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Crayfish field guide of Romania

Lucian Pârvulescu

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Reviewers:
David M. Holdich - BSc, PhD, DSc Nottingham, UK
Catherine Souty-Grosset - PhD, Université de Poitiers, FR

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The electronic version can be downloaded at www.crayfish.ro.

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design, graphics and photos by Lucian Pârvulescu
first cover: *Austropotamobius torrentium*
back cover: Beuşniţa brook (Nera's affluent)

Crayfish field guide of Romania

Lucian Pârvulescu

Several recommendations

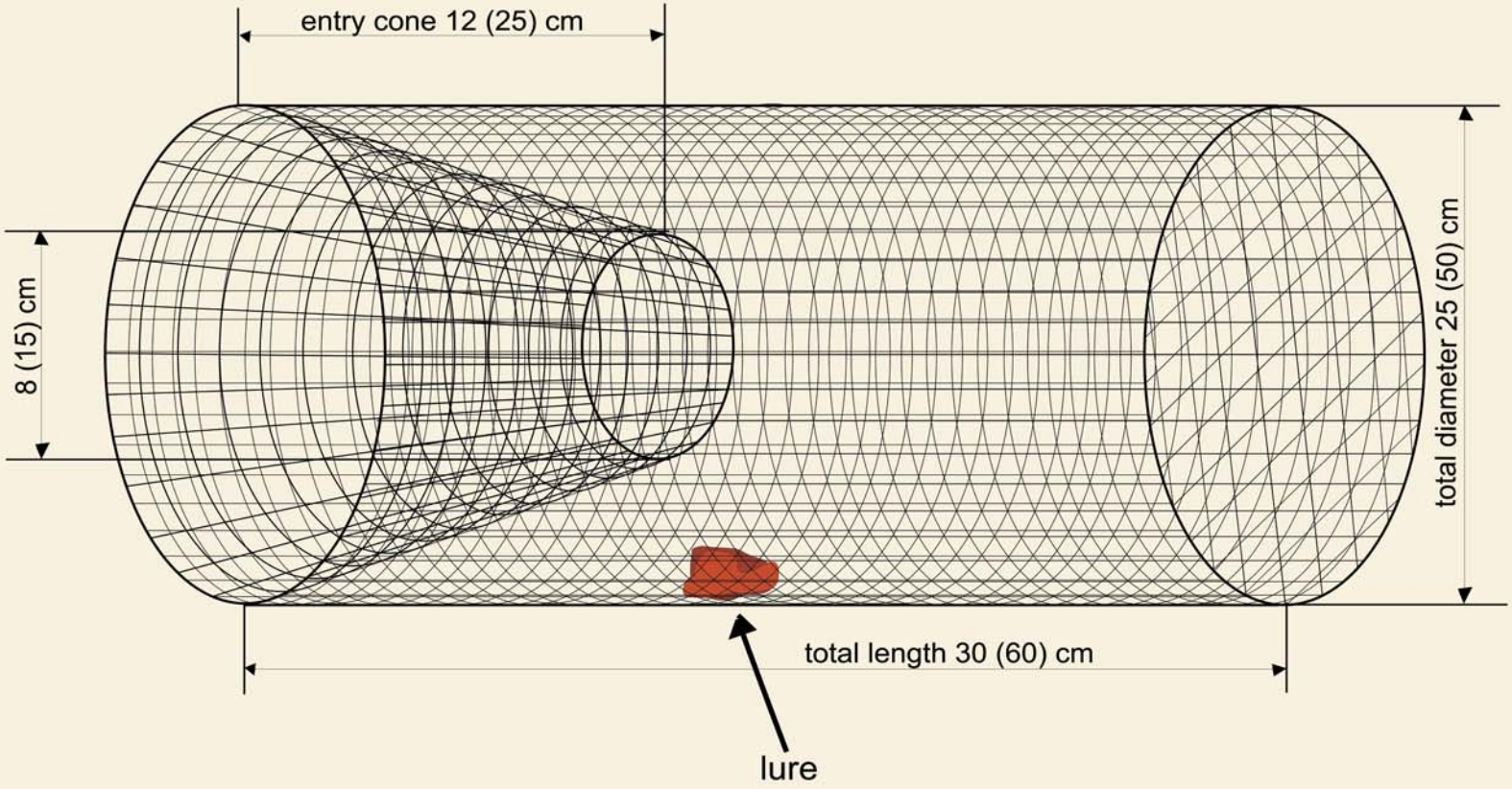
The study of freshwater crayfish provides, in addition to knowledge of the wildlife, objective information about the quality of the freshwater environment. Being the largest invertebrate in our country's fauna, the crayfish is both the guardian and the "informer" within the ecosystem it occupies. Crayfish are omnivorous, consuming carrion especially, thus effectively participating in maintaining a clean and healthy habitat.

To determine the presence of a crayfish species in a habitat involves capturing and then identifying the species, a delicate manoeuver both for the scientists and for the animal. There are several and different methods of capture starting with the fortunate situation where we simply "meet" the crayfish in the river bed all the way to the organized method of monitoring. It should be noted that, regardless of the method, a crayfish caught must necessarily be released in the same place where it has been captured (unless it is an alien species such as the spiny-cheek crayfish), and the period during which it can be taken out of the water is limited between ten minutes for species in mountain rivers and no more than one hour for the species in the plain area. The crayfish are never to be kept in containers with a small volume of water because they will soon consume the oxygen and will suffocate; it is much better for them to be kept in a shady and cool place, without water until the observations are over. Photographic images, which can be obtained very quickly, can be useful for their identification. The cephalic area and the claws are the important parts for identification purposes.

In order to catch freshwater crayfish it is important that the method is suitable to the geographical work area. Species of mountain waters are better captured by searching with the hand in the refuges in the river bed (but the method requires experience and willingness to enter the water). The trapping method is applicable to a wider range of habitats, seasons or researchers. The trap to catch crayfish is a bow net (attached drawing) constructed of small mesh wire netting. The bait can be any piece of food, liver or rotting meat being among the most attractive ones. The trap's dimensions must be adapted to both the target species and the habitat type, therefore as far as the springs are concerned the trap diameter must not exceed 25 cm and the entrance 8 cm. For other waters the diameter may be of 40-50 cm with the entry of 12-15 cm. Also, the trap can be constructed with a single entry cone or two, at both ends.

Monitoring involves repeated observations on the size and population dynamics, activity and health status, or any other matter intended to be pursued.

