Blue-Cloud Hackathon Winners
Final Report
Please answer the following questions as best as you can

Team Name: AqADAPT
Team Participant: Ines Haberle; Domagoj Hackenberger Kutuzović; Tamara Đerđ; Branimir Hackenberger Kutuzović; Bruno Ćaleta; Marija Purgar; Damir Kapetanović; Jadranka Pečar Ilić; Nina Marn; Tin Klanjšček
Project Name: PerfeCt – Performance of aquaculture under Climate change
Submission date of this report: 02/09/2022

About your project

1. **About the team:** Describe your affiliation and/or research community and research domain? (max. 50 words)

> The team consists of collaborating scientists from Ruđer Bošković Institute in Zagreb and Department of Biology at the University of Osijek, Croatia. The project brought together experts in (marine) biology, oceanology, microbiology, ICT and software development, at different stages of their career: from PhD students to senior scientists.

2. **Project summary and milestones/tasks** that have been completed (max. 300 words)

> Project PerfeCt was initiated as an idea of creating a geospatial web application to forecast the effects of climate change on aquaculture, specifically three key aquaculture performance factors: food conversion ratio, time-to-market, and risk of disease (vibriosis). The application is targeted to everyone interested in aquaculture farming, distribution, and decision-making processes, with the focus on environmental risk assessors, policymakers, aquaculture farmers, and general public. It aims to provide information necessary to strengthen investor confidence and support development of smart policies.
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> Four milestones were planned in the post-Hackaton development roadmap, and all have been reached: (i) additional user inputs, (ii) refinement (additional scenarios, increase in resolution), (iii) improved model for Vibriosis, and (iv) user feedback. After the initial user feedback immediately following the Hackathon, user inputs have been expanded to include selections of a reference year, time period for hind-/forecasts, and the feeding intensity. Application (currently available at http://perfect-demo.ddns.net/login) has been refined by including additional climate change scenarios (SSP), and increasing resolution with additional depths. *Vibrio* model was improved as a result of a thorough comparison and evaluation of published *Vibrio* growth models; this resulted in a publication (Purgar et al. 2022, 10.3390/microorganisms10091765). Baranyi model gave best

predictions for aquaculture habitats, and has therefore been implemented into the platform; we are trying to improve the model further by using machine learning. User feedback is gathered continuously, with two major occasions: immediately after the Hackathon (most suggestions already implemented), and after the online presentation event with key stakeholders held on 29th August 2022. We are monitoring user activity in the app, and there is also an online form for user feedback (https://tinyurl.com/perfect-demo-survey).

Workshops with IMEC representatives in April and September 2022 helped us to identify primary users – environmental consultancy agents and aquaculture technologists – and summarize the long term vision of the project.

3. **Challenges**: Describe the particular scientific, technical, research or business challenges that you faced. Describe deviations from the initial project plans (max. 100 words)

All planned post-Hackathon milestones for the 6-month period have been reached. Development of the *Vibrio* growth model was challenging, due to extensive literature review needed to explore, systematize, and analyse the performance of existing models. Another challenge was organizing the meetings with the stakeholders and primary users, and acquiring their feedback (due to scheduling conflicts and preoccupations), however the promotion event that we held on 29th of August 2022 helped overcome this setback.

The benefit of Blue-Cloud

4. **Blue-Cloud Relevant Outputs.** Summarise how your work is relevant in the context of Blue-Cloud e.g as a user how you leveraged Blue-Cloud outputs and results and the Open Science platform around 100 words)

Our application relies on a range of different types of open-source data. While some data (e.g. Copernicus temperature) was already available through Blue-Cloud, our project contributed by bringing new data on locations of fish farms and MPAs – available up to that point only through Croatian governmental repositories – and putting them available through Blue-Cloud to broader audience. We also integrated the 'Add-my-pet database' containing parameters of dynamic energy budget (DEB) models for more than 900 fish (and more than 3300 animal species overall). Another contribution is that the code underlying our application, containing equations for both fish DEB and *Vibrio* growth models, was made freely available through Blue-Cloud, making it accessible to anyone interested in exploring, re-using, or expanding the code.

