biodiversa+
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Concept note on a methodological approach to define priorities for monitoring biodiversity

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What is Biodiversa+

Biodiversa+ is the new European co-funded biodiversity partnership supporting excellent research on biodiversity with an impact for policy and society. It was jointly developed by BiodivERsA and the European Commission (DG Research & Innovation and DG Environment) and was officially launched on 1 October 2021.

Biodiversa+ is part of the European Biodiversity Strategy for 2030 that aims to put Europe's biodiversity on a path to recovery by 2030.

The Partnership aims to connect science, policy and practise for transformative change. It currently gathers 81 research programmers and funders and environmental policy actors from 40 European and associated countries to work on 5 main objectives:

1. Plan and support research and innovation on biodiversity through a shared strategy, annual joint calls for research projects and capacity building activities
2. Set up a network of harmonised schemes to improve monitoring of biodiversity and ecosystem services across Europe
3. Contribute to high-end knowledge for deploying Nature-based Solutions and valuation of biodiversity in the private sector
4. Ensure efficient science-based support for policy-making and implementation in Europe
5. Strengthen the relevance and impact of pan-European research on biodiversity in a global context

More information at: https://www.biodiversa.eu/

Executive Summary

In this report Biodiversa+ introduces a generic methodological approach to identify biodiversity monitoring priorities driven by stakeholder needs. The approach is based on a 'supply and demand' framework, which lists categories of usage of biodiversity monitoring data and results, and by extension identifies users of such data. We then propose a simple survey targeting these users, in order to highlight their needs to be used as thematic priorities. This document reviews the design of the survey and the wording of the core question, as well as important elements regarding the stratification (which information is required to properly interpret the results) and analysis of the answers. We advocate for a periodical deployment strategy, for instance over 2 to 4 years, with users' suggestions contributing to the next survey cycle. The survey is generic enough to be applied at various scale from local to regional, and answer to different communities. At the European scale, we recommend to consider this periodical survey as a cornerstone of the European landscape of biodiversity monitoring, which could possibly become a mission under the umbrella of the future European biodiversity observation coordination centre (EBOCC).

1. General context

This document presents a methodological approach for the establishment of priorities for biodiversity monitoring, and has been prepared by the working group of the Biodiversa+ sub-task 2.1.1 on biodiversity monitoring priorities (hereafter WG2.1.1, or "we" in active sentences). The WG2.1.1 is tasked with the definition and revision of Biodiversa+ monitoring priorities, and specifically has to work on revising biodiversity monitoring priorities for each Biodiversa+ cycle. On 13–14 May 2024, the WG2.1.1 met in Paris for a workshop dedicated to a simple question: "***How do we define priorities for biodiversity monitoring?***" (the question relates to the actual process, i.e. the methodology). The current concept note is a practical synthesis of the discussions, decisions and brainstorming that happened in 2024, before, during, and after the Paris meeting[1].

Although prepared within the context of Biodiversa+, the European biodiversity partnership[2], the relevance of these guidelines should extend outside of the partnership, and be valuable more broadly for any actor of biodiversity monitoring and beyond. In short, this document presents a **methodology to define priorities, with respect to biodiversity monitoring**. It is our hope that the proposed approach will reach a large audience dealing with similar issues.

The basis of this methodology is a **survey** that aims to reach users of biodiversity monitoring data and results as broadly as possible. The idea behind this approach is to let users determine where biodiversity monitoring efforts should be put in order to properly meet their needs. The first section of this concept note thus reflects on users' needs through a supply-and-demand framework. The second section offers the foundations to prepare the aforementioned survey. In order to inform our work, both sections include results from two surveys run in the spring of 2024, the first one focused on uses of biodiversity monitoring data and results, the second one focused on priority topics in answer to a simple question. These two surveys contribute to our thought process both by their results and by the example of the form and wording of the survey themselves.

With this in mind, it is important to mention how we defined **biodiversity monitoring** for the sake of this concept note. Biodiversity monitoring refers to "1) the repeated observation of a [biological] system in order to perceive change in some quality or quantity; 2) a periodic standardised data collection or measurement of a particular set of biodiversity variables in specific sample areas."[3] Biodiversity monitoring has three defining characteristics:

- **Long-term:** There is no predetermined end to biodiversity monitoring, as it is supposed to last for as long as it is relevant;
- **Status and trends:** A single point in time can only define the status, while repeated observations are necessary for evaluating trends and the determining factors for change;

[1] The meeting report is available on-line here: https://drive.google.com/file/d/1PrBfsIZqzF718O_0IWtGa2aSuSYJI-RJ/view?usp=sharing
[2] Biodiversa+ website: https://www.biodiversa.eu/
[3] Silva del Pozo, M., Body, G., Rerig, G., Basille, M. (2023). Guide on harmonising biodiversity monitoring protocols across scales. Biodiversa+ report. 60 pp. https://www.biodiversa.eu/wp-content/uploads/2023/10/Biodiversa_Best-practices_2023_v5_WEB.pdf

- Biodiversity monitoring is **level, realm and scale agnostic**: it addresses all components of biodiversity from genes to ecosystems, through species and habitats, from terrestrial, marine and freshwater realms, at all geographic and temporal scales.

2. The supply-and-demand framework

Biodiversity monitoring does not happen for the sake of it—rather it serves various purposes, and it is thus important to identify these. In order to understand users' needs for biodiversity monitoring, we propose a 'supply and demand' framework for the information stemming from biodiversity monitoring schemes. This information represents the first step of the full chain of knowledge and takes the form of a gradient from raw data directly collected in field programmes to processed or modelled data (e.g. in the form of Essential biodiversity variables[4]), but does not include synthetic (or aggregative) indicators which are a step further in the chain. Altogether, we refer to this information as biodiversity monitoring **data and results**. We have identified **5 broad categories of usage of biodiversity monitoring data and results**:

- **Assessment**, which corresponds to the act of evaluating the biological state (status and/or trend) of species or habitats (such as IUCN red lists, or reporting for the Habitat Directive for instance), or the progress of action plans and public policies;
- **Awareness**, which covers activities synthesising information to convey a message (communication) in order to mobilise society in a general sense;
- **Management**, in all its dimensions: 1) *preventive*, i.e. efforts to minimise external influences on species, habitats and ecosystems through conservation and protection; 2) *corrective*, i.e. efforts to revert to a state of reference (to be defined) through manipulation such as restoration and rewilding; 3) *exploitative*, i.e. sustainable use of natural resources;
- **Research**, whether it is the production of new and increasing knowledge to understand the natural world, or the production of forecasts and scenarios;
- **Economy & finance,** i.e. environmental perspective in the economic sector. This includes investment under green (or sustainable) finance, i.e. the comprehensive understanding of nature-related risks for companies and financial institutions, and effective strategies for managing them, as well as the assessment and improvement of corporate environmental performance. This category is somewhat transversal to the others, but in effect relates to public and private investors (through financial markets) as well as business stakeholders (generally speaking, the private sector) that makes it worth its own category[5].