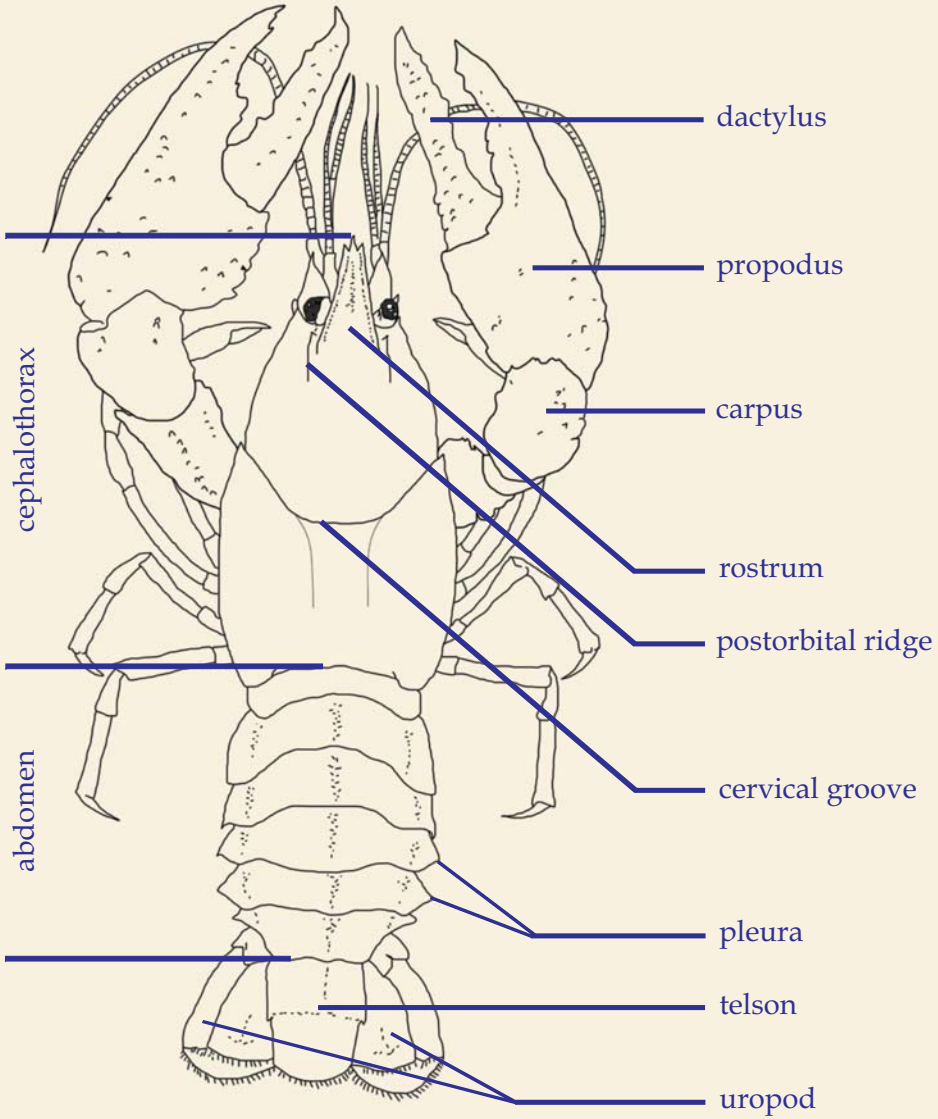
Warning! Setting a trap in a habitat requires responsibility and requires approval from environmental institutions. Once set a trap should be compulsory checked at least once a week and after removal from service it should not be left in the water!



Life trap, single entry

Important elements

for idenfifiction



cephalothorax = head (cephalon) + thorax (pereon)

rostrum = part of the cephalothorax located between and above the eyes, ends in pointed **apex**

postorbital ridge/ridges = one or two swellings on the cephalothorax located behind the orbit of the eye

chela = claw = **propodius** (fixed finger articulating with the **carpus**) + **dactylus** (mobile finger)

abdomen (pleon) = 6 abdominal segments (pleomeres)

pleura = edges of the abdominal segments

caudal fin = **telson** + **uropod**

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Key to crayfish in Romania

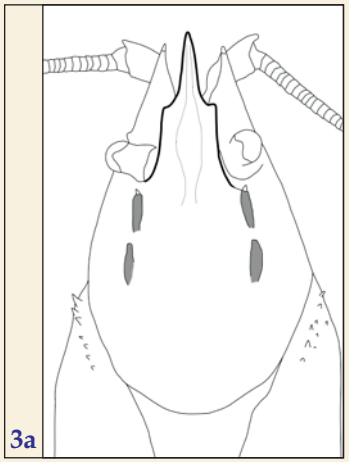
1. Two pairs of post-orbital ridges **3**
2. One pair of post-orbital ridges **4**

3a. First post-orbital ridges more prominent and ending apically with a spine, the second post-orbital ridges are blunt. Strong rostrum with parallel edges +/- sharp apex. Sides of the cephalothorax and of the cervical groove with spines ..... ***Astacus astacus***

3b. Both post-orbital ridges visible and with one apical spine each. Strong rostrum with parallel edges, sharp apex. On the sides of the cephalothorax and of the cervical groove 1-3 prominent spines and several tubercles or small spines ..... ***Astacus leptodactylus***

4a. The postorbital ridges as a crease, triangular shaped rostrum with a less obvious apex and without median carina..... ***Austropotamobius torrentium***

