GuardIAS
GUARDING EUROPEAN WATERS FROM INVASIVE ALIEN SPECIES

Book of Abstracts

Second Virtual GuardIAS Conference

Cost-efficient IAS Detection and Monitoring: Novel Tools and Citizen Science

19th - 20th November 2026

Funded by the European Union

Second Virtual GuardIAS Conference
(19th - 20th November 2026)

The second virtual GuardIAS Conference is hosted and organized by **INVASIVESNET** - the International Association for Open Knowledge on Invasive Alien Species, a partner organisation of the **GuardIAS Project**.

Organizing Committee:

Frances E. Lucy, Vadim E. Panov, Sebastian Gomez-Maldonado, Clara Giachetti, Tomos Jones and Sara Meehan

Scientific Committee:

Stelios Katsanevakis, Greta Srebaliene, Elena Tricarico, Tim Adriaens, Ana Cristina Cardoso, Ana Nunes, Lorenzo Vilizzi, Bruce Conn, Catherine McCann, Anastasija Zaiko, Calum McNeil

Edited by:

Frances E. Lucy, Vadim E. Panov, Sebastian Gomez-Maldonado, Clara Giachetti, Tomos Jones and Sara Meehan

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Contacts:

Email: office@invasivesnet.org
Website: https://guardias.eu/welcome-to-the-second-guardias-conference/
X/Bluesky: @invasivesnet
Youtube: @invasivesnet

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Foreword

It is a great pleasure to welcome participants to the Second GuardIAS Virtual Conference: "Cost-efficient IAS Detection and Monitoring: Novel Tools and Citizen Science".

The **GuardIAS Project** is a three-year initiative funded by the European Union's Horizon Europe Research and Innovation Programme which commenced on 1 January 2025. The project brings together a diverse consortium of researchers, practitioners, policymakers, and stakeholders with a shared objective: to enhance the prevention, detection, and management of Invasive Alien Species (IAS), with a particular focus on aquatic environments.

The GuardIAS Project addresses both freshwater and marine invasive alien species, recognising their significant ecological, economic, and social impacts. The project employs a multidisciplinary approach that integrates artificial intelligence, environmental DNA (eDNA) analysis, satellite remote sensing, underwater robotics, and advanced monitoring systems. Collectively, these tools contribute to the development of effective approaches for the early detection, monitoring and management of invasive species.

Beyond technological innovation, GuardIAS seeks to improve understanding and awareness of IAS risks among the public and key stakeholders. The project aims to support evidence-based decision-making and the prioritisation of management actions, while fostering greater public engagement and collaboration across sectors and regions.

Building on the success of the inaugural GuardIAS Virtual Conference, which attracted over 400 registrations from participants around the world, this second conference continues to provide a platform for sharing research and innovation in the field of invasive alien species. The conference focuses on cost-efficient approaches to IAS detection and monitoring, including smart detection technologies, eDNA and molecular diagnostics, AI-assisted species detection, citizen science and participatory surveillance networks, data integration, and the translation of detection into effective management and policy action.

The abstracts presented in this volume include both oral and poster presentations and reflect the breadth and depth of ongoing research and innovation within the GuardIAS consortium. Contributions from researchers outside the GuardIAS Project are also welcomed, broadening the conference scope both geographically and scientifically. Collectively, these abstracts highlight advances in IAS detection and monitoring and their potential to improve management practices and reinforce efforts to preserve biodiversity and ecosystem resilience in the face of biological invasions.

We are grateful to all those who contributed to this conference, whose work and participation help to strengthen international collaboration and advance the development of effective approaches to the detection, monitoring and management of invasive alien species.

Frances E. Lucy, Vadim E. Panov, Sebastian Gomez-Maldonado, Clara Giachetti, Tomos Jones and Sara Meehan

on behalf of the Scientific and Organizing Committee

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Keynote Speaker

Many Eyes on the Water: Lessons from FreshWater Watch for Cost-Effective Aquatic Monitoring

Prof. Steven Loiselle
Associate Professor, University of Siena (Italy), Senior Research Lead at Earthwatch Europe

Citizen science has become an increasingly powerful tool for monitoring the health of our freshwater ecosystems, but building a programme that produces robust, decision-relevant data as well as remaining accessible to volunteers is far from straightforward. Drawing on more than a decade of experiences in 30 countries, this keynote traces the development of FreshWater Watch, a global citizen science initiative coordinated by Earthwatch Europe. From a simple set of water quality protocols to a network generating data used by regulatory agencies, researchers and communities, the talk examines the chemical, ecological and social dimensions of the programme. We will explore: the trade-offs in selecting robust yet volunteer-friendly indicators, the quality-control and training systems needed to make citizen-generated data trustworthy, and the social infrastructure required to sustain long-term participation. It closes by reflecting on key lessons regarding scaling, data quality, and community engagement, insights that might be transferable to other citizen science-based monitoring efforts, including the detection and management of invasive alien species.

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Smart detection technologies for IAS surveillance

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Introducing the Smart Weed Alert Tool (SWAT): Harnessing citizen science and open biodiversity data to detect new weeds when they first invade

Kate G. McAlpine

Department of Conservation, 18-32 Manners Street, Wellington 6011, New Zealand

Presenter email: kmcalpine@doc.govt.nz

Oral Presentation

Early detection is widely recognised as the most cost-effective stage for managing invasive alien species, yet detection programmes often remain constrained by limited resources and reliance on chance observations. The Smart Weed Alert Tool (SWAT) is a new open-source digital platform being developed in New Zealand to transform passive biodiversity reporting into proactive weed detection. SWAT enables users to create personalised alerts based on a wide range of criteria relevant to their interests and responsibilities. SWAT automatically scans newly published occurrence records in the Global Biodiversity Information Facility (GBIF), drawing on data from citizen science platforms such as iNaturalist, as well as government agencies, herbaria, research institutions, and other contributors. When new records match a user's alert criteria, SWAT delivers an automated email notification, enabling rapid assessment and response. By leveraging biodiversity data that are already being collected and shared, SWAT provides a highly cost-efficient approach to early detection that requires no additional field monitoring infrastructure. Instead, it adds value to existing investments in citizen science and biodiversity data mobilisation by connecting observations directly with biosecurity and weed management needs. This presentation will introduce SWAT's design, functionality, and underlying concept, demonstrating how large volumes of biodiversity observations can be converted into actionable intelligence. The presentation will also explore how citizen scientists, land managers, researchers, and government agencies can strengthen weed detection simply by contributing observations to platforms such as iNaturalist and by mobilising occurrence records through GBIF. Although initially developed for weeds in New Zealand, SWAT is built on globally accessible data from GBIF, making it readily adaptable to other invasive species and countries. The same approach can be applied wherever biodiversity observations are shared through iNaturalist or GBIF. By transforming passive biodiversity data streams into targeted alerts, SWAT demonstrates how open-source tools, open biodiversity data, and citizen science can improve early detection while reducing management costs at scale.

Keywords: GBIF, biodiversity data mobilisation, open-source tools, weed detection

Funded by the European Union

Surveillance at incursion scale: high-speed underwater imaging and machine-learning detection for marine pests too widespread for conventional response

Brett Kettle[1], David Kettle[1], Joshua Riddell[1]

[1] *Flying Fish Technologies, Queensland, Australia*

Presenter email: brett@fft.ai

Oral Presentation

Marine incursions can outpace the response toolkit. At kilometre scales, diver and ROV surveillance can map boundaries, verify clearance, and revisit sites at useful intervals. Effective management is undermined by slow data once an incursion spans hundreds of kilometres of coastline. Exotic *Caulerpa* in northern New Zealand reached this condition within two years of detection. Crown-of-thorns starfish outbreaks on the Great Barrier Reef have persisted at scales beyond conventional control for decades. We describe a technology pair built to provide rapid surveillance capabilities that complement existing management techniques: Vertigo3, a towed high-speed imaging platform, and SeaScape, the analytics layer that turns its imagery into detections and decision products. Vertigo3 is towed, but flown rather than dragged. It is piloted in real time through a fly-by-wire control system, holding low altitude above the seabed as terrain and habitats change beneath it. Hydrodynamic control surfaces generate excess manoeuvring forces, so the platform operates widely within a towed envelope rather than following the tow point. Working altitude is tailored to the detection target: 0.6 to 1.8 m for centimetre-scale *Caulerpa* thalli, and 1.5 m to 3 m for decimetre-scale starfish. It surveys small targets at about 7 km/h in low light conditions and larger targets at 14 km/h in clear water. In its first exotic *Caulerpa* campaign for Biosecurity New Zealand it surveyed 97.2 km of transects in 6 days, covering 58 ha of seabed; a recent COTS trip covered 55 km and 44 ha in 3 days. Coverage per operating day exceeds diver and ROV rates by one to two orders of magnitude. SeaScape is a permissioned, AI platform that manages the pipeline from raw imagery to operational reporting: quality screening, geolocation, labelling, model training, and management reporting. We separate research-grade from operations-grade Machine Learning, and we quarantine whole habitats before training and testing on them, rather than reporting a single within-domain accuracy figure. Automated detection of *Caulerpa* consistently reached precision of 91%; for COTS, 96%. Stress testing models within and out of domain locates the operational envelope – where the tool can deploy now, and where more training imagery is required first – information important to those managing an incursion. These operational capabilities allow delimitation surveys at regional scale in days rather than seasons; clearance verification with an auditable image record; repeat surveys frequent enough to measure spread and treatment effect; separation of seasonal patterns; and a growing multi-habitat image archive that shortens the training path to each new target. Faster surveillance lets incursion managers direct resources to priority interventions.

Keywords: invasive species surveillance, *Caulerpa*, crown-of-thorns starfish, underwater imaging, machine learning, biosecurity

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Automated detection and abundance estimation of macrobenthic taxa in underwater videos: A case study on the Basque Coast

Igor Granado[1], Ibon Galparsoro[1], Xabier Lekunberri[1], Inma Martin[1], Natalia Montero[1], Joxe Mikel Garmendia[1], **Jose A. Fernandes-Salvador[1]**

[1] *AZTI, Marine Research, Basque Research and Technology Alliance (BRTA), Pasaia, Spain*

Presenter email: jfernandes@azti.es

Oral Presentation

Developing robust and cost-effective methods for marine biodiversity monitoring is crucial for detecting ecological change, mapping vulnerable habitats, and supporting the management of both native and invasive alien species (IAS). Remotely operated vehicles (ROVs) combined with computer vision offer significant potential for increasing the spatial and temporal coverage of underwater monitoring programmes while reducing costs. However, the manual analysis of large volumes of video footage remains time-consuming and resource intensive. To address this challenge, we developed a semi-automated workflow for the detection and abundance estimation of 12 conspicuous benthic taxa from ROV imagery collected in the southeastern Bay of Biscay. The system was trained and validated using approximately 20 hours of video footage from 42 transects. Three object-detection approaches were evaluated: YOLOv8x, Faster R-CNN, and a Weighted Boxes Fusion (WBF) ensemble. The WBF approach achieved the highest detection performance (mAP50 = 0.832 ± 0.028) and was subsequently used for abundance estimation. Comparison of automated and expert-derived counts across independent transects resulted in a mean absolute percentage error of 20.2%, demonstrating the potential of the approach to substantially reduce image-analysis effort while maintaining reliable abundance estimates. Although the present study focuses on native macrobenthic taxa, the proposed workflow is directly applicable to invasive alien species monitoring. The same methodology can be trained to automatically detect, map, and quantify marine IAS from underwater imagery, supporting early detection, distribution mapping, abundance assessment, and long-term surveillance programmes. By enabling rapid processing of large image datasets, the approach provides a scalable and cost-efficient tool for biodiversity monitoring and IAS management, contributing to evidence-based conservation and ecosystem management.

