s. There was a period of intense recording activity in Ireland between 1892 and 1914 (Kerney, 1999), with a number of publications in the *Irish Naturalist* and books cataloguing the species of Ireland (Scharff, 1891, 1892; Stelfox, 1911) (see figure 2 overleaf). The establishment of the Non-Marine Molluscan Database at the National Biodiversity Data Centre has made it possible to evaluate decline in order to identify species at risk of extinction in Ireland in accordance with the guidelines of the International Union for the Conservation of Nature (IUCN). The IUCN revised its categories and criteria for the red listing of species in 2001 (IUCN, 2001), and in 2003 produced guidelines for using the categories on a regional basis (IUCN, 2003). These were followed for the production of this Red List.

NOMENCLATURE

The taxonomic checklist (Table 3 in Appendix 1) used here follows Anderson (2005), with the exception of *Margaritifera durrovensis*. The River Nore population of the pearl mussel has been taxonomically uncertain in the scientific literature (Stelfox, 1929; Chesney *et al*., 1993; Lucey, 2006) since its formal description (Phillips, 1928) and has been described as a species (e.g. European Union directive on conservation of natural habitats [92/43/EEC]; Costello *et al*., 1998), subspecies (e.g. McMillan & Zeissler, 1990; Moorkens *et al*. 1992), and ecophenotype (e.g. Chesney *et al*., 1993; Lucey, 2006). We follow the EU Habitats Directive by assigning species to the taxon. Common names follow Kerney (1999), with the exception of the bivalves, which follow Killeen *et al*. (2004).

COVERAGE AND DATABASE STRUCTURE

The current Non-Marine Molluscan Database contains approximately 80,000 records and the distribution of these records, pre and post 1980, is shown in Figure 1.

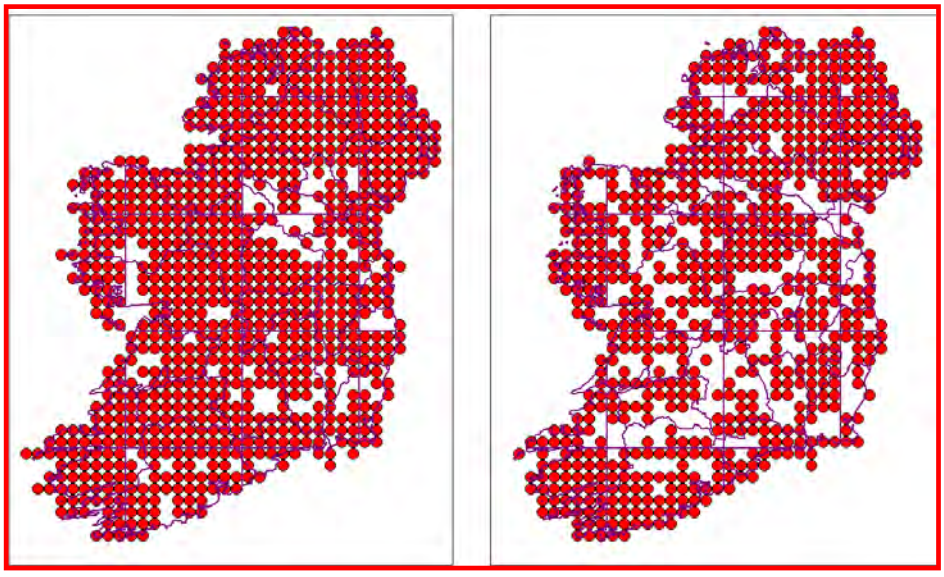


Figure 1: Distribution of all records in the all-Ireland database prior to 1980 (left), including and after 1980 (right).

The year 1980 was chosen as the point from which to assess decline. However, data is not equally distributed across this time point - 63% of the data is attributed to the earlier recording period and 36% to the more recent period. Despite this, there is reasonable distribution coverage pre- and post-1980, and this year was also used for the Irish bee and water beetle Red Lists (Fitzpatrick *et al.*, 2006; Foster *et al.*, 2009). Coverage at the ten kilometre scale is good for records pre-1980 (up to and including 1979), mainly due to the dedicated efforts of a group of conchologists working at the early part of the last century and the contributions for the Conchological Society's mapping scheme which started in 1961. Many of the records post-1980 can again be attributed to the mapping scheme that resulted in the 1999 Atlas of British and Irish Molluscs (Kerney, 1999). Many additional records from species specific projects, publications and consultants' records were added to the database. Though there are fewer post-1980 records, the records that do exist are from targeted fieldwork. Thus, rare species, and species of conservation concern, have a good number of records post-1980. Where the recording effort is a problem is with widespread species, where apparent losses may be attributed to the reduced geographic spread of sampling and to the reduced sampling of non-priority habitats.

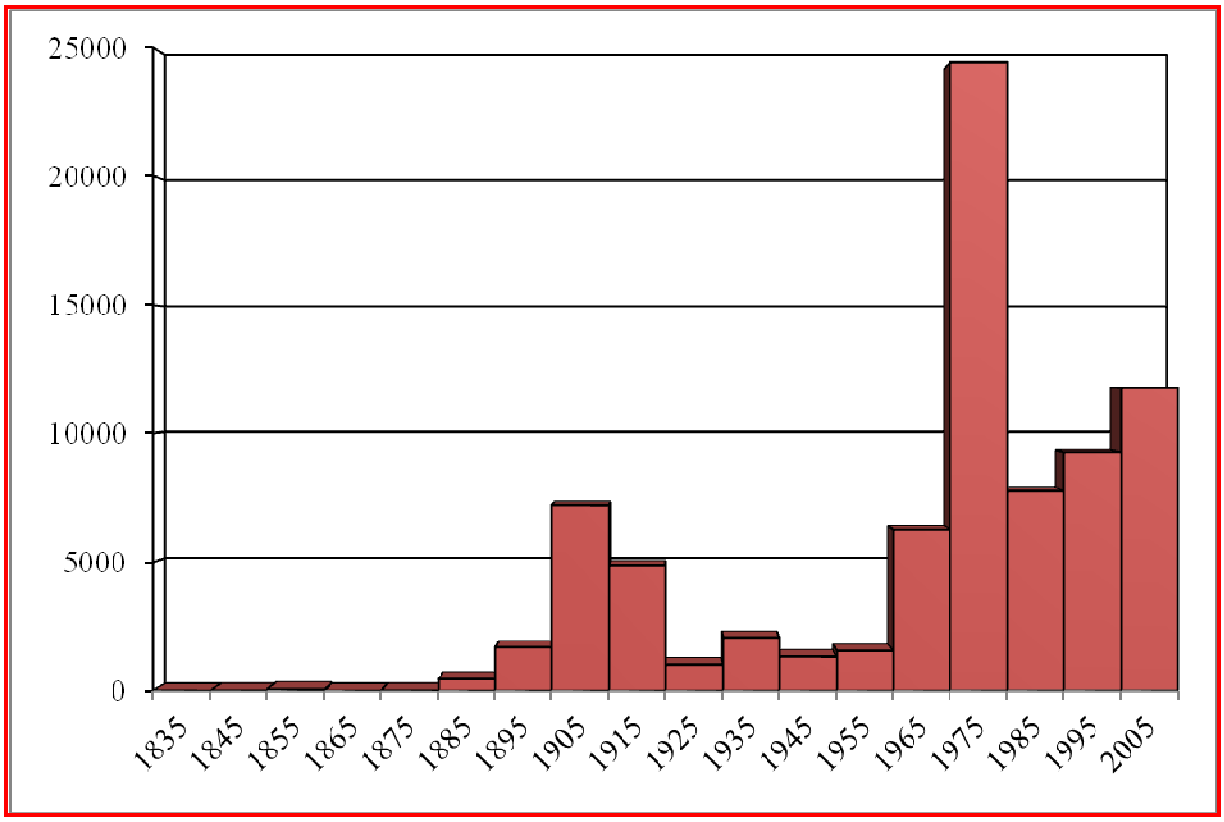


Figure 2: Distribution of records by decade, excluding the period from 2006 - date. Some records in the database have date ranges spanning more than one decade. These records have been distributed evenly across the date ranges.

SUMMARY OF EVALUATIONS

The total number of species of non-marine molluscs that have been recorded in Ireland is 177. Of these, 27 species were considered 'ineligible for assessment at a regional level' because they are 'not a wild population or not within its natural range in the region', nor are they part of the modern Irish fauna (IUCN, 2003). Eleven are hothouse alien species which are incapable of surviving and reproducing in the wild (Table 3 in Appendix 1) and a further 15 species are considered recent introductions, one of which is the alien invasive species *Dreissena polymorpha*. *Truncatellina cylindrica* was discussed in the Red List workshop, despite the fact that the species is not on the current checklist for Ireland (Anderson, 2005). Kerney (1999) quotes an Irish record from Groomsport, Co. Down, from 1850, however the current consensus among experts is that the specimen is a well preserved subfossil. Thus, the species is not considered part of the current Irish fauna. All of these species are categorised as 'Not Applicable' (na) under IUCN Regional Red List guidelines (Table 3 in Appendix 1).

The remaining 150 species were all evaluated for potential Red List status. Prior to the Red List workshop held on the 8th of April 2009 at the NPWS offices in Dublin, a list of species qualifying as being of 'least concern' was produced. This list was created in a stepwise process:

- A preliminary list was generated initially of species that were
    1. widespread, with over 100 10km squares post 1965 in Kerney's atlas and with records in each of the four provinces of Ireland, and are not declining significantly according to Kerney (1999) and
    2. known to be expanding in range.
- This list was then assessed by regional experts (R. Anderson and E. Moorkens); species that the experts considered under threat in Ireland were taken from the least concern list and put forward for evaluation at the workshop, while other species were added to the least concern list.

The least concern list was treated in a conservative fashion and none of the species on the list fulfilled any of the requirements for an IUCN threat or near threat category. In total, 70 species were considered of least concern. All other species (80) were evaluated during the Red List workshop using maps generated from the non-marine molluscan database of Ireland. The workshop was attended by Andrew Byrne (National Biodiversity Data Centre), Eugenie Regan (National Biodiversity Data Centre), Ferdia Marnell (NPWS), Naomi Kingston (NPWS), Roy Anderson, Evelyn Moorkens and Ian Killeen.

Six Irish non-marine mollusc species are on the global IUCN Red List of Threatened Species; *Vertigo angustior, V. moulinsiana, V. geyeri, Quickella arenaria* (= *Catinella arenaria*), *Myxas glutinosa, Margaritifera margaritifera* and *Margaritifera durrovensis* (= *M. m. durrovensis*) (Mollusc Specialist Group, 1996). The three *Vertigo* species and Q. *arenaria* are considered at 'lower risk' of global extinction and *M. glutinosa* is considered data deficient, although it is worth noting that these species have been considered globally vulnerable in previous assessments (e.g. IUCN, 1990; Groomsbridge, 1994). *Margaritifera margaritifera* and *M. durrovensis* (listed as *M. margaritifera* ssp. *durrovensis* in the IUCN Red List) are considered endangered and critically endangered respectively. The *Vertigo* and *Margaritifera* species listed above are protected under the EU Habitats Directive (Annex II). Appendix 2 summarises the

regional Red List status of Irish species in other European countries. The Irish populations of ten species are of particular global importance. Of these, the populations of *Leiostyla anglica* and *M. glutinosa* make up approximately 50% of estimated global populations, while with *Ashfordia granulata* and *Zonitoides excavatus* Irish populations comprise approximately 20% of a putative global population.

Table 1: Lists of species evaluated as regionally extinct or under threat of regional extinction

Regionally extinct (RE)	
Helicigona lapicida (Linnaeus, 1758)	*Omphiscola glabra* (O.F. Müller, 1774)
Critically Endangered (CR)	
Pisidium conventus Clessin, 1877	*Pomatias elegans* (O.F. Müller, 1774)
Margaritifera margaritifera (Linnaeus, 1758)	*Truncatella subcylindrica* (Linnaeus, 1767)
Margaritifera durrovensis Philips, 1928	
Endangered (EN)	
Gyraulus laevis (Alder, 1838)	*Pisidium pulchellum* Jenyns, 1832
Hydrobia acuta neglecta (Muus, 1963)	*Pupilla muscorum* (Linnaeus, 1758)
Mercuria cf. *similis* (Draparnaud, 1805)	*Quickella arenaria* (Potiez & Michaud, 1835)
Merdigera obscura (O.F. Müller, 1774)	*Spermodea lamellata* (Jeffreys, 1830)
Myxas glutinosa (O.F. Müller, 1774)	*Succinella oblonga* Draparnaud, 1801
Pisidium moitessierianum Paladilhe, 1866	*Vertigo moulinsiana* (Dupuy, 1849)
Pisidium pseudosphaerium Schlesch, 1947	*Vertigo pusilla* Müller, 1774
Vulnerable (VU)	
Acicula fusca (Montagu, 1803)	*Pisidium lilljeborgii* Clessin, 1866
Anisus vortex (Linnaeus, 1758)	*Radix auricularia* (Linnaeus, 1758)
Anodonta anatina (Linnaeus, 1758)	*Sphaerium nucleus* (Studer, 1820)
Anodonta cygnea (Linnaeus, 1758)	*Tandonia rustica* (Millet, 1843)
Aplexa hypnorum (Linnaeus, 1758)	*Testacella haliotidea* Draparnaud, 1801
Arianta arbustorum (Linnaeus, 1758)	*Vallonia pulchella* (O.F. Müller, 1774)
Balea perversa (Linnaeus, 1758)	*Ventrosia ventrosa* (Montagu, 1803)
Cecilioides acicula (Müller, 1774)	*Vertigo angustior* Jeffreys, 1830
Cochlodina laminata (Montagu, 1803)	*Vertigo antivertigo* (Draparnaud, 1801)
Helicella itala (Linnaeus, 1758)	*Vertigo geyeri* Lindholm, 1925
Leiostyla anglica (A. Férussac, 1821)	*Vertigo lilljeborgi* (Westerlund, 1871)
Limax cinereoniger Wolf, 1803	*Zenobiella subrufescens* (J.S. Miller, 1822)
Musculium lacustre (O.F. Müller, 1774)	*Zonitoides excavatus* (Alder, 1830)

Table 1 lists the species evaluated as regionally extinct or under threat of regional extinction in 2009. For this red list, species were considered to be extinct if they had not been recorded since 1979 and had been specifically searched for in the intervening 30 years. Two species were evaluated as regionally extinct, *Helicigona lapicida*, which has been searched for but not seen alive since 1968 (Marjory Fogan), and *Omphiscola glabra*, where the last known population was recorded in 1979 and subsequently lost to habitat destruction (Hurley, 1981). Five were evaluated as critically endangered, 14 as endangered, and 26 as vulnerable. This is a total of 47 out of 150 native species. Therefore almost 30% of the species evaluated had a threat status (Figure 3). A further 6 species (4%) were considered near threatened, and if the current trends of increasing rates of population decline and habitat destruction continue, these species may be elevated to a threatened category in the future.

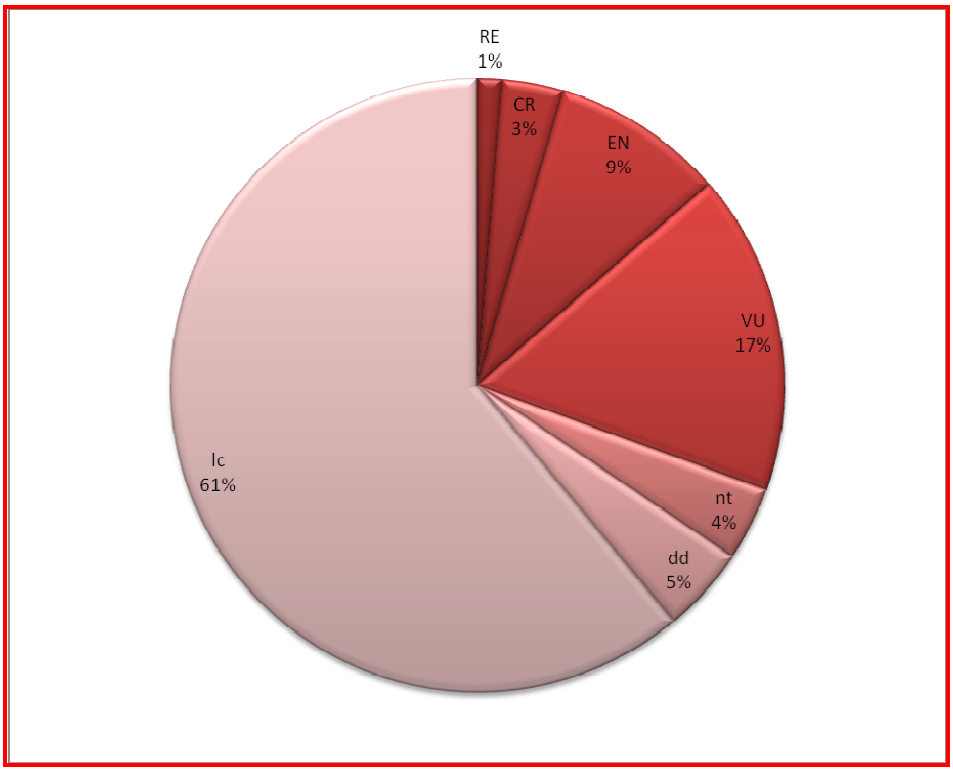


Figure 3: Percentage of the native Irish non-marine molluscan fauna within each of the IUCN regional Red List categories.

