

CHILOPODA - CENTIPEDES

(DUIZENDPOTEN - MILLEPATTES - HUNDERTFÜSSER)



Terrestrial arthropods with unfused trunk segments, all but the last two with a pair of legs; number of legs varies from 15 to 181 pairs; first pair modified as large poison fangs; most species are nocturnal predators, well adapted to chase insects and other small prey; in many species, the female cares for the eggs and young in underground burrows; ca. 3,000 species described worldwide.

Questionnaires completed by Koen LOCK (Ghent University) and Richard KIME (Royal Belgian Institute of Natural Sciences).



Thirty-one species have been recorded (LOCK 2001a, LOCK 2001b). Based on data from the Netherlands, France, Germany and the United Kingdom, 10 to 20 additional species are expected. Since 1950, the species number augmented with nine species, thanks to an increase of the faunal knowledge. A representative collection is housed in the Royal Belgian Institute of Natural Sciences. The highest species richness is found in the Calestienne, followed by the somewhat less diverse Hautes Fagnes and Lorraine. Although Lower and Middle Belgium are characterised by a rather poor fauna, an important number of species have been observed here because most research took place in these parts of Belgium (LOCK 2001b). The Hautes Fagnes are of special importance to the centipedes among others because of the occurrence of three particular varieties or subspecies: *Lithobius microps exarmatus*, *L. tricuspis mononyx* and a variety of *L. forficatus*.

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SYMPHYLA - SYMPHYLANS

(DWERGPOTIGEN - SYMPHYLES - ZWERGFÜSSER)



Small (less than 1 cm), mainly white and blind myriapods; trunk with 14 segments, first 12 each with a pair of legs; penultimate segment with a pair of cerci; generally confined to moist areas; feeding on living or rotting vegetation; between 200 and 500 known species worldwide.

Questionnaire completed by Christian DÜKER (State Museum of Natural History, Görlitz).



At least five species have been recorded (various articles). Twenty additional species are expected based on the symphylans present in France, Germany and the Grand Duchy of Luxembourg. Taxonomic knowledge of this group is very poor and no

representative collection nor an expert able to identify organisms to the species level were found in Belgium.

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DIPLOPODA - MILLIPEDES

(MILJOENPOTEN - DIPLOPODES, MILLEPATTES - DOPPELFÜSSER, TAUSENDFÜSSER)



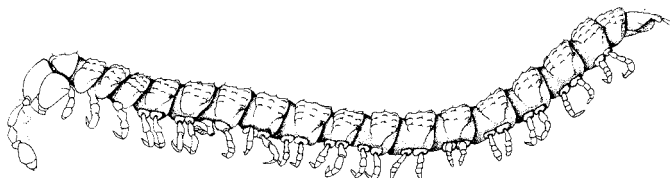
Most diverse group of myriapods characterised by the fusion of most trunk segments in pairs to form diplosegments, each with two pairs of legs; generally restricted to moist areas under logs and stones, and in leaf litter; mainly feeding on decaying vegetation; when disturbed, some species, called pill millipedes, curl up like pill bugs, while others spray or secrete toxic or irritating defensive substances; ca. 10,000 species described, while a total of up to 80,000 species is expected worldwide.

Questionnaire completed by Richard KIME (Royal Belgian Institute of Natural Sciences).



Fifty species have been recorded (unpublished species list). Less than ten additional ones are expected, based on the millipede species registered in neighbouring countries. Taxonomic knowledge of this group is good; a representative collection is housed in the Royal Belgian Institute of Natural Sciences. Since 1962, the species number has augmented by seven species thanks to an increase of the faunal knowledge. The highest diversity is found in Middle Belgium, followed by, in decreasing order of species richness, Upper Belgium and the Lorraine. Forests, and mainly the semi-natural ones, are of essential importance for the conservation of the millipede fauna. At the population level, up to 15 co-

existing species were observed within 100 m² (KIME & WAUTHY 1984) and a maximum of 700 individuals were found within 1 m² (KIME 1992).



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Until 25 years ago, very few records of the small diplopod *Macrosternodesmus palicola* in Belgium and adjacent countries existed. Recent fieldwork revealed the species to be widespread in calcareous localities (from BLOWER 1985, courtesy of The Linnean Society and The Estuarine and Coastal Sciences Association).


References and further reading

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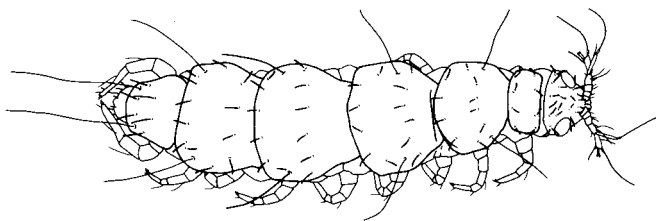
PAUROPODA - PAUROPODS

(PAUROPODEN, WEINIGPOTIGEN - PAUROPODES - WENIGFÜSSER, ZWERGTAUSENDFÜSSER)

 Small (less than 2 mm), generally colourless, and thus largely unnoticed myriapods with a pair of legs on all 11 or 12 trunk segments, except on the first and last ones; frequently abundant in leaf litter and soil (up to 5 million individuals per ha); feeding on dead plant and animal matter, and on fungi; ca. 700 known species worldwide.

Questionnaires completed by Yasunori HAGINO (Natural History Museum and Institute, Chiba, Japan) and Walter HÜTHER (independent expert, Germany), with the contribution of Ulf SCHELLER (independent expert, Sweden).

 Eleven species have been recorded (REMY 1940, with species list). Based on their presence in neighbouring and Central European countries, 11 to 25 additional species may occur. Taxonomic knowledge is considered to be poor to moderate. No Belgian expert able to identify organisms to the species level was found. A representative collection (REMY collection) is housed in the 'Muséum National d'Histoire Naturelle', Paris.



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Stylopauropus (S.) pedunculatus (LUBBOCK, 1867) is one of the most widely distributed pauropod species, occurring in Europe, Africa, Asia, North America and Australia. This soil dweller, living in leaf litter, under stones and logged wood, has a body length of around 1.5 mm (drawing by Y. HAGINO).

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CRUSTACEA - CRUSTACEANS

(SCHAALDIEREN, KREEFTACHTIGEN - CRUSTACÉS - KREBSTIERE)

 Mostly aquatic arthropods with gills; body with dorsal carapace; appendages biramous and modified for collecting food, swimming, walking, respiration and reproduction; sexes usually separate; development with nauplius stage; most are free-living, some sessile and a few parasitic; fossil record dates back to the Cambrian; ca. 40,000 species known worldwide.

CLADOCERA - WATER FLEAS

(WATERVLOOIEN - PUCES D'EAU - WASSERFLÖHE)

 Relatively primitive crustaceans with completely enclosed body by an uncalcified shell (or carapace) and with five or six trunk limbs used for feeding and respiration; post-abdomen has a series of denticles along the dorsal margin, lateral setae and a terminal pair of claws; making up a large portion of freshwater zooplankton; one of the

secrets for their success is the mode of reproduction; when conditions are good, the females parthenogenetically produce more females every two or three days; when environmental conditions become adverse, these females produce sexually active males and females which together produce fertilised eggs called ephippia; these are extremely resistant to cold and drying and can be transported to new habitats by wind or in mud that clings to other animals; global number of observed species for this group range from 500 to 600; this number will increase considerably in the near future because of ongoing order reviews and a quickly evolving group taxonomy.

Questionnaire completed by Henri DUMONT (Ghent University).



Eighty species have been observed, four of which are considered as introductions. Up to five additional species are expected, mainly in the southern part of the country. Since DUMONT's species list (1989), six additional species (*Alona rustica*, *Eurycerus glacialis*, *Bythotrephes longimanus*, *Moina micrura*, *M. weismanni* and *Simocephalus serrulatus*) were discovered (synthesis on additional species in FORRÓ *et al.* 2003). Lower Belgium, including the Kempen, shows the highest species diversity. No significant increase or decrease in species number occurred during the last decades. Taxonomic expertise of this group is considered to be good and some six to eight Belgian experts able to identify organisms to the species level were identified. A representative collection is managed by the Ghent University.

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'PHYLLOPODA - PHYLLOPODS, LARGE BRANCHIOPODS or LEAF-FOOTED CRUSTACEANS'

(KIEUWPOOTKREEFTEN - GRANDS BRANCHIOPODES - BLATTFUSSKREBSE, URZEITKREBSE)



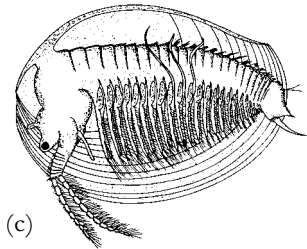
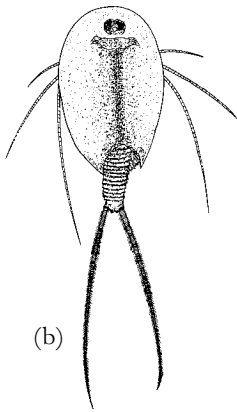
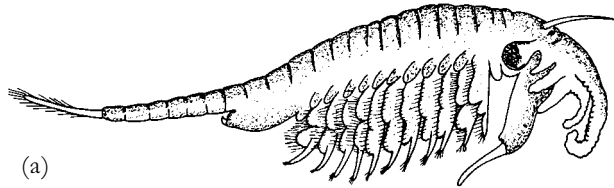
The term 'Phyllopoda' is considered to have no taxonomic value, but is still used for descriptive purposes when referring collectively to the Anostraca, Notostraca and Conchostraca. Large and diverse group of relatively primitive crustaceans; flattened and leaf-like limbs on the thorax used for respiration, locomotion and feeding; abdominal limbs are generally reduced in number or lacking; dormant embryos able to survive extremely unfavourable circumstances are produced during adverse periods; ca. 410 species described worldwide, many more to be discovered.

Questionnaire completed by Luc BRENDONCK (Catholic University of Leuven).



Seven species have been recorded (BRENDONCK 1989) and two additional ones are expected (HÖDL & RIEDER 1993). However, except for the recent finding of an introduced conchostracan species (*Leptestheria dabalacensis*), which seems to have vanished in the meantime, and the observation of a population of *Chirocephalus diaphanus*, destroyed shortly afterwards because of the hardening of the location, no phyllopods have been collected since 1959. This group is considered to be taxonomically well known in Belgium and collections are housed in the Royal Belgian Institute of Natural Sciences and the Zoological Museum of the University of Liège. Middle Belgium shows the highest species

richness, followed by Lower Belgium and the Hautes Fagnes (BRENDONCK 1989, LONEUX & THIERY 1998). Habitats essential for the survival of these species are temporary pools, loam pits and ditches (BRENDONCK 1989).



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Examples of (a) an anostracan, *Chirocephalus diaphanus*, (b) a notostracan, *Triops cancriformis*, and (c) a conchostracan, *Limmadia lenticularis*. These three species were once present in Belgium but their present status is unknown (drawings by L. BRENDONCK).

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OSTRACODA - OSTRACODS

(MOSELKREEFTEN, OSTRACODEN - OSTRACODES - MUSCHELKREBSE, OSTRACODEN)



Oligomeric aquatic crustaceans fully enclosed in a calcified bivalved carapace; most are less than 1 mm in carapace length; locomotion by swimming or by crawling over the substratum; widely distributed in all aquatic environments; fossil record is expected to go back to the Ordovician; ostracods are of proven value for interpreting geologic age, depth, salinity and other parameters of sedimentary rocks; 9,000 living species worldwide and many more to be discovered.

Questionnaire completed by Karel WOUTERS (Royal Belgian Institute of Natural Sciences).



Following WOUTERS (1989) and MEISCH *et al.* (1990), both with partial species lists, and ATHERSUCH *et al.* (1989), 76 freshwater and 29 marine species have been observed. Up to 60 additional species are expected (ATHERSUCH *et al.* 1989, MEISCH 2000).

For Belgium and the neighbouring countries, taxonomic knowledge of this group is considered to be moderate. The highest species richness in Belgium is found in the marine zone, followed by the creek area and Lower Belgium. Middle and Upper Belgium and the Lorraine seem to be characterised by a lower species diversity, but this may be due to a lower sampling effort. A representative collection is housed in the Royal Belgian Institute of Natural Sciences.

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COPEPODA - COPEPODS

(ROEIPOOTKREEFTEN - COPÉPODES - RUDERFÜSSKREBSE)



Maxillopodan crustaceans characterised by the presence of a head shield and the absence of a carapace and abdominal appendages; often possessing a single median eye; size ranging from 0.5 to 10 mm (a few exceptions are up to 30 cm long); occupying a wide range of aquatic and semi-aquatic habitats from the deepest part of the ocean up to 5,000 m above sea level in the Himalaya; some orders are parasitic on, or live in association with, a wide range of fishes and invertebrates; free-living forms are suspension feeders or predators; harpacticoids occur also as scavengers, algal grazers, etc.; ca. 13,000 species described, but this is considered to be only 10% of the total species number worldwide.

Questionnaire completed by Frank FIERS (Royal Belgian Institute of Natural Sciences).



Since these organisms are mainly studied in relation to their ecological niche, this overview of Belgian species will be subdivided into four categories: freshwater and semi-aquatic forms, marine benthic forms, marine pelagic forms, and parasitic and commensal forms.

So far, 84 species have been recorded in the freshwater and semi-aquatic environments (LINDBERG 1950, DUMONT 1989, FIERS & GHENNE 2000, ALEKSEEV *et al.* 2002, FORRÓ *et al.* 2003, all with partial species list). At least 15 additional species are expected as a result of several ongoing studies and revisions. Since 1950, the freshwater species number has augmented with 52%, or 42 species, as a result of increasing faunal knowledge. Upper Belgium, although less studied, shows the highest species diversity, followed by Middle Belgium and the Lorraine. Karst habitats and the interstitial environment of rivers are essential for the freshwater and semi-aquatic copepod fauna. Taxonomic knowledge of this group is considered to be moderate and two Belgian scientists are currently able to identify organisms to the species level. When neighbouring countries are included, the number of

experts rises to ten. Representative collections are managed by the Royal Belgian Institute of Natural Sciences and the Ghent University.

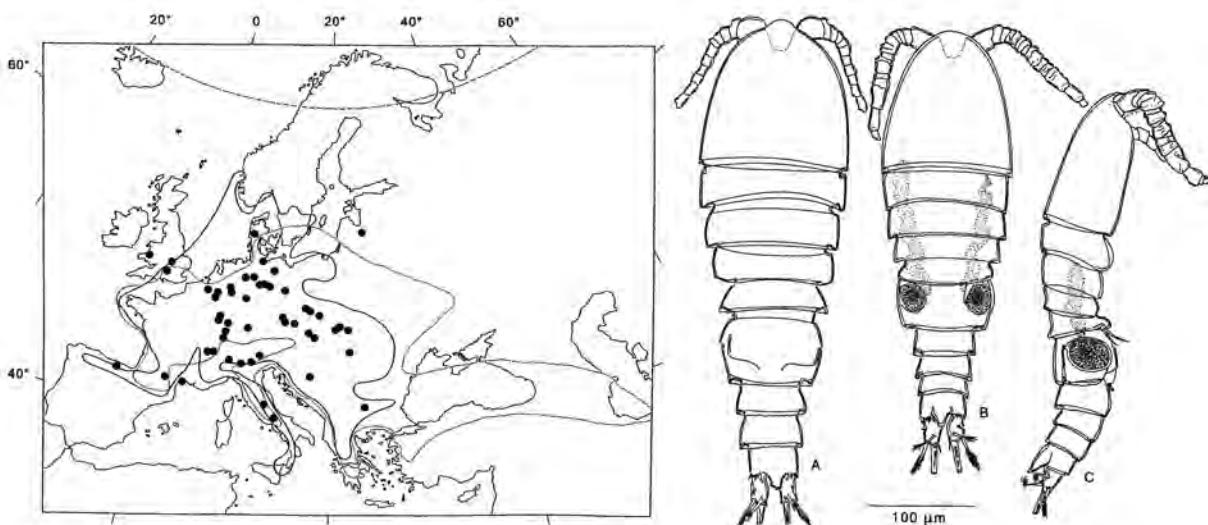
Approximately 180 marine benthic species have been observed (HERMAN 1989, with partial species list). A considerable number of additional species can be expected based on the 515 species reported from the entire North Sea. As for the freshwater forms, two Belgian scientists are currently able to identify organisms to the species level and the expert number increases to almost ten when neighbouring countries are included. Apart from the North Sea, the tidal zone and estuarine areas show a considerable species richness, following investigations in neighbouring countries.

