Invasive Alien Species Policies and Programmes in CEE

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Assessment of Invasive Alien Species Policies and Programmes in Central and Eastern Europe: A Focus on Poland and Hungary

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1. Introduction

The colonisation and spread of invasive alien species (IAS) are recognised as one of the most significant contemporary threats to global biodiversity. They are not only an environmental problem but also an economic and social challenge worldwide. International and national efforts have been put in place to address the complexity and dynamics of invasions. The EU Regulation (No 1143/2014) on the prevention and management of the introduction and spread of IAS, which was approved by the European Parliament and Council on 22 October 2014, outlines both preventive and remedial actions against invasive species and is perceived as a major step towards reducing the threats posed by IAS. One target of the EU Biodiversity Strategy for 2030 also relates to IAS, aiming to reduce by 50% the number of Red List species threatened by invasive alien species.

Member States have applied diverse solutions to adapt and implement the EU regulation according to their specific conditions, organisational structures, and political situations. The current study investigates the Polish and Hungarian national measures, especially legislation, implemented projects, and other steps taken. It provides a general overview of IAS management and highlights some good practices and lessons learned that could be applicable in other Central and Eastern European (CEE) countries.

2. Poland: Analysis of Policies and Programmes on IAS

2.1. Legislation

The Polish Act of 11 August 2021 on Alien Species (Alien Species Act) — entered into force on 18 December 2021 — represents a robust framework for regulating the management and control of non-native species that pose threats to biodiversity, ecosystems, and human activities. It complements the EU regulation, defining the national legal framework for combating IAS. The Alien Species Act ensures compliance with EU standards while addressing specific national concerns. Key objectives include preventing the introduction and spread of invasive species, mitigating their impact, and promoting effective management strategies. The Act designates competent authorities, including the General Directorate for Environmental Protection (GDEP) of Poland and regional environmental protection directorates, responsible for inspections, permit issuance, and implementation of control measures. In emergencies, such as serious threats posed by invasive species, the Act enables swift measures such as euthanasia or immediate eradication to safeguard biodiversity, human health, and economic activities.

Moreover, the Act transposes elements of the EU IAS regulation, such as the maintenance of an IAS Registry by the GDEP and the implementation of permit systems to reduce the risk of species release or escape into the wild. The IAS Registry serves as a repository for information on invasive alien species posing threats to Poland, facilitating data collection and public awareness. Lists of IAS posing threats to the EU and Poland are established, with regulations governing permissions and permits for certain activities involving IAS. Authorities issue permits for scientific research, production, commercial use, and pet ownership, subject to strict criteria. Reporting mechanisms for new IAS sightings are in place, along with penalties for violations. Additionally, actions such as remedial measures and restoration efforts are specified, with cooperation among various state services encouraged. The regulations prioritise early intervention and emphasise the principle of "polluter pays" for releasing IAS into the environment. Overall, the legal framework aims to mitigate the adverse impacts of IAS on biodiversity, ecosystem services, human health, and the economy.

Competent authorities, including regional environmental protection directorates, national park directorates, maritime office directorates, and the Chief Inspector of Fisheries, contribute to the IAS Register, enhancing collaboration and information exchange. The Act establishes a comprehensive monitoring and evaluation framework to assess the effectiveness of actions taken to control/eradicate invasive species. Designated authorities and stakeholders conduct assessments to evaluate the effectiveness of control measures, track the spread of invasive species, and adjust management strategies as needed. This continuous monitoring ensures adaptive management approaches, enhancing the Act's efficacy in addressing invasive species threats.

Overall, the national Alien Species Act underscores Poland's commitment to environmental stewardship and biodiversity conservation. By aligning with EU regulations, establishing designated authorities, and implementing comprehensive monitoring and evaluation mechanisms, the Act enhances Poland's capacity to address invasive species threats effectively and sustainably.

2.1.1. Prospective Legal Regulations: Changes in Hunting Law

The changes in the Hunting Law[1] in Poland have introduced significant modifications aimed at the protection, preservation, and management of game animal populations, particularly focusing on addressing the threat posed by certain IAS to the European Union and Poland. These changes include:

1. **Definition of Hunting:** The concept of hunting now encompasses the tracking, shooting with hunting firearms, and capturing of birds or mammals belonging to IAS that pose a threat to the European Union and Poland, using methods permitted by the Hunting Law or regulations of the Council of Ministers on remedial actions.

[1] In: https://www.gov.pl/web/rdos-olsztyn/zmiany-w-prawie-lowieckim

2. **Elimination of IAS:** Unlike game species, IAS do not require prior hunting planning. Instead, the annual hunting plan for IAS posing a threat will only include the number of individuals observed and captured in the previous year. These species can be eliminated throughout the year, as they are not subject to hunting or closed seasons. An individual hunting authorisation allows the shooting of any number of IAS animals posing a threat to the European Union and Poland.
3. **Documentation and Authorisation:** Individuals intending to eliminate IAS must possess an individual hunting authorisation, which specifies the number of animals obtained from these species. This authorisation, along with the individual hunting stay record book, has been valid since 1 April 2022.
4. **Sustainable Management Exemption:** In cases where IAS pose a threat to the European Union and Poland due to their negative impact on biodiversity or related ecosystem services, the principles of sustainable management of game animal populations do not apply. This exemption allows for more targeted and immediate action against these species without the constraints of population management.

Overall, these changes reflect a proactive approach to addressing the challenges posed by invasive alien species, ensuring greater flexibility and efficiency in their control and management while safeguarding biodiversity and ecosystem health in Poland.

2.2. Programmes and Projects

Many projects have been launched and implemented in the past few years in Poland to address targeted IAS issues. This review highlights seven projects that were implemented by different organisations such as the Green Federation Association (*Federacja Zielonych GAJA*) and the Institute of Nature Conservation of the Polish Academy of Sciences. A brief description of the projects emphasises the main objectives and outcomes, with a more detailed description of the results in the Annex. These projects were considered important to include as they provide methodological and financial lessons that can be applied in other countries.

2.2.1. Education in the Field of Eradication and Control of Population Size of Invasive Alien Species by Hunters and Anglers (Implementation Period: 2020–2021)

The project[2] aimed to utilise fishing and hunting to eradicate IAS. The IAS of concern include *Neogobius melanostomus*, *Pseudorasbora parva*, *Nyctereutes procyonoides*, *Carassius gibelio*, *Faxonius limosus*, *Pacifastacus leniusculus*, *Procyon lotor*, *Perccottus glenii*, *Neovison vison*, and *Trachemys scripta*. The project provided guidelines to anglers and hunters to eradicate the identified IAS. The guidelines provided details about the physical appearance of these species, habitat, behaviour, origin, and their impacts, as well as hunting guidelines in terms of optimal hunting period and hunting weapons. Other project activities included:

(i) conducting a media campaign promoting the involvement of anglers, fisherpeople, and hunters in active nature conservation in the aspect of IAS, including the publication of guides on combating alien species;
(ii) educational and promotional activities related to events involving anglers, fisherpeople, and hunters (conferences, fairs, competitions); and
(iii) participation in the technical working group on invasive alien species of the European Commission.

