



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

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acomment01.	Comments:	degree	affiliation	assessment date
(1)	dr hab.	Department of Hydrobiology, Faculty of Biology and Environmental Protection, The Nicolaus Copernicus University, Toruń	25-01-2018	
(2)	dr hab.	Department of Ecology and Vertebrate Zoology, Institute of Ecology and Environmental Protection, Faculty of Biology and Environmental Protection, University of Lodz	25-01-2018	
(3)	mgr	Institute of Nature Conservation of the Polish Academy of Sciences in Cracow	30-01-2018	

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

Polish name: Czebaczek amurski

Latin name: ***Pseudorasbora parva*** (Schlegel, 1842)

English name: Topmouth gudgeon

acomm02.	Comments:		
	Polish name (synonym I)	–	Polish name (synonym II)
	Latin name (synonym I)	<i>Leuciscus parvus</i>	Latin name (synonym II)
	English name (synonym I)	Stone moroko	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
- 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	

acomm04.	Comments:
	Topmouth gudgeon is a species that spreads across the Polish territory, distributed locally, but in almost the entire country. Its occurrence is strongly correlated with the neighbourhood of fish farms, from where it often penetrates into open waters. It creates reproducing populations, and its number increases (Witkowski et al. 2009 - P, Gatunki obce w Polsce 2018 - B). It often occurs on a large scale and becomes a dominant in fish fauna. For example, in Ruda Sułowska, in one of fish ponds with an area of approx. 5 ha, 300 kg of topmouth gudgeon was obtained, and in the Sumina River (the Odra basin) several thousand individuals of this species were recorded per 100 m ² (Witkowski 2009 - P, Witkowski 2011 - 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

acomm05.	Comments:
	The topmouth gudgeon has a negative impact on 2 domains: natural environment and domesticated animals. This influence manifests itself through competition (mainly depletion of the food base) (Gozlan et al. 2010, Britton et al. 2010 - P), preying on eggs and larvae of native fish species (Gozlan et al. 2010 - P), parasitic transmission (Gozlan et al. in 2005 - P), causing cascading changes in the food web (the so-called top-down effect), leading to an increase in phytoplankton abundance and acceleration of eutrophication (Gozlan et al. 2010 - P). It is also food for piscivorous species (Musil and Adámek 2007 - 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 type="checkbox"/>	medium
<input checked="" type="checkbox"/>	high

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

acomm06. Comments:
Topmouth gudgeon is widely settled almost all over Europe, as well as in North Africa, Central Asia, Oceania and the Middle East (Gozlan et al. 2010 - P, Gatunki obce w Polsce 2018, Witkowski 2011 - B). This species permeates from fish farms to open waters as a result of independent expansion. Natural expansion is the second most important (after human activities) way of spreading of the topmouth gudgeon (Gozlan et al. 2010 - P, Witkowski 2011 - B). Due to the fast rate of spreading of the topmouth gudgeon (5 countries on average are affected by the invasion within a decade, Gozlan et. al 2010 - P), the likelihood of occurrence of this species in the natural environment in Poland will increase due to self-expansion (in the areas where it does not occur yet).

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

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

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

acomm07. Comments:
In the vast majority of cases, topmouth gudgeon is introduced into new waters as a result of unintentional human activities: accidentally, along with stocking material of other fish species (Gozlan et al. 2010 - P, Witkowski 2011 - B). This species was introduced to Poland at the end of the 1980's together with the stocking material of Asian herbivorous fish, mainly bighead carp (*Aristichthys nobilis*) and silver carp (*Hypophthalmichthys molitrix*) (Witkowski 2009 - P). The probability of introducing topmouth gudgeon to the areas previously unsettled in Poland due to unintended human activities is still high.

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	

acomm08. Comments:
In just a few cases, topmouth gudgeon was introduced intentionally by humans (Witkowski 2011, Gatunki obce w Polsce 2018 - B), e.g. as food for predatory fish (Cakic et al. 2004 - P). Nevertheless, individuals of this species are sometimes used by anglers as a live bait

(Witkowski 2009 - P). In this way, the species can be intentionally caught, kept and moved to new places. It should be noted that the topmouth gudgeon is a small size fish, <12.5 cm long (FishBase 2018 - B).

