UNIWERSYTET ŚLĄSKI
W KATOWICACH

INSTYTUT OCHRONY PRZYRODY PAN

Appendix A

Harmonia^{+PL} – procedure for negative impact risk assessment for invasive alien species and potentially invasive alien species in Poland

QUESTIONNAIRE

A0 | Context

Questions from this module identify the assessor and the biological, geographical & social context of the assessment.

a01. Name(s) of the assessor(s):

first name and family name

1. Maciej Bonk
2. Przemysław Śmietana
3. Karolina Mazurska

acomm01. Comments:

	degree	affiliation	assessment date
(1)	mgr	Institute of Nature Conservation, Polish Academy of Sciences in Cracow	30-01-2018
(2)	dr hab.	Department of Plant Ecology and Environmental Protection, Faculty of Biology, University of Szczecin	01-02-2018
(3)	mgr	Institute of Nature Conservation, Polish Academy of Sciences in Cracow	02-02-2018

a02. Name(s) of ***the species*** under assessment:

Polish name: –

Latin name: ***Faxonius rusticus*** (Girard, 1852)

English name: Rusty crayfish

Fundusze Europejskie Infrastruktura i Środowisko

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acomm02. Comments:

Polish name (synonym I)	Polish name (synonym II)
–	–
Latin name (synonym I)	**Latin name (synonym II)**
Orconectes rusticus	–
English name (synonym I)	**English name (synonym II)**
–	–

a03. **Area** under assessment:

Poland

acomm03. Comments:

–

a04. **Status** of *the species* in Poland. *The species* is:

	native to Poland
X	alien, absent from Poland
	alien, present in Poland only in cultivation or captivity
	alien, present in Poland in the environment, not established
	alien, present in Poland in the environment, established

aconf01. Answer provided with a

low	medium	high
	X	

level of confidence

acomm04. Comments:

This species can be offered for sale as an aquarium animal (Chucholl 2013 – P). However, the import of individuals is possible. In the United States, from where rusty crayfish originates, it is the most common species used for educational purposes. In Europe, the only reported population in the river (Dessoubre) in France near the border with Switzerland (Carral et al. 2006 – P), was originally recognised as the population of *Faxonius rusticus*, and due to a genetic review classified as *Orconectes juvenilis* (Mrugała et al. 2015 – P). There is a very high risk of uncontrolled introduction of this species in Europe due to its relatively high commercial value (large body size, including large claws) and easy access to live individuals on the market, In the natural environment in Poland, this species has not been reported so far. There are also no data on its keeping for ornamental purposes in Poland.

a05. The impact of *the species* on major domains. *The species* may have an impact on:

X	the environmental domain
	the cultivated plants domain
X	the domesticated animals domain
X	the human domain
	the other domains

acomm05. Comments:

Faxonius rusticus has a high metabolism rate (twofold higher than in case of related species) (Jones and Momot 1983 – P). Thus, its feeding behaviour pressure has a strong impact on occupied biocenoses sites forming the serious threat to local biodiversity (Logde et al. 1985, Gunderson 1995 – P). This species is a serious competitor to spiny-cheek crayfish (Momot 1997, Hamr 1999 – P). Like in case of displacing spiny cheek crayfish from the invaded areas, this species is expected to displace the native European crayfish even more effectively. In its early stage of life, this species is a bentophage (an organism feeding on bottom organisms) and is a fish competitor (Hamr 2002 – P). These features make it a potentially harmful to wild animals and aquaculture stock. Being the North-American species, it is potentially a crayfish plague vector which is harmful to animals in the natural

	environment and in farms. It may have a potentially negative effect on human health by carrying some species of trematodes. Under favourable conditions (clay), this species digs a network of burrows in the bottom (Hamr 1997 – P), which is potentially dangerous for terrestrial hydrotechnic systems. However, the risk connected with digging burrows is quite low as this phenomenon is rather rare.