The project's focus on educating hunters and anglers about the eradication and control of invasive alien species promotes education and awareness. Increasing awareness among these groups can lead to more responsible practices and proactive involvement in conservation efforts. Engagement of anglers and hunters enables the use of the extensive network of anglers as observers, which significantly contributes to monitoring the spread of invasive species. Creating online portals for reporting observations and encouraging active participation from anglers can enhance data collection efforts.

[2] In: https://gajanet.pl/projekty/edukacja-w-zakresie-ias/

Overall, the project's educational focus and collaborative initiatives contribute significantly to raising awareness and promoting proactive involvement in invasive species control efforts.

2.2.2. Ecosystem Services, Invasive Alien Species, and Agronomy: Can We Leave Agricultural Land to Protect Native Biodiversity and Ecosystem Services if the Risk of Invasion Is High? (Implementation Period: 2022–2025)

The project[3] employs a comparative approach between land allocation and sharing strategies, integrating agronomy and biodiversity conservation. Research sites span regions with centuries-old agricultural traditions, focusing on abandoned agricultural areas vulnerable to alien species invasion. Data collection involves field observations, ecological surveys, and potentially genetic analyses to assess the effectiveness of different land management strategies. Expected outcomes include insights into optimal land management strategies for balancing agricultural production and biodiversity conservation, particularly regarding invasive species control. The project addresses a critical need for sustainable land use practices, offering practical solutions to mitigate the spread of IAS while ensuring food production.

The project delves into the critical dilemma of land use allocation versus land sharing for balancing food production and nature conservation. Stemming from the University of Cambridge's 2005 proposal, it aims to reconcile agricultural intensification with biodiversity protection. While both strategies have merits, the study leans towards land sharing, emphasising the importance of extensively managed mosaic crops to support wild species. By focusing on regions with longstanding agricultural traditions, the research explores the optimal approach for both nature conservation and food production. It also addresses the overlooked risk of invasive species colonisation in abandoned agricultural areas, particularly pertinent in Central Europe. The investigation's hypothesis suggests that, in areas prone to invasion, land sharing may

[3] In: https://www.iop.krakow.pl/projekty,2,projekty_naukowe_(finansowanie_krajowe),244.html

offer a more effective strategy for controlling invasive species and safeguarding biodiversity while ensuring sustainable agricultural production.

Overall, this project not only contributes to academic knowledge but also holds practical implications for contemporary agricultural policies, such as the European Union's "greening policy."

2.2.3. Developing Methods of Combating at Least 10 Invasive Alien Species with Pilot Activities in the Field (Implementation Period: 2020–2022)

The project[4] beneficiary is the General Directorate for Environmental Protection of Poland, and its main objectives include determining the degree of invasiveness of alien species in Poland, identifying the species most threatening to native wildlife, and developing methodologies for their control or eradication.[5] The project was divided into separate parts concerning aquatic plants/weeds: Carolina fanwort (*Cabomba caroliniana*), Water fern (*Azolla filiculoides*), W*estern waterweed* (*Elodea nuttallii*), knotweed — Japanese knotweed (*Reynoutria japonica*) — crayfish — Spiny-cheek crayfish (*Orconectes limosus*), Signal crayfish (*Pacifastacus leniusculus*), Red swamp crayfish (*Procambarus clarkia*) and Marbled crayfish (*Procambarus fallax* f. *virginalis*) — and turtles — Common snapping turtle (*Chelydra serpentina*) and Painted turtle (*Chrysemys picta*).

2.2.3.1. Methods Used to Control Invasive Crayfish Species

Combat methods developed for invasive crayfish were based on the direct elimination of individuals from the population, habitat modification, biological control, and public education and outreach (see detailed list of methods/actions in Annex I/5.1.1.). The most

[4] In: https://www.iop.krakow.pl/projekty,5,inne_projekty_realizowane_przez_iop_pan,232.html.

[5] Solarz, W.; Mazurska, K.; Bonk, M.; Maciaszek, R.; Śmietana, P.; and Cierlik, G. 2022. *Compendium of control methods for a minimum of 10 invasive alien species, including pilot field activities – crayfish (signal crayfish, Louisiana crayfish, marbled crayfish).* General Directorate for Environmental Protection. In: https://www.iop.krakow.pl/pobierz-publikacje,2216.

effective methods for controlling invasive crayfish were, according to the summary of indications (see Annex I/5.1.2. Table 1), manual capture, trap-type traps, and diving captures. These methods have been deemed suitable for various species and types of water, with assessments made regarding their side effects, effectiveness, ease of use, efficiency, and level of social acceptance. Experts involved in remedial actions against invasive crayfish have collectively agreed upon these evaluations. It is worth noting that for manual capture, a variant without water drainage was considered, further emphasising its efficacy in addressing the invasive species' proliferation.

The summary of approximate common costs for various eradication methods is provided in Annex I/5.1.2. Table 2. It presents a comprehensive overview of the approximate costs associated with various eradication methods for invasive crayfish, along with the specific conditions under which these calculations were made. It outlines the expenses related to equipment and materials, as well as personnel costs, presented in Polish złoty (PLN) gross and net, respectively. Each method is described in detail, including the core part activities and post-execution monitoring requirements. The inclusion of such detailed cost breakdowns allows for better planning and budgeting when implementing eradication strategies, aiding decision-makers in choosing the most cost-effective approach tailored to their specific circumstances.

2.2.3.2. Recommended Methods for Preventing the Spread and Combating Carolina fanwort

Three main selected methods for reducing the occurrence of Carolina fanwort in Poland were: 1) Manual removal (diving method), 2) Use of benthic barriers, 3) Cutting Carolina fanwort (mowing method).

Among them, the most effective method for controlling Carolina fanwort was found to be the method involving the use of benthic barriers —in places where this method was used, only slight re-growth of the controlled species (individual specimens) was observed. The use of benthic barriers involves physically covering the surface with Carolina fanwort with a benthic mat (usually jute mats), which, by cutting off light access to the plants, leads to their death. The material is placed underwater by an experienced

diving team and biodegrades after 1–2 years. It allows for the elimination of even 100% of plants from the bottom surface covered by the controlled species. A particularly desirable effect of this method is the colonisation of the mats by native species, which germinate and outgrow the jute mats. The appearance of dense clusters of native plants enables the permanent occupation of space and the elimination of the controlled species.

The second most effective method was found to be the manual removal method (diving method). It involves the elimination of entire plants along with the parts rooted in the bottom by a team of qualified and trained divers. Such a procedure should be considered, especially when the plant has just begun its invasion in each reservoir and the area covered is small (e.g. several hundred metres or single scattered sites). In such cases, if the procedure is carried out with great care, even a single application can fully eliminate the plant from the water body or watercourse. The above-mentioned methods were also the most favourable in terms of the time and labour required for the conducted treatments. The environmental impact of these methods is minimal (especially since the diving method is very selective), and they can potentially be recommended for use in controlling the species in protected areas.

