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. Borys Kala
2. Bartłomiej Gorzkowski – external expert
3. Karolina Mazurska

acomm01. Comments:

	degree	affiliation	assessment date
(1)	mgr	Polish Society for Nature Conservation "Salamandra"	26-01-2018
(2)		Epicrates Foundation, Lublin	30-01-2018
(3)	mgr	Institute of Nature Conservation, Polish Academy of Sciences in Cracow	30-01-2018

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

Polish name: Żółw malowany

Latin name: ***Chrysemys picta*** (Schneider, 1783)

English name: Painted turtle

Współfinansowano w ramach projektu nr POIS.02.04.00-00-0100/16 pn. *Opracowanie zasad kontroli i zwalczania inwazyjnych gatunków obcych wraz z przeprowadzeniem pilotażowych działań i edukacją społeczną* ze środków Unii Europejskiej w ramach Programu Infrastruktura i Środowisko 2014-2020

acomm02.	Comments:

Polish name (synonym I) –	Polish name (synonym II) –
Latin name (synonym I) *Chrysemys dorsalis*	Latin name (synonym II) *Chrysemys marginata*
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
	alien, absent from Poland
	alien, present in Poland only in cultivation or captivity
X	alien, present in Poland in the environment, not established
	alien, present in Poland in the environment, established

aconf01.	Answer provided with a	low	medium **X**	high	level of confidence

acomm04.	Comments: Painted turtles are sporadically found on the market in Poland, and consequently this species is incidentally observed in the natural environment. There is virtually no literature data on the occurrence of these reptiles in the area of our country. Only three confirmed cases of observation of painted turtles were demonstrated by Kala et al. (2015), based on oral information – in Łukie lake in the Poleski National Park (during control catches one female was caught) (Piotrowski 2014 – I , oral information), in 2012 one individual was observed in Warsaw (PTOP „Salamandra" 2015 – B), and in 2013 one individual was caught in Lublin (Gorzkowski 2015 – I). So far, no cases of reproduction of painted turtles in Poland and in other EU countries have been demonstrated.

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: Painted turtle is a species rarely found in Europe – it is observed in Germany, Austria and Spain (DAISIE 2008 – B). Probably, it was also observed in the Netherlands (Bugter et al. 2011 – P). Only three confirmed cases of observation of this species come from Poland (Kala et al. 2015 – I). Therefore, information concerning the impact of painted turtle on the European nature is very limited. It is highly probable that this impact may be similar to the impact of pond slider. Painted turtle is omnivorous – depending on the opportunity it eats both living and dead organisms, while it preferably feeds on living organisms – which are able to move (Ersnt i Lovich 2009 – P). Similarly to other reptiles, painted turtle may be a vector of various pathogens hazardous both to humans and farm animals. It was found out that it carries, among others, the following bacteria: *Salmonella* spp. (Chambers and Hulse 2006, Goławska et al. 2017 – P), *Mycobacterium fortuitum-like* and *Mycobacterium peregrinum* (Ebani et al. 2012 – P) and a nematode *Falcaustra affinis* (Najberek 2018 – N).

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:

	low
X	medium
	high

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

acomm06. Comments:

Among the countries bordering with Poland, painted turtle is only observed in Germany (DAISIE 2008 – B), however, it is not excluded that single individuals occur also in the remaining countries – especially in the Czech Republic or Slovakia, where terrarium care is a very popular hobby. Officially, in the years 2003-2014 only 548 individuals of this species were imported to Europe, while 348 were imported to Germany (for scientific purposes), 137 to Great Britain and smaller numbers to Spain, Denmark and Switzerland (Kala et al. 2015 – I). Individuals of this species are able to migrate over long distances – while males migrate further than females. Ernst and Lovich (2009 – P) report an example of a river population, where males migrated over a distance of 21.5-26 km, females 7-8 km and young individuals 2 km.

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	high **X**	level of confidence

acomm07. Comments:

There are no known cases of unintentional introductions of the individuals of this species as "stowaways".

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

	low
X	medium
	high

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

acomm08. Comments:

Painted turtle is an attractive species, which in the case of increased supply would undoubtedly find a wide group of buyers on the terrarium species market. As a consequence, individuals of this species could potentially be released to the natural environment on a large scale, similarly as it takes place in the case of pond slider. However, the number of painted turtles legally imported to Europe is incomparably smaller that the number of the imported pond sliders (Kala et al. 2015 – I). It is unlikely that this situation will change. As a consequence, the scale of the introduction of painted turtles is proportionally smaller.