Keywords: computer vision, biodiversity monitoring, underwater video surveys, benthic mapping, marine imaging

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Small panels, big insights: A cost-efficient approach to monitoring fouling communities in Irish marinas

María Isabel Cordón-Krumme[1], Rob McAllen[1], Ruth O'Riordan[1]

[1] *School of Biological Earth and Environmental Sciences & Sustainability Institute, University College Cork, Cork, T12 YN60, Ireland*

Presenter email: MariaIsabel.CordonKrumme@ucc.ie

Oral Presentation

Marinas are important sites for the arrival, establishment and secondary spread of non-indigenous (NIS) and invasive alien species (IAS) because they combine high vessel traffic with abundant artificial substrates suitable for colonisation. Cost-efficient, repeatable and comparable approaches are therefore needed to monitor these environments. This study assessed the potential of settlement panels for monitoring fouling communities in two recreational marinas on the southwest coast of Ireland: Kinsale and Baltimore. At each marina, ten 14 × 14 cm PVC settlement panels were deployed at approximately 1.5 m depth for three months during summer 2026. Panels were assigned to open, partially caged and caged treatments to examine whether predator exclusion influenced community development. Panels were monitored every two weeks to assess colonisation and biomass, alongside continuous measurements of temperature and dissolved oxygen. Fouling communities developed rapidly at both marinas, with biomass increasing throughout the deployment period and clear differences in community composition between locations. A diverse assemblage of sessile organisms colonised the panels, including barnacles, bivalves, bryozoans and tunicates. Notably, the non-indigenous bryozoan *Watersipora subatra* (Ortmann, 1890) was detected in Baltimore Marina. Our findings highlight the value of settlement panels as a simple, standardised and cost-efficient approach for characterising fouling communities while simultaneously contributing to NIS and IAS surveillance. This approach could complement existing monitoring efforts in marinas and other high-risk introduction points. It is planned that the panels will be deployed again during another three seasons.

Keywords: biofouling, settlement panels, non-indigenous species, invasive alien species, marinas, Ireland; distribution monitoring

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From historical public imagery to population trends: Retrospective monitoring of invasive species with QGIS

Erola Fenollosa[1,2], Rob Salguero-Gómez[2]

[1] *Smart Biodiversity Lab, Department of Genetics Microbiology and Statistics, University of Barcelona, Spain*
[2] *Department of Biology, University of Oxford, UK*

Presenter email: erola.fenollosa@gmail.com

Oral Presentation

Long-term population data are essential for understanding biological invasions, yet systematic monitoring often begins only after an invasive species has become established. Historical aerial and satellite imagery provides an opportunity to look backwards in time and reconstruct population dynamics where field-based demographic data are unavailable. Here, we present a retrospective image-based approach for reconstructing long-term population dynamics from publicly available historical imagery. Using invasive plant populations as a case study, repeated images are processed to identify individuals or patches, extract spatially explicit population information, and quantify changes through time. This approach transforms existing image archives into ecological time series, enabling the reconstruction of population trajectories without requiring historical field surveys. Beyond demonstrating the workflow, we discuss the opportunities and limitations of retrospective image-based monitoring, including changes in spatial resolution, image availability, detectability and temporal sampling. Historical imagery cannot replace prospective monitoring, but it can substantially extend the temporal baseline available for understanding invasion dynamics. Combined with increasingly accessible imagery and automated image-analysis methods, retrospective monitoring offers a cost-efficient complement to conventional surveillance and a promising source of demographic information for invasive species research and management.

Keywords: invasive species, retrospective monitoring, remote sensing, population dynamics, historical imagery, QGIS

Read the full article: https://doi.org/10.1002/rse2.70071

Supporting video tutorials: https://www.youtube.com/playlist?list=PL_LKE-yTi9kBXfw_qDdJCQ3Sxu2fjGvDD

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Listening to the invasion: Assessing the potential of passive acoustics for monitoring *Pterois miles* in Greek waters

Federica Soccio[1], Vassilis Galanos[2], Vasilis Trygonis[2], Agnese Marchini[1], Davide Michel Lelong[1], Alkistis Douka Adamantia[2], Maria Zotou[2], Stelios Katsanevakis[2]

[1] *University of Pavia, Department of Earth and Environmental Sciences, Italy*
[2] *University of the Aegean, Department of Marine Sciences, Greece*

Presenter email: federica.soccio01@universitadipavia.it

Oral Presentation

This study focuses on exploring the potential of passive acoustic monitoring (PAM) as an early detection tool for the invasive lionfish, *Pterois miles*, which has spread throughout the eastern Mediterranean Sea. This predator can reduce native species populations, potentially triggering cascading effects on ecosystem structure and functioning. Changes in biological communities may also be reflected in the underwater soundscape, providing valuable information on biodiversity and environmental status.
To investigate the potential effects of lionfish invasion on coastal soundscapes and explore the development of acoustic early detection tools, two complementary monitoring approaches are being implemented in Greek areas with established lionfish populations: Santorini and Crete.

In Santorini, fixed hydrophones have been deployed at both control and removal sites, where volunteers regularly carry out lionfish removal activities. These deployments provide continuous acoustic monitoring of marine soundscapes and biological activity. Visual underwater surveys are also conducted to assess fish abundance and the composition of native fish assemblages.

In Crete, baited remote underwater video systems (BRUVs), coupled with hydrophone recorders, are used at both control and removal sites to investigate potential relationships between acoustic emissions and individual behaviour. Additionally, recordings of captive lionfish under controlled tank conditions are planned to further investigate their sound production and characterize their acoustic repertoire.

The resulting acoustic datasets will contribute to the development of automated acoustic detection tools and will be incorporated into an acoustic library following the FAIR principles (Findable, Accessible, Interoperable, and Reusable). Furthermore, the collected material will support the development of a citizen science initiative on the Zooniverse platform, promoting public engagement in the monitoring and management of invasive marine species.

Keywords: bioacoustics, IAS, early detection, soundscape

Funded by the European Union

Comparing sampling methods for early detection of alien species in port fouling communities

Ingrid Ravasi[1], Lucia Foresto[1], Agnese Marchini[1], Anna Occhipinti-Ambrogi[1], Jasmine Ferrario[1]

[1] *Department of Earth and Environmental Sciences, University of Pavia, Italy*

Presenter email: ingrid.ravasi01@universitadipavia.it

Oral Presentation

The implementation of cost-effective, long-term monitoring in high-risk areas, such as commercial ports and recreational marinas, is essential for the early detection and management of marine alien species. However, Europe still lacks a unified agreement on a standardized monitoring approach. In this context, four different sampling methods were tested in 2021 at two sites in the Gulf of La Spezia (Ligurian Sea, Italy), with the aim of evaluating their effectiveness in detecting alien species. Fouling communities were collected using i) horizontal PVC panels, following a standardized protocol developed by the Smithsonian Environmental Research Center (SERC, USA); ii) vertical PVC panels; iii) in-water scraping within a fixed quadrat; iv) off-water scraping through a hand-held rigid net. The sessile component of the fouling assemblages was analysed through morphological identification. Across all methods, 75 sessile taxa were detected, including 13 alien species.

The structure of fouling assemblages differed significantly between the four methods, except for the samples collected using the two different orientations of PVC panels at one site. While both the SERC method and vertical panels yielded comparable species richness, the former proved to be the most effective in detecting alien species. Conversely, certain taxa were exclusively observed in scraping samples, suggesting that integrating multiple complementary approaches may optimize the assessment of fouling communities and improve the detection of alien species.

Keywords: marine bioinvasions, monitoring methods, macrozoobenthos, recreational marinas

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Is the Iberian Peninsula protected from the faunal Ponto-Caspianization?

Ismael Soto[1,2], Francisco J. Oficialdegui[1], Belinda Gallardo[3]

[1] *Estación Biológica de Doñana (EBD), CSIC. Seville, Spain*

[2] *University of South Bohemia in Ceske Budejovice, Faculty of Fisheries and Protection of Waters, South Bohemian Research Center of Aquaculture and Biodiversity of Hydrocenoses, Zátiší 728/II, 389 01 Vodňany, Czech Republic*

[3] *Instituto Pirenaico de Ecología (IPE), CSIC. Zaragoza, Spain*

Presenter email: isma-sa@hotmail.com

Oral Presentation

Ponto-Caspian taxa are the single largest donor pool for freshwater invasions in Europe, yet the Iberian Peninsula has so far accumulated only a handful of established species. Whether this reflects genuine biogeographic protection or merely a lag is a question with direct consequences: surveillance budgets are finite, and Iberia contains almost 3,000 reservoirs which may facilitate their invasions. We therefore ask where limited detection effort should be deployed. We integrated openly available data across the three stages of the introduction–establishment–spread framework. Arrival was quantified for 30 peninsular ports by combining cargo statistics, climatic match to donor regions, and the availability of adjacent freshwater, weighted geometrically so that a single weak component cannot be offset by strength elsewhere. Establishment was modelled for 68 species using transferable ensemble species distribution models (maxent, boosted regression trees, random forests) calibrated globally on cleaned GBIF occurrences with bioclimatic, topographic, socioeconomic, and water-chemistry predictors, validated via spatial block cross-validation and combined using AUC-weighted averaging. Spread was modelled with a gravity-type connectivity model over a network of 2,985 reservoirs linked by river corridors, shared sub-basins and inter-basin transfers, calibrated on the observed post-2001 spread of *Dreissena polymorpha*. Introduction risk concentrated at Valencia, Bilbao and Tarragona, while Algeciras ranked last despite the largest cargo volume of any Iberian port. Establishment suitability was higher in the calcareous eastern and central basins than in the siliceous west, with water chemistry mattering most for calcifying taxa. The connectivity model identified a potential set of reservoirs that may be invaded in the near future, where inspection and low-density detection methods such as environmental DNA would be most efficiently deployed. Built entirely from open data and reproducible code, the workflow is transferable to other regions.

Keywords: Ponto-Caspian, risk-based surveillance, species distribution models, connectivity modelling, eDNA prioritisation, Spain

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Bugwood - tools for efficient invasive species education, detection and monitoring for professionals and the public

Chuck Bargeron[1], Joe LaForest[1], Rebekah Wallace[1]

[1] Center for Invasive Species and Ecosystem Health, University of Georgia, Tifton, GA, USA

Presenter email: cbargero@uga.edu

Oral Presentation

In 2026, Bugwood (University of Georgia's Center for Invasive Species and Ecosystem Health) celebrates 30 years of developing tools and resources to support education, outreach, research, and applied programs. Bugwood has evolved from CD-ROM projects into a widely used network of online tools and image resources that help organizations communicate science, document species, and support management decisions. Bugwood Images, EDDMapS, Wild Spotter, and the Connect platform help programs collect, share, and apply information to support collaboration and measurable impact. Bugwood continues to work with partners to identify emerging needs and develop practical, accessible tools that benefit both professionals and the public. This presentation will highlight lessons learned and explain how, as a community, we need to focus on partnerships rather than reinventing the wheel.

Keywords: smartphone apps, web-based tools, information technology, citizen science best practices

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AI-assisted species detection

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Not all observations are equal: Accounting for observation processes in AI-assisted invasive species surveillance

Erola Fenollosa[1,2], Connor Dean-Pijuan[2], Gaspar Fuster[3], Rob Salguero-Gómez[2]

[1] *Smart Biodiversity Lab, Department of Genetics, Microbiology and Statistics, University of Barcelona, Spain*
[2] *Department of Biology, University of Oxford, UK*
[3] *Universitat Oberta de Catalunya, Spain*

Presenter email: erola.fenollosa@gmail.com

Oral Presentation

The increasing availability of georeferenced imagery and biodiversity observations offers new opportunities for scalable and cost-efficient invasive species surveillance. Artificial intelligence (AI) can automate species detection from sources such as street-level imagery, citizen science, UAVs and Earth observation. However, these sources differ fundamentally in spatial coverage, sampling effort, temporal availability and detectability. Treating their outputs as equivalent observations may therefore introduce substantial biases into ecological inference. Here, I illustrate this challenge using AI-assisted detection of the invasive *Opuntia spp.* from street-level imagery. An object-detection workflow transforms opportunistically collected images into georeferenced species observations, providing a case study to examine how the underlying observation process shapes the ecological information obtained. We distinguish three components of surveillance: the ecological process determining where a species occurs, the observation process determining where and when information is available, and the detection process determining whether the species is identified when observable. We argue that moving from automated detection towards observation-source-aware inference is essential for robust multisource invasive species monitoring. Explicitly accounting for sampling bias, spatial structure and detection uncertainty can help transform heterogeneous observations into interpretable and actionable information for early warning and management.