Fifteen marine pelagic species have been recorded (M'HARZI *et al.* 1998 with partial species list) and about 20 additional species are expected. Taxonomic knowledge of this subgroup is good and one Belgian scientist is currently able to identify organisms to the species level, together with the ca. ten experts in the neighbouring countries.

No real inventories of the parasitic and commensal copepod species in Belgium exist. Dozens of species are expected based on KABATA (1992) and GOTTO (1993). While no Belgian expert is able to identify parasitic and commensal copepods to the species level, up to ten European scientists do possess this expertise. For the parasitic and commensal species, as well as for the marine benthic and pelagic ones, no (representative) collection could be identified.

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The minute, stygobiont cyclopoid *Graeteriella unisetigera* (GRAETER, 1908) belongs to the cryptozoic fauna in leaf litter (FIERS & GHENNE 2000). The distribution of this species in Europe shows a remarkable coincidence with the extension range of the beech (*Fagus sylvatica*). (a) Adult female, in dorsal view; (b) adult male, in dorsal view; (c) adult male, in lateral view (drawing by H. VAN PAESSCHEN).

BRANCHIURA - BRANCHIURANS or FISH LICE

(VISLUIZEN - BRANCHIURES, POUX DE POISSONS - KIEMENSCHWANZKREBSE)



Highly specialised ectoparasitic crustaceans with paired compound eyes and 1-3 median simple eyes; living on marine and freshwater fish; attaching to host by maxillae, modified into suckers or grasping claws; flattened oval body and carapace provide streamlining to prevent detachment from swimming host; ca. 130 described species worldwide.

Personal communications by Geoff BOXSHALL (The Natural History Museum, London) and Geoffrey FRYER (Windermere, Cumbria).



In the freshwater environment, one species was recorded and two additional ones are expected. Only the genus *Argulus* has European representatives. The most widely distributed European species, *Argulus foliaceus*, is present in Belgium. Another common European species is *A. coregoni*, but, to our knowledge, it has not (yet) been observed in Belgium. It is unclear whether *A. japonicus*, which was introduced in Europe and shows a preference for fish monocultures (VAN DAMME 1985), has been observed in Belgium yet. If not, it is highly expected. Information on the possible presence of marine fish lice in Belgian waters is not available.

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TANTULOCARIDA - TANTULOCARIDS



Ectoparasitic marine crustaceans with highly modified body, consisting of a sacciform, unsegmented thorax and strongly reduced abdomen; both biramous and uniramous appendages present; parasitic on crustaceans, especially the deep-water forms; ca. 25 species described worldwide, but many more expected among others given the recent description (1983) of the taxon.

Personal communication by Geoff BOXSHALL (The Natural History Museum, London).



No species recorded but one to three species expected based on observations in adjacent waters. Specimens of the expected species are present in the Crustacea collection managed by The Natural History Museum in London.

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CIRRIPEDIA - CIRRIPEDES or BARNACLES

(RANKPOTIGEN - CIRRIPEDES - RANKENFÜSSER, CIRRIPEDIEN)



Sessile, marine, filter-feeding crustaceans that live attached to rocks, floating objects, ships or animals; some are boring in calcareous substrates while others are parasitic; in the Thoracica, the most important and well-known group, the mantle is usually covered with calcareous plates; pedunculate barnacles are living attached by a tough, fleshy stalk, called peduncle (e.g. *Lepas*); in sessile barnacles (e.g. *Balanus*, *Verruca*), the stalk is reduced to a flattened basis and the calcareous plates completely surround the body; movable valves at the top can be opened to allow filter-feeding; parasitic and boring species are not covered with plates and show a reduced morphology; generally, thoracican barnacles, unlike the major part of the other crustaceans, are hermaphroditic; most boring and parasitic barnacles are dioecious; cross-fertilisation of their neighbours is generally the rule; ca. 800 species described worldwide.

Questionnaire completed by Francis KERCKHOF (Marine Ecosystem Management / RBINS).



Between 1830 and present, 28 species have been reported for the Belgian waters. Not all of them can be regarded as belonging to the Belgian fauna. Especially earlier workers often mentioned species brought in by fishermen, originating from remote fisheries. Other species have been found only occasionally (e.g. *Balanus reticulatus*, *B. trigonus*), but until now their establishment and permanent presence has not been observed. Yet other species can be regarded as vagrants. They reach the Belgian marine waters attached to floating objects, often with a southern origin (e.g. most Lepadomorpha, *Solidobalanus fallax*), or attached to stranded leatherback turtles (*Stomatolepas elegans*). They occur irregularly in Belgian waters where they are able to survive for some time.

Hence, at this moment, only 13 species are considered as belonging to the Belgian fauna. The Thoracica are dominantly present with ten species (8 Balanomorpha, 1 Lepadomorpha and 1 Verrucomorpha). A partial species list of this order can be found in VAN FRAUSUM 1989. The parasitic Rhizocephala are represented by two species (*Peltogaster paguri* and *Sacculina carcini*) and the boring Acrothoracica by one (*Trypetesa lampas*). Based on the recorded species in adjacent waters, recent studies (KERCKHOF & CATTRIJSE 2001), the worldwide expansion of mainly Balanomorpha species and in-depth studies of the poorly investigated (parasitic) subgroups, three or four additional barnacle species are expected.

Introduced species, all Balanomorpha, play an important role in the Belgian barnacle fauna. Of the eight species belonging to the Belgian fauna, six are introduced through fouling or ballast water, and the expansion of the distribution area of some species normally occurring in more southern and warmer waters. *Elminius modestus*, for example, was originally native to New Zealand and Australia, but reached the groynes and piers of the Belgian coast via harbours in south-east England, and has now become the most common barnacle species of the Belgian fauna. Another example is *Balanus amphitrite*. This species, typical for warmer waters, is now very common in the harbour of Ostend and present on buoys and groynes. As hard substrata are important for the settlement of barnacles, the overall creation of artificial habitats, such as groynes and especially harbour installations, added to the success of the Balanomorpha.

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NEBALIACEA - NEBALIACEANS

(NEBALIA'S - NÉBALIES - MITTELKREBSE)



Small, marine, mud-dwelling crustaceans characterised by a large bivalved carapace, consisting of two halves joined by an adductor muscle, a rostral plate covering the head and a caudal furca or tail; suspension feeding on bottom sediments; ca. 20 species described worldwide.

Questionnaire completed by Jan MEES (Flanders Marine Institute) with the contribution of Ann DEWICKE and Bregje BEYST (both Ghent University).



Only one species, *Nebalia bipes*, is present in the Belgian part of the North Sea. This species, with a maximum length of 12 mm, occurs in coastal areas throughout the North Atlantic. No additional species are expected.

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BATHYNELLACEA - BATHYNELLACEANS

(FONTEINKREEFTEN - BATHYNELLACÉS - BRUNNENKREBSE)



Blind, elongated crustaceans with seven or eight pairs of legs (peraeopods), typically occurring interstitially in fresh water (exception made for one species living secondary in polyhaline conditions); length ranging from 0.5 to 3.5 mm; no carapace; thorax and abdomen differentiated; eight free thoracic segments, five pleomeric segments and a pleotelson (14 body segments); uropods well developed; occurring worldwide; Bathynellacea and Anaspidacea together form the Syncarida of which about 160 species are known worldwide.

Personal communication by Véronique GHENNE and Frank FIERS (both Royal Belgian Institute of Natural Sciences).



One species, *Antrobathynella stammeri* (JAKOBI, 1954), was discovered in August 2002 in the hyporheic of a small tributary of the river Meuse, where it occurs abundantly. A second population was found in November of the same year. The taxon Bathynellacea was expected to be present in Belgium, which is now confirmed. The specimens are deposited in the collections of the Royal Belgian Institute of Natural Sciences. One or two additional species are expected.

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STOMATOPODA - MANTIS SHRIMPS

(BIDSPRINKHAANKREEFTEN - STOMATOPODES - HEUSCHRECKENKREBSE, MAULFUSSKREBSE)



Marine, generally large (2-30 cm), raptorial carnivorous crustaceans typically occurring in shallow tropical or subtropical seas; living in individual burrows or in cracks or crevices from which they emerge to attack passing organisms; second thoracic limbs are specialised either to hold swimming prey (e.g. fish, prawns) or to club and crack shells or exoskeletons (e.g. molluscs, crabs); ca. 400 species described worldwide.

Questionnaire completed by Cees HOF (University of Bristol).



No species were recorded in Belgian waters until now, but one to three species are expected based on the occurrence of stomatopod larvae in the southern part of the North Sea and the Channel, the presence of adult specimens of *Platysquilla eusebia* along the Atlantic coast of France and of *Rissooides desmaresti*, which is now considered to belong to the British native fauna, before the coasts of England, Wales and the Netherlands. While

taxonomic knowledge of this group in the neighbouring countries is good, no Belgian scientist with stomatopod expertise could be identified.

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MYSIDACEA - MYSIDS or OPOSSUM SHRIMPS

(AASGARNALEN - MYSIDACÉS - SPALTFUSSKREBSE, SCHWEBGARNELEN)



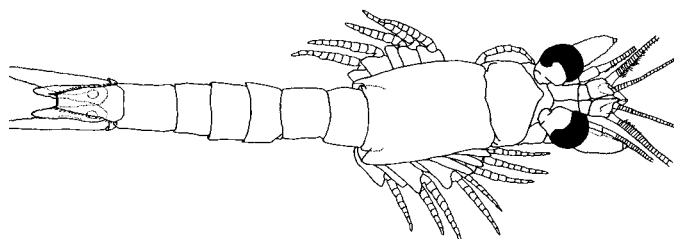
Generally small and often extremely numerous crustaceans with well-developed carapace and stalked compound eyes; most species live in or on the substratum or swim in the shallow waters above; many mysids are filter-feeders, except for some scavenging benthic forms and species preying on zooplankton; female mysids have a large brood pouch in which the developing stages are retained before being released as juveniles; 1,022 species described worldwide.

Questionnaire completed by Jan MEES (Flanders Marine Institute).



So far, 19 species have been observed and up to six additional ones (TATTERSALL & TATTERSALL 1951) are expected. Apart from the North Sea, mysids are also present in the tidal zone, in brackish water pools and estuaries. Especially in the turbid brackish water zone of estuaries, extremely high densities of mysids are noted (MEES *et al.* 1993). Up to 1,000 individuals of *Neomysis integer* were found on 1 m² in brackish water pools. Taxonomic expertise of this group is good; a representative collection is housed in the Ghent University. Brackish water systems are of essential importance for *N. integer*.

In October 1999, in a brackish pond, the Ponto-Caspian invader *Hemimysis anomala* was observed for the first time in Belgium (VERSLYCKE *et al.* 2000), and in 2000 and 2001, the species was collected in the Meuse (VANDEN BOSSCHE 2002). Its invasion could have dramatic effects on the zooplankton composition and abundance, given its strong preference for cladocerans over copepods as prey. Further research is needed to demonstrate the impact of this invader on local ecosystems.



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Hemimysis anomala (SARS, 1907), a species of Mysidacea initially only known from the Caspian and Black Sea. In October 1999, it was collected for the first time in Belgium. It was found in a brackish remainder pond, connected to the Westerschelde estuary via a sluice (from VERSLYCKE *et al.* 2000, courtesy of the Royal Belgian Society for Zoology).

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CUMACEA - CUMACEANS

(ZEEKOMMA'S - CUMACÉS - CUMACEEN)



Marine crustaceans occurring worldwide in predominantly benthic habitats; body length up to 35 mm; burrowing or constructing tubes in the sediment; feeding on organic matter in sediment or filter-feeding; swimming via anterior thoracic limbs, burrowing via posterior ones; they may periodically emerge from the sediment and gather in the water column in what are thought to be mating swarms; females incubate the eggs in a brood pouch; ca. 1,200 species worldwide.

Questionnaires completed by Ute MÜHLENHARDT-SIEGEL (Zoological Institute and Zoological Museum, Hamburg) and Jan MEES (Flanders Marine Institute), with the contribution of Ann DEWICKE and Bregje BEYST (both Ghent University).



So far, 12 species have been recorded. At least three and up to 15 additional species are expected, based on the cumacean fauna observed along the French and British coasts. *Pseudocuma gilsoni* is described from Belgian marine waters. The most important European collections on cumaceans are housed in the natural history or zoological museums of London, Paris and Copenhagen. This group is taxonomically well known in western Europe.

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TANAIDACEA - TANAIDACEANS or TANAIDS

(SCHAARPISSEBEDDEN - TANAIDACÉS - SCHEERENASSELN)



Marine crustaceans living in mucous tubes or burrows in muddy sediments beneath shallow waters; body length ranging from 0.5 to 20 mm; poor swimming and crawling abilities; some tanaidaceans secrete a thread or 'life line', facilitating return to the burrow or tube; some species are filter-feeders, but most are raptorial; sex change is common in this group: in many species, individuals begin life as females and breed once or more before molting to become functional males; females possessing a marsupial brood pouch; ca. 850 species described worldwide.

Questionnaires completed by Graham BIRD (independent expert, United Kingdom) and Marco FAASSE (independent expert, the Netherlands).



Three species have been recorded (two in HOLTHUIS 1950, one in VANOSMAEL *et al.* 1982) and nine additional species could occur based on their presence in adjacent French, Dutch and British waters. However, the species richness is expected to be relatively low because of the predominance of sandy or muddy substrates and the lack of influence from either warmer Lusitanian or colder Norwegian waters. At present, there

seems to be no Belgian expert able to identify organisms to the species level. Representative collections for the European tanaidacean fauna are housed by The Natural History Museum in London and the Zoological Museum in Copenhagen.

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ISOPODA - ISOPODS

(PISSEBEDDEN - ISOPODES, CLOPORTES - ASSELN)



Dorsoventrally flattened crustaceans without carapace; body length from 0.5 to 500 mm (*Bathynomus giganteus*), although most species are less than 20 mm long; worldwide distribution and present in marine, freshwater and terrestrial habitats; varying feeding habits: isopods are predators, herbivores, saprovores or parasites; most have strong biting and chewing mouth parts, but parasitic forms are often adapted to suck the body fluids of their hosts; females incubate the eggs in a brood pouch; the fossil record, although limited, suggests that this group dates back to, at least, the Carboniferous; ca. 10,000 species worldwide.

Questionnaires completed by Karel WOUTERS (Royal Belgian Institute of Natural Sciences) for the terrestrial species and by Guido RAPPÉ (National Botanic Garden of Belgium) for the marine and brackish water species. Frank FIERS (Royal Belgian Institute of Natural Sciences) provided information on the freshwater species.



Thirty-three terrestrial species have been recorded (WOUTERS *et al.* 2000, with checklist of 30 species, one subspecies and one species of which the record is doubtful; LOCK & VANACKER 1999, LOCK & DURWÆL 2000 and LOCK 2001). Five species can be qualified as alien species. A cartography showing the distributional records of 30 terrestrial isopod species in Belgium is available in WOUTERS *et al.* (2000). The highest species richness is found in calcareous areas. Six additional species are expected following BERG & WIJNHOFEN (1997). The terrestrial isopods are taxonomically well known and a representative collection, including the marine and brackish water forms, is housed in the Royal Belgian Institute of Natural Sciences.

In the marine and brackish water environment, 31 species are recorded (RAPPÉ 1989, with species list) while 10 to 15 additional species may occur (GLAÇON 1977, HUWÆE 1977). The highest species richness is found in the North Sea, followed by the tidal zone and the coastal area. The species *Prodajus ostendensis*, living parasitically on the mysid *Gastrosaccus spinifer*, is described from Belgian marine waters. If present trends persist, two marine species will have disappeared from Belgium during the following decades. The conservation of the brackish water environment is essential for the survival of some species.

Four freshwater species, two epigeal and two hypogean, are known to occur in Belgium. Additional hypogean species might be present. *Proasellus bermallensis*, described from gravel

beds of the river Meuse, is apparently endemic in the Meuse basin with four published localities in Belgium and one in the Netherlands (HENRY 1974).

