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. Magdalena Bartoszewicz
2. Henryk Okarma
3. Karolina Mazurska

acomm01. Comments:

	degree	affiliation	assessment date
(1)	dr		22-01-2018
(2)	prof. dr hab.	Institute of Nature Conservation, Polish Academy of Sciences in Cracow	26-01-2018
(3)	mgr	Institute of Nature Conservation, Polish Academy of Sciences in Cracow	01-02-2018

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

Polish name: Nutria

Latin name: ***Myocastor coypus*** Molina, 1782

English name: Coypu

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) *Myopotamus bonariensis*	Latin name (synonym II) *Mus coypus*	
	English name (synonym I) Coypu rat	English name (synonym II) Nutria	

a03. **Area** under assessment:

Poland

acomm03.	Comments: –

a04. **Status** of *the species* in Poland. *The species* is:

	native to Poland
	alien, absent from Poland
	alien, present in Poland only in cultivation or captivity
X	alien, present in Poland in the environment, not established
	alien, present in Poland in the environment, established

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

acomm04.	Comments: Nutria (also called coypu) was brought over to Europe from South America as an animal for fur farming in the beginning of 20th century. Breeding of these animals has no lengthy tradition in Poland. It was started by a small import of several nutria pairs from Argentina in 1926. Before the beginning of World War II, there were approx. 500 females in Poland; then, after the war, a reconstruction of the breeding herd was attempted by importing genetic material from Czechoslovakia, West and East Germany. In 1950s, 563 animals were brought over, resulting in a steadily yearly increase in hide production in next years, reaching its peak in 1980. Poland was globally the largest manufacturer of nutria hides from cage breeding then (at the time, 3.4 million hides were obtained) (Kowalska *et al.* 2010 – P). In 2016, only three nutria farms included into the breeding value assessment existed in Poland (two in Greater Poland, one in Lesser Poland), in which approx. 400 females of the breeding herd were kept (Anonymous 2016 – I). However, multiple smaller farms are still operating, which is proved by numerous advertisements concerning sales of the animals, published in Internet portals. Wild populations has been known since 1960 (usually occurrence of adults, but there are also reports on reproduction in the natural environment), formed due to escapes from farms – the first one in the Milicz area (Lewartowski and Zimowski 1986 – P). However, they do not survive for a longer time, harsh winters being the limiting factor. Nutria populations are very sensitive to climatic fluctuations. Their sizes increase as a result of mild winters and in places where industrial pollution maintains a high water temperature (Doncaster and Micol 1989 – P, Litjens 1980 – P). Low temperatures result in a direct mortality of individuals and cause a dramatic decrease in fat reserves, leading to an increased abortion of embryos and a decrease in the reproductive success (Newson 1966 – P, Norris 1967 – P).

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

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

acomm05. Comments:

Nutria is a large herbivorous rodent, which may adversely affect aquatic flora, including rare and endangered plant species (Ehrlich and Jedynak 1962 – P, Woods *et al.* 1992 – P, Prigioni *et al.* 2005 – P). It inhabits water shores and usually stays not further than 100 m from the shore. Nutria may pose a hazard for rare plant species, but its influence is sometimes considered positive, because it limits growth of reed bed, thus inhibiting lake overgrowing (Mihaylov *et al.* 2017 – P). Nutria may affect some water bird species by reducing the area of habitats convenient for nesting (Prigioni *et al.* 2005 – P). A decrease in populations of whiskered tern *Chlidonias hybrida* was found in Italy, because the rodent limited the availability of proper breeding habitats – floating leaves of water lily *Nymphea* (BirdLife International 2018 – I). It was also found that nutria was destroying nests of some species (Eurasian coot *Fulica atra*, mallard *Anas platyrhynchos*), using them as platforms for resting and hair care, sometimes also removing eggs from the nests (Angelici *et al.* 2017 – P). Nutria causes serious damage by digging dens in river banks, dams, and earth embankments (LeBlanc 1994 – P, Bertolino 2006 – I). It may also cause damage by seeking food in various types of crops: corn, sorghum, beets, cereals, lucerne, vegetables (Schitoskey *et al.* 1972 – P, Kuhn and Peloquin 1974 – P, LeBlanc 1994 – P, Bertolino 2006 – I). Moreover, it may affect any kind of crops by causing them to be flooded as a result of damages of watercourse banks and reservoir shores. The species is a carrier for a series of diseases and pathogens affecting animal and human health (LeBlanc 1994 – P, Bartolino 2006 – I, Najberek – in preparation).

