



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. Przemysław Śmietana
2. Maciej Bonk
3. Wojciech Solarz

acomment01.	Comments:	degree	affiliation	assessment date
(1)	dr hab.	Department of Plant Ecology and Environmental Protection, Faculty of Biology, University of Szczecin	04-02-2018	
(2)	mgr	Institute of Nature Conservation, Polish Academy of Sciences in Cracow	01-02-2018	
(3)	dr	Institute of Nature Conservation, Polish Academy of Sciences in Cracow	05-02-2018	

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

Polish name: –
Latin name: ***Orconectes virilis*** Hagen, 1870
English name: Virile crayfish

acommm02.

Comments:

The proposed Polish name: Rak krzepki. A collective species (in a broad sense) formed by a group of genetically and morphologically close relatives, including *Orconectes deanae*, *Orconectes nais* and *Orconectes quinebaugensis* (Kouba et al. 2013 – P).

Populations of this species known from European waters are quite different genetically from known populations on the American continent (Filipova et al. 2010 – P).

Polish name (synonym I)

–

Polish name (synonym II)

–

Latin name (synonym I)

Faxonius virilis

Latin name (synonym II)

Cambarus couesi

English name (synonym I)

–

English name (synonym II)

–

a03. Area under assessment:

Poland

acommm03.

Comments:

–

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

native to Poland

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

level of confidence

X

acommm04.

Comments:

As recently as 2006, the species' position in Europe was found only in the Netherlands (Carral et al. 2006 – P) to be confirmed two years later in the Lee River (tributary of the Thames) in London (Ahern et al. 2008 – P). Having considered the availability of this species on the aquarist market in our country, it cannot be ruled out that this species is present in the open waters of Poland.

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

the environmental domain

the cultivated plants domain

the domesticated animals domain

the human domain

the other domains

acommm05.

Comments:

It is an omnivorous species, and because of this trait, it has significant effect on aquatic biocenoses of both plants and animals (macrobenthos) (Chambers et al. 1990, Hanson et al. 1990 – P) including fish (Dorn and Mittelbach 2004 – P).

A vector of crayfish plague threatening native crustaceans (Tilmans et al. 2014 – P) and wild native crayfish. Under favorable conditions it can potentially cause damage by digging burrows (Hamr 2002 – P).

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:

<input checked="" type="checkbox"/>	low
<input type="checkbox"/>	medium
<input type="checkbox"/>	high

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

acomment06. Comments:
The species occurred in Europe as a result of introduction (Carral et al. 2006 – P) and its displacement in various countries of this continent (Kouba et al. 2014 – P) has the same origin (Kouba et al. 2013 – P). However, the pace of spread in the Netherlands (Koesse and Blokland 2008 – P) indicates that *O. virilis* can relatively effectively migrate through waterways. Despite this, due to the rarity of the species, natural expansion to Poland, at least in the near future, seems relatively unlikely. It does not occur in countries bordering Poland.

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

<input type="checkbox"/>	low
<input checked="" type="checkbox"/>	medium
<input type="checkbox"/>	high

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

acomment07. Comments:
Transfer by angling and fishing equipment cannot be ruled out, however, only assuming the presence of the species at least in Poland's neighboring countries. The high activity of Polish anglers in the Benelux countries means that individuals can be brought to the country. This probability should not exceed 10 cases per decade.

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

<input type="checkbox"/>	low
<input type="checkbox"/>	medium
<input checked="" type="checkbox"/>	high

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

acomment08. Comments:
The history of re-introduction of crayfish into European waters combined with high activity (e.g. angling) of Polish citizens (subject-related groups - Facebook) in the regions of the current European occurrence of this species (England, the Netherlands) create an extremely high risk of introducing *O. virilis* to Polish waters. In case of using it as a bait, or as a crayfish for introduction in private waters, it seems that it is highly probably that it can get access to the natural environment of the country.

