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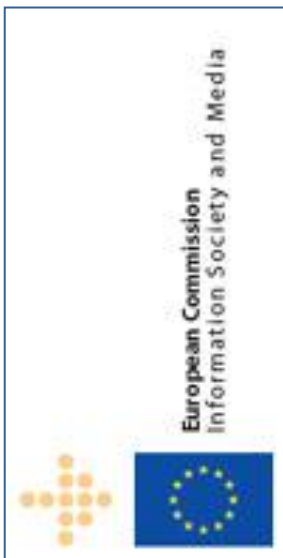
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# GLOSSARY

ABBREVIATION	DEFINITION
CoP	Community of Practice.
EBIAT	Earnings Before Interest Alter Taxes – an aquaculture investment indicator.
EBITDA	Earnings Before Interest, Taxes, Depreciation and Amortization – an aquaculture investment indicator.
FCR	Feed Conversion Rate – an aquaculture performance indicator.
GPD	Growth Rate per Day – an aquaculture performance indicator.
IRR	Internale Rate of Return – an aquaculture investment indicator.
LTD	Life To Date – a qualifier for aquaculture performance indicators, e.g. LTD SGR.
MR	Mortality Rate – an aquaculture performance indicator.
NPV	Net Present Value – an aquaculture investment indicator.
SFR	Suggested Feeding Rate – an aquaculture performance indicator.
SGR	Specific Growth Rate – an aquaculture performance indicator.
Virtual Laboratory	A VRE conceived to serve the needs arising in a specific research question and/or in a given region / area and /or in a given Community of Practice.
VLab	Virtual Laboratory.
VRE	Virtual Research Environment.
WP	Work Package.
Virtual Research Environment	An innovative, web-based, community-oriented, comprehensive, flexible, and secure working environment conceived to serve the needs of a given community engaged in a (research) task.

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# DELIVERABLE SUMMARY

Virtual Research Environments and Virtual Laboratories are among the key products the BlueBRIDGE project is called to develop and to deliver to serve its target communities and application scenarios. The deployment and operation of a Virtual Research Environment is a task that involves the reuse of existing technologies as well as the development of new technologies aiming at offering new facilities. The development of the technology, both the generic as well as that which is oriented to serve the specific needs of a given community/target scenario, is captured by other deliverables. This report describes the activities performed to provide the BlueBRIDGE community with the set of Virtual Research Environments (VREs) and Virtual Laboratories (VLabs) hosted by the BlueBRIDGE portal from September 2015 to November 2016. A total of 38 VREs \ VLabs have been deployed and operated, overall serving more than 1500 users across 22 countries. This requested to deal with approximately 600 tickets (32 tickets for VRE creation\update, 244 requests for support, 315 requests for incidents and bugs).

# EXECUTIVE SUMMARY

Virtual Research Environments (VREs) and Virtual Laboratories (VLabs) are “systems” specifically conceived to provide their users with a web-based set of facilities (including services, data and computational facilities) to accomplish a set of tasks by dynamically relying on the underlying infrastructure. VREs and VLabs are among the key products to be developed and delivered by the BlueBRIDGE project to support the target communities and application scenarios, namely *Blue Assessment*, i.e., supporting the collaborative production of scientific knowledge required for assessing the status of fish stocks and producing a global record of stocks and fisheries; *Blue Economy*, i.e., supporting the production of scientific knowledge for analysing socio-economic performance in aquaculture; *Blue Environment*, i.e., supporting the production of scientific knowledge for fisheries & habitat degradation monitoring; and, *Blue Skills*, i.e., boosting education and knowledge bridging between research and innovation in the area of protection and management of marine resources, giving them a new volume and thematic and geographical reach.

From the development and operation perspective there is no major difference between VREs and VLabs, they are based on the same enabling technology and are governed by the same procedures and policies. The rationale leading to name them differently results from the willingness to highlight their diversity in scope. VREs are devised to serve larger communities and cases than VLabs. In essence, VREs are dedicated to discussing and developing various approaches and solutions to be applied to concrete cases and scenarios. VLabs are devised to serve specific communities and practitioners confronting a given research question.

The development of VREs and VLabs is based on three main activities: (i) the development of software artefacts that realise a set of functions (including those needed for accessing certain datasets), (ii) the deployment of these artefacts in an operational infrastructure, and (iii) the final deployment and operation of well-defined Virtual Research Environments and Virtual Laboratories by exploiting the facilities offered by the deployed infrastructure and its services.