4b. Post-orbital ridges prominent, ending apically in obvious spine, rostrum with parallel edges and sharp apex. Many hepatic spines on the sides of the cephalothorax ..... ***Orconectes limosus***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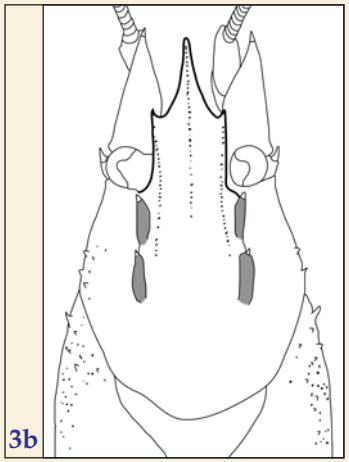
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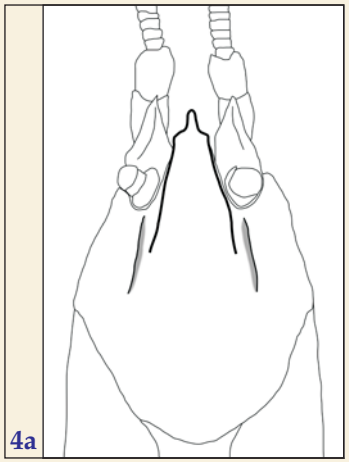
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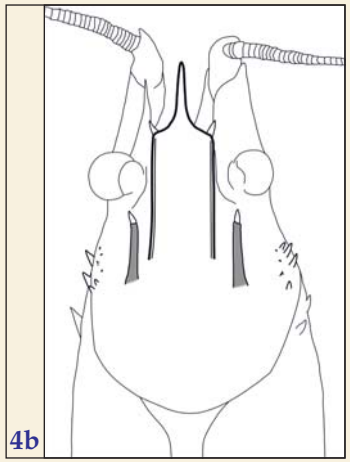
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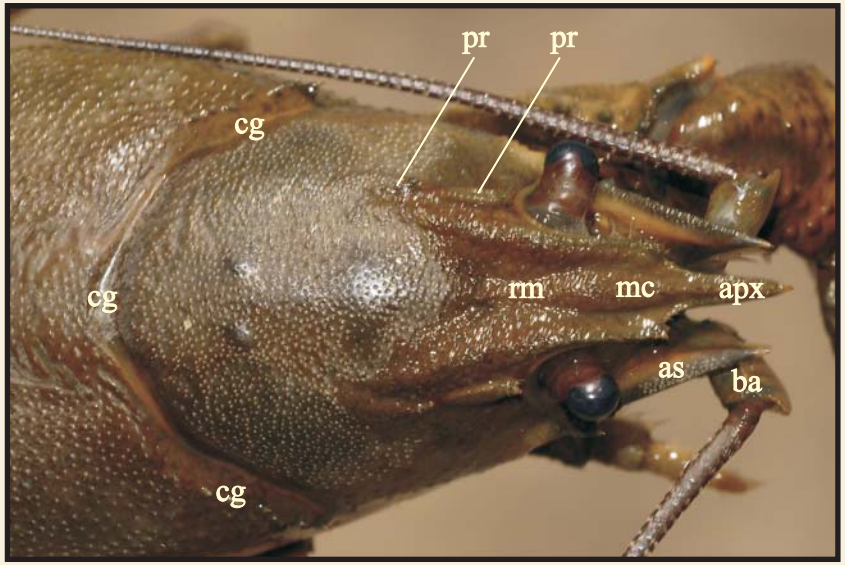
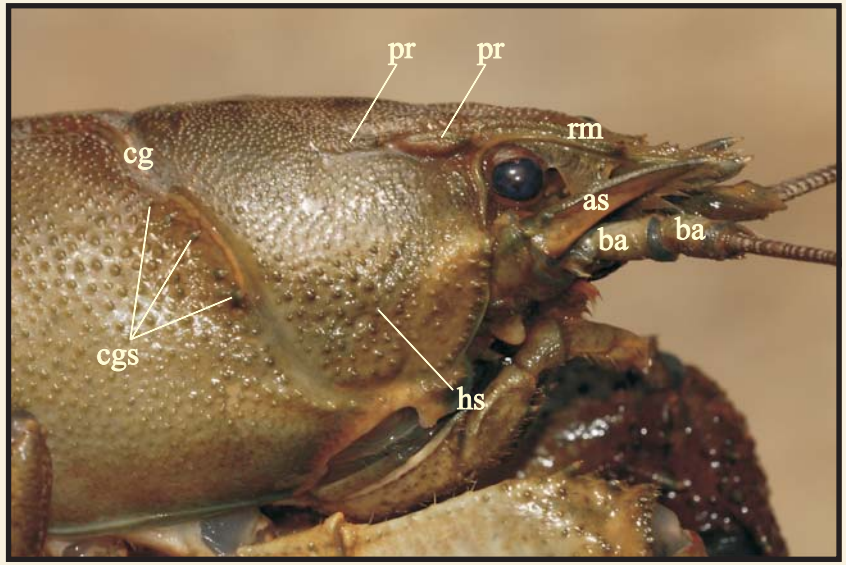
Important elements for identification



cephalic region, dorsal view

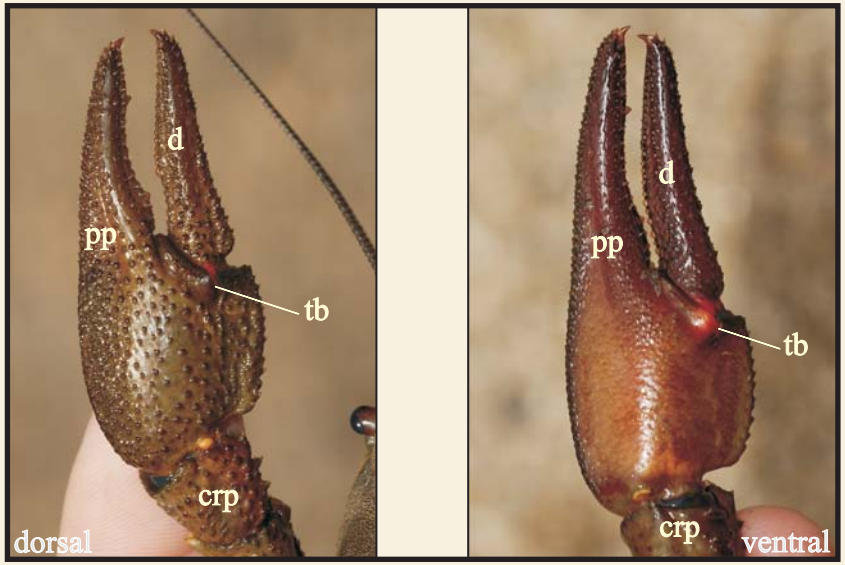
- rostrum (**rm**)
- apex (**apx**)
- median carina (**mc**)
- postorbital ridge (**pr**)
- cervical groove (**cg**)
- antennal scale (**as**)
- bazis articles of antenna (**ba**)



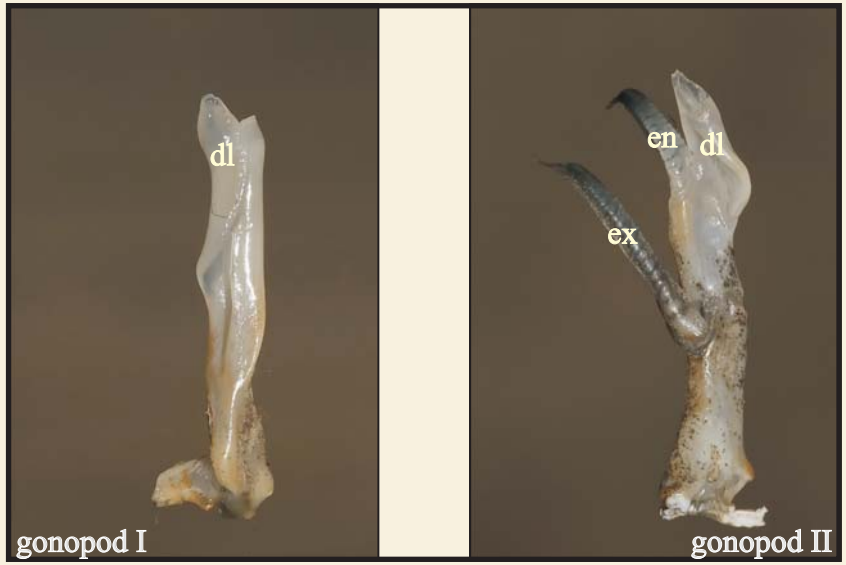
cephalic region, side view

- hepatic spines (**hs**)
- rostrum (**rm**)
- postorbital ridge (**pr**)
- cervical groove (**cg**)
- cervical groove spines (**cgs**)
- antennal scale (**as**)
- bazis articles of antenna (**ba**)

Important elements for identification



chela, dorsal and ventral view



gonopodes (only at male)

- propodium (**pp**)
- dactylus (**d**)
- tubercle (**tb**)
- carpus (**crp**)

- exopodite (**ex**)
- endopodite (**en**)
- distal lobe (**dl**)

Astacus astacus (noble crayfish)

It is a robust, medium-sized crayfish, the adults often exceeding 10 cm in length. The dorsal colour varies from olive-brown to dark-brown. The ventral side is paler in colour. The rostrum has more or less parallel and has a denticulated median redge and a sharp apex. From a post-orbital view, there are two ridges, the first one ends with a spine and the second is blunt. Behind the cervical groove there are some spines. The claws are strong, the propodum has a median cavity bordered by two tubercles and the dactylus has only a single tubercle in the proximal third. The claws are characteristically red underneath.