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:

- | | |
|-------------------------------------|---|
| <input type="checkbox"/> | non-optimal |
| <input type="checkbox"/> | sub-optimal |
| <input checked="" type="checkbox"/> | optimal for establishment of <i>the species</i> |

aconf05.	Answer provided with a	low	medium	high	level of confidence
				X	

acomm09.	Comments: The species is found in the United States in similar climatic conditions that dominate in Poland. What is more, it also spreads north, currently being in expansion in Canada (Phillips et al. 2009 – P). It has similar climate requirements as common and the most numerous species of crayfish in our country - spinycheek crayfish, <i>O. limosus</i> . Therefore, the existing conditions in Poland should be considered as optimal.
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a10. Poland provides **habitat** that is

- | | |
|-------------------------------------|---|
| <input type="checkbox"/> | non-optimal |
| <input type="checkbox"/> | sub-optimal |
| <input checked="" type="checkbox"/> | optimal for establishment of <i>the species</i> |

aconf06.	Answer provided with a	low	medium	high	level of confidence
				X	

acomm10.	Comments: The species inhabits various types of waters, so it can find good conditions in the majority of the country (Phillips et al. 2009 – P). Depending on the habitat conditions, it is crowded out or crowds out spinycheek crayfish (also common in Poland) in American waters (Hamr 2002 – P). It is therefore justifiable to state that habitat conditions optimal for <i>O. virilis</i> exist in domestic waters.
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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:

- | | |
|-------------------------------------|-----------|
| <input type="checkbox"/> | very low |
| <input type="checkbox"/> | low |
| <input checked="" type="checkbox"/> | medium |
| <input type="checkbox"/> | high |
| <input type="checkbox"/> | very high |

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

acom11. Comments:
 Dispersion from a single source (Data type: A)
 In general, crayfish demonstrate considerable mobility and it is possible that individuals of this species will move over distances greater than 500 m.
 Estimation (Data type: C)
 The species presents quite significant migratory capacity (Koesse and Blokland 2008 – P) in rivers and canal systems. It also has the ability to travel by land, Carral et al. 2008 – P). Considering this property found in similar spinycheek crayfish, the distances over which crayfish can travel by land, most probably do not exceed 1 km.

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

<input type="checkbox"/>	low
<input type="checkbox"/>	medium
<input checked="" type="checkbox"/>	high

aconf08. Answer provided with a

low	medium	high
		X

 level of confidence

acom12. Comments:
 All introductions in individual European countries (France, Sweden, the Netherlands, and England) were the result of deliberate introductions. The species with relatively powerful pincers with shape resembling those of European crayfish (*Astacus astacus*), therefore it appears to be an attractive substitute in terms of its commercial aspect. This goal was the reason behind the first, luckily unsuccessful introductions to the waters of France and Sweden (Carral et al. 2006 – P).
 If the species appears in Poland, it should be assumed that it will spread with human involvement, often as a fishing lure and unconsciously with angling and fishing equipment, at a high frequency.

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:

<input type="checkbox"/>	inapplicable
<input type="checkbox"/>	low
<input type="checkbox"/>	medium
<input checked="" type="checkbox"/>	high

aconf09. Answer provided with a

low	medium	high
	X	

 level of confidence

acommm13.

Comments:

In the American habitat conditions, a significant effect (food pressure) has been demonstrated on aquatic biocenoses of both plants (Chambers et al. 1990 – P) and animals (macrobenthos) (Hanson et al. 1990 – P), including fish (Dorn and Mittelbach 2004 – P) mainly by eating the listed organism groups. In Poland, through eating, it may have an effect on a number of protected plants, including the hardly reintroduced *Marsyle quadrifolia* (Polish Plant Red Data Book, category EW – P). Due to the small size of this fern species, the entry of crayfish into its positions may cause serious reduction in the number or extinction.

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

- low
- medium
- high

aconf10.

Answer provided with a

low	medium	high X
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level of confidence

acommm14.

Comments:

As a species with significant food effects on biocenosis (Chambers et al. 1990, Hanson et al. 1990, Dorn and Mittelbach 2004 – P) this crayfish is a competitor for herbivorous organisms and benthophags, including fish. Under favorable conditions, it crowds out spinycheek crayfish (a foreign species in Poland) or is crowded out by spinycheek crayfish Having a level of competitiveness similar to that of spinycheek crayfish, it is a confirmed danger of competitive crowding out of native crayfish species (Chucholl and Chucholl and Daudey 2008 – P). This applies in particular to *Astacus astacus* European crayfish, a species listed in the Polish Red Data Book of Animals (Krzywosz and Śmietana 2004 – P), with the threat status of the VU (Krzywosz and Śmietana 2004 – P).

A detailed analysis included in Śmietana's (2013 – P) study shows that in case of Pomerania, which is a representative area of lowlands in Poland, where direct competition with American spinycheek crayfish is found, the estimated status of European crayfish threat should be much higher. Having analyzed the results obtained during the performance of the foregoing study, it was found that European crayfish in Pomerania should be considered critically endangered, i.e. CR and in the highest A1 category (according to the state of 2011 - The IUCN Red List of Threatened Species). With a high probability, a similar situation may apply to other areas of the country.