5. **User feedback**. Please provide your user feedback on the services provided by Blue-Cloud (around 100 words)

The general Blue-Cloud user experience was very positive. The organisation of the user interface into dashboard, workspace and catalogue offers an easy way to navigate between searching and using available services, whether to access, store or analyse data. The JupyterHub is well optimized to receive new coding, and offers array of preinstalled packages facilitating the overall coding process. The workspace allows for sharing data and code with others, making it very useful for collaborations. The DDAS proved very useful in searching and retrieving marine data of interest. Overall, we have only a minor suggestion: a single sign-in procedure that would accommodate the access to the Blue-Cloud Getaway and the DDAS at once.

6. **Benefits:** Please describe the main benefits obtained through the use of the Blue-Cloud resources and who benefits from it. (around 100 words)

> Although the main Blue-Cloud VLab is not intended for large-scale processing, one has enough resources to store and run the code without the need for own hardware resources. This allows both experienced coders and beginners to develop and test scripts without any additional hardware and software investments. The possibility to create a shared workspace was of great importance to us, because we could easily work on the same project from multiple locations.

7. **Tips & Tricks:** Did you consult any Blue-Cloud training resources or sessions? Do you have any tips & tricks for potential users of the Blue-Cloud resource you used? (max. 50 words) (optional)

8. **Limitations and future improvement**: What additional features would you like to see in the next version of the resource you used? (max. 50 words) (optional)

> Single sign-in for multiple platform access.

Outreach & Impact

9. **Outreach activities/events:** Did you participate in and or organise any outreach activities? Please provide information about the event, the participants and numbers and links. Are there resources produced that can be reused (no limits)

> Together with other winning teams, our team participated in the *'Ocean Decade Laboratory - An Accessible Ocean'* satellite event, and the *'EU Green Week 2022 partner event - Digital solutions for a sustainable blue economy'*, where we presented the purpose and functionality of our application. Additionally, we participated in a science popularization event 'IRB Open days' at Ruđer Bošković Institute, Zagreb, Croatia, where approximately 500 students were introduced to our application, and to the benefits of the Blue-Cloud in our research.
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> Articles about the Blue-Cloud Hackathon and our team's success has been published in two public outputs: the RBI newsletter ([link to the web news](#)) and in a regional newspapers *Glas Slavonije* ([link](#); in Croatian).
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> As a part of the Blue-Cloud award contract, we organized an online outreach event on 29th of August 2022 where we presented evolved version of our platform and promoted the Blue-Cloud initiative and its services to interested stakeholders and general public. The participants had the opportunity to meet up and discuss with the team members, learn more about the platform and see the live demonstration of how to use it. All participants were also invited to test the platform at their own pace, and fill in a short survey to give their honest feedback. There were in total 19 participants attending, including people from the largest Croatian aquaculture farms (Kornat-Ittica and Cromaris), private institute (Oikon), three universities (Zadar, Osijek, Zagreb), and the Ruđer Bošković Institute. The event included a demonstration of the tool, which helped our project to gain visibility, but also enabled us to gather valuable feedback.
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> The recording of the event can be accessed at the AqADAPT YouTube channel (https://www.youtube.com/channel/UCPurELVskX-DMiH3r3mO2sg ; direct video link: https://www.youtube.com/watch?v=w60gv_iNhDc)

10. Impact: What is the impact of your project (activities/outcomes, etc.) for your team and institute? What is the impact for scientists, citizen scientists, government bodies and industries, and the public? (around 200 words)

The members of AqADAPT team are all scientists regularly collaborating on research and solutions that promote and support sustainable development. In the case of Blue-Cloud Hackathon, we again came together to work on the project PerfeCt, actualizing old and developing new ideas focused on supporting a sustainable aquaculture. The project, especially after being recognized as a winning one by the Blue-Cloud, contributed to wide visibility of our work and affiliated organizations, and the associated funds will help us develop the concept further.

The visibility to the general public is very important because the transparency and positive outputs of our scientific work are crucial to raise the overall confidence in science, including the results, advice and solutions it provides. Visibility to science-funding agencies (and the Blue-Cloud funds) also help in maintaining the funding for high quality research. Indeed, a manuscript emanating from this work has already been published (Purgar et al. 2022, DOI: 10.3390/microorganisms10091765). Lastly, the contact with FAO, as well as with aquaculture industries gained throughout this project, contributes towards making our research more focused and applicable, but also towards recognizing the value of our research and promoting its practical use. User feedback gathered during and after the online presentation event suggests current application is great for large-scale and long-term planning, but farmers would like to see additional features for day-to-day operations, giving us a clear direction for potential future application developments and refinement.