The species is protected!

Astacus leptodactylus (narrow-clawed crayfish)

Large-sized crayfish with robust appearance, the adult specimens often exceed 14 cm in length. The colour can range from olive green to yellowish brown to dark brown. The ventral side is lighter in colour and tends to be a dirty white. The rostrum is strong with denticulated parallel edges, with a clear median carina. The apex is long and sharp. From a post-orbital view, there are two crests each ending with one spine. There is a strong spine under the orbit, at the base of the antennal scale. The cervical groove and the cephalothorax edges have some spines. The long fingers of the claws are characteristic and are noticeably longer in males. Both the propodum and the dactylus are smoother than the carpus, which is tuberculate. Sometimes the claws may be sickle-shaped.

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Austropotamobius torrentium (stone crayfish)

Rarely exceeds 10 cm in length. The cephalothorax is smooth and the colour varies from dark brown to light orange or even white. The ventral side is lighter in colour and tends to be creamy white and is more intense on the ventral side of the claws. The rostrum has an isosceles triangle shape, with smooth, fine edges. The apex is short compared to the other species. From a post-orbital view, there is only one fine ridge without spines. The cervical area is smooth, with no more than some small tubercles. The claws are relatively strong, like the claws of a noble crayfish, but with a shorter tuck. The propodum has the median cavity bordered by two tubercles and the dactylus has only a single tubercle in the proximal third.

The species is strictly protected!

Orconectes limosus (spiny-cheek crayfish)

It is a slim, medium-sized crayfish, adults ones rarely exceeding 12 cm in length. The crust colour varies from olive-brown, light-brown to dark-brown, sometimes bluish-brown too. Usually there are reddish-brown bands to be distinguished on both the abdominal segments and the pleura. The ventral part of the claws has a lighter colour, but it never gets as far as red or reddish brown, while the top is coloured in orange with black strips (feature visible on their ventral side). The rostrum is elongated and its edges are parallel and finish up with spines. The apex is long and sharp. As far as the post-orbital perspective is concerned, there is only one long ridge ended at the back with a spine. The cephalothorax is smooth but there are 1-2 big spines and 3-6 smaller ones to be found on the sides of both the cervical groove and the cephalic area. The propodum of the strong and smooth claws presents no cavity and their dactylus presents a median tubercle.There is a prominent, curved spine on the inner side of the carpus. There is a robuste spine on the ventral side of the ischiopodite of the second pair of legs.

Cephalothorax - dorsal view

Astacus astacus (noble crayfish)

- The edges of the rostrum, converging in the proximal area, become almost parallel in the area between the orbits. The apex is strong and sharp (although it can often get broken), with jagged median carina.
- As far as the post-orbital section is concerned there are two ridges, the first one ended with a spine and the second one more discrete and blunt. The cervical groove is clearly emphasized.
- The antennal scale is equal or almost equal to the length of the two base segments of the antenna.

Astacus leptodactylus (narrow-clawed crayfish)

- The edges of the rostrum are parallel and strong, ended at the back with spines. The apex is long and sharp, with a clear median carina.
- As far as the post-orbital section is concerned there are two strong ridges, each ended at the back with a spine. The cervical groove and the cephalothorax edges also present spines.
- The antennal scale's length is equal or almost equal to the one of the two base segments of the antenna. There is a strong spine at the base of the scale, under the orbit.

Cephalothorax - dorsal view

Austropotamobius torrentium (stone crayfish)

- The rostrum's distal converging edges give it the appearance of an isosceles triangle. The apex is small (with mucro aspect).
- As far as the post-orbital section is concerned there is only one long and discrete ridge, without spines. The cervical groove is emphasized.
- The antennal scale is obviously shorter than the length of the two base segments of the antenna.

Orconectes limosus (spiny-cheek crayfish)

- The rostrum has parallel and strong edges, ended at the back with two spines. The apex is long and sharp, without any median carina.
- As far as the post-orbital section is concerned there is only one long and strong ridge, ended at the back by a spine. The cervical groove and the cephalic area edges have 2 to 5 large spines and several small ones, as well as tubercles.
- The antennal scale is equal or almost equal to the length of the two base segments of the antenna. There is a strong spine at the base of the scale, under the orbit of the eye.

Cephalothorax - side view

Astacus astacus (noble crayfish)

- The two post-orbital ridges are visible; the anterior one is stronger, ended with a spine.
- The cervical groove presents 4-6 discrete spines. The edges of the cephalic region have small tubercles.
- The antennal scale is equal or almost equal to the length of the two base segments of the antenna.

Astacus leptodactylus (narrow-clawed crayfish)

- The two strong post-orbital ridges end at the back with one spine each.
- The cervical groove presents 1-2 strong spines and several smaller ones. Small tubercles may be seen on the side of both the thoracic and the cephalic region.
- The antennal scale is equal or almost equal to the length of the two base segments of the antenna. There is a strong spine at the base of the scale, under the orbit.

Cephalothorax - side view

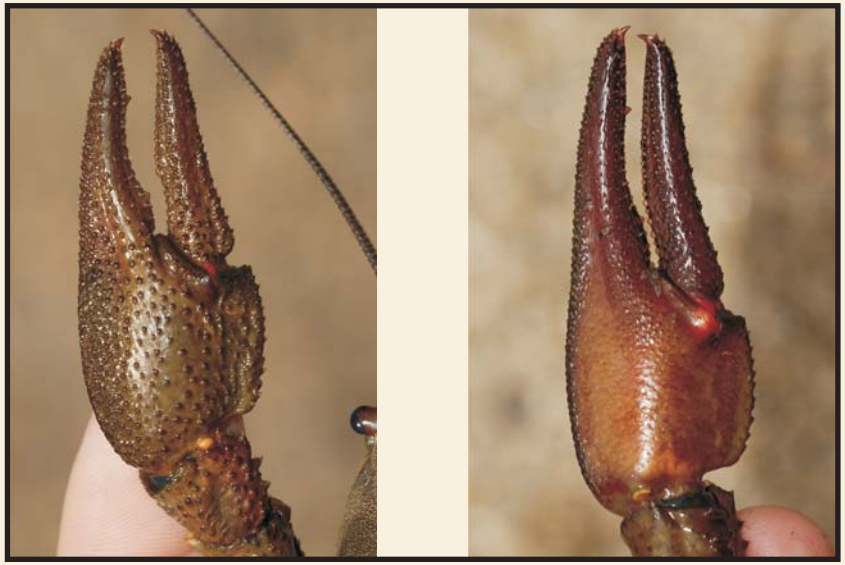
Austropotamobius torrentium (stone crayfish)

- The post-orbital ridge is visible and has the shape of a strip, without spines.
- The cervical groove presents no spines, only small tubercles.
- The antennal scale is visibly shorter than the length of the two base segments of the antenna.