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AMPHIPODA - AMPHIPODS

(VLOKREEFTEN - AMPHIPODES, PUCES DE PLAGE ou DE RIVAGE - FLOHKREBSE)



Laterally compressed malacostracan crustaceans with worldwide distribution; length usually ranging from 1 to 30 mm, with a few larger species; maximum length record: 340 mm; mostly marine, but a significant number of freshwater species and some semi-terrestrial and terrestrial ones occur; most amphipods are benthic, with free-swimming, crawling, burrowing, nestling, tubiculous and commensal forms; about 5% are pelagic; only a few species are parasitic; feeding modes are diversified: some are predators or scavengers, but detritivorous, grazing and filter-feeding forms are also well represented; as in the isopods, the eggs are incubated in a thoracic brood pouch; at least 7,500 species described worldwide.

Questionnaire completed by Claude DE BROYER (Royal Belgian Institute of Natural Sciences) with the contribution of Jan VANAUVERBEKE (Ghent University). Additional notes provided by Marco FAASSE (independent expert, the Netherlands).



Following an unpublished checklist and database, 126 species have been recorded, subdivided in 100 marine and brackish water, ten subterranean, six freshwater, eight semi-terrestrial and at least two species found as ectoparasite or commensal on cetaceans stranded in Belgium (HAELTERS 2001). Following their occurrence in adjacent parts of the North Sea and on the invasive character of some freshwater amphipods, up to 120 additional species can be expected. Taxonomic knowledge of this group is moderate to good and a representative collection is housed in the Royal Belgian Institute of Natural Sciences. During the last decades, the number of recorded species increased slightly because of the further improvement of the faunal knowledge and the invasion of some species mainly coming from neighbouring countries.

Gammarus tigrinus and *Crangonyx pseudogracilis*, both originating from North America, and the Ponto-Caspian *Dikerogammarus villosus* (killer shrimp) and *Corophium curvispinum*, have been found rather recently in freshwater systems in Belgium. The southern European *Echinogammarus berilloni* (oldest observation dates back to 1925) and the Mediterranean and Ponto-Caspian *Orchestia cavimana* (around 1900) arrived earlier (VERCAUTEREN & WOUTERS 1999, VANDEN BOSSCHE 2002, WOUTERS 2002). *Caprella mutica*, originating from the West Pacific, was discovered in our coastal waters (FAASSE & KERCKHOF, in prep.). For Belgium, the highest species richness is found in the marine waters, followed, in decreasing order of amphipod diversity, by the freshwater fauna of Upper and Middle Belgium with the Sonian Forest. The conservation of subterranean waters of good quality is essential for stygobiont amphipods.

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The caprellid amphipod *Caprella mutica* SCHURIN, 1935, a west Pacific species, recently discovered in Belgian and Dutch coastal waters (drawing by R. VAN OUTRYVE).

EUPHAUSIACEA - EUPHAUSIDS

(LICHTGARNALEN, KRILL - EUPHAUSIACÉS - LEUCHTKREBSE)



Marine, pelagic, shrimp-like crustaceans with shallow carapace, ranging from 40 to 150 mm in length; species often have wide longitudinal but restricted latitudinal distributions; sometimes exceedingly numerous, forming dense swarms; major food source for predators (e.g. fish, squid) and macro filter-feeders (e.g. baleen whales); are of increasing economic importance to humans; about 90 species described worldwide.

Questionnaire completed by Jan MEES (Flanders Marine Institute), with the contribution of Ann DEWICKE and Bregje BEYST (both Ghent University).



Only one species, *Nyctiphanes couchi*, has been recorded in Belgian marine waters. This species mainly occurs during winter but never displays high densities and thus cannot be regarded as an important food source for higher trophic levels. Based on MAUCHLINE (1984), no additional species are expected.

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DECAPODA - DECAPODS

(GARNALEN, KRABBen en KREEFTEN, TIENPOOTKREEFTEN - DÉCAPODES - ZEHNFUSSKREBSE)



Major and most conspicuous group of malacostracan Crustacea including crabs, lobsters, crayfish, hermit crabs (suborder Reptantia) and prawns (suborders Dendrobranchiata, Stenopodidea, Caridea, Eukyphida and Euzygida); possessing large carapace which covers head and thorax, and encloses gills; first three pairs of thoracic limbs are specialised for food handling; in all decapod species, the females brood the eggs, with the exception of the dendrobranch prawns which shed the eggs into the water; ca. 10,000 species are known worldwide.

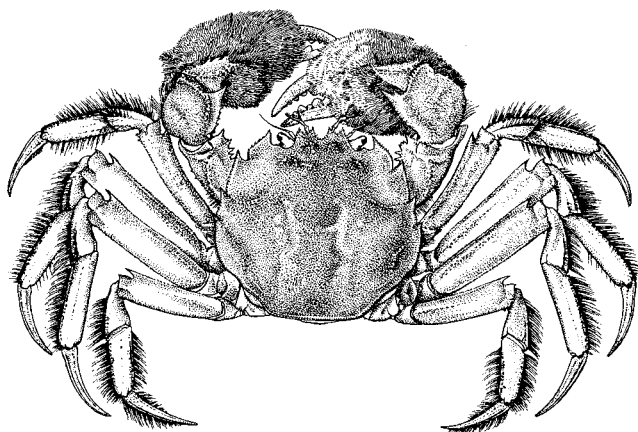
Questionnaire completed by Cédric D'UDEKEM D'ACQZ (scientific associate, Royal Belgian Institute of Natural Sciences).



So far, 60 species have been recorded and 12 additional ones are expected. Both numbers are based on the collection 'Exploration de la Mer' (assembled by G. GILSON 1899-1939 and housed in the Royal Belgian Institute of Natural Sciences), ADEMA (1991) and several small publications. Other collections are kept by the Zoological Museum of the University of Liège and the North Sea Aquarium in Ostend. The species number has augmented with six species since 1950 because of an increase of the faunal knowledge and the introduction of alien species. The highest species richness is found in the North Sea, followed by the tidal zone and Upper Belgium. Habitats with an essential importance for decapod species are running waters (GERARD 1986).

Since 1900, eight alien species have established more or less stable populations in Belgian waters. One example is the freshwater crayfish *Orconectes limosus*, originating from the eastern part of the USA, which is now by far the most common crayfish in Belgium. It is very resistant to pollution and a vector of the crayfish plague, which has a dramatic impact on European species. If present trends persist, the native species *Astacus astacus* will disappear from Belgium because of the crayfish plague, the competition with exotic species and the pollution and destruction of habitats (GERARD 1986). Other freshwater invaders are the southern European *Atyaephyra desmaresti* (probably first recorded in Belgium in 1895),

the Turkish or narrow-clawed crayfish *Astacus leptodactylus*, the North American signal crayfish *Pacifastacus leniusculus*, the blue crab *Callinectes sapidus* (first Belgian record: 1981), the dwarf crab *Rhithropanopeus harrisi* (first Belgian record: 1985) and the Chinese mitten crab *Eriocheir sinensis* (first Belgian record: 1933) (WOUTERS 2002). Furthermore, Asian shore crabs of the genus *Hemigrapsus* are rapidly spreading along the European coasts, with a quickly expanding population in the southern part of the Dutch marine waters (D'UDEKEM D'ACUZ & FAASSE 2002, BRETON *et al.* 2002). In the near future, they can be expected in Belgian waters, with a possible negative impact on the native marine and estuarine fauna and flora.



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Male specimen of the Chinese mitten crab *Eriocheir sinensis* H. MILNE EDWARDS, 1854 (carapace width: 8 cm). This species was observed for the first time in Belgium in 1933. Until the early 1950s, it was a common to very common species in estuarine and inland waters; afterwards it disappeared almost entirely. Since the 1980s, it has gradually reappeared along the coast and in the basins of the rivers Yser and Scheldt, even in lowland canals, smaller rivers and isolated ponds (drawing by V. LECLERCQ, © RBINS).

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PENTASTOMIDA - TONGUE WORMS or PENTASTOMIDS

(TONGWORMEN - PENTASTOMIDES - ZUNGENWÜRMER, PENTASTOMIDEN)



Small group of vermiform parasites with unsegmented body, ringed externally and legless; living in the respiratory tracts of reptiles and also some mammals and birds; body highly reduced, up to 15 cm long, males are usually much smaller; mouth lies between two pairs of retractable claws used to cling to the respiratory epithelium; several species occasionally infect the human nasal passages, but usually without causing symptoms; ca. 110 species worldwide.

Questionnaire completed by John RILEY (University of Dundee).



No Belgian pentastomid records are known to us, although at least three species are expected to occur. *Reighardia sterna*, a parasite occurring in the air sacs of seagulls, was recorded among others in the Netherlands and will almost certainly occur in


Belgium. *Reighardia lomviae* is found in the air sacs of guillemots (*Uria aalge*) and puffins (*Fratercula arctica*) and is also expected to occur. Adults of *Linguatula serrata* parasitise the nasal sinuses of foxes (*Vulpes vulpes*) and possibly domestic dogs (*Canis familiaris*), while intermediate stages are found in grazing animals such as rabbits, hares and sheep. This species is also expected to occur although it will probably be less common than the two bird-parasitising species. No Belgian expert able to identify organisms to the species level was found and taxonomic knowledge is lacking.

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ANNELIDA - SEGMENTED WORMS or ANNELIDS

(RINGWORMEN, GELEDE WORMEN - ANNELIDES, VERS ANNELÉS - RINGELWÜRMER)


 Segmented, coelomate worms with a body wall consisting of both circular and longitudinal muscle fibres; transparent, moist cuticle covers body; all annelids except leeches have chitinous hair-like structures, called setae; fossil record goes back to the Cambrian, maybe to the Precambrian; include the Polychaeta, 'Archannelida', Hirudinea and Oligochaeta.

POLYCHAETA - BRISTLE WORMS or POLYCHAETES

(BORSTELWORMEN, VEELBORSTELIGEN - POLYCHÈTES - VIELBORSTER, BORSTENWÜRMER)

 By far the most extensive class of annelids; inside and outside segmentation; possessing parapodia and numerous setae; present in every marine habitat, uncommon in fresh water, some are parasitic; polychaetes are a dominant component of the macrobenthos of many marine habitats, and in some areas they dominate the biomass; most polychaetes are burrowers in sand or mud (sand worms, tube worms), with appendages for feeding; other bristle worms are errant and tend to have well-developed eyes and sensory appendages; finally, some polychaetes have a permanently pelagic existence and often predate on plankton; ca. 9,000 species described worldwide, at least 10,000 additional species to be expected.

Questionnaire completed by Markus BÖGGEMANN (Johann Wolfgang Goethe University, Frankfurt). Additional information from Ingrid KRÖNCKE (Research Institute Senckenberg) and Jan GOVAERE (Royal Belgian Institute of Natural Sciences).

 Based on HARTMANN-SCHRÖDER (1996), and BÖGGEMANN (1998), some 450 species are expected. The vast majority occur in the marine zone, although a few species are expected in brackish water, and most species live in or on the sediment. The number of recorded species is uncertain and probably lies between 200 and 250 (pers. comm. J. GOVAERE). There is a lack of published overviews on the Belgian polychaetes. Up to 1995, some 160 species were recorded in the Netherlands. Only one expert able to identify organisms to the species level could currently be identified in Belgium. Since 1970, the number of recorded species in western Europe has increased by some 30%. There seems

to begin a trend of intruding species from warmer waters. The Ponto-Caspian *Hypania invalida* is an example of a recent introduction. It was first recorded in the Meuse in 2000 (VANDEN BOSSCHE 2002) and seems to have already reached Antwerp via the Albert Canal (pers. comm. T. VERCAUTEREN).

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'ARCHIANNELIDA - ARCHIANNELIDS'

(ARCHIANNELIDEN - ARCHIANNELIDES - ÜRRINGELWÜRMER)



This category was created for a group of generally minute annelids, presumed to be primitive because of their simple body structure. This simple morphology is now regarded as secondary and related to the interstitial habitat of the animals. Most archiannelidan families, and the ca. 50 encompassed species, are to be transferred to the Polychaeta and the category 'Archiannelida' should be eliminated (WESTHEIDE 1990). For additional general features, see under Polychaeta.

Questionnaire completed by Wilfried WESTHEIDE (University of Osnabrück).



As for the Polychaeta, the number of recorded species of this group in Belgium is uncertain (but probably very low) because of fragmented data (eight species recorded in the Netherlands). Some 20 species should occur based on WESTHEIDE (1990, with species list), while up to five additional species could be expected. All species belong to the interstitial marine meiofauna. Species of the families Nerillidae and Protodrilidae probably dominate this group in Belgium. Habitats with essential importance for the survival of these species are sandy intertidal and subtidal areas, especially the coarse sand areas without much detritus.

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HIRUDINEA - LEECHES

(BLOEDZUIGERS - SANGSUES, HIRUDINÉES - BLUTEGEL, HIRUDINEEN)



Blood-sucking, hermaphroditic annelids possessing chitinous jaws, a cocoon-secreting clitellum and a fixed number of somites; body usually flattened dorso-ventrally, lacking setae, parapodia or tentacles; usually with anterior and posterior suckers for attachment to host and locomotion; predators, ectoparasites or scavengers; usually occurring in fresh water, some species in the marine or terrestrial environment; ca. 500 described species worldwide.

Questionnaires completed by Eike NEUBERT (Forschungsinstitut und Naturmuseum Senckenberg) and Wilfrida DECRAEMER (Royal Belgian Institute of Natural Sciences).



Nineteen species have been recorded, two of which were found on imported marine fish species (VERRIEST 1950, DE PAUW & VERRIEST 1963, MAQUET 1985). Additionally, one marine species for Belgium is mentioned in NEUBERT & NESEMANN (1999). Some more species are expected following their presence in neighbouring countries. Information on general trends is not available. The well-known *Hirudo medicinalis* has become rare (MAQUET 1985), although this author adds that more sampling of freshwater bodies is required. It is the only vermiform species protected by the Bern Convention. In general, taxonomic knowledge of this group in Belgium is considered insufficient, similar to most parts of Europe, and it would be recommended to build a Hirudinea collection covering all types of freshwater systems (pers. comm. E. NEUBERT). A number of leech species occurring in Belgium are part of the collections of the natural history museums of Budapest, London and Senckenberg. Habitats essential for the survival of leeches are fast running waters characterised by natural conditions and potamic biotopes with natural shore conditions.

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OLIGOCHAETA - EARTHWORMS and AQUATIC OLIGOCHAETES

(REGENWORMEN en ZOETWATERBORSTELWORMEN, WEINIGBORSTELIGEN - VERS DE TERRE et OLIGOCHÈTES AQUATIQUES - WENIGBORSTER)



Recently, *Oligochaeta* and *Hirudinea* have been joined in the taxon *Clitellata* (MARTIN 2001). Hermaphroditic annelids with inside and outside segmentation; possessing a clitellum and few setae, but no parapodia; new segments added throughout life; two-third of the species are earthworms (terrestrial species usually burrow in moist soils); many species in fresh water, a few hundred in the marine environment, some are parasitic; ca. 6,000 described species worldwide.

Questionnaires completed by Guy JOSENS (Université Libre de Bruxelles) for the terrestrial species and by Patrick MARTIN (Royal Belgian Institute of Natural Sciences) for the aquatic species.



Up to 1999, 52 species were recorded in the marine and freshwater environments (MARTENS 1989, MARTIN 1992, both with partial species list). In June 2000, a new species for the Belgian fauna, *Vejdovskyella comata*, was found in a small lake in Vosselaar, Province of Antwerp (VERCAUTEREN *et al.* 2001). The aquatic fauna is dominated by the families Naididae (27 species) and Tubificidae (17 species). Some 20 additional species are expected, based on the oligochaete fauna of the Netherlands (MOL 1984). Taxonomic knowledge of the aquatic oligochaetes is considered to be moderate, and a representative

collection on the Belgian species and information on trends are lacking. For the aquatic species, the highest richness is found in Middle and Upper Belgium (excl. the Hautes Fagnes) and the Lorraine, while Lower Belgium and the Hautes Fagnes show a lower diversity. Few species have been recorded in the Belgian marine waters.