A number of criteria were used as the basis for evaluating species threat category (Table 2). Overall the criterion A2 (a continuing observed or estimated population decline) was used most frequently. The decline was based on the percentage decline in number of 10km records between pre-1980 and post-1980 taking into account the difference in total number of 10km square records between the two time periods. The final decision, however, was made using expert opinion as well as the data available, for example, whether a lack of records was related to lack of recording effort or an absence of the animals from searched sites. A number of species were considered threatened by their restricted or fragmented geographic range and documented declines (B2). Again this was based directly on the maps as well as expert opinion. For example, a species may have two localities according to the maps

presented but, in some cases, experts knew that those sites were no longer suitable. Criteria A1, C, D1 and E were not used as they are based primarily on population counts or quantitative assessments, and are generally not appropriate in assessing invertebrates.

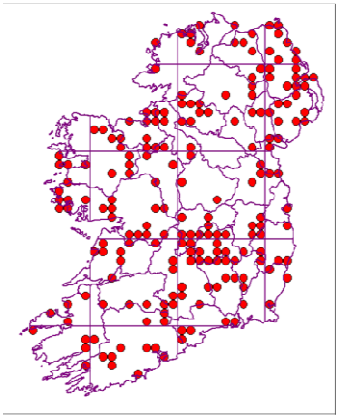
Table 2: Summary of evaluations and breakdown of main IUCN criteria

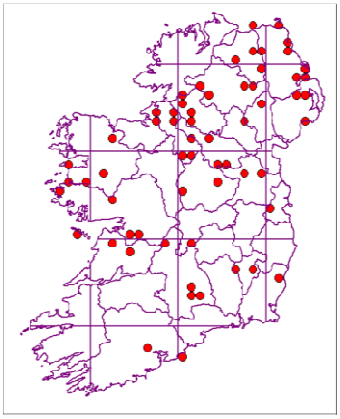
		IUCN Criteria					
	No. spp.	**A2**	**A3**	**A4**	**B1**	**B2**	**D2**
Critically endangered	5		2	2	2	2	
Endangered	14	9		1		5	
Vulnerable	26	17		4		3	4
Near Threatened	6	2		2		1	1

THE MAPS

The maps cover 56 taxa in alphabetical order. All RE, CR, EN, and NT species are covered, plus a few species of interest from amongst those data-deficient or evaluated of least concern. Two maps are presented for each species - maps on the left represent records from ca. 1835 to 1979; the maps on the right show recent records from 1980 to 2008. For some species more recent data was used during the evaluation process, including data from 2009, however these data are not presented on the maps.

CLASS GASTROPODA





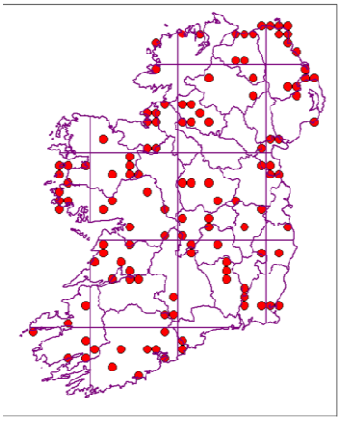
Acanthinula aculeata

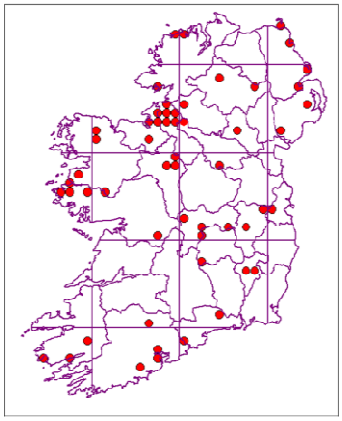
Prickly Snail

IUCN Near Threatened

A3c

Commoner in the north and west of Ireland. A declining species with 69% decline in records across the island. The species is often associated with hedgerow and fen margin habitats and may be declining due to habitat loss and lowering of habitat quality.





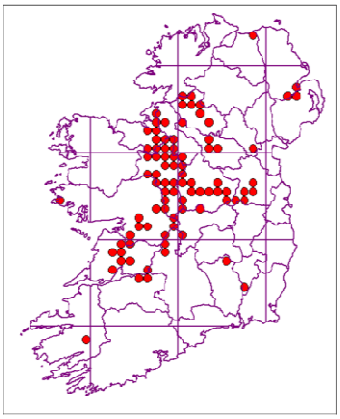
Acicula fusca

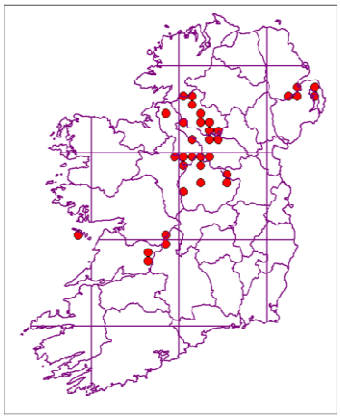
Point Snail

IUCN Vulnerable

A2c

A. fusca is essentially a soil or deep litter species preferring shaded environments on base-rich strata. A widespread, but declining, species that has had a 55% decline in records since 1980. A major threat is the loss of rough wet grasslands. This species is a near endemic to Britain and Ireland with small populations in France, Belgium and Germany.





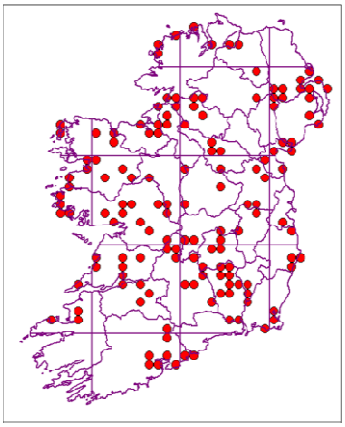
Anisus vortex

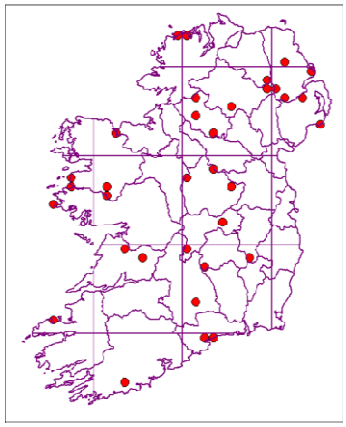
Whirlpool Ram's Horn

IUCN Vulnerable

A2c

Anisus vortex is found in clear, weedy water in larger streams, rivers and lakes. It has suffered a 63% distributional decline since 1980. The species is known to be lost from a number of sites where it was previously recorded. It is a rare species in the major canal systems in Ireland (Royal & Grand Canal) and was rarely encountered in a recent study (Moorkens & Killeen, 2005). A major factor in its decline is falling water quality.





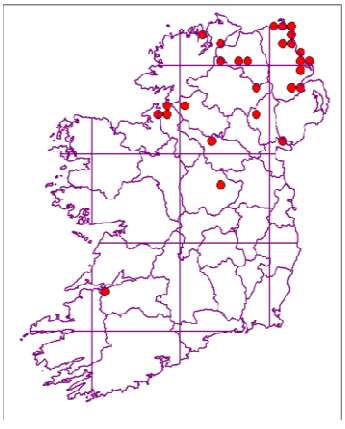
Aplexa hypnorum

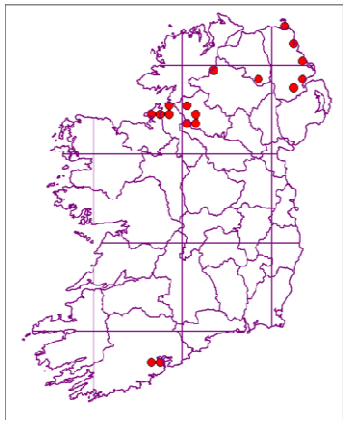
Moss Bladder Snail

IUCN Vulnerable

A2c

A widespread but declining species in Ireland due to loss of habitat, such as infilling of farm ponds and ditches (Kerney, 1999), and land drainage in general. The species prefers late sucessional habitats, ditches and ephemeral ponds and pools.





Arianta arbustorum

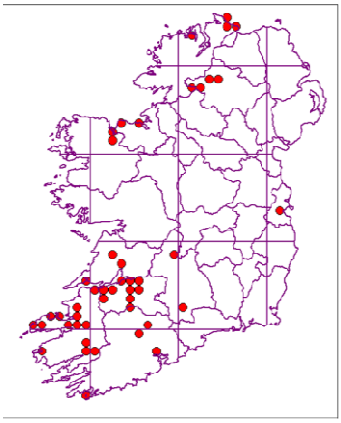
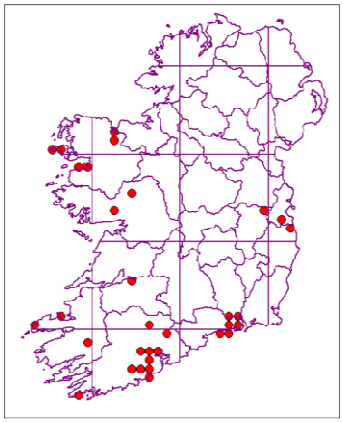
Copse Snail

IUCN Vulnerable

A2c; B2ab(ii,iii,iv)

A declining species with a fragmented distribution. It is associated with a number of rare or threatened habitats including open wet fen margins and open damp woodlands

and areas at the base of limestone escarpments.

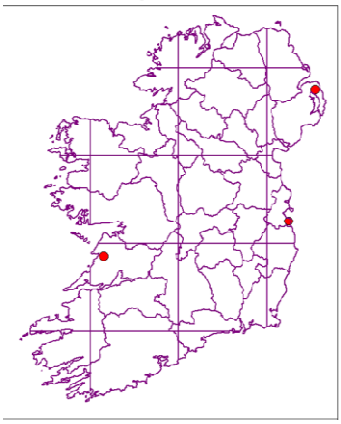
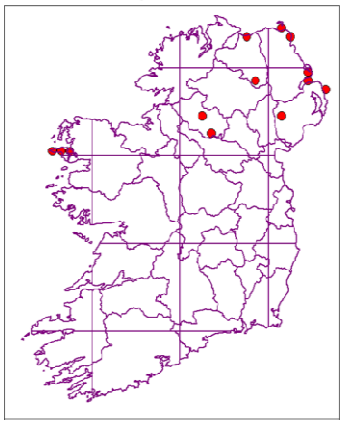
Ashfordia granulata

Silky Snail

IUCN Near Threatened

B2ab(ii,iii,iv)

This species has suffered a 25% decline in records since 1980, attributed to habitat loss, primarily of lightly wooded habitats and changes in grazing pressures therein. Irish population is of global importance, supporting >20% of total global population. The species is confined to Britain and Ireland with outlier populations in north-west France and northern Spain (Kerney, 1999).

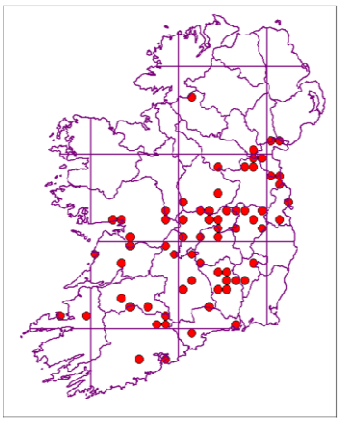
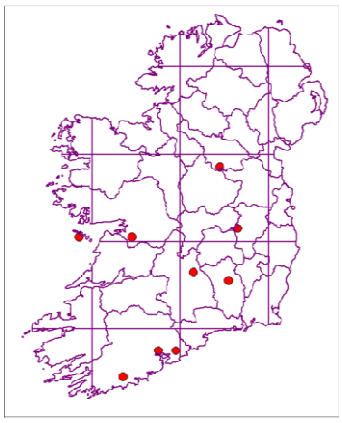
Balea perversa

Tree Snail

IUCN Vulnerable

A4c

Despite taxonomic confusion between this species and *Balea heydeni*, current knowledge suggests it is a rare and possibly declining species in Ireland. It is vulnerable at the western edge of its global range here, and may be suffering loss of suitable habitat. The species is especially associated with old, limestone or lime-mortared walls.

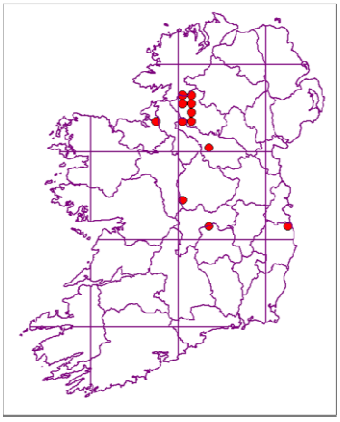
Cecilioides acicula

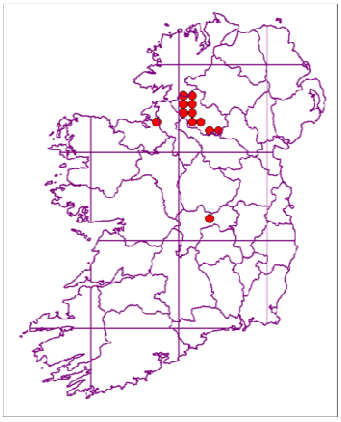
Blind Awl Snail

IUCN Vulnerable

A2c; B2ab(ii,iii,iv)

A probable introduction from Mediterranean countries, although there are some reports of subfossil material in Britain. A declining species across much of its range though perhaps under-recorded. It is a subterranean species associated with deep calcareous soils and limestone pavement, the latter a threatened habitat.





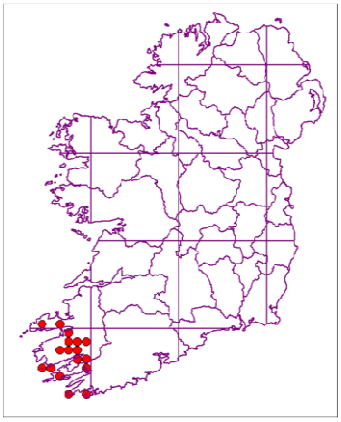
Cochlodina laminata

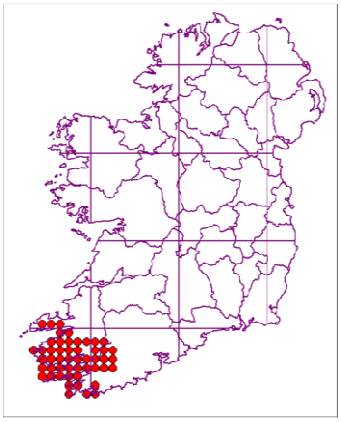
Plaited Door Snail

IUCN Vulnerable

D2

An arboreal species most frequent in limestone areas, and often seen ascending the trunks of trees such as beech or ash. The Fermanagh records are considered to comprise a single population, and this species is thus threatened due to the restricted area of occupancy.



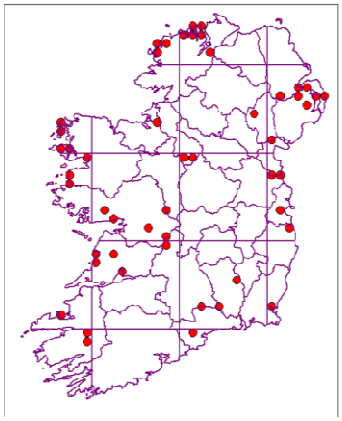


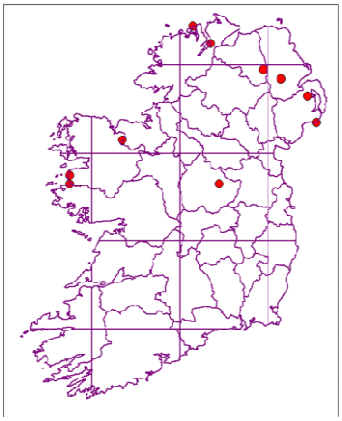
Geomalacus maculosus

Spotted or Kerry Slug

IUCN Least Concern

Restricted to sandstone areas of Kerry and west Cork. This species has a strong viable population and may be capable of expanding its range with global warming (R. Anderson, pers. comm.). The Irish population is important in a global context with the Iberian populations being severely threatened. It is protected under European law.





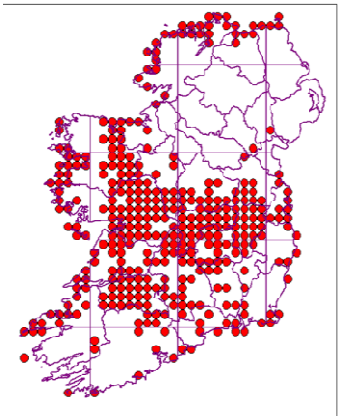
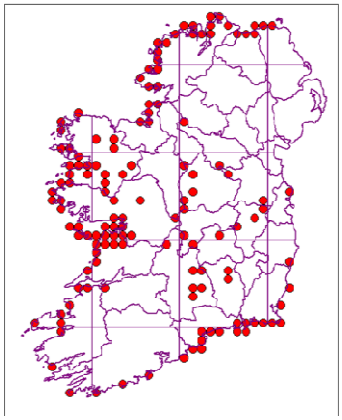
Gyraulus laevis

Smooth Ram's Horn

IUCN Endangered

A2c

A pioneer species frequently occurring in temporary or new habitats with hard or very slightly saline water, such as farm, coastal and quarry ponds. Severely declining primarily due to the nature of the transitory habitats it prefers and to habitat loss.