[4] Pereira, H. M., Ferrier, S., Walters, M., Geller, G. N., Jongman, R. H. G., Scholes, R. J., Bruford, M. W., Brummitt, N., Butchart, S. H. M., Cardoso, A. C., Coops, N. C., Dulloo, E., Faith, D. P., Freyhof, J., Gregory, R. D., Heip, C., Höft, R., Hurtt, G., Jetz, W., Karp, D. S., McGeoch, M. A., Obura, D., Onoda, Y., Pettorelli, N., Reyers, B., Sayre, R., Scharlemann, J. P. W., Stuart, S. N., Turak, E., Walpole, M. & Wegmann, M. (2013). Essential Biodiversity Variables. Science, 339(6117), 277–278. http://dx.doi.org/10.1126/science.1229931

[5] See Heck, A., Eggermont, H., Mandon, C. (2023) Report of the use of biodiversity monitoring data in private decision making. Biodiversa+ report. 29 pp. https://www.biodiversa.eu/wp-content/uploads/2023/04/D2.4-Use-biodiversity-monitoring-data-private-decision-making.pdf

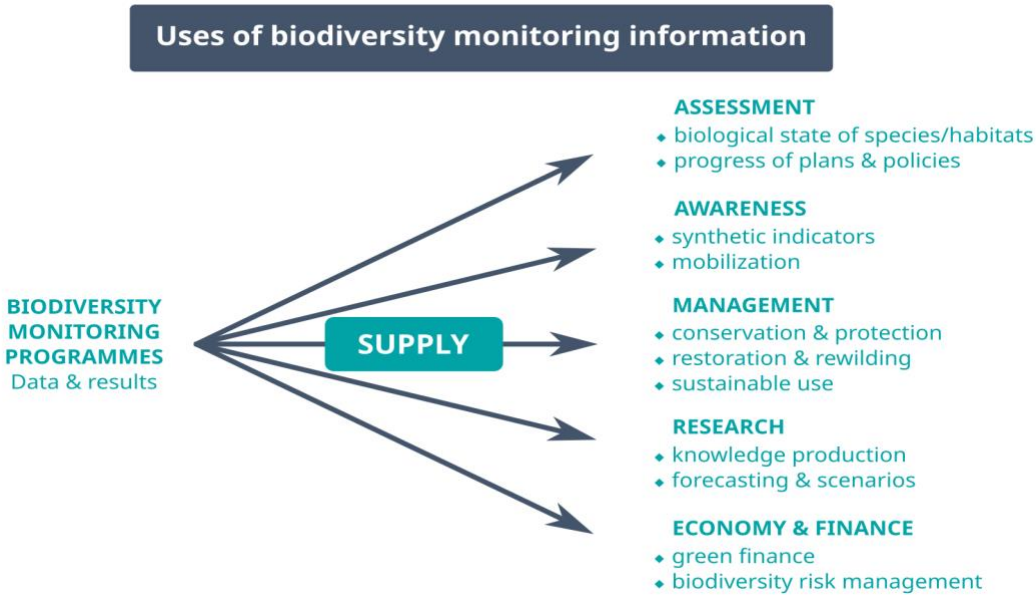

Figure 1a: Five main uses of biodiversity monitoring information (supply perspective)

These broad categories are not meant to be exhaustive or mutually exclusive. Rather, they form the basis for an operational understanding of biodiversity monitoring. Every user of biodiversity monitoring data and results should be able to identify with one or several categories.

From this, we can revert the situation as to highlight **demand from users** for biodiversity monitoring data and results (the right-hand side of figure 1b):

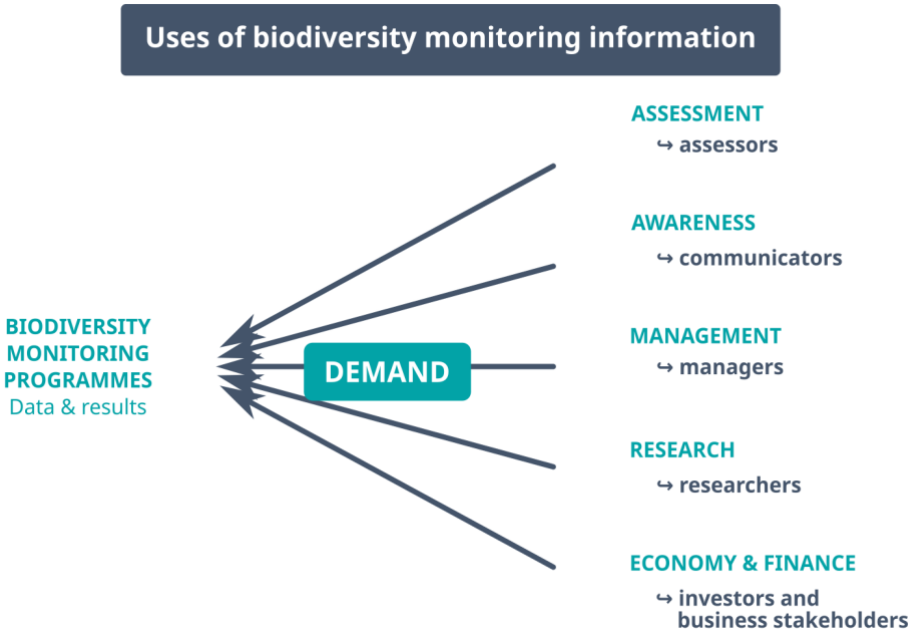

Figure 1b: Five main uses of biodiversity information (demand perspective)

Flipping the chart highlights the cornerstone of our approach: biodiversity monitoring priorities should follow from users' demand with a bottom-up approach, as opposed to a top-down approach where users' can only deal with available information without any influence on it. First of all, this approach allows to balance demands by sector (i.e. usage), or on the contrary prioritise sectors, so that biodiversity monitoring data and results effectiveness is maximised. Second, efforts can then be prioritised following users' needs, which ensures that biodiversity monitoring programmes best answer actual demands from all stakeholders that use their data and results.

In the rest of this document we will detail how we designed a **survey that targets users of biodiversity monitoring data and results**, in order to identify topics in need of biodiversity monitoring. Challenges and gaps are also addressed, with suggestions and possible solutions provided.

Box 1: A survey on uses of biodiversity monitoring data and results

From April to June 2024, Biodiversa+ ran a short survey on protocol harmonisation, in order to identify and map structured communities in the field of biodiversity in Europe. This survey was largely shared in the entire Biodiversa+ network and beyond, and resulted in 91 individual answers. We took the opportunity of this survey to identify and list existing uses of biodiversity monitoring data and results: Respondents were (optionally) asked

> **"If you are involved in [a given] community, how do you use biodiversity monitoring data and results? (please provide examples)"**

To this specific question, 63 answers were collected (69 % response rate). We manually screened all answers and matched them to the first 4 categories outlined above[6] (each answer could be associated with several categories). In the process, we also tried to identify uses that were not covered by the 4 categories.

A short synthesis of the results indicates that:

- The 4 categories were well represented, with a minimum of 22 % of the answers for Management, 32 % for Awareness, 46 % for Assessment, and 54 % for Research (total proportion is > 100 % due to multiple categories being possibly associated to each answer);
- Half of the responses (52 %) were associated to a single category of uses, while the other half (48 %) was associated to multiple categories (43 % to 2 categories, 4 % to 3 categories, and 2 % to all 4 categories);
- Most common combinations were Awareness and Research (14 %), Assessment and Research (11 %), and Assessment and Management (8 %). All other combinations accounted for ≤5 % of all answers;
- While the survey provides a limited sample, with possible biases, it seems that the 4 categories correspond well to the reported uses, and no missing uses were identified in the process. Please note that the match is done *a posteriori*, and the categories were not mentioned at all in the survey.