The lowest effectiveness of control was determined for the third analysed method — cutting Carolina fanwort (mowing method). As part of the work conducted by this method, Carolina fanwort was controlled using V-shaped mowing machines and tools for bottom scraping. Mowing Carolina fanwort is one of the most used methods to combat the development of invasive aquatic plants. The method is characterised by simplicity of implementation and low application cost. It is particularly often used to clean areas intended for recreational, navigational and other purposes. Considering the obtained results and based on the knowledge of the biology and regenerative properties of Carolina fanwort, the use of this method for permanent elimination or control of this IAS is not recommended. Despite the application of the treatment twice, re-colonisation of the bottom surface and occupation of the entire available space by Carolina fanwort shoots were observed. Strong shoot regeneration occurred in a very short time. Single flowering specimens were also observed. The limitation of the controlled species' occurrence was very short-term (2–3 weeks), and in terms of control objectives, it was

ineffective. However, the method can be used as a preliminary method before laying benthic mats to clean the bottom and preliminarily weaken the condition of the invasive plant, while simultaneously reducing the amount of biomass subject to decomposition.

None of the methods described above affects human health or the economy, and based on consultations and discussions with reservoir users and residents, the applied methods have high social acceptance and low inconvenience. The selection of method and a comprehensive approach to the task of Carolina fanwort removal should be considered individually, depending on the location where the work will be carried out. It also seems reasonable to combine several methods at one site, thereby increasing the effectiveness of the conducted treatments. Since aquatic ecosystems usually also serve as habitats for many animal groups such as fish, birds, or amphibians, after conducting field reconnaissance, the timing of treatments that may interfere with their habitats should be adjusted to be carried out outside the breeding season. Additionally, composting or storing removed aquatic plants must be preceded by appropriate studies, (e.g. regarding the content of heavy metals and other particularly harmful substances in the plants).

Overall, before deciding on the application of a specific method, reconnaissance of the possibility of using the method and the method of conducting preparatory work should be carried out, and the scope of executive and post-executive monitoring should be planned.[6]

2.2.3.3. Recommended Methods of Controlling Invasive Alien Turtle Species[7]

Among the investigated control methods (detailed list see in Annex I/5.2.1.), the most effective methods are, depending on the habitat, capture in beach traps and trap-type traps, as well as manual capture. The summary of indications for the application and

[6] General Directorate for Environmental Protection. 2023. *Development of principles for controlling and combating invasive alien species along with pilot actions and social education (Report No. POIS.02.04.00-00-0100/16)*. In: https://projekty.gdos.gov.pl/files/artykuly/186884/Kompendium-zwalczania-IGO--Cabomba-caroliniana_icon.pdf.

[7] Wojciech, S.; Mazurska, K.; Gorzkowski, B.; Kala, B.; Kolanek, A.; Maciaszek, R.; Rawski, M. and Cierlik, G. 2022. *Kompendium zwalczania inwazyjnych gatunków obcych - żółwie [Compendium of combating invasive alien species - turtles]*. General Directorate for Environmental Protection. In: https://www.iop.krakow.pl/pobierz-publikacje,2217.

non-application of individual methods is presented in Annex I/5.2.2. Table 3. These assessments were agreed upon based on the opinions of experts involved in remedial actions against IAS turtles.

Several methods, listed below with reasons, should not be used for controlling alien turtle species in Poland:

- **Dewatering of water bodies:** Dewatering can have detrimental effects on aquatic ecosystems by disrupting habitats and potentially harming native species that rely on the water bodies. Additionally, it may not effectively target alien turtle species without causing significant environmental damage.
- **Shooting:** Shooting as a control method is not suitable in populated areas due to safety concerns and the risk of unintentional harm to humans or non-target species. Moreover, shooting may not be an effective long-term solution for managing alien turtle populations.
- **Angling:** Angling, or recreational fishing, is ineffective for controlling alien turtle species as they are not typically attracted to bait used for fishing. Additionally, angling may not be a humane method for managing populations and can cause unnecessary suffering to the turtles.
- **Promotion of native predators:** Introducing or promoting native predators as a means of controlling alien turtle species can disrupt local ecosystems and may lead to unintended consequences, such as unbalanced predator-prey dynamics or harm to other native species.
- **Fencing of water bodies:** Fencing water bodies to prevent access by alien turtle species may not be practical or effective, as turtles are known to be proficient climbers and may still find ways to access the water bodies. Additionally, fencing can impact other wildlife and may not be a sustainable or cost-effective solution.
- **Use of tracking dogs:** Using tracking dogs to locate alien turtle species is unlikely to be effective, as turtles are not easily tracked by scent (like mammals). This method may also disturb native wildlife and habitats without significantly reducing turtle populations.

In summary, these methods are not recommended due to their ineffectiveness, potential negative impacts on ecosystems, and ethical considerations. Alternative methods that are humane, environmentally sustainable, and targeted specifically at the behaviour and biology of alien turtle species should be considered for effective management and control.

2.2.3.4. Recommended Methods for Controlling Aquatic Invasive Plant Species in Poland

The methods used to combat invasive plant species encompass various approaches, including mechanical, physical, chemical, biological, and mixed methods. Mechanical methods involve physically removing plants or parts of plants from the environment, such as uprooting, mowing, or covering surfaces. Physical methods utilize techniques like electric impulses, thermal treatments, or lowering water levels to control invasive plants. Chemical methods involve the application of herbicides to eradicate invasive species. Biological methods utilize natural enemies or grazing by herbivorous animals to manage invasive plants. Mixed methods combine different approaches, such as mechanical and chemical treatments.

Among these methods, recommended approaches for use in areas of exceptional natural value are those that ensure effectiveness, have minimal impact on the environment, and are legally permissible. Mechanical methods that do not significantly alter habitats, such as uprooting or mowing, are often recommended. Conversely, methods such as electric or thermal treatments are not recommended due to insufficient information on their effectiveness and potential environmental impact. Overall, the effectiveness of control methods depends on factors such as the specific invasive species, the habitat, and legal considerations. Recommended methods aim to achieve the desired control goals while minimizing harm to the natural environment.

In the case of Nuttall's waterweed (*Elodea nutallii*), to minimize its impact on native biodiversity and ecosystems, various strategies should be applied. Besides mechanical, chemical, and biological methods, the environmental consequences need to be considered carefully. Chemical control involves the use of herbicides to kill Nuttall's

waterweed, although this method can have negative impacts on non-target species and water quality. The use of biological control (e.g. the introduction of herbivorous insects or pathogens) can also have unintended consequences and should be carefully monitored.

2.2.4. An Integrated Approach to Protecting Ecosystems Against Invasive Alien Plants in Southern Poland (implementation period: 2021-2024)

The project[8] aimed to strengthen the resistance of selected ecosystems to the negative effects of climate change through their comprehensive protection against the entry of invasive plant species, based on their early detection and identification of their spread routes, as well as increasing public awareness. The overarching goal of the project is to enhance the resilience of selected ecosystems, primarily riparian and terrestrial (forests, meadows, grasslands), to the negative effects of climate change by comprehensively protecting them from invasive alien plant species, particularly species from the genus *Heracleum* (hogweeds), *Solidago* (goldenrods), *Reynoutria* (knotweeds), and *Impatiens glandulifera* (Himalayan balsam).

