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. Sławomir Keszka – external expert
2. Beata Więcaszek – external expert
3. Wojciech Solarz

acomm01. Comments:

| | degree | affiliation | assessment date |
|---|---|---|---|
| (1) | dr inż. | Faculty of Food Science and Fisheries, West Pomeranian University of Technology in Szczecin | 27-01-2018 |
| (2) | dr hab. inż. | Faculty of Food Science and Fisheries, West Pomeranian University of Technology in Szczecin | 23-01-2018 |
| (3) | dr | Institute of Nature Conservation of the Polish Academy of Sciences in Cracow | 05-02-2018 |

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

Polish name: Pirapitinga

Latin name: ***Piaractus brachypomus*** (Cuvier, 1818)

English name: Pirapitinga

Fundusze Europejskie Infrastruktura i Środowisko
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| | |
|---|---|
| acomm02. | Comments:<br>In the area of its natural occurrence, it is also called Tambaqui, Caranha, or Paco. |

| | |
|---|---|
| Polish name (synonym I)<br>Pacu | Polish name (synonym II)<br>Pirania paku |
| Latin name (synonym I)<br>*Colossoma brachypomum* | Latin name (synonym II)<br>*Myletes brachypomus* |
| English name (synonym I)<br>Red pacu | English name (synonym II)<br>Red-bellied pacu |

**a03**. **Area** under assessment:

**Poland**

| | |
|---|---|
| acomm03. | Comments:<br>– |

**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 | high<br>**X** | level of confidence |

| | |
|---|---|
| acomm04. | Comments:<br>The species is not established in Poland due to the optimal temperature range required for life (Amazon and Orinoco basin) – 23-30°C. Więcaszek et al. (2016 – P). |

**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:<br>The species can have an impact by predation on other fish, including farmed fish, although it is not an obligate carnivore. It can also be a source and vector of new pathogens in the natural environment. It can have an impact on humans under favourable conditions, directly biting with strong teeth, or indirectly due to its negative effect on human activity in the environment, by deterring people from entering water bodies. |

## 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:

| | |
|---|---|
| **X** | low |
| | medium |
| | high |

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

acomm06. Comments:

The species does not occur in countries neighbouring Poland (except a single report from Slovakia in 2004) (Hensel 2004 – P, Więcaszek et al. 2016 – P), and therefore the probability of its occurrence in the natural environment in Poland as a result of self-propelled expansion is low.

**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:

So far, reports on this species found in the natural environment have been associated with intentional releases from aquariums; there are no reports on alternative sources of pirapitinga and other types of human actions related to this species in our geographical area (Więcaszek et al. 2016 – 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:

Pirapitinga individuals were released into the environment in the past. There is still a risk of further releases of overgrown specimens from aquariums to open waters, but this depends on the popularity of this species in the aquarium fish market. The ban on trading this species came into force in 2014, while piranhas can live up to 28 years. Therefore, there may be a large number of these fish in aquarium cultures. Because over the past decade pirapitinga has been found in Poland more than 10 times (Więcaszek et al. 2016 – P), the probability for the species to be introduced into Poland's natural environment by intentional human actions is high.

## 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:

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

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

acomm09. Comments:

Laboratory studies on pirapitinga have shown that its minimum thermal limit of tolerance is 11-13°C. Below this temperature the life functions of the species change dramatically leading to the death of the fish. Pirapitinga stops feeding at temperature below 16-18°C (Więcaszek et al. 2016 – P). The equatorial climate and humid climate are favourable climate types in the secondary range of pirapitinga.

**a10**. Poland provides **habitat** that is

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

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

acomm10. Comments:

Pirapitinga lives in rivers and river basins, as well as floodplains in the tropics, but it shows great adaptability to other habitat conditions. Apart from the temperature of water, the remaining properties of the environment do not rule out the survival of individuals of this species in Poland. However, there are no optimal habitats for this species in Poland (e.g. with a suitable substrate) which would enable species reproduction.

