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. Mariusz Sapota – external expert
2. Anna Lizińska – external expert
3. Wojciech Solarz

acomm01. Comments:

	degree	affiliation	assessment date
(1)	dr hab.	Department of Marine Biology and Ecology, Institute of Oceanography, Faculty of Oceanography and Geography, University of Gdansk	22-01-2018
(2)	dr	Department of Marine Biology and Ecology, Institute of Oceanography, Faculty of Oceanography and Geography, University of Gdansk	31-01-2018
(3)	dr	Institute of Nature Conservation of the Polish Academy of Sciences in Cracow	27-01-2018

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

Polish name: Babka bycza

Latin name: ***Neogobius melanostomus*** (Pallas, 1814)

English name: Round goby

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) –	Latin name (synonym II) –
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
	alien, present in Poland in the environment, not established
X	alien, present in Poland in the environment, established

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

acomm04.	Comments: In the Baltic Sea, the first round goby washas been caught on 9 June 1990, in the vicinity of Hel (Skóra and Stolarski 1993 – P). In the same year, several specimens of this species were observed near Hel and Gdynia. Between 1990 and 1993, round goby was sporadically caught in this area. Since 1994, clearly increasing tendencies in the population of the round goby and the gradual extension of the area occupied by this species have been recorded. In the same year, the first specimens of the round goby were observed in the internal part of the Puck Bay. The area inhabited near Gdynia was also increased. Furthermore, in early spring the first round gobies were caught in an area distant from the shore, at a depth of several dozen metres. When extending the area of its occurrence, the round goby first inhabits the most favourable areas for this species, which in the case of the Gulf of Gdańsk are mainly inshore areas with a hard bottom The round goby gradually inhabited the Puck Bay. In the subsequent years, in occupied areas the size of population and its range was growing. This led to a change in the structure of the fish assemblage in inner part of the Puck Bay. Round goby has become a codominant in fish community together with the three-spined stickleback. The importance of round goby has achieved the is highest importance in the Puckh Lagoon. In that area shallow bottom covered by plants and small wave size foundare the most favourable environment for this species. In 1995 the round goby was recorded, for the first time, outside the Gulf of Gdańsk, very close to its boundary, in Dębki, near the mouth of the Piaśnica River (Grygiel 1995 – N, Kuczyński 1995 – P). Taking into account the whole Gulf of Gdańsk, in 1997 together with the increase in abundance onin previously occupied areas in the mouth of the Vistula River was noticed. The appiranceappearance of the round goby in fresh waters was also noticerecorded, and the first specimens were caught in the Death Vistula River. Since 1999 the round goby has been common in all shallow areas in the western part of the Gulf of Gdańsk. The first specimens of this species were caught in the Vistula Lagoon (Borowski 1999 – P). A small increase in the population of the round goby in the Vistula Lagoon was observed in 2001 and the presence of this species was also recorded in the area of the Władysławo harbour.

The round goby was commonly netted not only near the mouth of the Vistula River, but also several dozen kilometres upstream the river, up to the Kiezmark. There were also reports about catching this fish much further upstream in the Vistula River, as far as in Grudziądz. In the first decade of the 21st century the round goby became established along the entire Polish coastline (it is notted from the Gulf of Gdańsk to the Bay of Pomerania), penetrating river mouth areas.

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

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

acomm05. Comments:

In areas with considerably large populations of the round goby, this species significantly affects the trophic network. Due to its dietary preferences (Skóra and Rzeźnik 2001 – P, Sapota 2005 – P), eating mainly bivalves (chiefly the species which is a predominant bivalve in the environment), a significant change takes place in the functioning of the trophic network. Filter feeders (primarily bivalves) are commonly considered to be the death end of the trophic network (Sapota 2005 – P) and the round goby changes this situation significantly by returning the matter and energy stored in filter feeders into the trophic network. The round goby is also becoming an important component of the diet of birds (cormorants, herons) and predatory fish in the littoral zone.

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
	medium
X	high

aconf02. Answer provided with a

low	medium	high	level of confidence
		X	

acomm06. Comments:

Environmental conditions in Polish waterbodies are appropriate for this species (tolerated water temperature 0 – 35 °C, tolerated water salinity 0 - 45) and it has become established in Poland (Sapota 2004 – P, Sapota and Skóra 2005 – P).

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

	low
	medium
X	high

aconf03. Answer provided with a

low	medium	high	level of confidence
		X	

acomm07.	Comments: This species is established in Poland. It has been introduced into rivers and waterbodies probably as a result of transport in ballast waters or on the hull surfaces of ships sailing between various regions (Sapota 2004 – P, Sapota and Skóra 2005 – P). The extension of its range of occurrence into neighbouring regions is a result of natural migration associated with, among other things, an increase in its population density, while the occurrences in distant areas are caused by the transport of the specimens of this species in ballast waters or on ship hulls (Sapota 2005 – P).