Detailed answers are provided in Appendix 1.

[6] The survey was designed before the last category ("Economy & finance") was added to the framework.

3. A survey for biodiversity monitoring priorities

A) Process and structure of the survey

The most important part of a survey is its process (i.e. how is the survey run) and its structure (i.e. how many questions of which type). The WG2.1.1 advocated several approaches that can be summarised as follows:

1. One-step structured survey (i.e. only closed questions), possibly with open comments;
2. One-step semi-structured survey (i.e. one open-ended questions with one or several closed questions);
3. Two-step guided survey: a first round with an open-ended question, and a second round with a closed question stemming from the first round.

Among the three suggestions, the first one (**"One-step structured survey, possibly with open comments"**) was deemed more practical for a broad survey, allowing for a relatively quick survey (closed questions take less time to respond than open-ended ones) together with results that are more manageable (see section "Analysis"). Of course, this is a trade-off as respondents are not allowed to answer freely to closed questions as they have to choose from a list—we suggest different solutions to circumvent this limitation below.

Such a quick, one-step, survey can also be repeated regularly more easily, for example every other year, to get a dynamic list of biodiversity monitoring priorities that reflects current state of the art and users demand. We provide additional information on how to update the survey at every cycle below.

While the premise of this work is to keep the survey as simple as possible, it is not always possible (see Box 2: The "coffee-machine" survey below). In particular, a straightforward approach is to have a single all-inclusive question for every aspect of biodiversity. While intellectually satisfying, it is rather difficult to implement with the aim of being exhaustive. As a consequence, **we propose to address priorities by realm (marine/freshwater/terrestrial) and biological level (species/habitat or ecosystem)**. In other words, the main content of the survey will be divided into 6 combinations of realm×biological level. We suggest limiting the number of items (candidate priorities) presented in each category (realm×level) to 15–20. We propose that an individual score for each item would be more appropriate than a ranking among items, given the difficulty to rank such a long list of items (some priorities might be deemed equally important or unimportant, hence blurring answers past the very first items).

Reflecting on the choice of a structured survey, we advise to allow respondents to **add comments as frequently as possible**, either to supplement existing elements, or to justify and explain their choices. In particular, an open text box for additional suggestions will be provided at the end of each question of the survey, and circumvent potential frustration stemming from limited choices (by design). This will enable respondents to suggest items that will feed the subsequent iteration of the survey (i.e. possibly included in the next list of candidate priorities), which should be explicitly stated in the survey. Note that, with the 6 combinations together, about a hundred choices will be presented to respondents, allowing for a relatively high degree of freedom, also addressing the aforementioned frustration.

Box 2: The "coffee-machine" survey

In April 2024, before the Paris workshop on Priorities, we ran a short survey aiming at getting a first perspective on the types of answers given to a simple question about biodiversity monitoring priorities. The survey was run informally (hence the nickname "coffee-machine" survey) with colleagues that are easy to approach, and was not meant to be representative of the monitoring landscape. However, we asked to try to balance the first 4 categories of the supply-and-demand framework[7]. A single question, that was meant to be simple and unambiguous, was asked in the coffee-machine survey:

> **"If you were in charge of biodiversity monitoring, what should be in your opinion the priority subjects of monitoring? Rank the first three."**

We collected answers from 43 colleagues of 8 partners, covering all 4 categories of the supply-and-demand framework. Several lessons can be learned from this survey:

- No matter how simple the question seems to be, there are complex answers provided.
- Even if explicitly requested to give a specific number of answers (here, 3), there is always room for a different number of answers (here, from 1 to 8), as long as it is technically possible.
- Do not assume—state explicitly. In this case, there was no context given, only the question on biodiversity monitoring priorities. Answers varied greatly with respect to the level of details and precision. Along the same line, a number of answers were related to methods, protocols or results, which were not meant to be the subject of the survey. Altogether, it essentially shows that respondents have different views of what they considered a relevant topic for biodiversity monitoring priorities.

Ultimately, what the coffee-machine survey showed is that it is difficult to obtain answers that match expectations without being very clear on the terms (definitions seem mandatory) and format (for instance, if 3 answers are expected, make sure to technically constrain the question to 3 answers) of the survey.

Detailed answers are provided in Appendix 2.

[7] The survey was designed before the last category ("Economy & finance") was added to the framework.

B) Wording of the main question

During the Paris workshop on priorities, the WG2.1.1 worked on the exact formulation of the question(s) asked in the survey, with the objective to be explicit and unambiguous. The exercise included group discussions and propositions, before a plenary session allowed to reach a final formulation by consensus. Given that the structure of the survey was decided to be 1) by realm (marine, freshwater, terrestrial) and 2) by biological level (species, habitat/ ecosystem), the same formulation was proposed for all 6 combinations. Here we present it with *marine species* as an example. To avoid ambiguities as much as possible, we subsequently ran an exercise with ChatGPT, asking it to evaluate the formulation of the final question, with respect to the context of the survey and what we expect from it[8]. The outcome of this evaluation did not highlight significant problems, and only slightly modified the wording. The final wording is this[9]:

> **"According to your opinion, please evaluate the level of priority for monitoring for the following list of <marine species> from 0 (no priority) to 5 (highest priority)."**

This specific wording in turn raised a few points of discussion that required further clarification:

- **Scale:** range and direction. Here we suggest 'from 0 (not a priority) to 5 (top priority)', but other scales exist, from binary (yes/no) to seven-point scale (very low to very high), or rank ordering. Simpler schemes lack granularity and do not allow for proper hierarchisation of responses, potentially leading to many ties. More complicated schemes compensate for that, at the expense of a higher cognitive load on respondents. Odd schemes (e.g. three-point or five-point scales) provide a middle value that can be overused for undecided respondents, while an even number of answers forces respondents to lean towards a more decisive score instead of a neutral one. Altogether, the proposed six-point scale, from 0 (not a priority) to 5 (top priority), offers a good tradeoff between the benefits in terms of differentiation and clear decision-making to identify top priorities, and the cost of decision fatigue for the respondent.
- **N/As:** Allow for no answer (N/A) vs. all answers required? We suggest to allow for the possibility to leave any item blank (i.e. not giving a score), and to have N/A as the default answer. In other words, giving a score would require an action from respondents, hence a active thought process. This should in part prevent from automatically answering items without paying too much attention. On top of that, that would allow a respondent that does not feel expert enough in an entire realm to simply skip it and go directly to the next question. To ensure that respondents do not skip by accident, there should always be the possibility to go back and forth in the survey, and a summary of all answers should be provided before final submission.
- **Survey audience:** Who do we send the survey to? Opinion will depend on personal vs. institutional. On the other hand, the context of the survey should be clear about which factors to consider in order to score biodiversity monitoring priorities (which is related to the supply-

[8] Interaction with ChatGPT specifically focused on 1) the wording to avoid ambiguities; 2) the scoring scale. The complete script with ChatGPT is available here: https://chatgpt.com/share/0bd902df-aba3-4331-8cba-700e71fe8187

[9] Note: Throughout this document, elements to be directly put in the survey are coloured in dark blue.

and-demand framework). See the next section on “Stratification” for suggestions on how to account for these considerations.