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 **X**	level of confidence

acomm06. Comments:

Among the countries neighbouring with Poland, nutria occurs in Germany (Walther *et al.* 2011 – P) and Czech Republic (Reggiani 1999 – P, Anděra, Červený 2003 – P, Špryňar 2007 – P). According to the data obtained from hunters, in the period of 2006 to 2015, nutria has increased its range in Germany twice and is found even in 16% of hunting districts currently (Anonymous 2017 – I). One may anticipate that because of the species' features and mild winters occurring in recent years, the probability of emergence as a result of unassisted expansion is high.

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: Nutria is a large animal, thus the probability of introduction of a species into the natural environment as a result of unintended human action is very low.

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

	low
X	medium
	high

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

acomm08.	Comments: The legislature does not allow for intentional relocations of this species in the natural environment. At present, there are only three registered nutria farms in Poland, numbering approx. 400 animals of the breeding herd altogether (Internet source: Krajowe Centrum Hodowli Zwierząt [National Centre of Animal Husbandry] 2016 – P), or several thousand animals in total. However, at least a dozen or so other suppliers offering nutrias may be found on Internet portals (Serwis olx.pl. 2018 – I). Moreover, nutrias are sporadically kept as pets (Natalia Bet 2015 – I). Therefore, escapes or releases of the animals are probable and may occur in various parts of Poland. The probability old escape was assessed as medium: more than 1 but less than 10 cases per decade.

A2 | Establishment

Questions from this module assess the likelihood for *the species* to overcome survival and reproduction barriers. This leads to *establishment*, defined as the growth of a population to sufficient levels such that natural extinction within *the area* becomes highly unlikely.

a09. Poland provides **climate** that is:

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

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

acomm09.	Comments: The natural range of nutria extends southwards of the 23rd degree of latitude and includes Argentina, Bolivia, southern Brazil, Chile, Paraguay and Uruguay (Carter and Leonard 2002). The climatic similarity of Poland to the countries of origin of this species does not exceed 94% (according to the Harmonia^{+} methodology). Populations of the species, originating, most of all, from farm escapees, exist and spread in countries having a climate similar to that of Poland, mostly in Western Europe (Reggiani 1999). However, nutrias are not resistant to low temperatures, so in Poland, frigid winters have been probably the most limiting factor for their invasion hitherto, and the species has not spread in Northern Europe as yet.

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:

Within the boundaries of its original range, nutria inhabits all types of waterlogged areas, ponds, lakes, rivers, streams. The species tolerates a broad range of habitat conditions in aquatic habitats and it is nor limited by specific requirements concerning them, also that of water purity (Litjens 1980 – P, Doncaster and Micol 1989 – P). In the area of Europe, it exhibits the same habitat preference, choosing calm and stagnant waters; sometimes, it occurs in brackish waters near seashores as well (Robert *et al.* 2013 – P). It occurs within the boundaries of urban areas too (Walther *et al.* 2011 – P), also in Poland (Król 2017 – I). The species has been introduced into European countries with habitats similar to those existing in Poland, it persists there and even spreads (Reggiani 1999 – P). It is a species requiring aquatic habitats for occurrence, therefore it is only limited by areas with a low hydration.