A1 | Introduction

Questions from this module assess the risk for *the species* to overcome geographical barriers and – if applicable – subsequent barriers of captivity or cultivation. This leads to *introduction*, defined as the entry of *the organism* to within the limits of *the area* and subsequently into the wild.

a06. The probability for ***the species*** to expand into Poland's natural environments, **as a result of self-propelled expansion** after its earlier introduction outside of the Polish territory is:

X	low
	medium
	high

aconf02.	Answer provided with a	low	medium **X**	high	level of confidence

acomm06. Comments:

This species does not occur in neighbouring countries of Poland. This species has great abilities to migrate in river systems at a rate up to 4.7 km/year (Momot 1997 – P); however, the effective expansion of this species by natural means from few stands outside Poland seems to be highly unlikely.

a07. The probability for *the species* to be introduced into Poland's natural environments by **unintentional human actions** is:

X	low
	medium
	high

aconf03.	Answer provided with a	low	medium **X**	high	level of confidence

acomm07. Comments:

If the species occurs in waters of neighbouring countries, it can be potentially introduced to Poland with fishing and angling equipment. The probability is rather low regarding the current conditions and its settlement in Europe. The accidental spreading from other countries should not happen more than once per decade.

a08. The probability for *the species* to be introduced into Poland's natural environments by **intentional human actions** is:

	low
	medium
X	high

aconf04.	Answer provided with a	low	medium	high **X**	level of confidence

acomm08. Comments:

The intentional release of crayfish from aquaria to open waters seems to happen quite often. If there is an interest in farming this species, such cases will be more frequent – more than 10 times per decade. The ornamental fish keeping sector seems to be the most probable source of the potential introduction of this species. Large body size of this species

and a high metabolism rate increase the probability of its introduction to open water as the method of removing such individuals from farming when they go beyond expectations of fish keepers. An individual can start the stable population on the introduction site because an inseminated crayfish female can store sperm for many months.

A2 | Establishment

Questions from this module assess the likelihood for *the species* to overcome survival and reproduction barriers. This leads to *establishment*, defined as the growth of a population to sufficient levels such that natural extinction within *the area* becomes highly unlikely.

a09. Poland provides **climate** that is:

	non-optimal
	sub-optimal
X	optimal for establishment of *the species*

aconf05. Answer provided with a

low	medium	high
		X

level of confidence

acomm09. Comments:

Faxonius rusticus is very active when temperatures exceed 6-8°C. It enters a hibernation below 4°C (Prins 1968 – P). Thus, this species requirements are very similar to climatic requirements of spiny-cheek crayfish *Orconectes limosus*. They have the common area of coexistence in North America (Hamr 2002 – P). Taking into account spreading of spiny-cheek crayfish in Poland, these climate conditions should be assumed as optimal also for *Faxonius rusticus*. In accordance with Harmonia^{+PL} – the procedure of negative impact risk assessment for potentially invasive alien species in Poland, the climatic similarity between Poland and its natural habitat is within the range of 94-100%.

a10. Poland provides **habitat** that is

	non-optimal
	sub-optimal
X	optimal for establishment of *the species*

aconf06. Answer provided with a

low	medium	high
		X

level of confidence

acomm10. Comments:

Results of introducing this species in America reveal its high adaptive skills to different types of water habitats and simultaneous competitive displacement of spiny-cheek crayfish (Klocker and Strayer 2004 – P). Thus, conditions for establishment of *Faxonius rusticus* in Poland are optimal. This species occurs in rivers and stagnant waters. However, it is difficult to determine which types of habitats are the most favourable to them.

A3 | Spread

Questions from this module assess the risk of *the species* to overcoming dispersal barriers and (new) environmental barriers within Poland. This would lead to spread, in which vacant patches of suitable habitat become increasingly occupied from (an) already-established population(s) within Poland.

Note that spread is considered to be different from range expansions that stem from new introductions (covered by the Introduction module).

a11. The capacity of *the species* to disperse within Poland by natural means, **with no human assistance**, is:

	very low
	low
	medium
X	high
	very high

aconf07.	Answer provided with a	low	medium **X**	high	level of confidence

acomm11. Comments:

Assessment (Type of data: C)
Currently, this species has not been reported in Poland. However, if the species occurs in open waters forming connected systems, it will become a dangerous invasive species which can become widespread quickly. Its high dispersion capacities are confirmed by reported spreading distance of nearly 5 km per year in North America (Momot 1997 – P).

a12. The frequency of the dispersal of *the species* within Poland by **human actions** is:

	low
	medium
X	high

aconf08.	Answer provided with a	low	medium	high **X**	level of confidence

acomm12. Comments:

Due to its low attractiveness among aquarists (probably because of too big body size), this species is not commercially available in Poland. Still, there is a high risk that for the same reasons, this species will attract the interest of owners, administration, or fisheries, which is connected with the serious danger of its illegal introduction, and consequently, spreading by means of e.g. fishing equipment. An effective introduction is possible even with one individual because female crayfish can store sperm in a sperm packet for many months (Gunderson 1995 – P).