C) Lists of candidate priorities

While the list of candidate priorities themselves does not fall within the scope of this Concept note, the content of these lists was also briefly discussed, and suggestions on a potential approach on how to obtain it is presented here. We propose that the actual lists of items (candidate priorities) presented in the survey are discussed and decided *a priori* by ***ad hoc* expert groups** (possibly within Biodiversa+). Our suggestion is to bring together up to 20 experts per realm (marine/freshwater/terrestrial) from various organisations and countries (including, but not necessarily limited to Biodiversa+ partners). These expert groups will meet once for half a day, for a thematic workshop: they will first brainstorm on candidate priorities, then discuss and finally vote to establish a list of species or group of species, and a list of habitats/ecosystems (20 items maximum per list). These workshops will be organised and animated by Biodiversa+ ahead of the survey being made public.

During the Paris workshop, two other points were raised and were followed by a discussion about their inclusion in the survey:

1. Address both current and ideal priorities, as well as, short/medium/long term ones;
2. Mention processes, ecosystem services, and pressures

The discussions showed that both topics were not mature enough to be tackled explicitly through the survey. Experts groups which will deal with candidate priorities may include those in their discussions.

Importantly, each item in the list needs to be self-explanatory, or additional explanation needs to be easily accessible (for example with a mouseover). We advise to use predefined terms, e.g. from EU-approved dictionaries (such as EnvThes, a thesaurus for long term ecological research, monitoring and experiments[10]), to maintain consistency and ease understanding of the terms.

D) Stratification

The stratification process is a key methodological aspect of the survey, designed to enhance the understanding of the results by **acknowledging and accounting for the diversity within the respondents and identifying potential bias**. One of them being the respondent population: Ideally, the survey audience should be representative of the target population (users of biodiversity monitoring data and results). However, we must acknowledge that biases will exist for instance, based on their geographical location or organisation type. There are various ways to account for

[10] EnvThes - Thesaurus for long term ecological research, monitoring and experiments, on the eLTER vocabularies website: https://vocabs.lter-europe.net/envthes/en/

these biases (see next section "*Analysis*"), but critical information about them is necessary—and needs to be asked in the survey. To achieve effective stratification, the survey will include questions that allow respondents to self-identify accurately.

Two leading principles should guide the design of the survey when it comes to self-identification:

- **Length:** Keep the "self-identification" part of the survey concise to encourage completion, trying to reach a balance on the information to cognitive load ratio.
- **Clarity:** Explain the purpose of these stratification elements, to encourage completion (e.g. "To understand different perspectives and analyse the results without bias, we will ask about your background. Your answers will remain anonymous, although you can leave your contact details at the end of the survey for follow-up information.").

The following elements were suggested, with the fields considered mandatory marked with an asterisk (*):

- **Are you answering for yourself/organisation/country?* [unique choice]**

  - Self
  - Organisation
  - Country

    - **Organisation type**
      If responding on behalf of an organisation, the following elements are then requested: [all optional]

    1. Name of your organisation: [text field]

    2. Which sector is your organisation from? [unique choice]
    - Private
    - Public
    - Mixed

    3. Which kind of organisation is it? [unique choice]
    - NGO
    - Government
    - Academia/research institution
    - Professional association
    - Finance
    - Other: [text field]

    4. What is the geographical scope of your organisation? [multiple choice]
    - European or global
    - National
    - Sub-national

- **Working country* [unique choice]**
  Provide a scrolling list for respondents to select their working country.

- **Usage of biodiversity monitoring data and results* [multiple choice]**
  Please pick one or several uses of biodiversity monitoring data and results for your work among the following categories:

    - **Assessment**, which corresponds to the act of evaluating the biological state (status and/or trend) of species or habitats (such as IUCN red lists, or reporting for the Habitat Directive for instance), or the progress of action plans and public policies;
    - **Awareness**, which covers activities synthesising information to convey a message (communication) in order to mobilise society in a general sense;
    - **Management**, in all its dimensions: 1) *preventive*, i.e. efforts to minimise external influences on species, habitats and ecosystems through conservation and protection; 2) *corrective*, i.e. efforts to revert to a state of reference (to be defined) through manipulation such as restoration and rewilding; 3) *exploitative*, i.e. sustainable use of natural resources;
    - **Research**, whether it is the production of new and increasing knowledge and understanding the natural world, or the production of forecasts and scenarios;
    - **Economy & finance**, i.e. environmental perspective in the economic sector. This includes investment under green (or sustainable) finance, i.e. the comprehensive understanding of nature-related risks for companies and financial institutions, and effective strategies for managing them, as well as the assessment and improvement of corporate environmental performance.

    - ☐ Assessment
    - ☐ Awareness
    - ☐ Management
    - ☐ Research
    - ☐ Economy & finance
    - ☐ Other: [text field]

- **Realm(s) of expertise* [multiple choice]**
  Please pick one or several realms below that fall within your expertise (i.e. for which you feel comfortable sharing your knowledge and opinion in the context of this survey):

    - ☐ Marine
    - ☐ Freshwater
    - ☐ Terrestrial
    - ☐ Other: [text field]

The discussions also raised the following points about respondent's identification:

- **Anonymity:** Default to anonymity, unless respondents choose to share their contact details at the survey's conclusion for follow-up information (optional). However, regardless of this follow-up decision, the survey should provide information about how and where the final results will be made publicly available.

- **Additional fields**: Although answers may differ based on other elements such as age range or job experience, they were deemed not important enough to be included in the survey (and compensate for the time and privacy intrusion they represent).

E) Analysis

Analysing the results is fundamental as it enables the synthesis of data and brings out **patterns in the respondents' answers**. It is crucial to identify the intended audience (e.g. policy makers, Biodiversa+ partners, projects coordinators) and the rationale for the analysis (e.g. short- vs. long-term priorities) before beginning the process. Then, choosing the appropriate type of analysis, given the type of data, can be challenging, and different methods and tools are available. Further critical points include resources, i.e. who should actually carry out the analysis, under which funding, and the integration of AI-based services. In general, it is essential to construct an intuitive and reproducible workflow to guarantee that the work does not rely on a single individual and can instead be shared among interested partners.

• Analysis of closed questions

For simple closed questions as the ones we suggest in this survey, a **frequency analysis** is appropriate. To display results, a word cloud can be useful and effective if well done. However, as mentioned before, it is essential to consider (and account for) the potential biases in the responses, in order to have representative outcomes. Several factors can introduce bias (see previous section "*Stratification*"), including the distribution of responses by country. Indeed, larger countries, with larger biodiversity monitoring programs and communities, such as France, Germany, Spain, and Italy, may have a greater influence on the overall results. A possible solution would be to weight answers based on countries' area. Similarly, a weighted analysis can account for differences in the proportion of public vs. private organisations, or the type of organisations (e.g. governmental, NGO, research, etc.). Importantly, a minimum set of answers should be expected for each stratification (15–20).

Another aspect of frequency analysis is the identification of weak signals, i.e. answers that are not common enough to reach a consensus and be highlighted by their frequency, but are nonetheless relevant in terms of biodiversity monitoring priorisation. While important, this is not straightforward to analyse and will need further research. Analysis of dissensus can be considered, for instance focusing on standard deviation or other measures of spread of answers, in order to precisely highlight where dissensus lies.