A3 | Spread

Questions from this module assess the risk of *the species* to overcoming dispersal barriers and (new) environmental barriers within Poland. This would lead to spread, in which vacant patches of suitable habitat become increasingly occupied from (an) already-established population(s) within Poland.

Note that spread is considered to be different from range expansions that stem from new introductions (covered by the Introduction module).

a11. The capacity of *the species* to disperse within Poland by natural means, **with no human assistance**, is:

	very low
	low
	medium
X	high
	very high

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

acomm11. Comments:

Dispersion from a single source (Type of data: A)
It is evaluated that an average dispersion ration of nutria amounts to several kilometres per year. In years 1937-1945, nutria colonised 65 km of Norfolk river in Great Britain. In French Ardennes, it spreads with a rate of 3.4-12.9 km per year on various rivers. In Eastern Europe, migrations of a single animal at the distance of 65 km have been ascertained (Robert *et al.* 2013 – P). There is information (Anonymous 2017 – I) about doubling of the range of populations in Germany from 2006 to 2015. Nutria populations spread, encompassing already, among others, Holland and Belgium, which are colonised mostly from the direction of Germany (Robert *et al.* 2013 – P). Taking into account the biological features of the species (size, life history, fertility, behaviour), the population spreading rate was estimated as high (from 5 km per year to 50 km per year).

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

	low
X	medium
	high

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

acomm12. Comments:

Expert assessment – no documented data from published research results. The legislature does not allow for intentional relocations of this species in the natural environment. Taking into account the availability of the animals originating from farms, keeping nutrias as pets, and risk of escape or intentional release, relocations with participation of humans are probable. One should expect that the frequency of animal relocation at distances larger than 50 km will be average (more than 1 case, but no more than 10 cases 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
	medium
X	high

aconf09. Answer provided with a

low	medium	high	level of confidence
		X	

acomm13. Comments:

Nutria is classified as one of the 100 globally most dangerous invasive species (Lowe *et al.* 2000 – P). Nutrias are herbivorous (sporadically, they may eat small arthropods and bird brood, found while searching for food) and aquatic plants are the basis of their diet both in their natural rangeland, and in places where they've been introduced (Woods *et al.* 1992 – P, Reggiani 1999 – P). Such a tendency in the nutrias diet occurs even when they have access to a rich base of land plants near the banks of watercourses, for instance cultivated plants (d'Adamo *et al.* 2000 – P). Nutria consumes from 800 to 1500 g of food daily, up to 25% of the body mass (Robert *et al.* 2013 – P). It was proved that 7 of 12 endangered aquatic plant species in Italy is eaten by nutrias, suggesting that some particularly sensitive species may experience long-term effects from nutrias' feeding (Prigioni *et al.* 2005 – P). Moreover, these animals may damage both deciduous and coniferous tress, including seedlings of swamp cypress *Taxodium distichum* (Kuhn and Peloquin 1974 – P, Myers *et al.* 1995 – P). The influence of nutria on aquatic vegetation may be very significant, leading to a large reduction of reedy areas (Ehrlich and Jedynak 1962 – P) and a downright elimination of various species of the genus *Rumex* and yellow water-lily *Nuphar lutea* (Bertolino 2006 – I) in vast areas. Occurring in high densities, nutria may reduce shore flora, which may suppress the process of natural succession (Ruys *et al.* 2012 – P). The decay of some habitats may also affect adversely fish and invertebrates (*e.g.* dragonflies) connected with these habitats (Bertolino 2008 – I) . Nutria may affect bird breeding destructively by eating eggs and nestlings (Bertolino 2006 – I, Bertolino *et al.* 2011 – P), using floating nests as places for rest (Angelici *et al.* 2012 – P), as well as by eating floating vegetation which constitutes a habitat of some species of water birds. A decrease in populations of whiskered tern was found in Italy, because the rodent limited the

availability of proper breeding habitats – floating leaves of water lily *Nymphea* (BirdLife International 2018 – I).

