Survey of the land malacofauna of the quarry of Loën (Belgium)

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ABSTRACT. In the context of a program to promote biodiversity protection, a team of members of the Royal Belgian Society of Malacology and of the naturalist association Natagora Basse-Meuse has accurately studied the malacofauna of the quarry of Loën (Belgium). 38 gastropods species has been observed in 32 stations, with moreover juvenile specimens and clutches, demonstrating the malacological interest of this closed site.

RESUME. Dans le contexte d'un programme de promotion de la protection de la biodiversité, une équipe de membres de la Société Royale Belge de Malacologie et de l'association naturaliste Natagora Basse-Meuse a étudié en profondeur la malacofaune du site de la carrière de Loën (Belgique). 38 espèces de gastéropodes ont été observées sur 32 stations, avec de plus des juvéniles et des pontes, attestant de l'intérêt malacologique de cet espace fermé.

INTRODUCTION

The Quarry Life Award is an international research competition for the promotion and education about biodiversity in quarries. This contest is organized by HeidelbergCement, a German multinational company headquartered in Heidelberg, Germany. In Belgium, the main activity of this industrial group is mining and extracting.

The obvious aim of such a contest is to establish that a mining site provides in fact a great variety of landscapes and habitats, without almost no disturbance from human activities and as a result with beneficial effects on local flora and fauna. From this point of view, it is very interesting to improve the knowledge of the fauna of the various systematics groups.

The Royal Belgian Malacological Society (in French : Société Royale Belge de Malacologie - S.R.B.M, former S.B.M.) has seen in this contest an unique opportunity to access to areas usually closed to non industrial people and to therefore evaluate the malacological value of such mining sites.

A particular site seemed to be the easier to study: the quarry of Loën (Lixhe, Liège, Wallonia), located in central-eastern Belgium, in the Meuse river low valley and managed by the CBR cement works, member of the HeidelbegCement group. The reason is that some links already exists between the quarry and an association called Natagora. The main aim of this non-profit organisation is to protect the nature in Belgium through buying and managing land, protecting species, education of the general public running and specific public and lobbying local and regional governments.

It happens that a few the members of the S.R.B.M. are also members of Natagora and the choice of a specific quarry to be part of the Quarry Life Award contest was therefore straightforward.

This paper reports the results of the survey of the malacofauna of this quarry of Loën, study performed by both S.R.B.M. and Natagora Basse-Meuse (the local component of Natagora), looking for land molluscs (snails and slugs) and freshwater molluscs.

The Loën quarry is certainly of a high interest for the molluscs study for many reasons. First, it is located near several very interesting calcareous natural areas such as the Montagne St Pierre, Thier de Caster and Oost-Maarland (of which Natagora Basse-Meuse survey the malacofauna); such a location is extremely important in understanding the evolution of mollusc communities and the expansion of certain species. Moreover, it presents a rich diversity of biotopes and habitats, ranging from extremely dry stations with very little vegetation to wet meadows and woods with ponds and streams. And lastly, as stated earlier, it is a

site very little impacted by human activity other than the actual quarry exploitation.
That's because the authors and their team felt it of very high interest to identify, photograph on the field, list and establish distribution maps of these molluscs species in the Loën quarry because one can find there various biotopes sites, sites that are closed and so protected. All this information should lead to accurate surveys and precise mapping of the high biodiversity islands located in this quarry, confirming that some parts of this site function as "malaco-sanctuaries" and are therefore very important to preserve as a natural treasure.

ECOLOGICAL NOTE

Ecological roles of mollusks

Mollusks have not an anecdote ecological role in nature; they can contribute for the good functioning of the environment by various ways.
Slugs and snails are obviously a component of the food web: they are heterotrophs. Land slugs and snails have a bad reputation in the public because there are considered as "salad eater" and so as one of the enemies of the gardeners. This is true than a small number of species is a serious pest for agriculture and horticulture (essentially *Arion vulgaris*, *Arion hortensis*, *Deroceras invadens*, *Deroceras reticulatum*, *Cornu aspersum*) able to destroy great quantity of fruits and vegetables, and flowers. However, the large number of gastropod species is not a threat for our fruits and vegetables, numerous species have completely different diet such as eating mushrooms, lichens, algae, dead wood, detritivore, some ones are carnivorous. *Oxychilus draparnaudi* and *Limax maximus* predate other gastropods, notably the invasive species.
In this food web, slugs and snails are also preys for numerous species, and even constitute a major part of the diet of mammals (notably hedgehog, shrew, field mouse, badger) and some birds (notably thrushes). In forest, density of birds can be correlated to the density of snails and slugs (Pabian et al. 2012). Some insects are specialist predator of gastropods. The carrion beetle *Phosphuga atrata*, the larvae of the beetle *Drilus flavescens* and glowworms *Lampyris noctiluca* are specific predator of landsnails. Note also that some land snails are intermediate host of some complex parasites as flatworm *Leucochloridium paradoxum* affecting *Succinea putris*. The parasite, located finally inside eye stalks, modifies the look of the snail which becomes very attractive for birds (the final host). Infected snail is recalled "zombie snail". Another famous example is the common liver fluke *Faciola hepatica* has as intermediate hosts several aquatic lymnaeid snails as *Galba truncatula*, *Stagnicola palustris* and *Lymnea palutris*. The infection of cattle and human is not due to direct consumption of snails but from eating water plants (ex.watercress).
Some commensal relation exists also with mollusks. The European bitterling (*Rhodeus amarus*) is fish where the male defends a territory where there is a freshwater mussel and protect it. A female lays her eggs inside the mussel thanks an ovipositor; and the male deposits his sperm in the inhalant current produced by the mussel, so that fertilization occurred inside the mussel. After hatching, the young will benefit from a double barrier: the mussel sheltering them, and their father protecting it. Another example is the oligochaeta *Chaetogaster limnaei limnaei* which is an external commensal of numerous aquatic gastropods like the genus *Lymnaea*, *Physa* or *Ancylus*, and living on the shell or directly inside the shell. The worm participes to the clean of the shell, and the mollusk provides protection.
Even death, land snails is useful for a series of species. The empty shell become an shelter for numerous animals like woodlice, diptera, ants, microlepidoptera, solitary bees, or smaller mollusks. Some species lay their eggs with a food stock in an empty shell as some solitary bee as in *Osmia bicolor* and *Osmia arulenta*.
Freshwater mussels play a key role as filter-feeders. During this feeding, mussels clean the water, so increasing the sunlight penetration in water and so increase the production of phytoplankton, the installation of some amphibian and fish. Note that unfortunately, some invasive species as Corbicula genus have so high-density population than this filtering is too efficient: Phytoplankton is completely removed from the food web, and the impact is catastrophic on all the food chain (Pigneur et al., 2014). This is the case in the Meuse river where fish density and even fish predator have significantly decreased.
As a major component of pedofauna in the litter and the soils, gastropods play a role as a decomposer. Furthermore, as some species are able to burry or even live as an earthworm, these species contribute to aeration and the mixing of the soil.
Another underestimated function of gastropods is their role in the dispersion of some plants and lichens (zoochory). Similarly to ants which disperse seeds of numerous herbaceous species (myrmochory), notably attracted by elaiosomes (fleshy structure rich in lipids and proteins), plants use gastropods in the same way. Slugs and snails eat the elaiosome with the complete seed. Seeds resist to the digestive tractus of these mollusks, and are released several hours after in faeces, several ten of meters farther of the mother plant (Türke et al. 2010). Slugs and snails provide also the dispersion of lichens. As a reminder, lichen is not a classical plant, but a composite organism that arises from algae (or cyanobacteria) living among filaments of a fungus in a symbiotic relationship. Dispersion is naturally complex for lichen because only the fungus produces spores, which need to find new algae to develop a new lichen. If spores can travel a very long distance with winds, to colonize the next tree is generally very difficult. But a piece of consumed

lichens being passing by the digestive tract of gastropods can survive and produce new lichen on the next tree or rock (Boch et al. 2011). This is efficient for the lichen because the two symbiotic organisms are already together. The case of gastropochory of lichens is a rare case of direct symbiosis between three organisms, each one belong to a different kingdom (prokaryote, fungus and animal).