Orconectes limosus (spiny-cheek crayfish)

- The post-orbital ridge ends tat the back with a strong spine.
- The cervical groove presents 1-2 strong spines and some tubercles or small spines, and the cephalic area edges have 2-7 spines and more tubercles.
- The antennal scale is equal or almost equal to the length of the two base segments of the antenna. There is a strong spine at the base of the scale, under the orbit of the eye.

Chela - dorsal and ventral view



Astacus astacus (noble crayfish)

- Dorsally, the colour of the chelae is similar to the one of the body, but the dactylus' joint is red. The ventral coloration is red. There is one tuber at the base of the dactylus, on each side, brown on the dorsal side and red-orange on the ventral one.
- The internal edge of the propodum's base is convex and with small spines. The claws are strong, slightly longer than the propodum's base. On the internal side of the claw, the propodum presents a cavity edged by two tubercles, while the dactylus, with a slightly distorted aspect, has a tubercle in the third base.
- The lost claws regenerate with the next moult, but in a smaller size.

Astacus leptodactylus (narrow-clawed crayfish)

- Dorsally, the colour of the chelae is similar to the one of the body, but the dactylus' joint is whitish. The ventral coloration is whitish. There is one tuber at the base of the dactylus, on each side, a brown-reddish one on the dorsal side and a whitish one on the ventral side.
- The edges of the propodum's base are convex, with small spines on the internal side. The claws are longer than the propodum's base, straight or sometimes curved, but without tubercles.
- The lost claws regenerate during the next moult, but in a smaller size.

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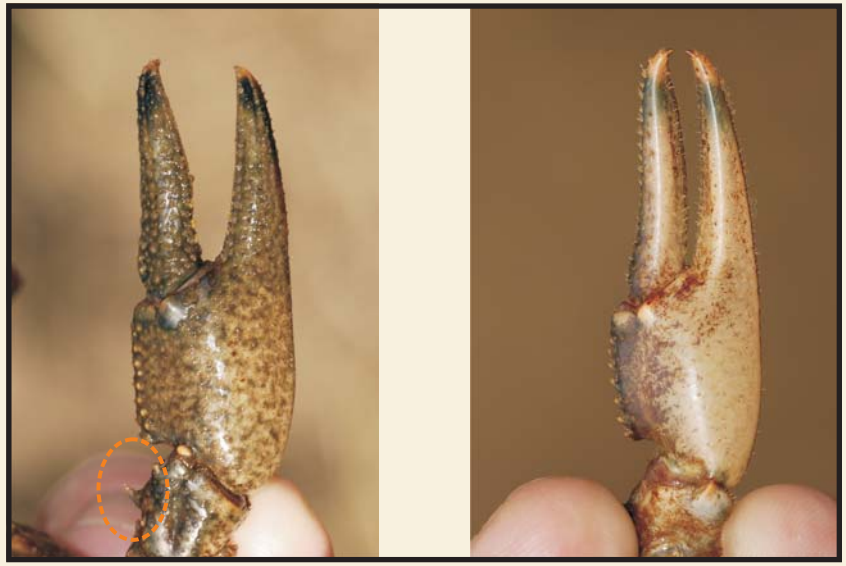
Chela - dorsal and ventral view

Austropotamobius torrentium (stone crayfish)

- Dorsally, the colour of the chelae is similar to the one of the body, while the dactylus' joint is brown. The ventral coloration is orange and white or dirty white. There is one tuber at the base of the dactylus, on both sides. On the dorsal side it is crimson and on the ventral side orange.
- The edge of the propodum's base is almost straight, without spines. The claws are strong, almost as long as the base of the propodum. On the internal side of the claw, the propodum presents a cavity edged by two tubercles, while the dactylus, with a slightly distorted aspect, has a tuber in the third base.
- The lost claws regenerate during the next moult, but in a smaller size.



Orconectes limosus (spiny-cheek crayfish)

- Dorsally, the colour of the chelae is similar to the one of the body, the dactylus' joint being brown. The ventral coloration is dirty white. At the base of the dactylus, on both sides, there is one tuber, brown-grey on the dorsal side and white on the ventral side. The tip of the claws is orange with a black stripe, feature that is more visible on the ventral side.
- The internal edge of the propodum's base is relatively straight, with clear-coloured small tubercles. The claws are equal or slightly longer than the propodum's base, straight or slightly deformed, with clear-coloured small tubercles. There is a curved spine on the inner side of the carpus.
- The lost claws regenerate during the next moult, but in a smaller size.

Abdomen - side view

Astacus astacus (noble crayfish)

- The dorsal colour is similar to the rest of the body, while the ventral one is clearer.
- The pleura have the same colour and a heartshaped aspect with a rounded tip.

Astacus leptodactylus (narrow-clawed crayfish)

- The dorsal colour is similar to the rest of the body, while the ventral one is clearer.
- The pleura have the same colour, a heartshaped aspect with a rounded tip and ended with a spine.

Abdomenul - side view

Austropotamobius torrentium (stone crayfish)

- The dorsal colour is similar to the rest of the body, while the ventral one is clearer.
- The pleura have the same colour, a heartshaped aspect with a rounded tip.

Orconectes limosus (spiny-cheek crayfish)

- Dorsally, the background colour is similar to the rest of the body, while the ventral one is clearer. There are often reddish-brown stripes on the abdominal segments.
- The pleura may be stained in red and have a heartshaped aspect, with a well rounded tip.

♂ Gonopods I and II

Astacus astacus (noble crayfish)

- The distal lobe (the rolled lobe) of the first gonopod (pleopod) measures about ½ of the total length.

- The exopodite of the second gonopod (pleopod) has about the same length as the endopodite, the distal lobe of the endopodite (the rolled lobe) measuring approximately 1/5 of the total length.

Astacus leptodactylus (narrow-clawed crayfish)

- The distal lobe (the rolled lobe) of the first gonopod (pleopod) measures about ½ of the total length.

- The exopodite of the second gonopod (pleopod) has about the same length as the endopodite, the distal lobe of the endopodite (the rolled lobe) measuring approximately 1/2 of the total length.

♂ Gonopods I and II

Austropotamobius torrentium (stone crayfish)

- The distal lobe (the rolled lobe) of the first gonopod (pleopod) measures about 1/2 of the total length.

