Management in Practice

Testing the efficacy of different Larson trap designs for trapping Egyptian geese (*Alopochen aegyptiacus* L.) in Flanders (northern Belgium)

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Abstract

In Western Europe, the Egyptian goose is considered one of the most rapidly spreading invasive bird species. Listed as a species of Union Concern by the EU, it is subject to restrictions and measures and European Member States are urged to develop management strategies. Since common techniques such as shooting, moult trapping and egg control have been inadequate at lowering population numbers, there is a high demand for alternative effective control strategies. Here, we report on field trials testing the use of walk-in traps with live decoy birds. Trials were spread out over several years to establish optimal trapping season and trap design and to explore different deployment options. We found that in Belgium the breeding period was the optimal season for deploying traps, which suggests the territorial response is the main driver of trapping efficiency. Land-based designs performed significantly better than other trap types at catching Egyptian geese and had far fewer by-catches. The strategy in which traps were deployed at short intervals over various locations had the highest efficiency. We conclude that the use of land-based versions of this trap type can be a useful addition to a wider management strategy when used on a large scale and aimed at trapping adult birds prior to breeding. Given the high effort needed for this type of trapping and the expected effectiveness of other management techniques, the method is best combined with post breeding shooting.

Key words: invasive alien species, birds, wildlife management, live trapping

Introduction

The Egyptian goose (*Alopochen aegyptiacus* Linnaeus, 1766), a shelduck relative native to sub-Saharan Africa and the Upper Nile Valley, established non-native breeding populations in various countries across the world including Europe, the USA and the Arab Emirates. In Western Europe, the species is considered one of the most rapidly spreading invasive species (Banks et al. 2008; Kampe-Persson 2010; CAB International 2018; Huysentruyt et al. 2020a). The European Breeding Bird Atlas reports the first feral breeding population in the Netherlands in 1967 followed by a > 25% increase in the early years of colonization, decreasing to 17% per year currently, with an estimated 30,000 breeding pairs (Keller et al. 2020).

The species is still expanding its range in Europe. Since 2017, the Egyptian goose is listed as an invasive species of Union Concern by the European Union (EU) and is thus subject to restrictions and measures set out in Regulation (EU) 1143/2014. This regulation imposes a ban on keeping, importing, selling and breeding but also urges European Member States to develop management strategies. Hence, information on effective control strategies for the species is currently in high demand.

In Belgium, following escapes from an ornamental bird collection of the Royal Domain (Laeken), the Egyptian goose was first reported in the wild in the 1980s. The species started breeding in the early nineties and is now widely established in the country (Vangeluwe and Roggeman 2002; Vermeersch et al. 2020). Census data on the wintering population show a similar increase since the mid-1990s. Devos and Onkelinx (2013) report stable winter maxima (2010–2015) for Flanders of 3,500–4,000 birds with maxima up to 5,630 birds during the winter 2016–2017 (*unpublished data*). The Egyptian goose is now the most reported alien bird species in the country and occurs in 84% of the entire territory (Adriaens et al. 2019). Following an ecological impact assessment (Branquart 2009), the Egyptian goose was qualified as a widespread invasive species with high environmental impact (Vanderhoeven et al. 2015; Anselin et al. 2010).

In Flanders, the northern part of Belgium, different feral goose species are managed using an integrated strategy of moult captures, hunting and egg control, which has succeeded in lowering population numbers of resident greater Canada goose (*Branta canadensis* Linnaeus, 1758), barnacle goose (*Branta leucopsis* Bechstein, 1803) and feral greylag goose (*Anser anser* f. *domestica*) (Reyns et al. 2018; Adriaens et al. 2020; Huysentruyt et al. 2020b) but which currently appears largely ineffective for managing Egyptian goose in the region. In response to the EU Regulation, management strategies for eradication and spread limitation were proposed and were scored for feasibility by a group of experts and practitioners (Adriaens et al. 2019). Based on this work, both eradication and spread limitation would have medium to high feasibility in Belgium, with the likelihood of reintroduction being the most limiting success factor. The Netherlands and Germany have especially large populations of the species, and exchanges between these countries have been confirmed based on ringing data suggesting a more dispersive character than populations in the UK (van Dijk and Majoor 2011).