Mollusks and quarries

Quarries are clearly concerned because numerous habitats can be present before, during and after exploitations.
Generally, the direct exploitation front is hostile for live. Old previous habitats disappeared, and sometimes geologic configurations can give some potential impact on the ground water. Some interesting cave systems can disappeared or affected by the exploitation. A case is known in the crustacean amphipoda *Microniphargus leruthi* discovered in only one locality in Belgium which has been destroyed by the expansion of a quarry (Martin et al. 2009). However, other populations of this species were fortunately discovered after in Germany, Luxembourg and British Isles (Knight & Gledhill 2010). Fortunately again, none equivalent negative story is reported in our region concerning mollusks. Concerning groundwater, quarries can potentially have a negative impact if this interstitial and ground waters are drained to allow exploitation. Concerning mollusk, only one species (*Avenionia roberti*) located essentially in Meuse river could be threated. Some population close Maastricht (The Netherlands) and several ones in very close Germany are known outside Wallonia (Belgium). However, its real state of population is completely unknown, just identified in total in 20 localities. Exploitation of water and pollution are identified as the first potential threats for this species.
On the other hand, exploitation creates all a series of new environments and habitats, sometimes original, sometimes becoming of major interest, where the nature is welcome. Exploitation can create access to or create new cavities potentially suitable for colonization by cave species. Exploitation in quarries can create also new habitats.
1) New cavities as we have already said. This is interesting for cave species (troglobites, troglophiles and trogloxenes).
2) Creation of large open zones where quiet or abandoned areas are suitable for xeric and thermophilic species.
3) Creation of rocky cliffs interesting for petrophilic species. The size of these newly-created cliffs are sometimes so large in quarries than these sites can become the most important sites for these species because cliffs are rare in our country with a relative weak relief. Just a few cliffs exist in deep valleys in Wallonia, mainly in limestone area. This is interesting for petrophilic and xero-thermophilic species. The orientation to the sun (and to the wind) can play a major impact in species distribution on the cliffs.
4) Creation of ponds and lakes, particularly if plants have colonized this new aquatic environment, is suitable for aquatic species of lentic environment such as freshwater gastropods and also bivalves.
5) Some quarries are located on calcareous zones (chalk, limestone,...) have a high potential to welcome large population of gastropods, but also large number of species.
6) Older or unexploited zones can be occupied by woods. These zones welcome all series of forest species which search shadow, humidity, litter and tree trunks to live. This is potentially a zone of refuge of species present naturally before the beginning of the exploitation.
7) Excepted for the current exploitation front or areas directly exposed to circulation of trucks, quarries are generally quiet environment without pressure of urbanization, without the pressure of high human occupation (sports, recreations, tourism, ...), and without the pressure of intensive culture. For all this advantages, quarries is become an interesting refuge zones for biodiversity and this is certainly the case for mollusks.
8) Sometimes, natural environment is so affected than a species can find the majority of living site in quarries and practically none in the original natural habitat, which are completely modified or disappeared. This new environment close of older becomes a substitution habitat. This is particularly true for aquatic species, and for numerous species living in rocks and cliffs. In these cases, quarries can become the only refuge for these species.
9) Quarries are frequently located on a larger region than the exploitation area, with the same geology, geomorphology and soil. So different fragmented habitats can exist, with for each ones their own populations of each species. If quarries can be a supplementary population, the most interesting point is that quarries can play the link of different disconnected areas of the same habitat, and so maintain in contact these different populations. This is the concept of metapopulation. More these metapopulations are large, with numerous exchange of population, and more these metapopulations and sub-populations can survive and avoid any risk of local extinction, so at long term avoid the extinction of a species.

MATERIAL AND METHODS

First exploring and various information of the Loën quarry reveal that there are here various biotopes, giving a preliminary list of types:

- ♦ sunny crests and slopes (SCS);
- ♦ shrubs and shaded boulders below cliffs (SSB);
- ♦ dry grasslands or meadows (DGM);
- ♦ wet woodlands (WW);

♦ dry woodlands (DW);
♦ ponds, lake and temporary pools (PL);
♦ of course, industrial estate (IE).

According to this analysis, we have planned the study of the area to access each kind of biotope that will be carried out by the observers, defining possible stations to explore and planning the way to reach them. Finally, 32 stations have been explored, corresponding to various biotopes, for a height from 52 to 121 m (Figs 1-2, table 1).

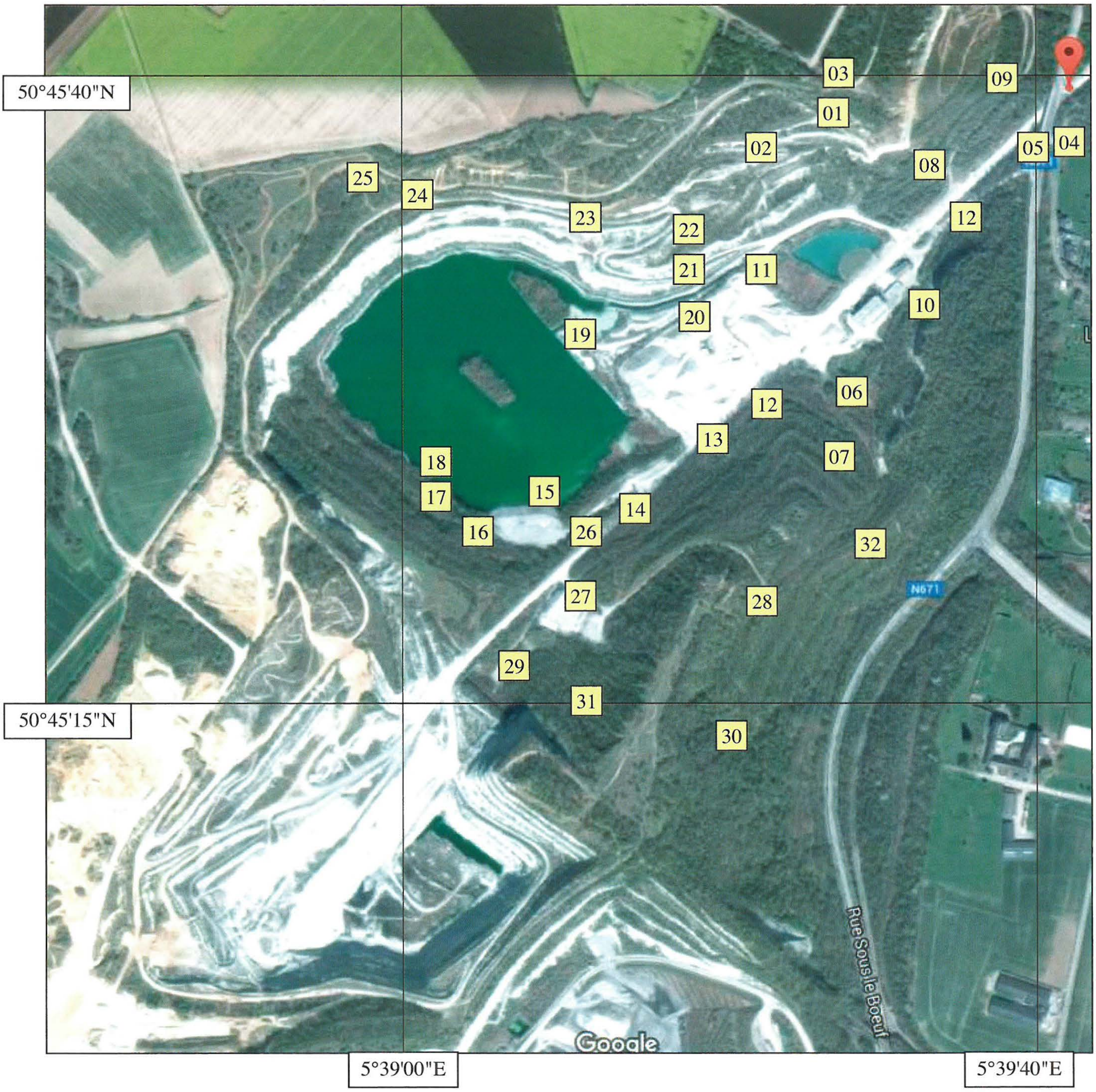

Figure 1. Map with stations location (background from Google Map)