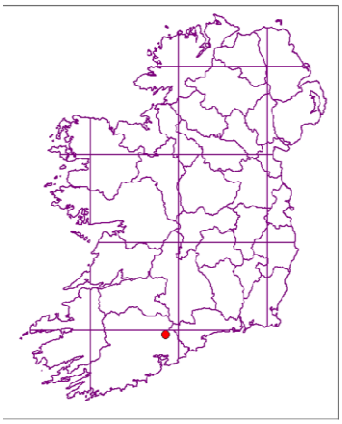
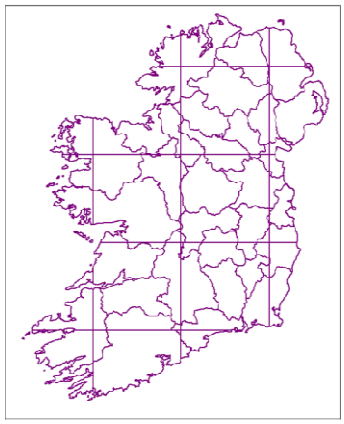
Helicella itala

Heath Snail

IUCN Vulnerable

A2c

This species has declined by over 60% in distribution since 1980, primarily within the central limestone plain of Ireland. The species was not assessed as endangered since the coastal populations appear stable. Habitat loss and changing agricultural practice in grasslands are the major contributing factors in its decline.

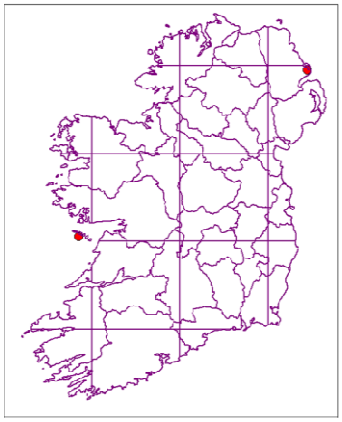
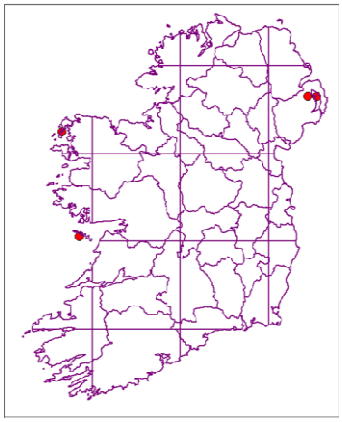



Helicigona lapicida

Lapidary Snail

IUCN Regionally Extinct

Known in Ireland only from limestone bluffs in the gorge of the River Blackwater, Carrick-a-Brick Castle, Fermoy, East Cork (Phillips, 1914). Its status as a native is questionable according to Kerney (1972), who failed to find living material during a visit to the site in 1971. No live specimens have been found in recent times. It is known mostly from limestone rocks and quarries in Britain where it appears to be also declining.

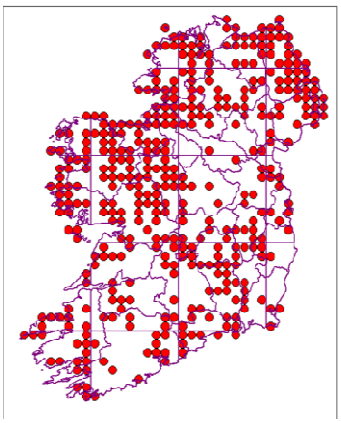
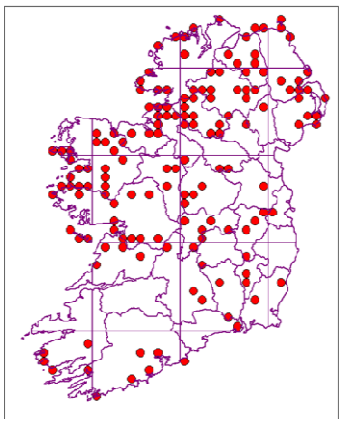



Hydrobia acuta neglecta

IUCN Endangered

B2ab(iii,iv)

This species occurs in coastal lagoons where incoming freshwaters dilute impounded sea water and the preferred salinity range has been given as 10-24‰ (Fretter and Graham, 1978). An extremely rare and declining species in Ireland, with recent population losses (J. Nunn, pers. comm.). It is likely that this species has disappeared from Northern Ireland.

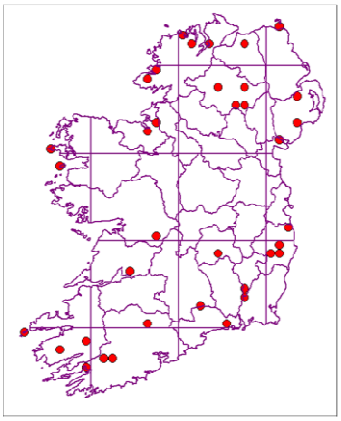
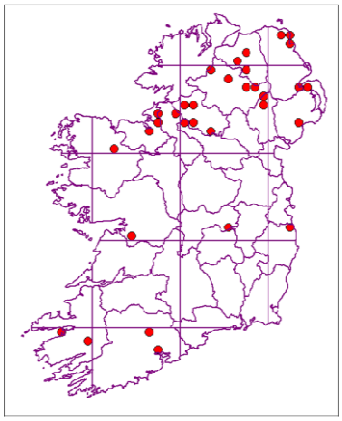
Leiostyla anglica

English Chrysalis Snail

IUCN Vulnerable

A2c

Common in wet, shaded habitats on neutral to base-rich soils. Towards the west coast it occupies acid coastal heath and can be found around gorse in rough pasture. A widespread species showing some decline. Near endemic to Ireland and Britain and more common in Ireland than elsewhere in Europe (Kerney, 1999). The Irish population accounts for at least 50% of the global population.

Limax cinereoniger

Ash-black Slug

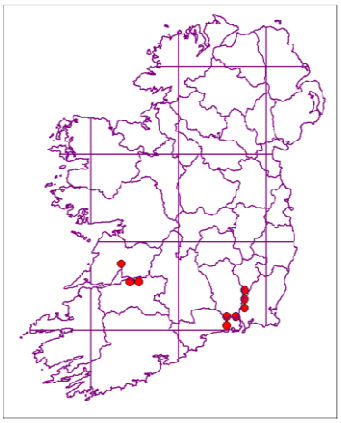
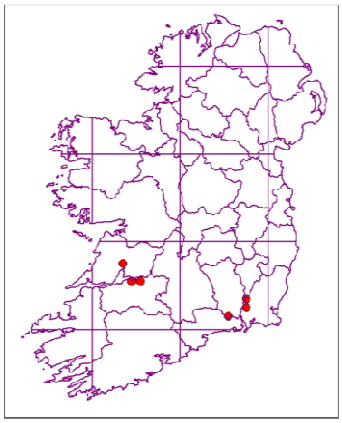
IUCN Vulnerable

A2c

Republic of Ireland: A2c

Northern Ireland: LC

Mostly recorded from old, minimally disturbed broadleaf woodlands or on cliffs with relic woodland vegetation on western coasts. Population decline is confined to the Republic of Ireland and may be related to forestry practices there.

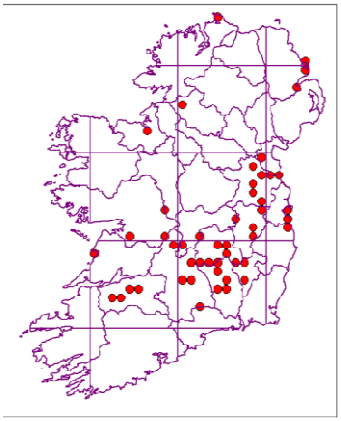
Mercuria* cf. *similis

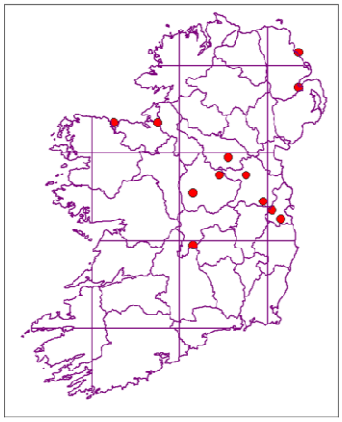
Swollen Spire Snail

IUCN Endangered

B2ab(ii,iii)

This species has a very limited distribution, with two fragmented populations in the Suir/Barrow and Shannon estuaries. There is a 33% recorded decline with some historical sites being lost (e.g. Tramore; A. Byrne, pers. comm.). The Irish population is significant globally.





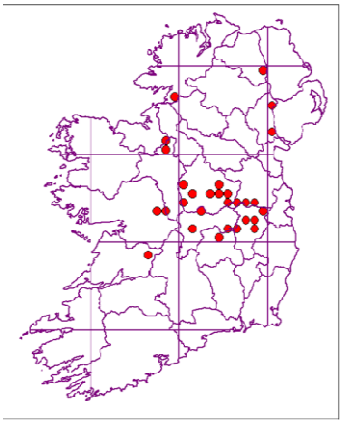
Merdigera obscura

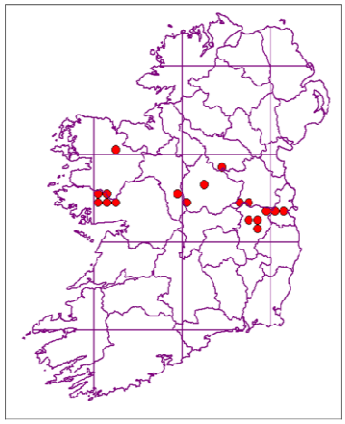
Lesser Bulin

IUCN Endangered

A2c

A habitat specialist particularly associated with calcareous escarpments and calcareous woodlands. Severe declines of 75% in its recorded distribution in Ireland have been noted since 1980, likely due to habitat loss.





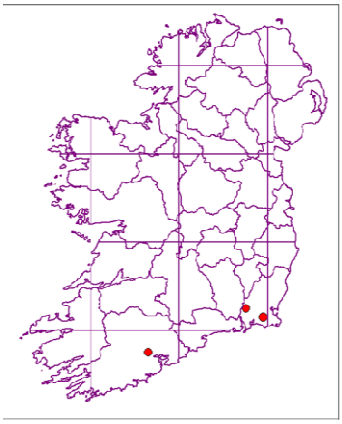
Myxas glutinosa

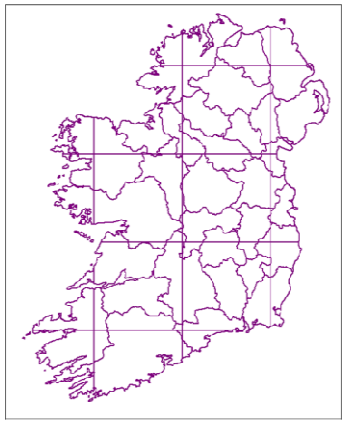
Glutinous Snail

IUCN Endangered

A2c

This is a declining species, primarily due to habitat degradation through eutrophication, with populations in Ireland fragmenting. The Irish population is considered globally important (up to 50% of the global population (E. Moorkens & I. Killeen, pers. comm.)). A globally threatened species (IUCN).



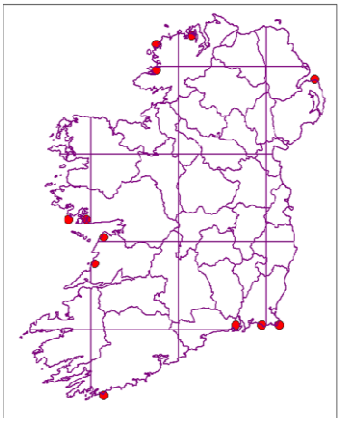


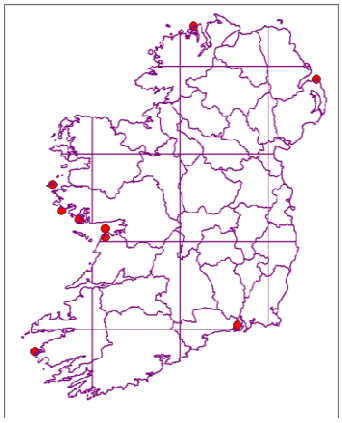
Omphiscola glabra

Mud Pond Snail

IUCN Regionally Extinct

Always one of the rarest of Irish molluscs, its history in Ireland is reviewed by Hurley (1981). A colony was reported by Roche (1929) from Ballymacar Bridge, Shelmaliere Commons, near New Ross, Co. Wexford. This site has now been drained (Hurley, 1981) and the colony destroyed.



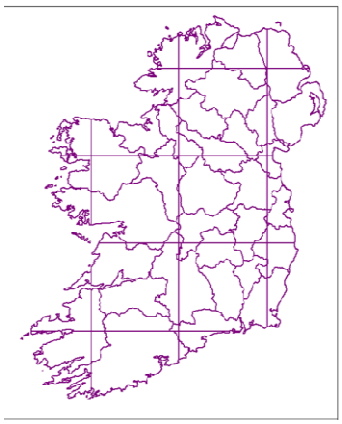


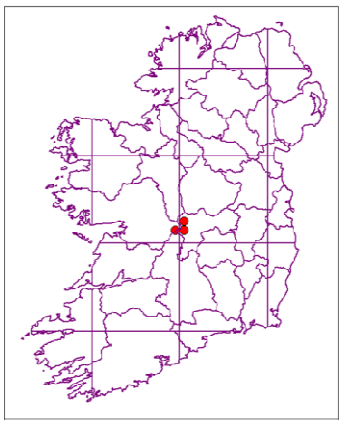
Otina ovata

Ear Snail

IUCN Least Concern

A member of the upper tidal crevice fauna, but extremely localised in Ireland. It can be regarded as near-endemic to Britain and Ireland. The Irish population is globally important, though not threated.



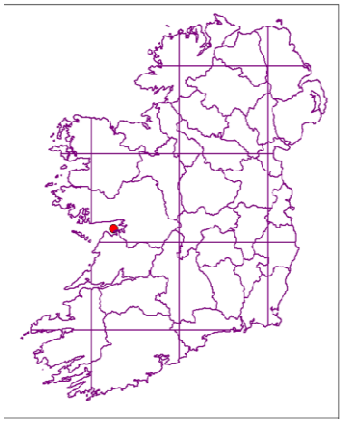


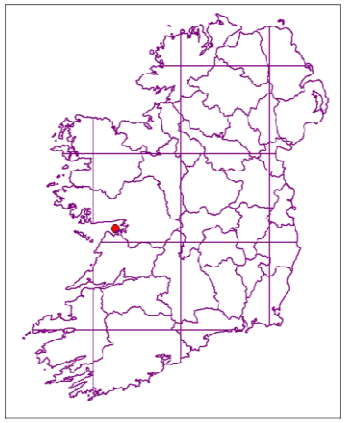
Oxyloma sarsi

Slender Amber Snail

IUCN Data Deficient

Added to the Irish list by Holyoak and Holyoak (2004). Found on the banks of the R. Shannon north of Portumna, South-east Galway.





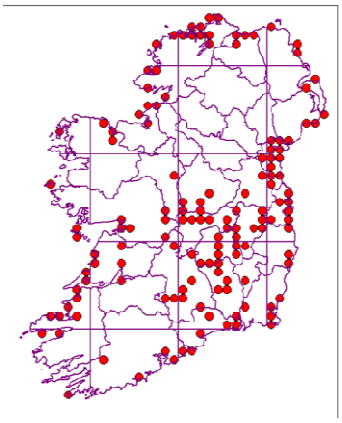
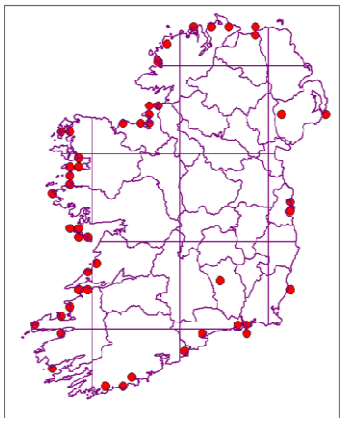
Pomatias elegans

Round-mouthed Snail

IUCN Critically Endangered

B2ab(iii)

With a very restricted range in Ireland, and found only at one small site near New Quay, Co. Clare (Platts, 1977). Within the northern part of its range this species is confined to highly calcareous soils. At New Quay it has been found on limestone pavement close to the sea. A major threat is development pressure and physical disturbance.