This report documents the last of the above three activities – i.e. the exploitation of the services and technologies offered by the underlying infrastructure to serve the needs of defined scenarios – as implemented in the context of the BlueBRIDGE project from September 2015 to November 2016.

As of November 2016, **12 VREs and 26 VLabs** were created and operated<sup>1</sup>. In particular, the following 9 VREs / VLabs were inherited from iMarine<sup>2</sup>: [Bay of Bengale Large Marine Ecosystem Hilsa Assessment WG VRE](#) was deployed to provide the members of the Hilsa Assessment Working Group<sup>3</sup> with a working environment giving access to data and technical information for this fish species stock assessment; [BiodiversityLab](#) was deployed to support the needs of scholars willing to perform experiments (e.g. species distribution maps production, species data inspection) on single individuals or groups of marine species; [BiOnym](#) was deployed to provide scientists dealing with species names with a service (ByOnym) to compare a set of scientific names against taxonomic reference lists including recognised ones; [FAO Tuna Atlas](#) was deployed to offer facilities for harmonising and standardizing multiple data source on tuna and bill-fish catches to feed 2 FAO tools: the Atlas of Tuna and Billfish Catches, the global tuna catches by stock; [iSearch](#) was deployed to provide its users with information retrieval and semantic web facilities for seamlessly discovering information objects from heterogeneous data sources; [Scalable Data Mining](#) was deployed to provide its users with a rich array of ready-to-use data analytics methods including niche modelling, supervised machine learning workflows, Bayesian models; [Tabular Data Lab](#) was deployed to provide its users with a working environment supporting the management of tabular data, i.e. to import, curate, analyse, visualize and publish tabular data resources

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<sup>1</sup> As of November 2016, 7 out of these 38 VREs \ VLabs are in *available* status only, i.e. these VREs \ VLabs are up and running and ready to be validated by the VRE designer: Alieia VRE, Ellinika Psaria VRE, Forky's VRE, Global Record of Stocks and Fisheries, GRSF Admin, ICES Training Course on Management Strategy Evaluation (ICES\_MSE).

<sup>2</sup> <http://www.i-marine.eu>

<sup>3</sup> The WG is convened on an ad-hoc base. The group counts some 15 members and is led by a consultant contracted through the BOB-LME project. Currently the project is awaiting approval of its second phase.

in a collaborative way; [Vulnerable Marine Ecosystem \(VME\) DB](#) was deployed to support the development and storage of Fact Sheets on VMEs; [WECAFC-FIRMS](#) was deployed to support national data collection and regional data sharing through FIRMS to support priority regional fishery management plans in the WECAFC area. During the first 15 months of the project, these VREs / VLabs have been updated to rely on the latest services and facilities resulting from BlueBRIDGE developments. Among the enhancements, worth to cite the new version of the data analytics framework and its support for Open Science practices, the enhanced version of the geospatial data catalogue, the new product catalogue as well as the enhancements for collaboration and communication based on social networking.

The following 29 VREs / VLabs were original creation of the BlueBRIDGE project.

In particular, the following 5 originates from the *Blue Assessment* domain: [Global Record of Stocks and Fisheries \(GRSF\)](#) was deployed to provide its users with unified access to authoritative stocks and fisheries records resulting from the aggregation of data from multiple sources performed by the GRSF Admin VRE; [GRSF Admin](#) was deployed to support the production of the authoritative stocks and fisheries records populating the GRSF VRE; [ICCAT \(ICCAT BFT-E\)](#) was deployed to provide the International Commission for the Conservation of Atlantic Tunas with a demonstrative / training environment with the BlueBRIDGE capacities and capabilities on stock assessment; [Stock Assessment](#) was deployed to support the needs and discussions arising in the context of Task 5.1, i.e. to support the design and development of innovative stock assessment workflows and methods; [Stocks & Fisheries Knowledge Base](#) was deployed to support the needs and discussions arising in the context of Task 5.2, i.e. to support the development of methods and approaches for the development of a global knowledge base of stock and fisheries (the GRSF).