Keywords: artificial intelligence, biodiversity monitoring, detectability, observation process, sampling bias, spatial statistics

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AI-Assisted video monitoring of marine biodiversity in Italian Marine Protected Areas

Francesca Acampa[1,2,3,4], Giovanni Ficarra[4], Matteo Rampolla[4], Simone Raponi[4], Chiara Petrioli[4,5], Simonetta Fraschetti[2,3,6]

[1] *Department of Earth and Marine Sciences, University of Palermo, Palermo, Italy*
[2] *Department of Biology, University of Naples Federico II, Naples, Italy*
[3] *National Biodiversity Future Center (NBFC), Palermo, Italy*
[4] *WSense srl, Rome, Italy*
[5] *Sapienza University of Rome, Rome, Italy*
[6] *Consorzio Nazionale Interuniversitario per le Scienze del Mare (CoNISMa), Rome, Italy*

Presenter email: francesca.acampa@unipa.it

Oral Presentation

Marine Protected Areas (MPAs) require reliable and temporally representative biodiversity data to assess ecosystem status, evaluate conservation effectiveness, and support adaptive management. However, field-based underwater monitoring is often constrained by limited observation periods, logistical requirements, high operational costs for at-sea field activities, and observer-related effects. High-frequency underwater video monitoring, particularly when combined with artificial intelligence (AI), offers new opportunities to overcome some of these limitations and expand our capacity to observe marine ecosystems over extended periods.

Between September 2025 and July 2026, custom-designed underwater platforms were deployed through three monitoring campaigns within the fully protected zones of two MPAs in southern Italy, Porto Cesareo and Torre Guaceto. The activity was developed through a collaboration between the Department of Biology of the University of Naples Federico II, WSense srl, and the management bodies of the two MPAs, bringing together expertise in marine ecology, underwater engineering, computer vision, artificial intelligence, and marine conservation. The platforms were equipped with fixed-view underwater cameras oriented towards ecologically relevant habitats, including rocky reefs and *Posidonia oceanica* meadows. The three multi-week deployments provided extensive high-resolution video datasets documenting marine biodiversity while minimizing direct disturbance to organisms and habitats.

This activity represents a novel monitoring experience for both MPAs and contributes to a still relatively uncommon application of extended underwater video observation within Italian marine conservation. However, extending observations over multiple hours and days can result in a large volume of imagery, with the need to extract ecologically meaningful information becoming extremely time-consuming as monitoring effort increases.

To address this effort, the project integrates ecological expertise with AI-assisted species detection. The monitoring campaigns have generated a large dataset of biological observations, with fauna instances being manually annotated and progressively incorporated into the training dataset of a Transformer-based Object Detection model. Training follows an iterative human-in-the-loop workflow: expert annotations train the model, a marine ecologist reviews and corrects model predictions on subsequent video datasets, and the validated information is incorporated into successive training phases. Model training and data analysis are still in progress, and more comprehensive results are expected to be available by the time of the Conference.

This ongoing process aims to progressively improve automated detection and classification while building a novel, standardized baseline of underwater biodiversity observations for the monitored MPAs, providing a reference for future comparisons, the assessment of changes over time, and potentially supporting MPA monitoring and management.

Keywords: artificial intelligence; computer vision; marine biodiversity; Marine Protected Areas; species detection; underwater video monitoring

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Introducing Machine learning-based monitoring for Invasive Alien Species (IAS) of fish in the Aegean Sea using a YOLO model

Gwenolé Coat[1,2], Silvia Giacomello[1], Emma P. Donald[1], Laura Macrina[3], Anastasia Miliou[1], Thodoris Tsimpidis[1]

[1]*Archipelagos Institute of Marine Conservation, Samos, Greece*

[2] *Institut supérieur de l'électronique et du numérique (ISEN) nantes, Carquefou, France*

[3]*Marine Science Program, Biological and Environmental Science and Engineering Division, King Abdullah University of Science and Technology (KAUST), Saudi Arabia*

Presenter email: gwenole.coat@isen-ouest.yncrea.fr

Oral Presentation

Invasive alien species (IAS) are a growing threat to Mediterranean biodiversity, driving habitat degradation, altering food‑web dynamics, and intensifying competition with native species. Increasing anthropogenic pressures and rising sea temperatures are creating progressively more favourable conditions for the establishment of non‑native species throughout the Mediterranean. Underwater cameras are now increasingly used to monitor newly introduced fish species and track their spread and ecological impact, but manual video analysis remains a major bottleneck for data processing. This study developed an automated species detection and classification pipeline using YOLOv11 for detection and Roboflow for image annotation and storage. Data collection was done by underwater visual census (UVC) and remote underwater video (RUV) biodiversity surveys from June to August 2025 at five coastal sites of Samos and Lipsi islands, eastern Aegean Sea, Greece. A total of 2,371 underwater images of 32 fish species were taken from these surveys to train the automatic detection models, with a specific focus on detection of the IAS rapidly spreading in the Aegean Sea (*Siganus luridus*, *Siganus rivulatus*, *Pterois miles, Fistularia commersonii, Parupeneus forsskali*, and *Sargocentron rubrum*). For the categorisation, two types of models were considered: a CNN-based YOLOv11 model and a transformer based DeiT3-Small model.. The detection model was trained directly on these images and the categorisation models were trained on cropped images of the fish extracted from this dataset, resulting in 7,646 crops. The images were grouped based on the video they were taken from to avoid leakage, and then split into training/validation/testing with a target ratio of 70/15/15. The CNN-based YOLOv11 detection model reached a mAP50 accuracy of 0.885 and a recall of 0.808. The CNN-based YOLOv11 categorisation model reached a top-1 accuracy of 0.58 and a top-5 accuracy of 0.96. The transformer-based categorisation model reached a top-1 accuracy of 0.57 and a top-5 accuracy of 0.96. The application of this pipeline in marine IAS monitoring enables rapid processing of underwater footage, reducing the constraints of manual video analysis and helping to overcome a key bottleneck for data analysis in the region.

Keywords: YOLO model, Automatic Detection Model, Marine biosecurity, Convolutional neural network (CNN), transformer, mAP50

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Poster Presentations

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Early detection of *Rugulopteryx okamurae* using COI metabarcoding and citizen science (GuardIAS CaSt11)

Panagiota Xanthopoulou[1,2], Stelios Katsanevakis[1], Chrysoula Gubili[2]

[1] *Department of Marine Sciences, University of the Aegean, Mytilene, Greece*
[2] *Fisheries Research Institute, Hellenic Agricultural Organisation - DIMITRA, Nea Peramos, Kavala, Greece*

Presenter email: xanthopop@inale.gr

Poster Presentation

Effective management of invasive alien species (IAS) in estuarine and coastal ecosystems requires monitoring approaches that are not only scientifically robust, but also affordable, scalable, and socially engaging. The GuardIAS project addresses this need through a case study targeting *Rugulopteryx okamurae*, a brown alga of Union concern that is established in the western Mediterranean and has high potential to expand into the Ionian Sea (Greece). We developed a cost-efficient early-warning system combining environmental DNA (eDNA) metabarcoding with inclusive citizen science. The system uses novel, low-cost POMPOM (Polyamide Meshes for Ports Organismal Monitoring) passive sampling devices. Their simple and visually appealing design can stimulate public curiosity, while their ease of deployment and retrieval makes them suitable for use by citizens, port authority staff, NGOs, and trained local volunteers. POMPOMs were deployed at eight high-risk entry points, including ports and marinas, across the Ionian Sea, together with two control sites in the Aegean Sea (Crete and Lesvos). Eight seasonal sampling campaigns were initiated in autumn 2025 and will continue for over two years. Species detection is based on COI metabarcoding, enabling simultaneous screening for *R. okamurae* and characterization of broader eukaryotic communities. During the first two sampling campaigns (autumn 2025 and winter 2026), 22 alien species were detected, while *R. okamurae* was not recorded. Although the target species was not detected, these initial results demonstrate the operational feasibility of the monitoring system and provide a biodiversity baseline for the surveyed sites. The absence of the target species further emphasizes the importance of sustained, repeated surveillance for strengthening early-warning capacity and preparedness. By combining an inexpensive passive sampler, citizen-supported deployment, and molecular biodiversity assessment, this study demonstrates a scalable and cost-effective approach to IAS surveillance. It illustrates how citizen science and eDNA can be integrated to expand monitoring coverage, reduce technical and financial barriers, and increase public engagement in the early detection and management of aquatic biological invasions.

Keywords: environmental DNA, COI metabarcoding, invasive seaweed, citizen science, Mediterranean Sea

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Environmental DNA metabarcoding for the detection of alien freshwater fishes in Northern Greece: applications, insights, and taxonomic limitations

Panagiota Xanthopoulou[1,2], Chrysoula Gubili[2]

[1]*Department of Marine Sciences, University of the Aegean, Mytilene, Greece*
[2]*Fisheries Research Institute, Hellenic Agricultural Organisation - DIMITRA, Nea Peramos, Kavala, Greece*

Presenter email: xanthopop@inale.gr

Poster Presentation

Early and accurate detection of alien freshwater fish is essential for effective management of invasive species, yet traditional survey methods often under-detect rare and/or cryptic. This study applied 12S eDNA metabarcoding (MiFish) to assess fish community composition and screen for alien species across 13 sampling stations in the Lyra Stream (Evros, Greece) within the Dadia Forest National Park. Water samples were collected twice, during a wet (May) and a dry (October) season. Results were compared against historical electrofishing surveys, which had previously recorded three established alien species: *Carassius gibelio*, *Gambusia holbrooki*, and *Lepomis gibbosus*. eDNA metabarcoding detected 16 fish species overall, including the Endangered *Cobitis puncticulata*. Among alien taxa, *G. holbrooki* and *L. gibbosus* were resolved to species level, while *Carassius* could only be resolved to genus level, reflecting a known taxonomic blind spot in 12S reference databases that limits discrimination between the invasive *C. gibelio* and congeneric *C. auratus*. Despite this limitation, eDNA detected alien species across multiple stations, corroborating and extending prior records and supporting the region's classification within a low-to-moderate invasive fish prevalence category nationally. These findings highlight both the power and the current constraints of eDNA metabarcoding for invasive species surveillance: while the approach offers a sensitive, non-invasive, and spatially scalable tool for early detection of alien fishes, incomplete reference databases can produce resolution failures for closely related taxa. We argue that combining eDNA with traditional monitoring provides the most robust framework for tracking invasive fish spread in Mediterranean freshwater systems, and we call for expanded regional barcode reference libraries to minimise remaining taxonomic gaps.

Keywords: environmental DNA, 12S metabarcoding, invasive fish, electrofishing, Evros river

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Range expansion and population control of the signal crayfish (*Pacifastacus leniusculus*) in the Kupa River Basin, central Croatia

Krešimir Žganec[1], Leopoldina Dakić[2], Filip Grabner[2], Antonija Bišćan[2], Magdalena Novoselić[3], Ivana Maguire[3], Sandra Hudina[3]

[1] *University of Zadar, Department of Teacher Education Studies in Gospić, dr. Ante Starčevića 12, 53000 Gospić, Croatia*

[2] *Public Institution NATURA VIVA for Management of Protected Natural Resources in the County of Karlovac, Croatia*

[3] *University of Zagreb Faculty of Science, Department of Biology, Rooseveltov trg 6, Zagreb, Croatia*

Presenter email: kzganec@unizd.hr

Poster Presentation

Following its first introduction to Sweden in 1960, the signal crayfish (*Pacifastacus leniusculus*) rapidly became one of the most widespread invasive alien crayfish species in Europe, with substantial impacts on native crayfish populations and freshwater macroinvertebrate assemblages. In Croatia, the species was first recorded in 2008 in the Mura River in northern Croatia and was subsequently illegally introduced in 2011 into the Korana River in the Kupa River basin (central Croatia). In this study, we investigated the range expansion of the invasive signal crayfish in the Kupa River basin, focusing on the karst rivers Korana and its tributaries, as well as Gojačka Dobra and Mrežnica. Previously published data for the Korana River from 2012–2018 were combined with data collected during 2023–2026 using baited LiNi traps (5–10 traps per site) to assess the current distribution and ongoing range expansion of the species. In the Korana River, the invaded range increased from 9.3 km of the lower river course in 2012 to approximately 48 km by 2026. In Gojačka Dobra, signal crayfish was first detected in 2023, as a result of an illegal introduction that likely occurred 3–4 years before its initial detection. In 2023, its distribution was restricted to a 7.7 km section of the lower river. By 2026, the invaded range had expanded by 2.7 km downstream and 1.5 km upstream. In 2025, signal crayfish was also detected in the lower Mrežnica River, approximately 2.5 km upstream of its confluence with the Korana, indicating natural, unaided dispersal from the Korana River. From 2023 to 2026, the Public Institution NATURA VIVA of the County of Karlovac implemented signal crayfish population control measures in the Korana River and its tributaries. Control efforts in Gojačka Dobra commenced in 2025 and are planned to continue until 2028. Overall, approximately 30,000 signal crayfish were removed from the Korana River and its tributaries over the four-year period. In Gojačka Dobra, a total of 15,675 individuals were removed during 2025 and 2026 from the invaded river section. These findings demonstrate the rapid range expansion and high dispersal capacity of signal crayfish in the Kupa River basin. The observed expansion despite ongoing removal efforts highlights the challenges of controlling established populations of this invasive species and provides an important basis for adapting and improving management strategies in the coming years.