In the terrestrial habitats, 33 species have been recorded (BOUCHÉ 1978, TÉTRY 1940, both with partial species list), of which nine belong to the Enchytraeidae, a family with terrestrial, aquatic and amphibian species. The subspecies *Lumbricus castaneus rubelloides* is only known in Belgium. At least six additional species are expected based on their presence in neighbouring countries. The terrestrial oligochaete fauna is relatively well known, but information on trends is not available because of the lack of historical data. The species richness is linked to the soil and humus type and the oligotrophic forest soil is identified as a crucial habitat for earthworm species. Three introduced species were found in Brussels and at least one additional species, used in lumbriculture, would be able to survive in natural conditions. As well as for the aquatic species, a representative collection of the terrestrial species present in Belgium is not available.

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SIPUNCULA - PEANUT WORMS

(SPUITWORMEN, PINDAWORMEN - SIPUNCULIENS - SPRITZWÜRMER)



Bilaterally symmetrical, unsegmented marine worms possessing a retractile anterior body part, called introvert, with tentacles; adults usually sessile, often burrowed in sediment or coral; length up to 1 m; present at all depths from intertidal to abyssal; different feeding methods are used in different habitats; ca. 300 described species worldwide and additional ones expected.

Questionnaires completed by José SAIZ SALINAS (University of the Basque Country,

Bilbao), Peter GIBBS (UK Marine Biological Association) and Edward CUTLER (Harvard University, Cambridge).



So far, three species have been recorded (WESENBERG-LUND 1933). Some nine additional species are expected following their distribution in the Atlantic, among others along the coasts of France, Germany and England. In Belgium, taxonomic expertise of this group is very poor and no expert able to identify organisms to the species level could be identified. Specimens of the three observed as well as of three of the expected species are present in the collection of the Royal Belgian Institute of Natural Sciences. Specimens of these and other sipunculan species possibly occurring in Belgian waters are present in the collections of the 'Musée National d'Histoire Naturelle', Paris.

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ECHIURA - SPOON WORMS

(SLURFWORMEN, STERWORMEN - ÉCHIURIDÉS, ÉCHIURES - RÜSSELWÜRMER, ISELWÜRMER)



Unsegmented marine worms with smooth or warty body, sometimes with setae; general body shape cylindrical or ovoid with typical, flattened or grooved, proboscis, which is highly extensile (up to 1-2 m for spoon worms with body size of 40 cm); adults sessile, burrowed in sediments or living in abandoned shells or in rubble; present at all depths from intertidal to abyssal; ca. 140 species described worldwide.

Questionnaire completed by José SAIZ SALINAS (University of the Basque Country, Bilbao).



One species, *Echiurus echiurus*, has been recorded (WESENBERG-LUND 1933) and three additional ones are expected (SAIZ SALINAS 1987). In Belgium, knowledge of this group is very poor, information on trends is not available and no scientist able to identify organisms to the species level could be identified. In the neighbouring countries, collections of spoon worms with species occurring in the Belgian marine waters are housed in the natural history museums of London and Paris.

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MOLLUSCA - MOLLUSCS

(WEEKDIEREN, MOLLUSKEN - MOLLUSQUES - WEICHTIEREN)



Highly successful phylum; unique rasping organ called radula; ventral muscular foot; fleshy mantle which surrounds the soft parts, encloses the mantle cavity,

secretes the calcareous shell and forms the siphons; respiration by ctenidia (molluscan gills) or by diffusion through the skin, often via specialised epithelium in the mantle cavity; reproduction gonochoristic or hermaphroditic; very old group with continuous fossil record since the Cambrian; most species are marine, only two classes (Gastropoda and Bivalvia) also with freshwater species; only the Gastropoda invaded land; adult size ranging from 0.35 mm (Gastropoda: Omalogyridae) up to 22 m (Cephalopoda: Architeuthidae); number of described species worldwide is often underestimated; recent estimates range in the order of 95,000-108,000 species; ca. 200,000 is a realistic figure of currently living species; generally eight classes recognised of which five present in Belgium: Polyplacophora, Gastropoda, Bivalvia, Scaphopoda and Cephalopoda, totalising ca. 320 species; species of the classes Caudofoveata and Solenogastres could be expected in the Belgian marine waters (pers. comm. L. VON SALVINI-PLAWEN).

A database with historical and recent mollusc records and a major reference collection of the terrestrial, freshwater, marine and brackish water species occurring in Belgium are present in the Royal Belgian Institute of Natural Sciences. Many private collections of varying importance exist.

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POLYPLACOPHORA - CHITONS

(KEVERSLAKKEN - CHITONS, POLYPLACOPHORES - KÄFERSCHNECKEN)



Distinct group of elongated, bilaterally symmetrical marine molluscs characterised by a mantle bearing eight transverse, articulating plates and calcareous or chitinous spicules or bristles; most species are intertidal grazing herbivores; a flattened foot clamps the animal firmly to the hard substratum; when disturbed, the foot and mantle edge create suction, making it hard to dislodge the animal; so far, 890 species have been described worldwide, the real number could be the double of this.

Questionnaire completed by Richard VAN BELLE (Royal Belgian Institute of Natural Sciences). Additional information by Bruno ANSEEUW and Yves TERRYIN (both scientific associates to the RBINS).



Six species recorded (BACKELJAU 1986), all but one are considered to be occasional introductions. Only *Leptochiton asellus* seems native in the Belgian marine

waters. Specimens of *Lepidochitona cinerea* are occasionally found. *Acanthochitona communis* and *A. crinita* are probably accidental introductions through the import of mussel and oyster spat. Taxonomic knowledge of this group is very good. Three naturalists follow in the footsteps of E. LELOUP in studying this group worldwide. Chiton species occurring in Belgian and adjacent waters are present in the collection of the Royal Belgian Institute of Natural Sciences of which the R. VAN BELLE collection is part.

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GASTROPODA - SNAILS and SLUGS

(SLAKKEN en NAAKTSLAKKEN - LIMAÇONS et LIMACES, GASTÉROPODES, GASTROPODES - SCHNECKEN und NACKTSCHNECKEN)



The largest and most diverse molluscan class, being present in nearly all aquatic and terrestrial environments; basically bilaterally symmetrical, but by torsion the visceral mass has become asymmetrical; radula very diverse with up to 100,000 teeth in some taxa; typically possess one, mostly coiled shell, although it is reduced in some groups and even absent in many marine and terrestrial species (slugs); foot is usually prominent and used for crawling, is greatly reduced in sedentary forms but enlarged in burrowers; an operculum is carried on the postero-dorsal surface of the foot in many marine, few terrestrial/freshwater species; many pulmonates and opisthobranchs display complex mating behavior; between 80,000-90,000 species described worldwide; at least equally more to be discovered, especially in terrestrial habitats.

Questionnaire completed by Thierry BACKELJAU (Royal Belgian Institute of Natural Sciences) for the marine species, by Rose SABLON (id.) for the brackish and freshwater species and by Harry VAN LOEN (id.) for the terrestrial species. Additional information by Jackie VAN GOETHEM (id.).



Some 120 species are present in the terrestrial environment (VAN GOETHEM 1989), 29 of which belong to two families: Hygromiidae and Helicidae. Some 10 alien species can be expected, even a few native ones also to be discovered. Middle Belgium, especially the Condroz and the Fagne-Famenne region, shows the highest species richness, followed by the Lorraine region, Upper Belgium, Lower Belgium and the coastal area (MARQUET 1982). Taking 1950 as a baseline, some 50 terrestrial species show a severe decline in Belgium (MARQUET *et al.* 1987, VAN GOETHEM *et al.* 1987) because of the destruction and drying out of habitats, fragmentation, acidification and eutrophication. If present trends persist, minimum 10% of the current species richness in terrestrial habitats is expected to disappear from Belgium during the following decades. Since 1900, 12 species have been introduced. The appearance of alien species has been recorded in detail since the 1960s (e.g. *Boettgerilla pallens*, *Deroceras caruanae*, *Arion lusitanicus*). Habitats important for the

survival of stenoeious species are marshy areas, river banks, dunes and calcareous grasslands (ANTEUNIS 1956, MARQUET 1982).

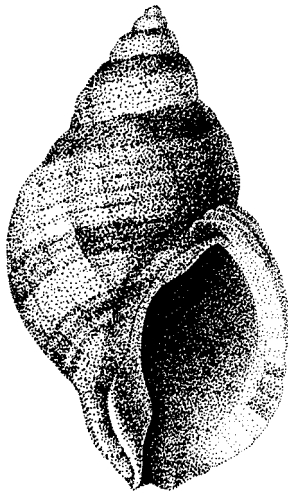
Sixty freshwater species are recorded (VAN GOETHEM 1989) and some ten additional ones are expected. Almost 20 freshwater species have been introduced since 1900. The species richness of the freshwater fauna is highest in Middle Belgium, followed by Lower Belgium and Upper Belgium. Stagnant fresh water shows a higher species richness than running waters. These two ecosystem types hold clearly distinct faunas. For the recently studied sites, the species number seems to stay about the same when comparison is made with historical data. Shallow ditches bordering pastures and arable fields, and small temporary pools are identified as important habitats for the conservation of some particular species.

Some 40 gastropod species form stable populations in the marine and brackish habitats (BACKELJAU 1986, with species list) and a rough estimation of ten additional species is suggested. Since newly settling species and vanishing ones seem to compensate each other, the species number in the Belgian marine waters remains about the same. Habitats with special importance for the marine gastropod fauna are groynes, piers and ship wrecks, as well as the scarce and highly threatened brackish water habitats. Man-made constructions have enriched the marine, littoral mollusc fauna, which otherwise would mostly comprise soft substratum species. A striking example of an introduced species with a stable population is *Crepidula fornicata* (slipper limpet). A recent survey of the fauna on buoys in Belgian marine waters revealed several species new to the country's fauna such as *Pusillina inconspicua*, *Crisilla semistriata* and *Odostomia plicata* (KERCKHOF, in prep.). One species, *Nucella lapillus* (dog whelk), became extinct because of the presence of the antifouling agent tributyltin (TBT) in the environment (KERCKHOF 1988).

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Nucella lapillus (LINNAEUS, 1758), dog whelk or Atlantic dog-winkle. Solid shell, up to 35 mm in length, very variable in colour. On rocky shores, groynes and pier piles. Feeds on barnacles and mussels. Atlantic coast from Norway to N. Africa and east coast of N. America. Seems to have disappeared in Belgium due to chemical pollution, in particular TBT antifouling paints (drawing by DE WESPIN, © RBINS).

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BIVALVIA - BIVALVES

(TWECKLEPPIGEN - BIVALVES - MUSCHELN)



Molluscs possessing a shell with two valves, articulated dorsally by a shell hinge complex (typically containing a ligament and cardinal and lateral teeth); most of the species are filter-feeding; gills generally well developed and plate-like; body strongly compressed laterally, lacking tentacles, eyes (except for scallops and some others) and radula; inhalant and exhalant siphons present; foot well developed in species that burrow in sand or mud, but reduced, vestigial or absent in attached forms; other methods of locomotion are creeping, swimming, climbing and boring; between 12,000 and 15,000 species described worldwide.

Questionnaires completed by Thierry BACKELJAU (Royal Belgian Institute of Natural Sciences) for the marine species and by Rose SABLON (id.) for the brackish and freshwater species.



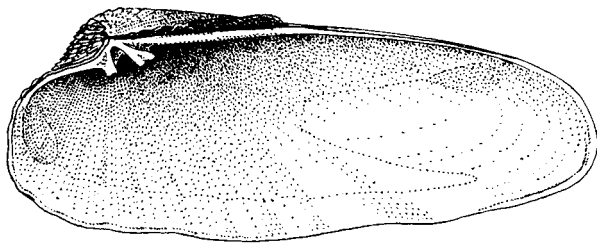
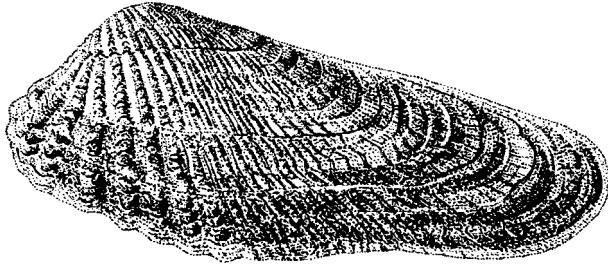
Forty brackish and freshwater species have been recorded (VAN GOETHEM 1989, with species list) and at least five additional ones are expected. The freshwater bivalve fauna is well known but information on trends is lacking. Lower, Middle and Upper Belgium have an equal and high species richness, followed by the tidal and coastal zones and the Belgian Lorraine (ADAM 1960). Stagnant and running waters have an equally high but distinctly composed faunal richness. The conservation of relatively pure and non-calciferous rivers (e.g. for *Margaritifera margaritifera*), mainly in Upper Belgium, and of non-polluted small pools, particularly in agricultural areas, is of significant importance for the survival of many bivalve species. Freshwater clams from the families Unionidae and Margaritiferidae release larvae, called glochidium, that need attachment to certain fish species in order to parasitise for several weeks. This facilitates dispersal of the species. *Dreissena polymorpha*, *Corbicula fluminea* and *C. fluminalis* are examples of alien species invading freshwater habitats, including cooling, pumping and/or cleaning installations, causing significant economic impact. Recently, two exotic species of the genus *Anodonta* have been found in ponds in Flanders.

Approximately 30 bivalve species form stable populations in the Belgian marine waters and some ten additional species are also expected to be established or in process to do so (BACKELJAU 1986, with species list). As well as for the marine gastropods, the species number remains more or less constant because of compensating numbers of vanishing species and new settlings. Habitats with special importance are groynes, piers and ship wrecks, as well as the scarce and highly threatened brackish water habitats. Some examples of alien species that established stable populations are *Petricola pholadiformis* (American piddock or false angel wing) and *Ensis directus* (= *E. americanus*) (American jack-knife clam, SEVERIJNS 2002). On the other hand, the recent occurrence of *Lutraria lutraria* along the Belgian coast (VAN HAELEN & KERCKHOF 2003) is an example of a species native to the northwestern European fauna that has recently colonised Belgian marine waters.

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Petricola pholadiformis LAMARCK, 1818, American piddock. Thin, elongate shell, up to 65 mm in length, sculptured by numerous concentric lines crossed by more than 40 radiating ribs. Mechanical borer into clay and limestone, occurring from midtide level to low water. This exotic species was introduced from America around 1890 in the British Isles with American oysters, and, from there, colonised several N. European countries. In Belgium, it almost completely displaced the native piddock *Barnea candida* (drawing by J. VAN MELDEREN-SERGYSELS, © RBINS).

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SCAPHOPODA - SCAPHOPODS, (ELEPHANT) TUSK SHELLS or TOOTH HELLS

(OLIFANTSTANDEN, STOOTTANDEN, TANDSCHELPELEN - DENTALES, SCAPHOPODES, DENTS MARINES - RÖHRENSCHALER, GRABFÜSSER)



Infaunal marine molluscs possessing a one-piece tubular shell open at both ends; reduced head without eyes, with radula; numerous (30-300) tentacle-like structures called captacula surround mouth and serve to capture prey; feed on a wide range of interstitial organisms; cylindrical foot for burrowing, water movement (respiration) and expelling gametes (spawning); ca. 600 species described worldwide.

Questionnaire completed by Thierry BACKELJAU (Royal Belgian Institute of Natural Sciences).



Two species, *Dentalium entalis* and *D. vulgare*, have been recorded (BACKELJAU 1986). *D. entalis* is only known from empty shells. Some living specimens of



D. vulgare, probably imported through fishery activities, were observed at the Belgian coast. No additional species are expected. Taxonomic knowledge of this group is good, but information on trends is completely lacking. Shells of both species are present in the mollusc collection of the Royal Belgian Institute of Natural Sciences.

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Dentalium vulgare (DA COSTA, 1778), common tusk. Shell up to 45 mm. As for *D. entalis*, the other scaphopod species recorded from Belgian marine waters, there is no evidence of stable populations (drawing by J. VAN MELDEREN-SERGYSELS, © RBINS).

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CEPHALOPODA - CEPHALOPODS or SQUIDS and OCTOPUSES

(INKTVISSEN - CÉPHALOPODES - KOPFFÜSSER, TINTENFISCHE)



Primarily swimming marine molluscs possessing two strong chitinous jaws and a radula; they include cuttlefish, squids, octopods and nautilus as well as several important fossil groups like the ammonoids, nautiloids and belemnoids; shell usually with numerous chambers, but is most commonly internalised and reduced in living forms; absent in octopuses; mostly carnivorous; prehensile, muscular tentacles with suckers surround the mouth and assist in food capture, mating and locomotion; species of the genus *Nautilus* have 80-90 arms without suckers; most species are active swimmers, using reverse jet propulsion; escape response by producing an 'ink' cloud; copulation is often preceded by complex courtship which sometimes involve rapid attractant and warning colour changes in the skin; giant squids measure up to 22 m; ca. 900 species worldwide, several hundreds to be discovered.

