



Appendix A

## Harmonia<sup>+PL</sup> – 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. Borys Kala
2. Bartłomiej Gorzkowski – external expert
3. Wojciech Solarz

acomment01.	Comments:	degree	affiliation	assessment date
	(1)	mgr	Polish Society for Nature Conservation "Salamandra"	15-01-2018
	(2)		Epicrates Foundation, Lublin	26-01-2018
	(3)	dr	Institute of Nature Conservation, Polish Academy of Sciences in Cracow	26-01-2018

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

Polish name:      Żółw jaszczurowaty  
Latin name:      ***Chelydra serpentina*** Linnaeus, 1758  
English name:     Snapping turtle

acommm02.	Comments:		
	Polish name (synonym I)	Skorpucha jaszczurowata	Polish name (synonym II) Żółw kajmanowaty
	Latin name (synonym I)	–	Latin name (synonym II) –
	English name (synonym I)	North American snapping turtle	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

aconff01.	Answer provided with a	low	medium <b>X</b>	high	level of confidence
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acommm04. Comments:  
 The species is sporadically found in the natural environment in the territory of Poland. At the end of 20<sup>th</sup> century, attempts to introduce the snapping turtle were carried out in Poland inspired by a Polish citizen living in the USA permanently. Within the framework of this operation, an unspecified number of eggs of these reptiles were imported to our country. The eggs were transported by air by random persons, who were instructed to dig them in the ground. There is no available data on the success of the operation – single individuals which have hatched during the transport have been passed down to the Zoological Garden in Warsaw and to an elementary school in Głogówek (Kala *et al.* 2015 – I). Moreover, within the framework of a realised research project „Invasive species of turtles as a source and vector of microflora pathogenic for animals and humans,” one individual of the snapping turtle was caught in a pond in the area of Kutno in 2016 (B. Gorzkowski 2018 – oral inf. – I). Also, a single individual was observed in a reservoir in Wrocław in 2014 (PTOP “Salamandra” 2015 – B).

**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:  
 The snapping turtle is a species relatively rarely found in the natural environment in Europe, including Poland. For this reason, information concerning the influence of the species on European nature are very limited. The snapping turtle is omnivorous – it eats almost everything which fits in its jaws – both carrion, and alive food (Ernst and Lovich 2009 – P). Van Dijk (2012 – I) reports that in its natural range, this turtle occurring in a higher density may affect the local ecosystem significantly. Also Bonin *et al.* (2006 – P) suggest that introduction of the species may have a significant impact on the local

environmental resources. In Majorca, no interactions of the snapping turtle with the native herpetofauna were proved, however, it is assumed that the species potentially may exert an adverse impact on the native fauna connected with the aquatic environment – birds, amphibians and reptiles (including, *i.a.*, the European pond turtle *Emys orbicularis*) (Pinya and Carretero 2011 – P). As other reptiles, the snapping turtle may be a vector of pathogens dangerous for both humans, and farm animals. Among others, occurrence of *Salmonella* spp. with it was found (Chambers and Hulse 2006, Gaertner *et al.* 2008, Goławska *et al.* 2017 – P). Adult snapping turtles pose a hazard for humans (Mito and Uesugi 2004 – P). Because of their relatively large size and strong jaws, they may bite acutely (and even amputate fingers or toes) (Bugter *et al.* 2011 – P). While in danger, they may be aggressive irrespectively of the attacker’s size – among others, a case of repeated attacks of an adult snapping turtle on horses trying to drink water has been observed (Ernst and Lovich 2009 – 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 type="checkbox"/>	low
<input checked="" type="checkbox"/>	medium
<input type="checkbox"/>	high

aconf02.	Answer provided with a	low	medium <b>X</b>	high	level of confidence
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acomm06.	Comments:
	The snapping turtle occurs in the natural environment in the territory of Germany and Holland (DAISIE 2008 – B). In Holland single individuals were observed in nature, both alive, and dead, in years 2005-2009 (Bugter <i>et al.</i> 2011 – P). Probably, individuals of the species occur also in other neighbouring countries of Poland, however, there is no data available on this subject in the literature. Usually, spontaneous migrations of the snapping turtles under natural conditions reach relatively small distances, therefore, the possibility of unassisted expansion from neighbouring countries should be considered moderate. In South Dakota, the average yearly distance covered by the snapping turtles observed there amounted to 0.92 km. One female travelled for 3.4 km in 10 days, but the majority of the animals moved on much shorter distances. 74% of the individuals were caught again in the same reservoirs, in which they had been caught previously (Ernst and Lovich 2009 – P). Studies carried out in Japan indicated that during one month, the female which travelled the longest distance, covered 1890 m (Kobayashi <i>et al.</i> 2006 – P).