The Egyptian goose, being a fairly new species to the region, has not attracted much attention as a game species from hunters and appears to be difficult to hunt due to its vigilant nature and its large territorial spread during much of the year, although some evidence from the Netherlands suggests shooting to be a potentially successful management approach (Gyimesi and Lensink 2012; Huysentruyt et al. 2020a). In Flanders, the Egyptian goose can be culled through hunting yet, unlike greylag (*Anser*

anser Linnaeus, 1758) and Canada goose, is not legally classified as a game species. As a consequence, there is no requirement to report the bag number of Egyptian goose, making it difficult to assess the effectiveness of shooting as a management policy. In general, although hunting bag data on the species are scarce within the invasive range and hunting pressure can vary locally, the overall effect of this measure on the population is expected to be limited unless a sufficient proportion of the population is culled annually (e.g. 20,000 in the Netherlands) (Gyimesi and Lensink 2012; Huysentruyt et al. 2020a). Moreover, the Egyptian goose is largely unaffected by moult trapping since the birds are more vigilant and flocks quickly scatter but they do not easily leave the water and, in contrast to true goose species, also dive easily (Huysentruyt et al. 2020a). For instance, Van Daele et al. (2012) report only marginal numbers of Egyptian goose trapped during moult captures in Flanders and could not find an effect of moult trapping on population numbers. Egyptian geese also do not generally nest in colonies and regularly use nesting sites in trees, making the nests less accessible for egg oiling or addling. Although in specific cases egg oiling can be used to manage Egyptian geese (Baker et al. 1993), for goose species management in general, this measure is known to be ineffective at the population level (Klok et al. 2010). This results in a management approach in Flanders in which shooting is currently the only tool, with an estimated minimal effect on population control.

Given the difficulties in applying traditional goose management approaches for the Egyptian goose, there is a need for alternative population control methods. From ringing efforts in their native range, it has long been known that Egyptian geese can be trapped using baited walk-in traps with live decoy birds, the so-called Larsen traps (Siegfried 1967). The use of live decoy birds in these trap types exploits territorial behaviour. Prior to and during the reproductive season, breeding Egyptian geese are highly territorial, are spread across the landscape and will actively and fiercely defend these territories (Callaghan and Brooks 2016; Huysentruyt et al. 2020a). In addition to a territorial response, the bait used in these traps also aims to attract birds through foraging behaviour. Cumming et al. (2011) reported by-catches of Egyptian goose in baited walk-in traps without decoy birds set up to trap ducks.

Here, we report on a field trial and follow-up study to test the use of walk-in traps with live decoy birds as part of a wider management scheme. The study was split up into three different stages. In a first stage, the optimal season for deploying this trapping method was investigated using a floating trap design. In a second stage, we used the optimal time of year as established in stage 1 to compare different trap designs and functionalities. This was done in a more adaptive management approach, mainly focusing on comparing land-based walk-in traps with the floating design. In a third and final stage, we communicated the information obtained in the first two