The following 7 originates from the *Blue Economy* domain: [Alieia VRE](#), [Ellinika Psaria VRE](#), and [Forky's VRE](#) were deployed to serve the homonymous aquaculture company by providing each of them with a set of aquafarming assessment tools to perform evaluation growth analysis and techno economic investment analysis; [Aquaculture Training Lab](#) was deployed to provide its users with a demonstrative / training environment of the aquafarming assessment tools to perform the evaluation growth analysis and techno economic investment analysis; [Performance Evaluation in Aquaculture](#) was deployed to support the needs and discussions arising in the context of Task 6.1, i.e. to support the development of methods and approaches for understanding the performance of an aquafarm; [Strategic Investment Analysis](#) was deployed to support the needs and discussions arising in the context of Task 6.2, i.e. to support the development of methods and approaches for supporting the identification of locations of interest for aquafarm investors and stakeholders; [Strategic Investment Analysis and Scientific Planning/Alerting \(SIASPA\) VRE](#) was deployed to provide its users with an environment offering a geospatial multi-factor optimization and alerting platform for intelligent identification of locations of interest for investors and stakeholders seeking optimization of intended investments and scientists seeking areas that are becoming of environmental importance.

The following 2 originates from the *Blue Environment* domain: [Aquaculture Atlas Generation](#) was deployed to support the needs and discussions arising in the context of Task 7.1, i.e. to support the development of methods and approaches for the effective and efficient production of aquaculture products (maps of human activity and natural zones) contributing to an aquaculture atlas compliant with FAO National Aquaculture Sector Overview (NASO) standards; [Protected Area Impact Maps](#) was deployed to support the needs and discussions arising in the context of Task 7.2, i.e. to support the development of methods and approaches for reporting on marine features that are important for biodiversity such as seagrass, mangroves, reefs and geomorphology (seamounts, canyons, etc.) as well as human use features which may pose threats to biodiversity (aquaculture) in marine managed areas.

The following 8 originates from the *Blue Skills* domain: [ICES Training Course in the R Environment \(ICES TCRE\)](#) was deployed to support the ICES Training Course in the R Environment (TCRENV), 29 February - 4 March 2016, ICES HQ, Denmark; [ICES Training Course on Data Limited Stock Assessment \(ICES DALSA\)](#) was deployed to support the ICES training course on Data Limited Stock Assessment, 12 - 16 September, Reykjavik, Iceland; [ICES Training Course on Design and Analysis of Statistically Sound Catch Sampling Programmes \(ICES DASC\)](#) was deployed to support the ICES training course on Design and analysis of statistically sound catch sampling programmes, 12-16 September 2016, ICES, Copenhagen, Denmark; [ICES Training Course on Management Strategy Evaluation \(ICES\\_MSE\)](#) was deployed to support the ICES Training Course on

Management Strategy Evaluation (the course was cancelled); [ICES Training Course on Principles and Methods of broadband/wideband technologies: application to Fisheries Acoustics \(ICES FIACO\)](#) was deployed to support the ICES training course “Principles and methods of broadband/wideband technologies: application to fisheries acoustics”, 8-12 December 2016, Bergen, Norway; [ICES Training Course on Social Science Methods for Natural Scientists \(ICES TCSSM\)](#) was deployed to support the ICES training course on Social Science Methods for Natural Scientists, 26-28 May 2016, Faculté Victor Segalen, Brest, France; [ICES Training Course on Stock Assessment Advanced \(ICES SA\)](#) was deployed to support the ICES training course on Stock Assessment Advanced, 28 November-2 December, ICES HQ, Copenhagen, Denmark; [Knowledge Bridging](#) was deployed to serve the needs and discussions arising in the context of the Blue Skills project objective / activity;

The following 4 were created to support the cooperation and collaboration among the consortium members: [BlueBRIDGE-EAB](#) was deployed to serve the needs and discussions arising in the context of the project External Advisory Board; [BlueBRIDGE-PSC](#) was deployed to serve the needs and discussions arising in the context of the Project Steering Committee; [BlueBRIDGE Project](#) was deployed to serve the needs and discussions arising in the context of the project; [Blue Commons](#) was deployed to serve the needs and discussions arising in the context of the Blue Commons project objective / activity; [Blue Uptake](#) was deployed to serve the needs and discussions arising in the context of the Blue Uptake project objective / activity;

Finally, the following 2 were created to provide generic environments for experiencing with the data analytics facilities. [R Prototyping Lab](#) was deployed to provide its users with a complete development and integration environment for R including BlueBRIDGE data analytics platform (Dataminer, SAI) and RStudio®; [RStudio Lab](#) was deployed to provide its users with a development environment for R based solely on RStudio®.