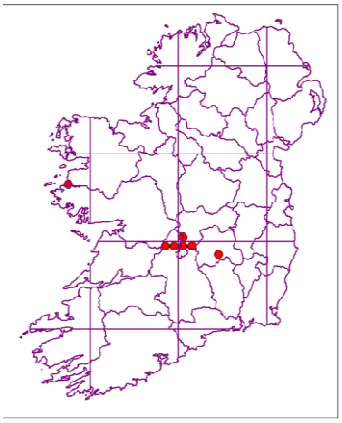
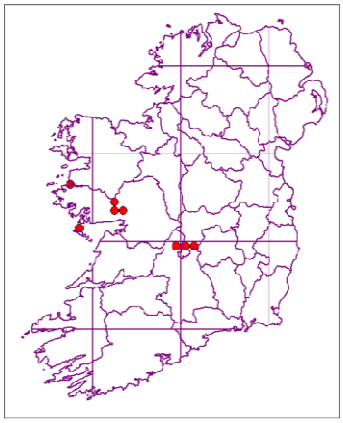
Pupilla muscorum

Moss Chrysalis Snail

IUCN Endangered

A2 c

This species is restricted to dry, calcareous, inland habitats, coastal dune systems and coastal calcareous rock exposures. It has suffered a 66% distributional decline in Ireland. The severe losses in central areas may be due to loss of semi-natural calcareous grasslands. The coastal populations are becoming increasingly rare and local. Under grazing may be a major threat to the species.

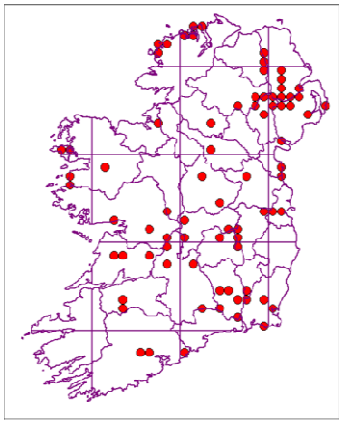
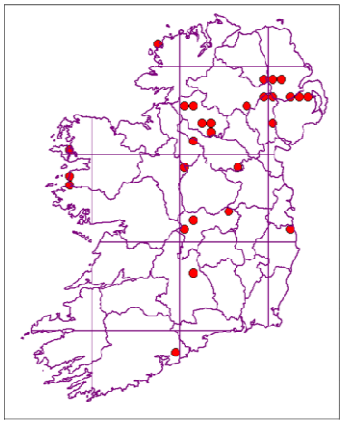
Quickella arenaria

Sand-bowl Amber Snail

IUCN Endangered

B2ab(i,ii,iii,iv)

A species of sparsely vegetated dune hollows and grazed, sparsely vegetated flood plains of larger lakes. The Irish population is globally important, with Dooaghtry in Co. Mayo possibly the most important site in the world (R. Anderson & E. Moorkens, pers. comm.). It is threatened by habitat destruction, with the three sites in Offaly and North Tipperary shown in the post-1980 map having been lost recently (E. Moorkens, pers. comm.).

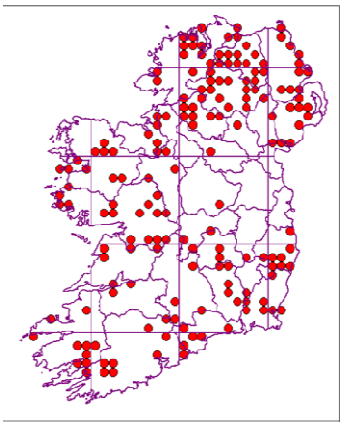
Radix auricularia

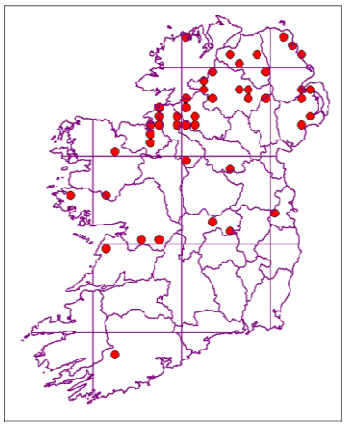
Ear Pond Snail

IUCN Vulnerable

A2c

This species has declined in recorded distribution by over 30% since 1980. It is considered a low abundance species in general, but with recent population losses.





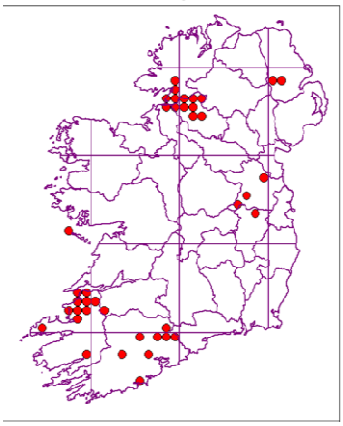
Spermodea lamellata

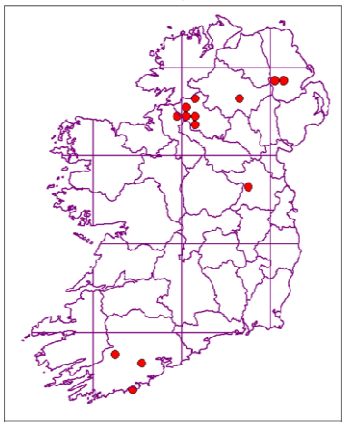
Plaited Snail

IUCN Endangered

A2c

A classic 'Atlantic' species restricted to the fringes of north-west Europe. Preferred habitats are older broadleaf woodlands where it inhabits deep, stable leaf litter. It has suffered severe distributional decline in the last 30 years in Ireland (73% reduction in records). Drier summers and woodland habitat management are two likely drivers of the loss of this species. Ireland has a significant proportion of the global population.





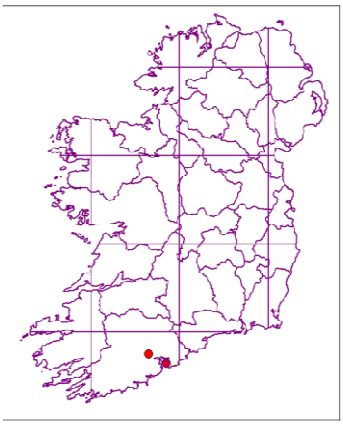
Succinella oblonga

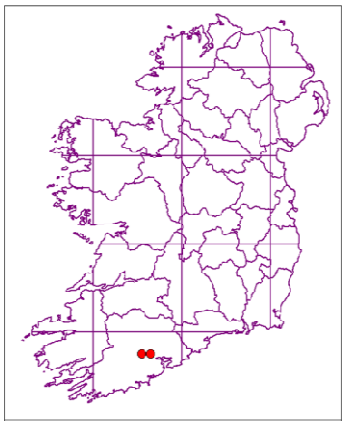
Small Amber Snail

IUCN Endangered

A2c

A declining species across Ireland with considerable distributional (68%) and population losses. The species has declined mainly due to habitat destruction. The species requires open sites, often short-cropped grazed habitats. With the advent of increased eutrophication sward height has increased in a number of sites, making conditions unsuitable for the species.





Tandonia rustica

Large or Rustic Keeled Slug (also known as the Bulb-eating slug)

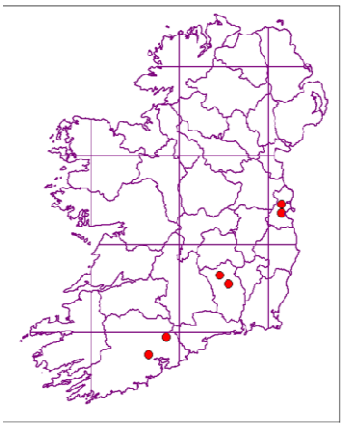
IUCN Vulnerable

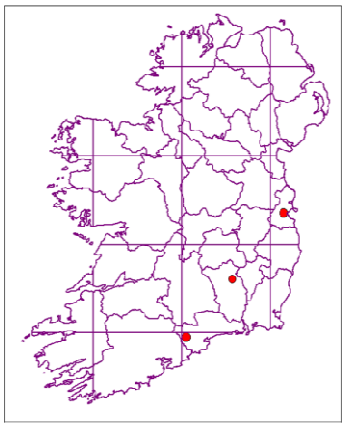
D2

The species is found abundantly in leaf litter of old semi-natural woods around Blarney Castle to the west of the town, but nowhere else in the vicinity. There is no indication that it is an introduction, more likely a rare and restricted native (R. Anderson, pers. comm.)

Notes on Testacella spp.

All *Testacella* species are probably under-recorded due to their subterranean life habits. They are all carnivorous 'semi-slugs' that spend most of their life under the ground in loamy soils hunting earth worms. They are rarely seen unless dug up. The continuing spread of the New Zealand flatworm *Arthurdendyus triangulatus*, which is a potentially competitive earthworm predator, gives cause for concern. The data and best expert judgement suggests that *T. scutulum* is not of conservation concern at present, but the other two species are presented below. All three are possible introductions as remains have not been detected in postglacial deposits.





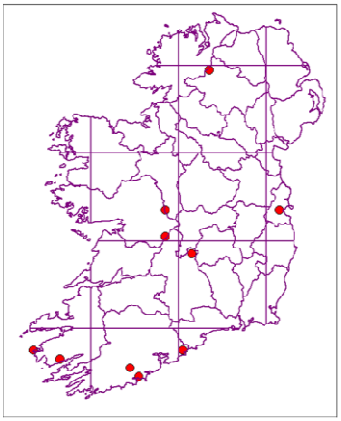
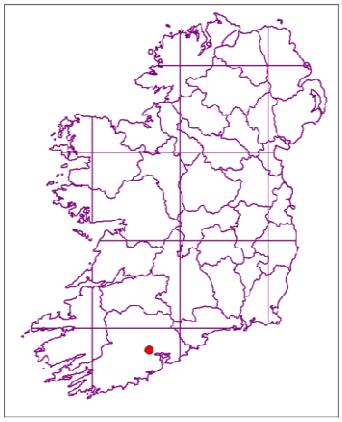
Testacella maugei

Maugé's Shield Slug

IUCN Near Threatened

D2

Like the other species of *Testacella,* this is an earthworm predator living in deep, friable loams where it hunts its prey. The reasons for its apparent decline are unclear but it was formerly recorded in traditional kitchen gardens, which are now less common.

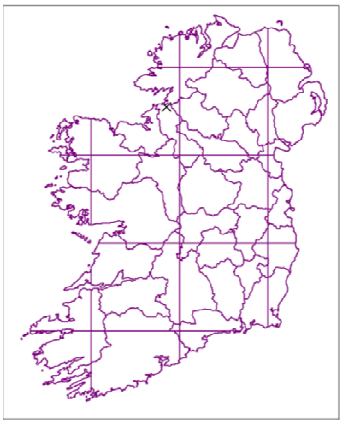
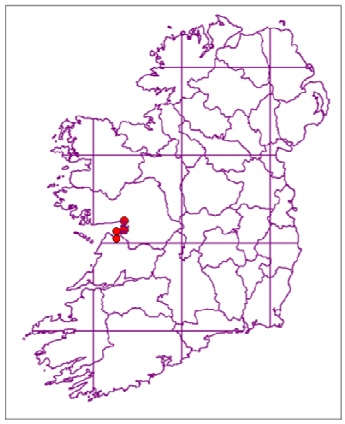
Testacella haliotidea

Common Shield Slug

IUCN Vulnerable

D2

Always localised and rare with sites scattered across Ireland. Recent records are for a wooded site in Cork. Although under-recorded, there appears to be a real decline in this species (R. Anderson, pers. comm.).

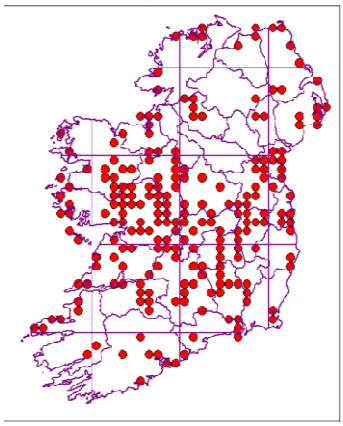
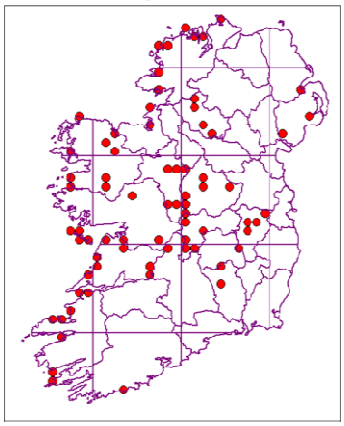
Truncatella subcylindrica

Looping Snail

IUCN Critically Endangered

B1ab(i,ii,iii,iv)

Recently added to the Irish List from two sites on inner Galway Bay (M31, M32), Carrowmore lagoon and Rincarna lagoons (coll. S. M. Smith, 2000). The species is at the northern edge of its geographic range in Ireland but several sites have been added since discovered.

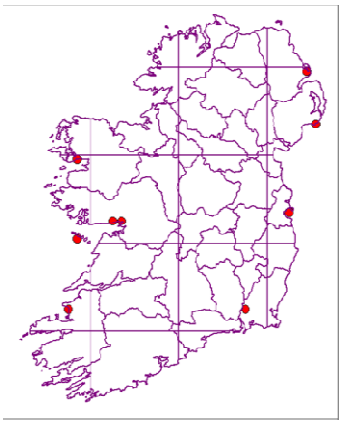
Vallonia pulchella

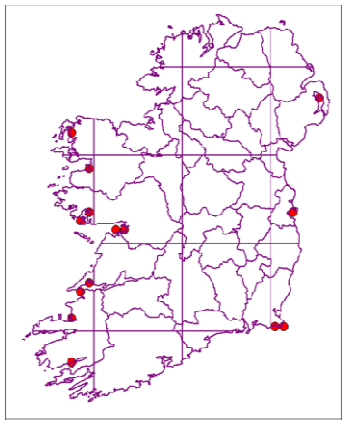
Beautiful Grass Snail

IUCN Vulnerable

A2c

This species mainly occurs in pasture on the floodplains of lakes and rivers inland. It has declined due to agricultural intensification and drainage.





Ventrosia ventrosa

Spire Snail

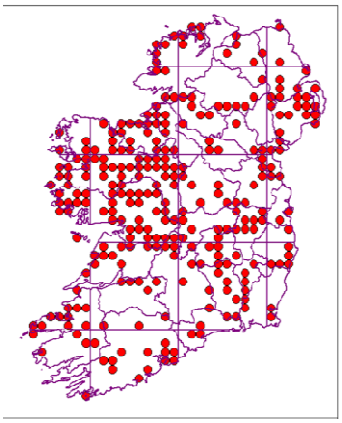
IUCN Vulnerable

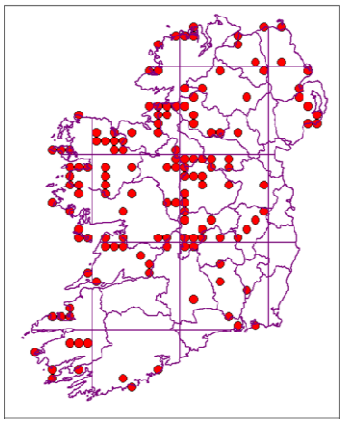
B2ab(iii)

Republic of Ireland: VU B2ab(iii)

Northern Ireland: CR B2ab(iii)

This is a specialist habitat species inhabiting non-tidal lakes or ponds that are inundated with saltwater only infrequently. Apart from continuing damage to amphi-saline coastal lagoons, mainly by agricultural activities, the reasons for its decline are poorly known.





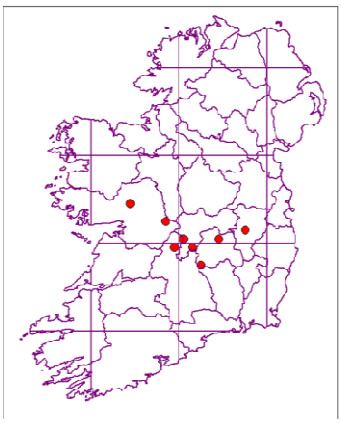
Vertigo antivertigo

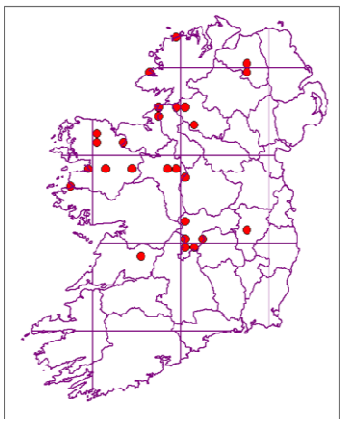
Marsh Whorl Snail

IUCN Vulnerable

A1c

Locally frequent across Ireland in fens, marshes, lakeshores and riverbanks. However, it has experienced greater than 30% distributional decline since 1980. This is probably due to loss of rough, wet grasslands and undrained pastures.