	The probability of a release to the natural environment in Poland of more than 10 individuals of this species within a decade seems unlikely.

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: The natural range of the occurrence of painted turtle is very wide – it covers most of the area of the United States – except for the south-western part. In the North, it reaches up to the southern part of Canada. In painted turtle, a phenomenon of a so-called temperature-dependent sex determination during incubation of eggs occurs, while there are two temperature thresholds, at which both males and females hatch well – 20 and 28^{o}C (Ernst and Lovich 2009 – P). A similarity between the climate prevailing in the north part of the natural range of the species and the climate of Poland is very high, therefore the conditions for the development and reproduction of these reptiles in the area of our country seem optimal.

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: This species occurs in most types of freshwater habitats such as lakes, ponds, oxbow lakes, bogs or rivers. It prefers watercourses with slow current or reservoirs with a soft bottom and large amount of aquatic vegetation. The presence of suitable sites for basking – boughs, roots, stones etc. protruding above the surface of the water is very important. Painted turtles are tolerant to water pollution – e.g. in Minnesota the presence of this species was observed in the area of a flooded landfill site (Ernst and Lovich 2009 – P). It is an omnivorous species. Therefore, it can be assumed that habitat conditions prevailing in Poland are optimal for the establishment of the species. The exception will be mountainous areas, because the low temperature of water will be unfavourable for these turtles, therefore, their presence in creeks and mountain streams or seepage spring areas should not be expected.

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	high **X**	level of confidence

acomm11. Comments:

Dispersion from a single source (Data type: A)
Painted turtle may spontaneously migrate over long distances – there are known cases of the migration of males at a distance of 26 km and of females at a distance of 8 km (Ernst and Lovich 2009 – 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 **X**	high	level of confidence

acomm12. Comments:

Assuming that painted turtles will be widely dispersed in the natural environment in Poland, it should be expected that a translocation of individuals for different reasons will be relatively frequent (over 10 individuals per decade), e.g. turtles will be caught in good faith by random people, and subsequently released back into the wild, due to the lack of authorized entities ready to take over such animals (currently such situations occur most probably in relation to pond sliders) (Kala 2017).

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 **X**	high	level of confidence

acomm13. Comments:

There is no literature data on the impact of painted turtles on the European native species. Assuming that the species will be widely spread in the environment and considering the fact that it is an opportunistic omnivore, it can be presumed that its effect on some native species associated with freshwater habitats may be significant. It is worth noting that painted turtle in favourable habitats may occur at a high concentration of over 800 individuals per ha (Frazer et al. 1991 – P), which may additionally increase its pressure on local populations of victims. In the natural range of the occurrence, the diet of painted turtle includes, among others salamanders, e.g. *Notophthalmus viridescens* and frogs, e.g. *Rana catesbeiana* (both larval and adult forms) (Ernst and Lovich 2009 – P). Therefore, in Polish conditions, there is a high probability that the diet of painted turtle will include e.g. such species of special concern as northern crested newt *Triturus cristatus* or European fire-bellied toad *Bombina bombina* or other Polish amphibians.

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

	low
	medium
X	high

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

acomm14. Comments:

There is no literature data on the impact of painted turtles on native species through competition. It can only be presumed that this effect is similar to the effect of pond slider, as both species are characterized by fairly similar biological parameters. This means that the presence of painted turtles in a habitat may have an effect especially on native European pond turtles as a result of a competition for various elements of the environment such as basking sites, hibernation areas, breeding grounds or food resources. It is not excluded that this effect is greater than in the case of pond sliders, as this species in favourable habitats may occur at very high concentrations – even above 800 individuals per ha (Frazer et al. 1991 – P), while Ernst and Lovich (2009 – P) report of observations of up to 50 individuals of painted turtle basking on one log at the same time.

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	high **X**	level of confidence

acomm15. Comments:

The only native species potentially able to crossbreed with painted turtle is European pond turtle. Both species belong to the same family of *Emydidae*, however to different genera: *Chrysemys* (painted turtle) and *Emys* (European pond turtle). The emergence of such a type of an intergeneric hybrid is unlikely.