The project's scope:

- Active protection of terrestrial and riparian ecosystems by limiting the negative impact of invasive alien plant species (IAP)
- Development, refinement, and testing of innovative methods for controlling IAP
- Early detection of invasive plant species and sources of their spread by attempting to identify pathways of their dissemination in ecosystems/areas covered by the project
- Increasing public awareness of the negative impact of IAP on native biodiversity

Various actions were undertaken to eliminate and/or limit the populations of the invasive plants, increase biodiversity, and consequently attempt to restore the original

[8] In: https://www.iop.krakow.pl/projekty,3,projekty_aplikacyjne,238.html.

character of the areas. These include single mowing during the growing season, removal of Caucasian hogweed by manual digging, and renaturation activities in the buffer zone. The area for renaturation was prepared through cultivation practices, and then a specialized plant mixture was sown, considering the habitat needs of numerous components, which included seeds of rare plant species, further enhancing the area's exceptional landscape and aesthetic value. Additionally, innovative methodological solutions were planned to be implemented which will effectively reduce *Solidago* populations.

2.2.5. Study of Genomic Variation in the Context of the Success of an Invasive Species Using the Example of the Raccoon (2020/37/B/NZ8/03801) (implementation period: 2021-2024)

The project[9] focuses on the study of raccoon populations from their natural range in the United States and their invasive range in Poland, the Czech Republic, and Germany. The intensive expansion of this species in Europe began approximately 20 years after its introduction, mainly from Germany. To answer the question of how local adaptations of invasive populations arise and what their importance is for the success of an invasive species, and to identify places in the genome that are subject to natural selection, data on raccoon genomic variation obtained using two alternative approaches will be used. The exome sequencing method will be used, which enables the identification of genetic variability in coding regions of the genome (i.e. those that may have a direct impact on the development of local adaptations). Additionally, the markers associated with restriction sites that allow us to estimate genetic variability at random locations throughout the genome will be used. To check whether invasive populations are less exposed to pathogen pressure, the diversity of enteric pathogens found in them will be compared with those from the natural range using genetic metabarcoding.

The obtained results will answer the question of what importance the variability at the genomic level has for the success of the invasion of alien species, what is its relationship

[9] In: https://www.iop.krakow.pl/projekty,2,projekty_naukowe_(finansowanie_krajowe),229.html

with the development of adaptation in new local habitats, and will also allow us to estimate the pathogen pressure of natural and invasive populations.

2.2.6. Combating Invasive Alien Species (implementation year: 2020)

In the framework of the project[10], the effectiveness of methods to eradicate Sosnowski's hogweed was tested (depending on the area occupied, its accessibility for employees carrying out the task, the density of plants, and the distance from the nearest water reservoirs and streams). Sosnowski's hogweed is a species that is dangerous to nature and humans. On hot, sunny days, the essential oils produced by the plant can cause serious burns.

The type of method depends on the size of the population, habitat, and availability of land. Previous experience shows that the best results are achieved by combining techniques, which involve combining two or more methods (e.g. alternating mowing with chemical methods, cutting the root collar, and removing individual specimens). The treatment is performed by spot application of a chemical agent to the plant. It should be remembered that the use of chemical treatments is prohibited in protected areas and on organic farms, as well as near reservoirs and watercourses. Mowing does not eliminate the plant from the environment but prevents the production of seeds and, therefore, further spread. However, the condition is to repeat mowing many times during the growing season to prevent flowering. Hogweed seeds left in the soil retain their ability to germinate for several years. Cutting the root collar with a sharp spade yields very good results. This procedure is recommended for single individuals and small patches.

In practice, many methods for removing these species from the environment are used worldwide, but none of them has been described as completely effective and universally recommended. The most effective approach for eliminating or reducing the population of Caucasian hogweeds in each area is the use of combined methods. Most actions

[10] In: https://wfos.gdansk.pl/zwalczanie-obcych-gatunkow-inwazyjnych-projekty-dofinansowane-ze-srodkow-wfosigw-w-gdansku/

aimed at controlling hogweed populations are recommended in spring (at the beginning of the growing season), with repetition in the following months. The procedures should be repeated over the years until the roots of the plants die and the soil is cleansed of seeds.

Some of the recommended methods to prevent the spread and combat hogweeds include chemical methods, mechanical methods, surface covering methods, agrotechnical methods, grazing of livestock, biological methods, and revegetation and reclamation. It is recommended to develop comprehensive national or regional strategies for combating Caucasian hogweeds, based on cooperation between entities responsible for invaded areas and involving society. Methods for combating Caucasian hogweeds should always be tailored to the nature of the population and local conditions. Mowing only restricts the spread of hogweeds, but easier to implement, less costly (in terms of time and labour), and more effective in limiting the scale of population invasion in Poland is the destruction of sites in the early stage of their development. Combating should be carried out by trained individuals with attention to the correctness of actions and adherence to safety and hygiene measures. Waste obtained in the process of eliminating Caucasian hogweed sites must always be disposed of. Public education on methods of dealing with Caucasian hogweeds is necessary. Continuous monitoring of the scale of the invasion of Caucasian hogweed species in Poland is necessary (both in invaded areas and in areas currently free from the discussed species).

2.2.7. Combating invasive species of knotweed by the Chojnów Forest District (implementation period: 2014-2020)

The project[11] on combating invasive species of knotweed (funded by the European Union and led by the Institute of Technology and Life Sciences, Department of Nature and Rural Landscape Protection) addressed the challenge of controlling knotweed species along a dirt road in the Piskórka locality, Prażmów commune. The project utilised soil

[11] In: https://chojnow.warszawa.lasy.gov.pl/aktualnosci/-/asset_publisher/eGA4WkPQpffY/content/projekt-dotyczacy-zwalczania-inwazyjnych-gatunkow-rdestowcow

cultivation techniques such as mulching, ploughing, harrowing, seeding with grass mixtures, and mowing to remove knotweeds. Despite facing difficulties, including the resilience of knotweed populations, the project observed positive outcomes in reducing knotweed density. Additionally, alternative methods like electroshocks and special nets were tested nearby. The project emphasised the importance of early intervention. Further analysis will determine the most effective strategies for combating these invasive species, with ongoing updates expected.

2.3. Further Initiatives

2.3.1. The Alien Hunter Initiative

This initiative[12], stemming from research on invasive ornamental shrimp epibionts, takes a comprehensive approach to combat the release of aquarium species into natural Polish watercourses. The ongoing activities aim to address legal non-compliance, inadequate education among aquarium owners, and the threat posed by released species to ecosystems and the economy. By collaborating with scientists, naturalists, aquarists, and anglers, the initiative seeks to create a publicly accessible database and map of aquarium species in Poland. Despite challenges, including widespread distribution of released species and negligence in compliance, the project advocates for responsible aquarium practices and legal awareness. Through documentation of observations and data transfer, the initiative engages citizens in monitoring and mitigating the impact of invasive species on aquatic environments. The project website serves as a hub for information, resources, and community engagement, emphasizing collective responsibility in safeguarding natural habitats. Participation is encouraged from all interested parties to support the initiative's goals.