## 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:

| | |
|---|---|
| **X** | very low |
| | low |
| | medium |
| | high |
| | very high |

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

acomm11. Comments:

Assessment (data type: C)

Without human assistance the pirapitinga has no capacity for dispersal in Poland.

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

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

| | | | | | |
|---|---|---|---|---|---|
| aconf08. | Answer provided with a | low<br>X | medium | high | level of confidence |

acomm12. Comments:

The characteristics of the species and its potential threat to humans generally rule out the risk of dispersal of pirapitinga from the existing locations of occurrence to new ones. It should be expected that even if pirapitinga becomes established and spreads on a large scale in Polish waters, such incidents will occur less frequently than once in a decade. Experience with the presence of the species in countries of the Iberian Peninsula, where the temperature of water is similar to that in the area of its natural occurrence, showed the lack of reproduction, hence the accidental dispersal of spawn or fry on fishing equipment should be assumed as practically impossible (Ribeiro et al. 2008 – P).

## 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 |
| X | low |
| | medium |
| | high |

| | | | | | |
|---|---|---|---|---|---|
| aconf09. | Answer provided with a | low | medium<br>X | high | level of confidence |

acomm13. Comments:

The investigated pirapitingas captured in Polish waters had empty stomachs; scales from Cyprinidae fish were found only in one case (Więcaszek et al. 2016 – P). It should therefore be assumed that even in the case of wide spreading in Polish waters, the species may cause at most a slight drop in the number of native species that are not species of special concern. However, studies in the waters of southern Asia have demonstrated the great flexibility of the species towards changing its diet in non-native environmental conditions (Correa et al. 2015 – P).

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

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

| | | | | | |
|---|---|---|---|---|---|
| aconf10. | Answer provided with a | low | medium | high<br>**X** | level of confidence |

acomm14. Comments:

Even in the case of a large-scale spread, pirapitinga would not compete with species native to Poland, because there are no species of fish feeding on similar food preferred by pirapitinga (nuts fallen into water, hard fruit, seeds; Correa et al. 2015 – 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<br>**X** | level of confidence |

acomm15. Comments:

There are no other species from the order *Characiformes*, family *Serrasalmidae*, living in Polish waters and related to pirapitinga, so there is no possibility of interbreeding

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

| | |
|---|---|
| | very low |
| **X** | low |
| | medium |
| | high |
| | very high |

| | | | | | |
|---|---|---|---|---|---|
| aconf12. | Answer provided with a | low<br>X | medium | high | level of confidence |

acomm16. Comments:

Studies on pirapitingas in Poland revealed only one species of parasite, *Mymarothecium viatorum*, which is a specific parasite for the *Piaractus* genus. Therefore, this parasite has no chance of survival and development on species native to Poland (Boeger et al. 2002 – P). Nevertheless, newly emerging pirapitinga individuals should still be monitored for hosting parasites, because so far only a few individuals have been examined for the transmission of pathogens and parasites.

**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<br>**X** | high | level of confidence |

acomm17. Comments:

Even if the species occurs throughout the country, its potential impact on abiotic properties should be considered negligible, due to its low activity in the new environment. In the worst case scenario, the pirapitinga can cause easily reversible changes in processes occurring in habitats that are not classified as habitats of special conservation concern.

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

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

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

acomm18. Comments:

Previous experience with the presence of the species in other European countries suggests that the species has no cascade effect on the food network (Leunda 2010 – P). Therefore, even if the species spreads in Poland, it may cause, in the worst case scenario, easily reversible changes in processes occurring in habitats that are not classified as habitats of special conservation concern.

## 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:

Even if the species spreads throughout Poland, it cannot have any impact on cultivated plants. Systems of plant cultivation in Poland exclude interactions between cultivated plants and pirapitingas.

**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:

This is an animal species.

**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:

This is an animal species.

**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:

Regardless of the scale of its spread, the species cannot disturb the cultivation system's integrity. The lack of effect of the species on plants cultivated in Poland through herbivory and parasitism excludes the effect of the species on the cultivation system's integrity.