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

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

aconf03.	Answer provided with a	low	medium	high <b>X</b>	level of confidence
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acomm07.	Comments:
	Unintended bringing along of the snapping turtles as the so-called “stowaways” seems unlikely. These turtles achieve relatively large size – male carapaces may have lengths of

almost 50 cm, while those of females – 40 cm. There is no available data on accidental introductions of the species.

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
				<b>X</b>	

acommm08. Comments:  
 Most probably, all cases of the snapping turtle’s introduction are consequences of intentional human action. Despite the regulations in force concerning dealing with and possessing individuals of alien invasive species (including the snapping turtle), this reptile is gaining in Poland in recent years. On Polish-language webpages, one may easily find sale offers of the specimens of this species, with prices starting as low as 80 PLN per specimen (Kala 2017 – A). In turn, in terrarist markets, the prices of these turtles are even lower – young individuals are available already for 60 PLN, and the sellers are bringing them in large boxes containing even several dozens of individuals (Gorzowski 2017 – A). There is a high probability that the low unit price, increasing popularity, large size of adult individuals, and aggressive behaviour of the snapping turtles will result in a significant increase in the number of cases of illegal introduction of the species in the territory of Poland in near future. Potentially, the number of such events may be well higher than 10 per decade.

## 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
				<b>X</b>	

acommm09. Comments:  
 The natural range of the snapping turtle is very wide – it encompasses whole eastern and middle parts of United States – from Florida in the South to southern part of Canada in the North. Such a large area is characterised by strongly variable climatic conditions, which perfectly illustrates the highly adaptive abilities of the species in this regard. At a temperature of egg incubation in the range of 21-22°C, individuals of both sexes hatch (Ernst and Lovich 2009 – P). According to the climatic similarity map of Poland in relation to the whole world, the climate of northern part of the natural range of the species is very close to that of Poland (similarity in the range of 94-100%), thus the conditions for growth and reproduction of these reptiles in the territory of our country should be considered optimal.

a10. Poland provides **habitat** that is

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

aconf06. Answer provided with a 

low	medium	high
		<b>X</b>

 level of confidence

acommm10. Comments:  
Under natural conditions, the snapping turtle inhabits all kinds of freshwater habitats, preferring watercourses having a slow current, muddy or sandy bottom, developed aquatic vegetation and numerous submerged branches. It occurs at various heights in relation to the sea level – from 0 to 2000 m a.s.l. It is omnivorous – it eats almost everything which fits in its jaws – both carrion, and alive food (Ernst and Lovich 2009 – P).

### 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
- high
- very high

aconf07. Answer provided with a 

low	medium	high
	<b>X</b>	

 level of confidence

acommm11. Comments:  
Dispersion from a single source (Data type: A)  
In South Dakota, the average yearly distance covered by the snapping turtles amounted to 0.92 km. One female travelled for 3.4 km in 10 days, but the majority of the animals moved on much shorter distances. 74% of the individuals were caught again in the same reservoirs, in which they had been caught previously (Ernst and Lovich 2009 – P). Studies carried out in Japan indicated that during one month, the female which travelled the longest distance, covered 1890 m (Kobayashi *et al.* 2006 – P). There is no data on spontaneous spreading of snapping turtles in Europe.

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

- low
- medium
- high

aconf08. Answer provided with a 

low	medium	high
	<b>X</b>	

 level of confidence

acommm12. Comments:  
So far, the snapping turtle is a species very rarely found in the natural environment of Poland. Presumably, it results from the fact that this reptile has not been a very popular species among our terrarists. However, this situation has been changing in recent years –

offers of sale of the snapping turtles are becoming increasingly popular both in the Internet (Kala 2017 – A), and in various kinds of terrarist stock exchanges (Gorzowski 2017 – A). In consequence, the number of illegal introductions in Poland may increase over the next few years, all the more that the purchase price of an individual of the species is relatively low. Most probably, cases of relocation of individuals from populations occurring in Poland (assuming that the species will be widespread) through humans to distances longer than 50 km will not be frequent – not more than 10 cases per decade. Such events may occur as a result of catching an individual by random persons, who, due to a lack of infrastructure prepared for taking animals of such a type, will be releasing caught reptiles back to the natural environment. Accidental (unintended) relocations of the snapping turtles in the environment by humans seem unlikely.