Questionnaires completed by Thierry BACKELJAU (Royal Belgian Institute of Natural Sciences) and Uwe PIATKOWSKI (Institut für Meereskunde, Kiel).



Eight species have been recorded (BACKELJAU 1986, with species list) and five to nine additional species are expected (BACKELJAU 1986, SEAWARD 1990). Taxonomic knowledge of this group is good. W. ADAM (1909-1988) developed leading expertise during his long career at the Royal Belgian Institute of Natural Sciences. Information on trends in cephalopod occurrence is not available because of the scarcity and discontinuity of data. Representative collections are housed in the Royal Belgian Institute of Natural Sciences and in the natural history museums of London, Paris, Copenhagen and Hamburg.

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TARDIGRADA - WATER BEARS or TARDIGRADES

(BEERDIERTJES, MOSBEERTJES - TARDIGRADES - BÄRTIERCHEN)



Very small (body length from 0.1-0.5 mm, some species up to 1.7 mm), bilaterally symmetrical coelomates with four pairs of short, claw-bearing legs and a complex buccal apparatus for sucking liquid food; worldwide distribution, at elevations ranging from the Himalaya to the ocean abyss; slow creeping; mainly occurring in freshwater ponds and in water film on mosses, liverworts, etc., or in forest litter; other species interstitial in marine sediment or among shore algae; few species ectoparasitic on sea cucumbers, crustaceans and molluscs; many species use anabiosis and cryptobiosis when conditions are unfavourable, being able to survive temperatures near absolute zero (-270°C) and as high as 150°C; ca. 800 described species worldwide and many more to be expected.

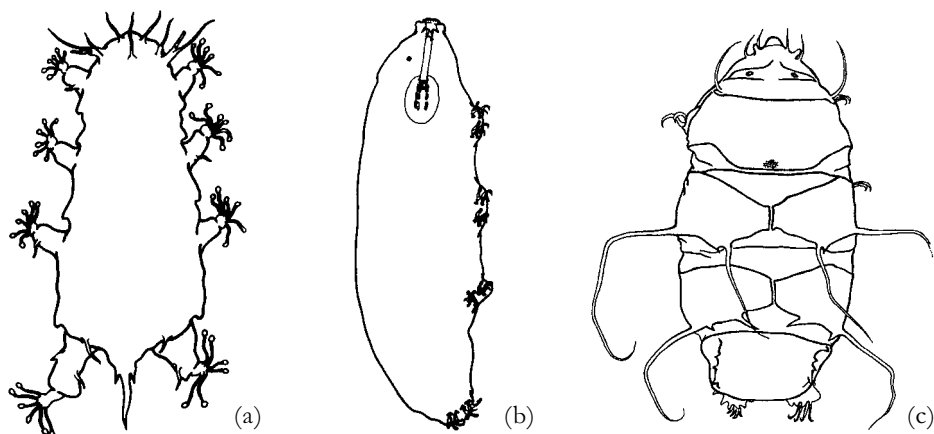
Questionnaire completed by Willem DE SMET (RUCA, University of Antwerp).



Forty-five species have been recorded (HASPESLAGH 1989, VAN ROMPU & DE SMET 1995, 1998, all with partial species lists). Since 1958, the species number has augmented with 29 species thanks to an increase of the faunal knowledge. Some 100 additional species are expected based on DASTYCH (1988), SÉMÉRIA (1994) and MC INNES (1994). Taxonomic knowledge of this group is poor to moderate. No representative collection of species present in Belgium could be identified. For Belgium, the highest diversity is found in the terrestrial environment followed by, in decreasing order of species richness, running and stagnant fresh water and the marine environment.

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(a) A marine heterotardigrade, *Batillipes littoralis* (length: 180-230 μm), (b) a limno-eutardigrade, *Amphibolus weglarskae* (500-600 μm), and (c) a limno-terrestrial heterotardigrade, *Testechiniscus spitsbergensis* (170-500 μm), all three occurring in Belgium (drawings by E. VAN ROMPU).

ECTOPROCTA, BRYOZOA - MOSS ANIMALS, ECTOPROCTS or BRYOZOANS

(MOSDIERTJES - ECTOPROCTES, BRYOZOAIRES - MOOSTIERCHEN, EKTOPROKTE, BRYOZOEN)



Individually minute (less than 1.2 mm long) animals cloning themselves to form sessile colonies with a wide range of structures; all ectoproct colonies start as a single, sexually produced individual called ancestrula, which buds repeatedly to form a colony of interconnected genetic replicates; most species are marine but the class Phylactolaemata occurs exclusively in fresh water; feeding via lophophore; ectoproct fossils have been dated back as far as the early Ordovician; ca. 5,700 species recorded worldwide, of which 65 to 70 in fresh water.

Questionnaires completed by Jean-Loup D'HONDT (Muséum National d'Histoire Naturelle, Paris) for the whole Belgian ectoproct fauna, and by Gaby GEIMER and Jos MASSARD (Luxembourg University Centre) specifically for the freshwater species. Additional information on the marine Bryozoa from Hans DE BLAUWE (Strandwerkgroep).



Fifty species, 41 in marine and nine in freshwater habitats, have been recorded (LOPPENS 1948, with partial species list, LACOURT 1949, GEIMER & MASSARD 1986). Some 40 to 50 additional species, of which two or three in fresh water, are expected based on the ectoproct faunas of the United Kingdom, France and the Netherlands. During recent investigations, DE BLAUWE (pers. comm.) found 20 species living attached to substrate in Belgian marine waters and some 80 species washed up, mostly originating from the Channel. A major gap in Ectoprocta research is the sublittoral environment, where ship wrecks, gravel soils, stones and shell (grit) banks probably yield a rich and surprising bryozoan fauna.

Examples of alien species are *Tricellaria inopinata*, originating from the North Pacific Ocean, and *Bugula simplex*, first described from the Adriatic Sea. Both species were found in harbours and marinas, suggesting introduction by man (DE BLAUWE & FAASSE 2001). Taxonomic knowledge of Ectoprocta is considered to be moderate and collections holding

species occurring in Belgium are housed in the natural history museums of Paris, London and Leiden. Based on his personal collection from Zeeland, Belgium and France, H. DE BLAUWE is preparing a reference collection to be deposited in the Royal Belgian Institute of Natural Sciences.

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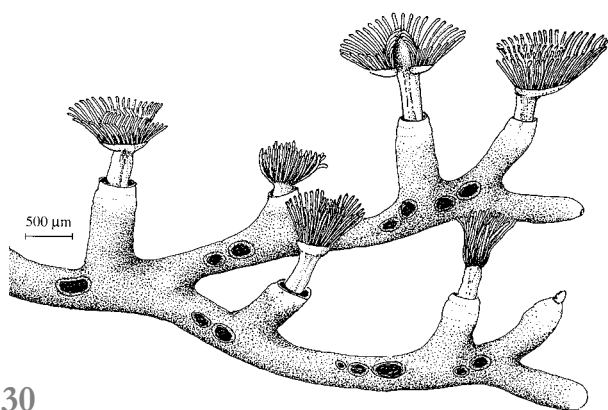
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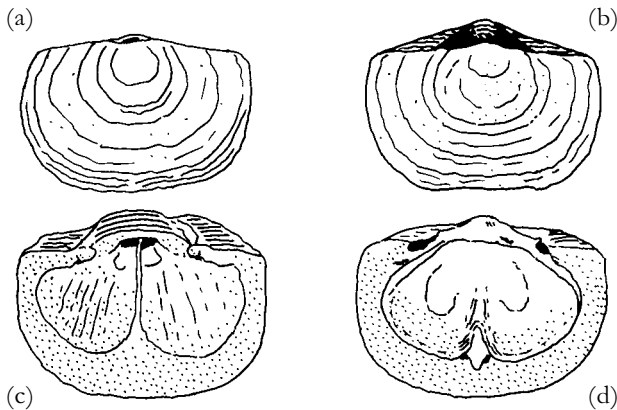
Part of a colony of *Plumatella repens* (L., 1758), the most common freshwater bryozoan in Europe, occurring in stagnant and running freshwater habitats in Belgium (from GEIMER & MASSARD 1986).

BRACHIOPODA - LAMP SHELLS or BRACHIOPODS

(BRACHIOPODEN, ARMPOTIGEN - BRACHIOPODES - ARMFÜSSER, LOCHMUSCHELN)

 Sedentary or sessile, marine coelomates enclosed by bivalved shell with dorsal and ventral valves (usually unequal in size), opened and closed by antagonistic muscles; large and complex lophophore within the shell; anchorage (and movement) via pedicle; length from 1 mm to more than 9 cm; occurring at all depths from intertidal to abyssal; fossils of Brachiopoda are known from the Cambrian and the group was very abundant throughout the Paleozoic era; ca. 350 living species described worldwide; more than 15,000 fossil species known.

Questionnaire completed by Alan LOGAN (University of New Brunswick). Additional data from Francis KERCKHOF (Marine Ecosystem Management / RBINS) and Gordon CURRY (University of Glasgow).



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Argyrotheca cistellula (SEARLES-WOOD, 1841), a very small brachiopod (ca. 1 mm) often occurring on pebbles in shallow waters, together with *Gwynia capsula*. So far, only remains of specimens have been observed in Belgian waters. (a-b) Ventral and dorsal views of exterior, (c) interior of ventral valve showing dentition and median septum, (d) interior of dorsal valve showing loop and median septum (drawings by A. LOGAN).



Empty shells of two species, *Gwynia capsula* and *Argyrotheca cistellula*, were found in sediment samples taken at the Flemish Banks (pers. comm. F. KERCKHOF). Since living specimens have not been found until now, these shells are for the time being considered to be washed up subfossil brachiopods. Because both species are rather small (1.5 to 3 mm), they are easily overlooked. In addition to these, three other species may occur (BRUNTON & CURRY 1979), although natural hard substrate necessary for anchorage is scarce. Taxonomic knowledge of this group is very poor. A representative collection is present at The Natural History Museum in London.

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PHORONIDA - PHORONIDS

(HOEFIJZERWORMEN - PHORONIDIENS - HUFEISENWÜRMER)



Sedentary marine vermiforms, inhabiting secreted chitinous tubes, in shallow seas; most are infaunal dwellers in soft sediments, others have their tubes cemented to hard substrates; all species feed by extending an anterior lophophore into the water (filter-feeders); length from 1 mm to 50 cm (mostly less than 10 cm); ancestral phoronids are assumed to have been free-living worms; ca. 14 known living species worldwide.

Questionnaire completed by Christian EMIG (Marseille Oceanology Center).



One species, *Phoronis hippocrepi*, is known from the coastal waters off Ostend (EMIG 1979). It is unclear if additional species may occur. In the Netherlands, three additional species are expected next to the observed *P. hippocrepi*. Four phoronid species are present along the German coasts. For Belgium, taxonomic knowledge of this group is very poor and no expert able to identify specimens to the species level was found.

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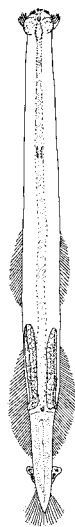
CHAETOGNATHA - ARROW WORMS or CHAETOGNATHS

(PIJLWORMEN - CHÉTOGNATHES, VERS FLÈCHES - PFEILWÜRMER)



Marine, planktonic, hermaphroditic predators looking like tiny transparent arrows; length of adults ranges from 0.5 to 12 cm; mouth surrounded by bristles,

used for catching and holding prey; occurring in high concentrations during certain periods; feeding on small planktonic organisms, from diatoms to juvenile fish; highly sensitive to changes in salinity and temperature; ca. 110 species described worldwide.



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Sagitta setosa MÜLLER, 1847, one of the two species of Chaetognatha recorded in Belgian marine waters. Neritic, typically inhabiting shallow waters and having a maximum body length of 14 mm (from PIERROT-BULTS & CHIDGEY 1988, courtesy of The Linnean Society and The Estuarine and Coastal Sciences Association).

Questionnaires completed by Jan MEES (Flanders Marine Institute) with the contribution of Ann DEWICKE and Bregje BEYST (both Ghent University), and by Jean-Paul CASANOVA (University of Provence).



Two species, *Sagitta elegans* and *S. setosa*, have been recorded. Both can be abundant at certain times of the year. No additional species are expected. For Belgium and the neighbouring countries, taxonomic knowledge of arrow worms is good. No representative collection could be identified.

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HEMICHORDATA - ACORN WORMS or HEMICHORDATES

(EIKELWORMEN, KRAAGDRAGERS - HÉMICORDÉS, HÉMICHORDÉS - KRAGENTIERE, HEMICHORDATEN)



Marine, benthic coelomates with buccal diverticulum, dorsal nerve cord and pharyngeal slits, but without notochord; there are two classes: the very obscure and poorly studied Pterobranchia which are sessile, tiny (usually less than 1 cm) and dwell in deep water, while the well-known Enteropneusta (length ranges from 2.5 cm to 2.5 m) usually burrow in the sandy intertidal zone of temperate waters; ca. 96 described species worldwide.

Questionnaires completed by Cyril BURDON-JONES (Queensland Museum, Australia) and by Elis KNIGHT-JONES (University of Swansea).



No species have been recorded. At least two are expected among others based on HAYWARD & RYLAND (1990). In the Netherlands, *Protoglossus koehlerii* was observed while *Rhabdopleura normani* is expected. Other species which might occur in Belgian waters are *R. compacta*, *Saccoglossus pygmaeus*, *S. borsti*, *Glossobalanus sarniensis* and *G. marginatus*. Larvae of these last two species are common in the North Sea plankton. Taxonomic knowledge of this group is clearly insufficient and a Belgian scientist able to identify organisms to the species level was not found. Representative collections are housed in The Natural History Museum in London and the Zoological Museum in Copenhagen.

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ECHINODERMATA - ECHINODERMS

(STEKELHUIDIGEN - ÉCHINODERMES - STACHELHÄUTER)



Marine, radially symmetrical, pentamerous coelomates with complex hydraulic system of tubes called water vascular system; many forms move via tube feet (podia); internal calcareous skeleton will generally develop; length ranges from 2 cm to 2 m; six extant classes: Asterozoa (sea stars or starfish), Ophiurozoa (brittle stars), Echinozoa (sea urchins), Holothurozoa (sea cucumbers), Crinozoa (feather stars) and Concentricyclozoa (sea daisies); 8,000 described species worldwide, from tidal to abyssal zones.

Questionnaire completed by Claude MASSIN (Royal Belgian Institute of Natural Sciences).



Fifteen species have been recorded: four species of sea cucumbers, four sea urchins, three sea stars and four brittle stars (MASSIN & DE RIDDER 1989, with species list). Five to seven additional species are expected, based on GLAÇON (1977) and WOLF (1975). The echinoderm fauna of the Belgian Continental Shelf (BCS) is less rich than the one in adjacent waters, possibly because of the lower variety of habitats. Taxonomic expertise of this group is very good. A representative collection is present at the Royal Belgian Institute of Natural Sciences.

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CHORDATA - CHORDATES

(CHORDADIEREN, CHORDATEN - CHORDÉS, CORDÉS - CHORDATIERE, CHORDATEN)



Bilaterally symmetrical, coelomate deuterostomes with a living endoskeleton; notochord (rodlike) present at some stages in life cycle; a dorsal tubular nerve cord and pharyngeal gill slits which both may alter or disappear in later stages of life cycle; include Tunicata, Cephalochordata and Vertebrata.

TUNICATA (UROCHORDATA) - TUNICATES

(MANTELDIEREN, ZAKPIJPEN - TUNICIERS, UROCORDÉS - MANTELTIERE, TUNIKATEN)



Marine, filter-feeding animals with sac-like tunics surrounding the body; showing affinities to other chordates only in juvenile stage; generally from 1 mm to 4 cm, some giant species up to 60 cm; poorly represented in fossil record (no hard parts); three classes: Ascidiacea (sea squirts), containing more than 90% of all urochordate species, Appendicularia or Appendicularia (larvaceans) and Thaliacea (salps); Ascidiacea are benthic, sessile, globular or tubular animals with incurrent and excurrent siphons; single, social or

compound individuals; Copelata and Thaliacea are small planktonic animals, barrel-shaped (Thaliacea) or with neotenous characteristics (Copelata); between 1,250 and 2,000 species described, while a total species number of 3,000 is expected worldwide.