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

X	low
	medium
	high

aconf10. Answer provided with a

low	medium	high	level of confidence
		X	

acomm14. Comments:

The ecological niche of nutria overlaps onto niches of two species occurring in Poland: muskrat *Ondatra zibethicus* and Eurasian beaver *Castor fiber*. One should expect a strong competition for food with muskrat, whose diet is based on aquatic vegetation too (Willner *et al.* 1980). However, muskrat is an alien species in Poland. Eurasian beaver is a protected species included in Regulation of the Minister of Environment of 16 December 2016 on protected animal species – P, but at present, it is very widespread in Poland and its abundance is very high (Okarma 2018 – I). Also, a direct competition for food of nutria and beaver should not be expected, as their dietary spectra differ significantly (Czech 2000 – I). Beavers feed on over 200 herbaceous plant species and and on over 100 tree species (Czech 2000 – I), whreas nutria only restricts itself to herbaceous plants. That is why the competitive influence of nutria on native species is evaluated as low.

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	level of confidence
		X	

acomm15. Comments:

There is no published scientific data on cases of crossbreeding of nutria with other species, as there are no closely related species.

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

	very low
	low
	medium
X	high
	very high

aconf12. Answer provided with a

low	medium	high	level of confidence
		X	

acomm16. Comments:

Nutria may be a carrier for at least 30 pathogens, including parasites, *i.a.* protozoa, nematodes, liver fluke *Fasciola hepatica* (Lewis *et al.* 1984 – P, Najberek – in preparation) and *Trichinella* spp. (OIE list) (Moretti *et al.* 2001 – P), which may be transmitted to wild ungulates and carnivores, particularly in situations when the latter use water contaminated with nutria excrements and urine (LeBlanc 1994 – P). Also, nutria may be infected with toxoplasmosis (Howerth *et al.* 1994 – P) and tuberculosis. A hypothesis has been formulated that nutria plays a role in the epidemiology of leptospirosis, however probably its participation in spreading the bacteria in the environment is significantly less

	important than that of rats (Bertolino 2006 – I). These pathogens may be dangerous for native species, they may bring about permanent health damage in the infected animals.

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

	low
X	medium
	high

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

acomm17. Comments:

Digging burrows, nutria infracts the structure of watercourse banks and reservoir shores. As it also feeds on plant roots and underground rhizomes, it causes a destabilisation of the upper soil layer, followed by its erosion. On the other hand, breaking banks and increased sedimentation on river bottoms increases the flood risks in low areas (Robert *et al.* 2013 – P). Activity of nutria inhibits also the plant growth in waterlogged areas, which are habitats of particular care. However, these processes are reversible.

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

	low
X	medium
	high

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

acomm18. Comments:

The nutria diet mostly consists of aquatic plants, and it removes more plants than it eats actually, because it also builds platforms for rest, feeding, grooming and breeding (Robert et al. 2013 – P). As a result, it may cause a significant reduction of vegetation patches, particularly reed. Nutrias, especially while occurring in high densities, may disturb the integrity of whole swamp and waterlogged ecosystems. In Louisiana (USA), nutrias are considered an important factor causing the decay of the native coastal swamp complex by reducing the plant biomass and changing the composition of plant associations (Shaffer *et al.* 1992 – P, Evers *et al.* 1998 – P). Louisiana has lost more than 8,000 ha of swamp because of the destruction of vegetation caused by nutrias, and the adverse impact of the rodents is evident in more than 40,000 ha of swamp (Marx *et al.* 2004 – P). Moreover, destruction of water vegetation (particularly reed) by nutrias may affect endangered bird species, reducing their nesting possibilities (Scaravelli 2002 – P). It has been proved for little bittern *Ixobrychus minutus* in Ticino Valley (Italy), because of thinning out of vegetation and disturbing during the nesting period (Prigioni *et al.* 2005 – P). Also, nutria reduces the breeding success of other water birds, especially those which build floating nests (Bertolino *et al.* 2011 – P). Nutria contributes into decreases in abundance of some fish and invertebrates (Bertolino 2008 – I). In the worst case scenario, the species causes hardly reversible changes of processes occurring in habitats which do not belong to habitats of particular care, or easily reversible changes of processes occurring in particular care habitats.