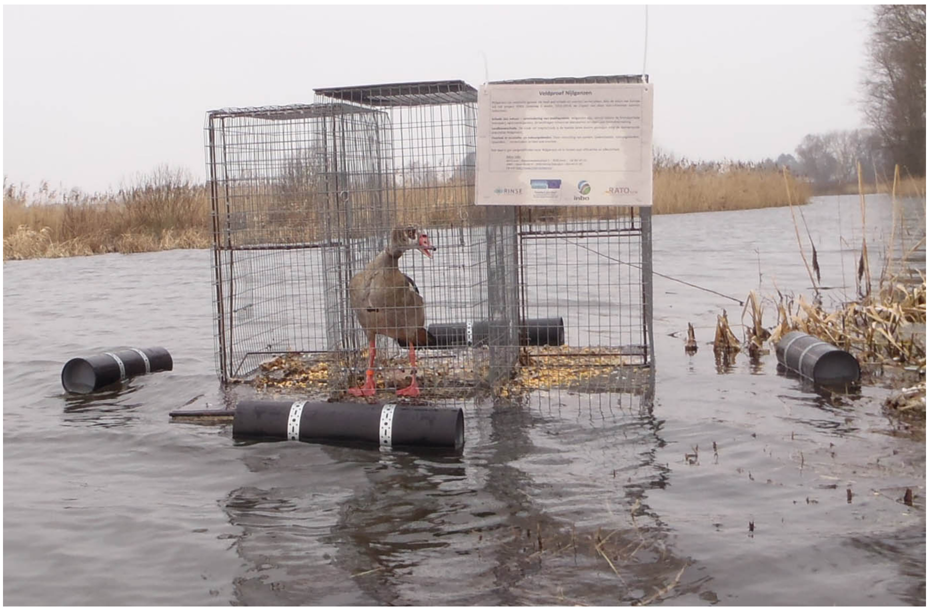

Figure 1. Floating Larsen trap for Egyptian goose (©RINSE).

stages back to the trappers and performed a long-term follow-up on larger scale deployment of this trapping technique. For the first stage, we hypothesized the territorial response would prevail over the attractive power of bait in the traps and that this effect would be the highest during the reproductive season. As the main part of the breeding season in Western Europe is from March to June (Lensink 1996, 1999; Van Daele et al. 2012), we expected higher trapping efficiency during and just prior to those months. In a second stage, we expected that adjustments to the floating trap type used in the first stage would result in a higher trapping efficiency. We expected trappers to prefer land-based designs, even at similar or even slightly lower efficiency, because they are more practical in the field. Follow-up data were used to get an impression of the effort per bird trapped. We discuss our results in the context of its feasibility as an additional management tool and tentatively explore its potential within management strategies for the Egyptian goose in the region.

Materials and methods

Stage 1 – optimal trapping season

In order to avoid vandalism or the release of trapped and/or decoy birds, floating traps were used in the initial stage. These floating traps were composed of a square raft with additional floaters on the edges (Figure 1). On the raft, a cage made up out of three compartments was mounted. The central compartment was constructed to hold the decoy bird while the two adjacent compartments were one-sided walk-in traps. The raft was further baited with maize so that birds stayed on the raft for a longer time, to increase the chances of trapping. To further minimize tampering with the traps, a sign was attached to the traps, explaining the field experiment and

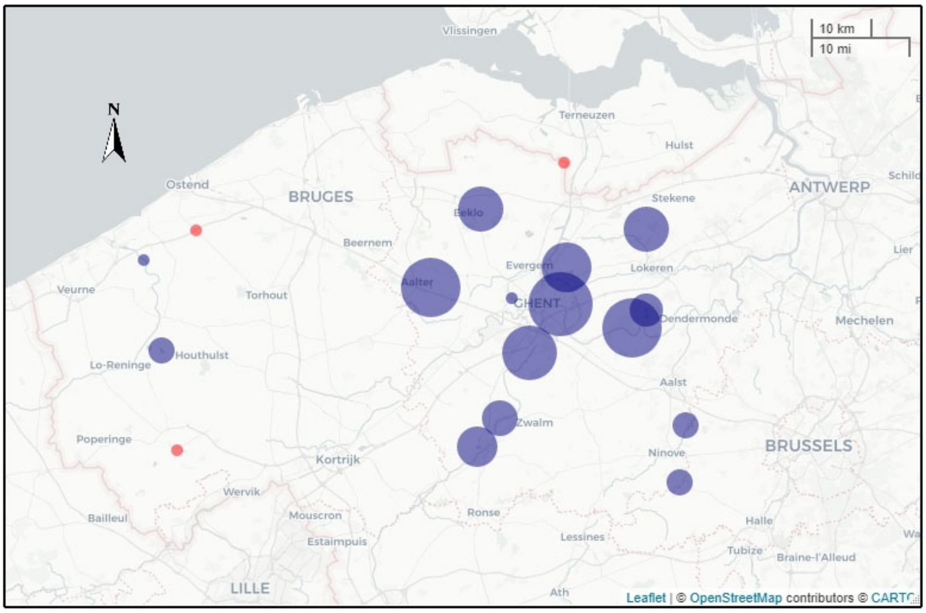

Figure 2. View of the 18 trapping locations retained for analysis in stage 1 of the study with reference to the total number caught. Red dots indicate no success, the size of the blue dots is proportional to the total number of geese caught (N = 1–13).