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

	very low
	low
	medium

X	high
	very high

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

acomm16. Comments:

Until recently, available scientific literature showed significant deficiency concerning the knowledge about bacteria, parasites, viruses and fungi occurring in invasive and alien species of turtles (Goławska et al. 2017 – P). Although the situation has been recently improved to some extent, because of, among others, a research project conducted in the area of Poland and focused on this issue, data of parasites and pathogens transmitted by this analysed species are still little. For this reason, the answer to this question is based on the expert assessment.

Similarly to other reptiles, painted turtle may be a vector of various pathogens hazardous to animals present in the natural environment. It was found out that it carries, among others, the following bacteria: *Salmonella* spp. (Chambers and Hulse 2006, Goławska et al. 2017 – P), *Mycobacterium fortuitum-like* and *Mycobacterium peregrinum* (Ebani et al. 2012) and a nematode *Falcaustra affinis* (Najberek 2018 – N). The lack of information on the transmission of other pathogens and parasites most probably results from that fact that no research which could confirm it has been conducted so far in relation to this species. There is a high probability that painted turtles can be a vector of similar pathogenic factors and parasites, as pond sliders, which are much better examined in this respect (a similar nature of the species, similar conditions of keeping animals in the period prior to the introductions). So far, in pond sliders the presence of numerous pathogens posing a threat to native species of fish, amphibians, reptiles, birds and mammals, i.e. the above-mentioned *Salmonella* spp. was found (Soccini and Ferri 2004, Martínez et al. 2005, Konieczna et al. 2016 – P), *Aeromonas* spp. (Soccini and Ferri 2004, Pękala et al. 2016 – P), *Pseudomonas* spp. (Soccini and Ferri 2004, Pękala et al. 2016 – P), *Shewanella putrefaciens* (Pękala et al. 2016), *Chlamydia* spp. (Mitura et al. 2016, Mitura et al. 2017 – P), *Acinetobacter* spp. (Pękala et al. 2016), *Yersinia* spp. (Soccini and Ferri 2004 – P), *Klebsiella* spp. (Goławska et al. 2016 – P), *Citrobacter* spp. (Pękala et al. 2016), *Acinetobacter* sp., *Chryseobacterium indologenes* and *Serratia* sp. (Paździor at al., 2016 – P). Moreover, painted turtle, similarly to pond slider, can probably be a host and a vector of North American trematodes *Neopolystoma orbiculare*, *Polystomoides oris* and *Spirorchis elegans* and a nematode *Spiroxys contortus*. All these parasites have also been found in the species of turtles native to the countries of Western and Southern Europe (including, among others, European pond turtle) (Kirin et al. 2001, Mihalca et al. 2007, Vernau et al. 2011, Iglesias et al. 2015, Domenech et al. 2016, Goławska et al. 2017 – P).

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

	low
X	medium
	high

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

acomm17. Comments:

There is no literature data on the effect of this species on abiotic properties of ecosystems. However, it can be assumed, with a very high probability, that in the worst case this species causes easily reversible changes in habitats of special concern. Depending of the type of the inhabited reservoir, at a high density of turtles, these changes may potentially consists in e.g. cloudiness and contamination of water.

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 **X**	medium	high	level of confidence

acomm18. Comments:

Assuming that the species establishes in Poland and is spread throughout the country, it can be expected that it will have a significant impact on aquatic organisms, with which it will share the same reservoirs. It can, e.g. reduce the population size of some molluscs, insects and amphibians (Ernst and Lovich 2009 – P), including species of special concern in different developmental forms. In the worst case, in the situation of the appearance of the species in habitats of special concern, it can lead to hardly reversible changes – e.g. by introducing alien pathogens hazardous to native fauna of pathogens to the environment.

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:

Painted turtle is not a parasite of plants. This species is omnivorous, however its plant diet is limited to aquatic vegetation. Therefore, its presence in the environment is not predicted to have an effect on cultivated plants.

