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. Karolina Mazurska
2. Wojciech Solarz
3. Henryk Okarma

acomm01. Comments:

	degree	affiliation	assessment date
(1)	mgr	Institute of Nature Conservation, Polish Academy of Sciences in Cracow	10-01-2018
(2)	dr	Institute of Nature Conservation, Polish Academy of Sciences in Cracow	29-01-2018
(3)	prof. dr hab.	Institute of Nature Conservation, Polish Academy of Sciences in Cracow	11-03-2018

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

Polish name: Gęsiówka egipska

Latin name: ***Alopochen aegyptiacus*** (Linnaeus, 1766)

English name: Egyptian goose

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: Another Polish synonym used in trading for Egyptian goose is gęś nilowa.

Polish name (synonym I) Gęś egipska	Polish name (synonym II) Kazarka egipska
Latin name (synonym I) *Alopochen aegyptiaca*	Latin name (synonym II) *Anas aegyptiaca*
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: Before 2006, Egyptian geese had been observed sporadically in Poland. The species, including the first successful breeding, were reported 4 times in 2007. In 2008, a vast increase in Egyptian geese was observed – at least 38 individuals, including 3 breeding pairs (Gatunki obce w Polsce 2018, NOBANIS 2018 – B). Six breeding attempts of Egyptian goose were noted in 2014 (Komisja Faunistyczna *[Avifaunistic Commission]* 2015 – P), and 244 in 2017 (Ornitho.pl 2018 – B). Egyptian goosne is classified as extremely rarely breeding, taking into account 6-7 nesting pairs a year (Stawarczyk et al. 2017 – P, Komisja Faunistyczna 2018 – I).

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: Egyptian goose has a negative impact on all domains subjected to the risk assessment. The effect on the natural environment is reflected in hybridisation with other species from the *Anatidae* family (Lensink 1996, Harrop 1998, Lever 2005, McCarthy 2006 – P), competition with other bird species for feeding ground and breeding sites (Van den Bergh 1993, Lensink 1996, van Dijk 2000 – P), and carrying pathogens, including avian influenza virus (H5N2 and H5N8 strains) (Gyimesi and Lensink 2010, Kleyheeg et al. 2017 – P). The impact on animal breeding and humans is mainly connected with the species ability to carry pathogens (e.g. avian influenza, H5N2 and H5N8 strains). Plant crops are affected due to Egyptian goose feeding on crops and grassland (Beck et al. 2002, Mangnall and Crowe 2002 – P) as well as trampling crops and contaminating them with excrements (Mangnall and Crowe 2002 – P). Water bodies, mainly used for recreation and leisure, contaminated with excrements (Gymesi and Lensink 2010 – P) demonstrate the species adverse effect on other domains.

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:

The species is established in Poland (Gatunki obce w Polsce 2018 – B, Komisja Faunistyczna 2018 – I, NOBANIS 2018 – B), which in accordance with Risk Assessment Methodology for *Harmonia*$^{+PL}$ procedure of negative impact risk assessment for invasive alien species and potentially invasive alien species in Poland (hereinafter "*Harmonia*$^{+PL}$"), indicates the answer: high probability with high level of confidence. In 2007 theere were 4 records of the species, inclusing the first successful breeding. In 2008, a vast increase in Egyptian geese was observed – at least 38 individuals, including 3 breeding pairs (Gatunki obce w Polsce *[Alien species in Poland]* 2018, NOBANIS 2018 – B). Six breeding attempts of Egyptian goose were noted in 2014 (Komisja Faunistyczna *[Avifaunistic Commission]* 2015 – P), and 244 in 2017 (Ornitho.pl 2018 – B).

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 **X**	level of confidence

acomm07. Comments:

The species is established in Poland (Gatunki obce w Polsce *[Alien species in Poland]* 2018 – B, Komisja Faunistyczna 2018 – I, NOBANIS 2018 – B), which in accordance with Risk Assessment Methodology for *Harmonia*$^{+PL}$ indicates the answer: high probability with high level of confidence. The probability that Egyptian goose has been introduced or will be introduced to the natural environment in Poland through unintentional human actions (e.g. with transported commodities, or as "hitchhiking" individuals in the means of transport or the luggage) is almost zero.

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:

The species is established in Poland (Gatunki obce w Polsce *[Alien species in Poland]* 2018 – B, Komisja Faunistyczna 2018 – I, NOBANIS 2018 – B), which in accordance with Risk

Assessment Methodology for *Harmonia*[+PL] indicates the answer: high probability with high level of confidence. The species occurres in Europe as a result of intentional introduction to the United Kingdom, Belgium or the Netherlands in the 1970s. Nowadays, the species is predominantly introduced in Europe through escapes or intentional releases (e.g. to public parks) from private collections (Gyimesi and Lensink 2010, Mazurska and Solarz 2016 – P). In Poland, individuals was introduced to the natural environment through e.g. escapes from private collections. The first breeding attempt of the species in Poland was reported in 2007. It was a result of the individuals escape from a small private zoo (Solarz and Okarma 2011 – P). Despite some trade restrictions on the species (the species is included in: a) the Commission Implementing Regulation (EU) 2017/1263 of 12 July 2017 updating the list of invasive alien species of Union concern established by Implementing Regulation (EU) 2016/1141 pursuant to Regulation (EU) No 1143/2014 of the European Parliament and of the Council, b) the Regulation of the Minister of the Environment of 9 September 2011 on the list of plants and animals of alien species that could be a threat to native species or natural habitats in case of their release into the natural environment – P), the species is still available in online trade (e.g. OLX 2018a, OLX 2018b, OLX 2018c – I).