• Analysis of free text

For free text instead (e.g. suggestions in comment boxes), it will be useful to analyse the answers with **text mining**, especially if the number of responses is high (making manual extraction of information tedious and time-consuming). A classical text mining approach works by first removing non-informative words (particles, pronouns, stop words, numbers, etc.), then goes through a process of lemmatisation (i.e. associate words to their dictionary form) before the words themselves can be analysed by various algorithms. Word relationships can also be analysed through text mining, which

can identify and process sequences of words (i.e. 2, 3, 4 consecutive words, also called *n*-grams), in order to highlight important information from more complex expressions. Text mining experts should be involved to carry out the analysis, for instance from the social sciences domain. It is important to consider if already developed tools are available, in order to avoid duplicating the effort.

- ### Resources

Since the survey has been planned to be run regularly, we need to determine the most efficient strategy on resource use and its administration to ensure long term success. Several potential approaches have been discussed;

- **Internal resource utilisation:** Assigning dedicated individuals within a working group, using the advantage of existing knowledge and expertise. This approach gives the opportunity of continuity and can rely on available budget and personnel. However increasing workload excessively within the group and avoiding overburdening members should be taken into consideration.
- **External expertise:** buying service from expertise on survey management can bring a fresh perspective on the survey process and it may improve response rates and data quality. While this option frees up internal resources for their core duties, it comes with additional budgetary considerations.
- **AI-supported approach:** The last few years have witnessed the rise of large language models (LLMs, e.g. ChatGPT) of increasingly high capacity, which are excellent at managing bodies of text. Free AI tools typically have limited capabilities, and data security must be considered. Paid AI options are available, but budget constraints need to be taken into account. Many tools and packages are available to run this kind of analysis and a decision has to be made if an all-in-one solution or different tools have to be used. An option would be the joint effort between data scientists and AI tools, which would ensure proper use of these powerful software.

F) Deployment strategy

The proposed survey aims at gathering valuable participant input to define priorities for future biodiversity monitoring efforts. We will express how their participation is crucial and their response will shape future development of the biodiversity monitoring landscape in Europe. For an engaging and straightforward experience and to encourage participation we will integrate several features. Participants will have the option to receive a personalised summary of their answers (if they choose to share their contact information) and for those who choose to remain anonymous, we will communicate where the results and outcome of the survey result will be publicly available. From the beginning a progress bar will inform the participant about completion status and estimated time remaining. The survey will be designed to be user-friendly, clear and concise, while still complete. Thus, while the wording of questions will remain simple and unambiguous to avoid confusion (see

section "*Wording of the main question*"), particular attention will be dedicated to their presentation in a clear context.

To guarantee that a representative set of answers is received, a suggestion is to perform a two-step distribution strategy aiming at maximising the number of respondents per category. The first step will be a broad communication campaign aiming at a wide diffusion, through Biodiversa+ and Partners' contacts. In a second step, targeted reminders will be sent, focusing on specific populations to ensure samples that are large enough across various categories (see section "*Stratification*" above). To achieve this, assigning a contact person per country or per Partner to directly reach their target group may help. Additionally, making it explicit in broad reminders which country/category/realm is still under-represented may favour participation of these target groups.

Following the lessons learned from the coffee-machine survey, it will also be important to conduct pilot testing beforehand to fine-tune the questions and highlight potential ambiguities. This will be an essential stage to ensure the survey is effective, by ensuring it is both comprehensive and concise.

Finally, the survey will be in accordance with the General Data Protection Regulation (GDPR) to guarantee privacy protection.

4 Conclusion and perspectives

We present in this document **guidelines and concrete recommendations for a survey-based methodology to define biodiversity monitoring priorities**. We propose an entire process, with repeated surveys through time, to update priorities and invest effort accordingly. The process is semi-directed with a structured survey (finite list of candidate priorities) to facilitate management and analysis of the responses. We recommend breaking down the survey into the three realms (marine/freshwater/terrestrial) and present a wording suggestion for the main questions. Finally, we discuss important considerations for the context and general information requested in the survey, as well as the analysis of the results.

A critical step not included in this Concept note is the actual priority revision process: Defining biodiversity monitoring priorities has already been done for Biodiversa+, at its inception in 2021, and revised a first time in 2023. In particular, we used **several deciding criteria**: 1) keep current priorities to the extent possible; 2) keep a manageable number of priorities; 3) contribute to better decision making; 4) focus on actionable priorities; 5) fill in monitoring gaps; 6) manifest a transnational perspective; 7) provide linkages to established initiatives; 8) emphasise Biodiversa+ added value. All criteria remain current, and should be carefully considered in the next revision. We refer to the report presenting the revision process and revised priorities for further details[11]. On top of that, we also need to identify gaps between pressing (short-term) and enduring (long-term) problems to invest effort and resources. Low-hanging fruits, with a direct return on investment, are obvious, but at the same time, there is a need to balance perspectives on the long term, and answer to the bigger picture.

One important consideration is the repetition of the survey as a first step for a continuous dialogue. Running the survey regularly (for instance every 2 to 4 years) will serve several purposes:

1. First and foremost, this update of priorities can **orient the biodiversity monitoring landscape towards relevant topics**. Huge efforts and funding are currently being invested in biodiversity monitoring, and a lot more is required to cover even the basic needs for data and results. Providing a dynamic framework for prioritising is essential to effectively meet the demands.

2. Second, the survey itself is dynamic, in the sense that open comments from one round will be used to feed the list of candidate priorities in the next round. This allows **the identification of emerging topics without much effort**, and in doing so, stay relevant with the demands of the community.

3. Third, the survey and its results can be used to **improve stakeholder engagement** for critical topics. In this sense, respondents become an essential part of the process, and not

[11] Basille M., Body G., Eggermont H., Mandon C. & Vihervaara P. (2023) Guidance note presenting shared goals/priorities for biodiversity monitoring within Biodiversa+. Biodiversa+ report. 21 p. URL: https://www.biodiversa.eu/wp-content/uploads/2023/06/D2.5-Priorities.pdf

only a commodity, allowing the respondent base to grow and become more engaged in this dialogue.

In the long run, such a survey could be a cornerstone of the European landscape of biodiversity monitoring. This work could promote a coordinated approach between national biodiversity monitoring coordination centres (nBMCCs) and the future European biodiversity observation coordination centre (EBOCC[12]), as well as thematic hubs, to establish and align their priorities. Ideally, even the management of the survey (through its successive iterations) could fall under the umbrella of EBOCC and become one of its fundamental missions.

[12] Liquete, C., Bormpoudakis, D., Maes, J., McCallum, I., Kissling, W.D., Brotons, L., Breeze, T.D., Ordóñez, A.M., Lumbierres, M., Friedrich, L., Herrando, S., Solheim, A.L., Fernández, M., Fernández, N., Hirsch, T., Carvalho, L., Vihervaara, P., Junker, J., Georgieva, I., Kühn, I., Grunsven, R.V., Lipsanen, A., Body, G., Goodson, H., Valdez, J.W., Bonn, A., Pereira H.M. (2024). EuropaBON D2.3 Proposal for an EU Biodiversity Observation Coordination Centre (EBOCC). 68 pp. https://doi.org/10.3897/arphapreprints.e128042

Appendix 1: Results of the 'uses' survey

Here are the detailed results of the uses survey, in which biodiversity experts were asked their community of interest, and then the following question:

"If you are involved in this community, how do you use biodiversity monitoring data and results? (please provide examples)"

In the following table, roles were assessed *a posteriori*, and not declared by the respondent. "A" stands for Assessor, "C" for Communicator, "M" for Manager, and "R" for Researcher.