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

	low
	medium
X	high

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

acomm08.	Comments: This species is established in Poland (Sapota 2005, Sapota and Skóra 2005 – P). The round goby was never intentionally imported to Poland. In Poland this species is not used for aquaristc proposesaquarium keeping; there are no known cases of using it as live bait by anglers. It was probably transported to the Baltic area in the ballast waters of ships.

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: ınd goby is a typical eurytopic species (organism capable of withstanding high fluctuations of environmental factors without harm). Water temperature and salinity are the decisive physical parameters limiting the occurrence of the fish population. The round goby tolerates a wide range of temperatures between -1 and 35°C (Moskalkova 1996 – P). The metabolic rate in summer (a temperature of 20-24°C) is 5-6 times higher than that observed in winter (a temperature of 0.5-3.5°C) (Skazkina and Kostyuchenko 1968 – P). Taking into account the temperature of water in Polish waterbodies, it cannot be considered as a factor limiting the spreading of the round goby. Water salinity is another significant environmental parameter that can limit the range of the species. The salinity tolerance of the fish can differ extremely at various stages of ontogenesis. The round goby shows a wide range of tolerance to salinity. This conclusion is supported primarily by the occurrence of the round goby in areas with various salinity levels. In the area of its indigenous occurrence, the round goby inhabits both saline and freshwater and rivers. At the same time, it is able to withstand salinity exceeding that of oceans, and it was even recorded in the Kadak Bay, on the eastern coast of the Caspian Sea, where salinity amounted to 40.6 PSU (Kazanchev 1981 – P). The sensitivity of the fish to various physical environmental parameters changes

	along with the development of an individual, and as a rule it is the highest at the early stages of ontogenesis. When considering the reproduction and development of the round goby, attention has been drawn to the absence of typical larval stage in its life cycle. Round gobies can reproduce both in saline and in fresh water. It seems that water temperature is a more limiting factor regarding reproduction and embryogenesis compared to salinity. The development of roe laid in temperatures below 12°C is inhibited (Sapota 2005 – P).

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: The males of the round goby actively take care of the laid roe. Nests in which the roe is laid constitute hard elements of the bottom to withcwhich the roe is glued. These can be rocks, boulders, stones, elements of concrete structures (piers, jetties, etc.), hard parts of plants, pieces of wood and even various litter lying on the bottom. In the southern Baltic Sea, where a sandy bottom prevails, it is difficult for the round goby to find an adequate number of places suitable for laying its roe, and that is why in areas with a hard bottom the nests can touchborder each other almost directly (Sapota et al. 2014 – P). The abundance of this species in the Gulf of Gdańsk is much higher than in other localities where it occurs (Sapota et al. 2014 – P, Corkum et al. 1998 – P). The availability of hard bottom elements where roe can be laid is a critical factor limiting the development of the round goby population.

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
X	low
	medium
	high
	very high

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

acomm11.	Comments: Population expansion (Data type: B) The analysis of population development in the Gulf of Gdańsk indicates a relatively slow expansion of the area occupied by the round goby. At the same time, it is clearly visible that this species avoids areas with stronger water currents such as the coasts of the Hel and Vistula spits. The body shape and the swimming method of the round goby do not predispose it to covering long distances. However, increasing the range of the occurrence of its population by more than one kilometre per year is possible and it results from the comperativelycomparatively large sizes of specimens (as 20 cm fish, travels faster than 7 cm- native species) and their observed natural migration (Sapota 2005 – P).

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

	low
	medium
X	high

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

acomm12. Comments:

Due to restricted possibility of natural dispersal of the round goby (no such case has been recorded in the literature), harbour areas are the most likely places for new invasions (Sapota and Skóra 2005, Van Beek 2006, Winkler 2006, Verreycken et al. 2011 – P). In these places ballast water, the most convenient means of transport for the round goby, is discharged during port operations. At the same time, regardless of natural bottom morphology, harbour areas are places where round gobies can easily find hard elements necessary for reproduction and providing shelter.(Sapota 2005 – P).

There are no publications involving the round goby's rate of spreading with human assistance, however, based on published reports, it can be concluded that the number of such cases exceeds 10 per decade.

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
X	medium
	high

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

acomm13. Comments:

As a carnivorous species, the round goby feeds mainly on bivalves and other invertebrates (Skóra and Rzeźnik 2001 – P) and it significantly affects the zoobenthos of its colonised areas. The round goby causes a serious decrease in the population of native species on which it feeds (bivalves, mainly the blue mussel *Mytilus edulis*). However, there is no data indicating that the diet of the round goby would include special care species.