A2 | Establishment

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

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

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

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

acomm09. Comments:

The species is established in Poland (Gatunki obce w Polsce *[Alien species in Poland]* 2018 – B, Komisja Faunistyczna 2018 – I, NOBANIS 2018 – B), which in accordance with Risk Assessment Methodology for *Harmonia*[+PL] indicates the answer: climate optimal for establishment, with high level of confidence. Egyptian goose prefers tropical (monsoon and savannah), dry (steppe and desert) and warm temperate (Mediterranean and subtropical) climate (CABI 2018 – B). It had been expected that the 0°C isocline would form the barrier of the possible expansion range as severe winters have a negative effect on Egyptian goose (Lensink 1998, Gyimesi and Lensink 2010 – P). As the species is spreading, overwintering and establishing in countries with colder summers and winters e.g. in Poland (continental climate), it is also capable of spreading in a cooler climate (Mazurska and Solarz 2016 – 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 species is established in Poland (Gatunki obce w Polsce *[Alien species in Poland]* 2018 – B, Komisja Faunistyczna 2018 – I, NOBANIS 2018 – B), which in accordance with Risk Assessment Methodology for *Harmonia*[+PL] indicates the answer: habitat optimal for establishment, with high level of confidence. In its natural and introduced range, the

species occurs in a wide range of habitats, with preference for ares adjacent to flowing and stagnant water (reservoirs, lakes, ponds, rivers, channels, marshes, wetland, and estuaries) (del Hoyo et al. 1992 – P, CABI 2018 – B). It is observed most frequently in the area being a combination of water bodies and meadows, usually covered with trees, (del Hoyo et al. 1992 – P), where it feeds at meadows and then rests on waters. Egyptian goose avoids densely forested areas (del Hoyo et al. 1992 – P). It occupies not only meadows, but also grasslands and croplands (CABI 2018 – B).

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
	high
X	very high

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

acomm11. Comments:

Assessment (Data type: C)
The species is capable of spreading rapidly in the natural environment without human actions. Germany is such an example. With 2200-2600 breeding pairs, Egyptian goose is considered to demonstrate the highest spreading rate among all alien birds (Bauer and Woog 2008 – P). The population started to expand in Germany in 1994, when only 7 breeding pairs were observed. According to the latest data, the estimated number of the species individuals is 5000, suggesting a 50% increase in the number of Egyptian goose pairs in Germany every year (Mazurska and Solarz 2016 – P). Therefore, the dispersion potential of the population established in Poland without human intervention, is considered very high – more than 10 km per year.

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

	low
	medium
X	high

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

acomm12. Comments:

Despite some trade restrictions on the species (the species is included in: a) the Commission Implementing Regulation (EU) 2017/1263 of 12 July 2017 updating the list of invasive alien species of Union concern established by Implementing Regulation (EU) 2016/1141 pursuant to Regulation (EU) No 1143/2014 of the European Parliament and of the Council, b) the Regulation of the Minister of the Environment of 9 September 2011 on the list of plants and animals of alien species that could be a threat to native species or natural habitats in case of their release into the natural environment – P), Egyptian goose is relatively frequently kept by hobby breeders. In Poland, the species individuals are offered for sale not only on black market, but also online (e.g. OLX 2018a, OLX 2018b, OLX 2018c – I). Due to an interest in breeding this species, individuals from wild populations are likely to

be captured, then transported to farms and bred. As kept individuals of Egyptian goose often are not rendered flightless by the owners, and the breeding farm is not properly secured, birds can escape and spread over new areas. For example, a first breeding attempt of the species in Poland was a result of the individuals escape from a small private zoo (Solarz and Okarma 2011 – P). It is also probable that caputured wild birds are delivered to zoos and rehabilitation centres for animals, from where they can escape as well. Cured individuals of Egyptian goose can be intentionally released from rehabilitation centres for animals, to which they were delivered to obtain a vet aid. Therefore, the frequency of the species dispersal by human actions should be defined as high (the estimated number of intentional and unintentional releases to the natural environment is more than 10 cases per a 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	medium **X**	high	level of confidence

acomm13. Comments:

Egyptian goose is mainly herbivorous. Its diet preference depends on the local availability of plant food. It can be grass, aquatic plants, as well as crops (maize, barley, wheat, oats) or other agricultural crops (sunflower seeds, lucerne, sugar beets, potatoes) (Halse 1984, del Hoyo et al. 1992, Kear 2005 – P, CABI 2018 – B). Occasionally, it may consume invertebrates (Kear 2005 – P). The effect of Egyptian goose through predation/herbivory on the reduced number of native species has not been so far confirmed. Taking into account the species impact on plant crops (it is locally considered as a crop pest, cf. question a19) and assuming its dispersion across Poland, the effect has been assessed as medium.