Keywords: invasive crayfish, distribution, spread, removal efforts, karst rivers

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Far from home: the first record of the alien sacoglossan *Thuridilla mazda* (Mollusca: Gastropoda) from the Aegean Sea

Jana Pohl[1‡], Noa A. ter Avest[2‡], Sonja Peters[3], Silvia Giacomello[2], Emma P. Donald[2], Nina Paul[3], Anastasia Miliou[2], Nathalie Yonow[4], Oscar Puebla[1], Laura Macrina[5]

[1]*Institute for Chemistry and Biology of the Marine Environment (ICBM), Carl von Ossietzky Universität Oldenburg, Germany*

[2]*Archipelagos Institute of Marine Conservation, 83100 Samos, Greece*

[3]*Leibniz Centre for Tropical Marine Research (ZMT), Fahrenheitstr. 6, 28359 Bremen, Germany*

[4]*Department of Biosciences, Swansea University, Singleton Park, Sketty, Swansea SA2 8PP, United Kingdom*

[5]*Marine Science Program, Biological and Environmental Science and Engineering Division, King Abdullah University of Science and Technology (KAUST), Thuwal 23955-6900, Saudi Arabia*

[‡]*These authors contributed equally to the publication*

Presenter email: jana.pohl@uni-oldenburg.de

Poster Presentation

The Mediterranean Sea is a global biodiversity hotspot under increasing pressure from the introduction of alien species, with the Aegean Sea representing a particular hotspot for their spread. Sacoglossan sea slugs of the genus *Thuridilla* are prone to cryptic diversity and colour variation that add complexity to their species-level identification. Native to the Mediterranean, *Thuridilla hopei* was the only species known from the basin until 2021, when the presence of *Thuridilla mazda*, native to the Caribbean, was initially confirmed. Since then, the latter has undergone a rapid eastward range expansion. Here we use an integrative approach combining macro-morphology, Scanning Electron Microscopy (SEM) of the radula, and molecular analyses of three DNA barcode markers, to analyse five specimens collected at two distinct sites between April and May 2026 on Samos Island, Greece. Morphological and radular characters corresponded with published descriptions and illustrations of *T. mazda*, and phylogenetic reconstructions recovered the newly collected specimens within a monophyletic clade alongside previously published material from the Atlantic, therefore confirming their identification at the species level. This study represents the first confirmed record of *T. mazda* from the Aegean Sea, thereby extending its known Mediterranean distribution to its north-easternmost locality to date, and provides new morphological and molecular reference data for future taxonomic and biogeographic work on the species.

Keywords: alien species, Mediterranean Sea, biodiversity, Heterobranchia, invertebrates, coastal waters

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Past, present and future multi-stressor interactions of shallow reefs ecosystems in the Levantine Sea

Leda L. Cai[1], Nikhil Thomas[1], Andromachi Gkoulia[1], Eleni Christoforou[1], Genna-Leigh Geldenhuys[1], Gil Rilov[2], Guy Raanan[2], Shai Ziberman[2], Louis Hadjioannou[1]

[1]*Cyprus Marine and Maritime Institute, Cyprus*

[2]*Israel Oceanographic and Limnology Research (IOLR), Israel*

Presenter email: leda.cai@cmmi.blue

Poster Presentation

In the Eastern Mediterranean, biological invasions are driven and intensified by environmental change, including climate change, marine heatwaves, pollution, such as microplastics, marine litter, and heavy metals and habitat degradation. At the same time, invasive species interact with these pressures, producing cumulative and potentially synergistic effects that reshape coastal and shallow-reef ecosystems. These interacting stressors threaten regional biodiversity, ecosystem functioning, and the ecosystem services provided by marine organisms. Understanding their combined effects at local scales is therefore essential for developing effective conservation, management, and policy strategies.

The PUREEF-Y project applies an integrated monitoring and experimental framework to assess current ecosystem condition and forecast future ecological change. The project combines seasonal biodiversity surveys, pollutant measurements, physicochemical monitoring, paleo-ecological and paleo-oceanographic reconstructions, species-specific metabolic-rate incubations, and mesocosm experiments simulating future warming and ocean acidification. Seasonal sampling is conducted across four intertidal and subtidal sites, including two Marine Protected Areas (MPAs). Intertidal communities are assessed using in situ quadrats positioned at the edges and centres of vermetid reefs. Subtidal fish communities are surveyed using SCUBA-based visual censuses, while benthic communities were assessed through photoquadrats analysed with CoralNet.

Preliminary results indicate higher native species richness within MPAs. However, the ratio of native to non-native species remained relatively consistent between protected and non-protected areas across seasons. Surveyed communities exhibited significant spatial and seasonal variation. Although native species were generally more abundant, non-native species contributed greater biomass, likely because the recorded non-native organisms were larger. Intertidal surveys further revealed greater taxonomic diversity at reef edges than at reef centres, with higher diversity during winter and spring than during summer.

Incubation-chamber experiments have quantified species-specific metabolic rates between native and non-native macroalgae communities, while planned mesocosm experiments are evaluating community responses to multi-stressor scenarios involving increased temperature and ocean acidification. These findings will be integrated into predictive models to forecast the ecological state of shallow reefs under changing environmental conditions. PUREEF-Y is designed not only as a research programme but also as a practical management tool, helping authorities determine where, when, and how to act. The project will provide cost-efficient, evidence-based recommendations for regional marine conservation, policy development, and adaptive ecosystem management.

Keywords: non-indigenous species (NIS), biodiversity assessment, climate change, incubation experiments, mesocosm experiments

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Integrated monitoring of non-indigenous species hotspots in the Eastern Ionian Sea

Ioannis Rallis[1,2]; Eirini Gratsia[1,2]; Markos Digenis[1]; Giorgos Chatzigeorgiou[3]; Zois Vlantaridis[1]; Christos Arvanitidis[2,4]; Jasmine Ferrario[5]; Argyro Zenetos[6]; Kasapidis Panagiotis[2]; Agnese Marchini[5]; Vasilis Gerovasileiou[1,2]

[1] *Department of Environment, Ionian University, Zakynthos, Greece*

[2] *Institute of Marine Biology, Biotechnology and Aquaculture, Hellenic Centre for Marine Research, Heraklion, Greece*

[3] *Institute of Oceanography, Hellenic Centre for Marine Research, Heraklion, Greece*

[4] *LifeWatch ERIC, Seville, Spain*

[5] *Department of Earth and Environmental Sciences, University of Pavia, Pavia, Italy*

[6] *Institute of Marine Biological Resources and Inland Waters, Hellenic Centre for Marine Research, Athens, Greece*

Presenter email: ioannisrallis@ionio.gr

Poster Presentation

The Mediterranean Sea is one of the world's most heavily invaded marine regions, with the central basin exposed to introductions and secondary spread of Lessepsian non-indigenous species (NIS) and maritime traffic. The Eastern Ionian Sea is a strategic yet understudied transitional area between the eastern and central Mediterranean. Its subregions, such as the oligotrophic southeastern Ionian sector, may function as environmental filters for NIS spread, or as corridors and stepping-stone areas, such as the more eutrophic Korinthiakos Gulf. Information on NIS in the Eastern Ionian Sea remains limited, particularly in ports and marinas, which may act as reservoirs and dispersal hubs for fouling communities.

The INVASIONS project aims to improve early detection and monitoring of NIS hotspots in the Eastern Ionian Sea. During an extensive field campaign, 16 Greek ports and marinas were surveyed using a standardized Rapid Assessment Survey. At each site, ten sampling points were examined for ten minutes, combining high-resolution photographs of conspicuous taxa with qualitative voucher sampling to support local species reference libraries. Bulk community samples were collected from hanging structures, plastic surfaces and hard artificial substrates, while three replicate seawater samples (≈50 L each) were filtered *in situ* for eDNA metabarcoding. Building upon the rapid assessment, four sites were selected for deployment of autonomous monitoring sensors (dissolved oxygen, pH, salinity and temperature) and habitat-mimicking settlement collectors targeting sessile, vagile and sciaphilic fouling communities. This will enable evaluation of succession patterns, habitat-specific detection efficiency and environmental variability. By combining visual surveys, voucher-based taxonomy, bulk sampling, eDNA and environmental monitoring, INVASIONS proposes a stepwise early-detection protocol progressing from rapid assessment to targeted monitoring in ecologically relevant areas, supporting an optimised and repeatable approach for long-term marine NIS monitoring.

Keywords: non-indigenous species, Eastern Ionian Sea, Rapid Assessment Survey, eDNA, biofouling

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DNA barcoding revealed the first confirmed introduction of *Ahnfeltia plicata* (Rhodophyta, Ahnfeltiales) outside its native range: a case from the Odesa Bay (Black Sea, Ukraine)

Sofia S. Sadogurska[1], Kateryna S. Kalashnik [2], Oleksandr V. Koshelev[2]

[1] *M.G. Kholodny Institute of Botany, National Academy of Sciences of Ukraine, 2 Tereschenkivska Str., Kyiv 01601, Ukraine*

[2] *Institute of Marine Biology, National Academy of Sciences of Ukraine, 37 Pushkinska Str., Odesa 65048, Ukraine*

Presenter email: s.sadogurska@gmail.com

Poster Presentation

The ongoing transformation of marine ecosystems, driven in particular by the introduction and spread of non-indigenous species, requires continuous monitoring. In the Black Sea, the Odesa Bay has long been an important area for monitoring such processes due to the presence of a major port and intensive shipping traffic, which have contributed to the active introduction of non-indigenous species in the region (Alexandrov et al., 2004). Macroalgae deserve particular attention because they play a key ecological role as structural components of coastal marine ecosystems, while a number of macroalgal introductions have already been recorded in the region (Minicheva, Eremenko, 1993; Minicheva, 2015). DNA barcoding is increasingly used to monitor non-indigenous species of macroalgae, as their identification based on morphology alone can be difficult due to morphological similarity among closely related species and cryptic diversity.

The study was conducted in the coastal zone of the Odesa Bay during July–August of 2023–2025. During such hydrobiological investigations in the shallow waters of the Odesa beaches an unidentified red alga, which had not previously been recorded either in the Odesa Bay or in the estuaries and bays of the northwestern Black Sea, was discovered. As the alga could not be reliably identified using conventional morphological methods, DNA barcoding was applied to determine its species identity. The rbcL marker, widely applied for red algal species identification (Saunders, Moore, 2013), was used for molecular phylogenetic analyses of the collected sample.

DNA barcoding and molecular phylogenetic analyses of the Black Sea sample showed that the closest match from GenBank is *A. plicata* JX969802 (100% identity), clearly confirming the identification of the specimen collected in Odesa Bay as the red alga *Ahnfeltia plicata* (Huds.) Fr. (Rhodophyta). This represents a new record not just for the flora of Ukraine, but also the first report of this species for the Black Sea and the first data, supported by morphological observations, photographs, and DNA barcode, confirming its presence in the Mediterranean basin as a whole. Continuous observations (2023–2025) indicate that the presence of *A. plicata* in Odesa Bay is not limited to a single introduction event, and its spread suggests the capacity to establish stable populations in this area.

In the literature, there is no evidence of aggressive expansion or invasive behavior of *A. plicata*. This species has a broad geographic distribution, although some authors have pointed out that it remains unclear whether this distribution reflects its natural range or results from widespread introductions (Milstein, Saunders, 2012). Our case of the introduction of *A. plicata* into the Black Sea, confirmed by the DNA barcoding data, is the first well-documented example of the rapid and successful naturalization of this species in a non-native region, suggesting the possibility of its potential introductions into other regions and stressing the need for further monitoring and research of this species.