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
- optimal for establishment of *the species*

aconf05. Answer provided with a

low	medium	high
		X

 level of confidence

acomm09. Comments:
The topmouth gudgeon in Poland has favourable conditions for reproduction and development, as evidenced by its widespread distribution in our waters. This species was first found in our country in 1990, in a pond near Milicz (Witkowski 2009 - P). Since then, an increase in the number and range of this species has been observed (Witkowski 2009 - P).

a10. Poland provides **habitat** that is

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

aconf06. Answer provided with a

low	medium	high
		X

 level of confidence

acomm10. Comments:
In Poland, there are optimal habitat conditions for the establishment of the topmouth gudgeon, as evidenced by its widespread distribution in our waters. The range of habitats in which the topmouth gudgeon is found is wide. Most often, however, this species occurs in small watercourses covered with vessel plants, ponds and lakes (FishBase 2018 - B). We should take into account the further increase in the number of the topmouth gudgeon in Poland.

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

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

aconf07.	Answer provided with a	low	medium	high X	level of confidence
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acommm11. Comments:
 Population expansion (Data type: B)
 The independent expansion of the topmouth gudgeon from the introduction sites takes place over a distance of about 25 km (Gozlan et al. 2010 - P). There is no detailed information at what time it takes place, however the ability of the species to spontaneously spread, bearing in mind the existing data on its occurrence, has been marked as very large. The topmouth gudgeon is recognized the most invasive species of fish in Europe (Gozlan et al. 2005, Pinder et al. 2005 - P). This species colonized almost all of Europe in less than 40 years (Gozlan et al. 2002 - P). It was first discovered in Poland in 1990. Over a dozen or so years it has spread in many places in our country (Witkowski 2009 - P). The topmouth gudgeon is found in Poland mainly in breeding ponds and related rivers (Witkowski 2009 - P), which indicates that, above all, the man contributes to the spread of the species. Nevertheless, natural expansion is also mentioned as an important factor (Gozlan et al. 2010 - P, Witkowski 2011 - B).

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
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acommm12. Comments:
 The spreading of topmouth gudgeon in Poland occurs mainly with the human participation. The sites on which this species is found are primarily breeding ponds and associated rivers (Witkowski 2009 - P). The pace of this process is fast. The topmouth gudgeon was first discovered in Poland in 1990. The number of subsequent reports is as follows (according to Witkowski 2009 - P): until 1993 - 10; until 1996 - 14; until 1999 - 27; until 2002 - 38; until 2005 - 43; until 2008 - 51.

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
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acommm13. Comments:
 The topmouth gudgeon is considered to be omnivorous; it mainly consumes animals and slightly plants (Gozlan et al. 2010 - P, Gatunki obce w Polsce 2018 - B). It feeds mainly on small invertebrates - Copepoda, Cladocera, Ostracoda, Mollusca, insect larvae (mainly Chironomidae), Rotifera - and detritus. Although topmouth gudgeon is not a typical fish-eating species, by predation and parasitism it can affect native fish species. Topmouth gudgeon preying on eggs and larvae of native fish species has been documented (Gozlan et al. 2010 - P). In addition, the topmouth gudgeon can be an optional parasite if it occurs with other species at high densities. In fish ponds in Moldova, topmouth gudgeon individuals (> 1 year old) caused wounds reaching the muscles in the bodies of silver carp (*Hypophthalmichthys molitrix*), bighead carp (*H. nobilis*) and grass carp (*Ctenopharyngodon idella*) (Gozlan et al. 2010 - P). Because in favourable habitat conditions the topmouth gudgeon density can reach very high values, the impact of this species on other aquatic organisms as a result of predation and parasitism should be considered as large. Preying on eggs and juvenile stages of fish by topmouth gudgeon in open waters and pond cultures of southern Europe probably contributed to reducing the number and even disappearance of some indigenous species of the carp family, including the species of special care - bitterling (*Rhodeus sericeus*) (Gatunki obce w Polsce). The species is noted in places where native special care species are present, e.g. bitterling (*Rhodeus sericeus*) and lake minnow (*Eupallasella (= Phoxinus) percnurus*). According to the results of monitoring of habitats and species with special regard to the particular protection areas of Natura 2000 habitats in 2015-2016 (PMŚ / CIEP 2018 - I), the threat to lake minnow from non-native species of amur sleeper (*Percottus glenii*) and topmouth gudgeon (*Pseudorasbora parva*) should be treated as potentially very large. This applies in particular to the Lubelskie and Mazowieckie Voivodships, where these species are more and more often recorded in the close vicinity of the lake minnow positions (SEM / GIOS 2018 - I).