providing contact information (Figure 1). The same signs were also placed on the banks of the lakes where the experiments took place. No vandalism was encountered. Traps were deployed at 20 locations in the provinces of East- and West-Flanders (Figure 2) for one workweek (Monday–Friday) in the middle of each month during one year, from February 2013 to January 2014. Traps were checked on a daily basis and all non-target native species were released on site. All Egyptian geese, non-target non-native species and feral greylag geese were removed and killed using CO_2. This was done in a closed dark small container in which geese were first stunned by gradually increasing the concentration of CO_2 up to 60% within one minute. After this, geese were killed by further increasing the concentration up to 70% and maintaining that level for another 5 minutes. Modification of the atmospheric environment, using carbon dioxide as a physiologically active gas producing both anoxia and hypoxia, is a commonly used method to kill geese, approved by the European Commission (RDA 2012; AVMA 2020) yet should be applied correctly (species-specific flow rate and target concentration) to shorten and mitigate the distress period of anoxia (Smith et al. 2022). We were aware that the removal of all captured geese could deplete local numbers and impact future trapping efficiency, but favoured this approach for two main reasons. First, the trials were performed within a management framework in which even standardized trials should maximally mimic common practice to allow implementation of findings. Second, not removing these geese would also impact future efficiency since this could result in multiple captures of the same individuals.

For evaluation of trapping efficiency, we compared the total number of Egyptian geese caught between different months. The experience of the different trappers was comparable in both provinces and trappers often switched between sites, hence we did not expect a trapper effect and did not include it in the analysis. We did include a random site effect, based on site specificity, differences in lake size and local Egyptian goose densities. We fitted a binomial generalized linear model in which we compared the number of Egyptian geese trapped to the maximum number possible within a trapping session. This maximum was equal to the number of available walk-in compartments multiplied by the number of days a trap was set per site. Under normal circumstances this was set at eight (n = two traps, four days), but it was lowered by the number of times by-catch was registered since this impeded Egyptian geese from being trapped. We compared a null model (random location effect only) with a model that also included month as a fixed effect and selected the optimal model using AIC. All analyses were performed using R version 4.0.2 (R Core Team 2020) and mixed effect models were fitted using the lme4 package (Bates et al. 2015).

Stage 2 – optimal design and function

In a second stage, we used the optimal time of year as established in stage 1 to compare the efficacy of the floating trap type with a land-based model. Based on the experiences in stage 1, trappers further suggested some improvements that could increase efficacy in the floating traps. This was either done by installing a double trap door so the geese could look through the trap or by adapting the design allowing the geese to enter the trap by swimming without having to climb onto the raft. We compared both these improved models with the standard floating trap used in stage 1 and with a land-based model. This was done April through June 2014. The choice of location was left to the trappers and the number of days was kept at 5-day intervals for the floating traps. Land-based traps were used at various time intervals, depending on the site. To compare trap types we used a generalized linear model with Poisson distribution testing the effect of month and trap type on the total number of Egyptian geese caught. The number of days a trap was used at a specific location was entered as an offset factor in the model. Given the very high variation in locations used, locality was omitted as a random effect.

Stage 3 – Experiences of deployment

For this last stage, the results of stage 1 and 2 were fed back to the trappers which they were free to implement at their own discretion, resulting in an opportunistic deployment of land-based traps only. In all but one occasion, where a standard land-based trap was used, traps used in this stage were modified to hold a potential maximum of 4 target birds (Figure 3). During all deployments, active traps were checked daily. Numbers of geese trapped was reported back for all deployment but additional specifics (period, trapping dates, discontinuation) were provided with high variability.

Figure 3. Land-based Larsen trap for Egyptian goose, with four trap compartments (©RINSE).

A single trap was set up at a fixed location in Zuienkerke (51.2185N; 3.1422E) from February 19th to August 15th 2015 for a total continuously active period of 177 days. In following years, this fixed location trap was also used but over varying time intervals that were not reported in detail, yielding only information on total numbers caught.

Next to the fixed location setup, 4 traps were deployed that were moved around between locations. 19 of these deployments were reported for 16 different locations, for periods that ranged from 3 to 70 days, with an average of 20 days at one site. We were informed these deployments were often discontinued but this was not reported in detail. Consequently, this did not allow us to estimate a geese/trapping unit/day ratio. In 3 additional cases only the year and total number caught was reported. For part of the data in 2019 and 2020 we received detailed data on dates of setup and capture, the number of visits, the hours spent and number of geese caught.