**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:

The species does not transmit any 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:

| | |
|---|---|
| | inapplicable |
| **X** | very low |
| | low |
| | medium |

| | |
|---|---|
| | high |
| | very high |

| | | | | | |
|---|---|---|---|---|---|
| aconf20. | Answer provided with a | low<br>**X** | medium | high | level of confidence |

acomm24. Comments:

The investigated pirapitingas captured in Polish waters had empty stomachs; scales from *Cyprinidae* fish were found only in one case (Więcaszek et al. 2016 – P). It should therefore be assumed that even if the species spreads on a wide scale in Polish waters, the effect of pirapitinga on fish species important for the fish farming sector will be very low.

**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<br>**X** | high | level of confidence |

acomm25. Comments:

Pirapitinga is not a typical carnivore, but in unfavourable food conditions it can change preferences and attack other fish, or eat dead fish. However, even if the species spreads on a wide scale in Polish waters, the effect of pirapitinga on fish species important for the fish farming sector will be very low.

**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<br>**X** | medium | high | level of confidence |

acomm26. Comments:

Studies on pirapitingas in Poland revealed only one species of parasite, *Mymarothecium viatorum*, which is a specific parasite for the *Piaractus* genus. Therefore, this parasite has no chance of survival and development on species native to Poland (Boeger et al. 2002 – P). Nevertheless, newly emerging pirapitinga individuals should still be monitored for hosting parasites, because so far only a few individuals have been examined for the transmission of pathogens and parasites.

## 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 is not a parasitic species.

**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:

Pirapitinga in large groups is potentially dangerous to humans, although reports on bites from pirapitingas are limited to the area of its natural occurrence. However, caution should be exercised when handling live specimens of the species due to their strong jaws and sharp teeth, used by this fish for crushing food, which in natural waters includes fruits falling into the water, other parts of plants and insects. Defending themselves, pirapitingas can inflict deep wounds with their teeth (Robins et al. 1991 – P). It should be assumed that even if the pirapitinga spreads on a wide scale in Polish waters, the probability of such incidents will be medium (1-100 cases per 100,000 people per year), and their effect small (the need for medical consultations will be rare, wounds will not lead to permanent disabilities, and the level of stress associated with them will be low).

**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 **X** | medium | high | level of confidence |

acomm29. Comments:

Studies on pirapitingas in Poland revealed only one species of parasite, *Mymarothecium viatorum*, which is a specific parasite for the *Piaractus* genus. Therefore, this parasite has no chance of survival and development on species native to Poland (Boeger et al. 2002 – P). Nevertheless, newly emerging pirapitinga individuals should still be monitored for hosting parasites, because so far only a few individuals have been examined for the transmission of pathogens and parasites.

## 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:

The negative effect of the species on tourist infrastructure, e.g. urban outdoor water bodies used for swimming and recreational reservoirs, can be manifested indirectly, by reducing the attractiveness of these places and lowering the number of people using these facilities. The effects of this are small and completely reversible.

## 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 species has no effect on provisioning services. Pirapitinga as an element of tropical climate ecosystems is not adapted to local conditions in the secondary range in Poland, where the climate is temperate, and thus has no effect on the production of food, organic raw materials and other resources of biological origin.

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

| | |
|---|---|
| | significantly negative |
| | moderately negative |
| **X** | neutral |
| | moderately positive |
| | significantly positive |

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

| | |
|---|---|
| acomm32. | Comments:<br>The species has no effect on regulation services. Pirapitinga is not a persistent active element of trophic networks in Poland, and due to climatic conditions in its secondary range, which are critical to species survival, it can not affect even biological regulation. |

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

| | |
|---|---|
| | significantly negative |
| **X** | moderately negative |
| | neutral |
| | moderately positive |
| | significantly positive |

| | | | | | |
|---|---|---|---|---|---|
| aconf29. | Answer provided with a | low | medium | high<br>**X** | level of confidence |

| | |
|---|---|
| acomm33. | Comments:<br>It seems that the presence of piranhas, even herbivore species, may have a moderately negative impact on tourist services related to water, especially beaches. It is connected with the low level of public education on species of fish, both native and alien, found in Polish waters. The emergence of pirapitinga arouses negative connotations (related to the perception of "piranhas"), affecting the attractiveness of places used for recreation and tourism. |