Questionnaire completed by Jean GODEAUX (University of Liège), with the contribution of Francis KERCKHOF (Marine Ecosystem Management / RBINS) and Claude MONNIOT (Muséum National d'Histoire Naturelle, Paris).



Sixteen sea squirt and two larvacean species have been recorded. Three more ascidian species seem to occur, following recent observations at the Sluice dock in Ostend (pers. comm. F. KERCKHOF). Records of three other ascidian species, present in the collections or mentioned in literature, have an uncertain status. Studies on the Belgian Tunicata are scarce and outdated. For example, there are as good as no recent data or observations on the seven species of Molgulidae, an ascidian family with representatives able to settle in sandy substrates, mentioned in DAMAS (1905) and collected from 1884 to 1886. A thorough investigation of harbour environments and hard substrata such as the mole of Zeebrugge or ship wrecks, is expected to yield a considerable amount of additional information and maybe new species for the Belgian fauna. Representative collections are housed in the Zoological Institute of the University of Liège, the Royal Belgian Institute of Natural Sciences, the marine stations in Roscoff and Wimereux, and the 'Musée National d'Histoire Naturelle' in Paris. *Styela clava* is an example of a recently introduced species.

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CEPHALOCHORDATA - LANCELETS

(LANCELVISJES - CÉPHALOCORDÉS - CEPHALOCHORDATEN)



Slim, fish-like animals rarely exceeding 5 cm in length; some features are intermediate between those of invertebrates and vertebrates; represented in the extant fauna only by two genera: *Branchiostoma* (formerly *Amphioxus*) and *Asymmetron*; cosmopolitan in shallow marine and brackish water, often burrowed in clean sands; between 20 and 30 species described worldwide.

Information provided by Jean GODEAUX (University of Liège) and Francis KERCKHOF (Marine Ecosystem Management / RBINS).



One species, *Branchiostoma lanceolatum*, is present (POLL 1947). Larvae have been found in planktonic samples taken from 1970 to 1975 in the frame of the development of the North Sea mathematical model. The species is common in the coarse

sandy sediments of the sand banks in Belgian marine waters, e.g. the Kwinte Bank and the Noord Hinder Bank. No additional species are expected. No targeted research on this group/species has taken place in the Belgian part of the North Sea. Specimens are stored in the Royal Belgian Institute of Natural Sciences, the Zoological Institute of the University of Liège and in some other university collections.

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VERTEBRATA or CRANIATA - VERTEBRATES or CRANIATES

(GEWERVELDEN - VERTÉBRÉS - WIRBELTIERE)



Animals with a brain case (cranium) and a spinal column of vertebrae which forms the skeletal axis of the body; cartilaginous or bony endoskeleton; integument (consisting of an epidermis and an inner dermis) often modified to produce hair, scales, feathers, horn, etc.; fossil record is thought to go back to the Upper Cambrian; from about 1 cm to 34 m; ca. 55,000 species known worldwide; several thousands more expected, especially fishes.

HYPEROARTIA and HYPEROTRETI (AGNATHA) - CYCLOSTOMES or JAWLESS FISHES or LAMPREYS and HAGFISHES

(KAAKLOZE VISSSEN, RONDBEKKEN - AGNATHES - KIEFERLOSE)



Since the taxa Agnatha and Cyclostomata are considered to be paraphyletic, their taxon names are not used anymore. They are discussed together for convenience.

Fishlike, jawless vertebrates without paired appendages; extant species have no scales; notochord persist in adult forms; lampreys attach themselves to fishes or invertebrates with a sucker-like structure which surrounds the mouth, feeding on blood and tissue; hagfishes have a terminal mouth with sensory barbels and scavenge carcasses of fishes and larger invertebrates or actively prey on smaller invertebrates; fossil history goes back to the late Cambrian; mainly marine; ca. 84 living species described worldwide.

Information gathered from literature (VANDELANNOOTE *et al.* 1998, PHILIPPART 1998). Information on the marine forms was provided by Jan HAELTERS (Marine Ecosystem Management / RBINS).



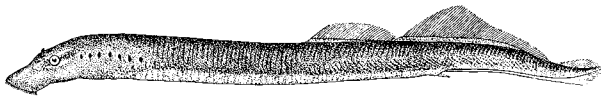
Three species are present in Belgian waters. The brook lamprey (*Lampetra planeri*) is occurring in Flanders and Wallonia, but is clearly in regression: the species disappeared from many rivers and subbasins, which is probably mainly due to the declined water quality and changes of the structural integrity of rivers and brooks, as well as to the low genetic diversity of small isolated populations.

The lampern or river lamprey (*Lampetra fluviatilis*) was last observed in the Walloon Region in 1964 and seems to be extinct there, although recent observations have been made in the

Grand Duchy of Luxembourg and in parts of the Meuse situated in the Netherlands, both near the Belgian border. In Flanders, the river lamprey is only abundant in the Lower Scheldt. In addition to the threats mentioned for the brook lamprey, the strong regression of the river lamprey is mainly due to migration barriers caused by pollution in some basins and structural changes in others. Together with other measures, removing and/or bypassing migration barriers could accelerate the recovery of populations.

The sea lamprey (*Petromyzon marinus*) is considered to be extinct in Wallonia and Flanders, although a single specimen was recently caught in the river Scheldt. The sea and river lamprey both occur at sea, but they have become uncommon in the Belgian marine waters mainly because of pollution and river construction works.

All three species are protected by the Bern Convention and the EU Habitats Directive. At the regional level, the sea and river lamprey are protected by the Walloon Regional Executive Order of 24 November 1988 in Wallonia while the Flemish Executive Decree of 20 May 1992 protects the brook, river and sea lamprey in Flanders. Sea and river lamprey are protected in marine waters (Royal Decree of 21 December 2001).



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Male individual of the river lamprey. This species is in strong regression, as are the brook and sea lampreys (drawing by L.S. BERG in POLL 1947).

References and further reading

See under Teleostomi.

CHONDRICHTHYES - CARTILAGINOUS FISHES

(KRAAKBEENVISSEN - POISSONS CARTILAGINEUX, CHONDRICHTHYENS - KNORPELFISCHE)



Fishes with fins, jaws and a cartilaginous skeleton; placoid scales usually cover the skin; no swim bladder or lung; male with pelvic claspers for sperm transfer; teeth not fused to jaws and replaced continually; two subclasses: the Elasmobranchii (sharks and rays) with ca. 815 described species and the Holocephali (chimaeras) with 31 described species worldwide.

Questionnaires completed by Philip VAS (independent expert, United Kingdom) and by Jan HAELTERS (Marine Ecosystem Management / RBINS).



Twenty-two species have been recorded, but all are, or have become, uncommon or rare. Some are only known as very rare vagrants. Once common, the piked



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The lesser spotted dogfish, *Scyliorhinus canicula*, is still one of the most common elasmobranch species in Belgian marine waters, although the number of specimens is also decreasing. Its length ranges from 40 to 70 cm, although exceptionally individuals can reach 1 m (drawing by C.L. BONAPARTE in POLL 1947).

dogfish (*Squalus acanthias*), angelshark (*Squatina squatina*) and common skate (*Raja batis*) are now extremely rare or have disappeared completely from Belgian waters. The lesser spotted dogfish (*Scyliorhinus canicula*), starry smooth hound (*Mustelus asterias*) and thornback ray (*Raja clavata*) are still the most common elasmobranchs.

branch species, but their abundance decreased significantly by overfishing, not only in Belgian marine waters, but in the southern North Sea in general. Chimaeras are not present in Belgian waters.

References and further reading

See under Teleostomi.

TELEOSTOMI (OSTEICHTHYES) - BONY FISHES

(BEENVISSEN - POISSONS OSSEUX, OSTÉICHTHYENS - KNOCHENFISCHE)



Fishes with fins, generally scaly skins, jaws and a bony skeleton; usually with air sacs that function either as lungs or as swim bladders for buoyancy; only the subclass Actinopterygii (ray-finned fishes) occurs in our region, consisting of the Chondrostei (sturgeons and paddlefishes), and the Neopterygii (formed by the paraphyletic Holostei and the Teleostei, the major superorder of the Osteichthyes and the dominant fish taxon since the Cretaceous); ca. 27,000 living species are known worldwide (<http://www.FishBase.org>), while guesstimates of the total number of species and subspecies reach 50,000 and more.

Questionnaires completed by Filip VOLCKAERT (Catholic University of Leuven) for the Belgian fish fauna in general, by Jan HAELTERS (Marine Ecosystem Management / RBINS) for the marine species and by Rudi YSEBOODT (UIA, University of Antwerp) for the freshwater species in Flanders. Jean-Claude PHILLIPART (University of Liège) provided data on the freshwater fish fauna of Wallonia. Additional information by Boudewijn GODDEERIS (Royal Belgian Institute of Natural Sciences).



Almost 120 species have been recorded in Belgian marine waters (POLL 1947, RAPPÉ & ENEMAN 1988, unpublished list by J. HAELTERS), but this figure includes more than 30 species which can be considered as vagrants or species which are, or have become, extremely rare. Many species have declined significantly because of overfishing, pollution and the destruction of habitats. Especially diadromous fishes have become rare or even extinct because of the destruction of estuarine or riverine habitats. Dozens of other marine species can be expected as vagrants (NIJSSEN & DE GROOT 1987, WHEELER 1969, WHITEHEAD *et al.* 1984-86). For information on the marine species protected by legislation, see HAELTERS & KERCKHOF (2002).

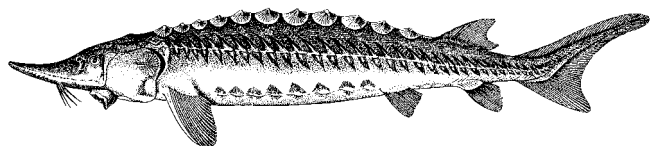
In Flanders, 83 bony fish species were registered in rivers, streams and brooks (BELPAIRE 2002). This species number can be subdivided in 19 introduced species (23%), 20 marine and brackish water species temporarily migrating to brackish or fresh water (24%), and 44 freshwater species (53%). Of the latter, 20% have disappeared from Flemish waters, 60% are threatened and only 20%, which constitutes only 9 species out of 44, are doing relatively well at the moment. Up to ten additional species can be expected based on MAITLAND (1978), MAITLAND & CAMPBELL (1992) and DE NIE (1996). Between 1950 and 1990, the species number in Flanders declined because of habitat destruction, water depletion, acidification, eutrophication and chemical pollution. Since 1990 however, this trend seems to be reversed and there seems to be an increase of the species number, because of recent introductions of non-native species, e.g. topmouth gudgeon (*Pseudorasbora parva*), fathead

minnow (*Pimephales promelas*), asp (*Aspius aspius*), sturgeon species (*Acipenser* spp.), etc. But also as a result of increasing water quality in the lower Sea Scheldt and other major watercourses. Unfortunately, the conditions in smaller watercourses and standing waters are not improving or even getting worse. For the Flemish Region, a red list can be consulted at http://www.instatat.be/Soorten/Vissen/rode_lijst.htm.

In Wallonia, the fish fauna consists of 52 species, 41 of which are considered to be indigenous. Sixteen species (39%) of this indigenous fish fauna disappeared or are rare or threatened, while 15 species (37%) are vulnerable, giving a total of 31 species (76%) with critical status. The richest fish biodiversity in the Walloon Region is located in the Meuse and Rhine basin and to a lesser extent in the Scheldt basin, containing some of the rare species (PHILIPPART 1998).

The burbot (*Lota lota*) became extinct in Belgium in the period 1950-1960. Other examples of extinct species in Belgium are: the Atlantic salmon (*Salmo salar*), common sturgeon (*Acipenser sturio*), twaite shad (*Alosa fallax*) and allis shad (*A. alosa*). Another major problem is the disappearance of the original genetic material of a lot of native fish species caused by the stocking of our waterbodies with exotic individuals for angling purposes. One example is the import of bitterling (*Rhodeus sericeus*) from Hungary.

Major collections are kept in the Royal Belgian Institute of Natural Sciences, the Zoological Museum of the University of Liège and the University of Namur. Smaller collections can be found in other universities and scientific institutions.



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The sturgeon (*Acipenser sturio*), an anadrome fish species, was already very rare in Belgian marine waters some 50 years ago and seems to be almost extinct now. Sporadically, a sturgeon is caught by Belgian fishermen, but these may be individuals of an introduced stock. The sturgeon is protected by the Royal Decree of 21 December 2001 concerning the protection of species in marine areas under Belgian jurisdiction (drawing by C.L. BONAPARTE in POLL 1947).

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AMPHIBIA - AMPHIBIANS

(AMFIBIEËN - BATRACIENS, AMPHIBIENS - LURCHE, AMPHIBIEN)



Vertebrates with naked skin; aquatic larval stadium; respiration by gills, integument and/or lungs; two pairs of sometimes reduced lateral appendages for walking and swimming; include frogs, toads, newts, salamanders and caecilians; more than 4,800 described species worldwide, possibly another 1,000 species to be expected.

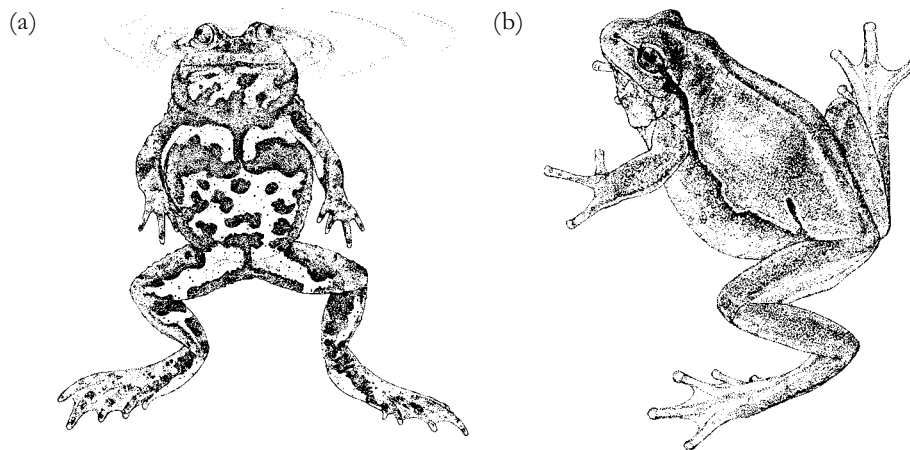
Questionnaire completed by Boudewijn GODDEERIS (Royal Belgian Institute of Natural Sciences).



Sixteen native species have been recorded (BAUWENS & CLAUS 1996, PERCSY *et al.* 1997, both with species list): six frog species, five toads and five salamanders and newts. One additional species, the parsley frog (*Pelodytes punctatus*), may be expected (PARENT 1983, PERCSY *et al.* 1997). Since 1981, one species, the yellow-bellied toad (*Bombina variegata*), has disappeared from Belgium (BAUWENS & CLAUS 1996, PERCSY *et al.* 1997) and the number of individuals of most species is decreasing, because of habitat destruction and fragmentation, isolation of populations, use of pesticides, acidification, manuring, water pollution and climate change. As a result, most of the species are rare or threatened. Only five amphibian species do not show a strong negative trend in Belgium: edible frog (*Rana esculenta* synklepton), common frog (*R. temporaria*), common toad (*Bufo bufo*), common newt (*Triturus vulgaris*) and Alpine newt (*T. alpestris*).

Following BAUWENS & CLAUS (1996) and PERCSY *et al.* (1997), the highest species richness is found in Upper Belgium and the Kempen, followed by the coastal zone (area beyond the tidal range). Essential for the conservation of amphibians are pools with species-specific adjacent terrestrial habitat. All species are protected by law. More conservation measures are needed outside the protected areas. In Flanders, specific conservation programmes have been developed for the common tree frog (*Hyla arborea*) and the common midwife toad (*Alytes obstetricans*) (VERVOORT 1994, VERVOORT & GODDEERIS 1996). Red lists are available for Flanders (http://www.instnat.be/content/page.asp?pid=ROL_staartpagina) and Wallonia (<http://mrw.wallonie.be/cgi/dgrne/sibw/sibw.esp.list2.pl?VAR=Amphibiens>).