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:

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:

X	inapplicable
	no / very low
	low
	medium
	high
	very high

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

acomm20. 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:

X	very low
	low
	medium
	high
	very high

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

acomm22. Comments:
The species does not affect the condition or yield 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
X	medium
	high
	very high

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

acomm23. Comments:
There is no literature data concerning pathogens and parasites transmitted by painted turtles to cultivated plants. The research conducted as part of the project "Invasive turtle species as a source and vector of animal and human pathogens" demonstrated that alien species of turtles (including painted turtle) are vectors for, among others, pathogens *Pseudomonas* spp. (Pękala et al. 2016 – P), while *Pseudomonas syringae* is included in the EPPO A2 list. This bacterium causes, among others, bacterial cancers of fruit trees, bacterial brown spot of bean, bacterial angular leaf spot of cucumbers, rot of cauliflower buds, bacterial spot of tomato or leaf sheath spot of corn. It can be supposed, with high probability that as the research progresses, the presence of *Pseudomonas* spp. will be confirmed also for painted turtle, although at the moment there are no such reports. Considering that *Pseudomonas syringae* is included in the EPPO A2 list, the effect of the species on cultivated plants was estimated as medium, with low level of confidence, because of the fact that the exact taxonomic status of the pathogen found in alien species of turtles 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
X	very high

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

acomm24. Comments:

Painted turtle can probably affect domesticated animals kept in aquacultures by predation (e.g. on fish roe), however there is no available literature data on this issue. At a wide spread of this species, the probability of such situations is high (over 100 cases per 100000 animals per year – in the case of roe this ratio can be several times higher). Considering the fact that the effect of predation is the death of the victim, the result of predation was determined to be high. Consequently, the effect of the species (probability x result) was determined as very big. This species does not affect farm or domesticated animals through predation.

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

	very low
X	low
	medium
	high
	very high

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

acomm25. Comments:

There is no literature data on the characteristics of painted turtles, which upon contact with farm or domesticated animals may affect them in a negative way (except the transmission of parasites and pathogens – vide question a26). Adult individuals of this species can painfully bite animals (however, the effect of biting should be considered small – it will be followed by a full recovery of an animal), however such situations will undoubtedly be sporadic on the national scale (1-100 cases per 100000 of farm or domesticated animals per year) and will rather concern domesticated animals (mostly dogs penetrating waterside zones of water reservoirs).

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
X	high
	very high

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

acomm26. Comments:

Similarly to other reptiles, painted turtle may be a vector of various pathogens hazardous to farm animals. It was found out that it carries, among others, the following bacteria: *Salmonella* spp. (Chambers and Hulse 2006, Goławska et al. 2017 – P), *Mycobacterium fortuitum-like* and *Mycobacterium peregrinum* (Ebani et al. 2011 – P) and a nematode *Falcaustra affinis* (Najberek 2018 – N). Salmonelloses may cause a number of complications, including death in different farm animals – e.g. cattle, swine or poultry. Some *Salmonella* serovars are subject to registration obligation in Poland.

The lack of information on the transmission of other pathogens and parasites most probably results from that fact that no research which could confirm it has been conducted so far in relation to this species. There is a high probability that painted turtles can be a vector of similar pathogenic factors and parasites, as pond sliders, which are much better examined in this respect (a similar nature of the species, similar conditions of keeping animals in the period prior to the introductions). So far, in the latter the presence of numerous pathogens posing a threat to native species of fish, amphibians, reptiles, birds and mammals, i.e. the above-mentioned *Salmonella* spp. was found (Soccini and Ferri 2004, Martínez et al. 2005, Konieczna et al. 2016 – P), *Aeromonas* spp. (Soccini and Ferri 2004, Pękala et al. 2016 – P), *Pseudomonas* spp. (Soccini and Ferri 2004, Pękala et al. 2016 – P), *Shewanella putrefaciens* (Pękala et al. 2016), *Chlamydia* spp. (Mitura et al. 2016, Mitura et al. 2017 – P), *Acinetobacter* spp. (Pękala et al. 2016 – P), *Yersinia* spp. (Soccini and Ferri 2004 – P), *Klebsiella* spp. (Goławska et al. 2017 – P), *Citrobacter* spp. (Pękala et al. 2016 – P), *Acinetobacter* sp., *Chryseobacterium indologenes* and *Serratia* sp. (Paździor et al. 2016 – P). Pękala et al. (2017 – P) report that microflora isolated from outer shells of alien species of turtles may become a source of hazard to the state of health of fish inhabiting aquatic ecosystems in Poland. In particular, they mention *Aeromonas* spp., *Pseudomonas* spp., *Shewanella putrefaciens*, *Citrobacter* spp., as well as *Chryseobacterium*. These bacteria cause a death of fish of any species. Therapy of fish is possible only in small breeding reservoirs such as ponds. In large reservoirs and watercourses the use of therapy is not feasible (Pękala 2018 – I). Moreover, painted turtle, similarly to pond slider, can probably be a host and a vector of North American trematodes *Neopolystoma orbiculare*, *Polystomoides oris* and *Spirorchis elegans* and a nematode *Spiroxys contortus*.