Results

Stage 1 – optimal trapping season

In 2 out of 20 locations, trapping was interrupted for several months so that trapping results were not comparable to other sites. In 18 of the remaining locations, 12 had full results, 4 were interrupted for only a single month (February due to ice formation) and a single location had no trapping session in February and December, adding up to a total of 776 trapping days. Since the field trial was set up to analyse the optimal trapping month and not to identify the optimal location, locations where no Egyptian goose was trapped during the entire field trial (N = 3, Figure 2) were omitted

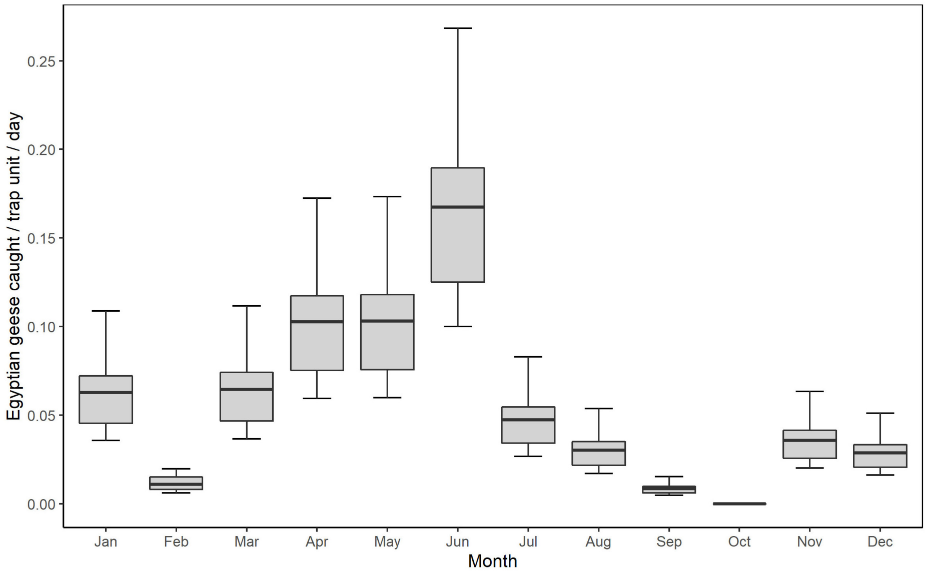

Figure 4. Monthly comparison of modelled trapping efficiency using a floating Larsen trap design at fixed locations over fixed time intervals (boxplots cover interquartile range (IQR), whiskers cover smallest and largest values within 1.5*IQR).

from the efficiency analysis, but retained for the reporting of by-catches. This led to a total of 648 trapping days for these remaining 15 locations and a total of 80 Egyptian geese caught. The model including month outcompeted the null model (ΔAIC = 33.59) and showed June to be the only month that performed significantly better than other months ($z = 2.52$; $p < 0.05$) while September performed significantly worse ($z = -1.89$; $p = 0.05$) (Figure 4). April ($z = 1.14$; $p = 0.25$) and May ($z = 1.11$; $p = 0.27$) were the only two other months that showed positive parameter estimates with a standard error interval excluding zero, which, although not significant, indicates a broader trend towards positive correlation during spring months. During this first stage, 67 by-catches were recorded, or 5.6 ± 4.2 per month on average, ranging from 0 in August to 15 in March. Most of the by-catches were waterbirds like mallard (*Anas platyrhynchos* Linnaeus, 1758) (20), Eurasian coot (*Fulica atra* Linnaeus, 1758) (19), common moorhen (*Gallinula chloropus* Linneaus, 1758) (10) and one great cormorant (*Phalacrocorax carbo* Linnaeus, 1758), which were all released on site. Other non-target catches were feral and non-native waterfowl like domestic greylag goose (8), Canada goose (7) and one mandarin duck (*Aix galericulata* Linnaeus, 1758) and were also euthanized after trapping. In addition, one red fox (*Vulpes vulpes* Linnaeus, 1758) was also trapped and released.