A4a | Impact on the environmental domain

Questions from this module qualify the consequences of *the species* on wild animals and plants, habitats and ecosystems.

Impacts are linked to the conservation concern of targets. Native species that are of conservation concern refer to keystone species, protected and/or threatened species. See, for example, Red Lists, protected species lists, or Annex II of the 92/43/EWG Directive. Ecosystems that are of conservation concern refer to natural systems that are the habitat of many threatened species. These include natural forests, dry grasslands, natural rock outcrops, sand dunes, heathlands, peat bogs, marshes, rivers & ponds that have natural banks, and estuaries (Annex I of the 92/43/EWG Directive).

Native species population declines are considered at a local scale: limited decline is considered as a (mere) drop in numbers; severe decline is considered as (near) extinction. Similarly, limited ecosystem change is considered as transient and easily reversible; severe change is considered as persistent and hardly reversible.

a13. The effect of *the species* on native species, through **predation, parasitism or herbivory is**:

	inapplicable
	low
	medium
X	high

aconf09.	Answer provided with a	low	medium	high **X**	level of confidence

acomm13. Comments:

This species has a great potential to induce pressure on biocenoses into which it has been introduced. *Faxonius rusticus* is able to reduce diversified composition of plant species (through herbivory) and animal species (through predation, e.g. Kreps et al. 2012 – P). Thus, it generally affects biodiversity (Lodge and Lorman 1987, Olsen et al. 1991 – P). In Poland, this species can affect many protected plants, including *Marsilea quadrifolia* whose reintroduction was difficult (this is a strictly protected species, extinct in the wild – this species does not occur in its natural habitats in Poland – EW category). As the population of this type of fern is low, occurrence of crayfish on its stands may result in a serious drop in its population, and even extinction.

a14. The effect of *the species* on native species, through **competition** is:

	low
	medium
X	high

aconf10.	Answer provided with a	low	medium	high **X**	level of confidence

acomm14. Comments:

This species displaces spiny-cheek crayfish in North America through competition. Thus, it is a considerably stronger competitor for native species: noble crayfish *Astacus astacus*, Danube crayfish *Astacus leptodactylus*) than spiny-cheek crayfish. According to literature data, intensive feeding of *Faxonius rusticus* on benthos in North America makes this species a strong competitor for benthic and young predatory fish (Hamr 2002 – P). There is a high level of confidence that it is a strong competitor for noble crayfish – a partially protected species, listed in the Polish Red Data Book of Animals, categorized as VU – a vulnerable species which is likely to become endangered (Krzywosz and Śmietana 2004 – P).

a15. The effect of *the species* on native species, through **interbreeding** is:

X	no / very low
	low
	medium
	high
	very high

aconf11.	Answer provided with a	low	medium **X**	high	level of confidence

acomm15. Comments:

This species does not interbreed with native species, e.g. of *Astacus* genus. However, it forms hybrids with North American related species, including spiny-cheek crayfish and *O. propinquus* (Roush 1997, Hobbs et al. 1989 – P). Hybrids of *O. rusticus* and *O. propinquus* create a stronger competition than the parent species (Roush 1997 – P).

a16. The effect of *the species* on native species by **hosting pathogens or parasites** that are harmful to them is:

	very low
	low
	medium
	high
X	very high

aconf12.	Answer provided with a	low	medium	high **X**	level of confidence

acomm16. Comments:

Faxonius rusticus is an intermediate host of trematodes of *Microphallus* genus, for which reptiles, birds, and mammals can be a definitive host (Sargent 2014 – P). For definitive hosts, infection can be fatal. There are no results from studies confirming that this species hosts crayfish plague (fatal disease to native species of crayfish in Europe). However, it should be assumed with high level of probability, and even confidence, that due to its origin, this species is a host to crayfish plague. Crayfish plague is a disease of crustacea from the list of OIE – Listed diseases, infections and infestations in force in 2018 – I).

a17. The effect of *the species* on ecosystem integrity, by **affecting its abiotic properties** is:

X	low
	medium
	high

aconf13.	Answer provided with a	low	medium **X**	high	level of confidence

acomm17. Comments:

This species is classified as showing relatively low burrowing behavior (Hamr 2002 – P), which is the only way that crayfish can affect abiotic properties. Only under favourable conditions, such as clay bottom and large population, this species can significantly affect abiotic properties.

a18. The effect of *the species* on ecosystem integrity, by **affecting its biotic properties** is:

	low
	medium
X	high

aconf14.	Answer provided with a	low	medium	high **X**	level of confidence

acomm18. Comments:

This species has a strong impact on water habitats, into which it has been introduced, through feeding behaviour. It is considered as the most serious destructive factor for submerged plant cover (Lodge and Lorman 1987 – P). It was particularly confirmed when this species was introduced to lakes with lower trophic level, where diversity of aquatic plants was rather poor (Hamr 2002 – P). This species has a significant adverse effect on invertebrates assemblages (Kreps et al. 2012 – P). Taking into account the expected considerable effect on the food chain (Roth et al. 2005 – P), this species should be assumed to have an important role also in Poland and to affect the ecosystem integrity when introduced. Therefore, it is a potentially serious threat to biocenoses of Polish waters, individual organisms and groups of organisms. It may also pose a threat to ecosystems and habitats of conservation concern, e.g. 3260 – water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation, 3150 – natural eutrophic lakes with Magnopotamion or Hydrocharition, 3140-1 – hard oligo-mesotrophic waters with benthic vegetation of Chara spp. and 3140-2 – weak oligo-mesotrophic waters with benthic vegetation of Nitellion flexilis

A4b | Impact on the cultivated plants domain

Questions from this module qualify the consequences of *the species* for cultivated plants (e.g. crops, pastures, horticultural stock).

For the questions from this module, consequence is considered 'low' when presence of *the species* in (or on) a population of target plants is sporadic and/or causes little damage. Harm is considered 'medium' when *the organism's* development causes local yield (or plant) losses below 20%, and 'high' when losses range >20%.

a19. The effect of *the species* on cultivated plant targets through **herbivory or parasitism** is:

	inapplicable
X	very low
	low
	medium
	high
	very high

aconf15.	Answer provided with a	low	medium	high **X**	level of confidence

acomm19. Comments:

In Poland, there is no cultivation system of aquatic plants. The likelihood of such cultivation systems is low. Thus, the effect of this species on cultivation of plants through herbivory should be assessed as very low.

a20. The effect of *the species* on cultivated plant targets through **competition** is:

X	inapplicable
	very low
	low
	medium
	high
	very high

aconf16.	Answer provided with a	low	medium	high	level of confidence

acomm20. Comments:

This species is not a plant.

a21. The effect of *the species* on cultivated plant targets through **interbreeding** with related species, including the plants themselves is:

X	inapplicable
	no / very low
	low
	medium
	high
	very high

aconf17.	Answer provided with a	low	medium	high	level of confidence

acomm21. Comments:

This species is not a plant.

a22. The effect of *the species* on cultivated plant targets by **affecting the cultivation system's integrity** is:

X	very low
	low
	medium
	high
	very high

aconf18.	Answer provided with a	low	medium	high **X**	level of confidence

acomm22. Comments:

In Poland, there is no cultivation system of aquatic plants. The likelihood of such cultivation systems is low. Thus, the effect of this species on cultivation of plants by affecting the integrity of such systems should be assessed as very low.

a23. The effect of *the species* on cultivated plant targets by hosting **pathogens or parasites** that are harmful to them is:

- [**X**] very low
- [ ] low
- [ ] medium
- [ ] high
- [ ] very high

aconf19.	Answer provided with a	low	medium	high **X**	level of confidence

acomm23. Comments:

There are not any known pathogens or parasites hosted by these species, which could be harmful to crops.

A4c | Impact on the domesticated animals domain

Questions from this module qualify the consequences of *the organism* on domesticated animals (e.g. production animals, companion animals). It deals with both the well-being of individual animals and the productivity of animal populations.

a24. The effect of *the species* on individual animal health or animal production, through **predation or parasitism** is:

- [ ] inapplicable
- [ ] very low
- [ ] low
- [ ] medium
- [**X**] high
- [ ] very high

aconf20.	Answer provided with a	low **X**	medium	high	level of confidence

acomm24. Comments:

A high metabolism rate of *Faxonius rusticus* suggests high demand on food, making this species an aggressive predator. These facts may potentially cause losses in extensive fish farms, particularly pond farms, and crayfish farms. Potentially, this species can feed on fish eggs and juvenile fish in aquaculture. However, it is difficult to predict precisely their interaction with farmed animals. Thus, the answer is provided with a low level of confidence. The consequence can be potentially high, but the likelihood is medium.

a25. The effect of *the species* on individual animal health or animal production, by having properties that are hazardous upon **contact**, is:

- [ ] very low
- [ ] low
- [**X**] medium
- [ ] high
- [ ] very high

aconf21.	Answer provided with a	low	medium **X**	high	level of confidence

acomm25. Comments:

It is an aggressive species with relatively large claws which constitutes a threat to animals (fish, crayfish) upon direct contact with farmed fish or crayfish. Consequences of hurt can be medium, and frequencies of such cases are difficult to predict, probably medium (1-100 cases per 100 000 animals per year).

a26. The effect of *the species* on individual animal health or animal production, by hosting **pathogens or parasites** that are harmful to them, is:

	inapplicable
	very low
	low
	medium
	high
X	very high

aconf22.	Answer provided with a	low	medium **X**	high	level of confidence

acomm26. Comments:

Faxonius rusticus is highly likely to be a vector for crayfish plague (like for example *Orconctes limosus*). Crayfish plague is a disease of crustacea from the list of OIE – Listed diseases, infections and infestations in force in 2018 – I). It is a fatal disease for all native European crayfish, including crayfish farmed in Polish conditions – Danube crayfish and noble crayfish.

A4d | Impact on the human domain

Questions from this module qualify the consequences of *the organism* on humans. It deals with human health, being defined as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity (definition adopted from the World Health Organization).

a27. The effect of *the species* on human health through **parasitism** is:

X	inapplicable
	very low
	low
	medium
	high
	vert high

aconf23.	Answer provided with a	low	medium	high	level of confidence

acomm27. Comments:

This species is not a parasite.

a28. The effect of *the species* on human health, by having properties that are hazardous upon **contact**, is:

	very low
X	low
	medium
	high
	very high

aconf24.	Answer provided with a	low	medium	high **X**	level of confidence

acomm28. Comments:

The risk of painful hurt by proportionally large claws (one of the biggest claws among related species), with a sharp tip is relatively high. More serious danger can be connected with infections caused by such injuries. However, the likelihood of such cases should be medium at the most (1-100 cases per 100 000 humans per year), and consequences – low (rare cases of medical consultations, no absence from work, lack of permanent impairments, low level of stress).

a29. The effect of *the species* on human health, by hosting **pathogens or parasites** that are harmful to humans, is:

	inapplicable
	very low
X	low
	medium
	high
	very high

aconf25.	Answer provided with a	low **X**	medium	high	level of confidence

acomm29. Comments:

The species is a host to trematodes of *Microphallus* genus, for which reptiles, birds, and mammals can be a definitive host (Sargent 2014 – P). There are no studies whether humans can be infected with trematodes. However, there is no basis to exclude such a risk. These diseases are severe and can lead to the permanent health impairment, and if untreated, they can cause death. But there is some uncertainty whether trematodes are human parasites, so the likelihood is low. Infections of wounds caused by pinching (pathogens on crayfish carapace or near wounds) are possible. The answer is provided with a low level of confidence as there are no studies on this issue and it is uncertain whether a common parasite for this species and humans exists.

A4e | Impact on other domains

Questions from this module qualify the consequences of *the species* on targets not considered in modules A4a-d.

a30. The effect of *the species* on causing damage to **infrastructure** is:

X	very low
	low
	medium
	high
	very high

aconf26.	Answer provided with a	low	medium **X**	high	level of confidence

acomm30. Comments:

This species digs burrows only in exceptionally favourable habit conditions and when its population is relatively large. On the above basis, there is a low likelihood of risk to water tightness of the terrestrial hydraulic equipment posed by this species. Even if such a case occurs, it will not be significant. Consequences of such events should be reversible (low), and their likelihood low (no more than 1 case per 100 000 facilities per year).