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

	low
	medium
X	high

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

acomm14. Comments:

Egyptian goose is known for its aggression towards other birds (Teixeira 1979, Lensink 1996, Pieterse and Tamis 2005 – P), which may cause a limited availability of foraging areas

mainly during moulting when many waterfowl species become flightless. Data from the Netherlands and Belgium demonstrate that an aggressive behaviour of Egyptian goose can result in a drop in a number of other waterfowl species (Sneep 1999, Mazurska and Solarz 2016 – P). Egyptian goose can chase away goshawks *Accipiter gentilis* and buzzards *Buteo buteo* from their territories, occupy their nests which makes them delay the breeding period and increases the risk of failure (van Dijk 2000 – P). This species also occupies nesting sites of common shelducks *Tadorna tadorna* and mallards *Anas platyrhynchos* (Van den Bergh 1993, Lensink 1996 – P). A number of studies on the effect of Egyptian goose on other bird species in the United Kingdom is relatively small, but this species is likely to compete with other species occupying tree hollows. This effect will be probably getting stronger as the population of Egyptian goose will be increasing. It can compete for nesting sites mainly with the following species occupying large tree hollows: owls (e,g. barn owl *Tyto alba*, tawny owl *Strix aluco*), common kestrel *Falco tinnunculus*, some species of ducks, stock dove *Columba oenas* and western jackdaw *Corvus monedula* (Wright 2011 – P, CABI 2018 – B). Sometimes poles for white stork *Ciconia ciconia* nests are also occupied by Egyptian goose. Egg lying starts relatively early – in February, thus Egyptian goose can occupy the best nesting sites before other species start their breeding period. In South Africa, a black sparrowhawk *Accipiter melanoleucus* was shown to raise a lower number of chicks due to usurpation of nests by Egyptian Geese (Curtis et al. 2007 – P). Present studies show that a black sparrowhawk avoids the direct conflict with Egyptian goose – a big and aggressive rival. Instead, it adopts a passive strategy of building many nests (Sumasgutner et al. 2016 – P). Aggressive territorial behaviour of Egyptian goose is demonstrated by the reported cases of drowning other species, such as: shelducks, mallards, common moorhens *Gallinula chloropus*, sparrows *Passer domesticus*, common starlings *Sturnus vulgaris*, common magpies *Pica pica* and common blackbirds *Turdus merula* (Eikhoudt 1973 – P). Nearly all the above species are native species in Poland and are the species of special concern. Thus, the widespread presence of Egyptian goose can significantly reduce the number of the above bird species and the effect of Egyptian goose should be considered as high.

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

	no / very low
	low
	medium
	high
X	very high

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

acomm15. Comments:

Waterfowl species are known to have a great propensity to hybridize with other species, even from other subfamilies (Weller 1969 – P). Egyptian goose interbreeds with other species of the *Anatidae* family (Banks et al. 2008 – P). The reported hybridisations are with: a mallard, a shelduck, a ruddy shelduck *Tadorna ferruginea*, a barnacle goose *Branta leucopsis*, and a Canada goose *B. canadensis* (Lensink 1996, Harrop 1998, Lever 2005, McCarthy 2006 – P). Those hybrids are usually infertile (Homma and Geiter 2010 – P). The majority of native species interbreeding with Egyptian goose is not currently endangered (Canada goose is an invasive alien species in Poland). It should be taken into consideration that the increased population of Egyptian goose can in future cause the serious loss of genetic integrity of these species (Mazurska and Solarz 2016 – P). Shelduck is the most threatened species among the above mentioned. Its hybridization with Egyptian goose can potentially result in its serious genetic consequences. In accordance with the accepted methodology, the overall effect of Egyptian goose through interbreeding should be considered as very high because both the likelihood of hybridisation and its result are high.

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

	very low
	low
	medium
	high
X	very high

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

acomm16. Comments:

Egyptian goose is a vector of avian influenza virus – H5N2 and H5N8 strains (Gyimesi and Lensink 2010, Kleyheeg et al. 2017 – P), paramyxovirus, serotype 3 (APMV-3) (Shihmanter et al. 1998 – P) and *Salmonella* (Wright 2011 – P). Avian influenza is a disease included in the list of the World Organization for Animal Health (OIE), and it is a notifiable disease. Paramyxovirus, serotype 1 (APMV-1) causes another disease from the list of OIE – Newcastle disease (highly contagious and devastating disease in poultry). In summer, large aggregations of birds during moulting can become sources, from where these diseases can easily spread (Gyimesi and Lensink 2010 – P). The species does not migrate over large distances. But ringing recoveries show that populations from neighbourhood countries exchange individuals. Spread of pathogens carried by birds seems to be limited (Gyimesi and Lensink 2010 – P).