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:

Upon direct contact, turtles can bite humans sorely, as these animals are actively defending themselves when attacked. The probability of such events was estimated as medium, or 1-100 cases per 100000 people per year. Probably, such situations may take place especially in areas used for recreational purposes, as well as by anglers, accidentally catching individuals of this species. Considering the fact that the result of biting is not hazardous for a human (except for the transmission of pathogenic organisms) – it was defined as low.

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
X	high
	very high

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

acomm29. Comments:

Similarly to other reptiles, painted turtle may be a vector of various pathogens hazardous to humans. It was found out that it carries, among others, the following bacteria: *Salmonella* spp. (Chambers and Hulse 2006, Goławska et al. 2017 – P), *Mycobacterium fortuitum-like* and *Mycobacterium peregrinum* (Ebani et al. 2011 – P) and a nematode *Falcaustra affinis* (Najberek 2018 – N). The lack of information on the transmission of other pathogens and parasites most probably results from that fact that no research which could confirm it has been conducted so far in relation to this species. There is a high probability that painted turtles can be a vector of similar pathogenic factors and parasites, as pond sliders, which are much better examined in this respect (a similar nature of the species, similar conditions of keeping animals in the period prior to the introductions). So far, in the latter the presence of numerous pathogens posing a threat to native species of fish, amphibians, reptiles, birds and mammals, i.e. the above-mentioned *Salmonella* spp. was found (Soccini and Ferri 2004, Martínez et al. 2005, Konieczna et al. 2016 – P), *Aeromonas* spp. (Soccini and Ferri 2004, Pękala et al. 2016 – P), *Pseudomonas* spp. (Soccini and Ferri 2004, Pękala et al. 2016 – P) *Shewanella putrefaciens* (Pękala et al. 2016 – P), *Chlamydia* spp. (Mitura et al. 2016, Mitura et al. 2017 – P), *Acinetobacter* spp. (Pękala et al. 2016 – P), *Yersinia* spp. (Soccini and Ferri 2004 – P), *Klebsiella* spp. (Goławska et al. 2017 – P), C*itrobacter* spp. (Pękala et al. 2016 – P), *Acinetobacter* sp., *Chryseobacterium indologenes* and *Serratia* sp. (Paździor et al. 2016 – P). Among the listed pathogens, a zoonotic (animal diseases) nature is manifested in particular by: *Salmonella* spp., *Acinetobacter* spp., *Yersinia* spp., *Klebsiella* spp., *Chlamydia* spp. and *Mycobacterium* spp., which in specific situations (a reduction in the immunity of the body) my pose a deadly threat to humans.. Therefore, the effect on human health was determined to be high. None of the above-mentioned pathogens is included in the OIE list.

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
X	low
	medium
	high
	very high

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

acomm30. Comments:

It can be assumed that in the case of establishment and increase in the population size in Poland, painted turtles can contaminate recreational areas, including urban reservoirs, fountains and bathing sites located around large cities, where the biggest numbers of these turtles is released. Assuming that this species spreads throughout Poland, and therefore it will most likely achieve a reproductive success because of appropriate habitat conditions, the problem of contamination of recreational areas may be important, as these turtles can form heavily concentrated populations – even over 800 individuals per ha (Frazer et al. 1991 – P). The probability of such events was estimated as medium, and the result as low – totally reversible. However, there is no literature data on the effect of painted turtles on infrastructure.

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:

	significantly negative
X	moderately negative
	neutral
	moderately positive
	significantly positive

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

acomm31. Comments:

There are no literature data on this issue. However, it seems that the species may have an impact on services related to food provisioning, through a transmission of parasitic and pathogenic organisms to domesticated animals. In the case of establishment and growth of population size in Poland, it can also affect animal production – e.g. as a result of predation on fish roe, as well as contaminate reservoirs used as sources of drinking water.

