

# The Scottish Genetic Diversity Scorecard

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# Contents

Background	Page 3
Aim	Page 4
Methods	Page 5
Progress and next steps	Page 6

# Background

In 2020, the first “Genetic Scorecard” for evaluating genetic health of Scottish species was produced. The aim of this scorecard was to establish a methodology that includes direct and indirect proxies to promote the long-term conservation of genetic diversity. The genetic health of 26 socio-economic species from terrestrial and freshwater ecosystems was evaluated using the criteria developed for the scorecard. This approach did not rely solely on prior genetic knowledge but incorporated expert assessments of demographic declines, hybridisation, and regeneration limitations that could lead to genetic diversity loss. It also identified existing mitigation strategies to prevent genetic risks and conserve genetic diversity of these species. The scorecard was later adopted as a complementary indicator for the Kinming-Montreal Global Biodiversity Framework (GBF)’s Goal A.

In sync with national reporting under GBF and in line with GBF’s Goal A and Target 4, we aim to update the scorecard every five years and there has been strong encouragement from NatureScot to commence this exercise, which is the

subject of the current project. This includes a refined methodology, additional proxies and a more extensive set of native Scottish species. Since the original scorecard was published in 2020, there has been an adoption of the *proportion of populations within species with an effective population size > 500* ( $N_e500$ ) as a headline indicator for both GBF’s Goal A and Target 4. The effective population size ( $N_e$ ) is usually extrapolated from the census size ( $N_c$ ) of a population (e.g.,  $N_e$  is often estimated as  $1/10^{\text{th}} N_c$ ). Additionally, the proportion of population maintained ( $PM$ ) has also been used as a complementary indicator for the GBF’s Goal A. These metrics have been incorporated into the revised genetic scorecard.

In addition to the terrestrial and freshwater species treated in the original scorecard, Scotland has extensive marine ecosystems. In this next iteration of the Genetic Scorecard, we have been including marine species and modifying the approach to accommodate the different features of marine systems compared to terrestrial and freshwater systems.

# Aim

To produce an updated Scottish genetic diversity scorecard for ongoing monitoring of biodiversity within terrestrial species and to expand its relevance to marine species to support strategies to prevent and reverse biodiversity decline.

# Method

We reviewed literature for potential proxies for genetic health evaluation. Then, the committee met to revise the existing scorecard criteria and template and incorporate the GBF's *Ne500* and *PM* approaches. A workshop was held to revise and finalise scorecard as well as agree on data gathering strategies. Participants included representatives from RBGE, NatureScot, the James Hutton Institute, the University of the Highlands and Islands (UHI), the Scottish Government, JNCC, and the University of Edinburgh.

Two additional workshops were organised with a focus on the marine ecosystem. The methodology and

criteria, including the definition of “population”—which differs from the original approach designed primarily for terrestrial ecosystems—were revised to accommodate marine species. Marine experts from NatureScot, SAMs, Nord University (Norway), UHI, and the Roslin Institute participated in these workshops.

Moving forward to the next phase, experts in both terrestrial and marine ecosystems have been identified and invited to complete scorecards for their species of interest. We will provide support in gathering necessary information and guidance on completing the scorecards.

# Progress and next steps

Following the Phase 1 workshops, the original methodology has been refined and potential data sources suitable for the scorecard were identified. For terrestrial species, databases such as GBIF, NBN Atlas, NBS Atlas Scotland and Plant Atlas 2000 can be great sources for species distribution data. The effective population size ( $N_e$ ) can be obtained from published literature and population genetic studies. When there is no available  $N_e$ , we use census size ( $N_c$ ) gathered from other sources, such as individual studies of species, ICES & Fisheries Stock Assessments and Marine Scotland Science Reports.

Several scorecards were updated or newly produced for species spanning terrestrial and marine ecosystems, e.g., woolly willow (*Salix lanata*), red squirrel (*Sciurus vulgaris*), sea grass (*Zostera marina*), cold-water coral (*Desmophyllum pertusum*) and bottlenose dolphin (*Tursiops truncatus*). The definition of population has been revised to cover a wider range of

scenarios for both terrestrial and marine ecosystems. Multiple population definitions reflecting different  $N_c/N_e$  estimations per species are also allowed in the revised scorecard. Additionally, a list of 80 potential marine species was compiled based on established selection criteria, 50 of which will be identified for prioritisation. The updated scorecards and the species list were then circulated for final review and modifications.

In the next phase, we will convene a workshop to inform experts about the scorecard concepts and methodology and guide them on how to complete species assessments. By the end of 2025, we aim to finalise scorecards for 25 terrestrial and 25 marine species. The next workshops are scheduled for 28<sup>th</sup> March and 10<sup>th</sup> April 2025.

The project team are also liaising directly with JNCC to connect the work in Scotland through to reporting at the UK level.



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