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

	low
	medium
X	high

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

acomm17. Comments:

Aggregations of Egyptian goose, particularly during the moulting period, can locally cause eutrophication in water bodies. This can shift the nutrient balance towards a high P/N ratio. This ratio at values above 6 can lead to a higher chance on the development of blue algae and bacterial loads (Gyimesi i Lensink 2010 – P). This effect can be hardly reversible and, assuming the spread of the species, can be observed in habitats of no or particular concern, including habitat type 3150 (oxbow lakes and natural eutrophic water bodies).

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 **X**	high	level of confidence

acomm18. Comments:

The effect of Egyptian goose on the ecosystem integrity by affecting its biotic properties can be observed as its intensive feeding on habitats that are not classified as habitats of special concern (e.g. nesting grasslands), which can locally cause hardly reversible disturbance of food web, that is, significantly reduced availability of food for other herbivores (Gyimesi and Lensink 2010 – P). Significant changes in element cycle caused by excrements of the species can result in cascading and hardly reversible changes in food webs in the ecosystems (Gyimesi and Lensink 2010 – P). They can include serious disturbance in dynamics of the cycle of producers (phytoplankton) and all elements in the food chain – feeders and organisms feeding on dead organic matter (Hessen et al. 2017 – P). Assuming the spread of

	the species, this effect can be observed in habitats of no concern or particular concern, including habitat type 3150 (oxbow lakes and natural eutrophic water bodies).

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
	medium
X	high
	very high

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

acomm19. Comments:

In South Africa, Egyptian goose is regarded as a serious agricultural pest mainly by barley and wheat farmers (Mangnall and Crowe 2001 – P). The south-African population has been continuously increasing, which causes considerable damage on plant crops, especially around water bodies used for moulting (Maclean 1993 – P). Particulalry significant damage is reported to young wheat, but Egyptian geese seemed to prefer surface seeds to growing plants (Mangnall and Crowe 2002 – P). The mean annual yield loss caused by the presence of the species in South Africa is estimated to be ca. 64.5%. In addition to actual consumption, the trampling effect of a large number of geese can also cause substantial damage to young sprouting plants which may be unable to recover (Mangnall and Crowe 2002 – P). Moreover, the crops are also damaged by defecation. In Europe, the adverse effect of the species on plant crops is increasing, e.g. in the Netherlands. The aggregation of a large number of Egyptian geese (e.g. aggregations during moulting, reaching more than 1000 individuals) causes damage to grasslands, especially that this occurs additional to the grazing of other species, e.g. greylag goose *Anser anser* and Canada goose. Moreover, Egyptian goose in England occupies a wider range of habitats in winter than during the nesting season, and switches to feed on grain and low grasslands (Sutherland and Allport 1991 – P). This behaviour was also confirmed in Belgium – Egyptian geese feed on crops, sugar beet and potatoes in winter and spring (Beck et al. 2002 – P). In the Netherlands, feeding on winter wheat is known from several areas in the western part of the country. The population of this species is expected to increase, and the damage to crops can achieve the level observed in South Africa (Mangnall and Crowe 2002 – P). Assuming the similar scenario in Poland, the effect of the species on cultivated plants should be considered as high (medium probability with high effect).

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 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: This species is not a plant.

a22. The effect of *the species* on cultivated plant targets by **affecting the cultivation system's integrity** is:

	very low
	low
X	medium
	high
	very high

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

acomm22.	Comments: Egyptian goose has an adverse effect on cultivated plants mainly through predation (cf. question a19). The adverse effect can be caused by trampling of many geese, which can also cause substantial damage to young sprouting plants which may be unable to recover (Mangnall and Crowe 2002 – P). Crops polluted by defecation are another type of damage that can locally affect the element cycle and result in cascading changes in food webs. Trampling and polluting by defecation are also observed in golf courses and parks in the Republic of South Africa (Little and Sutton 2013, Mackay et al. 2014 – P). Assuming the species is widespread, its impact on cultivated system by affecting its integrity would be medium (medium probability, medium effect).

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: No cases have been reported so far that Egyptian goose hosts parasites or pathogens harmful to cultivated plants. It is also unlikely to report such cases with the progress of studies.

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:

This species is a herbivore – it occasionally feeds on invertebrates (e.g. earthworms, locust) (del Hoyo et al. 1992 – P). So far, the effect of Egyptian goose on animal production through predation or parasitism has not been demonstrated.