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

X	low
	medium
	high

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

acomm14. Comments:

At most, this species can cause a small decrease in the population of native species which are not classified as special care species. It competes for habitats, mainly with other demersal species, chiefly the european flounder (*Platichthys flesus)* (Karlson 2007 – P). Competition for food has also been observed, involving species preying on benthic organisms, also primarily the Eeuropean flounder (Skóra and Rzeźnik 2001 – P). So far, no clear disadvantageous changes in the populations of competing native species have been documented. There are also no reports which would confirm the concerns expressed at the initial stages of inhabiting the territory of Poland, in which the round goby was said to drive away native species, mainly from the family *Gobiidae*, occupying their traditional shelters: hiding places under stones and shells, cracks in hydrotechnical structures and shipwrecks (Skóra 2011 – P).

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

- [**X**] no / very low
- [ ] low
- [ ] medium
- [ ] high
- [ ] very high

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

acomm15. Comments:

The round goby reproduces in pairs; the female lays its roe in a nest prepared and guarded by the male (Sapota 2005 – P). During spawning the male acts aggressively and chases any fish except the round goby females of its species away from the region neighbouring the nest. In the case of ichthyofauna, such a method of reproduction causes the likelihood of interbreeding with other fish species to be minimal. In spite of a stabilised population observed in the area of the Gulf of Gdańsk, so far there have been no recorded instances of interbreeding between the round goby and the native species of gobies.

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

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

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

acomm16. Comments:

This species is a host or vector for at least one pathogen/parasite which infests native species that are not classified as special care species and it causes at most a small decrease in their population (Kvach and Skóra 2004 – A). So far, no transfer of pathogens or parasites from its native regions to Polish waters, by the round goby, has been documented. Parasites found in round gobies in Polish waters belong to native parasitofauna. Species for which the round goby is a host, include e.g. those present in native fish: *Acanthocephaluslucii* or *Hystherothylaciumaduncum* (Kvach 2002 – P).

To date, there has been no data on a clear impact of the round goby on other species, which would be greater than that transmitted by native species. A harmful impact of transferred bacteria and pathogens on cormorants was recorded in the Great Lakes of North America (Corkum et al 2004 – P).

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

X	low
	medium
	high

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

acomm17. Comments:

In spite of the round goby preying on filter feeders, no decrease in the number of these organisms in their natural domain has been observed. That is why the impact of the round goby on the self-purification of waterbodies, populated by it, is minor.

Because the round goby feeds on bivalves, it accelerates the circulation of organic matter stored in this link of the trophic chain. Until the occurrence of the round goby, the energy stored in bivalves was returned to circulation only after being processed by detritus (Skóra, Rzeźnik 2001). In the worst case, this species causes easily reversible changes involving processes occurring in habitats that are not classified as special care ones.

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

	low
	medium
X	high

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

acomm18. Comments:

In the worst case, the round goby causes difficult to reverse changes involving processes occurring in special care habitats, e.g. in the waters of the inner Puck Bay.

In areas with large populations of the round goby it significantly modified importantly the trophic network. . Due to its food preferences (Skóra and Rzeźnik 2001 – P, Sapota 2005 – P), eating mainly bivalves (chiefly the species which is a predominant bivalve in the environment), a significant change takes place in the functioning of the trophic network. Filter feeders (primarily bivalves) are commonly considered to be the death end of the trophic network (Sapota 2005 – P) and the round goby changes this situation significantly by returning the matter and energy stored in filter feeders into the trophic network. The round goby is also becoming an important component of the diet of birds (cormorants, herons) (Bzoma 1998, Jakubas 2003 – P) and predatory fish (data not published) in the littoral zone. There are no confirmed results of studies indicating a significant transfer of large amounts of toxic substances from the food which the round goby consumes to the higher levels of the trophic pyramid.

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:

X	inapplicable
	very low
	low

	medium
	high
	very high

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

acomm19.	Comments: The species is a carnivorous animal.

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

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:

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 integrity of crops; no cultivations are underway in locations where its presence has been recorded.

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

X	very low
	low

	medium
	high
	very high

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

acomm23. Comments:

There are no known pathogens common for this species and for cultivated plants, and there are no conjectures that they could be identified as the research progresses.

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
X	very low
	low
	medium
	high
	very high

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

acomm24. Comments:

The species is neither a predatory fish nor a parasite. It feeds on bivalves and other invertebrates, and it does not affect animal husbandry.

The impact of the round goby on fish species stocked in the Baltic Sea is unknown. There have been no observed cases of predation or parasitism related to farm animals or pets.

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

X	very low
	low
	medium
	high
	very high

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

acomm25. Comments:

The round goby does not have any properties which would pose a threat during direct contact; therefore, its impact should be classified as extremely minor.

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
X	very low
	low
	medium

	high
	very high

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

acomm26.	Comments: There are no known pathogens/parasites common for the round goby and farm animal and pet species, and there are grounds to claim that such a common pathogen/parasite does not exist. No transfer of parasitic fauna from native regions to Poland has been reported. So far, there has been no data confirming higher, than the one caused by native species, impact round goby parasite on native species.