Keywords: alien species, biological invasions, Black Sea, non-indigenous species, rbcL, red algae, seaweed, taxonomy

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Shedding light on biofouling management and awareness of marine alien species among recreational boaters in Sardinia (Western Mediterranean)

Daniele Grech[1], Federica Montesanto[1]

[1] *International Marine Centre (IMC), 09170 Loc.tà Sa Mardini, Torregrande, Oristano, Italy*

Presenter email: d.grech@fondazioneimc.it

Poster Presentation

Marine recreational boating can contribute to the transport and secondary spread of non-indigenous species through biofouling. Within the ALIEM VIGIL project, the QUALIEM questionnaire (https://tinyurl.com/QUALIEMITA) was developed to investigate boating practices, perceptions of biofouling, awareness of its potential role for the spread of Invasive Alien Species (IAS), and current antifouling and cleaning practices among boat owners in Sardinia, Western Mediterranean Sea. A total of 54 questionnaires were collected between June and October 2026. The survey investigated characteristics and mobility of recreational vessels, experience and perception of biofouling, awareness of IAS, antifouling products and technologies, hull-cleaning practices, and maintenance of marina infrastructures. Respondents were predominantly male (90.4%), with a mean age of 59.6 years, and most had a university or higher education (59.3%). The sample was largely composed by sailing boats 81.1%, generally 5–15 m long, and almost all vessels were more than 10 years old. Boat use was relatively intensive: 51.9% reported using their vessel for more than eight months per year, while 81.5% undertook at least 20-daytrips annually. Although 27.8% of respondents had moored in Italian ports other than their usual port over the same period, none reported recent foreign port stays, suggesting that domestic connectivity may represent an important pathway for the spread of IAS within the surveyed fleet. Biofouling was widely perceived as a problem for navigation and vessel performance, and 44% of respondents reported having experienced direct impacts, including reduced speed, increased fuel consumption and fouling of propellers or seawater intakes. However, awareness of its role as a vector for IAS was limited: only 48.1% knew that biofouling can contain alien species. Antifouling maintenance was widespread: 90.7% of respondents reported periodic haul-outs for the renewal of antifouling coatings, while 77.8% regularly cleaned their hulls mechanically in the water. Notably, 16 respondents reported cleaning directly in port and a further 18 in coastal or near-port areas, highlighting a potential pathway for the release and redistribution of organisms and contributing to stepping stones dynamics. Knowledge of alternative foul-release technologies was comparatively low: only 47%were aware of silicone-based coatings, and just 8 respondents reported using them. Most respondents who did not use silicone coatings nevertheless expressed an interest in testing them (88%). Awareness of marina maintenance practices was also limited, with 63% unable to indicate how frequently pontoons, moorings and associated structures were cleaned. The QUALIEM survey highlights a combination of high vessel activity, frequent hull maintenance and limited awareness of the biosecurity implications of biofouling. The results identify in-water cleaning, marina infrastructure and insufficient knowledge of IAS pathways as key areas for targeted awareness, monitoring and prevention measures. Strengthening communication with recreational boaters and promoting effective, environmentally sustainable antifouling and cleaning practices could substantially contribute to reducing the risk of secondary spread of marine alien species in Sardinian coastal waters, while also providing a useful case study that could be further developed and replicated at a broader geographical scale.

Keywords: ALIEM VIGIL, biofouling, IAS, alien, Questionnaire

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Testing sustainable antifouling solutions along the Lithuanian coastline

Sebastiana Di Dio[1], Greta Srėbalienė[1]

[1] *Marine Research Institute, Klaipėda University, Klaipėda, Lithuania*

Presenter email: sebastiana.di.dio@ku.lt

Poster Presentation

Biofouling is defined as an accumulation of microorganisms, plants and animals on submerged surfaces (IMO, 2012), and it represents an important challenge for recreational and commercial vessels, as it can increase drag, fuel consumption, maintenance requirements and the risk of transporting non-indigenous species (NIS) (Davidson et al., 2016; Georgiades et al., 2020). Antifouling coatings are widely used to prevent or reduce biofouling; however, conventional biocidal coatings can release active substances into the surrounding environment (Lindholdt et al., 2015). Copper-based compounds are among the most widely used biocides in antifouling paints (Lagerström et al., 2018, 2020). In the Baltic Sea, the environmental implications of antifouling practices are particularly relevant because of the sea's salinity gradient and the sensitivity of its coastal ecosystems. Recent assessments have also identified antifouling paints as an important source of copper and zinc to Baltic coastal waters (Ytreberg et al., 2022; Kim et al., 2025).

The aim of this study was to investigate whether controlling biofouling in Baltic Sea coastal waters can be achieved using antifouling solutions with little or no biocide content. A static immersion experiment was conducted along five Lithuanian marinas (Šventoji, Smiltynė, Svencelė, Dreverna and Nida) using the SERC protocol (SERC, 2024). PVC (14x14 cm) panels treated with two different antifouling solutions, low-biocide and biocide-free coatings were immersed for six months at a depth of approximately one meter from April to October 2026. After the experimental period, the panels were retrieved and analysed to assess the biofouling community composition. The differences in fouling coverage among coating types were assessed together with the effectiveness of the treatment depending on the location.

This study will contribute to the development of more environmentally sustainable antifouling strategies for recreational boating in the Baltic Sea. Rather than assuming that higher biocide content necessarily provides better protection, this approach considers antifouling performance in relation to local environmental conditions. The results from this study may help identify situations in which lower-biocide or biocide-free solutions could provide an appropriate alternative to conventional antifouling paints and support more environmentally aware management of recreational boating. Additionally, this study will deepen the understanding of the NIS composition of the biofouling community along the Lithuanian coastline, which remains scarcely monitored.

Keywords: antifouling, Baltic Sea, biofouling, biocides

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eDNA and molecular diagnostics for non-native species detection and monitoring

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Optimising eDNA monitoring for cost-efficient detection and management of non-indigenous species in the Levantine Sea

Eleni Christoforou[1], Isabel S. Abihssira-Garcia[1], Maria Neophytou[1], Manos L. Moraitis[1], Zoya Harbuzova[2], Tamar Guy-Haim[2]

[1] *Cyprus Marine and Maritime Institute, Cyprus*

[2] *Israel Oceanographic and Limnology Research (*IOLR*), Israel*

Presenter email: eleni.christoforou@cmmi.blue

Oral Presentation

The Levantine Sea is undergoing rapid ecological change driven by climate warming, pollution, increased oligotrophication, and the introduction and spread of non-indigenous species (NIS). These pressures are transforming native benthic and pelagic communities and creating an urgent need for monitoring approaches that are accurate, scalable, and sufficiently cost-efficient to support routine monitoring and management.

The eDNALEV project evaluates environmental DNA (eDNA) as a non-destructive tool for biodiversity assessment and the early detection of NIS in the eastern Mediterranean Sea. For this purpose, water, sediment, and plankton samples are seasonally collected in Cyprus and Israel at impacted and non-impacted coastal sites. In parallel, artificial settlement structures are deployed for six months underwater to examine recruitment and colonisation patterns and provide complementary information on local biodiversity and NIS establishment.

A central objective of the project is to optimise eDNA sampling and processing protocols for the region to improve detection efficiency while reducing the time, labour, and financial resources required for monitoring. This includes comparing sample types, seasonal sampling strategies, molecular workflows, and analytical approaches, and assessing how eDNA results can be integrated with conventional observations and biotic indices. The project will therefore identify practical protocols suitable for repeated application across sites and jurisdictions, with particular attention to their transferability to management and policy contexts.

To date, one full year of seasonal sampling has been completed, two sets of settlement structures have been retrieved, and DNA has been successfully extracted from all samples. Ongoing work includes DNA amplification and sequencing, bioinformatic and statistical analyses to establish a baseline ecological assessment.

The project will provide an evidence-based framework for cost-efficient NIS detection and biodiversity monitoring, supporting early warning, prioritisation of management actions, and the uptake of eDNA-based surveillance in regional monitoring and policy programmes.

Keywords: environmental DNA (eDNA), non-indigenous species (NIS), early detection; cost-efficient monitoring, biodiversity assessment

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Impact assessments from a drop of water: eDNA reveals context-dependent impacts of American bullfrogs on native amphibians

Teun Everts[1,2], Jonathan Tibo[2], Hans Jacquemyn[2], Charlotte Van Driessche[1,3], Rein Brys[1]

[1] *Research Institute for Nature and Forest, Genetic Diversity, Geraardsbergen, Belgium*
[2] *KU Leuven, Plant Conservation and Population Biology, Heverlee, Belgium*
[3] *Ghent University, Terrestrial Ecology Unit, Ghent, Belgium*

Presenter email: teun.everts@inbo.be

Oral Presentation

The impacts of biological invaders on native species are complex, multi-faceted, and context-dependent. A wide array of mechanisms can cause these impacts, with consequences spanning from the genetic to the ecosystem level that can cascade up and down the ladder of biological organization. Both abiotic and biotic conditions mediate the magnitude and direction of these effects, complicating attempts to generalize the impacts of a given invader across different contexts. Consequently, empirical impact assessments must be conducted for particular non-native populations rather than extrapolated from other regions. Such assessments typically rely on long-term or large-scale data on the presence or density of native and non-native species. However, collecting these data using conventional monitoring approaches is often labor-intensive and costly. Here, we demonstrate that environmental DNA (eDNA) extracted from water samples can be used to quantify ecological interactions among native and non-native species and help revealing factors that mediate these interactions, using the American bullfrog (*Lithobates catesbeianus*) invasion in Belgium as a case study. We collected water samples from up to 140 ponds and estimated bullfrog densities using quantitative eDNA barcoding, characterized native amphibian communities using eDNA metabarcoding, and quantified abiotic and biotic pond characteristics. Our results revealed four key insights: (*i*) community-level impacts of bullfrogs intensify with increasing bullfrog density; (*ii*) native species that reproduce earlier than bullfrogs largely escape their impacts; (*iii*) native species with narrower ecological niches are more strongly affected; and (*iv*) structurally complex aquatic habitats provide only limited buffering capacity against bullfrog impacts. Together, these findings highlight the context-dependent nature of biological invasions and highlight eDNA as a cost-effective approach for assessing community-level impacts of aquatic invaders. By improving our ability to detect and understand interactions between native and non-native species, this approach can inform more effective invasion management strategies and evidence-based policy development.

Keywords: amphibians; environmental DNA (eDNA); barcoding and metabarcoding; freshwater ecology; *Lithobates catesbeianus*; water sampling

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Beyond presence–absence: scaling ddPCR eDNA surveillance to guide basin-wide muskrat and coypu eradication

Rein Brys[1] and Dan Slootmaekers[2]

[1] *Research Institute for Nature and Forest, Genetic Diversity, Geraardsbergen, Belgium*
[2] *Flanders Environment Agency, Belgium*

Presenter email: rein.brys@inbo.be

Oral Presentation

Large-scale monitoring is essential for the effective management of invasive semi-aquatic mammals such as muskrats (*Ondatra zibethicus*) and coypus (*Myocastor coypus*), both of which cause extensive ecological damage and destabilize critical water infrastructure. Traditional surveillance methods are labor-intensive, logistically challenging across vast aquatic networks, and often fail to detect elusive, low-density pioneer populations. Environmental DNA (eDNA) offers a high-sensitivity, non-invasive alternative, but transitioning eDNA from qualitative detection into a reliable, quantitative management tool across entire river basins remains a critical challenge.

Here, we present the development and field validation of a novel multimarker droplet digital PCR (ddPCR) assay for the parallel, target-specific detection of muskrat and coypu. To enable scalable monitoring across lotic systems, we standardized a stream-sampling protocol using merged sample pooling across designated river sections. This framework was deployed in regional surveillance campaigns from 2024 through 2026 across Northern and Eastern Flanders (Belgium) along the Dutch border.

Spatial eDNA detection patterns closely mirrored historical trapping records, while revealing previously unknown colonizations and tracking annual post-eradication population declines across the monitoring period. To evaluate whether eDNA can reliably quantify population abundance, we conducted a field study in Sint-Laureins during a four-week intensive removal campaigns. Pre- and post-trapping eDNA concentrations correlated strongly with the total number of captured individuals, confirming that quantitative ddPCR metrics serve as a reliable proxy for relative population density and eradication efficacy.

Beyond tracking target species, integrating these spatial eDNA insights allows managers to deploy control measures more efficiently while minimizing non-target bycatch risks for species, such like otters. Current efforts focus on establishing automated data workflows to feed an interactive public dashboard and formulating standardized operational sampling guidelines for conservation managers and trappers. Overall, this work demonstrates how upscaled ddPCR frameworks transform eDNA into an actionable, landscape-scale decision-support system for invasive species management.