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:

The effect of the species on individual animal health or animal production by having properties that are hazardous upon direct contact, has not been observed. However, assuming the species spread across Poland and taking into account its aggressive behaviour (Gyimesi and Lensink 2010 – P), this effect demonstrated by hitting with the beak or wings is possible (probability: 1-100 cases of direct contact per 100 000 of farm or domestic animals per year). But its results would be totally reversible. Therefore, the effect has been considered as 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
	very low
	low
	medium
	high
X	very high

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

acomm26. Comments:

Egyptian goose is a vector of avian influenza virus – H5N2 and H5N8 strains (Gyimesi and Lensink 2010, Kleyheeg et al. 2017 – P), paramyxovirus, serotype 3 (APMV-3)

(Shihmanter et al. 1998 – P) and *Salmonella* (Wright 2011 – P). Avian influenza is a disease included in the list of the World Organization for Animal Health (OIE), and it is a notifiable disease. Paramyxovirus, serotype 1 (APMV-1) causes another disease from the list of OIE – Newcastle disease (highly contagious and devastating disease in poultry). Large aggregations of Egyptian goose near poultry farms (e.g. during the moulting period in summer or winter feeding) may cause the occurrence of avian influenza or other pathogenic diseases (Gyimesi and Lensink 2010 – P). For example, Egyptian goose in South Africa caused an outbreak of H5N2 avian influenza at an ostrich farm (Thompson et al. 2008 – P). In Israel, Egyptian goose was shown to be the first species of the order Anseriformes to carry the avian paramyxovirus, serotype 3 (APMV-3) (Shihmanter et al. 1998 – P).

A4d | Impact on the human domain

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

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

X	inapplicable
	very low
	low
	medium
	high
	vert high

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

acomm27. Comments:

This species is not a parasite.

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

	very low
X	low
	medium
	high
	very high

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

acomm28. Comments:

This species is known for its aggressive behaviour (Gyimesi and Lensink 2010 – P). Although no cases of geese attacking humans have been reported in their introduced range, such attacks took place in, e.g. the Republic of South Africa (Little and Sutton 2013, Mackay et al. 2014 – P). Assuming the species spread across Poland, the probability of such a situation would be medium (1-100 case of direct contact per 100 000 humans per year) with the low effect (no permanent damage, low level of stress). Therefore, the effect has been considered as low.

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

	inapplicable
	very low
	low
X	medium

	high
	very high

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

acomm29. Comments:

Egyptian goose is a vector of avian influenza virus – H5N2 and H5N8 strains (Gyimesi and Lensink 2010, Kleyheeg et al. 2017 – P), paramyxovirus, serotype 3 (APMV-3) (Shihmanter et al. 1998 – P) and *Salmonella* (Wright 2011 – P). Avian influenza is a disease included in the list of the World Organization for Animal Health (OIE), and it is a notifiable disease. Paramyxovirus, serotype 1 (APMV-1) causes another disease from the list of OIE – Newcastle disease (Gyimesi and Lensink 2010 – P). Symptoms caused by avian influenza virus, H5N2 strain, are not particularly harmful to humans, even to workers on farms with infected poultry. In South Africa, humans in contact with the virus, which was lethal to ostriches from farms, suffered only from conjunctivitis and mild respiratory problems. So far, there has been no case of a human infected with avian influenza, H5N8 strain carried by Egyptian goose. But Salmonellosis is a serious disease in humans, but completely curable.

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:

Egyptian geese colonise water bodies that are also used for recreational purposes, and their excrements deteriorate attractiveness of such areas. A large number of geese can also defecate on public roads (Gymesi and Lensink 2010 – P). Trampling, polluting by defecation and aggressive behaviour cause annoyance in golf courses and parks in the Republic of South Africa (Little and Sutton 2013, Mackay et al. 2014 – P). Taking into account the assumptions on the species widespread in Poland, the probability of such cases has been considered as high with medium consequences, thus its effect is high. Within their natural range, individuals of Egyptian goose can cause collision with aeroplanes. Such situations occurred in the United Kingdom where the species is widespread (Wright 2011 – P). The problem can be thus regarded as marginal.

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:

X	significantly negative
	moderately negative
	neutral
	moderately positive
	significantly positive

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

acomm31. Comments:

The effect of the species on provisioning services has been considered as significantly negative because it has an adverse effect on agricultural crops, mainly grain and grasslands, through consuming, trampling and polluting by defecation (cf. questions a19 and a22) and on animal production by carrying avian influenza virus (H5N2 and H5N8), paramyxovirus, serotype 3 (APMV-3), and salmonellae (cf. question a26).

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:

The effect of the species on regulation and maintenance services has been considered as moderately negative because it has an adverse effect on biological regulation, that, is: control over animal diseases by transmitting avian influenza virus (H5N2 and H5N8), paramyxovirus, serotype 3 (APMV-3), and salmonellae (cf. question a26). Moreover, pollution by defecation may locally affect the cycle of elements, cause eutrophication of water bodies (cf. questions a17 and a18), and disturbance of food webs (cf. question a18).

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 **X**	level of confidence

acomm33. Comments:

The effect of Egyptian goose on cultural services has been considered as moderately negative because the individuals pollute water bodies, also used as human recreational and swimming water, by defecation which deteriorates their attractiveness. Trampling, polluting by defecation and aggressive behaviour can cause annoyance in recreational areas, such as golf courses and parks (cf. question a30). The species is very attractive and it is still kept in ornamental collections and zoos. Thus, a part of the society treats the species as a desirable element of the ecosystem. But due to the fact that Egyptian goose can have an adverse effect on native species, it can be also negatively perceived.