Table 1: Result of the 'uses' survey

Community	Uses of biodiversity monitoring data and results	A	C	M	R
Algemene broedvogelmonitoring (ABV, monitoring of breeding birds in Belgium-Flanders)	Assessing the conservation status of species for reporting to the Birds Directive. Similar initiatives for the Habitats Directive	×			
The Biodiversity Section at Dept. for Ecoscience, Aarhus University	We use them to assess the status of Danish EU protected nature (NATURA2000) and report it to the Danish Environmental Protection Agency that then sends it to the EU. We also use them for doing various scientific studies to gain knowledge used in our consultancy with the Danish environment and nature related authorities	×			×
The Swedish Butterfly Monitoring Scheme	Compile EU, national, regional and local indicators, species trends using TRIM, work with red lists, use data with NGOs, authorities, researchers etc.	×	×		×
1. Biodiversity Monitoring South Tyrol (Italy); 2. Vielfalter (Austria); 3. Österreichisches Biodiversitätmonitoring ÖBM Kulturlandschaft	I use Biodiversity data for basic and applied research questions				×
Species and habitats	Occurrence data on species and habitats for landscape planning and case studies			×	
Vigie Nature	Focal point for STOC (French BBS)	×	×		
Marine mammals	For MSFD GES evaluation, Habitats Directive conservation status and OSPAR QSR	×			
Monitoring for the water framework directive	I am involved in developing tools (bioindicators) to assess the quality of water ecosystems using the monitoring data	×			×
Birdlife Slovakia, Raptor Protection of Slovakia, Slovak Bat Conservation Society	Data are used for local protection - underground spaces with bat colonies are secured or regularly monitored, around raptor nests are established buffer zones without forest management			×	
Israel's National Monitoring Programs for the Mediterranean and Red Seas.	I compare the results in the National monitoring program's reports to those of the compliance monitoring programs required as part of the discharge permits for marine	×		×	

Community	Uses of biodiversity monitoring data and results	A	C	M	R
	infrastructure				
Strict forest reserves monitoring network	Scientific papers (e.g. Käber et al., 2023, Journal of Ecology)				×
ORE DiaPFC - Environmental Research Observatory Diadromous fish in coastal rivers (https://diapfc.hub.inrae.fr/)	In my personal research in population ecology, I use data from long-term monitoring of diadromous fish populations produced by the ORE DiaPFC				×
Bird monitoring, European Butterfly Monitoring, European Dragonfly monitoring, ...	Trend calculation; European Red List of Odonata, European Biodiversity Indicators, etc.	×	×		
Executive Environment Agency (by law); Eligible organisations to feed information into the National System for Biodiversity Monitoring are: Regional Inspectorates for Environment and Water; National Parks Directorates; Basin Directorates; Executive Forestry Agency structures; Nature Parks Directorates; other public institutions, e.g. local authorities; Academy of Sciences; Universities; Non-governmental organisations; companies and organisations related to agriculture, fishing, hunting, gathering of medicinal plants, mushrooms, etc. and volunteers.	The data obtained from the monitoring is used to develop and update the National Prioritized Action Framework (art. 8 of the Habitats Directive), Natura 2000 sites management plans and other strategic documents, action plans, etc. related to the protection and restoration of biodiversity			×	
Nature, animals and climate change	It is used to support scientific research etc. and for the locals and indigenous themselves to track changes and register data	×			×
Hungarian Biodiversity Monitoring System	E.g. policy making, management planning, authorization, reports etc.	×		×	
Bird monitoring group - eBird Israel	We use data to map breeding ranges, and detect temporal trends. This information is used for species or habitat management plans	×		×	
Marine ecosystem, Gulf of Eilat (Red Sea)	This is data is reported to Israel's Ministry of Environmental Protection	×			
HAMAARAG - (bird, mammal, reptile, plants and arthropod monitoring community); Israel Nature and Parks Authority (mammal, bird, aquatic fauna and more monitoring community); Society for the Protection of Nature in Israel (urban wildlife monitoring community); Israel Center for Aquatic Ecology (freshwater arthropod monitoring community), Israel Lepidopterists' Society + Steinhardt Museum of Natural History (butterflies)	We use our data to produce a national assessment of the state of nature in Israel to enable knowledge and science-based management of Israel's open landscape and biodiversity	×		×	

Community	Uses of biodiversity monitoring data and results	A	C	M	R
Bird, Mammal, Herpetofauna and Butterfly monitoring communities	Data compilation to determine the patterns of abundance and distribution of species	×			
NEMP - National Environmental Monitoring Programme in Estonia is in action annually since 1994. In 1993 and 1994 I was developing and organising fieldwork in 7 animal groups within this programme.	Every year I get a contract from a government institution (Keskkonnaamet, in these days), do the fieldwork, present the report	×			
BirdLife Israel - the Society for Protection of Nature in Israel	Research and monitoring - We operate a national scheme of field studies to understand the status and trends of the birds of Israel, migratory, seasonal and resident. Our bird observatories form the backbone of our monitoring scheme that includes also many large-scale and local studies often in collaboration with other organisations and academic institutions, including Israel Nature and Parks Authority. Conservation action - We apply knowledge acquired by our monitoring scheme to promote better conservation of birds and their habitats, through advocacy and legal action, working with other branches of SPNI often through the national planning system, in collaboration with other organisations in Israel, including NGOs and government agencies. In recent years, habitat restoration has become a main area of activity, connecting with SPNI's climate action. from: https://www.birds.org.il/en/article/BirdLife-Israel	×	×	×	×
Sea Watch (The Blue Half) - The Society for the Protection of Nature in Israel (SPNI)	Developed Sea Watch, an app that empowers the public to improve the ecological state of Israel's oceans and rivers by sending real-time reports on a variety of maritime environmental incidents and hazards straight to SPNI. The reports are collected by an SPNI team that verifies the information and alerts the authority assigned to each case, whether that be the Israel Nature and Parks Authority, the Ministry of Environment Protection or the local municipality," "Some of the reports are even handled directly by SPNI experts with the help of volunteers."		×	×	
Jellyfish Project	Jellyfish Project is a citizen science project in which researchers and citizens join hands to improve the quality of life on Israel's beaches by reporting and monitoring the swarms of jellyfish on the beaches through a dedicated application. Its goals are to provide solutions in the form of a real-time forecast and warning about the approach of jellyfish swarms to our shores, quantification of the jellyfish in the swarms and dissemination of information such as ways to avoid jellyfish stings and dealing with them. The accumulated data is studied and analysed by the researchers in order to gain understanding and knowledge about the jellyfish - mysterious marine animals whose impact on our quality of life is high		×		×
Biotisches und Abiotisches Monitoring Schottersäulenwassermanagement March-Thaya	Feedback for the management of pumping stations, impact assessment	×			