Keywords: coypu, environmental DNA (eDNA), droplet digital PCR (ddPCR), invasive species management, muskrat, semi-aquatic mammals, quantitative biomonitoring

Funded by the European Union

Beyond the target: eDNA metabarcoding reveals multiple non-native fishes in freshwater ecosystems

Thomas Baudry [1], Carine Delaunay[1], Frédéric Grandjean[1]

[1] *Université de Poitiers, Laboratoire Écologie et Biologie des Interactions, UMR CNRS 7267 Equipe Ecologie Evolution Symbiose, Poitiers Cedex, France*

Presenter email: thomas.baudry01@univ-poitiers.fr

Oral Presentation

Environmental DNA (eDNA) metabarcoding offers a cost-efficient approach for broad biodiversity surveillance, with strong potential for the early detection of aquatic invasive species (AIS). In Martinique, monitoring of non-native fishes has historically relied on electrofishing, while the subsequent development of single-target eDNA assays enabled the detection of previously overlooked species. A striking example was the invasive suckermouth catfish *Hypostomus robinii*, first caught in 2018 with its distribution precised by single-target eDNA at 18 stations. However, single-target approaches inherently depend on the species targeted and may underestimate the diversity of non-native fishes present. Here, we used fish eDNA metabarcoding to investigate whether a multi-species approach could provide a more comprehensive picture of fish invasions across Martinique. Controlled mock-community experiments were first used to validate the molecular and bioinformatic pipeline. Then, across 73 field sampling stations, we detected three Loricariidae taxa: *Hypostomus* sp., *Ancistrus temminckii* and *Pterygoplichthys pardalis*, represented at 42 stations. We also detected several *Oreochromis* species, with molecular signatures sometimes co-occurring at the same sampling sites. These results reveal a greater diversity of non-native fishes than previously captured by single-species monitoring approaches. By screening multiple taxa simultaneously from the same environmental samples, eDNA metabarcoding can reveal unexpected invaders and provide a rapid picture of invasion patterns across river networks. This highlights its potential as a cost-efficient early-warning tool, enabling the detection of emerging invasions beyond predefined targets and guiding targeted field validation and management.

Keywords: environmental DNA, metabarcoding, invasive alien species, early detection, freshwater fish, Martinique

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Sampling aquatic habitats to detect invasive ant eDNA

Lori Lach[1,2], Samantha Tol[2,3], Carl Shuetrim[1,2], Cecilia Villacorta-Rath[2,4]

[1] *James Cook University, College of Science and Engineering, PO Box 6811, Cairns, QLD 4870, Australia*
[2] *Centre for Tropical Biosecurity, James Cook University, Qld, Australia*
[3] *James Cook University, TropWATER, PO Box 6811, Cairns, QLD 4870, Australia*
[4] *James Cook University, TropWATER, 1 James Cook Drive, Townsville, QLD 4811, Australia*

Presenter email: Lori.lach@jcu.edu.au

Oral Presentation

Targeted environmental DNA (eDNA) has a history of use for the detection of aquatic organisms, but its application for the detection of terrestrial organisms is much less explored. Our previous work (Villacorta Rath et al. 2023, https://neobiota.pensoft.net/article/98898/), demonstrated detectability of invasive ant DNA in waterways downstream of known infestations but left many questions about how to design sampling strategies to maximize detection of undiscovered infestations. We therefore conducted field and laboratory tests to inform guidelines on where and when water sampling for invasive ant eDNA should be conducted to best complement existing methods and improve surveillance, using yellow crazy ants (*Anoplolepis gracilipes*) as our test species. Sampling from creeks and rivers downstream of known infestations revealed most detections were when rainfall in the preceding seven days was 20-30mm in the wet tropics (near Cairns, Australia) and 30-100mm in the dry tropics (near Townsville, Australia), but infestation size and its proximity to the sampling location were also important factors. Simulated rainfall experiments over soil that had been exposed to live yellow crazy ants revealed that eDNA concentration initially increased with increasing flushes, likely as water caused eDNA to unbind from the soil, before decreasing with subsequent flushes. Once in the water, yellow crazy ant eDNA degraded rapidly. Simulated rainfall over soil exposed to dead yellow crazy ants yielded consistent positive detections even after 24 months and led us to conclude that current yellow crazy ant eDNA assays should not be used to support proof of freedom. Targeted eDNA technology shows promise as a tool to complement existing methods of detecting invasive ant infestations, and more testing will elucidate the contexts in which it is most sensitive.

Keywords: early detection, delimitation, monitoring, non-invasive sampling, technology limitations

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Expanding eDNA resources for ornamental pest species detection

Cecilia Villacorta-Rath[1,2], Damien Burrows[2]

[1] *Centre for Tropical Biosecurity, James Cook University, Qld, Australia*
[2]*James Cook University, TropWATER, 1 James Cook Drive, Townsville, QLD 4811, Australia*

Presenter email: cecilia.villacortarath@jcu.edu.au

Oral Presentation

The ornamental fish trade is a pathway for introducing non-native freshwater fishes, creating a need for surveillance tools that detect incursions before populations become widespread. This study developed eDNA tools for ornamental fishes identified as posing a high establishment risk in Australia. Six targeted quantitative PCR assays were designed for *Betta splendens*, *Cichla* spp., *Clarias batrachus*, *Poecilia latipinna*, *Xiphophorus helleri* and *Xiphophorus maculatus*, together with a metabarcoding assay targeting Poeciliidae. Candidate assays were developed from mitochondrial sequence data and evaluated through in-silico and in-vitro testing using genomic DNA from target and non-target fishes. All targeted assays were specific to their target taxa. The Poeciliidae assay amplified target species earlier than the Australian native fishes tested. The assays were then applied to water samples collected across Queensland and the Northern Territory. Targeted screening detected *X. maculatus* at sites in the Townsville region, whereas the other five target taxa were not detected. The Poeciliidae metabarcoding assay excluded Australian native fishes during field-sample analysis but produced some species-level misassignments. These assays expand the molecular resources available for ornamental pest-fish surveillance and can support monitoring and early detection programs in northern Australia, although field validation and refinement of metabarcoding taxonomic assignments are recommended.

Keywords: early detection, delimitation, monitoring, non-invasive sampling, technology innovation

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Environmental DNA (eDNA) metabarcoding as a molecular tool for aquatic biodiversity assessment and early detection of non-native species

Abdul Ghaffar

Department of Aquaculture Science, Ocean University of China, Qingdao, China

Presenter email: abdulghaffarouc@yahoo.com

Oral Presentation

Aquatic ecosystems are increasingly threatened by biological invasions, biodiversity loss, and environmental changes, creating a need for rapid, sensitive, and cost-efficient monitoring approaches. Traditional biodiversity surveys based on morphological identification can be time-consuming and may overlook cryptic or microscopic organisms. Environmental DNA (eDNA) metabarcoding has emerged as a powerful molecular approach for detecting aquatic biodiversity and supporting early-warning systems for invasive alien species.

This study investigated planktonic microeukaryotic community diversity across five Chinese coastal bays using eDNA metabarcoding approaches combined with ecological and environmental data analysis. The molecular assessment provided insights into spatial variation of aquatic microbial communities and demonstrated the ability of eDNA-based methods to reveal biodiversity patterns that may remain undetected through conventional approaches.

The application of eDNA metabarcoding provides an efficient framework for aquatic biodiversity surveillance and has strong potential for monitoring non-native species introductions. Integrating molecular diagnostics with ecological observations and environmental monitoring can improve detection sensitivity, expand monitoring coverage, and support rapid management responses against biological invasions.

This research highlights the role of eDNA technologies as cost-effective tools for aquatic biosecurity, biodiversity assessment, and evidence-based conservation management.

Keywords: Environmental DNA, eDNA metabarcoding, invasive alien species, aquatic biodiversity, molecular ecology, biodiversity monitoring, biosecurity

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A collection of protocols, assays and barcodes for the detection and monitoring of invasive species in Europe

Amalia Mailli[1], Joost Raeyamekers[1], Mark Costello[1]

[1]*Faculty of Biosciences and Aquaculture, Nord University, Bodø, Norway*

Presenter email: amalia.a.mailli@nord.no

Oral Presentation

For more than a decade, environmental DNA (eDNA) has been a promising tool for aquatic biodiversity monitoring. Detecting invasive alien species (IAS) through eDNA can therefore provide an efficient, accurate, and cost-effective approach to target IAS through species-specific assays (e.g., using qPCR or ddPCR), or through analysing the complete community to detect the presence and abundance of IAS using metabarcoding.

As part of the EU-funded project *Guarding European Waters from IAS* (GuardIAS), we have developed a comprehensive repository of high-quality molecular barcodes, species-specific assays, and non-specific metabarcoding protocols to support the implementation of eDNA-based IAS monitoring across Europe.

First, we will present the results of a large-scale analysis of publicly available sequence databases to assess the availability of commonly used molecular markers, including Cytochrome c oxidase subunit I (COI). This analysis was conducted as part of a molecular information gap assessment for invasive and non-indigenous species occurring in European aquatic systems. In addition, we identified and curated links to high-quality COI sequences available through the Barcode of Life Data Systems (BOLD) for aquatic IAS.

Second, we will provide a general overview of a comprehensive depository of peer-reviewed studies containing primers and assays that target a selection of 304 invasive species that had been determined to be highly invasive in European aquatic systems. This protocol database provides general information on the primers and assays themselves (e.g.: primer, study information etc.), as well as a grading system (i.e.; Thalinger scale) that determines their validity, and applicability in the lab and in the field.

Finally, we will present a selection of protocol resources for metabarcoding analysis.

Through these resources, we aim to provide researchers, environmental managers, and other stakeholders with reliable, standardized, and FAIR-level molecular information to support their own implementation of eDNA-based monitoring IAS research.

Keywords: environmental DNA, reference database, eDNA, barcoding, metabarcoding, aquatic invasive species

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Citizen Science & participatory surveillance networks

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#TevereMolluschiFantastici…e dove trovarli: participatory science for freshwater IAS early detection and awareness

Roberto Crosti[1,2], Mauro Grano[2]

[1] *ISPRA, Italian Institute for Environmental Protection and Research-Biodiversity department, Italy*

[2] *#tevere molluschi fantastici*

Presenter email: roberto.crosti@isprambiente.it

Oral Presentation

#TevereMolluschiFantastici…e dove trovarli (#TiberFantasticMolluscs…and where to find them) is a participatory citizen science project developed by ISPRA to engage river communities in freshwater biodiversity monitoring and the early detection of invasive alien species (IAS) along the Tiber River, Italy.

The project involves paddling clubs, local community groups and individual citizens, who record freshwater molluscs during organised activities or opportunistically during recreational excursions. A distinctive feature is the use of social media as a distributed observation network: records can be submitted directly to project coordinators or shared publicly using the project hashtag, enabling additional observations to be identified through social media data mining.

Reported observations undergo a validation process for the reliability of the information, followed by expert verification of species identification. Records are successively uploaded into the Italian National Biodiversity Network (NNB) and made available through an information dashboard. This approach transforms scattered observations generated by river users into structured biodiversity information that can contribute to IAS surveillance.

During three years of activity, the project has documented significant IAS-related findings, including the first recorded observations of *Corbicula fluminea* in Umbria and *Dreissena polymorpha* in the upper Tiber valley. Importantly, the project has also moved beyond detection towards prevention and behavioural change: the "Check, Clean, Dry" biosecurity protocol has been introduced among local paddling clubs to reduce the risk of human-mediated dispersal of aquatic IAS.

The project demonstrates how recreational river users can become an active component of an IAS early-warning system. It also shows that less charismatic and sedentary submerged and partly buried organisms such as freshwater molluscs can provide an effective entry point for communicating biological invasions and promoting practical biosecurity measures. The Tiber experience highlights the potential of participatory science to connect early detection, biodiversity monitoring, stakeholder engagement and prevention, creating a community-based approach to freshwater IAS management.