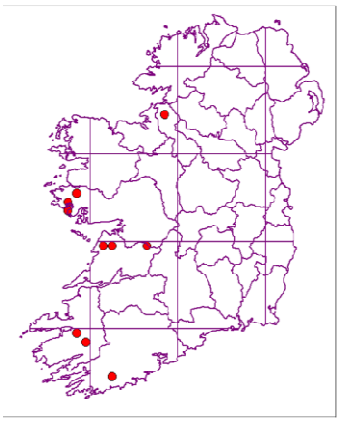
Vertigo geyeri

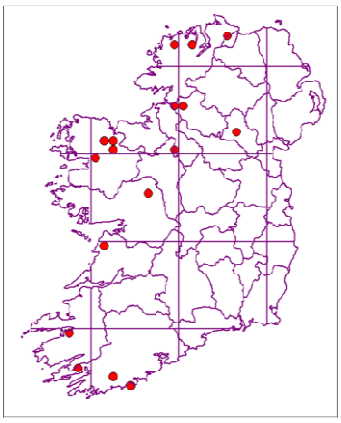
Geyer's Whorl Snail

IUCN Vulnerable

A2c

The principal habitat for this species is relict base-rich flushes within more complex habitat mosaics that can contain raised bog laggs, transition mires, lake shores, hill or mountain slopes, and wetlands associated with coastal dunes and machair (Moorkens, 2003). Targeted recording of this species has increased the number of 10km square records since 1980. However, this species is considered to be declining due to habitat loss (E. Moorkens and I. Killeen, pers. comm.). It is very habitat specific and the Irish population is important in a global context.





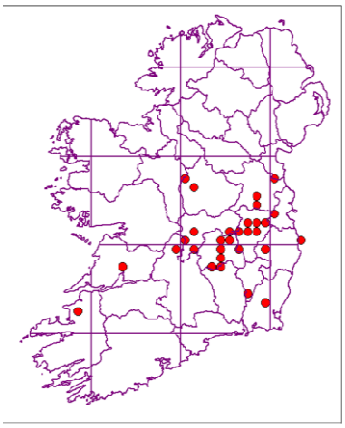
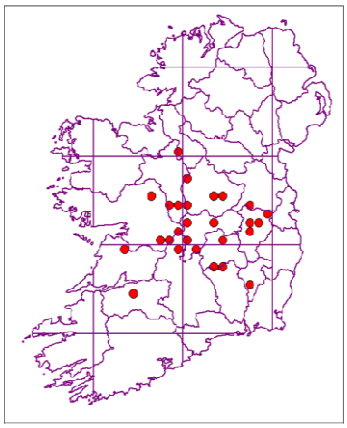
Vertigo lilljeborgi

Lilljeborg's Whorl Snail

IUCN Vulnerable

A2c

V. lilljeborgi is confined to exposed lakeshores on limestone where it inhabits lakeshore flushes or strand-line jetsam. It has suffered a distributional decline since 1980 due to habitat loss, agricultural drainage, poor water management and declining water quality (Kerney, 1999).

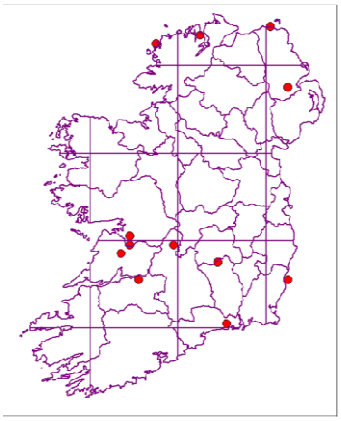
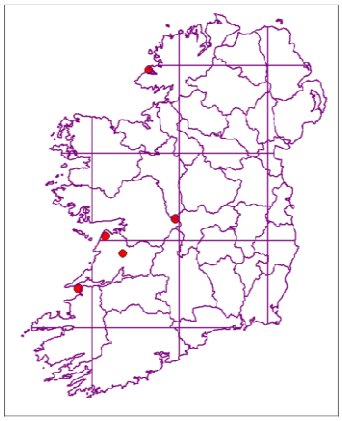
Vertigo moulinsiana

Des Moulins' Whorl Snail

IUCN Endangered

A4c

This species mainly inhabits calcareous lowland wetlands, particularly swamps, fens and marshes with tall vegetation. It appears to have declined due to habitat loss since 1980 and is expected to further decline in the future due to continuing decline in habitat quality (E. Moorkens & I. Killeen, pers. comm.).

Vertigo pusilla

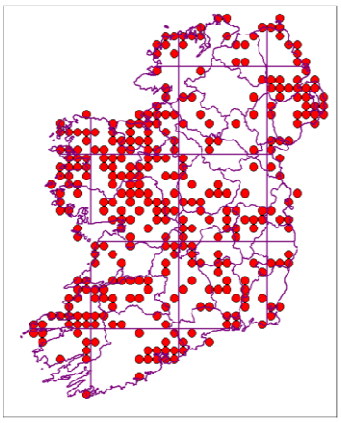
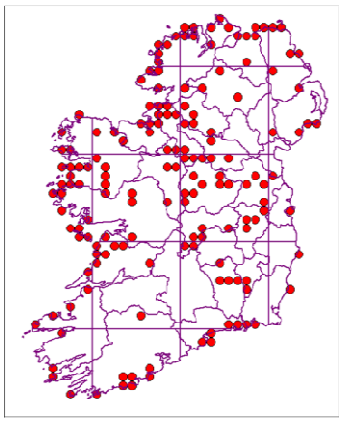
Wall or Wry-necked Whorl Snail

IUCN Endangered

A2c

Northern Ireland: RE

V. pusilla has had a 58% distributional decline since 1980. Historic sites have been revisited and the species has not been refound. Records mainly relate to sheltered walls in woodland or fixed dune habitat.

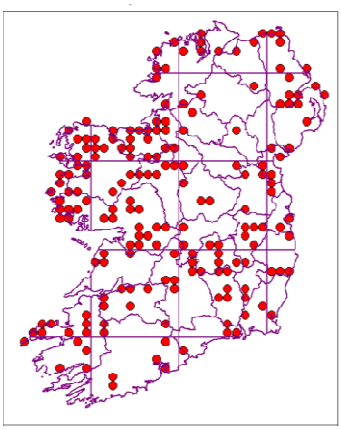
Vertigo pygmaea

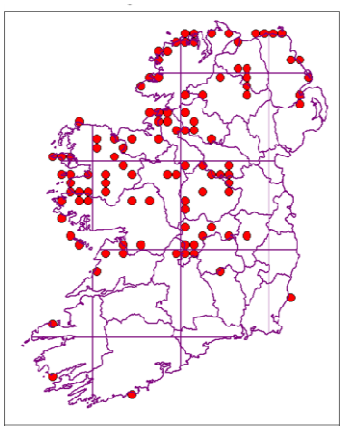
Common Whorl Snail

IUCN Near Threatened

A4c

A calcareous grassland species that has suffered a marked contraction on inland sites. Loss of sites across the island corresponds to about 30% since 1980.





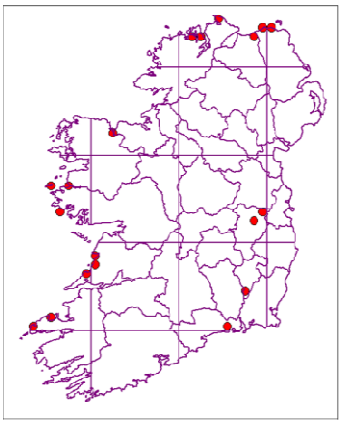
Vertigo substriata

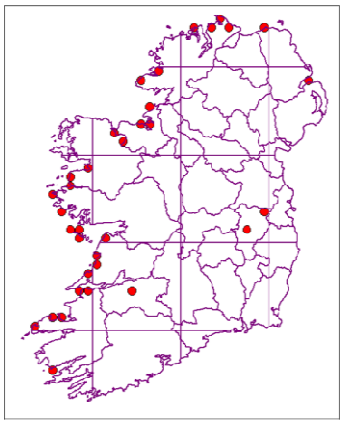
Striated Whorl Snail

IUCN Near Threatened

A4c

V. substriata is recorded principally from transition mires, but also occupies wet woodland, particularly in the west. It has suffered similar losses to that of *V. pygmaea*.





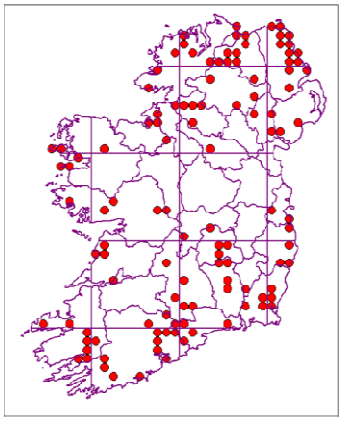
Vertigo angustior

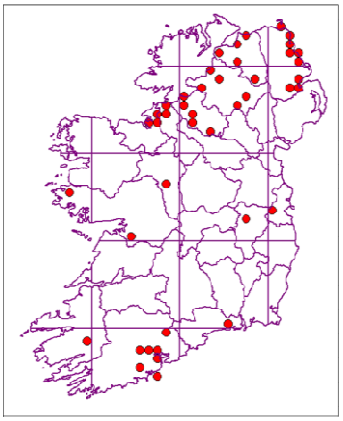
Narrow-mouthed Whorl Snail

IUCN Vulnerable

A2c

This species was widespread in Britain and Ireland in the early Postglacial but is now localised and rare. Its main habitats comprise fixed dunes along the west and north coasts of Ireland and hydrogeologically stable marshes in the central plain. The Irish population is of global importance.





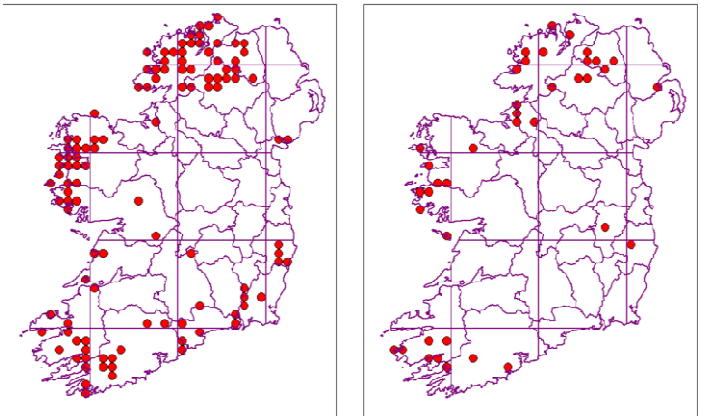
Zenobiella subrufescens

Brown Snail

IUCN Vulnerable

A2c

This is an old woodland relict species that has shown a decline of >60% since 1980. Principal threat to the species is habitat destruction (Kerney, 1999).



Zonitoides excavatus

Hollowed Glass Snail

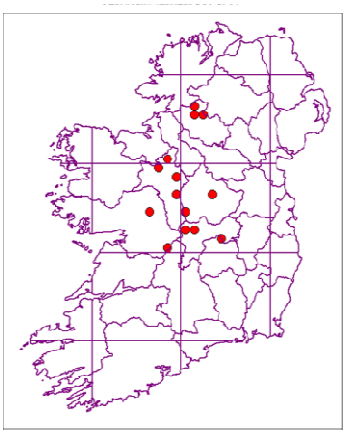
IUCN Vulnerable

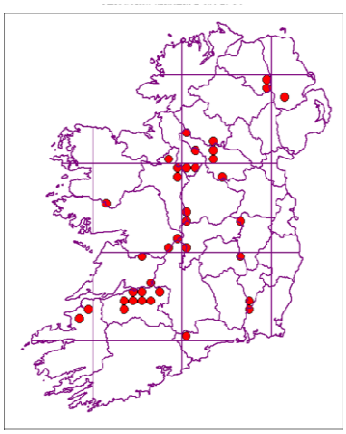
A2c

This species is associated with rough acid habitats, including rough *Juncus* pasture and old oak woodland margins. The Irish population is considered of global importance, comprising up to 20% of the world population. The species is a near Britain and Ireland endemic, with other populations only in coastal regions adjacent to the North Sea (Kerney, 1999).

CLASS BIVALVIA

Order Unionoida





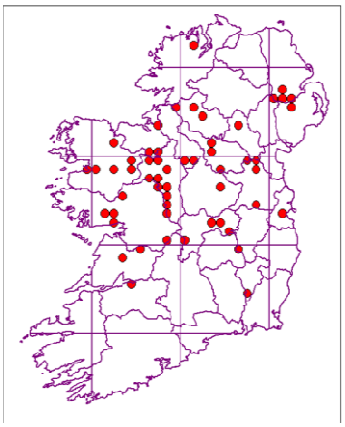
Anodonta anatina

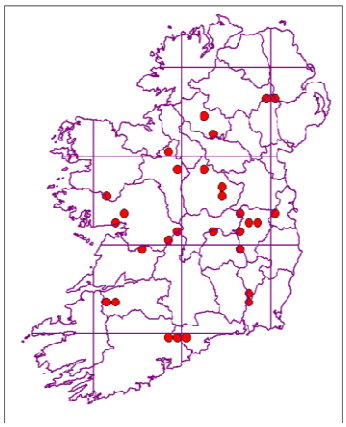
Duck Mussel

IUCN Vulnerable

A4ce

This species is widespread over most of lowland Ireland except the extreme west and north. It was formerly under-recorded due to confusion with *Anodonta cygnea*. It has been badly impacted by *Dreissena polymorpha* invasion of its habitats and is projected to decline even further as a direct result of continued range expansion by *Dreissena*, most recently into the Lough Neagh catchment.





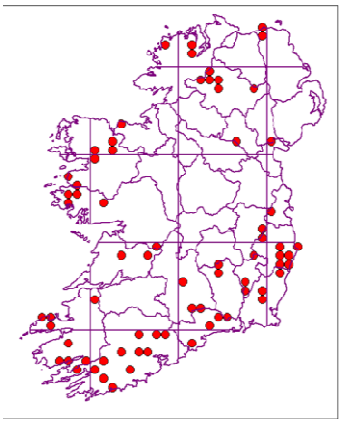
Anodonta cygnea

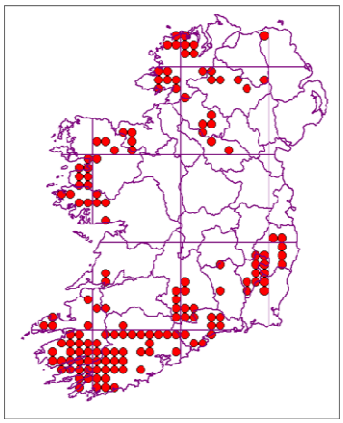
Swan Mussel

IUCN Vulnerable

A4ce

This is a species of stagnant muddy or silty habitats in larger water bodies. Similar to *A. anatina*, it is being significantly impacted by *D. polymorpha* invasion of its habitats.





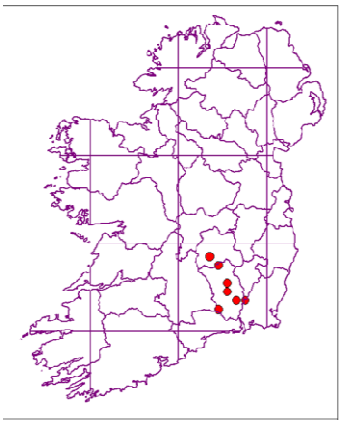
Margaritifera margaritifera

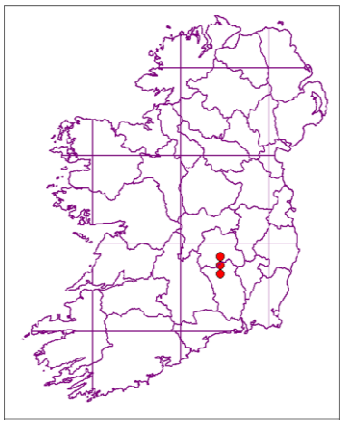
Freshwater Pearl Mussel

IUCN Critically Endangered

A3cde+4cde

Extensive surveys for this species in recent decades have enhanced our knowledge of its range in Ireland, at the same time as it continues to decline due to reduced water quality, increased siltation and to physical interference with its habitat. Of the remaining Irish populations only a handful are recruiting young and at least 90% have such depleted water quality and river bed conditions that they will probably never breed successfully again (Moorkens, 2006).





Margaritifera durrovensis[1]

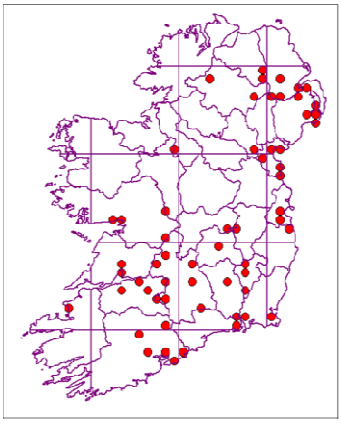
Nore Freshwater Pearl Mussel

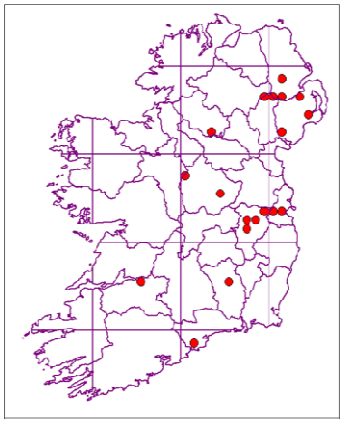
IUCN Critically Endangered

A3cde+4cde; B1ab(i,ii,iii,iv,v)

Margaritifera durrovensis is a unique hard water form of *Margaritifera margarifera* which is only known from the Nore River. This population is under threat due to declining river bed and water quality in its habitat (Moorkens, 2006). The reasons for its decline are therefore similar to those listed for *M. margaritifera*.