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

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

aconf10.	Answer provided with a	low	medium	high X	level of confidence
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acommm14. Comments:
 The topmouth gudgeon competes for food with native fish species, causing changes in the food web (Gozlan et al. 2010 - P) and depletion of the food base. It competes for food in the ponds, which results in a slowdown of growth (Britton et al. 2010 - P), a serious decrease in the production of the co-existing fish (Musil et al. 2014 - P). The topmouth gudgeon can therefore cause significant decreases in the number of special care species, such as bitterling (*Rhodeus sericeus*) and lake minnow (*Eupallasella (= Phoxinus) percnurus*), i.e. species with similar habitat preferences. According to the results of monitoring of habitats and species with special regard to particular protection areas of Natura 2000 habitats in 2015-2016 (PMŚ / CIEP 2018 - I), the threat to lake minnow from non-native species of amur sleeper (*Percottus glenii*) and topmouth gudgeon moroko should be treated as potentially very large. This applies in particular to the Lubelskie and Mazowieckie Voivodships, where these species are more and more often recorded in the close vicinity of the lake minnow positions (SEM / GIOS 2018 - I).

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

- high
- very high

aconf11. Answer provided with a

low	medium X	high
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 level of confidence

acommm15. Comments:
 In Poland there are no native species closely related to topmouth gudgeon, i.e. belonging to the species *Pseudorasbora*. There were no cases of hybridization between topmouth gudgeon and native species of fish. It should be noted that the compatibility of gametes between topmouth gudgeon and sunbleak (*Leucaspis delinatus*) has been demonstrated by artificial insemination (Gozlan and Beyer 2006 - P). There is no evidence, however, that hybridization occurs in nature between these species. In the area of natural occurrence of topmouth gudgeon interbreeds with another species of the *Pseudorasbora* species - *P. pumila* - causing annihilation of this species in places where it is accidentally dragged (Konishi et al. 2003, Gozlan et al. 2010 - P).

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

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

aconf12. Answer provided with a

low	medium	high X
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 level of confidence

acommm16. Comments:
 The topmouth gudgeon is a threat to native species of fish, especially through the transmission of two parasites: *Anguillicola crassus* and *Sphaerothecum destruens*. The *A. crassus* parasite is an invasive nematode parasitizing in the adult stage in the swim bladder of eels. This parasite weakens the condition of individuals of the European eel (*Anguilla anguilla*), thus indirectly contributing to the reduction of its population (Rolbiecki 2011 - P). *S. destruens* is an intracellular parasite attacking the host organs, which leads to the increased mortality of hosts. The negative effect of *S. destruens* has been documented on salmonids and cyprinids (Arkush et al. 1998, Gozlan et al. 2005, Andreou et al. 2012 - P). The introduction of topmouth gudgeon into the pond with the sunbleak resulted in the suppression of the reproduction of the sunbleak and the drastic drop in its population within 3 years; it was caused by *S. destruens* introduced with topmouth gudgeon (Gozlan et al. 2005 - P). There is no information about the degree of the infection of topmouth gudgeon individuals with the parasite in Poland. It is estimated that in the Netherlands, from 67 to 74% of topmouth gudgeon individuals are infected with *S. destruens* (Spikmans et al. 2013 - P). Topmouth gudgeon is noted in the habitats preferred by the special care native species –bitterling (*Rhodeus sericeus*) and lake minnow (*Eupallasea (= Phoxinus) percunurus*). It can infect these species with *S. destruens*, which is associated with the risk of significant decrease in the population size.

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

- low
- medium
- high

aconf13. Answer provided with a

low	medium X	high
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 level of confidence

acomm17.

Comments:

There are no premises that the topmouth gudgeon can directly interfere with the abiotic factors of the ecosystem. However, it may indirectly, as a result of intensive feeding on zooplankton, cause the cascade effect (top-down) in the trophic pyramid (Gozlan et al. 2010 - P) in the types of habitats in which it occurs, extending also to physico-chemical conditions, such as transparency and water chemistry as a result of an increase in phytoplankton abundance and acceleration of eutrophication.

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 X
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level of confidence

acomm18.

Comments:

Intensively feeding on zooplankton the topmouth gudgeon may cause the cascade effect (top-down) in the trophic pyramid (Gozlan et al. 2010 - P), resulting in an increase in phytoplankton abundance and accelerated eutrophication. These changes are hardly reversible, and because the species can also occur in special care habitats (e.g. habitat 3150 Natura 2000 – old river beds and natural eutrophic water bodies with communities of Magnopotamion, Hydrocharition), where species of protected fish can live - like a weatherfish (*Misgurnus fossilis*), bitterling (*Rhodeus sericeus*), lake minnow (*Eupallasella (= Phoxinus) phoxinurus*) - its impact was assessed as large. It should be remembered that under favourable conditions, the development of the topmouth gudgeon population is very intense. Due to the high density of individuals, the impact of this species on biota is large.