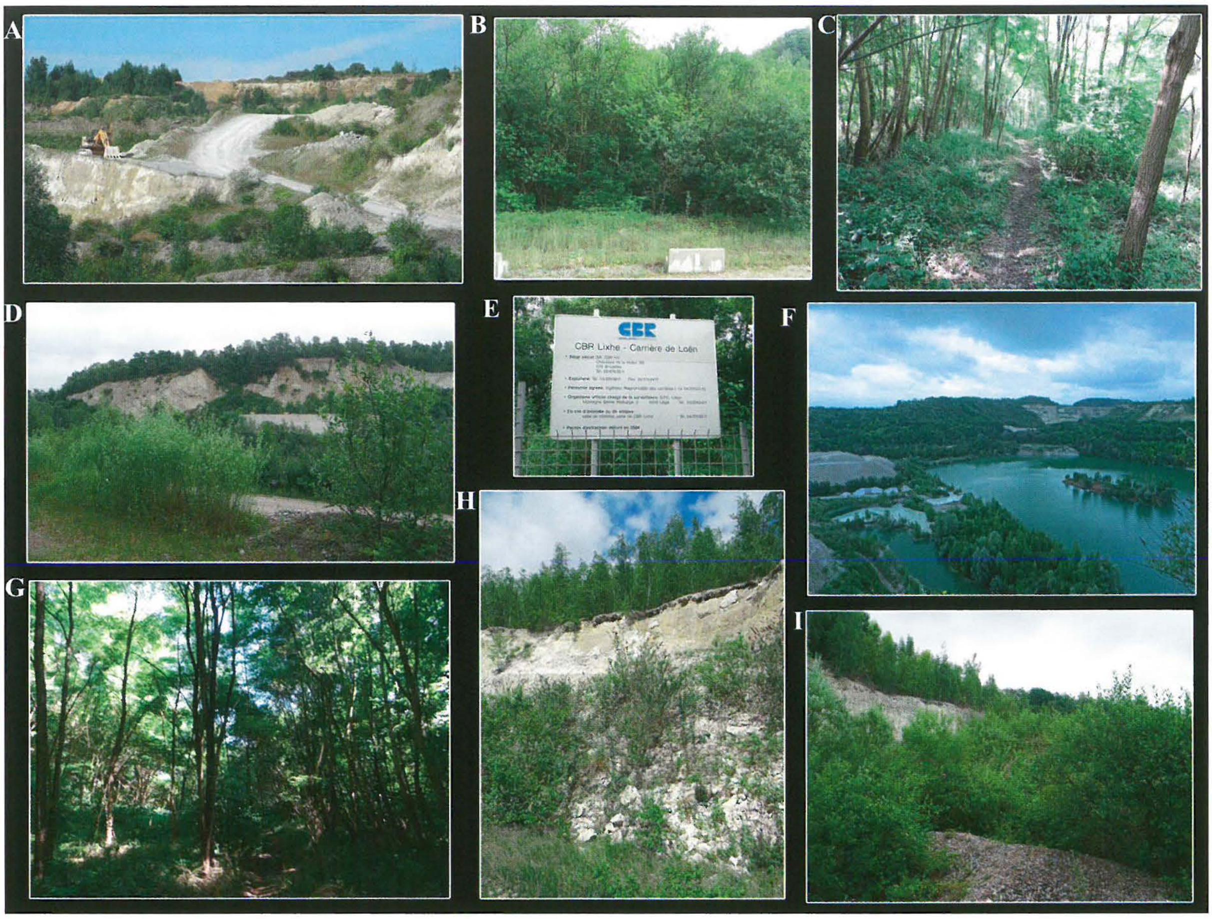

Figure 2. Some landscapes views in the Loën quarry. **A.** Stn 29; **B.** Stn 11; **C.** Stn 31; **D.** Stn 21; **E.** Entrance of the CBR Loën quarry; **F.** Stn 23 with perspective to stn 16-17-18; **G.** Stn 28; **H.** Stn 11; **I.** Stn 22 with perspective to stn 1 & 2.

A total amount of 32 stations were studied during 7 prospectings, following this timing: 15/4/2016 : stations 1, 2, 3; 30/4/2016 : stations 4, 5, 6, 7; 14/5/2016 : stations 8, 9, 10, 11; 29/5/2016 : stations 12, 13, 14, 15, 16, 17, 18, 19, 20; 13/7/2016 : stations 21, 22, 23, 24, 25; 6/8/2016 : stations 26, 27, 28, 29; 20/8/2016 : stations 30, 31, 32. More precisely:

station 1	50°45'37"N	5°39'26"E	SCS
station 2	50°45'36"N	5°39'21"E	SCS
station 3	50°45'38"N	5°39'26"E	DW
station 4	50°45'37"N	5°39'40"E	SSB
station 5	50°45'36"N	5°39'39"E	IE
station 6	50°45'26"N	5°39'26"E	SSB
station 7	50°45'24"N	5°39'28"E	WW
station 8	50°45'35"N	5°39'34"E	SSB
station 9	50°45'39"N	5°39'37"E	DW
station 10	50°45'30"N	5°39'32"E	SSB
station 11	50°45'32"N	5°39'21"E	SSB
station 12	50°45'26"N	5°39'21"E	WW
station 13	50°45'24"N	5°39'18"E	WW
station 14	50°45'22"N	5°39'15"E	IE
station 15	50°45'22"N	5°39'9"E	DGM
station 16	50°45'21"N	5°39'05"E	WW
station 17	50°45'23"N	5°39'02"E	WW
station 18	50°45'23"N	5°39'02"E	WW
station 19	50°45'29"N	5°39'10"E	IE
station 20	50°45'30"N	5°39'18"E	IE
station 21	50°45'31"N	5°39'17"E	SSB
station 22	50°45'33"N	5°39'17"E	SSB
station 23	50°45'34"N	5°39'08"E	DGM
station 24	50°45'34"N	5°39'01"E	DW
station 25	50°45'35"N	5°38'59"E	WW
station 26	50°45'21"N	5°39'13"E	SSB
station 27	50°45'18"N	5°39'11"E	DW
station 28	50°45'18"N	5°39'23"E	WW
station 29	50°45'15"N	5°39'06"E	SSB
station 30	50°45'14"N	5°39'20"E	WW
station 31	50°45'15"N	5°39'12"E	DW
station 32	50°45'21"N	5°39'28"E	WW

Table 1. List of the prospected stations of the quarry of Loën.

Typically, we plan a study of about half an hour to one hour per station. Some stations were explored in the springtime, other in the summertime These dates are interesting to know because one find usually more juvenile and subadult samples during the first months after the wintertime than in the later summer months.

Abbreviations

S.B.M.: Société Belge de Malacologie
S.R.B.M.: Société Royale Belge de Malacologie, former S.B.M.
stn: station

RESULTS

Systematics

The global results of our observations are listed there under (table 2) and illustrated in situ and/or with their shell (Figs 3, 4, 8).

Remarks

1) Falkner et al. (2002) have established that the north-west very common European invasive species known as *Arion lusitanicus* Mabille 1868 has to be called *A. vulgaris* Moquin-Tandon 1855, the *A. lusitanicus* name being restricted to another Portugese species (accepted in Werner-Schultes, 2012).
2) In the same way, Reise et al. (2011) established that the name *Deroceras panormitanum* (Lessona & Pollonera, 1882) (syn. *D. caruanae* Pollonera 1891) was until now almost always improperly for a species that is *D. invadens*, the former name being still valid for a another species living in Sicily and Malta;
3) That *Arion ater* and *A. rufus* are two different species or no is still an open debate.
4) We observed many juvenile and subadult specimens, for snails as well as slugs. The same observation is right regarding clutches (Fig. 9). This means clearly that the quarry is considered by the molluscs as a quiet and sheltered area, suitable for feeding, growing and breeding.
5) We failed to find freshwater molluscs in the waters of the lake and pond, neither gastropods nor bivalves. These waters seem very inhospitable, without plants and with many floating chalk-like particles in them.
The only freshwater snail we have found is *Potamopyrgus antipodarum* (the Jenkin's Spire Shell), practically observed only in temporary rain-fed pools, with the exception of only one individual detected on the edge of the lake (Fig. 9-I). Moreover, it is impossible to prospect the lake far from the banks, because the bottom sinks quickly and steeply.
Clearly we needed help from a team of divers. In fact, such a contacted team could agree to explore the bottom of the main lake of the quarry. But the chief engineer of the quarry deny them any access to the lake, arguing that a firemen report establish that there was no visibility near the bottom. Although the divers told us that there was trained to dive in such trouble water, we had to give up. A fisherman also reported us the presence of "freshwater mussels" (*Anodonta* species), but it was clearly impossible to verify this assertion.