These VRE are serving **more than 1500 users** in total spread across **22 countries** and **80 different organizations**. The top 10 countries are: Italy (13.04 %), France (8.70%), Greece (8.33 %), Denmark (4.35%), Spain (3.99 %), UK (2.90%), Norway (2.54%), Ireland (2.54%), Sweden (1.45%), Chile (1.09 %). The top 10 organisations are National Research Council of Italy (7.61%); Food and Agriculture Organization of the United Nations - FAO (5.07%); International Council for the Exploration of the Sea - ICES (4.35%); Institut de recherche pour le développement - IRD (3.99%); National Oceanic and Atmospheric Administration - NOAA (3.26%); Marine Institute Foras na Mara - Marine.ie (2.17%); Educational Departments (2.17%); Institute of Marine Research - IMR (1.45%); French Research Institute for Exploitation of the Sea - Ifremer (1.45%); Centro tecnológico expert en innovación marina y alimentaria - AZTI (1.09%).

This requested to deal with **approximately 600 tickets** (32 tickets for VRE creation\update, 244 requests for support, 315 requests for incidents and bugs).

## 1 INTRODUCTION

BlueBRIDGE WP4 “VREs Deployment and Operation” is called to deploy and operate the Virtual Research Environments and Virtual Laboratories identified and enacted by the technology resulting from WP5 Supporting Blue Assessment: VREs Development, WP6 Supporting Blue Economy: VREs Development, WP7 Supporting Blue Environment: VREs Development, WP8 Support Blue Skills: VREs Development as well as those enabled by the technology developed in WP9 VRE Commons Development and WP10 Interfacing Infrastructures.

Virtual Research Environments and Virtual Laboratories [4] are “systems” aiming at providing their users with web-based working environments offering the entire spectrum of facilities (including services, data, and computational facilities) needed to accomplish a given task by dynamically relying on the underlying infrastructure. VREs and VLabs are the key products to be delivered by the BlueBRIDGE project to meet the needs of its target community and scenarios. From the development and operation perspective there is no major difference among VREs and VLabs; they are based on the same enabling technology and are governed by the same procedures and policies.<sup>4</sup> The rationale leading to name them differently results from the willingness to highlight their diversity in scope. VREs are devised to serve larger communities and cases than VLabs. In essence, VREs are dedicated to discussing and developing various approaches and solutions to be applied to concrete cases and scenarios by VLabs. VLabs are devised to serve specific communities and practitioners confronting a given research question.

This deliverable – D4.3 ‘BlueBRIDGE VREs Operation Activity: Interim Report’ – details the activity leading to the deployment and operation of a series of Virtual Research Environments and Virtual Laboratories addressing the needs of the cases and scenarios falling under the domain of the “blue pillars”: *Blue Assessment, i.e.*, supporting the collaborative production of scientific knowledge required for assessing the status of fish stocks and producing a global record of stocks and fisheries; *Blue Economy, i.e.*, supporting the production of scientific knowledge for analysing socio-economic performance in aquaculture; *Blue Environment, i.e.*, supporting the production of scientific knowledge for fisheries & habitat degradation monitoring; and, *Blue Skills, i.e.*, boosting education and knowledge bridging between research and innovation in the area of protection and management of marine resources, giving them a new volume and thematic and geographical reach. The expectations and plans characterising VREs / VLabs are captured by dedicated deliverables: D5.1 Blue Assessment VRE Specification [7], D6.1 Blue Economy VRE Specification [1], Blue Environment VRE Specification [9], as well as milestones: MS6 Blue Assessment VRE Plan, MS7 Blue Economy VRE Plan, MS11 Blue Environment VRE Plan, MS4 Blue Skills VRE Plan.

This activity leads to the deployment and operation of **12 VREs and 26 VLabs** in the period from September 2015 to November 2016. Overall, these VREs / VLabs are serving the needs of **more than 1500 users** in total spread across **22 countries** and **80 different organizations** (cf. Sec. 3).

The remainder of this report is organised as follows: Section 2 describes the policies and procedures governing the planning and deployment of Virtual Research Environments and Virtual Laboratories. Section 3 describes the Virtual Research Environments and Virtual Laboratories that have been deployed and operated during the period. For each Virtual Research Environment / Virtual Laboratory, the deliverable describes the goal and the main facilities offered to their users. Section 4 reports conclusions.