Taxonomic knowledge of this group in Belgium is good and databases are managed by the Institute of Nature Conservation and by 'Hyla', a working group of the naturalist



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(a) The yellow-bellied toad (*Bombina variegata*) disappeared entirely from our country, probably due to the combination of habitat destruction and fragmentation with climate factors. Individuals of this species were last observed in the early 1980s. (b) The common tree frog (*Hyla arborea*) is particularly threatened following habitat destruction and fragmentation. Reproductive populations are reduced to six only in Flanders and are absent in Wallonia (drawings by E. DELAYE in collaboration with B. GODDEERIS, © RBINS).

association ‘Natuurpunt’, for the Flemish Region, and by ‘Raienne’, the herpetologist working group of ‘Aves’, for the Walloon Region. A reference collection is housed in the Royal Belgian Institute of Natural Sciences.


The garden-pond craze in the last decades has led to massive introduction of non-native amphibians. Several introduced frog species have developed reproductive populations in Belgium (PARENT 1997, JOORIS 2002, KOK *et al.* 2002, PERCSY & PERCSY 2002): the marsh frog (*Rana ridibunda*), Iberian water frog (*Rana perezi*), Levant water frog (*Rana bedriagae*) and American bullfrog (*Rana catesbeiana*).

References and further reading


See under Reptilia.

REPTILIA - REPTILES

(REPTIELEN, KRUIPDIEREN - REPTILES - KRIECHTIERE, REPTILIEN)

 Tetrapod vertebrates although legs may be strongly reduced or absent; skin covered with horny scales; breathing through lungs; no larval stages; include snakes, lizards, sphenodonts, turtles, crocodylians and amphisbaenians; ca. 8,000 species known worldwide, possibly between 1,000 and 1,500 more to be expected.

Questionnaire completed by Boudewijn GODDEERIS (Royal Belgian Institute of Natural Sciences).

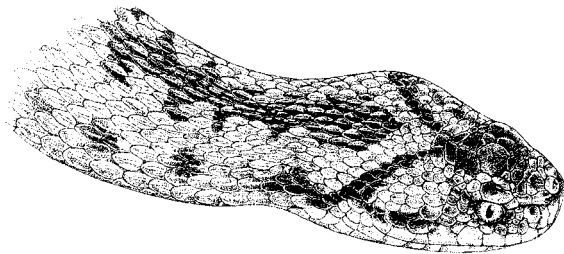
 Seven native species have been observed (three snake species, three lizards and the slow worm) and no additional species are expected (BAUWENS & CLAUS 1996, PERCSY *et al.* 1997, both with species list). As a result of the disappearance of terrestrial biotopes and the fragmentation of the landscape because of the expanding road system, the number of individuals of all species is declining, entailing the rare or threatened status for

most species. The highest species richness is found in Upper Belgium. Heaths and calcareous grasslands are considered to be essential habitats for the survival of reptiles in Belgium (BAUWENS & CLAUS 1996, PERCSY *et al.* 1997). All reptiles are protected by law, but, as well as for amphibians, more conservation measures are needed outside protected areas. For the adder (*Vipera berus*), a species protection plan has been developed (BAUWENS *et al.* 1995).

Like the amphibians, reptiles are taxonomically well known in Belgium. Databases are managed by the Institute of Nature Conservation, 'Hyla' ('Natuurpunt') and 'Rainne' ('Aves'). Red lists are available in Flanders (http://www.instat.be/content/page.asp?pid=ROL_staartpagina) and Wallonia (<http://mrw.wallonie.be/cgi/dgrne/sibw/sibw.esp.list2.pl?VAR=Reptiles>).

The introduction of various turtles for the pet-trade and the subsequent release of oversized individuals in ponds has led to the proliferation of non-reproductive populations of these long-living species, i.e. the European pond terrapin (*Emys orbicularis*) and the red-eared terrapin (*Trachemys scripta elegans*). These species cannot reproduce in Belgium because of the low summer temperatures (JOORIS 2002).

In the Belgian part of the North Sea, three sea turtle species, the loggerhead (*Caretta caretta*), green turtle (*Chelonia mydas*) and leathery turtle (*Dermochelys coriacea*), very rarely occur as vagrants. A database on strandings and sightings of marine turtles is kept by the Marine Ecosystem Management Department of the Royal Belgian Institute of Natural Sciences.



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The adder (*Vipera berus*) reaches a maximum length of 60 to 70 cm and is typically found in heath- and moorland but also in railway embankments, rough grassland and scrub (drawing by E. DELAYE in collaboration with B. GODDEERIS, © RBINS).

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AVES - BIRDS

(VOGELS - OISEAUX - VÖGEL)



Tetrapod vertebrates with feathers and bill; fore-limbs modified as wings (vestigial in a few species), hind-limbs used for walking or swimming; scales on feet only (on tarsometatarsus and in some species also on lower part of tibiotarsus; some species on the contrary have a feathered metatarsus); breathing through lungs; young altricial or precocial, according to ecological strategy of the species; ca. 9,800 species described worldwide but a little more than 10,000 expected, especially when refining systematics.

Questionnaire completed by Gunter DE SMET (Royal Belgian Institute of Natural Sciences).



Since 1800, 424 species have been recorded in Belgium according to the guidelines for assigning species rank by HELBIG *et al.* (2002), 406 of which belong to category A, i.e. observed at least once in the wild between 1950 and 2002. The other 18 species were recorded between 1800 and 1949, but have not been observed since. Until 1966, the official Belgian birdlist was based on decisions of the Commission of the Belgian Avifauna. Since 1967, the Belgian Avifaunal Homologation Committee (BAHC) and the Homologation Commission (CH) have taken the relay. The resulting species list is available at <http://www.bahc.be/documents.htm> (Belgian birdlist).

For breeding birds, the highest species richness is found in Lower Belgium (particularly in the coastal area including the polders and in the Kempen), followed by, in decreasing order of richness, Middle Belgium (including the Sonian Forest), Upper Belgium, the Lorraine, the Hautes Fagnes, the tidal range and the North Sea. Habitats considered of essential importance for the survival of certain species or populations are among others wetlands, deciduous forests, heaths and small-scale landscape elements.

Since 1950, the total number of species has increased from 334 to 424 species, which is an addition of 90 species (26.9%). The number of breeding bird species has augmented by 24.3% from 144 (in 1950) to 179 species (in 1999). The increase of the general species number is mainly due to the intensification of observations, most of the additions being vagrants. The high number of breeding birds reached in 1999 is partly due to species which take advantage of temporarily favourable conditions for settling. Striking examples are the (temporary) breeding success of duck, gulls, terns and wader species in the proximity of harbour infrastructures and activities, and the high numbers of great cormorant (*Phalacrocorax carbo*), grey heron (*Ardea cinerea*), grebes and duck species linked to eutrophication and the resulting enhanced availability of whitebait. Worryingly, some of our commonest breeding birds, most noticeably the house sparrow (*Passer domesticus*), show a steep decline in numbers. On the positive side, some former breeding birds have recolonised the country successfully. Peregrine falcons (*Falco peregrinus*) took advantage of nestboxes and are now preferring buildings to traditional nesting sites in quarries. Successful reintroduction

schemes of white storks (*Ciconia ciconia*) in Belgium, the Netherlands and other countries have favoured occasional nesting of the species in Flanders and Wallonia. In general, the increase in the number of breeding birds is mainly due to the following: range extension of breeding birds from abroad, large-scale infrastructure works (e.g. harbour of Zeebrugge), hunting restrictions (positive effect mainly on ducks, birds of prey, large species), long-term results of forestry practices, side-effects of pollution (e.g. eutrophication), reintroduction of formerly occurring breeding birds and climate change.

The disappearance of specific habitats and small-scale landscape elements, the fragmentation of habitats and the intensification of agriculture have led to the disappearance from Belgium of species like the black tern (*Chlidonias niger*), hoopoe (*Upupa epops*) and ortolan bunting (*Emberiza hortulana*). At least 20 other breeding bird species are highly threatened. For Flanders, a preliminary red list can be found at (http://www.instnat.be/content/page.asp?pid=ROL_staartpagina). A proposal of a red list for the Brussels Region is available at <http://www.aves.be/Surbru-Chapitre-6.html#Heading40>. The red list status of, and other useful data on, birds occurring in the Walloon Region can be found at <http://mrw.wallonie.be/cgi/dgrne/sibw/sibw.esp.list2.pl?VAR=Oiseaux>.

Not included in the total number of 424 species are some 20 species of dubious origin (e.g. white pelican, *Pelecanus onocrotalus* and greater flamingo, *Phoenicopterus roseus*) and not less than 173 species which occur in the wild only as escapes from captivity (e.g. budgerigar, *Melopsittacus undulatus*, and canary, *Serinus canaria*). Eight introduced species are considered as aliens with self-supporting breeding populations: Canada goose (*Branta canadensis*), Egyptian goose (*Alopochen aegyptiacus*), upland goose (*Chloephaga picta*), mandarin duck (*Aix galericulata*), ring-necked pheasant (*Phasianus colchicus*), feral pigeon (*Columbia livia*), ring-necked parakeet (*Psittacula krameri*) and monk parakeet (*Myiopsitta monachus*). The red grouse (*Lagopus lagopus*) was formerly also breeding, but its introduced population is now extinct.

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MAMMALIA - MAMMALS

(ZOOGLIEREN - MAMMIFÈRES - SÄUGETIERE)



Tetrapod vertebrates with, in some species, forelimbs modified as wings or flippers; hairy skin, neither scales nor feathers; females possess mammary glands; breathing via lungs; no larval stages; a total of 4,629 described species worldwide, some hundreds more to be discovered.

Questionnaires completed by Roland LIBOIS (University of Liège) and Georges LENGLET (Royal Belgian Institute of Natural Sciences) for the non-marine mammals, by Jan HAELTERS (Marine Ecosystem Management / RBINS) for the marine mammals and by Jacques FAIRON (Royal Belgian Institute of Natural Sciences) for the bats.



Sixty-eight non-marine and five marine mammal species are considered to belong to the Belgian fauna. Neither domestic animals and pets, nor man, are included in these figures. The 68 non-marine species can be subdivided in 9 Insectivora, 18 Chiroptera, 2 Lagomorpha, 5 Artiodactyla, 14 Carnivora and 20 Rodentia (FRECHKOP 1958, LIBOIS 1982, CRIEL *et al.* 1994, 1997).

One species, the wolf (*Canis lupus*), is extinct in Belgium and 22 other species are considered to be threatened in Flanders (CRIEL *et al.* 1994, red list for mammals in Flanders). For the southern part of the country, a red list can be found on the 'Système d'Information sur la Biodiversité en Wallonie' (SIBW) <http://mrw.wallonie.be/dgrne/sibw/especes/cew/cew93/mammifer.html>. A text on the status of mammals in the Brussels Capital Region is available at http://www.naturalsciences.be/cb/documents/regions/brussels/bru_mammals/brussels_mammals.htm.

Based on the European mammals atlas, two additional species are expected in Belgium: the water vole (*Arvicola sapidus*) and the lynx (*Lynx lynx*). The mammal species number stays more or less the same due to two opposite factors, balancing each other: the (re-)introduction or invasion of species on one side and the destruction and fragmentation of habitats leading to disappearance and threatened species on the other side. Due to this, the numbers of individuals of some species are declining. Examples are the dramatic regression of the greater and lesser horseshoe bat (*Rhinolophus ferrumequinum* and *R. hipposideros*). The highest species richness is found in Upper Belgium (excl. the Hautes fagnes), followed by, in decreasing order of richness, the Lorraine, Middle Belgium, the Hautes Fagnes and Lower Belgium (incl. the Kempen). A tight ecological network together with underground cavities and accessible man-made structures are of essential importance for the Chiroptera. The wild cat (*Felis silvestris*), the common dormouse (*Muscardinus avellanarius*) and some other mammalian species are highly dependent on leafy and more or less undisturbed forests.

Since 1900, the following species have been introduced in Belgium: the mouflon (*Ovis aries*), raccoon dog (*Nyctereutes procyonoides*), raccoon (*Procyon lotor*), American mink (*Mustela vison*), Siberian chipmunk (*Tamias sibiricus*), muskrat (*Ondatra zibethicus*) and coypu (*Myocastor*





coypus). The castor (*Castor fiber*) has been reintroduced illegally. See PEETERS & VAN GOETHEM (2002) for communications on the Siberian chipmunk, muskrat, coypu, badger (*Meles meles*), beech marten (*Martes foina*), European otter (*Lutra lutra*) and on Chiroptera.





Eighteen cetacean and five pinniped species have been observed at least once in Belgian waters, and a few more could be expected as vagrants. Only five marine mammals can be considered as indigenous in the Belgian part of the North Sea. Of these, the bottlenose dolphin (*Tursiops truncatus*) was regularly seen until the mid-twentieth century, but is now almost extinct in the North Sea. On the contrary, groups of white-beaked dolphins (*Lagenorhynchus albirostris*) have been observed regularly since 1960. The harbour porpoise (*Phocoena phocoena*) is the only relatively common cetacean in the shallow coastal waters of the southern North Sea. It is regularly observed in Belgian waters, especially in late winter and spring. Individuals of the harbour seal (*Phoca vitulina*) are continuously present and even winter in Belgian waters. Young animals are observed each year, mainly in the summer period. These probably originate from colonies in France (Somme Estuary), the United Kingdom (Wash Estuary) and the Netherlands (Zeeland, Wadden Sea). Young grey seals (*Halichoerus grypus*) are observed each year during the winter period. Adult are less common than harbour seals. In June 2003, a female of the harp seal (*Phoca groenlandica*) stranded on the beach of Middelkerke, being the first Belgian record of this species which normally occurs at the edge of the Arctic pack-ice. A database on strandings and sightings is kept by the Marine Ecosystem Management Department of the Royal Belgian Institute of Natural Sciences. The main mammal collections, including marine species, are housed in the Royal Belgian Institute of Natural Sciences and the Zoological Museum of the University of Liège.





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Table 4. Overview of the Metazoa in Belgium and the world. For Belgium, recorded and expected species (= recorded + additional expected species) are given. The last column indicates the world-wide number of described species per taxon. When available and higher than the described number world-wide, a guesstimate of the real total species number is added in italic.