## 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	level of confidence
			<b>X</b>		

acommm13. Comments:

Largely, the invasive status is attributed to the snapping turtle as a precaution. There are no detailed studies on the influence of the species on the natural environment even in Asiatic countries, where its invasion is most advanced. All the more in Europe, where the snapping turtles have been found only sporadically so far, an evaluation of its impact on native species and ecosystems is based on, to a high degree, analogies with much better known consequences of the presence of pond slider on our continent (Kala *et al.* 2015 – I). The snapping turtles eat both various plant food, and animal food, also eagerly feeding on carrion. At high densities, amounting to 1.2-49 individuals per 1 ha (or 19-166 kg of body mass of turtles per 1 ha), found in particularly favourable habitats of the species, their influence on the ecosystem is probably significant (van Dijk 2012). In Majorca, admittedly, no interactions of the snapping turtle with the native herpetofauna were proved; however, it is assumed that the species potentially may exert an adverse impact on the native fauna connected with the aquatic environment (Pinya and Carretero 2011 – P). Under conditions of Poland, taxons of particular concern, which may be hunted by the snapping turtle include, e.g.: amphibians (all species of local amphibians belong to species of particular concern), reptiles (European pond turtle, grass snake and dice snake – all 3 species belong to species of particular concern), and birds (apart from game species, all bird species associated with the aquatic environment belong to species of particular concern), all developmental forms of every aforementioned taxonomic groups being subjects of the risk of attack.

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

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

aconf10.	Answer provided with a	low	medium	high	level of confidence
		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

acom14. Comments:  
 In Europe, where the snapping turtles have been found only sporadically so far, an evaluation of their impact on native species and ecosystems in based on, to a high degree, analogies with much better known consequences of the presence of pond slider on our continent (Kala *et al.* 2015 – I). It may be supposed that when the snapping turtles occur in sites of occurrence of the European pond turtles, competition for food between these two species may arise to a certain degree.

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

<input checked="" type="checkbox"/>	no / very low
<input type="checkbox"/>	low
<input type="checkbox"/>	medium
<input type="checkbox"/>	high
<input type="checkbox"/>	very high

aconf11.	Answer provided with a	low	medium	high	level of confidence
		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

acom15. Comments:  
 The possibility of crossbreeding of the native European pond turtle with the snapping turtle is practically nought – these species belong to various families – *Emydidae* and *Chelydridae*, respectively.

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

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

aconf12.	Answer provided with a	low	medium	high	level of confidence
		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

acom16. Comments:  
 The available scientific literature exhibits significant deficiencies pertaining to knowledge on bacteria, parasites, viruses, and fungi occurring in invasive and alien turtle species. Usually, the fragmentary data concerns a specific infective agent, including, most frequently, the *Salmonella* bacilli and their role in causing infections of humans (Goławska *et al.* 2017 – P). The snapping turtle may be a host and carrier of various types of pathogens and parasites dangerous for native species, e.g. fish, amphibians, reptiles (including the European pond turtle), birds and mammals. Occurrence of *Salmonella* spp. was found with it (Gaertner *et al.* 2008 – P), and in North America, the frequency of occurrence of this pathogen with the snapping turtle was reaching even 100% (Chambers and Huls 2006 – P). In a case of alien turtle species (including the snapping turtle) entering the natural environment, they may become a source of *Salmonella* serovars absent in the natural environment previously, posing a new epidemiological threat for humans and animals (Konieczna *et al.* 2016 – P). Also, occurrence of *Trypanosoma chrysemys* protozoan, two nematode species *Falcaustra chelydrae* and *Falcaustra wardi*, as well as a trematode species *Telorchis geoclemmydis* were found with the species (Najberek in

preparation). However, there is no data on the subject of which native species may be infected by these pathogens and parasites, and what the consequences of the infection may be.

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

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

aconf13.	Answer provided with a	low	medium	high	level of confidence
			<b>X</b>		

acommm17. Comments:  
There is no literature data on the impact of the species on the abiotic factors of ecosystems. It seems that the influence of the snapping turtle is irrelevant in this regard.