ANALYSIS

Species richness

Table 1 resumes our results from the 32 stations. A total of 38 species were observed in the Loën quarries during our prospecting campaign. Despite some very interesting aquatic habitats as ponds, lake and marshes, only one aquatic species (*Potamopyrgus antipodarum*) were observed in ephemeral ponds and only one specimen of the same species were observed in the quarries lake. On the other hand, land species richness is very high for western Europe habitats, making Loën a very interesting sanctuary for malacofauna.
The analysis of cumulative curve by two different methods (extrapolation of estimated species richness Sest) and the Chao2 estimator shows the same results (Figs 5-6): the species richness of Loën quarry is statistically estimated to 40 species, indicated than only 2 species should be discovered yet. This result underlines that our effort of prospecting was very good because we have statistically observed 95% of the malacofauna.

Figure 3. Some shelled gastropods found in the Loën quarry.

A. ***Helicella itala*** (Linnaeus, 1758); **B-D.** ***Cepaea hortensis*** (O.F. Müller, 1774); **E** ***Monacha cartusiana*** (O.F. Müller, 1774); **F.** ***Clausilia bidentata*** (Ström, 1765); **G.** ***Oxyloma elegans*** (Risso, 1826); **H.** ***Oxychilus draparnaudi*** (H. Beck, 1837); **I.** ***Clausilia rugosa parvula*** (Férussac, 1807); **J.** ***Carychium tridentatum*** (Risso, 1826); **K.** ***Merdigera obscura*** (O.F. Müller, 1774); **L.** ***Cochlicopa lubrica*** (O.F. Müller, 1774); **M.** ***Helix pomatia*** (Linnaeus, 1758); **N.** ***Aegopinella pura*** (Alder, 1830); **O.** ***Oxychilus cellarius*** (O.F. Müller, 1774); **P.** ***Aegopinella nitidula*** (Draparnaud, 1805); **Q.** ***Cernuella neglecta*** (Draparnaud, 1805); **R.** ***Discus rotundatus*** (O.F. Müller, 1774); **S.** ***Pomatias elegans*** (O.F. Müller, 1774); **T.** ***Macrogastra attenuata lineolata*** (Held, 1836); **U.** ***Macrogastra rolphii*** (Turton, 1826); **V.** ***Trochulus hispidus*** (Linnaeus, 1758); **W.** ***Eucobresia diaphana*** (Draparnaud, 1805); **X.** ***Cochlodina laminata*** (Montagu, 1803); **Y.** ***Pupilla muscorum*** (Linnaeus, 1758).


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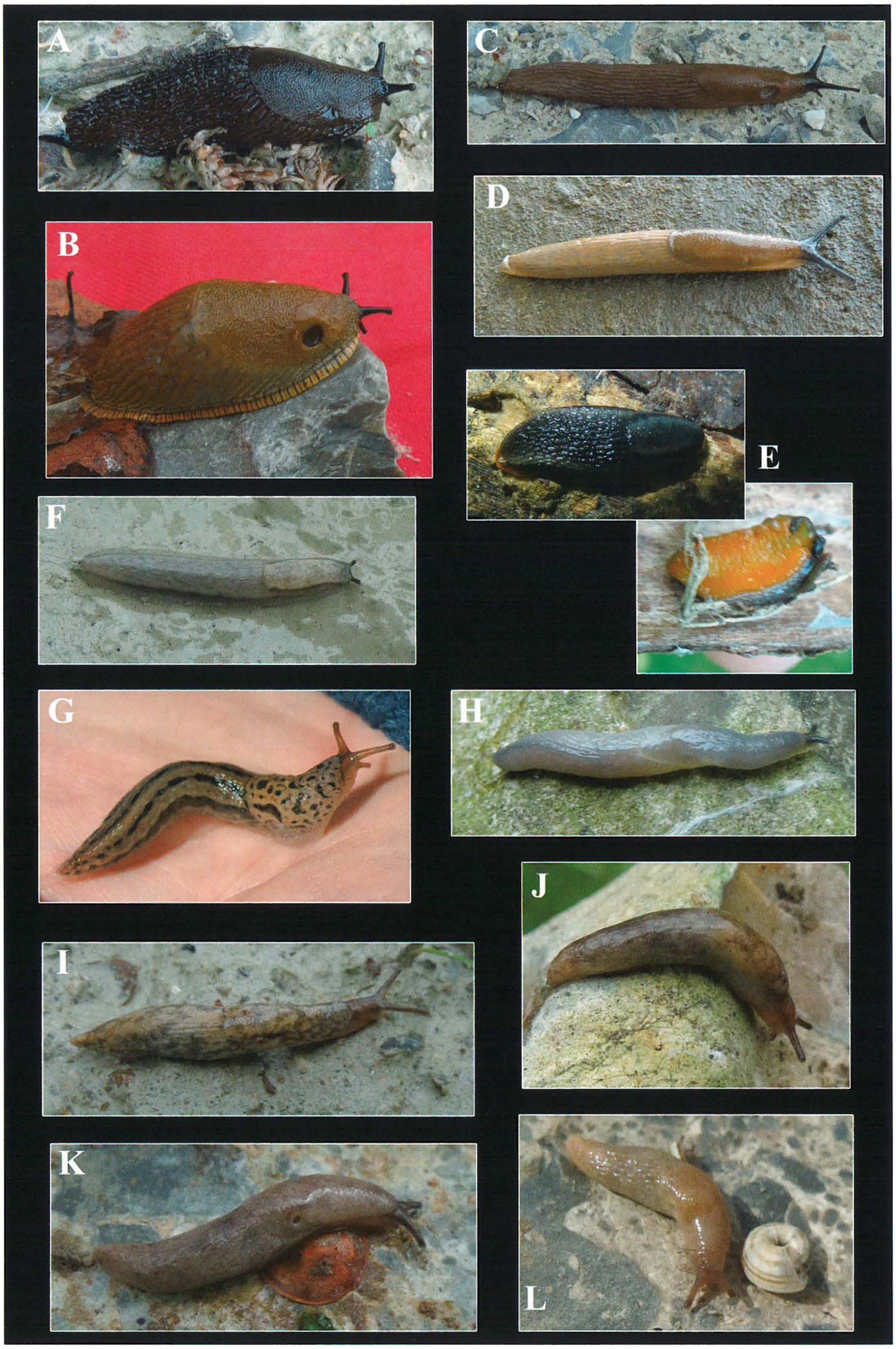


Figure 4. Some slugs found in the Loën quarry.

A. ***Arion ater*** (Linnaeus, 1768); **B.** ***Arion rufus*** (Linnaeus, 1758); **C-D.** ***Arion vulgaris*** Moquin-Tandon 1855; **E.** ***Arion hortensis*** A. Férussac, 1819 and its yellowish sole; **F.** ***Arion silvaticus*** Lohmander, 1937; **G.** ***Limax maximus*** Linnaeus, 1758; **H.** ***Boettgerilla pallens*** Simroth, 1912; **I-J.** ***Deroceras reticulatum*** (O.F. Müller, 1774); **K-L.** ***Deroceras invadens*** Reise, Hutchinson, Schunack & Schlitt, 2011.