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

- no / very low
- low
- medium
- high
- very high

aconf11.

Answer provided with a

low	medium	high X
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level of confidence

acommm15.

Comments:

The species does not interbreed with native crayfish.

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
- very high

aconf12. Answer provided with a

low	medium	high X
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 level of confidence

acomm16. Comments:
The species is a vector of bubonic plague (Tilmans et al. 2014 – P) - deadly disease of crustaceans listed on the OIE list OIE-Listed diseases, infections and infestations in force in 2018 – I), threatening, among others, *Astacus astacus* European crayfish (category VU in the Polish Red Data Book of Animals (Krzywosz and Śmietana 2004 – P) and The IUCN Red List).

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
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 level of confidence

acomm17. Comments:
This crayfish is considered to be a species which generally does not dig burrows (Tilmans et al. 2014 – P). As an exception, under favorable conditions, it can change the structure of the bottom by digging burrows (Hamr 1998 – P) at a rate of up to 1 meter in 24 hours (Hazlett and Rittschof 1985 – P). Even in case of a wide spread of the species in Poland, it is to be expected that in the worst case this species will result in easily reversible changes regarding processes occurring in habitats that do not belong to special care habitats.

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
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 level of confidence

acomm18. Comments:
It has a significant effect (mainly through foraging) on aquatic biocenoses, both on plants (Chambers et al. 1990 – P) and animals as well (macrobenthos) (Hanson et al. 1990 – P). The species is a predator preying on eggs and invertebrates, a herbivore that also feeds on macrophytes (Tilmans et al. 2014, Dorn and Mittelbach 2004 – P). It can therefore change the species composition and the number of individual organisms and groups of organisms, including those of great importance for ecosystems and special care habitats, e.g. 3260 - Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitriche-Batrachion* vegetation, 3150 - natural eutrophic lakes with *Magnopotamion* or *Hydrocharition* - type vegetation Due to the high level of aggression, it is able to crowd out species of other crayfish which dig burrows (e.g. European crayfish) (Hamr 2002 for Bobbjerg 1970 – P).

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
- very low
- low
- medium
- high
- very high

aconf15. Answer provided with a

low	medium	high
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 level of confidence

acomm19. Comments:
In Poland, there are no crops that could be threatened by this species.

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

- inapplicable
- very low
- low
- medium
- high
- very high

aconf16. Answer provided with a

low	medium	high
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 level of confidence

acomm20. Comments:
The 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:

- inapplicable
- no / very low
- low
- medium
- high
- very high

aconf17. Answer provided with a

low	medium	high
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 level of confidence

acomm21. Comments:
The species is not a plant.

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

- very low
- low
- medium
- high
- very high

aconf18. Answer provided with a

low	medium	high
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 level of confidence

acomm22.

Comments:

There are no crops of aquatic plants in Poland. However, the ability to dig burrows may have effect on the disturbance of water relations by impairing the tightness of the hydro-technical infrastructure used for irrigation of crops.

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

- very low
- low
- medium
- high
- very high

aconf19.

Answer provided with a

low	medium	high X
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level of confidence

acomm23.

Comments:

There is no data justifying the existence of such a threat.

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
- high
- very high

aconf20.

Answer provided with a

low X	medium	high
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level of confidence

acomm24.

Comments:

Through predation against benthos organisms and fish (Hanson et al. 1990, Dorn and Mittelbach 2004 – P) it may cause losses in cyprinids fish ponds, especially in the early stages of breeding, injuring or killing small individuals and constituting a strong food competition

The species can also present significant effect on the efficiency of open water fishing and breeding native crayfish in crayfish farms. In the latter case, one should assume as strongly eliminating interspecies competition on the part of this species in relation to native species and transmission of crayfish plague, as proven in spinycheek crayfish case. However, it is difficult to accurately predict the frequency of interaction with farm animals, hence the degree of certainty for the provided answer is small.

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
- medium

- high
- very high

aconf21. Answer provided with a

low	medium X	high
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 level of confidence

acommm25. Comments:
Species equipped with relatively powerful pliers (Carral et al. 2006 – P) and demonstrating high level of aggression (Bovbjerg 1970 – P). It creates the risk of injuries and even death in aquatic organisms, fish and crayfish, which may result in losses in the open water fishing production. Lack of experience in contact with this species allows the foregoing assessment only.