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

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

aconf14.	Answer provided with a	low	medium	high	level of confidence
			<b>X</b>		

acommm18. Comments:  
Assuming that the species will establish itself in Poland, and the number of its individuals will be increasing systematically in the area of the whole country, one may expect that it will affect aquatic organisms, with which it will be sharing the same reservoirs. For instance it may reduce the abundance of some endangered invertebrates, fish, amphibians, reptiles or birds associated with the freshwater environment (both eggs and nestlings, or adult individuals, and even birds with a size of the mute swan may fall prey to the snapping turtle) (Ernst and Lovich 2009 – P). In the worst case scenario, when the species emerges in habitats of particular concern, it may cause hardly reversible changes – e.g. introducing aliens pathogens to the environment, dangerous for the native fauna.

## 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:

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

aconf15.	Answer provided with a	low	medium	high	level of confidence
				<b>X</b>	

acomm19.

Comments:

The species does not affect cultivated plants by either herbivorousness or parasitism.

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 <b>X</b>
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level of confidence

acomm22.

Comments:

The species does not affect the condition or yields of cultivated plants.

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 <b>X</b>	medium	high
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level of confidence

acomm23.

Comments:

There is no literature data on pathogens and parasites transmitted by the snapping turtles to plant crops. Studies carried out within the framework of the “Invasive turtle species as a source and vector of microflora pathogenic for animals and humans” project proved that alien turtle species are a vector for, *i.a.*, the *Pseudomonas* spp. pathogen (Pękala *et al.* 2016 – P). One may suppose with a high probability that as the research advances, the presence of *Pseudomonas* spp. will be confirmed also for the snapping turtle, although there is no such ascertainment at present. Considering the fact that *Pseudomonas syringae* is included in the EPPO A2 list, the influence of the species on plant crops is defined as medium, with a low degree of certainty, because the exact taxonomic identification of the pathogen found with alien turtle species in Poland is not known.

### 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	medium <b>X</b>	high	level of confidence
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acomm24.

Comments:

Probably, the snapping turtle may affect farm animals in aquacultures by predation, however, there is no literature data available on this subject. Only Ernst and Lovich (2009 – P) report that these reptiles have a bad reputation because of stealing fish from anglers. When the species is widespread, the probability of such situations is high (more than 100 cases per 100,000 animals per year – in the case of fish spawn, the factor may be by many times higher). Considering the fact that predation leads to death of the prey, the predation effect is defined as high. In consequence, the impact of the species (probability × effect) is defined as very high. The species does not affect farm animals or domestic animals by parasitism.

**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	high <b>X</b>	level of confidence
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acomm25.

Comments:

The snapping turtle may attack single individuals of domestic or farm animals, which it would consider a threat. Such situations may occur near ponds and waterholes located in the areas of pastures. Ernst and Lovich (2009 – P) report an example of a large individual of

the snapping turtle, which has been attacking horses approaching a watering place. Also, e.g. cattle having access to waterholes on pastures may be attacked, as well as domestic animals – dogs and cats.

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

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

aconf22.	Answer provided with a	low	medium	high	level of confidence
			<b>X</b>		

acomment26. Comments:

Presence of *Salmonella* spp. was found with the snapping turtle (Chambers and Hulse 2006, Gaertner *et al.* 2008 – P). Salmonellosis may cause a number of complications with various farm animals, e.g. cattle, swine or poultry, including death. Some *Salmonella* serovars are obligatorily notifiable in Poland.