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: The round goby is not a parasite.

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

X	very low
	low
	medium
	high
	very high

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

acomm28.	Comments: Contact with the round goby does not trigger any significant responses of the human body. Allergies may occur in the case of people sensitive to contact with fish mucus, similar to contact with any other fish species.

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

	inapplicable
X	very low
	low
	medium
	high
	very high

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

acomm29. Comments:

There are no known common pathogens or parasites of the round goby and humans. There have been no reports involving the transfer of pathogens or parasites harmful to humans by the round goby.

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	medium	high **X**	level of confidence

acomm30. Comments:

This species builds nests on submerged elements of hydrotechnical infrastructure, but this does not cause the destruction of building structures. More than 100 events per 100,000 facilities are observed per year.

The round goby places its nests on submerged elements of hydrotechnical devices. More than 100 events of this type are observed per 100 000 objects a year (probability – high). These events do not cause the destruction of building structures, therefore, their impact is minor.

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
X	neutral
	moderately positive
	significantly positive

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

acomm31. Comments:

The significance of the round goby as a possible food source for humans is high, however, this fish is virtually not consumed in Poland.

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	high **X**	level of confidence

acomm32. Comments:

So far, no transfer of pathogens or parasites by the round goby from its native regions to Polish waters has been documented. Parasites found in round gobies in Polish waters belong to native parasitic fauna (Kvach 2002). The impact of parasites found in the body of this species does not depend on whether the host is a round goby or a native species of ichthyofauna.

In spite of the round goby preying on filter feeders, no significant drops in the numbers of these organisms in the natural environment have been observed. Due to the above, the impact of the round goby on the self-purification of waterbodies inhabited by it is minor.

Due to the feeding of the round goby on bivalves, it accelerates the flow of organic matter stored in this link of the trophic chain. Before the occurrence of the round goby, the matter stored in bivalves returned to the circulation only after being processed by detritus (Skóra, Rzeźnik 2001).

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	high **X**	level of confidence

acomm33. Comments:

The round goby has no impact on cultural services.

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:

This is a eurytopic species, withstanding high fluctuations of environmental factors, and established in Poland (Sapota 2005 – P). The predicted climatic changes should not affect the probability of its introduction into Poland.

Even assuming a worst case scenario, the climatic changes will not cause environmental parameters (salinity, water temperature, pH, etc.) to exceed the range of values acceptable for the round goby. This species in definitely eurytopic (Sapota 2005 – P). The foreseen climatic changes should not alter the probability of its introduction into Polish waters.

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:

This is a eurytopic species, withstanding high fluctuations of environmental factors, and established in Poland (Sapota 2005 – P). The foreseen climatic changes will not cause changes in its establishment within Poland.

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

	decrease significantly
	decrease moderately
X	not change
	increase moderately
	increase significantly

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

acomm36. Comments:

This is a eurytopic species, withstanding high fluctuations of environmental factors, and established in Poland (Sapota 2005 – P). The predicted climatic changes should not affect its spreading in Poland.

There are no barriers which would prevent the species from spreading in Poland. The species is eurytopic, tolerating a wide spectrum of environmental factors (Sapota 2005 – P). Therefore, the foreseen climatic changes should not affect its spreading in Poland.

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	high **X**	level of confidence

acomm37. Comments:

The foreseen climatic changes will not cause changes in the distribution and population numbers of the round goby in Poland, due to which the impact of this species on Polish natural environment will not change.

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:

Due to the biology of the species, the round goby is incapable of affecting cultivated plants or crop production, regardless of climatic changes.

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	high **X**	level of confidence

acomm39. Comments:

The predicted climatic changes should not change the impact on animal husbandry, including fish farming in Poland.

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	high **X**	level of confidence

acomm40. Comments:

No significant impact on humans, regardless of climatic changes.

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	high **X**	level of confidence

acomm41. Comments:

No significant impact on other objects regardless of climatic changes.

Summary

Summary**Module**	**Score**	**Confidence**
Introduction (questions: a06-a08)	1.00	1.00
Establishment (questions: a09-a10)	1.00	1.00
Spread (questions: a11-a12)	0.63	1.00
Environmental impact (questions: a13-a18)	0.42	0.83
Cultivated plants impact (questions: a19-a23)	0.00	1.00
Domesticated animals impact (questions: a24-a26)	0.00	1.00
Human impact (questions: a27-a29)	0.00	1.00
Other impact (questions: a30)	0.25	1.00
Invasion (questions: a06-a12)	0.88	1.00
Impact (questions: a13-a30)	0.42	0.97
Overall risk score	0.36	
Category of invasiveness	potentially 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 regularly is repeated.

acomm42. Comments:

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