[1] The taxonomy of this species is particularly contentious, and debate still continues as to its true taxonomic status. We use species here as it has been given full species status in the EU Habitats Directive (1992), however the latest checklist for Britain and Ireland (Anderson, 2005) does not give either subspecies or species status to the form.





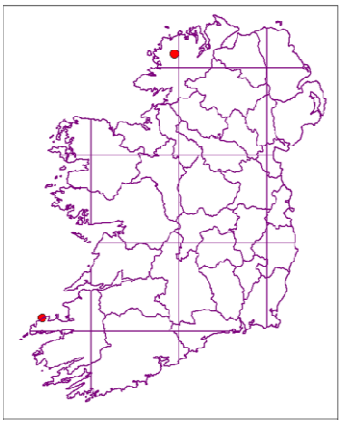
Musculium lacustre

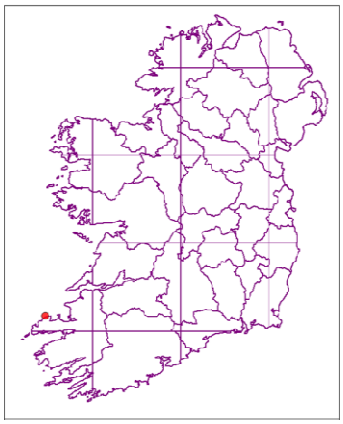
Lake (or capped) Orb Mussel

IUCN Vulnerable

A2c

M. lacustre is a species mainly of small, temporary wetland habitats, including swamps, ponds, vegetated margins of rivers, and areas subject to seasonal flooding around large lakes. It is highly tolerant of poor water quality and anoxic conditions but is intolerant of competition from other species and of more permanent conditions. Its decline is probably related to agricultural drainage activities and consequent habitat loss and deterioration.





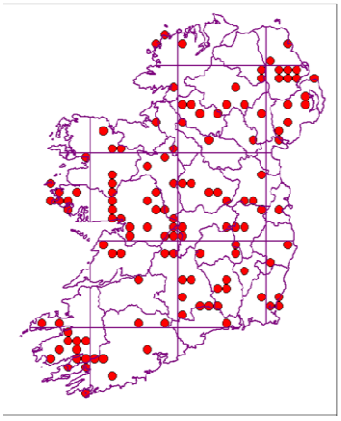
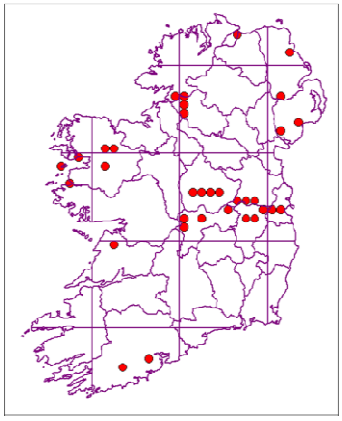
Pisidium conventus

Arctic-Alpine Pea Mussel

IUCN Critically Endangered

B2ab(i,ii,iii,iv)

P. conventus is an arctic species that in Ireland is restricted to deep or very cold lakes in the north and west. Both known sites have been revisited but it was only found at the Brandon site (Moorkens, 2005).

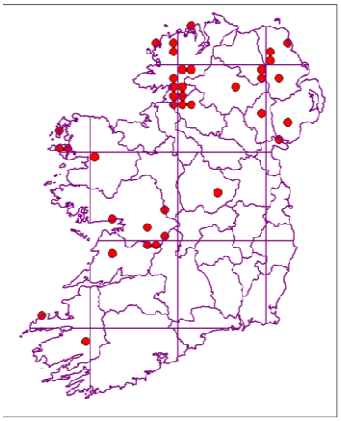
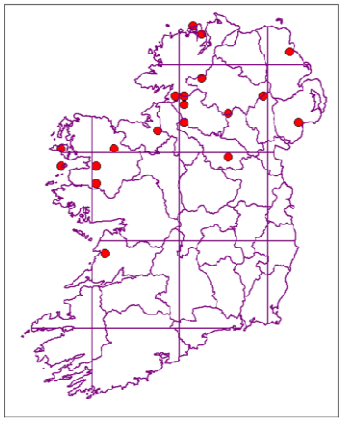
Pisidium hibernicum

Globular Pea Mussel

IUCN Near Threatened

A2c

The decline shown may be as a result of less surveying for the species. However, the absence of recent records from the south-east merits an assessment as Near Threatened. Specific drivers of decline are unknown, but it is listed as impacted by continuing climate change in other regions (Hering, 2006). In The Netherlands it is threatened by organic and chemical pollution (Bruyne *et al*., 2003).

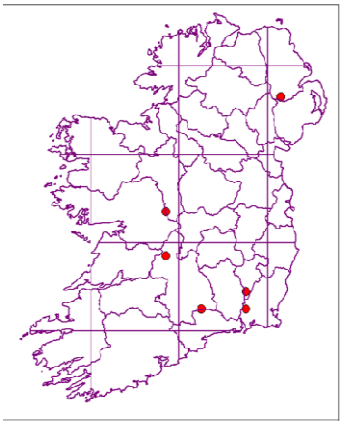
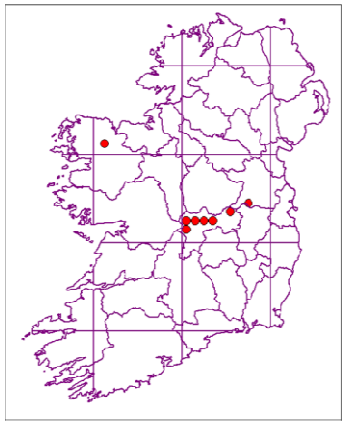
Pisidium lilljeborgii

Lilljeborg's Pea Mussel

IUCN Vulnerable

A4c

This is a species of deep, clear lakes in upland areas but also occurs in larger habitats in low-lying areas of the west and north. The distributional decline is possibly due to changes in lake water quality.

Pisidium moitessierianum

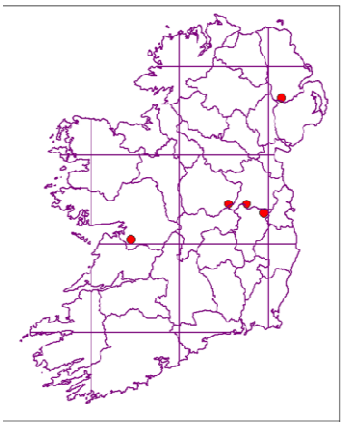
Moitessier Pea Shell

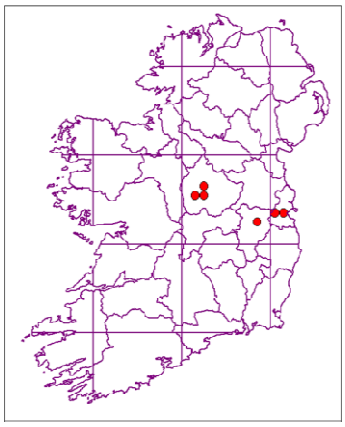
IUCN Endangered

B2ab(i,iii,iv)

Northern Ireland: Regionally Extinct

P. moitessierianum is characteristic of slow-flowing, moderately calcareous rivers. Thought to be extinct at one time but discovered along the Royal and Grand Canals by Moorkens and Killeen (2005). It has since been recorded from Lough Conn, Co. Mayo (I. Killeen & E. Moorkens, pers. comm.). It is rare and restricted in its distribution, and probably sensitive to eutrophication.





Pisidium pseudosphaerium

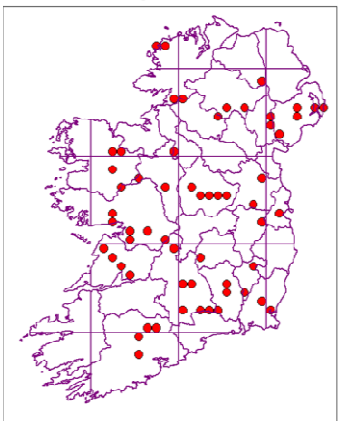
False Orb Pea Mussel

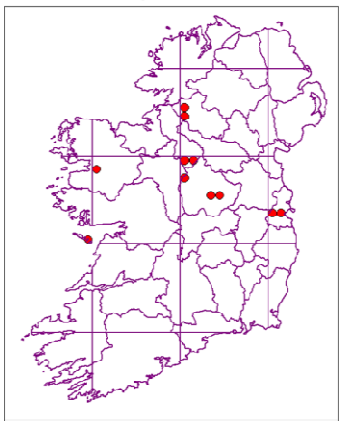
IUCN Endangered

B2ab(i,iii,iv)

Northern Ireland: Regionally Extinct

This species lives in richly vegetated, swampy habitats with clean, standing water and a muddy substrate. Most Irish records are from sections of the Grand and Royal Canals and their feeders. It is being lost through dredging. The only known Northern Irish population has been lost and it is considered extinct there (R. Anderson, pers. comm.).





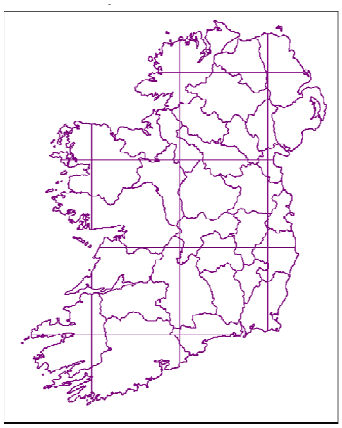
Pisidium pulchellum

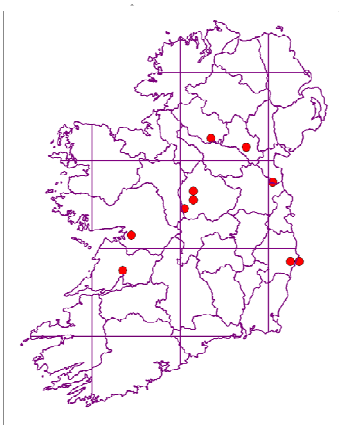
Iridescent Pea Mussel

IUCN Endangered

A2c

P. pulchellum has had an apparent 81% distributional decline since 1980. Confined to low trophic status, calcareous lakes, drains, streams, and canals, decline is due to eutrophication and habitat loss.





Sphaerium nucleus

Swamp Orb Mussel

IUCN Vulnerable

D2

S. nucleus was not recognised in Ireland until 2003 (Moorkens 2005) having previously been confused with *S. corneum*. The species remains under-recorded but has been found in transition mires (R. Anderson, pers. comm.), swamps and overgrown ditches (I. Killeen & E. Moorkens, pers. comm.), and also turloughs in the west (R. Anderson & C. Williams, pers. comm). There are ten 10 km square records for Ireland.

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APPENDIX 1: CHECKLIST OF IRISH NON-MARINE MOLLUSCS

Table 3: Checklist of Irish non-marine molluscs (following Anderson (2005) except for *Margaritifera durrovensis* which follows the EU Habitats Directive). Φ Refers to the number of 10 km squares in which the species has been recorded pre- and post- 1980. RE = regionally extinct, CR = critically endangered, EN = endangered, VU = vulnerable, NT = near threatened, dd = data deficient, lc = least concern, na = not applicable (a taxon is not applicable when evaluation against the criteria is not possible if the species has been introduced, is a vagrant, or if the species is an immigrant and has been in the country for less than 10 years).

	Assessment	Criteria	Φ Pre-1980	Φ Post-1980
CLASS GASTROPODA				
ORDER NERITOPSINA				
FAMILY NERITIDAE				
Theodoxus fluviatilis (Linnaeus, 1758)	lc			
ORDER ARCHITAENIOGLOSSA				
FAMILY ACICULIDAE				
Acicula fusca (Montagu, 1803)	VU	A2c	122	55
FAMILY VIVIPARIDAE				
Viviparus viviparus (Linnaeus, 1758)	na			
ORDER NEOTAENIOGLOSSA				
FAMILY ASSIMINEIDAE				
Assiminea grayana Fleming, 1828	na			
FAMILY BITHYNIIDAE				
Bithynia tentaculata (Linnaeus, 1758)	lc			
Bithynia leachii (Sheppard, 1823)	lc			
FAMILY HYDROBIIDAE				
Hydrobia acuta neglecta (Muus, 1963)	EN	B2ab (iii, iv)	2	4
Mercuria cf. *similis* (Draparnaud, 1805)	EN	B2ab (ii,iii)	9	6
Peringia ulvae (Pennant, 1777)	lc			
Potamopyrgus antipodarum (J.E. Gray, 1843)	na			
Ventrosia ventrosa (Montagu, 1803)	VU	B2ab(iii)†	9	14
FAMILY POMATIIDAE				
Pomatias elegans (O.F. Müller, 1774)	CR	B2ab(iii)	1	1
FAMILY TRUNCATELLIDAE				
Truncatella subcylindrica (Linnaeus, 1767)	CR	B1ab(i-iv)	0	2
ORDER ECTOBRANCHIA				
FAMILY VALVATIDAE				
Valvata piscinalis (O.F. Müller, 1774)	lc			
Valvata cristata O.F. Müller, 1774	lc			
ORDER PULMONATA				
FAMILY ACROLOXIDAE				
Acroloxus lacustris (Linnaeus, 1758)	lc			
FAMILY AGRIOLIMACIDAE				
Deroceras agreste (Linnaeus, 1758)	dd	0	1	
Deroceras laeve (O.F. Müller, 1774)	lc			
Deroceras panormitanum (Lessona & Pollonera, 1882)	na			
Deroceras reticulatum (O.F. Müller, 1774)	lc			
FAMILY ARIONIDAE				
Arion ater (Linnaeus, 1758)	lc			
Arion flagellus Collinge, 1893	lc			
Arion rufus (Linnaeus, 1758)	lc			
Arion vulgaris Moquin-Tandon, 1855	na			
Arion fuscus (O.F. Müller, 1774)	dd		0	2
Arion subfuscus (Draparnaud, 1805)	lc			
Arion circumscriptus Johnston, 1828	lc			
Arion fasciatus (Nilsson, 1823)	lc			
Arion silvaticus Lohmander, 1937	lc			
Arion distinctus Mabille, 1868	lc			
Arion hortensis A. Férussac, 1819	lc			

	Assessment	Criteria	Φ Pre-1980	Φ Post-1980
Arion intermedius Normand, 1852	lc			
Arion occultus Anderson, 2004	dd		0	2
Arion owenii Davies, 1979	lc			
Geomalacus maculosus Allman, 1843	lc			
FAMILY BOETTGERILLIDAE				
Boettgerilla pallens Simroth, 1912	na			
FAMILY CARYCHIIDAE				
Carychium minimum O.F. Müller, 1774	lc			
Carychium tridentatum (Risso, 1826)	lc			
FAMILY CLAUSILIIDAE				
Balea perversa (Linnaeus, 1758)	VU	A4c	3	13
Balea heydeni Von Maltzan, 1881	lc			
Clausilia bidentata (Ström, 1765)	lc			
Cochlodina laminata (Montagu, 1803)	VU	D2	12	12
FAMILY COCHLICELLIDAE				
Cochlicella acuta (O.F. Müller, 1774)	lc			
FAMILY COCHLICOPIDAE				
Cochlicopa cf. *lubrica* (O.F. Müller, 1774)	lc			
Cochlicopa cf. *lubricella* (Rossmässler, 1834)	lc			
FAMILY DISCIDAE				
Discus rotundatus (O.F. Müller, 1774)	lc			
FAMILY ELLOBIIDAE				
Leucophytia bidentata (Montagu, 1808)	lc			
Myosotella denticulata (Montagu, 1803)	dd		0	1
Myosotella myosotis (Draparnaud, 1801)	lc			
Merdigera obscura (O.F. Müller, 1774)	EN	A2c	49	12
FAMILY EUCONULIDAE				
Euconulus cf. *alderi* (J.E. Gray, 1840)	lc			
Euconulus cf. *fulvus* (O.F. Müller, 1774)	lc			
FAMILY FERUSSACIIDAE				
Cecilioides acicula (O.F. Müller, 1774)	VU	A2c B2ab(ii-iv)	67	9
FAMILY GASTRODONTIDAE				
Zonitoides nitidus (O.F. Müller, 1774)	lc			
Zonitoides excavatus (Alder, 1830)	VU	A2c		
FAMILY HELICIDAE				
Arianta arbustorum (Linnaeus, 1758)	VU	A2c B2 ab (ii-iv)	27	17
Cepaea nemoralis (Linnaeus, 1758)	lc			
Cepaea hortensis (O.F. Müller, 1774)	lc			
Cornu aspersum (O.F. Müller, 1774)	lc			
Helicigona lapicida (Linnaeus, 1758)	RE		1	0
Theba pisana (O.F. Müller, 1774)	na			
FAMILY HYGROMIIDAE				
Ashfordia granulata (Alder, 1830)	nt	B2ab(ii-iv)	46	36
Candidula gigaxii (L. Pfeiffer, 1850)	dd		3	0
Candidula intersecta (Poiret, 1801)	lc			
Cernuella virgata (Da Costa, 1778)	lc			
Helicella itala (Linnaeus, 1758)	VU	A2c	350	135
Hygromia cinctella (Draparnaud, 1801)	na			
Trochulus hispidus (Linnaeus, 1758)	lc			
Trochulus striolatus (C. Pfeiffer, 1828)	lc			
Zenobiella subrufescens (J.S. Miller, 1822)	VU	A2c	115	43
FAMILY LAURIIDAE				
Lauria cylindracea (Da Costa, 1778)	lc			
Leiostyla anglica (A. Férussac, 1821)	VU	A2c	398	152
FAMILY LIMACIDAE				
Lehmannia marginata (O.F. Müller, 1774)	lc			
Lehmannia valentiana (A. Férussac, 1822)	na			
Limacus flavus (Linnaeus, 1758)	na			
Limacus maculatus (Kaleniczenko, 1851)	na			