Community	Uses of biodiversity monitoring data and results	A	C	M	R
Dung beetle species and community (national level, France)	Red listing, community analysis, modelling, conservation	×		×	×
Réseau National de suivi de la Température des plans d'eau (RNT PE): the network is at the National level (France) and focuses on in-situ high-frequency temperature measurements. Lakes are selected to enter the network based on their characteristics (elevation, depth, surface) but also the management and biodiversity stakes. Data are used to compute indicators, and eventually (when enough data will be available), to quantify potential warming trends. Data are also used to calibrate models and satellite data, both allowing for spatial and temporal extrapolation.	Data are made available through http://geo.ecla.inrae.fr/maps/acceuil-map#project and compute indicators, e.g., average summer temperature, number of days above xx°C		×		
(Global) biodiversity monitoring community, soil biodiversity monitoring community	Analysing/modelling trends in biodiversity in response to climate change and high N deposition				×
Biotope mapping for the Austrian federal provinces	Biodiversity evaluation. E.g.: Environmental impact assessments	×			
Insect monitoring (among others)	Projects (e.g. GeMonA+, ABOL)				×
Lacs Sentinelles: The Lacs Sentinelles Network is a consortium of actors working on French mountain lakes, formed in 2013. The network gathers managers from national parks and natural conservatory area, researchers from universities (in France and bordering countries) and public research institutions, local experts, resources managers, and users' representatives, such as fishing associations and municipalities. Lacs Sentinelles's mission is to create a long-term "mountain lakes observatory" to follow the response of mountain lakes ecosystems to global changes in the French territory. The observatory focuses on 30 lakes located above 1800 m a.s.l.	Data are used to communicate with the public and managers (e.g., press releases), as well as in research program (examples: Typology of phytoplankton communities according to lakes characteristics (in prep); Contribution to a study comparing zooplankton communities between fish and fishless mountain lakes in the French and Italian Alps (in prep); Thermal response of lakes to historical heat waves (e.g., 2022)). More information: https://www.lacs-sentinelles.org		×		×
Orthoptera community	Status assessment of species, Update of national species-list, Reevaluation of Red List of Threatened Species	×			
Executive Environment Agency, Organisations providing data to the National System for Biodiversity	The data is used to develop and update the National Prioritised Action Framework, Natura 2000 sites management plans, Protected areas management plans,			×	

Community	Uses of biodiversity monitoring data and results	A	C	M	R
Monitoring (Regional Inspectorates for Environment and Water; National Parks Directorates, Nature Parks Directorates, Basin Directorates; Executive Forestry Agency structures, other public institutions, e.g. local authorities, Academy of Sciences, Universities, Non-governmental organisations, companies and organisations related to agriculture, fishing, hunting, gathering of medicinal plants, mushrooms, etc. and volunteers.	action plans and other strategic documents, investment proposals related to the protection and restoration of biodiversity				
Bird monitoring community	I supply data from and use the various PECBMS outputs for education and communication with decision-makers and the public		×		
Butterfly monitoring	Butterfly monitoring data is used on producing species trends for producing butterfly indicators (forest/grassland/urban butterfly indicator)	×	×		
Butterfly monitoring	To produce butterfly indicators		×		
Observation.org Spain	See research paper: “Can Citizen Science Contribute to Avian Influenza Surveillance?” https://doi.org/10.3390/pathogens12091183		×		×
LifeWatch GPS bird tracking network	Monitoring of habitat use and migration behaviour				×
Marine ecosystem	Deposit in project and program databases and scientific publications production				×
Marine ecosystems biodiversity	For scientific research				×
Fungal biodiversity monitoring	I have published one paper on the effects of urban development on fungi				×
Forest and non-forest natural communities	Data is collected in a personal database, on the basis of which we publish research data in the form of scientific papers				×
The DIVERSITY OF EUKARYOTIC MICROORGANISMS research consortium	Data are published as part of research articles				×
Freshwater and marine photosynthetic biofilm (periphyton and microphytobenthos) - Rivers, estuary and coastal environments - Microorganism community of mangrove sediments	DCE (French - Water framework directive)	×			
Monitoring of the effectiveness of management and restoration measures	Crossing management information and biodiversity monitoring data in order to define if management is useful or not to improve biodiversity conservation state	×		×	

Community	Uses of biodiversity monitoring data and results	A	C	M	R
Seabirds	Collective work to establish indicators, protocol, list of species to be monitored		×		×
Marine Benthic Habitat French monitoring community	Globally in France, OSPAR Benthic Habitat Assessments are used (when possible) for MSFD	×			
Benthic French monitoring	Research, Reporting to Europe, ecological monitoring	×			×
Aquatic fungi biodiversity monitoring	Mapping species distributions, developing novel biodiversity monitoring approaches, raising awareness		×		×
DNA-barcoding & metabarcoding community	Trying to establish protocols for long-term monitoring				×
iBOL - international Barcode of Life	We are still in preliminary stages, but the plan is to use these data to monitor biodiversity (richness, biomass) changes through time , to compare across sites, to detect species of interest (invasive/pests/conservation status, etc.)	×			×
Réseau 500 ENI (France)	Biodiversity monitoring in 500 ENI is expected to improve our understanding of the unintended effects of agricultural practices, including pesticide use, on biodiversity represented by several taxonomic groups of interest for farmers. See Andrade et al, 2021				×
Suivi Photographique des Insectes Pollinisateurs	The data are used for research in ecology, human sciences and is foreseen to be used to produce biodiversity indicators				×
The Nature and Parks Authority (NPA) "Bioblitz" monitoring program of marine nature reserves	I use the data for writing expert-opinion reports for planning committees and for promoting additional marine nature reserves		×	×	
Multi-taxon forest biodiversity studies	Scientific papers				×
Bats	I have used bat monitoring data in some presentations, articles and books since 1994. Many of those you can easily find on the web, even films on YouTube		×		×
	Research in plant biogeography, distribution modelling, finding actual localities of taxa needed for research, teaching biodiversity & nature conservation - nothing is more valuable for research and future challenges than high quality biodiversity data		×		×
The salamander project - The Society for the Protection of Nature in Israel (SPNI)	The salamander project includes data collection in surveys Nights by volunteers, collecting observations by residents and travellers (citizen science) and educational and outreach activities. The goal of the project is to preserve the salamander populations in the urban nature of Haifa, by expanding the knowledge about these populations, the maintenance of habitats, the participation of residents in activities and raising of awareness of salamanders. In addition, we collect observations of salamanders in their habitats in northern Israel		×	×	

Community	Uses of biodiversity monitoring data and results	A	C	M	R
Sharks in Israel	By utilising established social media apps, we eliminate the need for additional installations, making it effortlessly convenient for everyone to participate while maintaining an organic and lasting connection with our community. We are dedicated to motivating and inspiring our community members by sharing research findings, educating about local species, and providing a reliable platform for information. Our goal is to foster a sense of belonging, where every individual feels part of something greater and is strongly connected to the remarkable marine ecosystem of the Mediterranean Sea. Through our network of local chapters and unified collaboration, we continuously gather valuable data and insights about elasmobranchs across the Mediterranean. In partnership with esteemed organisations such as the EEA, WWF, and the IUCN Shark Specialist Group, our project's data contributes to global and regional research efforts, driving science-based conservation policies		×		×
Pelagic biology monitoring	National and Baltic sea status of Good Environmental Status (GES)	×			
LifeWatch camera trap network: monitoring of habitat use and migration behaviour	Abundance modelling, presence of species	×			×
Freshwater biodiversity of all taxonomic groups	Mobilising datasets, filling geographic and cultural gaps in biodiversity monitoring, connecting biodiversity researchers and practitioners across the globe, contributing to the development of biodiversity monitoring concepts		×		×
REBENT, EU Water Framework Directive, EU Marine Strategy Framework Directive	Research, EU reporting	×			×

Appendix 2: Results of the 'coffee-machine' survey

Here are the detailed results of the coffee-machine survey, in which biodiversity experts were asked the following question:

"*If you were in charge of biodiversity monitoring, what should be in your opinion the priority subjects of monitoring? Rank the first three.*"

The role was selected by the surveyor, who was part of the Biodiversa+ Working Group on Biodiversity monitoring priorities. One or several roles could be chosen within "Assessor", "Communicator", "Manager", "Researcher" (note that the realm was not requested, but some surveyors chose to communicate it).