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	high **X**	level of confidence

acomm34. Comments:

Egyptian goose has already overcome geographical barriers in the natural environment in Poland but the species cannot be considered as numerous. Egyptian goose prefers tropical (monsoon and savannah), dry (steppe and desert) and warm temperate (Mediterranean and subtropical) climate (CABI 2018 – B). Thus, the expected climatic changes will increase the likelihood of the introduction of Egyptian goose in Poland as a result of, e.g. an increased expansion from the German population (Mazurska and Solarz 2016 – P).

a35. ESTABLISHMENT – Due to climate change, the probability for *the species* to overcome barriers that have prevented its survival and reproduction in Poland will:

	decrease significantly
	decrease moderately
	not change
X	increase moderately
	increase significantly

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

acomm35. Comments:

Egyptian goose is an established species in Poland but it cannot be considered as numerous. Egyptian goose prefers tropical (monsoon and savannah), dry (steppe and desert) and warm temperate (Mediterranean and subtropical) climate (CABI 2018 – B). Thus, the expected climatic changes are likely to increase the breeding succes and lead to an increase of the population (Mazurska and Solarz 2016 – 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
	not change
X	increase moderately
	increase significantly

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

acomm36. Comments:

Egyptian goose has already overcome geographical barriers preventing its spread in the natural environment in Poland but the species cannot be considered as numerous. Egyptian goose prefers tropical (monsoon and savannah), dry (steppe and desert) and warm temperate (Mediterranean and subtropical) climate (CABI 2018 – B). Thus, the expected climatic changes are likely to increase the breeding succes and lead to an increase of the population (Mazurska and Solarz 2016 – P).

a37. IMPACT ON THE ENVIRONMENTAL DOMAIN – Due to climate change, the consequences of *the species* on wild animals and plants, habitats and ecosystems in Poland will:

	decrease significantly
	decrease moderately
	not change
X	increase moderately
	increase significantly

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

acomm37. Comments:

The species has a negative impact on the natural environment through competing, interbreeding with native species, carrying pathogens, and to a smaller extent, through herbivory and affecting abiotic and biotic properties in the ecosystems (cf. questions a13-a18). Assuming that the global warming is a consequence of expected climatic changes, the species is likely to spread and overcome further barriers (Mazurska and Solarz 2016 – P), and thus an increase in its population and successful breeding can be expected. An increased population is likely to increase an adverse effect of Egyptian goose on the natural environment.

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	high **X**	level of confidence

acomm38. Comments:

The species has a negative impact on cultivated plants through herbivory and, to a lower extent, through affected integrity of the cultivation system (cf. questions a19 and a22). Assuming that the global warming is a consequence of expected climatic changes, the species is likely to spread and overcome further barriers (Mazurska and Solarz 2016 – P), and thus we an increase in its population and successful breeding can be expected. An increased population is likely to increase an adverse effect of Egyptian goose on cultivated plants.

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	high **X**	level of confidence

acomm39. Comments:

The species has a negative impact on animal production by hosting pathogens and, to a lower extent, by having properties that are hazardous upon direct contact (cf. questions a25 and a26). Assuming that the global warming is a consequence of expected climatic changes, the species is likely to spread and overcome further barriers (Mazurska and Solarz 2016 – P), and thus an increase in its population and successful breeding can be expected. An increased population is likely to increase an adverse effect of Egyptian goose on animal production.

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	high **X**	level of confidence

acomm40. Comments:

The species has a negative impact on humans by hosting pathogens and having properties that are hazardous upon direct contact (cf. questions a28 and a29). Assuming that the global warming is a consequence of expected climatic changes, the species is likely to spread and overcome further barriers (Mazurska and Solarz 2016 – P), and thus an increase in its population and successful breeding can be expected. An increased population is likely to increase an adverse effect of Egyptian goose on humans.

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	high **X**	level of confidence

acomm41. Comments:

The species has an adverse effect on other domains mainly through contaminating, among other things, water bodies for recreation and leisure and public roads with excreta (cf. question a30). Assuming that the global warming is a consequence of expected climatic changes, the species is likely to spread and overcome further barriers (Mazurska and Solarz 2016 – P), and thus an increase in its population and successful breeding can be expected. An increased population is likely to increase an adverse effect of Egyptian goose on other domains.

Summary

Module	Score	Confidence
Introduction (questions: a06-a08)	1.00	1.00
Establishment (questions: a09-a10)	1.00	1.00
Spread (questions: a11-a12)	1.00	0.50
Environmental impact (questions: a13-a18)	0.92	0.67
Cultivated plants impact (questions: a19-a23)	0.42	0.67
Domesticated animals impact (questions: a24-a26)	0.42	0.83
Human impact (questions: a27-a29)	0.38	0.75
Other impact (questions: a30)	0.75	1.00
Invasion (questions: a06-a12)	1.00	0.83
Impact (questions: a13-a30)	0.92	0.78
Overall risk score	0.92	
Category of invasiveness	very 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:

–

Data sources

1. Published results of scientific research (P)

Banks AN, Wright LJ, Maclean IMD, Hann C, Rehfisch MM. 2008. Review of the status of introduced non-native waterbird species in the area of the African-Eurasian Waterbird Agreement: 2007 update British Trust for Ornithology, Norfolk.