Occurrence of species

As a result of the diversity of habitats of the Loën quarry, and as numerous species needs specific environmental conditions, it is normal than none species is observed in the totality of stations. However, some species are more frequently observed (Fig. 7). The ubiquist invasive species *Arion vulgaris* is not a surprise (62% of stations). *Cepaea hortensis* and *Discus rotundatus* are also two species largely spread in our region. *Helix pomatia, Clausilia rugosa parvula, Helicella itala* and *Cernuella neglecta* are species generally not very frequent even very rare for the last one. These species associated to limestone habitats are very widespread and frequent in the Loën quarry. The case of *Cernuella neglecta*, a rare species in our country, is largely observed in the quarry. At the opposite, some species were very rarely observed, sometimes only one times. This is true for species very difficult to observe because they live inside the soil (*Boetgerilla pallens*) or because they are very tiny (ex: *Vallonia, Carychium, Pupilla*). The case of *Macrogastra attenuata* is very interesting because this is a rare species in our country known just in some forest located in tributaries of the Meuse and in Montagne-St-Pierre. Localised in the station 17 in an isolated wood in the middle of the quarry, *M. attenuata* is perhaps a relictual population before exploitation.

The abundance by number of individuals is not used here because the degree of activity and detectability vary among species and weather conditions.

Communauty of mollusks

For the terrestrial species, some communities are clearly defined here. the most evident is the calciphilic species, where we can find species living only in limestone habitats or with a clear preference for it: *Helix pomatia, Helicella itala, Clausilia parvula, Cochlodina laminata, Pupilla muscorum, Pomatias elegans*. Other more ubiquist species are often more abundant in limestone habitats. The second most evident community is xerothermophilic species like *Cernuella neglecta, Helicella itala, Monacha cartusiana*. These species live in very sunny stations. At the opposite, the forest community avoids xerothermic stations and live in the woody habitats or sometimes with numerous shrubs: *Monachoides incarnatus*, *Cepaea hortensis* and *C. nemoralis*, *Eucobresia diaphana, Arion silvaticus, Macrogastra rolphi* and *M. attenuata,* and *Clausilia bidentata*. The hygrophilous community is poor in species and not very widespread in the quarry despite the available aquatic habitats. The typical example is *Oxyloma elegans*. For species living close to human or crops (synanthropic species) are practically absent here: none *Cornu aspersum*, none *Tandonia budapestensis* nor *Lehmania valenciana*. However, the exception is the large occurrence of *Arion vulgaris*, whereas other slugs as *Arion rufus* or *Arion ater* seem rarer. *Arion hortensis*, a species very abundant close the human habitat and culture, is very rarely observed here. *Boetgerilla pallens*, another slug considered in the past as synanthropic and known as largely widespread in our country, is also observed here. For invasive species observed in the Loën quarry, only two species are detected: *Arion vulgaris* that we have already discussed, and *Potamopyrgus antipodarum*, a species coming from New-Zealand! Finally, some ubiquist species are observed in a large number of different habitats: *Discus rotundatus* (excepted very sunny area) and *Arion vulgaris*. *Helix pomatia* is observed from open areas to dense wood.

Species richness by habitat type

Regarding the richness for the different categories of habitats (Fig. 10), the results are clear, more the habitat is rich in trees and more this habitat is humid, and more species can be observed. With 33 species, wet woodlands welcome the most of species. However, some species of close habitats are sometimes observed out of their classical habitat like *Cernuella neglecta* or *Helicella itala* sometimes detected in woods in lower part of open areas. Sunny crest and slopes, and dry grasslands and meadows are the most poor. However, poor in species does not mean not interesting for the malacofauna. Some species live typical in these dry and sunny areas as *Cernuella neglecta, Helicella itala, Monacha cantiana. Pupilla muscorum* were observed only in dry habitats.

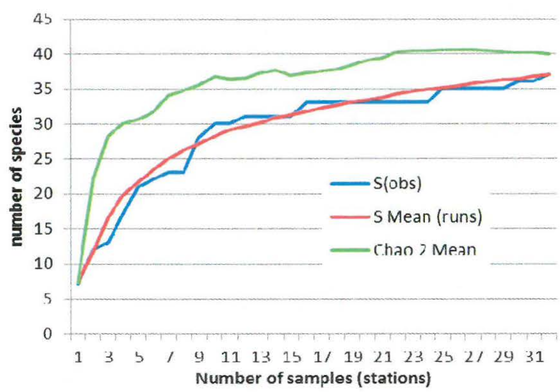


Figure 5. Species number as a function of sample number in Loën quarry: accumulation curve (Sobs: observed species richness), rarefaction curve [S mean: estimated species richness (= Sest)] and CHAO2 diversity estimator.

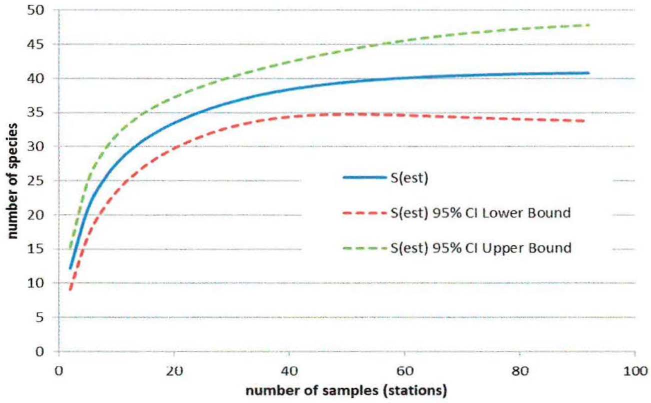


Figure 6. Extrapolation of the plot rarefaction curves (Sest) and 95% confidence interval.

CONCLUSION

The quarry of Loën can clearly be considered as a "malaco-sanctuary", regarding especially the number of observed species and the very high number of specimens for some species.

It is worth to be protected and explained in an educational way to the general public, using however accessible terminologies as for example vernacular names (table 3). The scientific name is indeed the only right way to consider a species in an official paper, but in front of the general public, in an educational context, this is not the same: most people don't like the Latin names, finding them too difficult and clearly tedious. So, a good strategy is to use the vernacular names of snails and slugs (in the adequate language!), as do the botanists for the flowers or the entomologists for the insects.