[12] In: https://lowcaobcych.pl/

3. Hungary: Analysis of Policies and Programmes on IAS

3.1. Legislation

The legal harmonisation of the EU Regulation on invasive alien species (No 1143/2014) has been achieved in two main steps. The first step involved implementing it at the Act level[13] (No CXXXVII of 2016), which incorporated authorisations for the application of the EU IAS Regulation into six individual sectoral legislations: nature conservation, agriculture, forestry, wildlife management, fisheries, and food chain control. This integration granted powers to address invasions. Hungarian legislation already contained provisions on invasive alien species prior to the EU regulation, but the new law ensured collaboration and joint action among the concerned sectors by making the application of the EU regulation mandatory. The Act on Nature Conservation[14] (No LIII of 1996) stipulates that the rules of the Regulation shall apply to the import, transit, export, keeping, breeding, introduction, crossing, sale, or use of invasive alien species in the country. Similarly, the Act on Forest (No XXXVII of 2009) and the Act on Fisheries Management (No CII of 2013) also include a provision that the authority is obliged to apply the provisions of the EU IAS Regulation and the supplementary provisions of the Act on Nature Conservation in its procedures. According to the Act on the State Certification of Plant Varieties (No LII of 2003), plant varieties listed as invasive alien species of Union or national concern are not eligible for state certification.

Based on the amending provisions of the Act on IAS, the Nature Conservation Act defines the authorities responsible for the licensing, control, obligations, and fines related to invasive alien species. Tasks related to invasive alien species are carried out by the authority whose actions concern an invasive alien species, or, in the absence of such an authority, by the nature conservation authority. The Nature Conservation Act also establishes basic rules for defence obligations, distinguishing between state

[13] In: https://mkogy.jogtar.hu/jogszabaly?docid=A1600137.TV

[14] In: https://njt.hu/jogszabaly/1996-53-00-00

interventions and public interest interventions depending on whether there is a person liable to carry out the defence.

If state or public interest interventions are undertaken, the costs may be financed from the dedicated budget (*Compensation for animals, plants, and GMOs*) of the Ministry of Agriculture (MoA) allocated for this purpose.

The second step involved a new governmental decree[15] (No 408/2016) on the management of invasive alien species, published in 2016. The Governmental Decree designates the bodies responsible for implementing the tasks outlined in certain articles of the EU IAS Regulation and specifies the tasks of the Minister responsible for nature conservation, sectoral national and regional authorities, national park directorates, and regional administrative bodies. For example, the Minister for nature conservation is responsible for preparing risk assessments for invasive alien species proposed for the Union concern list, analysing pathways, preparing action plans for priority pathways, coordinating national monitoring, establishing a uniform data collection system, and fulfilling notification and information obligations towards the Commission. The nature conservation authority with national competence is responsible, among other tasks, for emergency measures, operating the official surveillance system for early detection, and coordinating national inspections of the authorities. The governmental decree outlines the rules on applicable sanctions (such as the amount of fines and criteria for imposing fines), specialised issues to be examined in procedures, the obligation to notify and register pet animals of IAS species, and the institutions required to host them.

The national list of invasive alien species of Member State concern (based on Article 12 of the EU IAS Regulation) — to be established by ministerial decree from the Minister responsible for nature conservation after consulting other sectoral ministers — is currently under negotiation. The draft list includes nearly 150 species, primarily those threatening biodiversity and ecosystems. These species will be subject to the provisions of Articles 7 and 8 of the EU IAS Regulation to facilitate enforcement.

[15] In: https://net.jogtar.hu/rendelet?docid=A1600408.KOR

The comprehensive analysis of the pathways for species of Union concern in Hungary and the action plan for priority pathways was completed in 2020 and has been formally adopted by the Commission. Of the 66 species on the Union list, 33 have been recorded in the wild in Hungary, and a further 11 species have been found in contained holdings, of which 7 are potentially viable in the wild. The document addresses these 40 species, most of which (32 species) are aquatic plants or animals. The document identifies 14 pathways, 6 of which are prioritised: 1) Aquaculture, 2) Pet/aquarium/terrarium animal species, 3) Horticulture, 4) Decorative purposes other than horticultural, 5) Live feed and live bait, 6) Natural cross-border spread. Action plans have been elaborated for all 14 pathways. Each action plan includes measures and principles for prioritising measures, a list of the affected species of Union concern, a description of the pathway, its importance and temporal changes, the legislative background, the concerned actors, and available international guidance.

Provisions relating to invasive species are also addressed in lower-level legislation, such as specific sections on invasive species management included in nature conservation management plans. The reduction of invasive species is included as a specific objective in the National Biodiversity Strategy 2030[16] under Strategic Area 1 (Reducing threats to biodiversity) and is also part of measures for other objectives, such as developing a coherent network of protected areas, restoring degraded ecosystems, improving the status of species in unfavourable conservation status, halting the decline of pollinators, improving ecosystem resilience to climate change, and mitigating climate change effects. The need for action against invasive alien species is addressed in separate chapters of the V. National Nature Conservation Masterplan, an annex of the V. National Environment Programme until 2026.[17]

Overall, the two-step harmonisation process has successfully incorporated the necessary provisions into sectoral legislation, defined the responsibilities of relevant actors, and established rules of procedure, providing a framework for joint and effective

16 In: https://cdn.kormany.hu/uploads/sheets/1/14/141/14141a7031c32aa7f9338edf332e811.pdf

17 In: https://www.parlament.hu/irom42/01834/01834.pdf

action. On the positive side, the management of invasive alien species is being addressed horizontally across all concerned sectors, integrated into lower-level legislation, and increasingly prioritised in sectoral strategies.

3.2. Good Examples of National Implementation

3.2.1. Professional Management of Regional Bodies

Since the introduction of the national invasive species legislation, the Ministry of Agriculture has held regular professional meetings for national park directorates and conservation authorities. The organisations affected are informed about national and international developments and updates on implementation. The regional bodies report on the tasks carried out and the problems faced, which are discussed in detail, and agreements are made on how to manage them. They jointly define the tasks and priorities for the next period. The ministry also supports the work of regional bodies by providing them with technical material and guidelines. Ongoing communication, feedback, and joint management of problems greatly support a coherent national implementation.

3.2.2. Dedicated Budget for Interventions

As mentioned above, the Ministry of Agriculture provides a dedicated source — chapter-administered appropriation: *Compensation for animals, plants, and GMOs* — to cover the costs of invasive alien species control based on a ministerial order and internal procedures. A fixed annual budget is available for defence, but this can be increased if necessary. An intervention plan must be drawn up for the planned measures, and once approved, the cost of the actions carried out will be paid from the budget. The intervention plan contains basic information about the intervention area (name, protection status, area in hectares, owner/manager/land user), the name and amount of concerned invasive species (EU concern or other), the purpose of the intervention (e.g. eradication, population control), ecological characterization of the target area, a justification that the obliged person is not responsible for the introduction of a particular IAS and is performing due care in their activities, a description of the planned method, and a detailed cost estimation. The funding mainly supports interventions to maintain

the status of priority areas for biodiversity. In 2023, for example, more than 40 interventions were funded for nearly EUR 250 000. Among these, we highlight the control of signal crayfish in two streams in the Őrség region, which involved, in addition to trapping and manual catching, the installation of elements to prevent spreading.