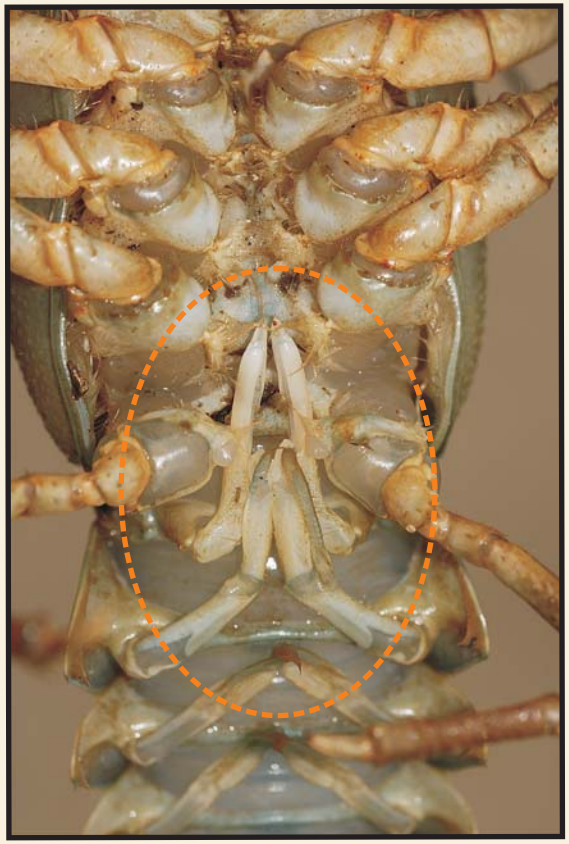
- The exopodite of the second gonopod (pleopod) measures no more than 2/3 of the endopodite's length, the distal lobe of the endopodite (the rolled lobe) representing approximately 1/2 of the total length.

Orconectes limosus (spiny-cheek crayfish)

- The distal lobe (the rolled lobe) of the first gonopod (pleopod) measures about 2/3 of the total length.

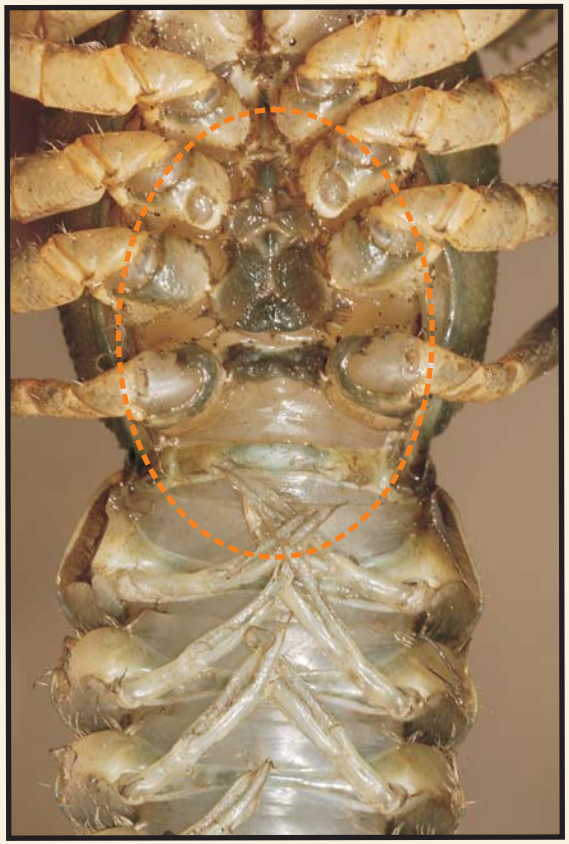
- The exopodite of the second gonopod (pleopod) measures no more than 4/5 of the endopodite length, the distal lobe of the endopodite (the rolled lobe) representing approximately 1/5 of the total length.

Sexual dimorphism - thorax and abdomen, ventral view



Male

The first two pairs of pleopods are transformed into gonopods and oriented backwards on the sternal plate; the genital openings are at the base of the 5th pair of legs.



Female

The first pair of pleopods is rudimentary, the other ones approximately equal, the sternal plate clear, the genital openings located at the base of the third pair of legs.

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Sexual dimorphism - abdomen, dorsal view

Male
Slender abdomen with non-flared pleura.

Female
Broad abdomen with flared pleura.

Habitat

- It lives in clean flowing waters (springs, streams, rivers) and even lakes, from the mountain to the hill area. It accidentally can get into caves (during floods), but does not handle very well in this environment.
- It digs galleries in the river banks or it lives hidden among submerged roots, and in their absence it hides under rocks or boulders.
- It is especially active at night, consuming almost any kind of food.
- It is sensitive to oxygen deficiency; massive loss can be registered in the eutrophic habitats during hot summers.

Astacus astacus (noble crayfish)

- It lives in slow flowing water or lakes, ponds and even channels, from the plain to the hill area.
- It hides within dirt banks or submersible vegetation, using even other various objects from waters.
- It is active both night and day, consuming almost any kind of food.
- It is less sensitive to oxygen deficiency; it may live several days on dry land at low temperatures. It can not stand chemical pollution.

Astacus leptodactylus (narrow-clawed crayfish)

- It lives in cold flowing waters (springs, streams, small rivers) in the mountain and submontane area, rarely to be found in rivers or lakes. It can get into caves where it usually accommodates well.
- It prefers galleries that it digs into river banks, but it often lives hidden among submerged roots or under rocks or boulders.
- It is especially active at night, consumes almost any kind of food.
- It is very sensitive to oxygen deficiency and pollutants.

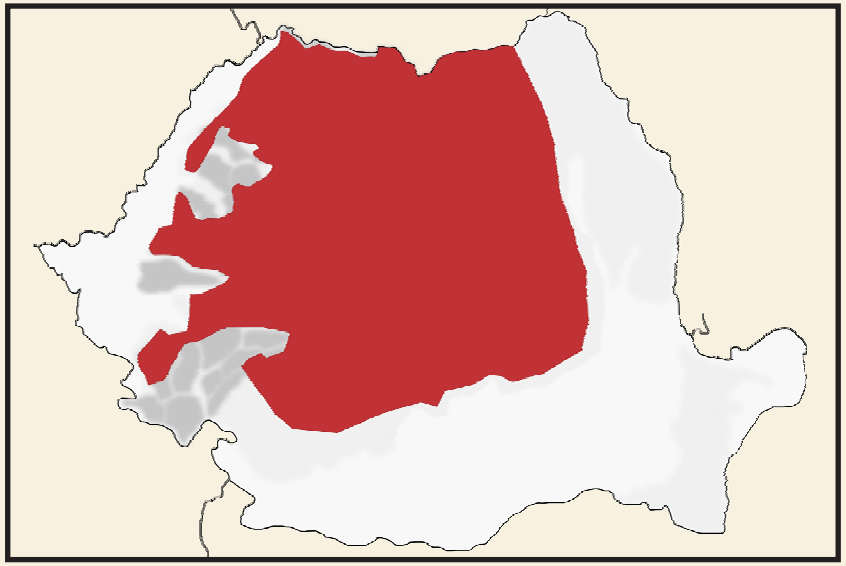
Austropotamobius torrentium (stone crayfish)