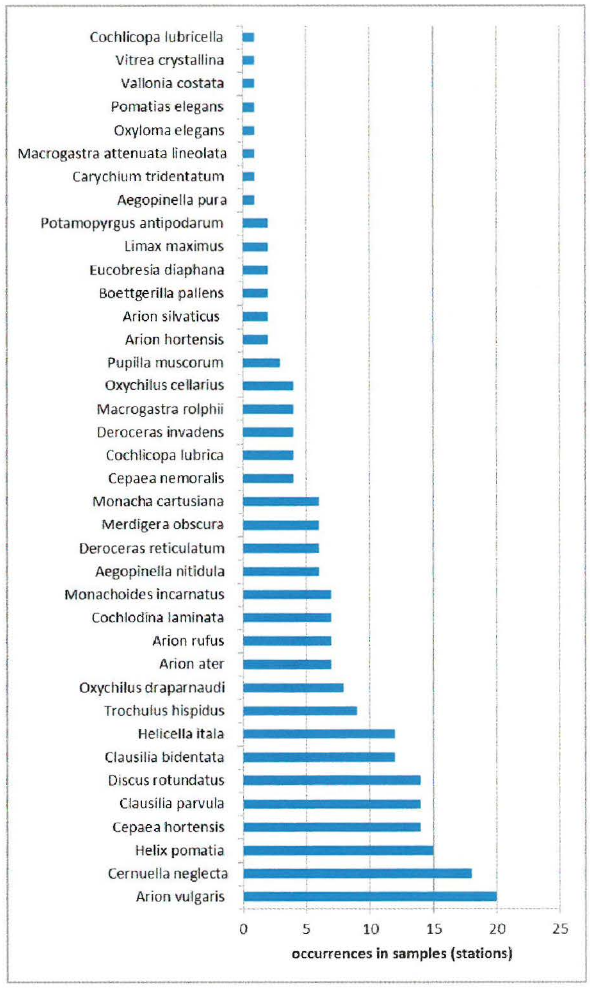
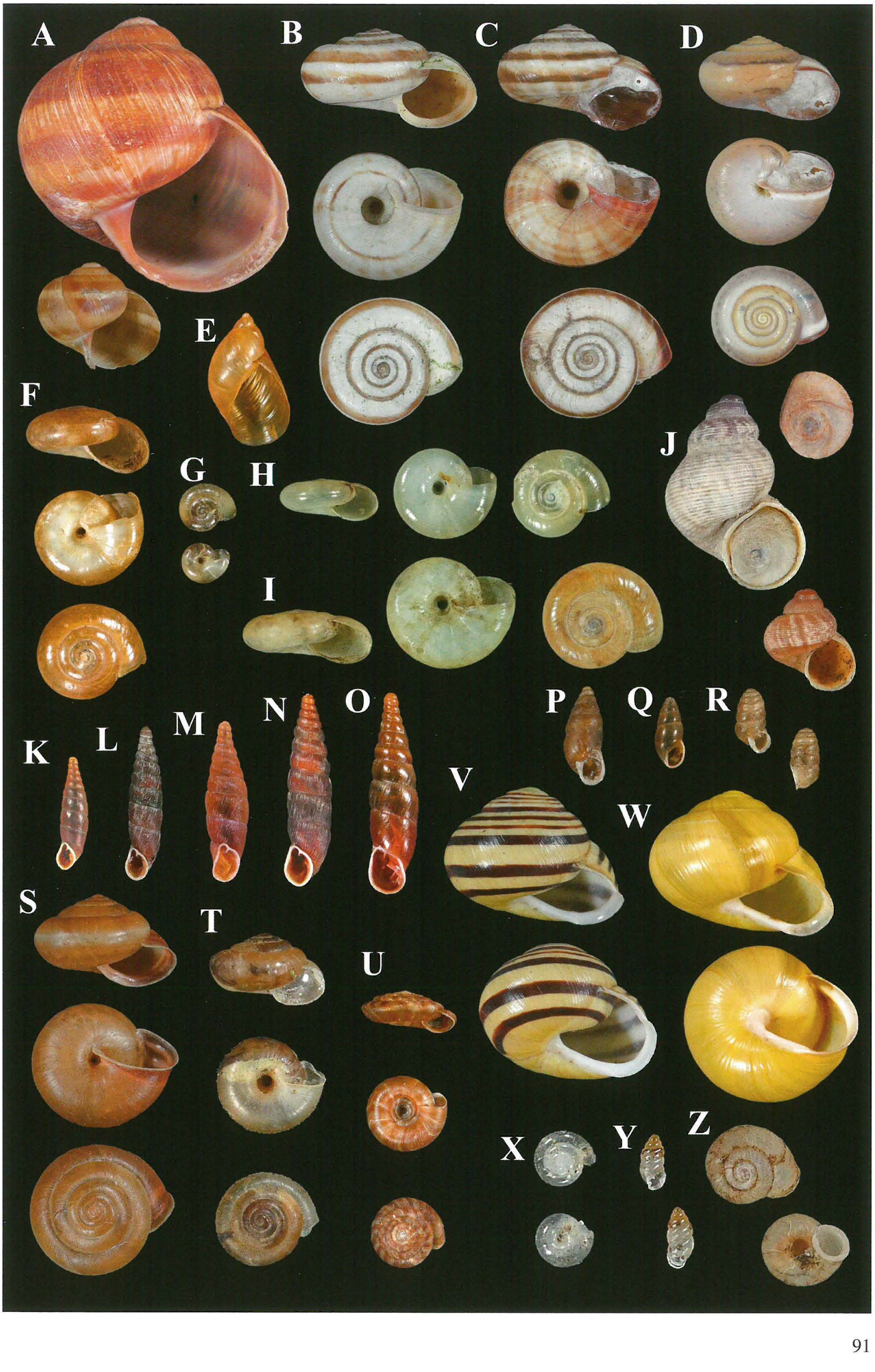


Figure 7. Occurrences of the observed species (number of stations).

Figure 8. Shells of some gastropods found in the Loën quarry.

A. ***Helix pomatia*** (Linnaeus, 1758), 39.5 x 36 mm; **B.** ***Helicella itala*** (Linnaeus, 1758), 8.3 x 14.5 mm; **C.** ***Cernuella neglecta*** (Draparnaud, 1805), 9.3 x 14.5 mm; **D.** ***Monacha cartusiana*** (O.F. Müller, 1774), 8.4 x 13.2 mm; **E.** ***Oxyloma elegans*** (Risso, 1826), 15.3 x 8.1 mm; **F.** ***Aegopinella nitidula*** (Draparnaud, 1805), 4.6 x 8.1 mm; **G.** ***Aegopinella pura*** (Alder, 1830), 1.4 x 3.5 mm; **H.** ***Oxychilus cellarius*** (O.F. Müller, 1774), 4.5 x 9.0 mm; **I.** ***Oxychilus draparnaudi*** (H. Beck, 1837), 6.5 x 13.3 mm; **J.** ***Pomatias elegans*** (O.F. Müller, 1774), 14.6 x 10.3 mm and juvenile specimen, 8.2 x 6.8 mm; **K.** ***Clausilia rugosa parvula*** (Férussac, 1807), 7.8 x 2.3 mm; **L.** ***Clausilia bidentata*** (Ström, 1765), 11.0 x 2.3. mm; **M.** ***Macrogastra rolphii*** (Turton, 1826), 12.7 x 3.3 mm; **N.** ***Macrogastra attenuata lineolata*** (Held, 186), 14.2 x 3 .7 mm; **O.** ***Cochlodina laminata*** (Montagu, 1803), 16.5 x 14.5 mm; **P.** ***Merdigera obscura*** (O.F. Müller, 1774), 9.0 x 3.9 mm; **Q.** ***Cochlicopa lubrica*** (O.F. Müller, 1774), 6.1 x 2.3 mm; **R.** ***Pupilla muscorum*** (Linnaeus, 1758), 3.5 x 2.1 mm; **S.** ***Monachoides incarnatus*** 9.8 x 14.5 mm; **T.** ***Trochulus hispidus*** (Linnaeus, 1758), 4.0 x 6.5 mm; **U.** ***Discus rotundatus*** (O.F. Müller, 1774), 2.8 x 5.5 mm; **V.** ***Cepaea hortensis*** (O.F. Müller, 1774) f. 12345, 13.8 x 18.1 mm; **W.** ***Cepaea hortensis*** (O.F. Müller, 1774) f. 00000, 14.2 x 19.3 mm; **X.** ***Vitrea crystallina*** (Müller, 1774), 1.1 x 3.2 mm.; **Y.** ***Carychium tridentatum*** (Risso, 1826), 2.1 x 0.8 mm; Z. ***Vallonia costata*** (O.F. Müller, 1774), 1.0 x 2.3 mm.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On another hand, the Loën quarry site is interesting also for its location. In Meuse valley, the limestone of open areas constitutes habitats dry and sunny able to welcome some species typically Mediterranean. This true for a series of plants and insects, and for several of them, these areas are the north limit of their repartition. These species frequently have colonized by following the valley from France to here. If we have not detected the case with mollusk, our study is a reference for potential future study. For instance, we have not detected *Hygromia cinctella* or *Monacha cantiana*, species observed in Montagne-St-Pierre. Other species clearly in expansion could be observed in a close future as *Cernuella virgata*.