Bauer HG, Woog F. 2008. Non-native and naturalized bird species (neozoa) in Germany, part I: occurrence, population size and status. Vogelwarte 46: 157-194.

Beck O, Anselin A, Kuijken E. 2002 Beheer van verwilderde watervogels in Vlaanderen. Onderzoeksresultaten en buitenlandse bevindingen. Instituut voor Natuurbehoud, Brussel.

Commission implementing regulation (EU) 2017/1263 of 12 July 2017 updating the list of invasive alien species of Union concern established by Implementing Regulation (EU) 2016/1141 pursuant to Regulation (EU) No 1143/2014 of the European Parliament and of the Council (OJ L 182, 13.7.2017, p. 37).

Curtis OE, Hockey PA, Koeslag A. 2007. Competition with Egyptian Geese *Alopochen aegyptiaca* overrides environmental factors in determining productivity of Black Sparrowhaks *Accipiter melanoleucus*. Ibis 149(3): 502-508.

del Hoyo J, Elliott A, Sargatal J. 1992. Handbook of the Birds of the World, Volume 1 Ostrich to Ducks. Lynx Editions, Barcelona.

Eikhoudt H. 1973. Nijlganzen Alopochen aegyptiacus (L) boven Friesland. Vanellus 26: 202-205.

Gyimesi A, Lensink R. 2010. Risk analysis of the Egyptian Goose in The Netherlands. Bureau Waardenburg bv / Ministry of Agriculture, Nature and Food Quality, Invasive Alien Species Team.

Halse SA. 1984. Diet, body condition, and gut size of Egyptian geese. Journal of Wildlife Management 48(2): 569-572.

Harrop AHJ. 1998. Successful hybridisation between Ruddy Shelduck and Egyptian Goose. British Birds 91: 281-281.

Hessen DO, Tombre IM, van Geest G, Alfsnes K. 2017. Global change and ecosystem connectivity: How geese link fields of central Europe to eutrophication of Arctic freshwaters. Ambio 46 (1): 40-47.

Homma S, Geiter O. 2010. Movements of neozoan ("exotic") geese in Germany and the Netherlands tracked by ringing. SOVON Ganzen en zwanendag, Arnhem.

Kear J. 2005. Ducks, geese and swans. Volume 2: species accounts. Oxford University Press, Oxford.

Kleyheeg E, Slaterus R, Bodewes R, Rijks JM, Spierenburg MAH, Beerens N, Kelder L, Poen MJ, Stegeman JA, Fouchier RAM, Kuiken T, van der Jeugd HP. 2017. Deaths among Wild Birds during Highly Pathogenic Avian Influenza A(H5N8) Virus Outbreak, the Netherlands. Emerg Infect Dis. 23(12): 2050-2054.

Komisja Faunistyczna. 2015. Rzadkie ptaki obserwowane w Polsce w roku 2014 – raport nr 31. Ornis Polonica 56: 99-136.

Lensink R. 1996. De opkomst van exoten in de Nederlandse avifauna; verleden, heden en toekomst. Limosa 69: 103-130.

Lensink R. 1998. Temporal and spatial expansion of the Egyptian goose *Alopochen aegyptiacus* in The Netherlands, 1967-94. Journal of Biogeography 25: 251-263.

Lensink R. 1999. Aspects of the biology of Egyptian Goose *Alopochen aegyptiacus* colonizing The Netherlands. Bird Study 46: 195-204.

Lever C. 2005. Naturalised Birds of the World. Poyser, London.

Little RM, Sutton JL. 2013. Perceptions towards Egyptian Geese at the Steenberg Golf Estate, Cape Town, South Africa. Ostrich: Journal of African Ornithology 84: 1-3.

Mackay B, Little RM, Amar A, Hockey PAR. 2014. Incorporating environmental considerations in managing Egyptian Geese on golf courses in South Africa. The Journal of Wildlife Management 78: 671-678.

Maclean GL. 1993. Robert's birds of southern Africa. 6th edition. John Voelcker Bird Book Fund, Cape Town.

Mangnall MJ, Crowe TM. 2001. Managing Egyptian geese on the croplands of the Agulhas Plain, Western Cape, South Africa. South African Journal of Wildlife Research 31(182): 25-34.

Mangnall MJ, Crowe TM. 2002. Population dynamics and the physical and financial impacts to cereal crops of the Egyptian Goose *Alopochen aegyptiacus* on the Agulhas Plain, Western Cape, South Africa. Agriculture, Ecosystems & Environment 90: 231-246.