	Assessment	Criteria	Φ Pre-1980	Φ Post-1980
Limax cinereoniger Wolf, 1803	VU	A2c*	36	32
Limax maximus Linnaeus, 1758	lc			
Malacolimax tenellus (O.F. Müller, 1774)				
FAMILY LYMNAEIDAE				
Galba truncatula (O.F. Müller, 1774)	lc			
Lymnaea stagnalis (Linnaeus, 1758)	lc			
Lymnaea fuscus (C. Pfeiffer, 1821)	lc			
Myxas glutinosa (O.F. Müller, 1774)	EN	A2c	29	18
Omphiscola glabra (O.F. Müller, 1774)	RE		3	1
Radix auricularia (Linnaeus, 1758)	VU	A2c	78	28
Radix balthica (Linnaeus, 1758)	lc			
FAMILY MILACIDAE				
Milax gagates (Draparnaud, 1801)	lc			
Tandonia budapestensis (Hazay, 1881)	na			
Tandonia rustica (Millet, 1843)	VU	D2	2	2
Tandonia sowerbyi (A. Férussac, 1823)	lc			
FAMILY OTINIDAE				
Otina ovata (Brown, 1827)	lc			
FAMILY OXYCHILIDAE				
Aegopinella pura (Alder, 1830)	lc			
Aegopinella nitidula (Draparnaud, 1805)	lc			
Nesovitrea hammonis (Ström, 1765)	lc			
Oxychilus alliarius (J.S. Miller, 1822)	lc			
Oxychilus cellarius (O.F. Müller, 1774)	lc			
Oxychilus draparnaudi (Beck, 1837)	lc			
Oxychilus navarricus (Bouguignat, 1870)	na			
FAMILY PHYSIDAE				
Aplexa hypnorum (Linnaeus, 1758)	VU	A2c		
Physa fontinalis (Linnaeus, 1758)	lc			
Physella acuta (Draparnaud, 1805)	na			
Physella gyrina (Say, 1821)	na			
FAMILY PLANORBIDAE				
Ancylus fluviatilis Müller, 1774	lc			
Anisus leucostoma (Millet, 1813)	lc			
Anisus spirorbis (L., 1758)	dd		0	2
Anisus vortex (Linnaeus, 1758)	VU	A2c	88	34
Bathyomphalus contortus (Linnaeus, 1758)	lc			
Ferrissia wautieri (Mirolli, 1860)	lc			
Gyraulus crista (Linnaeus, 1758)	lc			
Gyraulus albus (O.F. Müller, 1774)	lc			
Gyraulus laevis (Alder, 1838)	EN	A2c	50	10
Hippeutis complanatus (Linnaeus, 1758)	lc			
Planorbarius corneus (Linnaeus, 1758)	lc			
Planorbis planorbis (Linnaeus, 1758)	lc			
Planorbis carinatus O.F. Müller, 1774	lc			
FAMILY PRISTILOMATIDAE				
Vitrea contracta (Westerlund, 1871)	lc			
Vitrea crystallina (O.F. Müller, 1774)	lc			
FAMILY PUNCTIDAE				
*Punctum pygmaeu*m (Draparnaud, 1801)	lc			
FAMILY PUPILLIDAE				
Pupilla muscorum (Linnaeus, 1758)	EN	A2c	140	48
FAMILY PYRAMIDULIDAE				
Pyramidula pusilla (Vallot, 1801)	lc			
FAMILY SUCCINEIDAE				
Oxyloma elegans (Risso, 1826)	lc			
Oxyloma sarsii (Esmark, 1886)	dd		0	3
Quickella arenaria (Potiez & Michaud, 1835)	EN	A2c B2ab(i-iv)	7	8
Succinea putris (Linnaeus, 1758)	lc			

	Assessment	Criteria	Φ Pre-1980	Φ Post-1980
Succinella oblonga Draparnaud, 1801	EN	A2c	40	13
FAMILY TESTACELLIDAE				
Testacella haliotidea Draparnaud, 1801	VU	D2	10	1
Testacella maugei A. Férussac, 1819	nt	D2	6	2
Testacella scutulum Sowerby, 1820	lc			
FAMILY VALLONIIDAE				
Acanthinula aculeata (O.F. Müller, 1774)	nt	A2c	199	61
Spermodea lamellata (Jeffreys, 1830)	EN	A2c	171	46
*Vallonia costa*ta (O.F. Müller, 1774)	lc			
Vallonia cf. excentrica Sterki, 1893	lc			
Vallonia pulchella (O.F. Müller, 1774)	VU	A2c	217	73
FAMILY VERTIGINIDAE				
Columella aspera Waldén, 1966	lc			
Columella edentula (Draparnaud, 1805)	lc			
Truncatellina cylindrica (A. Férussac, 1807)	na			
Vertigo antivertigo (Draparnaud, 1801)	VU	A2c	280	142
Vertigo geyeri Lindholm, 1925	VU	A2c	8	26
Vertigo lilljeborgi (Westerlund, 1871)	VU	A2c	10	17
Vertigo moulinsiana (Dupuy, 1849)	EN	A4c	29	27
Vertigo pusilla O.F. Müller, 1774	EN	A2c◎	12	5
Vertigo pygmaea (Draparnaud, 1801)	nt	A4c	337	195
Vertigo substriata (Jeffreys, 1833)	nt	A4c	188	106
Vertigo angustior Jeffreys, 1830	VU	A2c	19	34
FAMILY VITRINIDAE				
Semilimax pyrenaicus (A. Férussac, 1821)	lc			
Vitrina pellucida (O.F. Müller, 1774)	lc			
CLASS BIVALVIA				
ORDER UNIONOIDA				
FAMILY MARGARITIFERIDAE				
Margaritifera margaritifera (Linnaeus, 1758)	CR	A3cde A4cde	71	153
Margaritifera durrovensis Philips 1928	CR	A3cde A4cde B1ab(i-v)	7	3
FAMILY UNIONIDAE				
Anodonta anatina (Linnaeus, 1758)	VU	A4ce	14	36
Anodonta cygnea (Linnaeus, 1758)	VU	A4ce	54	29
ORDER VENEROIDA				
FAMILY DREISSENIDAE				
Dreissena polymorpha (Pallas, 1771)	na			
FAMILY SPHAERIIDAE				
Musculium lacustre (O.F. Müller, 1774)	VU	A2c	59	19
Pisidium amnicum (O.F. Müller, 1774)	lc			
Pisidium casertanum (Poli, 1791)	lc			
Pisidium conventus Clessin, 1877	CR	B2ab(i-iv)	2	0
Pisidium henslowanum (Sheppard, 1823)	lc			
Pisidium hibernicum Westerlund, 1894	nt	A2c	128	34
Pisidium lilljeborgii Clessin, 1866	VU	A4c	38	19
Pisidium milium Held, 1836	lc			
Pisidium moitessierianum Paladilhe, 1866	EN	B2ab(i,iii,iv)	6	7
Pisidium nitidum Jenyns, 1832	lc			
Pisidium obtusale (Lamarck, 1818)	lc			
Pisidium personatum Malm, 1855	lc			
Pisidium pseudosphaerium Schlesch, 1947	EN	B2ab(i,iii,iv)	5	6
Pisidium pulchellum Jenyns, 1832	EN	A2c	59	11
Pisidium subtruncatum Malm, 1855	lc			
Sphaerium corneum (Linnaeus, 1758)	lc			
Sphaerium nucleus (Studer, 1820)	VU	D2	0	3
HOTHOUSE ALIENS				

	Assessment	Criteria	Φ Pre-1980	Φ Post-1980
CLASS GASTROPODA				
ORDER NEOTAENIOGLOSSA				
FAMILY THIARIDAE				
Melanoides tuberculatus (O.F. Müller, 1774)	na			
ORDER PULMONATA				
FAMILY GASTRODONTIDAE				
Zonitoides arboreus (Say, 1816)	na			
FAMILY HELICODISCIDAE				
Helicodiscus parallelus (Say, 1821)	na			
Radix rubiginosa (Michelin, 1831)	na			
FAMILY PLANORBIDAE				
Gyraulus chinensis (Dunker, 1848)	na			
Planorbella duryi (Wetherby, 1879)	na			
FAMILY PLEURODISCIDAE				
Pleurodiscus balmei (Potiez & Michaud, 1838)	na			
FAMILY SUBULINIDAE				
Allopeas clavulinum (Potiez & Michaud, 1838)	na			
Opeas hannensis (Rang, 1831)	na			
Subulina octona (Bruguière, 1789)	na			
FAMILY ZONITIDAE				
Hawaiia minuscula (Binney, 1840)	na			

**Limax cinereoniger* has been assessed as VU A2c in the Republic of Ireland and lc in Northern Ireland. The All-Ireland assessment is VU A2c.

†*Ventrosia ventrosa* has been assessed as VU B2ab(iii) in the Republic of Ireland and CR B2ab(iii) in Northern Ireland. The All-Ireland assessment is VU B2ab(iii).

⊚*Vertigo pusilla* has been assessed as EN A2c in the Republic of Ireland and RE in Northern Ireland. The All-Ireland assessment is EN A2c.

APPENDIX 2: NOTES ON NON-MARINE MOLLUSCAN RED LISTS IN EUROPE

Red list or conservation assessment coverage seems to be better for non-marine molluscs than other invertebrate groups with assessments from 24 countries assembled here (compared with 13 assessments quoted for bees (Fitzpatrick *et al*., 2006) and 12 assessments quoted for water beetles (Foster *et al*., 2009)). In addition to national red lists, detailed subnational (e.g. Alsace) and supranational (e.g. Carpathian region) red lists were assembled. There is a European red list (United Nations, 1991) in existence, though this list is considered out of date in light of more European countries producing conservation assessments. A new European Red List is being produced for molluscs and is scheduled for release in 2011.

The red data book listing invertebrates, other than insects, for **Britain** was published in 1991 (Bratton, 1991) by the Joint Nature Conservation Committee (JNCC). The book uses the same criteria as that of the 1983 IUCN Invertebrate Red List (Wells *et al*., 1983), with K designation representing 'Insufficiently Known' species. The molluscan species that also occur in Ireland were evaluated mainly by Michael Kerney, with additions from D.R. Seaward, J.M. Breeds, M.R. Hughes, M.J. Willing, and with reference to Fretter and Graham (1978). (**GB '91)**

The **Dutch** Red List was completed in 2003 by Bruyne *et al*. They used a different system to evaluate the species, however they included a guide to convert their assessments into the IUCN format (Table 4). (**NL '03**)

Table 4: The Dutch Red List categories and their IUCN equivalents.

Dutch Category	IUCN Equivalent
Verdwenen uit NL [VN]	EW
Ernstig bedreigd [EB]	CR
Ernstig bedreigd [EB]	CR
Bedreigd [BE]	EN
Kwetsbaar [KW]	VU
Gevoelig [GE]	NT

The Red List of the **Czech Republic** was completed in 2005 by Czech and Slovakian malacologists (Beran *et al*., 2005) and uses the IUCN criteria (with the exception of using Extinct (EX) for Regionally Extinct (RE)). There is a history of molluscan Red Lists in the Czech Republic and, formerly, Czechoslovakia; this list was used as it is the most up to date list available to the author. (**Cz '05**)

The **Lithuanian** Red Book (Raudonąją Knygą) of species was published in 2003 by the Ministry of the Environment. The species are listed according to their evaluation status (numbering and lettering system, Table 5). Despite this being a recent publication, the system is based on the older (pre-1994) IUCN methodology. One of the major differences is the inclusion of a category called indeterminate, which is something equivalent to data deficient. Species in this category may be at risk, although not enough is known about them to assess their status. (**Li '03**)

Table 5: The Lithuanian Red List categories and their IUCN equivalents

Lithuanian Category	IUCN Equivalent
Extinct [EX0]	Regionally extinct
Endangered [E1]	Endangered
Vulnerable [V2]	Vulnerable
Rare [R3]	Rare
Intermediate [I4]	Similar to data deficient

The **Polish** Red Data Book of Invertebrates was published in 2004 (Głowaciński & Nowacki (eds.), 2004) and is freely available online. The evaluation is based on recent IUCN criterion. (**Po '04**)

There are many local and sub-federal Red Lists of molluscs in **Germany**. The compiled designations given here are mainly from Glöer & Meier-Brook (2003) and are assessments for the whole of Germany. They follow an equivalent system to that of the IUCN and their assessment comparisons are listed below. Added to this, is the assessments taken from the University of Gottingen database (animal-base, 2005) for Germany (mainly for *Vertigo* spp.). It should be noted that there are a number of species protected by federal law in Germany, and the species that also occur here, in Ireland, are listed below. **(De '03)**

Species protected by German law - Anlage 1 zur Bundesartenschutzverordnung (Federal Species Regulation)

- Streng geschützte Weichtiere (Strongest protection for molluscs): *Margaritifera margaritifera.*
- Besonders geschützte Weichtiere (Particular protection for molluscs)*: Anodonta anatina, Anodonta cygnea,* and *Helix aspersa*.

Table 5: The German Red List categories and their IUCN equivalents

No.	German designation	Description	IUCN equivalent
0	**Extinct**		EX
1	**Threatened with extinction**		CR
2	**Highly endangered**	stark gefährdet	EN
3	**Endangered**	gefährdet	VU
4	**Potentially at risk**	potentiell gefährdet	NT
D	**Data deficient**		DD

The **Austrian** Red List (Strum, 2000) uses a similar system to that of Germany (see above). **(Au '00)**

The **Swedish** list was published in 2005 (Gärdenfors, 2005) and follows the IUCN categories and criteria. **(S '05)**

The **Slovakian** Red Book lists (Šteffek, 1994; Škapec, 1992) are based mainly on pre-1994 IUCN criteria (see above Table 5 for further explanation). **(Sl '94)**

The **Flanders** (Belgium) Red List was compiled in 1998 (Backeljau & Van Loen, 1998) by a molluscan expert, Dr. Thierry Backeljau. The list only covers the terrestrial species found in Flanders. **(Fl '98)**

The Red Book of **Latvian** rare and threatened plants and animals was published through the University of Latvia in 1998 (Spuris, 1998). The Latvian government has also published lists of species for special protection (Cabinet of Ministers 2000, 2004) and annexed species where micro-reserves are established (Cabinet of Ministers 2001, 2005). Also, there is a Key Woodland Indicator species list (biotope specialists and indicator species) established in Latvia, although the latter assessments are not included here. **(La '98)**

The only non-marine molluscan species recorded in Ireland that appears on the **Russian** red data book (Iliashenko & Iliashenko, 2000) is *Margaritifera margaritifera*.

The **Estonian** Red List is published through the Nature Conservation Committee of Estonian Academy of Sciences (1998) and follows the following categories:

0. *Extinct or probably extinct* - Species whose wild populations have disappeared or probably disappeared from Estonia. Despite repeated searches they have not been encountered after 1950 (in case of water habitats after 1965), but their occurrence in 1850 – 1949 (1850 – 1964) has been reliably documented.

1. *Endangered* - Species under strong threat of becoming extinct, whose numbers have declined to a critical level or whose habitats have been so drastically decreased that their survival in Estonia is unlikely if the influence of threat factors continues.

2. *Vulnerable* - Species whose populations are declining due to overexploitation, or due to destruction or damaging of habitats, and whose numbers and distribution decrease quickly and which are likely to fall into the category Endangered (1) in the near future if the influence of threat continues.

3. *Rare* - Species which occur in Estonia within restricted areas or in few habitats, or are very sparsely, and which do not belong to the categories Endangered (1) or Vulnerable (2), but whose populations are easily threatened.

4. *Care demanding* - Species which do not belong to the categories Endangered (1), Vulnerable (2), or Rare (3), but whose status requires attention. Still relatively common species, but their numbers have decreased so drastically that they may fall into the category Vulnerable (2) if the influence of threat factors continues. Also species which belonged earlier to the previous categories but are now out of danger.