Stage 2 – optimal design and functionalities

In the second stage, we compared different trap types within the three most optimal trapping months (April–June). In total, 73 Egyptian geese were caught during this trial: 38 in the land-based trap type, 19 in the standard floating trap, 14 in the double door floating trap and 2 in the adjusted floating trap geese were able to swim into. When accounting for

Table 1. Results of the AIC analysis for competing glm Poisson models evaluating trap type effect.

Model	Model structure	Npar	AIC	ΔAIC	AIC weight
m2	Total caught ~ Trap type	4	129.39	0.00	0.88
m1	Total caught ~ Month + Trap type (full model)	6	133.35	3.96	0.12
m3	Total caught ~ Month	1	179.33	49.94	0.00

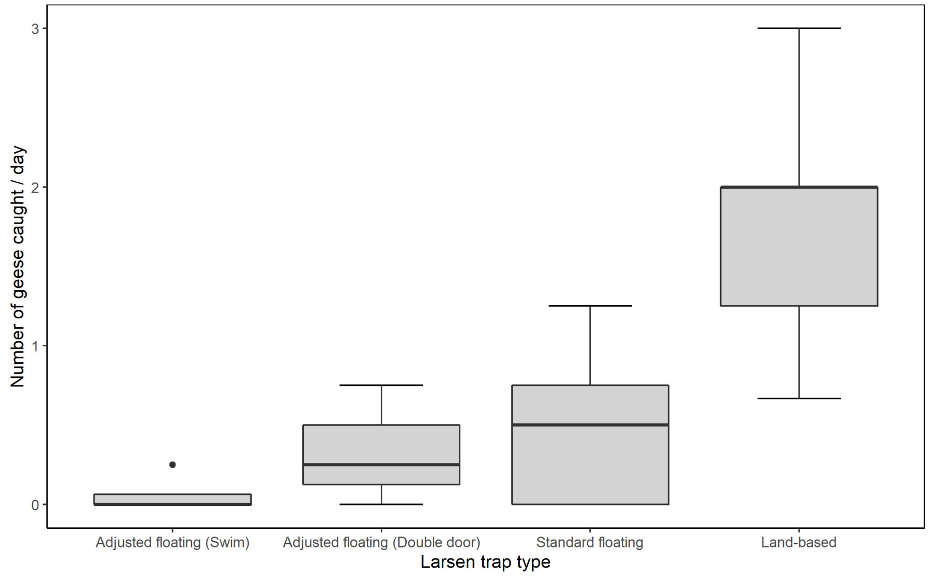

Figure 5. Comparison of the observed number of geese trapped per day using different trap types (boxplots cover interquartile range (IQR), whiskers cover smallest and largest values within 1.5*IQR).

exposure time, we did not observe an effect of trapping month on the number of geese caught in all trap types and the optimal model only included trap type as a fixed effect (Table 1). A post-hoc Tukey test showed the land-based Larsen trap performed significantly better than all other trap types (all at the $p < 0.001$ level). Within the water based trap designs, the original design performed better than the swim-in design ($p < 0.05$) but not the double door design ($p = 0.81$). We observed no difference in efficacy between the double door and swim-in design ($p = 0.12$). On average, land-based designs caught 1.83 ± 0.76 geese per trapping day, the traditional floating trap 0.43 ± 0.42, the adjusted double door design 0.32 ± 0.27 and the swim-in design 0.06 ± 0.12 (Figure 5). During this second stage, 32 by-catches were recorded: 23 mallards, 5 Eurasian coots, and 1 great cormorant, common moorhen, western jackdaw (*Corvus monedula* Linneaus, 1758) and carrion crow (*Corvus corone* Linneaus, 1758). Most by-catches were recorded in the adjusted double door type (18) and the traditional floating trap (12). In the both the swim-in type and land-based type only a single by-catch was recorded.

Stage 3 – experience of deployment

During the 177 day long deployment of the fixed location trap at Zuienkerke, Egyptian geese were captured on 86 different days. On most days (54) a single bird was caught but on other occasions two (18), three (5), or four (9) geese were captured, yielding a total of 141 or 0.80 geese per day. Although the trap was only active during nine trapping days in February, 24 geese were trapped in that month (2.66 geese/day), followed by 24 in March (0.77), 37 in April (1.23), 17 in both May (0.54) and June (0.56), 6 in July (0.16) and 16 during the fifteen days in August (1.06). On two occasions during this deployment, the fixed location trap had been tampered with and the decoy bird had been released. From 2016 to 2019, deployment data was incomplete but total numbers of Egyptian geese trapped at this location were 38 (2016), 34 (2017), 44 (2018) and 35 (2019).