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
- very high

aconf22. Answer provided with a

low	medium	high X
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 level of confidence

acommm26. Comments:
As a carrier of crayfish plague (Tilman et al. 2014 – P), which is a deadly threat to indigenous crayfish species resulting in the potential elimination of their breeding. Crayfish plague is a crustacean disease listed on the OIE list (OIE-Listed diseases, infections and infestations in force in 2018 – I).

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:

- inapplicable
- very low
- low
- medium
- high
- vert high

aconf23. Answer provided with a

low	medium	high
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 level of confidence

acommm27. Comments:
The 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
- low
- medium

- high
- very high

aconf24. Answer provided with a

low	medium	high X
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 level of confidence

acomm28. Comments:
 Relatively large pliers pose a risk of injury in case of improper handling. This is associated with the potential threat of bacterial infection with microorganisms present in the environment. However, the probability of such events should be medium at most (1-100 cases per 100,000 people per year), and the effect should be – small (rare medical consultations, no absenteeism at work, no permanent disabilities, low stress level).

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

- inapplicable
- very low
- low
- medium
- high
- very high

aconf25. Answer provided with a

low	medium X	high
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 level of confidence

acomm29. Comments:
 It is an intermediate host for trematodes of the *Microphallus* genus (Reisinger et al. 2015 – P), the final hosts of which include vertebrate animals (there is an unconfirmed probability that those also include humans). Parasitic diseases caused by infection with "new" parasites usually have a severe course and can cause permanent damage to health, and can result in death if left untreated, yet it is uncertain whether these trematodes are also human parasites, which determines the answer.

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:

- very low
- low
- medium
- high
- very high

aconf26. Answer provided with a

low	medium X	high
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 level of confidence

acomm30. Comments:
 Under favorable conditions this species basically does not dig burrows, although it can sometimes dig them very efficiently (Hazlett and Rittschof 1985 – P). This creates a certain threat to the durability of ground hydrotechnical equipment. The effects should be reversible and the probability – medium (from 1 to 100 events per 100,000 objects 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:

- | | |
|-------------------------------------|------------------------|
| <input checked="" type="checkbox"/> | significantly negative |
| <input type="checkbox"/> | moderately negative |
| <input type="checkbox"/> | neutral |
| <input type="checkbox"/> | moderately positive |
| <input type="checkbox"/> | significantly positive |

aconf27. Answer provided with a

low	medium	high
	X	

 level of confidence

acomm31. Comments:
By juxtaposing the ability of this species to have severe effect on the habitats through food and competitive pressure and carrying the crayfish plague, it can be said that it has a very large destructive potential in terms of fishing productivity (the size of fish catches).

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

- | | |
|-------------------------------------|------------------------|
| <input type="checkbox"/> | significantly negative |
| <input checked="" type="checkbox"/> | moderately negative |
| <input type="checkbox"/> | neutral |
| <input type="checkbox"/> | moderately positive |
| <input type="checkbox"/> | significantly positive |

aconf28. Answer provided with a

low	medium	high
	X	

 level of confidence

acomm32. Comments:
A species with a high adaptive capacity and ability to regulate the flow of matter and energy in water ecosystems. Considering similar habitat and climate requirements to those of spinycheek crayfish, it is necessary to assume presence of strong disturbances in the Polish waters' biocenoses.

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

- | | |
|-------------------------------------|------------------------|
| <input type="checkbox"/> | significantly negative |
| <input checked="" type="checkbox"/> | moderately negative |
| <input type="checkbox"/> | neutral |
| <input type="checkbox"/> | moderately positive |
| <input type="checkbox"/> | significantly positive |

aconf29. Answer provided with a

low	medium	high
		X

 level of confidence

acomm33. Comments:
Disruption of the coherence of cultural conditions related to the native species, i.e. European crayfish. European crayfish is a charismatic species, strongly embedded in Polish culture. For example, there are numerous references to the characteristics of European crayfish in the culture of the word (proverbs, sayings, comparisons). The presence of *O. virilis*, which has different characteristics than native species, will result in impaired understanding of the cultural role and importance of crayfish - with regard to the wide audience - wherein this

understanding should be additionally associated with the native crayfish as an important element of water biocenosis.

