Project BIOLAWEB

Deliverable D3.3

Learning and teaching material

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Deliverable summary

Deliverable D3.3 summarizes the learning and teaching material linked with workshops and training held within WP3 – Training and networking of the BIOLAWEB project. Learning and teaching material was used to support the educational process by helping researchers and students understand new metabarcoding methods, analyses of eDNA, and the development of ecological status indicators that are in accordance with the demands of the EU Water Framework Directive. Learning and teaching material are available at UB-ICTM repositories – CER (https://cer.ihtm.bg.ac.rs/handle/123456789/7506).

INRAE and NIVA experts led the preparation of learning and teaching material. UB-ICTM was responsible for compiling this report.

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1. Introduction

Within the framework of the WP3 – Training and networking, several trainings/workshops were implemented, which were attended by researchers and students from the University of Belgrade, Institute of Chemistry, Technology and Metallurgy – the National Institute of the Republic of Serbia (UB-ICTM) as well as from various institutes and faculties in Serbia and beyond.

The trainings of the BIOLAWEB project had the goal of training researchers and students:

- in the development of status indicators that are in accordance with the demands of the EU Water Framework Directive;
- in the application of metabarcoding and the sampling and analyses of eDNA;
- in developing new methods for ecological status assessment.

In this deliverable, we summarize the learning and teaching materials prepared by our partners from the French National Institute for Food, Agriculture, and Environment (INRAE) and the Norwegian Institute for Water Research (NIVA), which can help all workshop participants to refresh their knowledge and apply it in their work.

Learning and teaching materials are available at UB-ICTM repositories – CER (https://cer.ihtm.bg.ac.rs/handle/123456789/7506).

2. Workshop on index development

Dr Susanne C. Schneider from NIVA gave an introductory lecture during an online part of the workshop on index development titled "Introduction to Bioindication" in April 2023 (Subtask 3.1.1). The second part of the workshop took place in May 2023 at the UB-ICTM in Belgrade. The workshops were focused on the fundamental principles of bioindication, along with practical examples and case studies.

Learning and teaching materials from this workshop include three presentations:

1. Introduction to bioindication - part 1 – Dr Susanne C. Schneider
2. Introduction to bioindication - part 2 – Dr Susanne C. Schneider
3. Introduction to bioindication - part 3 – Dr Susanne C. Schneider

3. The first workshop – Metabarcoding of diatoms and phytoplankton for biomonitoring

The first workshop on the topic "Metabarcoding of diatoms and phytoplankton for biomonitoring" was held in March 2023 at the UB-ICTM (Subtask 3.2.1).

The workshop was led by scientists from the French National Institute for Food, Agriculture and Environment (INRAE): Dr Clarisse Lemonnier, Dr Frédéric Rimet, Dr Agnès Bouchez, and Dr Benjamin Alric, the leading experts in the field of metabarcoding for biomonitoring.

Learning and teaching materials from this workshop include 15 presentations:

1. General introduction to barcoding and metabarcoding – Dr Agnès Bouchez

2. Metabarcoding, main steps - part 1 – Dr Clarisse Lemonnier
3. Metabarcoding, main steps - part 2 – Dr Clarisse Lemonnier
4. Diatom metabarcoding for biomonitoring - part 1 – Dr Frédéric Rimet
5. Diatom metabarcoding for biomonitoring - part 2 – Dr Frédéric Rimet
6. Diatoms metabarcoding: Preservation and Storage - part 2 – Dr Agnès Bouchez
7. Diatom metabarcoding for biomonitoring - part 3 – Dr Frédéric Rimet
8. Diatom metabarcoding for biomonitoring - part 4 – Dr Frédéric Rimet
9. Diatoms metabarcoding: Intercalibration - part 4 – Dr Agnès Bouchez
10. Phytoplankton for biomonitoring reminders - part 1 – Dr Frédéric Rimet
11. Phytoplankton metabarcoding for biomonitoring - part 2 and 3 – Dr Clarisse Lemonnier
12. Phytoplankton metabarcoding for biomonitoring - part 4 – Dr Benjamin Alric
13. Technology transfer - part 1 – Dr Agnès Bouchez
14. Technology transfer - part 2 – Dr Frédéric Rimet
15. Skills evaluation

4. The second workshop – R programme

The second workshop regarding the use of diatom and phytoplankton metabarcoding data for biomonitoring and ecological studies, titled “Data processing, normalization of data (R programme with examples and R codes)” was organized in October 2023 at the UB-ICTM in Belgrade within the BgF Summer School (Subtask 3.2.2). Participants had the privilege of gaining valuable knowledge about state-of-the-art methods of processing sequences to obtain different community data (e.g., taxonomic composition, alpha and beta diversity, eco-phylogenetic analyses, etc.).

The workshop was led by scientists from INRAE: Dr Clarisse Lemonnier, Dr Frédéric Rimet, and Dr Benjamin Alric.

Learning and teaching materials from this workshop include five presentations:

1. Diatom metabarcoding for biomonitoring and for basic ecology – Dr Frederic Rimet
2. Ecological analysis of metabarcoding data - Introduction to R – Dr Claris Lemonier
3. Ecological analysis of metabarcoding data - Data preparation – Dr Claris Lemonier
4. Ecological analysis of metabarcoding data - Beta diversity – Dr Benjamin Alric
5. Use of phylogenies in ecology – Dr Frederic Rimet

5. Virtual training – Bioinformatics

The Virtual Training “Bioinformatics” was held onsite and online at the UB-ICTM in May–June 2024 (Subtask 3.2.4). During the training, participants learned the principles of the DADA2 pipeline and how to process DNA reads to get an amplicon sequence variant (ASV) table.

Dr Clarisse Lemonnier, an expert from the INRAE, led the training. Dr Frederic Rimet, Dr Benjamin Alric, Dr Benoît Paix, and Dr Antonija Kulaš provided technical support during the training.

Learning and teaching materials from this workshop include three presentations:

1. Bioinformatic analysis of metabarcoding data - DADA2 pipeline - Introduction to R
2. Bioinformatic analysis of metabarcoding data - DADA2 pipeline - Theoretical part

3. Bioinformatic analysis of metabarcoding data - DADA2 pipeline - Practical part

6. The first eDNA workshop

The workshop “Metabarcoding of macrophytes for biomonitoring” was organized in October 2023 as a part of the Blue Green Future (BgF) Summer school at the UB-ICTM in Belgrade (Subtask 3.3.1). Dr Andreas Ballot, NIVA’s scientist, gave several presentations and covered the following topics: an introduction to aquatic macrophytes, an introduction to field sampling of eDNA from aquatic macrophytes, an introduction to DNA isolation, PCR preparation, and (meta)barcoding analysis.

Learning and teaching materials from this workshop include five presentations:

1. Aquatic macrophytes – Dr Andreas Ballot
2. Sampling of aquatic macrophytes – Dr Andreas Ballot
3. Metabarcoding of macrophytes - General introduction DNA – Dr Andreas Ballot
4. DNA extraction – Dr Andreas Ballot
5. Barcoding Metabarcoding – Dr Andreas Ballot