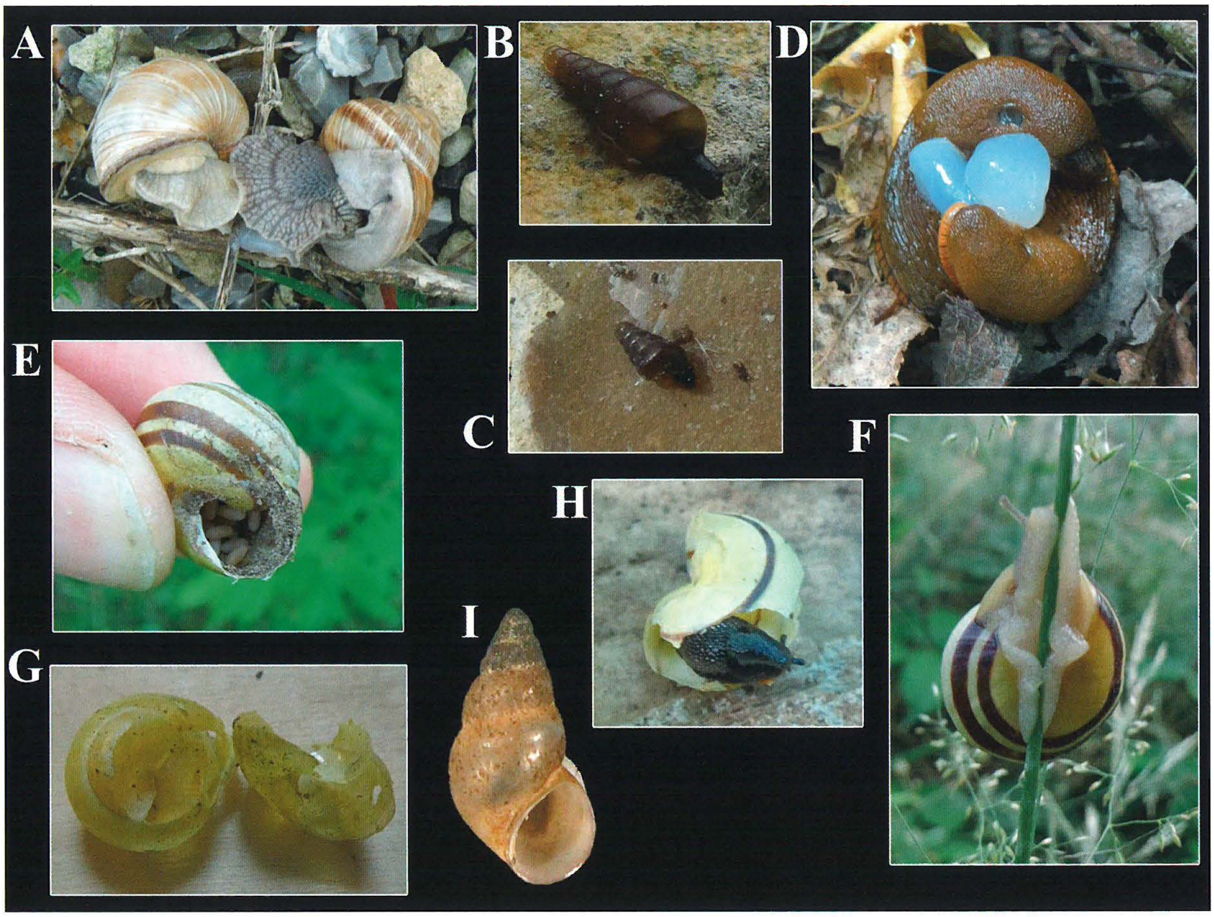

Figure 9. Miscellaneous. **A.** ***Helix pomatia*** (Linnaeus, 1758) ready to mate; **B.** ***Cochlodina laminata*** (Montagu, 1803) subadult; **C.** ***C. laminata*** (Montagu, 1803) juvenile; **D.** ***Arion vulgaris*** Moquin-Tandon 1855 mating with spawn; **E.** Ants eggs inside a *Cepaea* shell; **F.** ***Cepaea hortensis*** (O.F. Müller, 1774) with its foot around a plant stem; **G.** *Cepaea* shells probably broken by a thrush; **H.** ***Arion hortensis*** A. Férussac, 1819 sheltering in a broken *Cepaea* shell; **I.** The only freshwater snail we have found: *Potamopyrgus antipodarum* (Gray, 1843).

At the opposite, the Meuse valley is also a way of species introduction by the Netherlands. This is particularly true with aquatic species as *Corbicula sp.* and *Dreissena polymorpha* and *D. quagga*. The case of *Cernuella neglecta* is very interesting in this point of view. This species is considered as very rare in Wallonia, and recently only know in a cliff close to Lanaye (Lower part of Belgian valley of Meuse). The discovery of a large population of this species in the Loën Quarry underlines as the range of this species is in progress. At the exception of Montagne-St-Pierre region, this species is reported only in a small area in a station at Andenne (Delcourt in prep.).

Concerning *Macrogastra attenuata*, the Loën quarry is one of the most in the north-west location for this species with a central European distribution. Another location were recently reported close to Maastricht (Majoor, 2015).

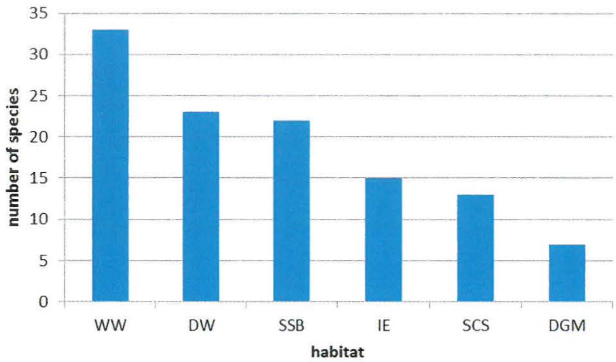

Figure 10. Species richness for different biotopes (WW: wet woodlands, DW: dry woodlands, SSB Shrubs and shaded boulders below cliffs, IE: Industrial estate, SCS: sunny crest and slopes, DGM: dry grasslands and meadows).

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Species \ Station	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Family Pomatiidae Newton, 1891																																
Pomatias elegans (O.F. Müller, 1774)					X																											
Famille Hydrobiidae Troschel, 1857																																
Potamopyrgus antipodarum (J.E. Gray, 1843)			X														X															
Family Carychiidae Jeffreys, 1830																																
Carychium tridentatum (Risso, 1826)																														X		
Family Succineidae H. Beck, 1837																																
Oxyloma elegans (Risso, 1826)					X																											
Family Cochlicopidae Pilsbry, 1900 (1879)																																
Cochlicopa lubrica (O.F. Müller, 1774)									X	X														X								X
Cochlicopa lubricella (Rossmässler, 1834)									X																							
Family Valloniidae Morse, 1864																																
Vallonia costata (O.F. Müller, 1774)																									X							
Family Pupillidae Turton, 1831																																
Pupilla muscorum (Linnaeus, 1758)		X																					X	X								
Family Enidae B.B. Woodward, 1903 (1880)																																
Merdigera obscura (O.F. Müller, 1774)		X								X												X			X			X			X	
Family Clausiliidae J.E. Gray, 1855																																
Clausilia bidentata (Ström, 1765)						X	X			X							X	X				X			X	X	X	X		X	X	
Clausilia rugosa parvula (Férussac, 1807)	X	X			X			X	X	X	X						X				X	X	X		X		X				X	
Cochlodina laminata (Montagu, 1803)				X	X				X	X	X																			X		X
Macrogastra attenuata lineolata (Held, 1836)																	X															
Macrogastra rolphii (Turton, 1826)	X																X								X							X
Family Patulidae Tryon, 1866																																
Discus rotundatus (O.F. Müller, 1774)				X	X				X	X							X				X	X	X	X	X	X		X	X	X		
Family Pristilomatidae T. Cockerell, 1891																																
Vitrea crystallina (O.F. Müller, 1774)																																X
Family Oxychilidae P. Hesse, 1927 (1879)																																
Oxychilus cellarius (O.F. Müller, 1774)										X												X		X						X		

Table 2. Observed land and freshwater species per station in the Loën quarry.

Station / Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Oxychilus draparnaudi (H. Beck, 1837)		X			X			X		X												X				X		X				X
Aegopinella nitidula (Draparnaud, 1805)					X				X	X							X													X		X
Aegopinella pura (Alder, 1830)																									X							
Family Limacidae Lamarck, 1801																																
Limax maximus Linnaeus, 1758	X																								X							
Family Agriolimacidae H. Wagner, 1935																																
Deroceras invadens Reise, Hutchinson, Schunack & Schlitt, 2011										X		X	X																	X		
Deroceras reticulatum (O.F. Müller, 1774)									X	X		X	X																	X		X
Family Boettgerillidae Van Goethem, 1972																																
Boettgerilla pallens Simroth, 1912									X	X																						
Family Vitrinidae Fitzinger, 1833																																
Eucobresia diaphana (Draparnaud, 1805)	X																													X		
Family Arionidae J.E. Gray, 1840																																
Arion ater (Linnaeus, 1768)									X	X		X					X					X		X			X					
Arion hortensis A. Férussac, 1819								X									X											X				
Arion rufus (Linnaeus, 1758)					X				X													X			X	X					X	X
Arion silvaticus Lohmander, 1937												X	X																			
Arion vulgaris Moquin-Tandon 1855				X	X	X	X			X	X	X	X		X		X	X		X	X	X				X	X	X		X	X	X
Family Hygromiidae Tryon, 1866																																
Cernuella neglecta (Draparnaud, 1805)	X	X			X			X	X	X		X			X			X			X	X	X	X		X	X		X		X	X
Helicella itala (Linnaeus, 1758)		X			X			X	X	X											X	X		X			X	X	X			X
Monacha cartusiana (O.F. Müller, 1774)									X	X													X		X		X		X			
Monachoides incarnatus (Müller, 1774)							X	X	X																			X	X	X		X
Trochulus hispidus (Linnaeus, 1758)	X	X			X				X	X							X								X			X		X		
Family Helicidae Rafinesque, 1815																																
Cepaea hortensis (O.F. Müller, 1774)				X	X	X	X		X	X	X	X						X								X		X		X	X	X
Cepaea nemoralis (Linnaeus, 1758)	X				X																			X	X							
Helix pomatia (Linnaeus, 1758)	X					X		X		X							X			X		X		X	X	X	X	X	X	X	X	