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
- increase moderately
- increase significantly

aconf30. Answer provided with a

low	medium X	high
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 level of confidence

acomm34. Comments:
This species has habitat-related requirements similar to spinycheek crayfish (Hamr 1998 – P), while on the American continent it has a much wider range from it, which suggests a wider range of tolerances, including temperature. Because in crayfish the metabolic rate increases with the ambient temperature level the temperature increase should be combined with greater efficiency of expansion. Global warming may promote population growth abroad, and therefore the risk of spreading towards Poland.

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
- increase moderately
- increase significantly

aconf31. Answer provided with a

low	medium X	high
-----	--------------------	------

 level of confidence

acomm35. Comments:
This species has habitat-related requirements similar to spinycheek crayfish (Hamr 1998 – P), while on the American continent it has a much wider range from it, which suggests a wider range of tolerances, including temperature. Because in crayfish the metabolic rate increases with the ambient temperature level, the temperature increase should be combined with greater efficiency of this species' adaptation to other habitat conditions. An increase in temperature may contribute to the colonization of mountainous areas that are colder. Therefore, the temperature may be a barrier in some regions in Poland.

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
- increase moderately
- increase significantly

aconf32. Answer provided with a

low	medium X	high
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 level of confidence

acomm36. Comments:
This species has habitat-related requirements similar to spinycheek crayfish (Hamr 1998 – P), while in America it has a much wider range from it, which suggests a wider range of tolerances, including temperature. Because in crayfishes the metabolic rate increases with the ambient temperature level, similar to all cold-blooded organisms, the temperature increase should be combined with greater efficiency of expansion. It is possible that with warming, it will be easier for it to colonize mountainous areas in which an increase in water temperature will favor the potential range expansion, as it can be the case in the description of a related species - spinycheek crayfish.

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
- increase moderately
- increase significantly

aconf33. Answer provided with a

low	medium X	high
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 level of confidence

acomm37. Comments:
This species has habitat-related requirements similar to spinycheek crayfish (Hamr 1998 – P), while in America it has a much wider range from it, which suggests a wider range of tolerances, including temperature. Because in crayfish - as in all cold-blooded organisms - the metabolic rate and associated e.g. need for food, motor activity and aggression, etc. increase with the level of ambient temperature, its growth should be combined with higher *O. virilis* pressure (food, competition, etc.) on habitats.

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
- not change
- increase moderately
- increase significantly

aconf34. Answer provided with a

low	medium	high X
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 level of confidence

acomm38. Comments:
There are no crops in Poland which could be threatened by this species.

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
- increase moderately
- increase significantly

aconf35. Answer provided with a

low	medium	high X
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 level of confidence

acomm39. Comments:
This species has habitat-related requirements similar to spinycheek crayfish (Hamr 1998 – P), while in America it has a much wider range from it, which suggests a wider range of tolerances, including temperature. Because in crayfishes the metabolic rate increases with the ambient temperature level, similar to all cold-blooded organisms, the temperature increase should be combined with greater competition and predation pressure which might be reflected in aquaculture results.

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
- increase moderately
- increase significantly

aconf36. Answer provided with a

low	medium	high X
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 level of confidence

acomm40. Comments:
This species has habitat requirements similar to spinycheek crayfish (Hamr 1998 – P), while in America it has a much wider range from it, which suggests a wider range of tolerances, including temperature. Because in crayfish the metabolic rate increases with the ambient temperature level, similar to all cold-blooded organisms, the temperature increase should be combined with greater efficiency of migration. This can result in increase of the possibilities of conflict meetings with humans (with the effect described in A28, i.e. mutilation).

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

- decrease significantly
- decrease moderately
- not change
- increase moderately
- increase significantly

aconf37. Answer provided with a

low	medium X	high
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 level of confidence

acomm41. Comments:
Due to the low probability of losses caused by burrows dug by this species, their possible increase due to greater organism activity at higher temperatures should be considered as irrelevant in this case.

Summary

Module	Score	Confidence
Introduction (questions: a06-a08)	0.50	0.67
Establishment (questions: a09-a10)	1.00	1.00
Spread (questions: a11-a12)	0.75	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	0.50
Human impact (questions: a27-a29)	0.38	0.75
Other impact (questions: a30)	0.25	0.50
Invasion (questions: a06-a12)	0.75	0.81
Impact (questions: a13-a30)	0.75	0.72
Overall risk score	0.56	
Category of invasiveness	moderately invasive alien species	

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 is regularly repeated.

acomm42.

Comments:

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Data sources

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2. Databases (B)

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3. Unpublished data (N)

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4. Other (I)

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5. Author's own data (A)

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