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 X
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level of confidence

acomm19.

Comments:

The topmouth gudgeon is considered to be an omnivorous species. It feeds mainly on animals. It also feeds on detritus and plants to a small extent.

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

acommm20. 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

acommm21. 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 X
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 level of confidence

acommm22. Comments:
The species is not a plant, it feeds mainly on animals and to a small extent with detritus, 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	medium	high X
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 level of confidence

acommm23. Comments:
The species is a freshwater fish, it is not a host or vector of pathogens or parasites harmful to plants.

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:

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

aconf20.	Answer provided with a	low	medium X	high	level of confidence
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acomm24. Comments:
The species is often noted in fish ponds (Witkowski 2009, Gozlan et al. 2010, Musil et al. 2014 - P) and can occur in attractive angling fisheries. It is not a typically fish-eating species, but it may feed on eggs and larvae of native fish species (Gozlan et al. 2010 - P). At high density of individuals, it can be an optional parasite, causing in other fish wounds reaching the musculature (Gozlan et al. 2010 - P). This was found in species such as silver carp (*Hypophthalmichthys molitrix*), bighead carp (*H. nobilis*) and grass carp (*Ctenopharyngodon idella*) (Gozlan et al. 2010 - P), but other farmed fish, especially from the carp family are also at risk.

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

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

aconf21.	Answer provided with a	low	medium X	high	level of confidence
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acomm25. Comments:
It was observed that the overgrown topmouth gudgeon individuals (older than 1 year) kept in high density nibbled other fish (silver carp, bighead carp, grass carp), causing tissue losses reaching the musculature (Gozlan et al. 2010 - P).

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

aconf22.	Answer provided with a	low	medium	high X	level of confidence
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acommm26.

Comments:

The topmouth gudgeon carries parasites that are harmful to breeding fish: *Anguillicola crassus* and *Sphaerothecum destruens*. *A. crassus* parasite weakens the condition of European eel (*Anguilla anguilla*), thus indirectly contributing to the reduction of its population (Rolbiecki 2011 - P). *S. destruens* is an intracellular parasite, causing an increase in mortality in the host population. The negative effect of *S. destruens* has been documented on various species of salmonids and cyprinids, including economically and recreationally exploited fish, such as common bream (*Abramis brama*), carp (*Cyprinus carpio*), roach (*Rutilus rutilus*) (Arkush et al. 1998, Gozlan et al. 2005, Andreou et al. 2012 - P). There is no information about the degree of infection of topmouth gudgeon individuals with the parasite in Poland. It is estimated that in Holland from 67 to 74% of topmouth gudgeon individuals are infected with *S. destruens* (Spikmans et al. 2013 - P).

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 does not parasitize people.

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

acommm28.

Comments:

The species is not a danger in direct contact with humans.

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	high X
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 level of confidence

acomm29. Comments:
The topmouth gudgeon is not a vector of pathogens or parasites that could be dangerous to humans.

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	high X
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 level of confidence

acomm30. Comments:
There are no known cases of the topmouth gudgeon impact on the infrastructure. There are no premises indicating that this species can affect other objects.

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
- moderately negative
- neutral
- moderately positive
- significantly positive

aconf27. Answer provided with a

low	medium	high X
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 level of confidence

acomm31. Comments:
The impact of topmouth gudgeon on supply services was defined as moderately negative, because it negatively affects domestic fish species, including those obtained economically from the wild and farmed, competing for food, feeding on fish eggs and larvae, wounding individuals of other species (facultative parasite) and transferring parasites (Gozlan et al. 2010 - P). This results in measurable economic losses. The population development of the topmouth gudgeon in the carp ponds in the Czech Republic reduced the abundance of food base for fish, resulting in an increase in the carp production costs by 100% (Musil et al. 2014 - P). The topmouth gudgeon is eaten by predatory fish species (Musil and Adámek 2007 - P), which is the subject of fisheries management. This is a positive effect of the

impact of topmouth gudgeon on supply services, although it does not compensate for the negative impact described earlier.

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 X	high
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 level of confidence

acomm32. Comments:
As a result of the cascade effect (top-down) in the trophic pyramid, which may occur at high density of the topmouth gudgeon, there may be an excessive increase in phytoplankton abundance, acceleration of eutrophication and, consequently, changes in the physico-chemical conditions of the habitat (Gozlan et al. 2010 - P). The topmouth gudgeon carries parasites and thus affects the regulation of zoonoses.