## 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<br>**X** | high | level of confidence |

| | |
|---|---|
| acomm34. | Comments:<br>The mechanism of introducing this species in Poland depends only on humans; pirapitingas do not penetrate into the natural environment as a result of leaking aquaculture facilities. However, in the future, it may be possible to breed this species if climate change occurs and thus conditions for thermophilic fish are created. Nothing is known about potential farming of this fish in Poland for consumption. In the world, however, it is quite often raised on fish farms for its tasty meat. This particularly concerns South America and southern Asia (Ma et al. 2003 – 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 |
| **X** | not change |
| | increase moderately |
| | increase significantly |

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

acomm35. Comments:

There is a probability of survival of this species in Polish waters due to climate change, but reproduction is impossible. In addition to temperature, spawning is influenced by other factors, e.g. type of substrate. In aquarium cultures, pirapitinga reproduces only with hormonal stimulation. Detailed studies conducted in Spain (where the climate is much warmer) showed the ability of pirapitinga to survive, but no reproductive success (Ribeiro et al. 2008 – P).

**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 **X** | high | level of confidence |

acomm36. Comments:

So far, pirapitingas managed to survive only near coal-fired power stations, in channels with waste cooling water where temperature is higher, also in the winter season. Potentially, if the mean temperatures increase, the species will be able to spread outside the "thermal islands". As a result of climate warming it could probably occur not only in heated waters but also in natural waters, although wintering in them could also be impossible.

**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:

As a result of climate change, a moderate increase in the negative impact on the natural environment could be exerted by more active foraging, with the increase of the current intensity and frequency of introducing the species to open waters.

**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 no effect on cultivated plants, so climate change is not an important factor that could influence it. Potential habitats of pirapitinga are not in direct contact with areas where plants are cultivated.

**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:

When plant food is lacking, pirapitinga can switch diet and predate on other fish, including farmed ones if it gets into aquaculture facilities.

**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 |
| **X** | increase moderately |
| | increase significantly |

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

acomm40. Comments:

As a result of climate change, the impact of pirapitinga on humans in Poland may increase moderately due to the potential increase of species activity in natural waters. The species may become more noticeable to people (those using, e.g. beaches, urban open water bodies used for swimming) and make them feel unsafe.

**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 |
| **X** | increase moderately |
| | increase significantly |

| | | | | | |
|---|---|---|---|---|---|
| aconf37. | Answer provided with a | low | medium **X** | high | level of confidence |

acomm41. Comments:

The impact of the species on other domains may increase moderately due to climate change because of the greater activity of the species. This may reduce the usability of facilities and have a negative effect on their attractiveness to people.

## Summary

| Module | Score | Confidence |
|---|---|---|
| Introduction (questions: a06-a08) | 0.33 | 1.00 |
| Establishment (questions: a09-a10) | 0.25 | 1.00 |
| Spread (questions: a11-a12) | 0.00 | 0.25 |
| Environmental impact (questions: a13-a18) | 0.04 | 0.58 |
| Cultivated plants impact (questions: a19-a23) | 0.00 | 1.00 |
| Domesticated animals impact (questions: a24-a26) | 0.08 | 0.17 |
| Human impact (questions: a27-a29) | 0.13 | 0.50 |
| Other impact (questions: a30) | 0.25 | 0.00 |
| Invasion (questions: a06-a12) | 0.19 | 0.75 |
| Impact (questions: a13-a30) | 0.25 | 0.45 |
| Overall risk score | 0.05 | |
| Category of invasiveness | non invasive alien species | |

## A6 | Comments

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

acomm42. Comments:

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## Data sources

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**3. Unpublished data (N)**

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**4. Other (I)**

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**5. Author's own data (A)**

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