3.2.3. Rapid Eradication – Success Stories

3.2.3.1. Egyptian Goose (Alopochen aegyptiaca)

The Egyptian goose is a very rare vagrant species in Hungary, observed mainly in autumn and winter on fishponds, wetland areas, and urban surroundings, usually among greater white-fronted goose flocks. The first breeding of the species was recorded in 2016 in a gravel pit lake at Zsennye (Vas County). Breeding was repeated in 2017, when again one pair and 10 chicks were observed. Local nature conservation authorities, the national park directorate, and the local hunting authorities, with the hunters, decided to shoot all specimens from a boat in July 2017 because the chicks were developed enough to fly. They shot one female and seven chicks; the male and two chicks flew away. They chose shooting because this method is rapid, painless, and does not cause long-term suffering for the individuals, meets animal welfare criteria, and is applicable in artificial lakes like the gravel pit lake at Zsennye, as there are not many strictly protected bird species. Since then, no new nesting of the species has been detected in Hungary.

3.2.3.2. Asian Hornet (Vespa velutina)

The Asian hornet is native to Southeast Asia and was accidentally introduced to France in 2004. Since then, the species has rapidly spread in Europe, reaching Hungary last year, with reports from 10 European countries. The first occurrence of the species in Hungary was recorded in Kimle in August 2023. Specimens have been seen in two apiaries. The species can cause enormous damage to apiaries, as native bee species have no defence against it. The Hungarian Beekeepers' Association called in Dutch-Belgian experts to find the nest and eradicate the colony in October 2023. First, a trap was used to catch a sufficiently strong individual that could carry a radio transmitter. Before placing the radio transmitter, the hornet was allowed to rest in a tent made of

tulle, and after the radio transmitter was installed, it was allowed to rest again. After release, the hornet rested on a tree, made cleaning movements, and then flew off. Two teams followed — one on the Mosoni-Danube and one on land. The nest, built on an acacia tree near a settlement at a height of 20 metres, was found within a short time. The whole nest was removed — for later analysis of the colony composition — and the bulk of the flying individuals was caught by vacuum. Traps were set to catch the remaining individuals. Later examination of the nest confirmed that it was not yet mature enough to have emerged with reproductive individuals, so the nest was removed in time.

3.2.4. Information to Stakeholders

The Ministry of Agriculture, together with the Fertő-Hanság National Park Directorate, launched the "Knowledge Base of Invasive Alien Species"[18] website in 2018. Currently, all national park directorates are partners and involved in developing the content of the website. The regularly expanded and updated website provides professional information on invasive species to a wide range of stakeholders. The information available from the main menu (Get to Know!/Handle Wisely!/Do Something!/Follow the Rules!) is also structured according to the main user groups, so that farmers, schoolchildren, and general users (pet keepers, hobby gardeners, and others) can easily find the information they need. Among the content elements, the case studies and management guidelines (currently available for 23 species), which enhance practical knowledge and help with defence, are definitely worth highlighting. Publications and news on invasive species are also available, and the publications can be downloaded from the site.

3.3. Programmes and Projects

In Hungary, no project dedicated specifically to invasive species management has been implemented or is ongoing. Typically, measures to control invasive species are included in nature conservation proposals, such as projects carried out by national park directorates under the Environment and Energy Efficiency Operational Programme,

[18] In: http://www.invaziosfajok.hu/en

transboundary projects (e.g. INTERREG), and EU projects (e.g. LIFE), which almost invariably include measures to control invasive species in order to conserve target habitats and species.

The National Park Directorates and their contracted experts were collecting data on invasive species as part of the Hungarian Biodiversity Monitoring System (HBMS)[19] and their nature conservation managers' tasks before the EU IAS Regulation came into force. However, since the regulation, this has been done in a more structured and systematic way, with additional support from the authorities. Under the HBMS, based on the habitat mapping sampling protocol, the description of habitat patches contains data on invasive plant species and their abundance. The spread of Carolina fanwort (*Cabomba caroliniana*) in the canals of the Danube-Tisza interfluve has been surveyed, and community-level survey programmes (e.g. aquatic invertebrates, fish) also collect data on invasive species. Related monitoring programmes, such as bird monitoring, amphibian and reptile mapping (Herp Atlas)[20], and large moth monitoring by light-trap networks, also provide information on IAS. In the case of Herp Atlas, data providers, in addition to native species, can report on *Trachemys scripta* or other amphibian and reptile species.

The ongoing Grassland LIFE Integrated Project (*Long-Term Conservation of Pannonian Grasslands and Related Habitats through the Implementation of Prioritized Action Framework (PAF) Strategic Measures – LIFE17 IPE/HU/000018*)[21] includes the completion of a national geodatabase on invasive species by the end of 2024 and its regular updating to monitor the spread of invasive species and interventions (eradication, control measures). The main objective of the database is to collect and display data on invasive species in a nationally uniform system and to support the work of the Ministry of Agriculture and its regional bodies. In the first stage, the database will compile data on invasive species collected by the National Park Directorates into one

[19] In: https://termeszetvedelem.hu/category/termeszetvedelmi-monitorozas-nemzeti-biodiverzitas-monitorozo-rendszer-nbmr/

[20] In: https://herpterkep.mme.hu/index.php?lang=hu

[21] In: https://www.grasslandlifeip.hu/en

system. Other systems may be added at a later stage. The database will be free of charge, open source, and will run on the OpenBioMaps[22] platform. It will be accessible to the general public as well as to the conservation sector.

After presenting the general situation of the project on invasive alien species, this study describes in detail one national survey and two voluntary data collection programmes that provide a significant amount of data on invasive species.

3.3.1. National Survey of Decapod Crustaceans

During 2017-2018, using a source provided by the Ministry of Agriculture, decapod crustaceans were surveyed at nearly 800 sampling sites of rivers, lakes, and reservoirs by experts from the national park directorates and the Research Centre of Fisheries and Aquaculture. Almost a third of the surveyed water bodies were dry or unsuitable for crayfish habitat. The applied methods were manual catching, netting, crab-potting, and electro-fishing. In addition to three native decapod species, eight invasive alien decapod crustaceans were detected. For each native and invasive crustacean species, 50 specimens were measured, and morphological analysis was performed (e.g. total body length, nose length, maximum throat width, telson width, scissor length). The distribution maps produced from the survey data were used, among other purposes, for reporting under the EU IAS Regulation.

3.3.2. Voluntary Data Collection Programmes

3.3.2.1. Mosquito Monitor

The national mosquito monitoring programme was launched in 2019 by the Centre for Ecological Research and the University of Pécs. In addition to the 50 native mosquito species, data are collected on three new invasive mosquito species: Asian tiger mosquito (*Aedes albopictus*), Asian bush mosquito (*Aedes japonicus*), and Korean bush mosquito (*Aedes koreicus*). These invasive mosquitoes can spread a number of pathogens (viruses, nematodes) that are dangerous to humans and animals. From an epidemiological perspective, it is important to know the spatial and temporal

[22] In: https://openbiomaps.org/

distribution of these species. On the website[23] of the monitoring programme, a detailed description is available about the morphology, ecology, distribution, and identification of the three target species. Citizen observations — photos of captured specimens sent via mobile app or email — are identified by dipterology experts. Based on the validated data (over 5000 observations), graphics, diagrams, and maps are created.