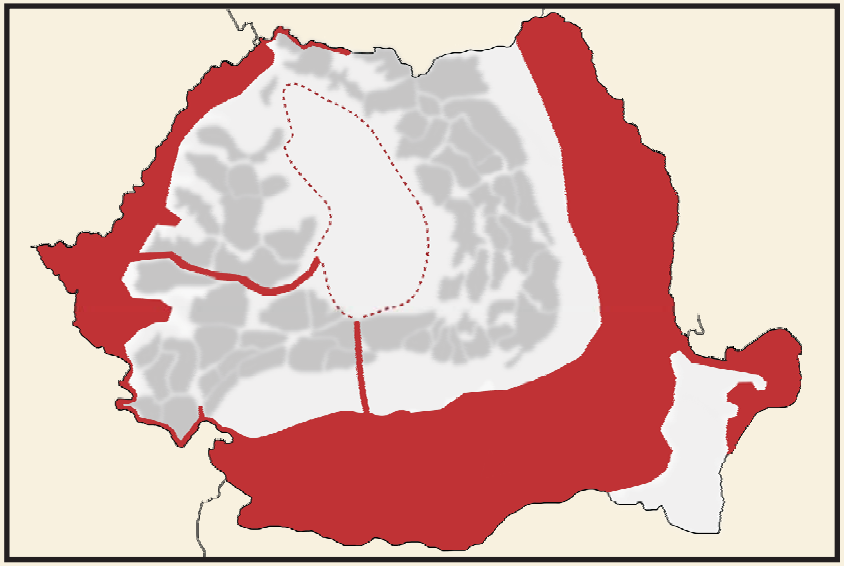
- Ecological preferences of the species are turbid waters with muddy sublayers, in the plain, large rivers, canals, lakes or ponds areas. It can nevertheless live in springs with rocky sublayers.
- It hides within the river banks or the submersible vegetation, using even various objects from waters.
- It is active both night and day, consuming almost any kind of food.
- It is highly resistant to oxygen deficiency or to low quality water, which gives it a great advantage in the invasion process. It can successfully live even several days without water.

Orconectes limosus (spiny-cheek crayfish)

Distribution in Romania and Europe

- most probable distribution area; - possible expansion





Astacus astacus (noble crayfish)

Indigenous to Romania, the area of distribution covers almost the entire country, lacking from both the high mountains and the plain area. Its area and the area of the *Austropotamobius torrentium* overlap only slightly.

Its distribution area occupies the center and the east of Europe, from France to South, Central and North Russia. It reaches Finland and Sweden, being very rare in both Norway and Britain. In the south, it can be found all the way to Greece and Northern Italy.

Astacus leptodactylus (narrow-clawed crayfish)

Indigenous to Romania, the distribution area covers the south, the west and the east side of the country, living in large rivers as well as in lakes, ponds or canals. As the spiny-cheek crayfish (*Orconectes limosus*) invaded its territory, the *Astacus leptodactylus* frequently lives with it in the same habitat.

The Ponto-Caspian area is today extended to almost the entire continent because of its artificial introduction into Western Europe. The only countries where it can not be found are Spain, Portugal, Ireland, Norway, Sweden and most of Greece.

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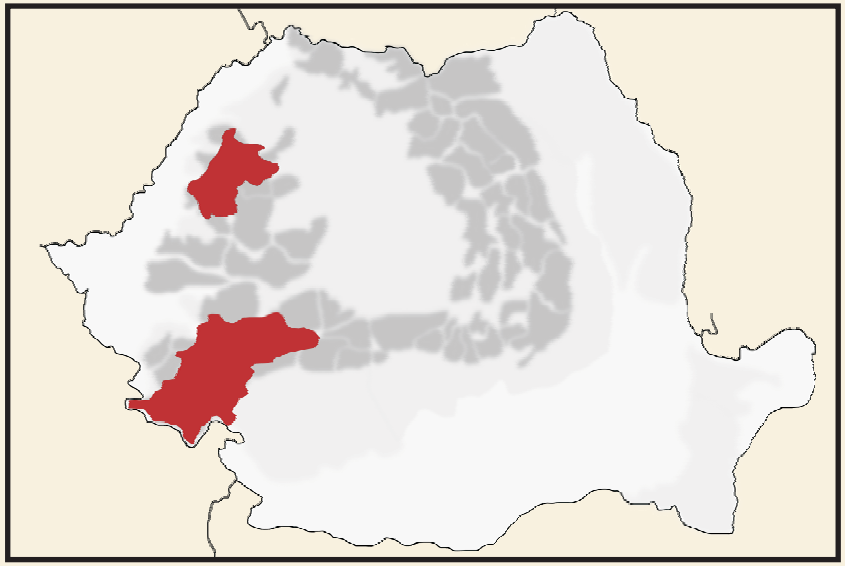
Distribution in Romania and Europe

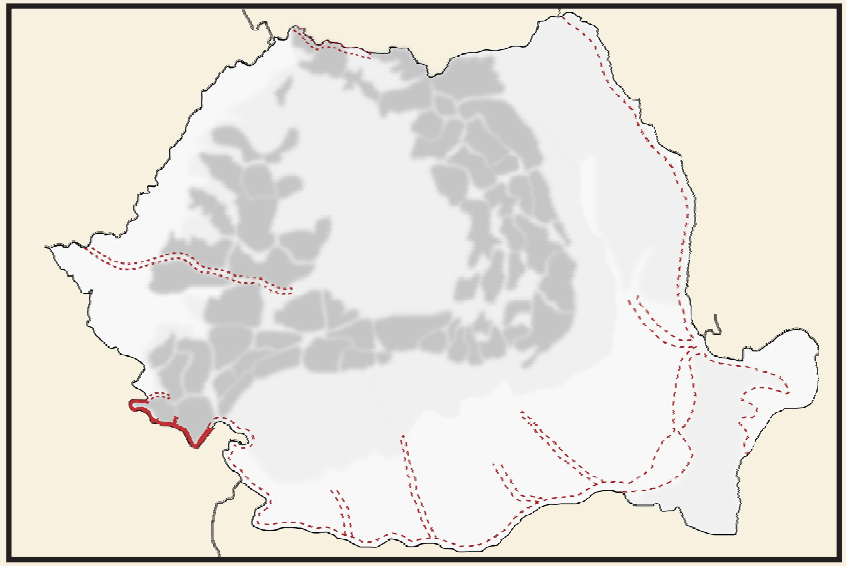
- most probable distribution area; - possible expansion



Austropotamobius torrentium (stone crayfish)

Indigenous species to Romania, the distribution area is divided in two main geographical regions by the catchment of river Mures: one metapopulation in the south–west and the second restricted to the north-western region.