The total number of geese caught using the moving land-based design was 56 in 2016, 47 in 2017, 54 in 2018. From 2019 onward, applying the same trapping technique over a larger area, a total of 76 Egyptian geese were caught in 2019 and 55 in 2020. 40 of the geese from 2019 were trapped at five different locations over a total of 127 active trapping days and 155 working hours during October, November and December 2019. In 2020, traps were setup at six locations in February and March for a total of 65 trapping days and 76 hours worked, yielding 55 Egyptian geese. By-catches were no longer reported during this third stage.

Discussion

Methods used to manage other invasive geese (moult trapping, egg control) are inadequate to effectively manage the Egyptian goose. Shooting could help reduce numbers but current efforts have not succeeded in population reduction although effectiveness remains hard to assess since bag data are scarce. Using Larsen traps with decoy birds could serve as an addition to a broader management approach, or as a valuable alternative at smaller and localised scales like early invasion stages, emerging breeding groups or in areas where shooting or hunting is not possible such as urban areas (Strubbe 2017). Our work contributes practical management experience and basic data on trap efficacy for Egyptian geese.

First, the results showed differences in optimal trapping month with a significantly higher efficiency in June and additional indications of a slightly higher trapping efficiency in April and May. During these months, a stronger appeal of the decoy bird is probably the main driver behind this higher efficiency since this is the main breeding period of Egyptian geese in Flanders (Van Daele et al. 2012). This could be a result of either territoriality, pair bonding behaviour or a combination of both although the observation that efficiency is highest in June, at which point breeding pairs have been formed and breeding is in its final stages, seems to favour territorial responses. Indeed, Egyptian geese are known to be highly territorial toward conspecifics during breeding (Cramp and Simmons 1977; Lensink 1999). The significantly higher trapping efficiency with the floating Larsen traps in June and indication of higher efficiencies in May and April, could be a good proxy for the entire western European range of the species where nest building, egg laying and breeding are mainly performed in the period March–June (Van Daele et al. 2012). However, it is known that the breeding period of the Egyptian goose can vary between regions. For instance, in central Europe, breeding generally starts in April and lasts until August. Also, our analysis shows that trapping success in other months was almost never zero, indicating traps can still work in other periods during the year. Indeed, broods of the Egyptian goose have been observed year round throughout the invasive range (Lensink 1999; Callaghan and Brooks 2017).

Another important factor, which was lacking from our analysis, were the sex and the behaviour of the decoy birds. Our data do not allow statements on the efficacy of female versus male decoys though the traps were able to trap male as well as female birds. From our limited experience, using a calm, frequently calling male as decoy seemed to trigger territorial behaviour in local birds most effectively (Huysentruyt et al. 2020a). Also, the efficiency of a decoy bird might vary in time. In general, tamer, docile decoy birds which exhibited little stress when placed in the trap seemed to perform better. This requires year round quality care to keep decoy birds in optimal condition and provide sufficient food and shelter for the decoy bird in the trap in order to adhere to animal welfare.

The land-based Larsen trap performed significantly better than all other trap types. Since floating traps were used to test optimal trapping season in stage 1, this calls for some caution when applying these results to the land-based traps. Therefore, although the results of the first two stages yielded clear results on optimal trapping season and trap type separately, it was difficult to derive and suggest an optimal combination of both. This was communicated as such to the trappers. To check how these result had been implemented, we evaluated the preferred deployment in later years. This showed that, although experiments with different trap types were still reported, the land-based trap type with live decoy bird was most widely used, probably because this trap was most practical to handle in the field. When set at a fixed location this did not result in very high trapping efficiency which was also not affected by deployment length. Traps deployed at short intervals over various locations showed a much higher efficiency. Finally, more detailed results from the last two years showed an average trapping efficiency of 0.32 geese per trapping day or 0.25 geese per working hour in October, November and March, while in February and March this number rose to 0.85 geese per day and 0.72 geese per hour worked. This again indicates that the breeding period, with its inherent territorial response, is the optimal period for trapping Egyptian geese. Although numbers can be higher later in the season, trappers preferred trapping prior to actual breeding to prevent couples from raising broods, effectively lowering local densities and reducing the risk of orphaning goslings by trapping parent birds.