Mazurska K, Solarz W. 2016. Risk Assessment of Egyptian goose *Alopochen aegyptiacus*. Generalna Dyrekcja Ochrony Środowiska. (https://circabc.europa.eu/).

McCarthy EM. 2006. Handbook of Avian Hybrids of the World. Oxford University Press.

Pieterse S, Tamis W. 2005. Exoten in de Nederlandse avifauna: integratie of concurrentie? het Vogeljaar 53(1): 3-10.

Regulation of the Minister of the Environment of 9 September 2011 on the list of plants and animals of alien species that could be a threat to native species or natural habitats in case of their release into the natural environment (Journal of Laws No 210, item 1260).

Shihmanter E, Weisman Y, Lublin A, Mechani S, Gruenberg R, Horowith H, Lipkind M. 1998. Avian paramyxoviruses serotype 3 isolated from captive birds in Israel: Clinical signs, pathology, and antigenic characterization. Avian Diseases 42(2): 418-422.

Sneep JW. 1999. Control and eradication of non-native terrestrial vertebrates in the Netherlands. In: Workshop on the control and eradication of non-native terrestrial vertebrates, Malta, s. 51-57. Environmental Encounters, Council of Europe Publishing.

Solarz W, Okarma H. 2011. Rekomendacje. In: Z. Głowaciński, H. Okarma, J. Pawłowski, W. Solarz (ed.); Gatunki obce w faunie Polski. I. Przegląd i ocena stanu. Wyd. Instytutu Ochrony Przyrody PAN w Krakowie, Kraków: 512-520.

Stawarczyk T, Cofta T, Kajzer Z, Lontkowski J, Sikora A. 2017. Rzadkie ptaki Polski. Studio B&W Wojciech Janecki, Sosnowiec.

Sumasgutner P, Millán J, Odette C, Koelsag A, Amar A. 2016. Is multiple nest building an adequate strategy to cope with inter-species nest usurpation? BMC Evolutionary Biology 16: 97.

Sutherland WJ, Allport G. 1991. The distribution and ecology of naturalized Egyptian Geese *Alopochen aegyptiacus* in Britain. Bird Study 38: 128-134.

Teixeira RM. 1979. Atlas van de Nederlandse broedvogels. Natuurmonumenten, 's-Graveland.

Thompson PN, Sinclair M, Ganzevoort B. 2008. Risk factors for seropositivity to H5 avian influenza virus in ostrich farms in the Western Cape Province, South Africa. Preventive Veterinary Medicine 86(1-2): 139-152.

Van den Bergh AB. 1993 De Nijlgans, een avifaunistische aanwinst of probleemvogel? Argus 18(2): 7-10.

van Dijk J. 2000. Hoe groot is de invloed van Nijlganzen *Alopochen aegyptiacus* op het broedsucces van roofvogels. De Takkeling (8): 218-220.

Weller MW. 1969. Potential dangers of exotic waterfowl introductions. Wildfowl 20: 55-58.

Wright L. 2011. GB Non-native Organism Risk Assessment for Alopochen aegyptiacus. (www.nonnativespecies.org).

2. Databases (B)

CABI. 2018. *Alopochen aegyptiacus* [original text by J. Marchant]. In: Invasive Species Compendium. Wallingford, UK: CAB International. (http://www.cabi.org/isc) Access: 2018-01-12.

Gatunki obce w Polsce. 2018. Internetowa baza danych. Instytut Ochrony Przyrody PAN w Krakowie. (http://www.iop.krakow.pl/ias/gatunki/311) Access: 2018-01-12.

NOBANIS database. 2018. European Network on Invasive Alien Species. (http://www.nobanis.org/species-info/?taxaId=714) Access: 2018-01-12.

Ornitho.pl. 2018. Internetowa baza danych. Ogólnopolskie Towarzystwo Ochrony Ptaków. (http://www.ornitho.pl/index.php?m_id=620&frmSpecies=81&sp_tg=1&maptype=max&y=2017&action=sp&tframe=0) Access: 2018-01-12.

3. Unpublished data (N)

–

4. Other (I)

Komisja Faunistyczna Sekcji Ornitologicznej Polskiego Towarzystwa Zoologicznego. 2018. Strona internetowa. (http://komisjafaunistyczna.pl/?page_id=10) Access: 2018-01-12.

OLX 2018a. Oferta sprzedaży osobników gęsiówki egipskiej. (https://www.olx.pl/oferta/gesi-egipskie-CID757-IDoBC1E.html#7d0ede300a) Access: 2018-01-12.

OLX 2018b. Oferta sprzedaży osobników gęsiówki egipskiej. (https://www.olx.pl/oferta/gesi-egipskie-nilowe-CID103-IDpIwFD.html#7d0ede300a) Access: 2018-01-12.

OLX 2018c. Oferta sprzedaży osobników gęsiówki egipskiej. (https://www.olx.pl/oferta/gesiowka-egipska-ges-nilowa-para-CID757-IDrh0PL.html) Access: 2018-01-12.

5. Author's own data (A)

–