In Europe it occupies a small area in both center and south. The northern boundary of the current spread region is Germany and the Czech Republic; to the west it reaches Luxembourg and eastern France, to the east it reaches Romania and Bulgaria and to the south Greece and even Turkey.



Orconectes limosus (spiny-cheek crayfish)

Species of North American origin, it has recently been reported in Romania in the Danube. The presence of the species in Romania currently overlaps only the *Astacus leptodactylus* areal, but it is very possible that this species areal will expand in the coming years.

The species was deliberately introduced in Europe in 1890 through an import from the North America. Since then its areal has been expanding and now it occupies a large part of the western and central Europe, from France, Great Britain, Italy all the way to Serbia, Romania, Poland, Belarus and Lithuania.

Conservation status

Government Emergency Ordinance no. 57/2007 on the regime of *the natural protected areas, the conservation of natural habitats, of wild flora and fauna*, supplemented and amended by the **Government Emergency Ordinance no. 154/2008** - community interest species, included in Appendix 5A

Fauna species protected by the **Berne Convention** on the conservation of wildlife in Europe, adopted by Romania by **Law 13/1993** - species listed in Appendix 3

Plant and animal species of community interest whose drawing from the nature and exploitation are likely to be subject to the management measures of the **European Council Directive no. 92/43 EEC** on the conservation of both the natural habitats and the wild fauna and flora – Appendix 5

IUCN Red List – vulnerable

Astacus astacus (noble crayfish)

The species is not included

Astacus leptodactylus (narrow-clawed crayfish)

Conservation status

Government Emergency Ordinance no. 57/2007 on *the regime of the natural protected areas, the conservation of natural habitats, of flora and fauna*, supplemented and amended by the **Government Emergency Ordinance no 154/2008** - priority species listed in Appendix 3

MMDD Order no. 1964/2007 on *the establishment of natural protected area system of the sites of community importance, as part of the European ecological network Natura 2000 in Romania*

Fauna species protected by the **Berne Convention** on the conservation of wildlife in Europe, adopted by Romania by **Law 13/1993** - species listed in Appendix 3

Plant and animal species of community interest whose drawing from the nature and exploitation are likely to be subject to the management measures of the **European Council Directive no. 92/43 EEC** on the conservation of both the natural habitats and the wild fauna and flora – Appendix 5

IUCN Red List – vulnerable

Austropotamobius torrentium (stone crayfish)

The species is not included

Orconectes limosus (spiny-cheek crayfish)

Selective bibliography

1. BĂCESCU M.C. (1967): Fauna Republicii Socialiste România - Crustacea, Decapoda. Editura Academiei Republicii Socialiste România, Bucureşti: 187-219
2. BĂNĂRESCU P., OPRESCU T. (1971): Ihtiofauna Râului Nera şi ocrotirea ei. *Ocrotirea Naturii* - Bucureşti 15 (2): 139-148
3. CĂLINESCU R.I. (1929): *Astacus torrentium* Schrank, în Munții Olteniei. *Revista arhivelor Olteniei* 8 (41/42): 106-109
4. ENTZ G. (1912): Uber die Flußkrebse Ungarns. *Mathematischen Naturwissenschaflichen Berichte aus Ungarn* 30 (2): 67-125
5. HOLDICH D.M. (2002): Distribution of crayfish in Europe and some adjoining countries. *Bulletin Français de la Pêche et de la Pisciculture* 367: 611-650
6. HOLDICH D.M., REYNOLDS J.D., SOUTY-GROSSET C., SIBLEY P.J. (2009): A review of the ever increasing threat to European crayfish from non-indigenous crayfish species *Knowledge and Management of Aquatic Ecosystems*: 394-395
7. IUCN (2010): IUCN Red List of Threatened Species. Version 2010.1. <www.iucnredlist.org>. Downloaded on 11 June 2010
8. MACHINO I., HOLDICH D.M. (2006): Distribution of crayfish in Europe and adjacent countries: updates and comments. Freshwater Crayfish 15: 292-323
9. MARCU O. (1929): Die Süβwasserdekapoden und ihre Verbreitung in der Bukovina. *Verhandlungen und Mitteilungen des Siebenbürg. Vereins für Natur-Vissenschaften zu Hermannstadt* 79-80: 86-88
10. PAPADOPOL M., DIACONU G. (1987). Contributions to the knowledge of the morphology of the Astacid Crayfishes from Romania. *Travaux du Muséum d'Histoire naturelle "Grigore Antipa"* 29: 55-62
11. PÂRVULESCU L. (2009): The epigean freshwater malacostracans (Crustacea: Malacostraca) of the rivers in the Anina Mountains (SW Romania). *Studia Universitatis Babeş – Bolyai, seria Biologia* 54 (2): 3-17
12. PÂRVULESCU L. (2008): The aquatic malacostracean fauna (Crustacea: Malacostraca) from the Mehedinți Plateau Rivers. *Studia Universitatis Babeş – Bolyai, seria Biologia* 53 (2): 17-24
13. PÂRVULESCU L., PALOŞ C., MOLNAR P. (2009): First record of the spiny-cheek crayfish *Orconectes limosus* (Rafinesque, 1817) (Crustacea: Decapoda: Cambaridae) in Romania. *North-Western Journal of Zoology* 5 (2): 424-428
14. PÂRVULESCU L., PETRESCU I. (2010): The stone crayfish *Austropotamobius torrentium* (Schrank, 1803) in the SW of Romania mountain and submountain area. Travaux du Museum National d'Histoire Naturelle „Grigore Antipa", 52
15. PÖKL M., HOLDICH D.M., PENNERSTORFER J. (2006): Identifyng native and alien crayfish species in Europe, European Project Craynet Publication, Poitiers, France
16. SCRIBAN I.A. (1908): Note sur les Ecrevisses de Roumanie. *Annales Scientifiques de l'Université de Jassy* 5: 80-83. (Jassy = Iasi
17. SOUTY-GROSSET C., HOLDICH D.M., NOËL P.Y., REYNOLDS J.D., HAFFNER P. (Eds.) (2006): Atlas of Crayfish in Europe. Muséum national d'Histoire naturelle, Paris (Patrimoines naturels, 64)
18. TATOLE V., IFTIMIE A., STAN M., IORGU E.I., IORGU I., OȚEL V. (2009): Speciile de animale Natura 2000 din România. Muzeul Național de Istorie Naturală „Grigore Antipa", Bucureşti

Contact

Lucian Pârvulescu PhD.

West University of Timişoara, Faculty of Chemistry, Biology, Geography
Pestalozzi 16A Street
300115 Timişoara

mobil phone: +4 0766489256
e-mail: parvulescubio@cbg.uvt.ro or parvulescubio@yahoo.com

Crayfish of Romania

For distribution maps, publications and many other informations visit the online database at www.crayfish.ro, available in both English and Romanian.

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