Web page and dashboard can be find here: https://www.nnb.isprambiente.it/it/citizen-science/teveremolluschifantastici-e-dove-trovarli

Keywords: participatory science, Tiber River, invasive freshwater mollusc, active citizenship

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AlienFish project: Integrating citizen science and molecular analyses for efficient detection and characterisation of range-expanding species in the Mediterranean Sea

Alessandro Nota[1], Elisabetta Moroni[2], Manuela Falautano[3], Luca Castriota[3], Emanuele Mancini[4], Ernesto Azzurro[5], Anna Olivieri[2], Francesco Tiralongo[6]

[1] *Department of Veterinary Sciences, University of Turin, Grugliasco, Italy*
[2] *Department of Biology and Biotechnology, University of Pavia, Pavia, Italy*
[3] *Italian Institute for Environmental Protection and Research (ISPRA), Palermo, Italy*
[4] *Department of Biological and Environmental Sciences and Technologies, University of Salento, Lecce, Italy*
[5] *National Research Council, CNR-IRBIM, Ancona, Italy*
[6] *Department of Biological, Geological and Environmental Sciences, University of Catania, Catania, Italy*

Presenter email: alessandro.nota@unito.it

Oral Presentation

Monitoring range-expanding fishes in the Mediterranean is particularly challenging due to a combination of different invasion sources and the presence of several poorly known taxa. Traditional field surveys are often difficult to implement on a large spatial scale, and are usually insufficient to obtain timely and geographically extensive information. Species reaching the Mediterranean through the Suez Canal, aquaculture activities, aquarium releases or ballast water transport represent non-native taxa, while range-expanding species from the Strait of Gibraltar, reaching the Mediterranean naturally, are considered neonative in the basin. However, distinguishing the different invasion sources remains another major challenge.

The AlienFish project addresses these constraints by combining participatory surveillance through social networks with targeted molecular analyses of rare, thermophilic or non-native Mediterranean fishes. Observations are collected through social networks and collaborations with amateur observers, professional fishers, and recreational fishers. Georeferenced photographic material is expert-validated and, for cryptogenic taxa, when specimens or tissue samples are available, integrated with morphological or molecular evidence. Targeting the mitochondrial DNA of expanding species usually allows us to distinguish the nature of the expansion (i.e., non-native or just range-expanding).

Starting from 2025, the dataset was further integrated with records collected within the campaign 'Attenti a quei 4!', a national survey promoted by ISPRA and the Italian National Research Council. Between 2020 and 2025, AlienFish validated 317 records comprising more than 70 fish taxa and 700 individuals along Italian coasts. Among non-native fishes, *Siganus luridus*, *Fistularia commersonii*, *Lagocephalus sceleratus* and *Pterois miles* accounted for more than 90% of the records, reflecting the huge expansion of these invasive species. Concerning cryptogenic taxa, molecular analyses allowed us to trace the origin of sea chubs (genus *Kyphosus*) and bigeyes (genus *Priacanthus*) specimens recently collected in the basin. The sequencing of complete mitochondrial genomes of native but poorly known taxa like medusafishes (Centrolophidae) further helps to resolve taxonomic ambiguities in poorly studied fish groups.

Our results show that broad observer networks can provide rapid alerts at low cost and on large temporal and geographical scales, while molecular analyses conducted on citizen-collected material can reduce misidentifications and help distinguish human-mediated introductions from climate-driven natural range expansions. Integrating these approaches can strengthen Mediterranean early-warning programmes by directing limited sampling efforts towards high-priority species and providing policymakers with reliable evidence.

Keywords: AlienFish, citizen science, non-native fishes, neonative fishes, early detection

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Integrating iNaturalist with scientific surveys fills spatial data gaps and enhances invasion risk monitoring

Amy Leigh Mackintosh[1], Mark John Costello[1], Ivain Martinossi-Allibert[1], Amalia Aikaterini Mailli[1], Lauriane Ribas-Deulofeu[1]

[1] *Faculty of Biosciences and Aquaculture, Nord University, Bodø, Norway*

Presenter email: amy.l.mackintosh@nord.no

Oral Presentation

Access to biodiversity data is a critical component for managing and conserving biodiversity under the impacts of climate change and human activity. Traditional scientific sampling is the primary source of biodiversity data, but these methods can be costly, constrained by logistics, and limited in temporal and spatial scale. Citizen science initiatives, such as iNaturalist, can collect large amounts of data across wide spatial and temporal ranges at minimal cost. The aim of this research was to assess whether citizen science-derived data of marine invasive alien species (IAS) in Europe fills spatial gaps present in traditional scientific databases. Preliminary results indicate that traditional databases largely contain more occurrence points per species, but these are more concentrated than the citizen science occurrence dataset. Citizen science data has the perception of being unreliable or of lower quality than traditional scientific surveys. However, the iNaturalist platform includes visual confirmation of records, community validation, and computer vision predictions to minimise these concerns. Thus, complementing traditional data with citizen science data allows for a cost-effective and near real-time monitoring of IAS.

Keywords: citizen science, iNaturalist, spatial gaps, biodiversity data, invasive alien species

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From Detection to Action: cost-efficiency, management & policy uptake

Funded by the European Union

How did we get here? Indicators for evaluating aquatic IAS management

Gemma Smith[1,2], Michael Elliott[1,3], Anita Franco[1], Katie Smyth[1]

[1] *International Estuarine & Coastal Specialists (IECS) Ltd., Leven, Hull, UK*
[2] *The Centre for Systems Studies, The Business School, University of Hull, UK*
[3] *School of Environmental and Life Sciences, University of Hull, UK*

Presenter email: Gemma.Smith@iecs.ltd

Oral Presentation

Invasive Alien Species (IAS) represent a threat to global biodiversity, requiring effective and coordinated management interventions. Specifically, aquatic IAS management is important to address one of the many pressures that compromise the health of aquatic ecosystems but faces multiple levels of complexity (across types of environments, scales of management, and the social-ecological context-dependence of biological invasions). Enhanced monitoring is often a recommendation for IAS management; however, effective management requires a broader scope that considers both social and ecological aspects. To ensure there is a loop of learning to enable adaptive management, we need to ask the question: "How do we know management will, and is, working?". This may be answered through the application of the Ten-tenets framework for sustainability and success in IAS management, as explored in this presentation. A systematic review of the literature was undertaken to identify existing IAS management evaluation indicators categorised by this framework. We found that existing indicators are predominantly quantitative, concentrating on biological aspects as well as technology to implement management and its economic cost. The study shows that qualitative aspects, such as cultural and socio-political dimensions, occurred less frequently in existing evaluations. We attribute this imbalance to three operational challenges: (i) the trade-offs of using qualitative indicators, which require balancing stakeholder engagement processes against the demand for rapid biosecurity actions; (ii) organisational memory loss, resulting in repetitive baseline monitoring; and (iii) a systemic tendency to monitor the spatial and temporal footprint of IAS rather than considering wider societal factors that influence the success of biosecurity management measures. Hence, the evaluation of management is necessary, firstly to ensure learning is retained, and to assess if past interventions can inform future ecosystem-based technical measures for managing IAS. Lastly, in operationalising this approach for practical use, we suggest a two-phase weighted evaluation that combines expert opinion, available data, and stakeholder input to evaluate the success or feasibility of implemented and planned technical measures for aquatic biosecurity.

Keywords: invasive alien species; marine management; freshwater management; indicators; biological invasions; ecosystem-based management

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From detection to action: Building an operational decision framework for AI-assisted management of invasive aquatic plants

Sietse Manning[1], Leon Sterk[1], Nynke Straatsma[1], Ludde Feldbrugge[2], Jelle Dalenberg[2], Bart Kroon[3]

[1] *Platform Datagestuurd Waterplantenbeheer (PDW), The Netherlands*
[2] *Objectherkenning, The Netherlands*
[3] *Goldmund, Wyldebeast & Wunderliebe, The Netherlands*

Presenter email: sietse@koww.nl

Oral Presentation

Early detection is widely recognized as one of the most effective and cost-efficient strategies for managing invasive alien species (IAS). Advances in drone technology, artificial intelligence (AI), and geospatial data processing have greatly improved the ability to detect species across large spatial scales. However, the value of these technologies is not determined solely by their capacity to generate observations. Management decisions require information that is sufficiently reliable, transparent and actionable to justify intervention, allocate resources and support policy objectives. While significant progress has been made in automated species detection, translating ecological observations into operational management decisions remains a major challenge.

The Dutch Platform Datagestuurd Waterplantenbeheer (PDW) is being developed to address this challenge for invasive aquatic plants. Rather than treating species detection as the endpoint of monitoring, PDW aims to establish an operational decision framework linking data acquisition, species recognition, ecological validation, spatial analysis and management prioritization. The platform combines drone imagery, AI-assisted species identification, ecological expertise and shared geospatial information to support evidence-based invasive species management across organizations and regions.

The approach consists of three interconnected stages. First, drone-based RGB imagery is collected to enable scalable and repeatable monitoring of aquatic ecosystems. Second, AI models analyze the imagery to identify and delineate invasive aquatic plant species, including *Cabomba caroliniana*, *Myriophyllum heterophyllum*, *Hydrocotyle ranunculoides* and *Ludwigia* spp. Native look-alike species are incorporated into model training, while ecological experts remain actively involved through annotation, validation and interpretation. This human-in-the-loop approach explicitly addresses uncertainty and reduces the risk of misclassification. Third, observations are integrated within a shared GIS environment where species occurrence, density and spatial context are translated into management information. These outputs support risk assessment, prioritization of intervention locations and allocation of limited management resources.

A central premise of PDW is that management decisions require a different level of certainty than species observations. Consequently, the platform focuses not only on detection performance, but also on identifying the information required before AI-generated observations can support management action. Particular attention is given to uncertainty, validation requirements, ecological risk, and the consequences of false-positive and false-negative detections. By linking observation confidence to management confidence, PDW seeks to support transparent and defensible decision-making.

The first operational prototype is currently being tested in collaboration with Dutch water management authorities. This presentation will discuss the conceptual development of the decision framework and share practical experiences from pilot implementations. We argue that the future value of AI-assisted IAS surveillance lies not only in improving detection efficiency, but in enabling robust pathways from detection to action. By integrating ecological expertise, remote sensing, artificial intelligence and spatial decision support, PDW contributes to scalable monitoring systems capable of supporting timely, cost-effective and evidence-based invasive species management. More broadly, the project illustrates how emerging monitoring technologies can be embedded within governance and decision-making frameworks, thereby helping to bridge the persistent gap between ecological observation and effective management action.

Keywords: invasive alien species; artificial intelligence; drone monitoring; decision support; geospatial intelligence; aquatic vegetation

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Data integration from multiple platforms: transforming diverse observations into actionable intelligence

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FWISE: global lessons for the world's first database of freshwater invasive species eradications

Anabell Espinosa[1,2], Graden Z. L. Froese[2], Bernie Tershy[2,3], Kelly Zilliacus[3], Donald Croll[3]

[1] *University of California San Diego, USA*
[2] *Freshwater Life, USA*
[3] *University of California Santa Cruz, USA*

Presenter email: a2espinosa@ucsd.edu

Oral Presentation

Freshwater ecosystems cover less than 1% of Earth's surface yet account for 34% of extinct and 45% of threatened animals, with invasive species being a leading driver of those extinctions. Decades of island conservation practice have shown that invasive animal eradication is an effective tool for the recovery of threatened native species. Eradications on islands have been supported by a well-organized island invasive community with a centralized database of successful and failed eradication attempts. Although there are multiple well-documented examples of freshwater native species recovery following the eradication of invasive animal species, there is no centralized database of freshwater eradication attempts to drive more and better restoration of freshwater ecosystems suffering from invasive species. To address this gap, we developed FWISE: the Freshwater Invasive Species Eradication Database. We compiled over 900 documented eradications across six continents using an approach that combined a systematic literature review of peer-reviewed publications with snowball sampling of government agencies and other practitioners in the gray literature. We used standardized data, including target species, outcomes, methods, waterbody characteristics, duration, and beneficiaries.

The FWISE database compiles freshwater invasive-species eradication attempts for 206 invasive species across 33 countries, with 418 native and at-risk species recorded as intended beneficiaries. Across the compiled record, 79% of eradication attempts were successful. The plant-based piscicide, rotenone, was the most frequently applied method, followed by netting/trapping, electrofishing, the antibiotic piscicide antimycin-A, and draining the water body dry. Project duration ranged from less than one day for piscicide treatments to several years for physical removal methods. We conducted a binomial generalized linear mixed model analysis of ~70% of eradication attempts with complete data from the FWISE database. We found that eradication success was associated with lower local human population density, smaller water bodies, and the use of rotenone versus other methods. By making this evidence openly available, FWISE provides practitioners with a reference for selecting methods, assessing feasibility, and benchmarking. The database is intended as a living infrastructure and will be made available for exploration in an easy-to-use app to catalyze a freshwater eradication movement comparable to the one transforming island restoration.