3.3.2.2. Harlequin Ladybird (Harmonia axyridis)

The species, originally native to Asia, was introduced to North America as a biological control of aphids and has been present in Europe since 1995. It was first recorded in Hungary in 2008. The species is a voracious predator, so while it is useful for aphid control, it poses a threat to native ladybird species (two-spotted, ten-spotted, and seven-spotted ladybirds). The Harlequin Project was launched by the Boglárka Foundation in the early 2010s with the primary objective of monitoring the spread of the species in Hungary. Knowing the exact distribution range of the newly emerging species, as well as the direction and speed of its spread, provides important information for its control. Enthusiastic amateurs, garden lovers, farmers, and conservationists could send data to a specified address, which, after validation, would be aggregated by the programme's managers. The 2017 distribution map[24] shows that the species is already present in most parts of the country.

[23] In: https://szunyogmonitor.hu/

[24] In: https://agraragazat.hu/hir/harlekin-projekt-a-remkatica/

4. Summary

The review provides a comprehensive overview of efforts in Poland and Hungary to combat the threats posed by invasive alien species (IAS) to native ecosystems, biodiversity, and public health. It encompasses various projects, initiatives, and legal regulations aimed at understanding, managing, and preventing the spread of invasive species.

- **Regulatory Measures**: The legal harmonisation of the EU IAS Regulation, adapted to national circumstances by modifying existing laws or introducing new legislation, provides an appropriate framework for joint and effective action in managing invasive species. This adaptation allows for targeted and immediate action against species that pose a threat to biodiversity and ecosystem services.
- **Practical Interventions**: By collecting and utilising the experience from implemented interventions, on-the-ground projects focus on eradicating specific invasive species. Various methods and their combinations ensure that adequate (tailored to local conditions) and rapid actions are applied against invasive species.
- **Projects and Research**: Projects and scientific research support national measures related to the management of invasive species, promoting more effective defence and intervention. These efforts contribute to a better understanding of the mechanisms driving invasion success and their impact on the natural environment.
- **Public Awareness**: Various initiatives (such as the Alien Hunter and Harlequin Project, and the operation of a thematic webpage) raise awareness about the risks of invasive alien species, including those associated with their release and introduction into the natural environment. These initiatives improve general knowledge and actions against IAS (e.g. how to avoid accidental spread).

Annex I

Detailed information about the project (Developing methods of combating at least 10 invasive alien species with pilot activities in the field) described in Chapter 2.2.3.

Invasive crayfish

List of control methods/actions:

Action 1 – Direct Elimination

- trapping — catching crayfish using various types of traps, such as funnel traps, hoop nets, or traps with bait.
- fishing with a hook and line — catching crayfish using a hook and line, often baited with animal or plant matter.
- electrofishing — using an electric current to stun or kill crayfish, making them easier to catch.
- mechanical removal — manually removing crayfish from the water by hand or using tools such as nets or traps.
- chemical control — using chemical agents to poison or sterilize crayfish, reducing their numbers or reproductive capacity.

Specific chemicals used for this purpose may vary depending on factors such as local regulations, environmental considerations, and the species targeted. Commonly used chemicals for sterilizing crayfish include those that contain active ingredients like difenacoum, niclosamide, or piperonyl butoxide, among others. These chemicals are typically applied to the environment where crayfish populations exist, such as water bodies or specific habitats, to reduce their numbers or reproductive capabilities.

Action 2 – Habitat modification

Habitat modification involves altering the physical or chemical characteristics of the environment to make it less suitable for IAS crayfish. This included:

- Removing or blocking access to breeding sites, such as burrows or nesting areas.
- Changing water flow patterns or levels to disrupt crayfish movement or breeding.
- Introducing barriers or obstacles to prevent crayfish from entering or exiting certain areas.
- Manipulating water temperature or quality to discourage crayfish colonization or reproduction.

Habitat modification was considered an effective long-term strategy for managing IAS crayfish populations, but it often required ongoing maintenance and monitoring to be successful.

Action 3 – Biological control

Biological control involves using natural predators, parasites, or pathogens to reduce the population of IAS crayfish. This included:

- Introducing predatory fish or other animals that feed on crayfish.
- Releasing parasitic organisms or pathogens that infected and killed crayfish.
- Using genetic manipulation to create sterile or less fertile crayfish populations.

Biological control was seen as an environmentally friendly alternative to chemical control methods, but it could pose risks to native species or ecosystems if not carefully managed.

Action 4 – Public education and outreach

Public education and outreach were important components of any IAS management strategy. This included:

- Raising awareness about the impacts of IAS crayfish on native ecosystems and economies.
- Providing information about how to identify, prevent, and control IAS crayfish.
- Promoting responsible behaviour among anglers, boaters, and other recreational users of aquatic environments.

Public education and outreach helped build support for IAS management efforts and encouraged local communities to take action to prevent the spread of IAS crayfish.

Monitoring and evaluation

Monitoring and evaluation are essential components of any IAS management program. For this project, this included:

- Conducting surveys to assess the distribution and abundance of IAS crayfish.
- Tracking changes in native species populations and habitat conditions.
- Evaluating the effectiveness of management actions and adjusting strategies as needed.

Monitoring and evaluation provided valuable feedback for decision-makers and helped ensure that IAS management efforts were cost-effective and environmentally sustainable.

Actions after combat

Actions after combat were aimed at consolidating the achieved results and preventing the recurrence of the problem. They included:

- Monitoring and surveillance — continued monitoring of IAS crayfish populations to detect any signs of resurgence or re-infestation.
- Habitat restoration — restoring native habitats that had been damaged or altered by IAS crayfish colonization.
- Public awareness and education — maintaining efforts to educate the public about the importance of preventing the spread of IAS crayfish and promoting responsible behaviour.
- Research and development — conducting further research to improve understanding of IAS crayfish biology, ecology, and control methods.
- Collaboration and coordination — working with other stakeholders, including government agencies, non-governmental organizations, and the private sector, to coordinate IAS management efforts and share best practices.

By taking these actions after combat, it is possible to reduce the risk of future invasions by IAS crayfish and minimize their impact on native ecosystems and economies.

Indications for use and non-use of control methods and approximate common costs for various eradication methods for controlling invasive crayfish

Table 1. Indications for the use and non-use of specific control methods for controlling invasive crayfish.

Control Method	Manual capture	Manual capture + traps	Trap-only	Diver capture	Magnetic attractors
Striped crayfish	Y	Y	Y	Y	Y
Signal crayfish	Y	Y	Y	Y	Y
Louisiana crayfish	Y	Y	Y	N	Y
Marbled crayfish	Y	Y	Y	Y	Y
Slow-flowing stream	Y	Y	Y	Y	Y
Fast-flowing stream	Y	Y	Y	N	Y
Small water body	Y	Y	Y	Y	Y
Large water body	N	Y	Y	Y	Y
Ecologically valuable areas	Y	Y	Y	Y	Y
Environmental Impact	Small	Small	Small	Small	Small
Human Health Impact	Small	Small	Small	Small	Small
Discomfort	Small	Small	Small	Small	Small
Effectiveness	High	High	High	High	High
Ease of Use	High	Medium	Medium	Medium	Medium
Efficiency	High	High	High	High	High
Level of Acceptance	High	High	High	High	High

Table 2. Approximate common costs for various eradication methods for controlling invasive crayfish.