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
	very low
	low
X	medium
	high
	very high

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

acomm19. Comments:

The influence of nutria on agricultural crops is most significant in areas close to water habitats, where the rodents occur in a high abundance (Bounds *et al.* 2003 – P). The crops, in which the largest damages are recorded, include: sugar cane, rice, corn, sorghum, sugar beet, fodder beet, cereals, lucerne (alfalfa), peanuts, melons, and various vegetables (Schitoskey *et al.* 1972 – P, Kuhn and Peloquin 1974 – P, LeBlanc 1994 – P, Carter and Leonard 2002 – P). Sometimes, the damage reaches up to 10% of the crop. However, the damage degree depends significantly on the distance between the field and the watercourse banks and reservoir shores. In general, nutrias more willingly feed on natural vegetation growing on the banks or shores of water bodies (Robert *et al.* 2013 – P). It has been estimated that in Italy, crop damages caused by nutria constitute a low percentage of all damages caused by animals, however, the share of the former in the total damage number has increased from 3 to 8% during six years (Panzacchi *et al.* 2007 – P). In the 1995-2000 period, despite killing more than 220,000 nutrias at the expense of €2.6 mln, the agricultural crop damages exceeded €0.9 mln (Bertolino 2006 – I). It is anticipated that the influence of the species on plant crops will be medium: it will pertain to from 1/3 to 2/3 plant crops being the object of the invasion, and, in the worst case scenario, the plant condition or yield of a single crop will be reduced by from approx. 5% to approx. 20%.

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:

	very low
X	low
	medium
	high
	very high

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

acomm22.	Comments: There is no published data on the impact of the species on condition or yielding of cultivated plants caused by changing the agroecosystem properties, including the cycles of chemical elements, hydrology, physical properties, food webs. It has been found that sometimes, damage caused by nutrias reach up to 10% of yield (Robert *et al.* 2013 – P). Nutrias may feed on cultivated plants, but as they feed no further than 100 m from banks or shores of water bodies usually, it is anticipated that their influence on the crop integrity will by low: less than 1/3 of the plant crops will be a target for the invasion. In the worst case scenario, plant condition or yield of a single crop will be reduced to a medium degree: from approx. 5% to approx. 20%.

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 is no known literature data on the fact that the species is a host or a vector for pathogens or parasites harmful for cultivated 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	medium	high **X**	level of confidence

acomm24. Comments:

Nutria is a herbivorous species, but sporadically, it may eat small arthropods and bird eggs found during feeding. It affects only the wild populations of invertebrates and birds. Meanwhile, the species does not affect the health of a single animal or the animal production at all.

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 **X**	high	level of confidence

acomm25. Comments:

There is no published scientific data known that the species has biological, physical and/or chemical properties, exerting harmful influence during contact with farm and domestic animals or animal production (e.g. toxins or allergens). Nutrias are rather large animals and they have sharp incisors, so in the case of a direct contact, bites and injuries may occur, but the probability of such cases is very low. However, cases of biting of pet animals by nutrias are reported in urban populations in Germany (Walther *et al.* 2011 – P). The probability of a direct contact has been estimated as medium: 1-100 cases per 100,000 farm animals or domestic animals per year; the effect was estimates as small.

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

	inapplicable
	very low
	low
	medium
X	high
	very high

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

acomm26. Comments:

Nutria may be a carrier of leptospirosis spirochaete, *Mycobacterium tuberculosis* and various parasites: protozoa and nematodes (Lewis *et al.* 1984 – P, Najberek – in preparation), which may be transmitted to farm animals, particularly in situations when the latter use water contaminated with nutria excrements and urine (LeBlanc 1994 – P). Nutria is a host of, among others, trichinosis (OIE list) and liver fluke. Therefore, infected animals are a natural reservoir of these parasites; they increase the group of carriers and maintain the presence of the disease among the farm species. These pathogens may cause permanent health damages in infected farm animals; the diseases caused by these pathogens are not completely curable.