Moreover, occurrence of *Trypanosoma chrysemys* protozoan, two nematode species *Falcaustra chelydrae* and *Falcaustra wardi*, as well as a trematode species *Telorchis geoclemmydis* were found with the snapping turtle (Najberek in preparation). Despite the fact that there is no hard data on the scale of the problem, it should be recognised that in the case of the snapping turtles entering breeding ponds or other water reservoirs, in which aquatic organisms are farmed, the turtles may affect these organisms as a vector of parasitic and pathogenic organisms. Pękala *et al.* (2016 – P) report that the microflora isolated from external shells of alien turtle species may pose a hazard for health of fish living in aquatic ecosystems of Poland. Particularly, they name *Aeromonas* spp., *Pseudomonas* spp., *Shewanella putrefaciens*, *Citrobacter* spp., as well as *Chryseobacterium*, however, they do not exclude infections caused by bacteria not known hitherto, for which the alien turtle species may be vectors. These bacteria may cause death of fish of any species. Treatment of fish is possible only in small breeding reservoirs such as ponds. In large reservoirs and watercourses, application of therapy is infeasible (Pękala 2018, oral inf. – A). Buccal cavity and cloaca swabs of a snapping turtle caught in a park pond in Kutno in 2016, within the framework of the “Invasive turtle species as a source and vector of microflora pathogenic for animals and humans” research program, revealed a presence of *Klebsiella pneumoniae* and *Klebsiella oxytoca* (Gorzkowski 2018 – A). *Klebsiella pneumoniae* infections were observed with cattle (Osman *et al.* 2014 – P) and swine (APHA Disease surveillance report 2014 – P). Bacteria of the *Klebsiella* genus may cause, e.g., mastitis with cattle or garget with swine.

## 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:

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

- high
- vert high

aconf23. Answer provided with a 

low	medium	high
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 level of confidence

acomm27. Comments:  
The species in not parasitic.

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 <b>X</b>	high
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 level of confidence

acomm28. Comments:  
Adult snapping turtles pose a hazard for humans (Mito and Uesugi 2004 – P). Because of their relatively large size and strong jaws, they may bite acutely (and even amputate fingers or toes) (Bugter *et al.* 2011 – P). When the species is widespread, one should expect that a direct contact of humans with the snapping turtle will be moderately probable (1-100 cases per 100,000 persons per year). Also the consequence of such contacts is rated as medium – permanent mutilation of humans will occur rarely. Problems connected with attacking humans may occur especially in various types of baths around cities – sites particularly exposed to release of alien turtle species, including snapping turtles.

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 <b>X</b>	high
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 level of confidence

acomm29. Comments:  
There is a high probability that the snapping turtles, similarly as the pond sliders, are vectors of pathogens posing a threat for humans. However, this species much less represented in scientific research on the subject, therefore the available data does not reflect the actual state indubitably. Presence of *Salmonella* spp. was found with the snapping turtle (Chambers and Hulse 2006, Gaertner *et al.* 2008, Goławska *et al.* 2017 – P), and the investigations carried out in the USA exhibited even 100% frequency of occurrence of this pathogen with studied individuals (Chambers and Hulse 2006 – P). Most often, alimentary intoxications caused by zoonotic *Salmonella* spp. strains have a mild course. However, sometimes they may have a systemic character, including death (Goławska *et al.* 2017 – P). Buccal cavity and cloaca swabs of a snapping turtle caught in a park pond in Kutno in 2016, within the framework of the “Invasive turtle species as a source and vector of microflora pathogenic for animals and humans” research program, revealed a presence of *Klebsiella pneumoniae* and *Klebsiella oxytoca* (Gorzowski 2018 – A). Both bacteria are dangerous for humans, particularly *K. pneumoniae* – pneumonia bacillum, which may cause, *i.a.*, pneumonia, infections within the alimentary tract, bones, joints or urinary system (which leads to sepsis sometimes), meningitis with newborn infants.

Transmission of the pathogen from the turtle to humans may occur in various situations – e.g. by biting, scratching or even abrasion.

## 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:

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

aconf26.	Answer provided with a	low	medium	high	level of confidence
		<b>X</b>			

acom30. Comments:  
 There is no literature data indicating an adverse impact of the snapping turtle on the infrastructure. However, in case of its establishing and increase in the population abundance in Poland, the snapping turtles may foul recreations areas and discourage people from using them, thus the turtles may induce a change in their use – e.g. baths located around cities, where the number of released snapping turtles may be highest. The probability of such type of events is defined as medium – 1-100 per 100,000 objects per year, the consequences being evaluated at small – completely reversible (the turtles may be caught).

## 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 type="checkbox"/>	significantly negative
<input checked="" 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	level of confidence
			<b>X</b>		

acom31. Comments:  
 There is no data available on this subject. However, it seems that the species may affect services connected with food supply, by transmitting parasitic and pathogenic organisms to farm animals, as well as by predation on fish (at various stages of development) in aquacultures. In case of their establishment and increase in the abundance in Poland, also contamination of reservoirs used as potable water sources may occur.