5. *Indeterminate* - Species known to be Extinct (0), Endangered (1), Vulnerable (2) or Rare (3), but whose degree of being endangered cannot be specified due to insufficient data. **(Es '98)**

The **Finnish** Red List was published in 2001 (Rassi *et al*., 2001) and follows the IUCN (post -1994) guidelines. **(Fi '01)**

Sneli *et al.* (2006) compiled the **Norwegian** Red List and follows IUCN guidelines. **(No '06)**

The Swiss federal Red List for molluscs was first published in 1994 by Turner *et al*. The compiled national Red List of invertebrates is published online through the Federal Office for the Environment

(FOEN), **Switzerland**, with the latest update made in 2007. The numbering system is similar to that of the German system. **(Sw '07)**

The regional Red List for the **Alsace** (France) region is included (ODONAT, 2003) This assessment was published in 2003 but does not follow IUCN categories. The species are categorised as follows: Extinct (Disparu), Endangered (En Danger), Vulnerable (Vulnérable), In Decline (En Déclin), Rare (Rare), Local (Localisé), To Clarify (À Préciser). **(Al '03)**

There is not a current Red List for **Nord – Pas-de-Calais** region of France, however there is a recent checklist for the area (Cucherat & Demuynck, 2006). The checklist also contains a status of the species in the region; species that are indicators of *Zones Naturelles d'Intérêt Ecologique Faunistique et Floristique* (ZNIEFF) are listed: *Acicula fusca, Leucophytia bidentata, Oxyloma sarsii, Quickella arenaria, Leiostyla anglica, Vertigo substriata, V. moulinsiana, V. pusilla, V. angustior, Limax cineroniger, Zenobiella subrufescen* and *Helicigona lapicida*. Collecting of *Cornu aspersum* is also regulated in the region (escargot).

There are four species in the Red List of metropolitan **France** (Bouchet, 1994) that co-occur in Ireland. *Margaritifera margaritifera, Myxas glutinosa, Pisidium pseudosphaerium* and *Vertigo moulinsiana* are all considered vulnerable in France.

The molluscan part of the red book of **Malta** (Schembri & Sultana, 1989) was written by Thake, M.A. & Schembri, P.J, and follows the pre-1994 IUCN criteria. Of the species that occurred in Malta and Ireland, *Truncatella subcylindrica* was considered rare, *Galba truncatula, Ventrosia ventrosa* and *Physella acuta* were considered vulnerable, *Hydrobia acuta neglecta*, *Mercuria similis*, *Pisidium casertanum* were endangered and *Planorbis planorbis* and *Radix balthica* were believed to be extinct from Malta.

The last **Danish** Red List is currently being updated, with certain groups to be published in 2009. The 1997 Red List (Stoltze & Pihl, 1998) attempted to evaluate non-marine molluscs (assessed by Michael Stoltz, in collaboration with Pia Baagøe (mussels), Kåre Fog (land snails) and Frank Jensen (mussels)), however there were inadequate data to produce categories. One exception was *Margaritifera margaritifera*, which was considered extinct from its only recorded site in Denmark.

The **Italian** red-list was born out of a project to make an inventory of all of the Italian fauna (FaunaItalia, 2000; Minelli *et al*., 2003). During this exercise taxon experts were asked to assign a threat category M ('minacciata' in Italian) to species considered endangered or vulnerable. The assessments were considered 'largely subjective' (Stoch, 2000). Three species were listed 'M' that also occur in Ireland: *Vertigo moulinsiana, V. geyeri* and *Balea perversa*.

The **Carpathian List of Endangered Species** was published in 2003 by the World Wildlife Fund and the Institute of Nature Conservation (Poland) and encompasses the Carpathian Mountains which straddle a number of countries (Austria, Czech Republic, Romania, Poland, Slovakia, Ukraine and Hungary) (Witkowski *et al*., 2003). The list includes a number of interesting endemic species but only the European protected *Vertigo angustior* (VU), *V. geyeri* (CR), *V. moulinsiana* (CR) and *Balea perversa* (CR) occur on both Irish and Carpathian lists.

The **European Red List**, an attempt at listing those species in Europe at risk of global extinction was published by the United Nations in 1991. *Vertigo angustior, V. geyeri, V. moulinsiana*, *Balea perversa, Oxyloma sarsii* and *Margaritifera margaritifera* are all listed. There is currently a revised list being

compiled, using IUCN guidelines, which will be published in 2011 (see: www.iucnredlist.org/europe or ec.europa.eu/environment/nature/conservation/species/redlist/)

The **Global Red List (IUCN, 2009)** includes six species listed that occur in Ireland: *Vertigo angustior, V. moulinsiana, V. Geyeri, Quickella arenaria (= Catinella arenaria), Myxas glutinosa, Margaritifera margaritifera* and *Margaritifera durrovensis (= Margaritifera margaritifera* ssp. *durrovensis)*.

Table 6: Summary of species found in Ireland that have a Red List status in 16 other European countries.

	IRL '09	RoI '06	GB '91	Cz '05	NL '03	Li '03	Po '04	De '03	S '05	Au '00	Sl '94	Fl '98	La '98	Es '98	Fi '01	No '06	Sw '07	Al '03
Acanthinula aculeata (O.F. Müller)	nt											EN		4	NT			
Acicula fusca (Montagu)	VU				NT			VU				RE						
Acroloxus lacustris (Linnaeus)	lc									4							3	
Aegopinella nitidula (Draparnaud)	lc			VU*								LR	4		NT			
Aegopinella pura (Alder)	lc				EN							VU		4	NT			
Allopeas clavulinum (Potiez & Michaud)	n/a																	
Ancylus fluviatilis O.F. Müller	lc												2					
Anisus leucostoma (Millet)	lc									3							3	
Anisus spirorbis (Linnaeus)	dd			VU				2	DD	4							3	R
Anisus vortex (Linnaeus)	VU																3	
Anodonta anatina (Linnaeus)	VU	VU															3	DÉ
Anodonta cygnea (Linnaeus)	VU	VU		VU			EN	2								EN		DÉ
Aplexa hypnorum (Linnaeus)	VU			VU*					NT								3	R
Arianta arbustorum (Linnaeus)	VU	VU										R						
Arion ater (Linnaeus)	lc											VU						
Arion circumscriptus Johnston	lc			NT*								LR			NT			
Arion distinctus Mabille	lc											LR						
Arion fasciatus (Nilsson)	lc																	
Arion flagellus Collinge	lc																	
Arion fuscus (O.F. Müller)	dd																	
Arion hortensis Férussac	lc											LR						
Arion intermedius Normand	lc			VU*								LR			VU		4	
Arion occultus Anderson	dd																	
Arion owenii Davies	lc																	
Arion rufus (Linnaeus)	lc																	
Arion silvaticus Lohmander	lc											LR			NT			
Arion subfuscus (Draparnaud)	lc											LR						
Arion vulgaris Moquin-Tandon	n/a																	
Ashfordia granulata (Alder)	nt																	
Assiminea grayana Fleming	n/a				EN													
Balea heydeni Von Maltzan	lc																	
Balea perversa (Linnaeus)	VU			VU	EN		CR					CR		5	NT		4	
Bathyomphalus contortus (Linnaeus)	lc									4	R						3	
Bithynia leachii (Sheppard)	lc			CR				2			R			4			3	
Bithynia tentaculata (Linnaeus)	lc																	
Boettgerilla pallens Simroth	n/a											LR						
Candidula gigaxii (L. Pfeiffer)	dd				EN							EN						
Candidula intersecta (Poiret)	lc											EN						
Carychium minimum O.F. Müller	lc											LR		4	NT			
Carychium tridentatum (Risso)	lc											LR						
Cecilioides acicula (O.F. Müller)	VU											LR				DD	4	
Cepaea hortensis (O.F. Müller)	lc											LR						
Cepaea nemoralis (Linnaeus)	lc											LR	3	4				
Cernuella virgata (Da Costa)	lc																	
Clausilia bidentata (Ström)	lc												3				4	
Cochlicella acuta (O.F. Müller)	lc																	
Cochlicopa cf. lubrica (O.F. Müller)	lc											DD					4	
Cochlicopa cf. lubricella (Rossmässler)	lc											DD					4	
Cochlodina laminata (Montagu)	VU	VU			VU							R						
Columella aspera Waldén	lc										I	DD						
Columella edentula (Draparnaud)	lc				VU							R						
Cornu aspersum (O.F. Müller)	lc																	
Deroceras agreste (Linnaeus)	dd				NT													
Deroceras laeve (O.F. Müller)	lc											LR					4	

	IRL '09	RoI '06	GB '91	Cz '05	NL '03	Li '03	Po '04	De '03	S '05	Au '00	Sl '94	Fl '98	La '98	Es '98	Fi '01	No '06	Sw '07	Al '03
Deroceras panormitanum (Lessona & Pollonera)	n/a											LR						
Deroceras reticulatum (O.F. Müller)	lc											LR						
Discus rotundatus (O.F. Müller)	lc																	
Dreissena polymorpha (Pallas)	n/a																	
Euconulus cf. alderi (J.E. Gray)	lc											DD					3	
Euconulus cf. fulvus (O.F. Müller)	lc											VU						
Galba truncatula (O.F. Müller)	lc																	
Geomalacus maculosus Allman	lc																	
Gyraulus albus (O.F. Müller)	lc																	
Gyraulus chinensis (Dunker)	n/a																	
Gyraulus crista (Linnaeus)	lc												3				3	
Gyraulus laevis (Alder)	EN	VU		VU*	EN			1	EN		R					VU	1	À P
Hawaiia minuscula (Binney)	n/a																	
Helicella itala (Linnaeus)	VU			EN	EN			VU				CR					4	
Helicigona lapicida (Linnaeus)	RE	CR			VU								0					
Helicodiscus parallelus (Say)	n/a																	
Hippeutis complanatus (Linnaeus)	lc																	R
Hydrobia acuta neglecta (Draparnaud)	EN	EN																
Hygromia cinctella (Draparnaud)	n/a																	
Lauria cylindracea (Da Costa)	lc				VU							R					3	À P
Lehmannia marginata (O.F. Müller)	lc											LR						
Lehmannia valentiana (A. Férussac)	n/a																	
Leiostyla anglica (A. Férussac)	VU																	
Leucophytia bidentata (Montagu)	lc																	
Limacus flavus (Linnaeus)	n/a				VU							LR					4	
Limacus maculatus (Kaleniczenko)	lc																	
Limax cinereoniger Wolf	VU	VU			VU							DD						
Limax maximus Linnaeus	lc					2 (V)						LR						
Lymnaea fuscus (C. Pfeiffer)	lc																	
Lymnaea stagnalis (Linnaeus)	lc																	
Margaritifera margaritifera (Linnaeus)	CR	CR		CR		0 (Ex)	EX	1	VU				1	1	VU	VU		
Margaritifera durrovensis Phillips	CR	CR																
Melanoides tuberculatus (O.F. Müller)	n/a																	
Mercuria cf. *similis* (Draparnaud)	EN	EN	EN		CR													
Merdigera obscura (O.F. Müller)	EN																	
Milax gagates (Draparnaud)	lc											DD						
Musculium lacustre (O.F. Müller)	VU			NT						3			3				3	
Myosotella denticulata (Montagu)	dd				NT													
Myosotella myosotis (Draparnaud)	lc				VU													
Myxas glutinosa (O.F. Müller)	EN	VU	EN	EX	CR			1	NT				3	4	NT	NT		
Nesovitrea hammonis (Ström)	lc																	
Omphiscola glabra (O.F. Müller)	RE	CR	VU		VU				VU									
Opeas hannensis (Rang)	n/a																	
Otina ovata (Brown)	lc																	
Oxychilus alliarius (J.S. Miller)	lc											VU		5	NT			R
Oxychilus cellarius (O.F. Müller)	lc											LR						
Oxychilus draparnaudi (Beck)	lc											LR						
Oxychilus navarricus (Bourguignat)	n/a															DD		LO
Oxyloma elegans (Risso)	lc			NT								EN						
Oxyloma sarsi (Esmark)	dd		VU		EN							CR				VU		
Peringia ulvae (Pennant)	lc																	
Physa fontinalis (Linnaeus)	lc			NT													2	R
Physella acuta (Draparnaud)	n/a																3	
Physella gyrina (Say)	n/a																	
Pisidium amnicum (O.F. Müller)	lc			CR*	VU			2			E					NT	3	DÉ
Pisidium casertanum (Poli)	lc																	
Pisidium conventus Clessin	CR						VU	3									4	
Pisidium henslowanum (Sheppard)	lc										S							
Pisidium hibernicum Westerlund	nt			CR*	VU			3		2							4	
Pisidium lilljeborgii Clessin	VU							2									4	
Pisidium milium Held	lc																4	
Pisidium moitessierianum Paladilhe	EN	EN		EN				3			E					NT	4	R
Pisidium nitidum Jenyns	lc									3	S							
Pisidium obtusale (Lamarck)	lc																	
Pisidium personatum Malm	lc				VU										NT			
Pisidium pseudosphaerium Schlesch	EN	VU		CR	EN			1			S				NT	NT	2	
Pisidium pulchellum Jenyns	EN				VU			1									4	R

	IRL '09	RoI '06	GB '91	Cz '05	NL '03	Li '03	Po '04	De '03	S '05	Au '00	Sl '94	Fl '98	La '98	Es '98	Fi '01	No '06	Sw '07	Al '03
Pisidium subtruncatum Malm	lc																	
Planorbarius corneus (Linnaeus)	lc																3	R
Planorbella duryi (Wetherby)	n/a																	
Planorbis carinatus O.F. Müller	lc										V						3	R
Planorbis planorbis (Linnaeus)	lc									4						DD	4	
Pleurodiscus balmei (Potiez & Michaud)	n/a																	
Pomatias elegans (O.F. Müller)	CR	CR			VU							RE					2	
Potamopyrgus antipodarum (J.E. Gray)	n/a																	
*Punctum pygmaeu*m (Draparnaud)	lc																	
Pupilla muscorum (Linnaeus)	EN			NT														LO
Pyramidula pusilla (Vallot)	lc																	À P
Quickella arenaria (Potiez & Michaud)	EN	EN	EN		EW						E	CR				VU	2	
Radix auricularia (Linnaeus)	VU																	R
Radix balthica (Linnaeus)	lc																	
Radix rubiginosa (Michelin)	n/a																	
Semilimax pyrenaicus (A. Férussac)	lc																	
Spermodea lamellata (Jeffreys)	EN				EW													
Sphaerium corneum (Linnaeus)	lc																	
Sphaerium nucleus (Studer)	VU																	
Subulina octona (Bruguière)	n/a																	
Succinea putris (Linnaeus)	lc											LR						
Succinella oblonga Draparnaud	EN	VU	R											4		VU		
Tandonia budapestensis (Hazay)	n/a										R	LR						
Tandonia rustica (Millet)	VU		K	NT	NT						R							
Tandonia sowerbyi (A. Férussac)	lc											DD						
Testacella haliotidea Draparnaud	VU											DD					4	À P
Testacella maugei A. Férussac	nt																	
Testacella scutulum Sowerby	lc																	
Theba pisana (O.F. Müller)	n/a											R						
Theodoxus fluviatilis (Linnaeus)	lc			EX	VU								4				1	LO
Trochulus hispidus (Linnaeus)	lc											LR						
Trochulus striolatus (C. Pfeiffer)	lc																	
Truncatella subcylindrica (Linnaeus)	CR	EN	R															
Truncatellina cylindrica (A. Férussac)	n/a		VU		VU							DD	0			CR		
Vallonia cf. excentrica Sterki	lc											R			NT			
Vallonia costata (O.F. Müller)	lc											LR						
Vallonia pulchella (O.F. Müller)	VU											VU						
Valvata cristata O.F. Müller	lc									3							3	
Valvata piscinalis (O.F. Müller)	lc																	
Ventrosia ventrosa (Montagu)	VU	VU			VU													
Vertigo angustior Jeffreys	VU	VU	EN	VU	EN	4 (I)	EN	VU				CR	2	4	NT	NT	3	DÉ
Vertigo antivertigo (Draparnaud)	VU			VU	VU			VU				CR			NT	NT	4	
Vertigo geyeri Lindholm	VU	VU	EN	CR		4 (I)					E		3		NT	VU	1	
Vertigo lilljeborgi (Westerlund)	VU	VU	R															
Vertigo moulinsiana (Dupuy)	EN	VU	R	CR	VU	4 (I)	CR	3			E	CR		5			2	DÉ
Vertigo pusilla O.F. Müller	EN	VU		NT				Lc				DD						LO
Vertigo pygmaea (Draparnaud)	nt			NT	VU							R		5	NT			
Vertigo substriata (Jeffreys)	nt			NT	EN			VU			S	DD					3	R
Vitrea contracta (Westerlund)	lc											DD	4		NT		3	R
Vitrea crystallina (O.F. Müller)	lc											DD			NT			
Vitrina pellucida (O.F. Müller)	lc											LR						
Viviparus viviparus (Linnaeus)	n/a			VU														R
Zenobiella subrufescens (J.S. Miller)	VU																	
Zonitoides arboreus (Say)	n/a																	
Zonitoides excavatus (Alder)	VU				CR													
Zonitoides nitidus (O.F. Müller)	lc											LR						

* These species had different designations for Moravia and Bohemia (Cz); the higher of the two threat categories is stated.

Figure 4: Countries (in red) from which conservation assessment information was attained.

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