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 X	high
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 level of confidence

acomm33. Comments:
The impact of topmouth gudgeon on cultural services has been described as moderately negative, because it adversely affects domestic fish species, attractive to anglers, competing for food, feeding on fish eggs and larvae, wounding individuals of other species (optional parasite) and transferring parasites (Gozlan et al. 2010 - P). It can therefore reduce the recreational values of fishing grounds.

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	high X
-----	--------	------------------

 level of confidence

acomm34. Comments:
There are no reasons to believe that climate change will affect topmouth gudgeon crossing geographical barriers. It is a species already introduced, and settled in Poland (Witkowski 2009 - P), characterized by high phenotypic plasticity and large adaptive abilities (Gozlan et al. 2010, Záhorská et al. 2013 - P).

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 X
-----	--------	------------------

 level of confidence

acomm35. Comments:
The topmouth gudgeon moroko is an established species in Poland. It is unlikely that this situation will change as a result of the climate change.

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 X
-----	--------	------------------

 level of confidence

acomm36. Comments:
The topmouth gudgeon is characterized by high phenotypic plasticity and has high adaptive abilities (Gozlan et al. 2010, Záhorská et al. 2013 - P), the most numerous being in macrophyte-covered environments (FishBase 2018 - B). As a result of the climate change, the development of submerged plants will take place (Alahuhta et al. 2010, Dhir 2015 - P) and it is to be expected that the development conditions of the topmouth gudgeon populations will be moderately improved. In the heated (by 5-7°C) waters of the Licheńskie Lake, the development of submerged vegetation, in particular of the foreign species – eel grass (*Vallisneria spiralis*) - stimulates the development of the topmouth gudgeon population (Kapusta et al. 2008, Záhorská et al. 2013 - P).

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 X
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 level of confidence

acomm37.

Comments:

It is predicted that as a result of the climate change, the impact of the topmouth gudgeon on cold-water species will increase due to food competition (Záhorská et al. 2013 - P). It should be assumed that this influence will increase at most moderately.

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:

The species does not affect crops and plant 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 X
-----	--------	------------------

level of confidence

acomm39.

Comments:

It is predicted that as a result of the climate change, the impact of the topmouth gudgeon on cold-water species will increase due to food competition (Záhorská et al. 2013 - P), this also applies to economically exploited fish. It should be assumed that this influence will increase moderately.

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 X	high
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level of confidence

acomm40.

Comments:

There is no evidence that the topmouth gudgeon affects people. It is unlikely that this situation will change as a result of the climate change.

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	high X
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 level of confidence

acomm41. Comments:
So far, there has been no impact of the topmouth gudgeon on other objects. It is unlikely that this situation will change as a result of the climate change.

Summary

Module	Score	Confidence
Introduction (questions: a06-a08)	1.00	1.00
Establishment (questions: a09-a10)	1.00	1.00
Spread (questions: a11-a12)	1.00	1.00
Environmental impact (questions: a13-a18)	0.75	0.83
Cultivated plants impact (questions: a19-a23)	0.00	1.00
Domesticated animals impact (questions: a24-a26)	0.67	0.67
Human impact (questions: a27-a29)	0.00	1.00
Other impact (questions: a30)	0.00	1.00
Invasion (questions: a06-a12)	1.00	1.00
Impact (questions: a13-a30)	0.75	0.90
Overall risk score	0.75	
Category of invasiveness	moderately invasive alien speciesp	

A6 | Comments

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

acomm42. Comments:
The topmouth gudgeon is considered to be one of the most invasive of foreign fish species. On this basis, it has been covered by regulations both in national (Regulation of the Minister of the Environment of 9 September 2011 on the list of plants and animals of alien species that could be a threat to native species or natural habitats in case of their release into the natural environment – P) and European (Commission implementing regulation (EU) 2016/1141 of 13 July 2016 adopting a list of invasive alien species of Union concern pursuant to Regulation – P) legislation, which aim at limiting the risk of biological invasions.
Despite this, after the risk assessment for Poland, the species was classified as an intermediate invasive category. The maximum value of the negative impact of this species (0.75) has been demonstrated for the module Impact on the natural environment (questions: a13-a18).
It should be remembered that the categories of invasiveness in this assessment were determined a priori, without the knowledge of the actual distribution of this parameter, and

the maximum value (0.75) obtained by the topmouth gudgeon is only by 0.01 lower than the pre-defined limit (0.76), above which the species is considered to be very invasive.

All these conditions should be taken into account when making decisions on how to deal with species and their prioritization.

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5. Author's own data (A)

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