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

- significantly negative
- moderately negative
- neutral
- moderately positive
- significantly positive

aconf28. Answer provided with a 

low	medium <b>X</b>	high
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 level of confidence

acomm32. Comments:  
The snapping turtles are vectors of various pathogenic organisms (Chambers and Hulse 2006 – P, Gaertner *et al.* 2008 – P, Goławska *et al.* 2017), so they may affect regulation of zoonotic diseases.

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

- significantly negative
- moderately negative
- neutral
- moderately positive
- significantly positive

aconf29. Answer provided with a 

low	medium <b>X</b>	high
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 level of confidence

acomm33. Comments:  
The snapping turtle spends most of its time at the bottom in deeper parts of reservoirs or dug in the mud in shallow waters (Ernst and Lovich 2009 – P). For this reason, the species is practically unnoticeable, thus not much attractive for most of the amblers and casual nature watchers. At the same time, the species is relatively aggressive and dangerous for humans and domestic animals (*e.g.* dogs). Conflict situations may lead to avoiding walks near reservoirs, in which the snapping turtles occur, *e.g.* out of concern about dog health.

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

Below, each of the Harmonia<sup>+PL</sup> 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	high <b>X</b>
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 level of confidence

acomm34.

Comments:

Climatic conditions in Poland fit within the range of conditions occurring in the natural range of the species. Thus, the climate is not a limiting factor for the invasion of this reptile in the territory of our country.

**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	high <b>X</b>
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level of confidence

acomm35.

Comments:

Climatic conditions in Poland fit within the range of conditions occurring in the natural range of the species. Climate warming will result in shortening of the duration of egg incubation period, because these phenomena are inversely linked. At an incubation temperature of 22°C, the incubation period lasts for 93 days, at 24°C – 73 days, at 26°C – 70 days, at 28°C – 63 days, and at 30°C – 62 days (Ernst and Lovich 2009 – P). A shorter incubation period may mean a greater reproductive success, and, in consequence, a faster invasion.

**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	high <b>X</b>
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level of confidence

acomm36.

Comments:

Climatic conditions in Poland fit within the range of conditions occurring in the natural range of the species. Thus, the climate is not a limiting factor for the invasion of this reptile in the territory of our country.

**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	high <b>X</b>
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level of confidence

acomm37.

Comments:

Assuming that a temperature rise is accompanied by a shortening of the egg incubation period, and, in consequence, the reproductive success of the species will increase, it may be supposed that also the impact of the species on the food supply including both plants, and animals will increase.

**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 <b>X</b>
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 level of confidence

acomm38. Comments:  
Irrespective of the changing climate, the species does not affect cultivated plants or crop production.

**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 <b>X</b>
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 level of confidence

acomm39. Comments:  
Assuming that a temperature rise is accompanied by a shortening of the egg incubation period, and, in consequence, the reproductive success of the species will increase, it may be supposed that also the impact of the species on farm animals and domestic animals by more frequent cases of transmission of various pathogen and possible biting will increase.

**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 <b>X</b>
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 level of confidence

acomm40. Comments:  
Assuming that a temperature rise is accompanied by a shortening of the egg incubation period, and, in consequence, the reproductive success of the snapping turtle will increase, it may be supposed that also the impact of the species on humans by more frequent cases of transmission of various pathogen and possible biting will increase.

**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 <b>X</b>	high	level of confidence
acomm41.	Comments: The climate of Poland is very similar to that of a part of the natural range of the snapping turtle – according to Fig. 1 in the Harmonia <sup>+PL</sup> document, the climatic similarity value is in the range of 94-100% (optimal conditions). Most probably, the climate warming will not contribute into any change in the impact of the species on other objects in Poland, <i>i.e.</i> the probability of events consisting in fouling recreational areas and discouraging people from using them will not exceed 100 cases per 100,000 object per year.				

## Summary

Module	Score	Confidence
Introduction (questions: a06-a08)	0.50	0.83
Establishment (questions: a09-a10)	1.00	1.00
Spread (questions: a11-a12)	0.50	0.50
Environmental impact (questions: a13-a18)	0.54	0.50
Cultivated plants impact (questions: a19-a23)	0.17	0.67
Domesticated animals impact (questions: a24-a26)	0.75	0.67
Human impact (questions: a27-a29)	0.63	0.50
Other impact (questions: a30)	0.25	0.00
Invasion (questions: a06-a12)	0.67	0.78
Impact (questions: a13-a30)	0.75	0.47
Overall risk score	0.50	
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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