Taxon	 Recorded	 Expected	 Described	 <i>Expected</i>
Porifera	32	32	> 7,000	<i>(10,000)</i>
Myxozoa	10	100-120	1,400	<i>(3,000-5,000)</i>
Cnidaria	33	≥ 100	9,000	
Ctenophora	2	4	100	
Turbellaria	± 400	> 450	8,000	<i>(15,000-20,000)</i>
Trematoda	103	325	15,000-18,000	
Monogenea	21	300-500	7,000-8,000	<i>(> 20,000)</i>
Cestoda	144	> 250	5,000	
Gnathostomulida	0	9-22	80	<i>(250)</i>
Dicyemida	0	3-15	200	
Orthonectida	0	≥ 6	22	
Nemertea	10	20-30	1,200	
Nematoda	545	2,500	25,000	<i>(100,000-1,000,000)</i>
Nematomorpha	12	> 17	324	<i>(400)</i>
Acanthocephala	3	12-25	1,150	
Rotifera	300	1,000	1,800	<i>(> 10,000)</i>
Cycliophora	0	1-2	3	
Kinorhyncha	2-4	17-24	150	
Priapulida	0	1-3	17	
Gastrotricha	37	> 50	450	
Loricifera	0	6	25 (125)	<i>(500)</i>
Entoprocta	10	20	150	<i>(300)</i>
Araneae	679	> 679	40,000	
Pseudoscorpiones	24	29	3,000	
Opiliones	26	30	2,400	<i>(3,500-5,000)</i>
Acari	970	1,220	30,000	<i>(500,000)</i>
Pycnogonida	14	14	1,000	
Protura	5	40-50	660	<i>(6,600)</i>
Diplura	2-3	7-10	800	
Collembola	130	250	6,000	<i>(50,000)</i>
Thysanura	5	6-7	250	
Ephemeroptera	65	± 65	2,100	
Odonata	69	70	5,300	<i>(10,000)</i>
Plecoptera	48	58	2,000	
Blattodea	8	8	3,500	

Taxon	 Recorded	 Expected	 Described	 Expected
Mantodea	1	1	2,000	
Orthoptera	51	56	20,000	
Dermaptera	4	5	1,900	
Psocoptera	73	82	3,000-4,000	
Anoplura	15	28	400	
'Mallophaga'	124	≤ 873	4,300	
Heteroptera	620	650	62,000	
Auchenorrhyncha	393-408	430-460	35,000	(100,000-1,000,000)
Psylloidea	64	79	2,000	
Aleyrodidea	7	13	1,200	
'Adelgoidea'	4	22	150	
Aphidoidea	371	500	4,700	
Coccoidea	19	100-125	7,600	
Thysanoptera	< 20	≥ 110	5,000	
Neuroptera	37	42	5,000	
Megaloptera	2	2	300	
Raphidioptera	4	4	150	
Mecoptera	7-8	7-8	550	
Siphonaptera	43	51	2,400	
Coleoptera	± 4,500	4,600-5,000	370,000	(≥ 2,000,000)
Strepsiptera	5	10	560	
Diptera	4,474	± 6,670	120,000-150,000	(≥ 2,000,000)
Trichoptera	202	220-225	7,000	
Lepidoptera	2,423	2,500	165,000	(≥ 1,000,000)
Hymenoptera	± 3,500	7,200	198,000	(≥ 2,000,000)
Chilopoda	31	41-51	3,000	
Symphyla	5	25	200-500	
Diplopoda	50	< 60	10,000	(80,000)
Pauropoda	11	22-36	700	
Cladocera	80	85	500-600	
'Phyllopoda'	7	9	410	
Ostracoda	105	165	9,000	
Copepoda	279	± 500	13,000	(130,000)
Branchiura	1	3	130	
Tantulocarida	0	1-3	25	
Cirripedia	13	16-17	800	
Nebaliacea	1	1	20	
Bathynellacea	1	2-3	160 (incl. Anaspidae)	

Taxon	 Recorded	 Expected	 Described	 Expected
Stomatopoda	0	1-3	400	
Mysidacea	19	25	1,022	
Cumacea	12	15-27	1,200	
Tanaidacea	3	12	850	
Isopoda	66	82-87	10,000	
Amphipoda	126	246	7,500	
Euphausiacea	1	1	90	
Decapoda	60	72	10,000	
Pentastomida	0	3	110	
Polychaeta (incl. 'Archannelida')	200-250 (+ 5 A.)	± 450 (+ 25 A.)	9,000 (+ 50 A.)	(19,000)
Hirudinea	20	> 20	500	(1,200)
Oligochaeta	86	> 112	6,000	
Sipuncula	3	12	300	
Echiura	1	4	140	
Caudofoveata	0	1	120	
Solenogastres	0	5	230	
Polyplacophora	1	2	890	
Gastropoda	220	250	80,000-90,000	(160,000-180,000)
Bivalvia	80	90-100	12,000-15,000	(25,000-30,000)
Scaphopoda	2	2	± 600	
Cephalopoda	8	13-17	± 900	
Tardigrada	45	145	800	
Ectoprocta	50	90-100	5,700	
Brachiopoda	0	2-5	350	
Phoronida	1	4	14	
Chaetognatha	2	2	110	
Hemichordata	0	2-7	96	
Echinodermata	15	20-22	8,000	(15,000)
Tunicata	18	24	1,250-2,000	(3,000)
Cephalochordata	1	1	20-30	
Hyperoartia and Hyperotreti (Agnatha)	3	3	84	
Chondrichthyes	22	22	846	
Teleostomi (Osteichthyes)	149	≥ 150	27,000	(50,000)
Amphibia	16	> 21	4,800	(5,800)
Reptilia	7	7	8,000	(9,000-9,500)
Aves	179	± 179	9,800	(± 10,000)
Mammalia	73	75	4,629	(± 5,000)

5. CONCLUSIONS

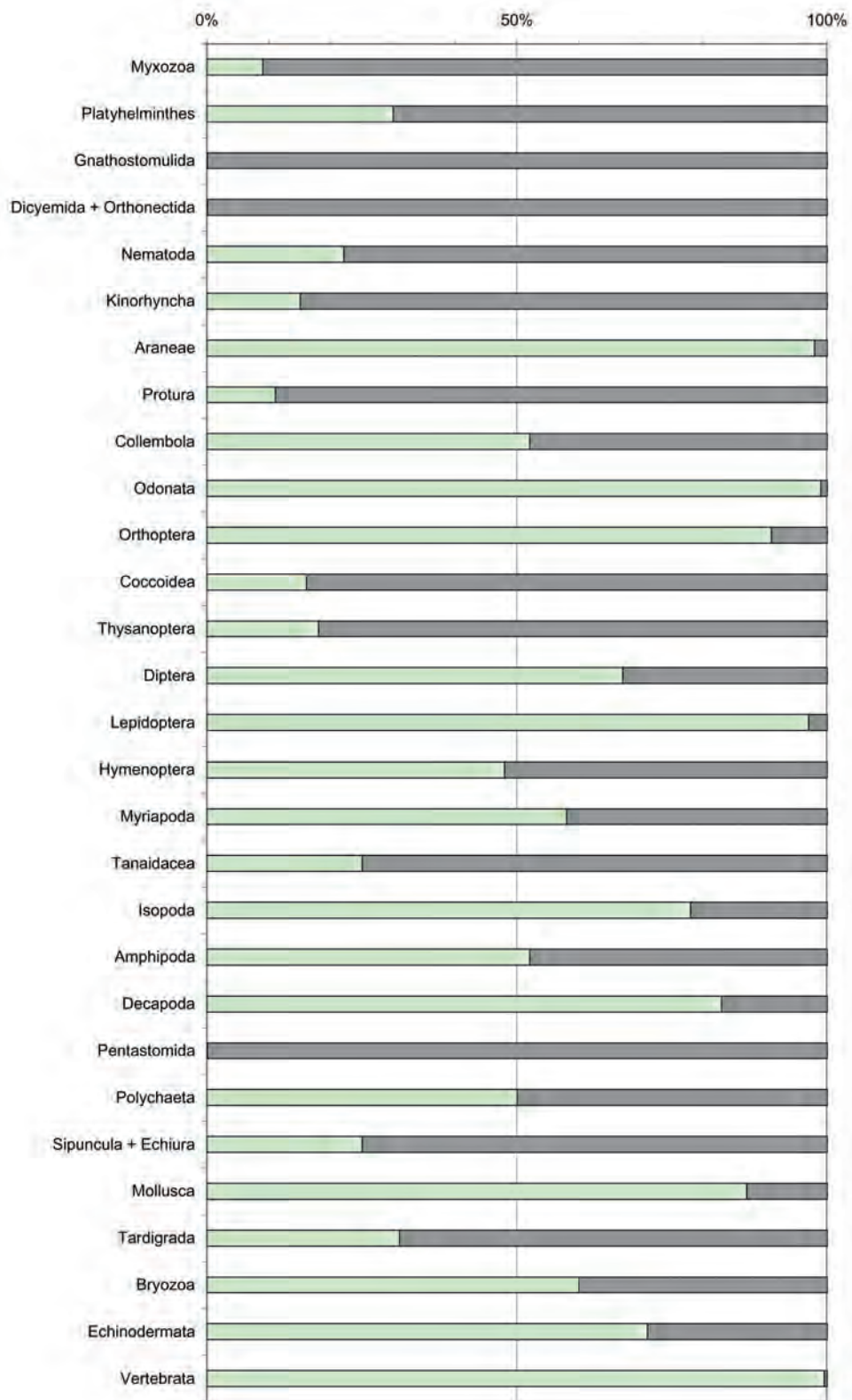
Approximately 22,500 animal species have been recorded so far in Belgium. The number of expected species ranges from 34,000 to 35,000 (table 4). As a consequence, roughly one-third of the animal species living in Belgium are still waiting to be discovered.

Knowledge of the Belgian fauna is unevenly balanced. Taxonomic groups of which individuals are easily observable, 'charismatic', economically significant or practical indicators for nature conservation are subject to sustained scientific attention. For these groups, e.g. vertebrates, ground beetles, butterflies, dragon- and damselflies, the number of recorded species probably reflects quite accurately the real number of existing species. In essence, this number is only influenced by the arrival of alien species, or by the disappearance of species, e.g. because of human activities.

In contrast, when species are small or obscure, difficult to study or regarded as of no direct human interest, e.g. protozoans and many groups of invertebrates, recorded totals are likely to reflect only a part of the real number of existing species, with a few exceptions such as sponges, sea spiders, some insect taxa, etc. (table 4). New collection methods and increased sampling efforts yielded significant numbers of new taxa for the Belgian fauna, even up to the class level (!), e.g. sampling of subterranean habitats by remote sucking, surveying ship wrecks in the Belgian marine waters by SCUBA diving.

Figure 38 summarises current knowledge for a variety of faunal groups. Vertebrates, from lampreys to mammals, not unexpectedly form the best-known major taxonomic group in Belgium, with a total of 449 recorded species and possibly another 10-15 expected. Besides vertebrates, other well-known groups are the Porifera (sponges), Araneae (spiders), Pycnogonida (sea spiders), and a number of insect orders such as the Ephemeroptera (mayflies), Odonata (dragon- and damselflies), Coleoptera (beetles) and Lepidoptera (butterflies and moths). For some other groups, our knowledge can be considered as good to quite good, e.g. Orthoptera (grasshoppers, locusts and crickets), Mollusca (molluscs), Decapoda (shrimps, lobsters, crabs, etc.) and Isopoda (isopods). Totals of well-known high-level invertebrate taxa are as follows: insects, more than 17,000 recorded species, about 8,000 additional species expected; arachnids, such as spiders, mites, etc., some 1,700 species recorded, possibly 300 more to be found; crustaceans, almost 800 species recorded, another 300 expected; molluscs, ca. 320 species recorded, some 50 more may be expected.

In addition to the popularity criteria mentioned above, the reasons for this unevenly balanced knowledge vary. In some cases, continuous research on selected groups was carried out during long periods at universities and scientific institutes. Some taxa can even be linked to a scientist who devoted his/her life to the study of that particular group. For popular groups, numerous accomplished naturalists, often actively organised in associations, contributed significantly to the inventory, distribution and phenology of the Belgian fauna. Synergies between these naturalists and professional researchers should be encouraged and further developed, as their endless field observations and collecting efforts provide invaluable material for the monitoring of biological diversity.



38

Some faunal groups in Belgium. Percentage of recorded (green) versus additionally expected (grey) numbers.

For quite a number of taxa, only about half of the species living in Belgium are known, e.g. Collembola (springtails), Hymenoptera (bees, ants, wasps and sawflies are well known, but not the parasitic wasps), Myriapoda (centipedes and millipedes are well known, but not the symphylans and pauropodans), Amphipoda (water fleas), Polychaeta (bristle worms), Cestoda (tapeworms) and Ectoprocta (moss animals). The majority of the taxonomic groups dealt with in this chapter have to be regarded as poorly known, if the percentage of recorded versus expected species is considered. Only 10 to 30% of the species estimated to be present in Belgium are known for a.o. Protozoa (protozoans), Myxozoa (myxozoans), Turbellaria (free-living flatworms), Trematoda (flukes), Nematoda (roundworms), Rotifera (rotifers), Kinorhyncha (muddragons), Protura (proturans), Mallophaga (chewing or biting lice), Coccoidea (scale insects and mealy bugs), Thysanoptera (thrips), Symphyla (symphylans), Tanaidacea (tanaids), Sipuncula (peanut worms), Echiura (spoon worms), and Tardigrada (water bears). Nevertheless, these groups have an ecologic, ecosystemic and/or socio-economic value as well.

The situation is even worse for groups such as Monogenea or monogenetic flukes (only about 5% of the expected species recorded) and for a number of marine groups, totally unknown, which are expected to occur in Belgium, such as: Gnathostomulida (jaw worms), Cycliophora (cycliophorans), Priapulida (priapulans), Loricifera (loriciferans), Tantulocarida (tantulocarids), Stomatopoda (mantis shrimps), Pentastomida (tongue worms), Aplousobranchia (aplousobranchians), Brachiopoda (lamp shells) and Hemichordata (hemichordates), as well as for the internal parasite taxa Dicyemida and Orthonectida (formerly classified in the Mesozoa). Finally, some taxa currently ranked at phylum level have not yet been complemented since the publication of their first species lists for Belgium, e.g. Nemertea or ribbon worms (1861, 1883), Nematomorpha (1943) and Kinorhyncha (1869), resulting in completely obsolete data. The same is true for a number of lower taxonomic groups such as the Dermaptera or earwigs (1888).

Terrestrial habitats have probably been the best sampled and inventoried, together with marine benthic and pelagic communities, and intertidal zones. However, about two-thirds of the roughly 12,000 animal species, not yet discovered but supposed to occur in Belgium, live in terrestrial habitats, e.g. Hymenoptera (especially the parasitic wasps or ichneumons), Diptera (true flies, mosquitoes, gnats) and other insect orders, Acari (mites), Nematoda (roundworms), etc. Possibly more than 2,000 species can still be expected from marine habitats, particularly crustaceans, rotiferans, bristle worms, roundworms, free-living flatworms, etc. This leads to the conclusion that existing collections may not be adequately studied, and/or that many of these habitats need new, innovative and repeated sampling.

Marine species living on hard substrates in subtidal waters are hardly known. Many new species can be expected within the Hydrozoa (hydroids and hydromedusae), Amphipoda (water fleas), Polychaeta (bristle worms), Gastropoda (snails and slugs), Ectoprocta (moss animals), etc. The marine interstitial habitats also are poorly known and many species belonging to the microbenthos can be expected, e.g. Protozoa (protozoans), Rotifera (rotiferans), Gnathostomulida (jaw worms). In brackish and freshwater habitats, particularly interstitial ones, and in subterranean environments, many new species for the Belgian fauna (even new species to science) can be expected within the Protozoa (protozoans), Rotifera (rotiferans), microscopic crustaceans and insect families such as the dipteran

Chironomidae (non-biting midges), Ceratopogonidae (biting midges), etc. Finally, also parasitic groups are generally poorly known, or not studied at all, e.g. Myxozoa (myxozoans), Trematoda and Monogenea (flukes), Cestoda (tapeworms), Acanthocephala (thorny-headed worms), etc.

For many zoological groups, the existence and location of major reference collections is indicated throughout the chapter. Natural history collections are most certainly indispensable for modern biological research, of which they are an integrated part. These collections will become even more important in assessing global change, loss of biodiversity and nature conservancy. Hence, more than ever before, natural history collections have a major role to play in science and society.

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General references and further reading

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Major faunal series in adjacent countries

(The main Belgian series on fauna, together with the main Belgian series on flora and nature in general, are enumerated in annex 1)

Archives de l'Institut Grand-Ducal de Luxembourg, Section des sciences naturelles, physique et mathématique, 1906-ongoing. Centre Universitaire de Luxembourg.

Bulletin de la Société Zoologique de France, 1876-ongoing. Société Zoologique de France, Paris.

Bulletin of The Natural History Museum [formerly Bulletin of the British Museum (Natural History)], Zoology Series, Entomology Series, 1950-ongoing. The Natural History Museum, London.

Cahiers de Biologie Marine, 1960-ongoing. Station Biologique de Roscoff.

De Levende Natuur, 1896-ongoing. Stichting De Levende Natuur, Utrecht.

Die Tierwelt Deutschlands und der angrenzenden Meeresteile nach ihren Merkmalen und nach ihrer Lebensweise, 1925-... Gustav Fischer Verlag, Jena.

Die Tierwelt der Nord- und Ostsee, 1925-1957. Akademische Verlagsgesellschaft Geest & Portig K.-G., Leipzig.

Entomologische Berichten, 1901-ongoing. Nederlandse Entomologische Vereniging, Amsterdam.

Faune de France, 1921-ongoing. Office Central de Faunistique, Paris.

Ferrantia - Travaux scientifiques du Musée national d'histoire naturelle de Luxembourg (formerly Travaux scientifiques du Musée national d'histoire naturelle), 1981-ongoing. Musée national d'histoire naturelle, Luxembourg.

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Marc PEETERS
Jackie VAN GOETHEM
Department of Invertebrates
Royal Belgian Institute of Natural Sciences
Vautierstraat 29
1000 Brussels