A5a | Impact on ecosystem services

Questions from this module qualify the consequences of *the organism* on ecosystem services. Ecosystem services are classified according to the Common International Classification of Ecosystem Services, which also includes many examples (CICES Version 4.3). Note that the answers to these questions are not used in the calculation of the overall risk score (which deals with ecosystems in a different way) but can be considered when decisions are made about management of *the species*.

a31. The effect of *the species* on **provisioning services** is:

X	significantly negative
	moderately negative
	neutral
	moderately positive
	significantly positive

aconf27.	Answer provided with a	low	medium	high **X**	level of confidence

acomm31. Comments:

This species has a significant ecological potential. If large populations are reported, it may have a direct and indirect impact which leads to reduced secondary productivity of (other than this species) zoocenosis elements, including populations of fish of economic value and farmed crayfish.

a32. The effect of *the species* on **regulation and maintenance services** is:

X	significantly negative
	moderately negative
	neutral
	moderately positive
	significantly positive

aconf28.	Answer provided with a	low	medium	high **X**	level of confidence

acomm32. Comments:

Due to its strong impact on aquatic organisms, it can affect ecosystems (e.g. Kreps 2012 – P). This species has a great potential to induce changes in biocenoses of sites, into which it has been introduced. *Faxonius rusticus* is known to be capable of reducing significantly the level of biodiversity (Lodge and Lorman 1987, Olsen et al. 1991 – P), including diversified composition of plant species (through herbivory) and animal species (through predation).

a33. The effect of *the species* on **cultural services** is:

	significantly negative
X	moderately negative
	neutral
	moderately positive
	significantly positive

aconf29.	Answer provided with a	low	medium	high **X**	level of confidence

acomm33. Comments:

Faxonius rusticus is an undesirable new species of crayfish, whose occurrence may additionally disturb the cultural significance of crayfish in Poland. It disturbs some conceptual connections of culture, which were historically developed on the basis of features of native

	species (e.g. a popular schematic association with the saying: "the presence of crayfish means clean water", which does not have to be true in case of *Faxonius rusticus*).

A5b | Effect of climate change on the risk assessment of the negative impact of *the species*

Below, each of the Harmonia^{+PL} modules is revisited under the premise of the future climate. The proposed time horizon is the mid-21st century. We suggest taking into account the reports of the Intergovernmental Panel on Climate Change. Specifically, the expected changes in atmospheric variables listed in its 2013 report on the physical science basis may be used for this purpose. The global temperature is expected to rise by 1 to 2°C by 2046-2065.

Note that the answers to these questions are not used in the calculation of the overall risk score but can be but can be considered when decisions are made about management of *the species*.

a34. INTRODUCTION – Due to climate change, the probability for *the species* to overcome geographical barriers and – if applicable – subsequent barriers of captivity or cultivation in Poland will:

	decrease significantly
	decrease moderately
	not change
X	increase moderately
	increase significantly

aconf30.	Answer provided with a	low	medium	high **X**	level of confidence

acomm34.	Comments: Regarding its invasive nature on North American continent and habitat requirements, this species is likely to demonstrate an increase in ecological resilience as average temperatures in Poland are increasing. Thus, the ability of this species to migrate will proportionally increase in the whole Europe, to overcome geographical barriers and to enter Poland will also increase.

a35. ESTABLISHMENT – Due to climate change, the probability for *the species* to overcome barriers that have prevented its survival and reproduction in Poland will:

	decrease significantly
	decrease moderately
	not change
X	increase moderately
	increase significantly

aconf31.	Answer provided with a	low	medium **X**	high	level of confidence

acomm35.	Comments: Regarding its invasive nature on American continent and habitat requirements, this species is likely to increase its reproduction effectiveness as average temperatures in Poland are increasing. Thus, the ability of this species to migrate will proportionally increase in the whole Europe. So, this species can more effectively overcome geographical barriers, such as waters with lower temperatures (e.g. in the mountains).

a36. SPREAD – Due to climate change, the probability for *the species* to overcome barriers that have prevented its spread in Poland will:

	decrease significantly
	decrease moderately

	not change
X	increase moderately
	increase significantly

aconf32.	Answer provided with a	low	medium **X**	high	level of confidence

acomm36. Comments:

The predicted global warming will improve the abilities of this species to spread. In particular, it will be able to overcome geographical barriers more effectively, such as waters with lower temperatures (e.g. in the mountains).

a37. IMPACT ON THE ENVIRONMENTAL DOMAIN – Due to climate change, the consequences of *the species* on wild animals and plants, habitats and ecosystems in Poland will:

	decrease significantly
	decrease moderately
	not change
X	increase moderately
	increase significantly

aconf33.	Answer provided with a	low	medium **X**	high	level of confidence

acomm37. Comments:

This species can easily adapt to new habitats, taking advantage of favourable conditions. Introduced populations which expanded to water courses supplying Rice Lake in Canada, became very dense, up to 113 individuals per a square metre of the bottom (Hamr 2002 – P). This size of population fully determine the structure and functions of biocenoses. Therefore, if this species occurs in waters in Poland, its impact on the natural environment will increase proportionally to the increase in temperature.

a38. IMPACT ON THE CULTIVATED PLANTS DOMAIN – Due to climate change, the consequences of *the species* on cultivated plants and plant domain in Poland will:

	decrease significantly
	decrease moderately
X	not change
	increase moderately
	increase significantly

aconf34.	Answer provided with a	low	medium	high **X**	level of confidence

acomm38. Comments:

This species does not affect plant crops. The predicted global warming will not change this situation.

a39. IMPACT ON THE DOMESTICATED ANIMALS DOMAIN – Due to climate change, the consequences of *the species* on domesticated animals and animal production in Poland will:

	decrease significantly
	decrease moderately
	not change
X	increase moderately
	increase significantly

aconf35.	Answer provided with a	low	medium	high **X**	level of confidence

acomm39.	Comments: An increase in temperature, which can potentially cause an increase in its established population and its spreading, as mentioned above, will accordingly raise a risk for effective farming of animals in the aquaculture.

a40. IMPACT ON THE HUMAN DOMAIN – Due to climate change, the consequences of *the species* on human in Poland will:

	decrease significantly
	decrease moderately
	not change
X	increase moderately
	increase significantly

aconf36.	Answer provided with a	low	medium	high **X**	level of confidence

acomm40.	Comments: *Faxonius rusticus* hosts parasites which are potentially hazardous to humans. With a predicted increase in temperatures, a moderate increase in the risk for possible infection through food can be expected.

a41. IMPACT ON OTHER DOMAINS – Due to climate change, the consequences of *the species* on other domains in Poland will:

	decrease significantly
	decrease moderately
X	not change
	increase moderately
	increase significantly

aconf37.	Answer provided with a	low	medium **X**	high	level of confidence

acomm41.	Comments: Due to the predicted global warming, digging burrows by individuals of this species can be locally more intensive. In consequence, the danger to the durability of terrestrial hydraulic equipment is likely to increase. Such changes should be rather marginal. Thus, it is difficult to define the direction of possible changes and probably consequences on other facilities will not be changed.

Summary

Module	Score	Confidence
Introduction (questions: a06-a08)	0.33	0.67
Establishment (questions: a09-a10)	1.00	1.00
Spread (questions: a11-a12)	0.88	0.75
Environmental impact (questions: a13-a18)	0.67	0.83
Cultivated plants impact (questions: a19-a23)	0.00	1.00
Domesticated animals impact (questions: a24-a26)	0.75	0.33
Human impact (questions: a27-a29)	0.25	0.50

Other impact (questions: a30)	0.00	0.50
Invasion (questions: a06-a12)	0.74	0.81
Impact (questions: a13-a30)	0.75	0.63
Overall risk score	0.55	
Category of invasiveness	moderately invasive alien speciesp	

A6 | Comments

This assessment is based on information available at the time of its completion. It has to be taken into account. However, that biological invasions are, by definition, very dynamic and unpredictable. This unpredictability includes assessing the consequences of introductions of new alien species and detecting their negative impact. As a result, the assessment of the species may change in time. For this reason it is recommended that it regularly repeated.

acomm42. Comments:

Like in case of other species of crayfish, this invasive potential may be underestimated. The reason is the lack of knowledge on possible consequences of this species occurrence in Europe. Information in this questionnaire is based on data from invaded areas in North America. The impact of this species on occupied areas is known to be significant (e.g. Olsen et al. 1991 – P). Nevertheless, taking into account the impact of other crayfish species introduced to Europe, the impact of *Faxonius rusticus* is likely to be important. Thus, the considerable caution is advised in case of this species. Farming and selling *Faxonius rusticus* should be banned in the whole European Union. If this species is not regarded as the species posing a risk to European Union, the ban on its farming and selling should be introduced into the national law. In particular, crayfish grown up in farms on the national level can be troublesome and released to open waters by aquarists.

Data sources

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2. Databases (B)

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3. Unpublished data (N)

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4. Other (I)

OIE 2018 OIE – Listed diseases, infections and infestations in force in 2018

5. Author's own data (A)

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