A4d | Impact on the human domain

Questions from this module qualify the consequences of *the organism* on humans. It deals with human health, being defined as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity (definition adopted from the World Health Organization).

a27. The effect of *the species* on human health through **parasitism** is:

X	inapplicable
	very low
	low
	medium
	high
	vert high

aconf23.	Answer provided with a	low	medium	high	level of confidence

acomm27. Comments:

This species in not parasitic.

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 **X**	high	level of confidence

acomm28. Comments:

No literature data is known that the species has biological, physical and/or chemical properties, exerting harmful influence during a direct contact with humans. However, nutrias are quite large animals and they have sharp incisors, and although they do not exhibit aggression against humans, cases of biting while in danger cannot be excluded. Cases of attacks on humans and biting humans by nutrias are reported in populations inhabiting parks in Germany (Walther *et al.* 2011 – P). Nutrias are also fed by humans in urban areas in Czech Republic (Holec 2009 – P), therefore biting events are probable. The probability of a direct contact has been estimated as medium: 1-100 cases per 100,000 humans per year; the effect was estimates as small.

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
X	very high

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

acomm29. Comments:

However, transmission of the diseases and parasites carried by nutria onto humans is not documented well, but potentially, they may include such diseases as: toxoplasmosis, chlamydiae, salmonellosis, tuberculosis, fascioliasis and trichinosis (Howerth *et al.* 1994 – P, Moretti *et al.* 2001 – P, Bounds *et al.* 2003 – P). These diseases are common in animals

kept on farms, where their densities are high and cleanliness standards are hard to maintain. Then, the risk of infection of persons having a frequent contact with the animals is high, particularly when use of personal protection measures, especially protective gloves and masks, is being neglected (Bounds *et al.* 2003 – P). It was found that nematodes and trematodes (*Strongyloides myopotami* and *Schistosoma mansoni*), causing schistosomal dermatitis, are the parasites most frequently transmitted on humans (LeBlanc 1994 – P). During the years of intense farming, nutrias have been farmed also for consumption; at present, their meat is eaten sporadically, mainly in Greater Poland, however it is still subjected to a test for trichinosis, obligatory in Poland. Also toxoplasmosis may be dangerous in case of consumption of undercooked meat. Trichinosis, particularly untreated, may be lethal for humans, that is why the influence on the human's health is evaluated as high.

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
X	high
	very high

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

acomm30. Comments:

Nutrias dig burrows not only in river banks, causing their erosion, but also in all earthwork structures in the vicinity of watercourses and reservoirs: flood banks, dams, dykes, embankments surrounding water reservoirs and water intakes, which lessens their resistance to water pressure and threatens with flooding of lower places (Hillbricht and Ryszkowski 1961 – P, LeBlanc 1994 – P). Washing out by rain may enlarge the existing damages additionally. In years 1995-2000 in Italy, despite the intense control of abundance of the nutria populations, damages in river banks and earthwork structures exceeded €10 mln (Bertolino 2006 – I, Panzacchi *et al.* 2007 – P). The probability was estimates as high: more than 100 cases per 100,000 objects; the effects was estimated as medium: partly 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
X	moderately negative
	neutral
	moderately positive
	significantly positive

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

acomm31. Comments:

Nutria may affect the supply services to a slight degree. The species may exert some influence on plant crops, particularly at a high abundance. However, crop losses are limited to the vicinity of water reservoirs, but there are also cases of flooding crops as a result of collapse of banks weakened by nutrias (Panzacchi et al. 2007 – P). Considering the above, the influence on the supply services is evaluated as moderately negative.