Keywords: FWISE, freshwater, eradication, database, invasive, global

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If a tree falls in the forest: Turning invasive species detections into actionable alerts with GBIF Alert

Damiano Oldoni[1], Soria Delva[1], Bram D'hondt[1], Quentin Groom[2], Toke Thomas Høye[3], Tim Adriaens[1]

[1] *Research Institute for Nature and Forest (INBO), Brussels, Belgium*

[2] *Meise Botanic Garden, Meise, Belgium*

[3] *Aarhus University, Denmark*

Presenter email: damiano.oldoni@inbo.be

Oral Presentation

If a tree falls in the forest and no one is around to hear it, does it make a sound? Applied to invasive alien species (IAS), the practical answer is uncomfortably clear: a detection that never reaches someone able to act on it might as well not have happened. Across Europe, growing investment in cameras, sensors, citizen science apps and eDNA is producing more IAS observations than ever. Yet these "falling trees" only translate into faster management if three things line up: the detections themselves, the workflows moving them from field to database, and the alert system turning data into a message someone can act on.

First, someone must see the tree fall. Getting more "eyes" on the landscape means rethinking who or what is looking. The **CamAlien** tool tested by the Biodiversa+ pilot project is one possible answer: a camera mounted on a vehicle, capturing images along linear infrastructure, paired with species identification developed in collaboration with Pl@ntNet. Preliminary deployments in Belgium, screening for species such as *Impatiens glandulifera*, *Ailanthus altissima* and *Baccharis halimifolia*, show the approach can reliably flag several target species, while also revealing some limitations. Camera-based tools like this are a scalable, low-cost layer of eyes, complementing citizen science and monitoring campaigns.

To be useful, a detection needs to become open, standardised, discoverable data. Fast and recurring data mapping to Darwin Core and data publication to GBIF, through an automated end-to-end pipeline, is what allows new detections to become available "as soon as possible" rather than months later, when the window for rapid response may have closed.

Finally, someone has to be “listening”. An alert system — software that watches incoming data, detects new occurrences of target species within areas of interest, and triggers notifications to practitioners, scientists and policymakers — is what turns GBIF occurrences into the sound that reaches the forester's ear. We present **GBIF Alert**, an open-source software engine deliberately built to be reused rather than reinvented. By separating the generic alert logic — data import, matching, visualisation and notification — from configuration variables such as target species lists and areas of interest, GBIF Alert allows any region or community to set up its own early alert instance without starting from scratch. One such instance, born out of the **LIFE RIPARIAS** project, is already operational in Belgium. GBIF Alert is now being further improved thanks to the EU funded **GuardIAS** and **OneSTOP** projects, expanding beyond its original scope towards a cross-realm, European-level early alert system.

Whichever IAS or area we speak about: better detection tools generate the observations; fast, open data-publishing workflows make them available in time; and a reusable alert engine like GBIF Alert makes sure that someone is there to hear the tree fall — and to act before the forest changes for good.

Keywords: alert system, early detection, invasive alien species, open data, GBIF Alert, open software

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Integrating invasion risk screening evidence into the European Alien Species Information Network (EASIN)

Lorenzo Vilizzi[1], Ana Cristina Cardoso[2], Chiara Magliozzi[2], Stelios Katsanevakis[3]

[1]*University of Lodz, Faculty of Biology and Environmental Protection, Department of Ecology and Vertebrate Zoology, Lodz, Poland*
[2]*Joint Research Centre of the European Commission, Ispra, Italy*
[3]*University of the Aegean, Department of Marine Sciences, 81100 Mytilene, Greece*

Presenter email: lorenzo.vilizzi@gmail.com

Oral Presentation

Accessible and traceable invasion risk evidence is essential for preventing and managing biological invasions, yet published risk screening results remain scattered across journal articles, reports and supplementary materials. We compiled and standardised published applications of the Invasiveness Screening Kit (ISK) family of decision support tools from 2005 to July 2026 and integrated their taxon-level results into the European Alien Species Information Network (EASIN). Each screening record retains the risk assessment area, toolkit, threshold, numerical score, risk classification and bibliographic source, while taxonomic names were harmonised with EASIN so that synonyms, outdated names and misspellings remain traceable. The resulting evidence layer comprises 3,221 screening records from 214 applications, covering 862 EASIN-linked taxa and 269 risk assessment areas, including all 27 EU Member States and 96 non-EU countries. Rather than assigning a single universal risk category to a species, the integration preserves the geographical and methodological context of individual assessments. Users can therefore identify whether a taxon has already been screened, retrieve the original evidence and applicable thresholds, compare outcomes among regions and through time, identify geographical or taxonomic gaps, and prioritise new or updated assessments. The integration transforms a dispersed body of screening evidence into a structured, source-traceable resource that can support research, horizon scanning and management prioritisation.

Keywords: biological invasions, decision support, evidence integration, risk screening, data interoperability, horizon scanning

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Appendix: Conference program

All times are GMT (Irish Time)

19th November: 09:15 – 10:00am

	Opening session **Session Chair Frances Lucy**
09:15	**Professor Stelios Katsanevakis** (GuardIAS Project Co-ordinator)**:** Welcome to the GuardIAS Conference 2026
09:30	**Dr Prof. Steven Loiselle** (Keynote Speaker): Many Eyes on the Water: Lessons from FreshWater Watch for Cost-Effective Aquatic Monitoring

19th November: 10:00 – 11:00am

	Smart detection technologies for IAS surveillance, Session 1 **Session Chair: Mark Costello**
10:00	**Kate McAlpine:** Introducing the Smart Weed Alert Tool (SWAT): harnessing citizen science and open biodiversity data to detect new weeds when they first invade
10:15	**Brett Kettle:** Surveillance at incursion scale: high-speed underwater imaging and machine-learning detection for marine pests too widespread for conventional response
10:30	**Jose A. Fernandes-Salvador**: Automated Detection and Abundance Estimation of Macrobenthic Taxa in Underwater Videos: A Case Study on the Basque Coast
10:45	**María Isabel Cordón-Krumme:** Small panels, big insights: A cost-efficient approach to monitoring fouling communities in Irish marinas

11:00-11:30 Coffee break: and browse the posters

19th November: 11:30 – 12.45pm

	Smart detection technologies for IAS surveillance, Session 2 **Session Chair: Mark Costello**
11:30	**Erola Fenollosa:** From historical imagery to population trends: retrospective monitoring of invasive species with QGIS
11:45	**Federica Soccio:** Listening to the invasion: Assessing the potential of passive acoustics for monitoring *Pterois miles* in Greek waters
12:00	**Ingrid Ravasi:** Comparing sampling methods for early detection of alien species in port fouling communities
12:15	**Ismael Soto:** Is the Iberian Peninsula protected from the faunal Ponto-Caspianization?
12:30	**Chuck Bargeron:** Bugwood - Tools for efficient invasive species education detection and monitoring for professionals and the public

12:45-13:45 Lunch Break

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19th November: 13:45 – 14:30pm

	AI-assisted species detection **Session Chair Philip Haubrock**
13:45	**Erola Fenollosa:** Not all observations are equal: accounting for observation processes in AI-assisted invasive species surveillance
14:00	**Francesca Acampa:** AI-Assisted Video Monitoring of Marine Biodiversity in Italian Marine Protected Areas
14:15	**Gwenolé Coat:** Machine learning-based monitoring for Invasive Alien Species (IAS) of fish in the Aegean Sea using a YOLO model

19th November: 14:30-15:15

	Poster Presentations **Session Chair: Sebastian Gomez-Maldonado**
14:30	**Panagiota Xanthopoulou**: Early detection of *Rugulopteryx okamurae* using COI metabarcoding and citizen science (GuardIAS CaSt11)
14:35	**Panagiota Xanthopoulou**: Environmental DNA metabarcoding for the detection of alien freshwater fishes in Northern Greece: applications, insights, and taxonomic limitations
14:40	**Krešimir Žganec:** Range expansion and population control of the signal crayfish (*Pacifastacus leniusculus*) in the Kupa River Basin, central Croatia
14:45	**Jana Pohl**: Far from home: The first record of the alien *Sacoglossan thuridilla mazda* (Mollusca: Gastropoda) from the Aegean Sea
14:50	**Leda L. Cai**: Past, Present and future multi-stressor interactions of shallow reefs ecosystems in the Levantine Sea
14:55	**Ioannis Rallis:** Integrated monitoring of non-indigenous species hotspots in the Eastern Ionian Sea
15:00	**Sofia S. Sadogurska:** DNA barcoding revealed the first confirmed introduction of Ahnfeltia plicata (*Rhodophyta, Ahnfeltiales*) outside its native range: a case from the Odesa Bay (Black Sea, Ukraine)
15:05	**Daniele Grech**: Shedding light on biofouling management and awareness of marine alien species among recreational boaters in Sardinia (Western Mediterranean)
15:10	**Sebastiana Di Dio:** Testing sustainable antifouling solutions along the Lithuanian coastline

15:15-15:45 Coffee Break

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19th November: 15:45 – 16:45pm

	eDNA and molecular diagnostics for non-native species detection and monitoring Session 1 **Session Chair Rein Brys**
15:45	**Eleni Christoforou:** Optimising eDNA Monitoring for Cost-Efficient Detection and Management of Non-Indigenous Species in the Levantine Sea
16:00	**Teun Everts:** Impact assessments from a drop of water: eDNA reveals context-dependent impacts of American bullfrogs on native amphibians
16:15	**Rein Brys:** Beyond presence–absence: Scaling ddPCR eDNA surveillance to guide basin-wide muskrat and coypu eradication
16:30	**Thomas Baudry:** Beyond the target: eDNA metabarcoding reveals multiple non-native fishes in freshwater ecosystems

Close of Day One

20th November: 9:30 – 10:15

	Panel Discussion: Cost-efficient Invasive Alien Species Detection and Monitoring: Novel Tools and Citizen Science
	Panel Chair: Tim Adriaens **Q&A Facilitator:** Frances Lucy **Panelists:** Anastasija Zaiko, Lisandro Benedetti-Cecchi, Anna Nunes, Daniel Nuijten

20th November 10:15-11:15

	eDNA and molecular diagnostics for non-native species detection and monitoring Session 2 **Session Chair Laura Verbrugge**
10:15	**Lori Lach:** Sampling aquatic habitats to detect invasive ant eDNA
10:30	**Cecilia Villacorta-Rath:** Expanding eDNA resources for ornamental pest species detection
10:45	**Abdul Ghaffar:** Environmental DNA (eDNA) metabarcoding as a molecular tool for aquatic biodiversity assessment and early detection of non-native species
11:00	**Amalia Mailli:** A collection of protocols, assays and barcodes for the detection and monitoring of invasive species in Europe

11:15-11:45 **Coffee break: and browse the posters**

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20th November: 11:45 – 12:30

	Citizen Science & participatory surveillance networks **Session Chair: Agnese Marchini**
11:45	**Roberto Crosti**: #TevereMolluschiFantastici…e dove trovarli: participatory science for freshwater IAS early detection and awareness
12:00	**Alessandro Nota:** AlienFish project: integrating citizen science and molecular analyses for efficient detection and characterisation of range-expanding species in the Mediterranean Sea
12:15	**Amy Leigh Mackintosh**: Integrating iNaturalist with scientific surveys fills spatial data gaps and enhances invasion risk monitoring

12:30-13:30 Lunch Break

20th November: 13:30 – 14:15

	From Detection to Action: cost-efficiency, management & policy uptake **Session Chair: Elena Tricarico**
13:30	**Gemma Smith:** How did we get here? Indicators for evaluating aquatic IAS management
13:45	**Sietse Manning:** From Detection to Action: Building an Operational Decision Framework for AI-Assisted Management of Invasive Aquatic Plants

20th November: 14:15 – 14:45

	Data integration from multiple platforms: transforming diverse observations into actionable intelligence **Session Chair: Damiano Oldoni**
14:00	**Anabell Espinosa:** FWISE: global lessons for the world's first database of freshwater invasive species eradications
14:15	**Damiano Oldoni:** If a tree falls in the forest: turning invasive species detections into actionable alerts with GBIF alert
14:30	**Lorenzo Vilizzi:** Integrating invasion risk screening evidence into the European Alien Species Information Network (EASIN)

Close of Conference

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