Table 2. Continued

Scientific name	Nom vernaculaire français	English vernacular name	Deutsch Mundart	Nederlandse landstaal naam
Aegopinella nitidula (Draparnaud, 1805)	Grande luisantine	Smooth Glass Snail	Rötliche Glanzschnecke	Bruine blinkslak
Aegopinella pura (Alder, 1830)	Petite luisantine	Clear Glass snail	Kleine Glanzschnecke	Kleine blinkslak
Arion ater (Linnaeus, 1768)	Arion noir, Grande limace noire	Large Black slug	Groβe Schwarze Wegschnecke	Duistere wegslak
Arion hortensis A. Férussac, 1819	Limace des jardins, Limace horticole	Garden Arion, Small stripped Slug	Echte Garten-Wegschnecke	Zwarte wegslag
Arion rufus (Linnaeus, 1758)	Arion rouge, Grande limace rouge	Marge Red Slug, Chocolate Arion	Groβe Rote Wegschnecke	Rode wegslag
Arion silvaticus Lohmander, 1937	Arion des bois	Forest Arion, Silver False-keeled Slug	Wald-Wegschnecke	Bos-wegslag
Arion vulgaris Moquin-Tandon 1855	Loche méridionale	Vulgar slug, Spanish slug	Spanische Wegschnecke	Spaanse wegslak
Boettgerilla pallens Simroth, 1912	Limace vermiforme	Worm Slug	Wurmnacktschne-cke	Grijze wormnaaktslak
Carychium tridentatum (Risso, 1826)	Auriculette commune	Herald Snail	Schlanke Zwerghornschne-cke	Slanke dwergslak
Cepaea hortensis (O.F. Müller, 1774)	Hélice jardinière, Escargot à bord blanc	White-lipped Grove Snail	Weißmündige Bänderschnecke	Witgerande tuinslak
Cepaea nemoralis (Linnaeus, 1758)	Escargot des haies, Escargot à lèvre brune	Brown-lipped Banded Snail	Schwarzmündige Bänderschnecke	Zwartgerande tuinslak, Gewone tuinslak
Cernuella neglecta (Draparnaud, 1805)	Hélice négligée	Neglected Dune snail	Rotmündige Heideschnecke	Afgevlakte duinslak
Clausilia bidentata (Ström, 1765)	Clausilie noirâtre	Door Snail	Kleine Glanzschnecke	Vale clausilia
Clausilia rugosa parvula (Férussac, 1807)	Clausilie naine	Door Snail	Kleine Schließmundschne-cke	Kleine clausilia
Cochlicopa lubrica (O.F. Müller, 1774)	Bulime brillant	Slippery Teardrop Snail	Gemeine Achatschnecke	Glanzende agaathoren
Cochlicopa lubricella (Rossmässler, 1834)	Petite brillante	Least Slippery Snail	Kleine Achatschnecke	Slanke agaathoren
Cochlodina laminata (Montagu, 1803)	Clausilie lisse	Plaited Door Snail	Glatte Schließmundschne-cke	Gladde clausilia
Deroceras invadens Reise, Hutchinson, Schunack & Schlitt, 2011	Loche maltaise	Longneck Field Slug, Tramp Slug	Mittelmeer-Ackerschnecke	Zwervende akkerslak
Deroceras reticulatum (O.F. Müller, 1774)	Limace réticulée	Netted Slug	Genetzte Ackerschnecke	Gevlekte akkerslak
Discus rotundatus (O.F. Müller, 1774)	Hélice bouton	Garden Disk Snail, Rounded Snail	Gefleckte Schüsselschnecke	Boerenknoopje

Table 3. Scientific names and the corresponding French, English, German and Dutch vernacular names (Van Goethem, 1988; Wardhaugh, 1989; Bogon, 1990; Fechter & Falkner, 1990; Kerney & Cameron, 1999; Fontaine et al., 2010; Gargominy, Prié et al., 2011; Gargominy, Ripken et al,; 2011; Vilvens et al., 2012a, 2012b, 2012c; Werner-Schultes, 2012; Wiese, 2014; Rowson et al., 2014).

Scientific name	Nom vernaculaire français	English vernacular name	Deutsch Mundart	Nederlandse landstaal naam
Eucobresia diaphana (Draparnaud, 1805)	Vitrine transparent, Vitrine diaphane	Ear-shaped glass snail	Ohrförmige Glasschnecke	Oorvormige glasslak
Helicella itala (Linnaeus, 1758)	Hélice des bruyères, Hélice ruban	Heath Snail	Gemeine Heideschnecke	Heideslak
Helix pomatia (Linnaeus, 1758)	Escargot des vignes, Escargot de Bourgogne	Roman Snail	Weinbergschnecke	Wijngaardslak, Gewone wijngaardslak
Limax maximus Linnaeus, 1758	Limace cendrée, Limace léopard	Tiger Slug, Spotted leopard Slug	Tigerschnegel	Tijgerslak
Macrogastra attenuata lineolata (Held, 186)	Clausilie linéolée	Lined Door Snail	Mittlere Schließmundschne-cke	Geribde clausilia
Macrogastra rolphii (Turton, 1826)	Clausilie de Rolph	Rolph's Door Snail	Spindelförmige Schließmundschne-cke	Gekielde clausilia
Merdigera obscura (O.F. Müller, 1774)	Bulime obsur	Lesser Bulin	Kleine Turmschnecke	Donkere torenslak
Monacha cartusiana (O.F. Müller, 1774)	Hélice chartreuse	Cartusian Snail	Kartäuserschnecke	Klein kartuizerslake
Monachoides incarnatus (Müller, 1774)	Moine des bois	Incarnate Snail	Rötliche Laubschnecke	Bos-loofslak
Oxychilus cellarius (O.F. Müller, 1774)	Zonite des caves, Hélice des celliers	Cellar Glass Snail	Keller-Glanzschnecke	Kelder-glansslak
Oxychilus draparnaudi (H. Beck, 1837)	Grande Zonite, Zonite des Draparnaud	Draparnaud's Snail	Große Glanzschnecke	Grote glansslak
Oxyloma elegans (Risso, 1826)	Ambrette élégante	Pfeiffer's Amber Snail	Schlanke Bernsteinschnecke	Slanke barnsteenslak
Pomatias elegans (O.F. Müller, 1774)	Cyclostome géant	Round-mounted Snail	Schöne Landdeckelschne-cke	Geruite rondmondhoren
Potamopyrgus antipodarum (J.E. Gray, 1843)	Hydrobie des Antipodes	Jenkin's Spire Snail	Neuseeländische Zwergdeckelschne-cke	Jenkin's waterhorentje
Pupilla muscorum (Linnaeus, 1758)	Maillot des mousses, Maillot mousseron	Moss Chrysalis Snail	Moos-Puppenschnecke	Mostonnetje
Trochulus hispidus (Linnaeus, 1758)	Hélice veloutée, Hélice hispide	Hairy Snail, Hairy Hygromia	Gemeine Haarschnecke	Haarslak
Vallonia costata (O.F. Müller, 1774)	Vallonie à côtes	Ribbed Snail	Gerippte Grasschnecke	Jachtorenslakken
Vitrea crystallina (O.F. Müller, 1774)	Zonite cristallin	Crystal Snail	Gemeine Kristallschnecke	Grote Kristalslak

Table 3. Continued