One other consideration when deciding on management options to deploy is the operating cost and the cost of production of the traps. The original land-based design was self-made and the cost of production (including labour) equalled 382 euros. Operating costs include the transportation, moving around and placement of the traps. Also, traps and decoy birds need to be inspected and baited daily and decoy birds need to be kept in captivity year round or replaced yearly. The human resources needed for this should depend on the number of locations where traps are placed, the distance between locations and the amount of traps and gear one trapper can carry. In our case, all locations were close to each other within a 120 km range. It was established that a single person could manage about 10 Larsen trap inspections/day.

Although by-catches can be released on site with daily inspections, they can lead to lower efficiency of trapping as a closed trap compartment is no longer available to the target species. During the first stage, the number of by-catches in relation to the total number of Egyptian geese caught was very high at 67:80. This may be due to the use of a floating trap type, given that almost all by-catches were water birds. In the second stage, overall, a 31:35 by-catch to catch ratio was observed for the water-based types (standard and double-door floating Larsen and swim-in), similar to the first stage. For the land-based type this ratio was very low with only a single carrion crow caught in comparison to a total of 38 Egyptian geese caught.

It is difficult to assess the potential impact of this management type on population growth of Egyptian geese. Like in other goose species, adult survival is a key element in population growth so the highest impact can be reached using management methods that target adult mortality. Given the use of the land-based trap type in late winter and early spring within a wider geographical scale, the current application is aimed at trapping adult birds prior to breeding. At its current rate and regional scale within Flanders, approximately 100 birds were caught each year, roughly resulting in an offtake of around 50 breeding pairs. This number is limited but could be increased by expanding this approach over the entire region of Flanders. If a similar effort could be attained in every province, 200–300 birds or 100–150 breeding pairs could be caught each year. Since this approach targets adult birds prior to breeding, this effort could help impact growth rate in a population of approximately 2000 breeding pairs and a yearly expected population growth rate of around 8% (Gyimesi and Lensink 2012). A management strategy in which trapping of birds pre-breeding is integrated with shooting adult birds post breeding, a technique that has also shown potential effectiveness in lowering Egyptian goose population numbers, is most likely to impact population numbers. Although in theory such a management strategy could be applied across the entire territory, it could also benefit from the identification of dispersive nuclei, i.e., areas where large flocks and breeding concentrations occur, under the assumption that tackling these first might limit dispersal to other regions. Although the trials described here can inform management practice, it is insufficient to properly evaluate the efficiency of trapping in reducing population growth rate, or to evaluate the relative contribution of different methods in an integrated management strategy. To better inform (adaptive) management of this invasive anatid, stage based population models could be drafted (Huysentruyt et al. 2020b). This could be achieved by coordinated upscaled trapping across the region and an increased shooting effort, alongside detailed monitoring of management efforts, the population and its demography. This would require detailed trapping and bag data, population counts, data on dispersal and migration as well as life-history parameters of the breeding population.

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Authors' contribution

FH, TA: research conceptualization, sample design and methodology, investigation and data collection, data analysis and interpretation, ethics approval, funding provision, writing – original draft, writing – review and editing. KVM: research conceptualization, sample design and methodology, investigation and data collection, writing – review and editing.

Ethics and permits

The trapping of geese and the treatment of decoy birds complied with the institutional and regional policies on the humane and ethical treatment of animals as set out in the Law on Animal Welfare of 14 August 1986 concerning the protection and welfare of animals. Decoy birds and trapped birds were transported and handled in line with a derogation on the Decision of the Flemish Government (permit numbers ANB/BL-FF/V12-00352, ANB/BL-FF/V12-00354, ANB/BL-FF/V12-00355) on species protection and species management of 15 May 2009 and later amendments to that legislation as well as a derogation on the Hunting Decree of 24 July 1991 for scientific research (permit numbers ANB/BL-FF/VERG 10-08790, 12-11578 and 15-08210).

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