Table 2: Results of the 'coffee-machine' survey

Role	Answers
Assessor	1. Species populations trends and distributions 2. Habitats evolution and distributions 3. Intraspecific diversity (population level)
	1. Ecosystem services and supply 2. Soil biodiversity and land use 3. Ecosystem services outside Natura 2000 areas and habitats
	1. Habitats, ecosystems 2. Common species 3. Protected areas
	1. Changes in landscape/land use 2. Marine biodiversity and habitats
	1. Genetic monitoring 2. Freshwater (rivers) biodiversity
	1. Habitats 2. Marine biodiversity 3. Soil biodiversity
	1. Invasive species 2. Invertebrates 3. Common species
	1. Protected areas and objectives 2. Common species
Assessor (freshwater)	1. Ranunculion fluitantis and Callitricho-Batrachion in watercourses 2. Mediterranean temporary ponds 3. Amphibious habitats
Assessor (marine)	1. Posidonia meadows 2. Reefs 3. Sands and muds

Role	Answers
Assessor (terrestrial)	1. Steppe grasslands 2. Rocky pastures and dry grasslands of the eu- and stenomediterranean 3. Alluvial forests
Communicator	1. Habitats 2. Soil biodiversity 3. Genetic monitoring
	1. Invasive species 2. Common species 3. Biodiversity of the agricultural land
Communicator (freshwater)	1. Ponds 2. Tufa 3. Groundwater
Communicator (marine)	1. Posidonia meadows 2. Reefs 3. Infralittoral sands
Communicator (terrestrial)	1. Grasslands 2. Hasmophytic vegetation 3. Forests – primeval forests, forests of deep ravines
Manager	1. Assessment of agroecological measures on biodiversity in and around agricultural parcels (all taxa) 2. Collect hunting bag statistics (abundance, sex ratio and age whenever possible) to assess hunting sustainability 3. Identify areas most sensitive to global change and intensify biodiversity monitoring in these areas and retreat areas to understand habitat change and species responses
	1. Urban biodiversity 2. Decline of invertebrates 3. Mountain biodiversity
	1. Habitat 2. Species 3. Pressures
	1. Implementation of natural environment monitoring networks, covering compartments such as groundwater, surface water, soil, and air 2. Monitoring biodiversity (species and vegetation) and abiotic components 3. Climate-related components, such as heat (related to leaf damage) and exotic species
	1. Monitoring the distribution and abundance of species (fauna and flora) listed as priorities in the Habitats Directive 2. Monitoring the distribution and abundance of invasive fauna and flora species; 3. Monitoring the impacts of tourism on species and habitats (whale watching activities and trails in protected areas)
	1. Vegetation cover percentage, including species richness 2. Water quality

Role	Answers
	3. Abundance of Invasive alien species (map distribution) 4. Survival rate of planted endemic species 5. Habitat connectivity 6. Economic benefits (evaluate the economic benefits derived from restored habitats or cost savings from ecosystem services like flood control or water supply) 7. Carbon sequestration rate (quantify the amount of carbon dioxide absorbed by vegetation and peatlands) 8. Education and awareness: number of educational programs, volunteering actions, workshops or outreach events related to habitat restoration and endemic species conservation).
	1. Freshwater (rivers) biodiversity
Manager (freshwater)	1. Wetland birds 2. Invasive alien species (animals and plants) 3. Succession progression of stagnant waters Manager (terrestrial) 1. Flora (orchids) of dry hill grasslands in the context of monitoring applied management options (effectiveness) 2. Succession stages of grasslands correlated with the appearance of different flora species 3. Ecological state of urban forests (morphology, canopy cover, veteran trees, deadwood, key groups such as fungi, cavity-nesting birds, saproxylic organisms…)
Researcher	1. Soil microfauna 2. Small mammals 3. Ponds (number and biodiversity)
	1. Methods (standards) 2. Funds 3. Variables
	1. Getting tools (cameras, traps etc.) 2. How to collect data 3. Sampling exchange policy between partners (in different countries)
	1. Effect assessment 2. Knowledge about permission at local, national and international level (sampling permissions) 3. Standards (monitoring protocols)
	1. Canopy algae cover (*Fucus spiralis* and *Gongrolaria abies-marina*) 2. Limpet abundance 3. Benthic predatory fish (e.g. *Serranus atricauda*) 4. Urchin abundance 5. Spread of non-native species 6. Megabalanus abundance
	1. Bats and changing methods that could be used more widely 2. Common species 3. Insects

Role	Answers
Assessor/Researcher	1. Land cover change monitoring (using Remote Sensing) 2. Invasive Alien Species monitoring (using a mixed Remote Sensing and Fieldwork methodological approach) 3. Species Richness and Diversity monitoring (using fieldwork)
	1. Common species
	1. Common species 2. Complex monitoring 3. Changes in landscapes/land use
	1. Taxonomically and geographically representative monitoring of species diversity and abundance 2. Habitat availability and quality 3. Abundance and quality of microhabitats
Assessor/Researcher (freshwater)	1. Species highly sensitive to interventions (coastal and shoal species) 2. Species highly sensitive to habitat succession 3. Common species
	1. Implementation of marsh bird monitoring programs (carp ponds, natural marshes, coastal marshes, saltpans) 2. Monitoring of marsh harrier (once every six years)
Assessor/Researcher (marine)	1. Species highly sensitive to interventions in habitats (fish-feeding species) 2. Mortality due to fishery gear 3. State of fish stock
	1. Monitoring of Procellaridae and monitoring of rat eradication measures 2. Monitoring of Shag 3. Monitoring of terns and gulls
Assessor/Researcher (terrestrial)	1. Species highly sensitive to interventions (raptors, migratory species) 2. Species highly sensitive to habitat succession 3. Common species
Communicator/Manager	1. Standardised monitoring of habitat types at a sufficiently general level 2. Monitoring (and modelling) of the state of ecosystems and ecosystem services 3. Monitoring of key species to support habitat and ecosystem monitoring
	1. Development of molecular species detection methods 2. Preparation of comprehensive DNA-barcode species library 3. Implementation of e-DNA in routine monitoring
Communicator/Researcher	1. Representatively stratified monitoring design 2. Detecting true absence in addition to presence 3. Assessing/observing abundance in addition to presence/absence