Method	Equipment and Materials* (PLN gross)	Personnel Costs* (PLN net)	Conditions
Manual Capture	1800	28 000	Core part: 2 persons, 30 days. Post-execution monitoring: 2 persons, 5 days
Manual Capture - with drying	7600	2400	All activities carried out in 1 day
Manual Capture and Trap	2700	28 000	Core part: 30 traps, 2 persons, 30 days. Post-execution monitoring: 30 traps, 2 persons, 5 days
Trap-only	2400	24 500	Core part: 30 traps, 2 persons, 30 days. Post-execution monitoring: 30 traps, 2 persons, 5 days
Traps with Magnetic Attractors	7000	21 600	Core part: 100 traps, 2 persons, 31 days. Post-execution monitoring: 100 traps, 2 persons, 5 days
Diver Capture	35 050	38 400	Core part: 3 divers, 3 non-divers, 5 days. Post-execution monitoring: 2 persons, 5 days

** It is important to note that these costs are intended as a guideline, and actual expenses may vary depending on factors such as location, scale of the operation, and availability of resources.*

Alien turtle species

List of control methods:

a) Manual Capture:

This method involves capturing turtles manually using nets and buoys. It is recommended to conduct captures during the turtles' active periods, typically from mid-April to early October. Manual capture is conducted using tools like nets, waders, gloves, and containers for transporting captured turtles. The process involves approaching or swimming towards resting turtles and capturing them using nets or handheld tools. Advantages include low equipment costs, simplicity, high selectivity, and immediate action capability. However, it is labour-intensive and less effective in deep waters or areas with dense vegetation. Although under favourable circumstances turtles can be successfully captured directly by hand, the effectiveness of manual capture is significantly increased when using hand nets or pickers.

b) Capture in Seine nets:

Seine nets are large fishing nets that are deployed vertically in the water and then drawn together horizontally to encircle fish or other aquatic animals, including turtles. Once enclosed, the net is pulled to shore or onto a boat to retrieve the captured turtles.

c) Capture in Fyke nets:

The method of trapping in a fyke net involves setting up special traps called fyke nets in the water to catch invasive turtle species. These traps are constructed from metal hoops covered with netting, forming cylindrical structures with a narrow entrance leading into the trap chamber. The method requires placing the traps in suitable locations in the water body and regularly checking and servicing them.

Basic tasks associated with using fyke nets include:

- Placing traps where turtles are present or likely to be.

- Put bait inside the trap to lure turtles.
- Regularly checking traps every few days, replacing bait, and repairing any damage.
- Monitoring the effectiveness of trapping and taking corrective actions if the method does not yield the desired results.

Advantages of the method:

- Low cost of equipment purchase.
- Applicability in various aquatic environments.
- Ease of trap handling and transportation.
- Safety for captured turtles.
- Ability to be used in locations inaccessible to other types of traps.

Disadvantages of the method:

- Low selectivity, which may result in bycatch of other species.
- Need for frequent trap checks due to the risk of bycatch mortality.
- Potential damage to and loss of traps due to various factors.
- The complex legal situation related to trap use.
- Negative societal perception, especially among fishing enthusiasts.

The fyke net trapping method is a relatively inexpensive and easy-to-use tool for controlling populations of invasive turtle species, but it requires regular monitoring and may result in bycatch. Additionally, its legal use may be restricted by legal and social considerations.

d) Capture in beach traps:

Beach traps are typically constructed on sandy shores or nesting beaches frequented by turtles. These traps consist of fenced enclosures or pitfall traps covered with netting or other materials to prevent turtles from escaping once inside.

e) Capture-in cage traps:

Cage traps are devices designed with a cuboid shape, featuring an entryway that snaps shut after the turtle triggers the locking mechanism by accessing bait placed inside. These traps are typically made of rigid, galvanized mesh and allow for easy inspection and removal of captured turtles.

- These traps consist of cages with bait inside, anchored to the waterbed with stakes.
- Like fyke nets, cage traps need to be checked regularly to prevent damage and ensure effectiveness.
- Advantages of cage trapping include high selectivity, adaptability to various environments, and safety for captured turtles.
- Disadvantages include high initial cost, difficulty in transport and deployment, and potential entanglement of non-target animals or people.

f) Capture using nets and buoys:

Nets and buoys can be deployed in aquatic environments to passively capture turtles as they swim or move through the water. Nets are anchored in place and equipped with buoys to keep them afloat and visible, allowing for easy retrieval of captured turtles.

Indications for use and non-use of methods for controlling alien turtle species

Table 3. Indications for the application and non-application of individual methods in case of alien turtles.

	Manual Capture	Drag Nets	Traps	Beach Traps	Cage Traps	Nets and Buoys
Snapping Turtle (*Chelydra serpentina*)	N	N	Y	N	Y	Y
Painted Turtle (*Chrysemys picta*)	Y	Y	Y	Y	Y	Y
Map Turtle (*Graptemys pseudogeographica*)	Y	Y	Y	Y	Y	Y
Slider Turtle (*Trachemys scripta*)	Y	Y	Y	Y	Y	Y
Slow-Flowing Streams	Y	N	Y	Y	Y	Y
Fast-Flowing Streams	N	N	Y	Y	N	Y
Small Bodies of Water	Y	Y	Y	Y	Y	Y
Large Bodies of Water	N	Y	Y	Y	Y	Y
Ecologically Valuable Areas	Y	Y	Y	Y	Y	Y
Impact on Nature	Small	Medium	Small	Small	Small	Medium
Impact on Human Health	Small	Small	Small	Small	Small	Small
Inconvenience for Humans	Low	Low	Low	Low	Low	Low
Effectiveness	High	Low	High	High	High	High
Ease of Use	High	Medium	Medium	High	Medium	Medium
Cost-effectiveness - Minimum Costs	High	High	High	High	High	High
Cost-effectiveness - Maximum Costs	High	High	High	High	High	High
Level of Social Acceptance	High	Medium	Medium	High	Medium	Medium

The colonisation and spread of invasive alien species are recognised as some of the most significant contemporary threats to the world's biodiversity. They present not only an environmental problem but also an economic and social challenge globally. The EU Regulation (No 1143/2014) on the prevention and management of the introduction and spread of IAS, approved in 2014, outlined both preventative and remedial actions against invasive species and was seen as a major step towards mitigating the threats posed by IAS.

Member States have applied diverse solutions to adapt and implement the EU Regulation according to their specific conditions, organisational structures, and political situations. This study investigates the national measures in Poland and Hungary, focusing on legislation, implemented projects, and other steps taken. It provides a general overview of IAS management and highlights some good practices and lessons learned that could be applicable to other Central and Eastern European countries.

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