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

	significantly negative
X	moderately negative
	neutral
	moderately positive
	significantly positive

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

acomm32. Comments:

Nutrias, especially while occurring in high densities, may disturb the integrity of whole swamp and waterlogged ecosystems (Shaffer *et al.* 1992 – P, Evers *et al.* 1998 – P), which may affect water retention and water cycle. Their activity may adversely affect the possibilities to prevent floods. Nutrias may carry several dangerous diseases, so they affect the regulation of zoonotic diseases.

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 **X**	high	level of confidence

acomm33. Comments:

Digging burrows, nutrias weaken the banks of watercourses and water reservoirs, increase the risk of injuries for persons using the water bodies e.g. for recreation. Moreover, digging up and erosion of these habitats resulting from it, adversely affect the aesthetic functions of these sites.

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
X	increase moderately
	increase significantly

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

acomm34. Comments:

Free-ranging nutria populations persist and spread in Germany and Czech Republic, under conditions of a climate similar to that of Poland. Thus, climate does not pose barrier for the emergence of the species in Poland, however, the climate warming may mitigate the mist important limiting factor, namely harsh winters. Therefore it is evaluated that the probability will increase moderately.

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
X	increase moderately
	increase significantly

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

acomm35. Comments:

Nutrias are found in the natural environment in Poland from time to time, but their populations cannot form and spread probably due to the sensitivity of nutria to climatic fluctuations, most of all, harsh winters which lead to freezing of water bodies and food deficiency. Climate warming by 1-2 degrees may reduce the temperature fluctuations, providing the species a greater chance to form stable populations.

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
X	increase moderately
	increase significantly

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

acomm36. Comments:

The original nutria rangeland was limited to South America – equatorial, tropical and subtropical climatic zones. Nutrias are found in the natural environment in Poland sporadically, but their populations cannot form and spread probably due to the sensitivity of nutria to climatic fluctuations, most of all, harsh winters. Considering the low tolerance of the species to low temperatures, the climate warming by 1-2 degrees may reduce the temperature fluctuations, increasing the probability of their expansion 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
	not change
X	increase moderately
	increase significantly

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

acomm37. Comments:

The influence on the natural environment: plants, animals, habitats and ecosystems will be increasing probably together with the increase in the abundance and spread of the species, resulting from the climate warming.

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
X	increase moderately
	increase significantly

aconf34.	Answer provided with a	low	medium **X**	high	level of confidence

acomm38. Comments:

Climate changes may result in an increase in the nutria's influence on plant crops, because an increase in the abundance and spread of the species is anticipated.

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
X	increase moderately
	increase significantly

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

acomm39. Comments:

The predicted climate changes may result in a wider spread and higher abundance of nutria in the natural environment. Therefore, it is probable that the influence on farm animals and breeding will increase moderately (by the transmission of the pathogens).

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:

The predicted climate changes may result in a wider spread and higher abundance of nutria in the natural environment. Thus, it is probable that the influence on humans will increase moderately (by the transmission of the pathogens).

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 influence of nutria on other objects may increase in the case of an increase in the abundance of its population in our country, caused by the possible climate warming..

Summary

Module	Score	Confidence
Introduction (questions: a06-a08)	0.50	1.00
Establishment (questions: a09-a10)	0.75	1.00
Spread (questions: a11-a12)	0.63	0.75
Environmental impact (questions: a13-a18)	0.46	1.00
Cultivated plants impact (questions: a19-a23)	0.25	1.00
Domesticated animals impact (questions: a24-a26)	0.33	0.83
Human impact (questions: a27-a29)	0.63	0.50
Other impact (questions: a30)	0.75	1.00
Invasion (questions: a06-a12)	0.63	0.92
Impact (questions: a13-a30)	0.75	0.87
Overall risk score	0.47	
Category of invasiveness	moderately invasive alien species	

A6 | Comments

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

acomm42.	Comments: –

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