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

	significantly negative
X	moderately negative
	neutral

	moderately positive
	significantly positive

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

acomm32. Comments:

Painted turtles may affect biological regulations. Similarly to other alien species of turtles, they are vectors of various pathogenic organisms (Pękala et al. 2016) – therefore, they may have an impact on the regulation of zoonotic diseases.

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

	significantly negative
	moderately negative
X	neutral
	moderately positive
	significantly positive

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

acomm33. Comments:

The presence of alien species of turtles in city parks can potentially increase their attractiveness for walkers. We assume that a properly selected number of turtles may encourage to visit green areas those people who do not usually visit such places (Teillac-Deschamps et al. 2009 – P). However, in the case of establishment and increase in the population size in Poland, painted turtles can contaminate recreational areas (and therefore negatively influence their aesthetic and recreational functions), including urban reservoirs, fountains and bathing sites located around large cities, where the biggest number of these turtles is released. Therefore, their impact on cultural services should be considered neutral.

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
X	not change
	increase moderately
	increase significantly

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

acomm34.	Comments: The climate prevailing in Poland is very similar to the climate prevailing in the natural range of the occurrence of painted turtle – according to fig. 1 in the Harmonia[+PL] document, the value of climatic similarity is in the range of 94-100% (optimal conditions). Therefore, global warming will not affect overcoming geographical barriers by the species in relation to 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
X	not change
	increase moderately
	increase significantly

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

acomm35.	Comments: The climate prevailing in Poland is very similar to the climate prevailing in the natural range of the occurrence of painted turtle – according to fig. 1 in the Harmonia[+PL] document, the value of climatic similarity is in the range of 94-100% (optimal conditions). Therefore, global warming will not result in the emergence of appropriate conditions for the survival and reproduction of painted turtles in Poland, as such conditions are most likely already met.

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
X	not change
	increase moderately
	increase significantly

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

acomm36.	Comments: The climate prevailing in Poland is very similar to the climate prevailing in the natural range of the occurrence of painted turtle – according to fig. 1 in the Harmonia[+PL] document, the value of climatic similarity is in the range of 94-100% (optimal conditions). Therefore, global warming will not be a condition for painted turtles to spread throughout the 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
X	not change
	increase moderately
	increase significantly

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

acomm37.	Comments: The climate prevailing in Poland is very similar to the climate prevailing in the natural range of the occurrence of painted turtle – according to fig. 1 in the Harmonia^{+PL} document, the value of climatic similarity is in the range of 94-100% (optimal conditions). Most probably, global warming will not contribute to the change in the effect of the species on native species of plants and animals.

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: The species has practically no effect on cultivated plants and global warning should not change this.

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
X	not change
	increase moderately
	increase significantly

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

acomm39.	Comments: The climate prevailing in Poland is very similar to the climate prevailing in the natural range of the occurrence of painted turtle – according to fig. 1 in the Harmonia^{+PL} document, the value of climatic similarity is in the range of 94-100% (optimal conditions). Most probably, global warming will not contribute to the change in the effect of the species on farm and domesticated animals.

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

	decrease significantly
	decrease moderately
X	not change
	increase moderately
	increase significantly

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

acomm40.	Comments: The climate prevailing in Poland is very similar to the climate prevailing in the natural range of the occurrence of painted turtle – according to fig. 1 in the Harmonia^{+PL} document, the value of climatic similarity is in the range of 94-100% (optimal conditions). Most probably, global warming will not contribute to the change in the effect of the species on humans in Poland.

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:

The climate prevailing in Poland is very similar to the climate prevailing in the natural range of the occurrence of painted turtle – according to fig. 1 in the Harmonia^{+PL} document, the value of climatic similarity is in the range of 94-100% (optimal conditions). Most probably, global warming will not contribute to the change in the effect of the species on other domains in Poland.

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)	0.71	0.58
Cultivated plants impact (questions: a19-a23)	0.17	0.67
Domesticated animals impact (questions: a24-a26)	0.67	0.67
Human impact (questions: a27-a29)	0.50	0.75
Other impact (questions: a30)	0.25	0.00
Invasion (questions: a06-a12)	0.74	0.81
Impact (questions: a13-a30)	0.71	0.53
Overall risk score	0.52	
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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