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<sup>4</sup> Because of this, in the remainder of the report, the terms “VRE” and “VLab” are used like synonymously.

## 2 VRES PLANNING AND PROCEDURES

Deployment and operation of VREs and V Labs is a collaborative effort involving the WP4 team called to deploy and configure the technology to create VREs / V Labs expected by the “blue pillars” as well as the work packages working to develop the enabling technology, i.e. (i) WP5-8 that focus on designing and developing technology specific to Blue Assessment, Blue Economy, Blue Environment, and Blue Skills VREs and (ii) WP9-10 that design and develop generic solutions supporting all the VREs.

The characterisation of the VREs and V Labs expected to serve the needs and objectives of Blue Assessment, Blue Economy, Blue Environment, and Blue Skills is captured by a series of specific deliverables [7][8][9]. The procedure leading to the creation of a VRE from the WP4 perspective is described in the section below.

### 2.1 PROCEDURE

The procedure leading to VRE deployment is a consolidated one, i.e. it is the procedure inherited from the D4Science infrastructure and described in the D4Science Wiki:

[https://wiki.d4science.org/index.php?title=Virtual\\_Research\\_Environments\\_Deployment\\_and\\_Operation](https://wiki.d4science.org/index.php?title=Virtual_Research_Environments_Deployment_and_Operation)

For the needs of BlueBRIDGE, it was decided to support this activity by the project activity tracker. A specific **VRE tracker** has been created with the goal of capturing the entire process from specification to operation. The following statuses are supported:

- **New:** the specification of the VRE is produced by the VRE designer / requester. This specification must contain:
  - VRE name and abstract;
  - Membership policy, i.e. whether the VRE is open or restricted, who is allowed to invite members;
  - VRE expected datasets;
  - VRE expected functionalities;
  - VRE due date;
- **Planned:** the WP4 team is fine with the specification, i.e. the specification contains enough details to proceed with the creation, and acknowledges that the creation of the VRE is feasible by the due date initially requested (or liaise with the designer / requester to find a mutually suitable date);
- **Available:** the VRE is up and running and ready to be validated by the VRE designer / requester;
- **Released:** the VRE has been validated and the target community can start using it;
- **Removed:** the VRE has been disposed of request of its manager;
- **Rejected:** the requested VRE cannot be created as the requirements outlined for it cannot be satisfied.

### 2.2 PLAN

The actual plan is captured by a series of tickets and is available via a dedicated live report in the activity tracker:

[https://support.d4science.org/projects/bluebridge/issues?query\\_id=48](https://support.d4science.org/projects/bluebridge/issues?query_id=48)

A screenshot of this report is available in Figure 1. The report collects all the tickets leading to the creation / update of a VRE / V Lab, clusters them by the current status of the request, and clearly indicate the percentage completed with respect to the planned task. By relying on this facility, the key players involved in the activity are immediately informed of any possible issue or action performed or to be performed.



#	Tracker	Status	Priority	Subject	Assignee	Updated	% Done	Due date	Sprint
<b>Planned (0)</b>									
<b>In Progress (3)</b>									
5886	VRE	In Progress	Normal	GRSF_Admin	Leonardo Candela	Nov 28, 2016 09:36 AM	<div style="width: 100%;"></div>	Nov 29, 2016	WP09
1679	VRE	In Progress	Normal	ICES Stock Assessment VRE	Scott Large	Nov 21, 2016 02:05 PM	<div style="width: 100%;"></div>	Oct 01, 2016	WP05
<b>Available (7)</b>									
4840	VRE	Available	High	Blue Economy VRE: Forky's	Gerardino Antzoulatos	Nov 07, 2016 02:21 PM	<div style="width: 100%;"></div>		WP06
1426	VRE	Available	Normal	Blue Economy VRE 2.1 - Strategic Investment analysis and Scientific Planning/Alerting VRE	Maximiliano Assante	Nov 23, 2016 10:35 AM	<div style="width: 100%;"></div>	Nov 11, 2016	WP06
4838	VRE	Available	Urgent	Blue Economy VRE: Alieia	Gerardino Antzoulatos	Nov 07, 2016 02:21 PM	<div style="width: 100%;"></div>		WP06
4841	VRE	Available	High	Blue Economy VRE: Ellinika Psaria	Gerardino Antzoulatos	Nov 07, 2016 02:21 PM	<div style="width: 100%;"></div>		WP06
1678	VRE	Available	Normal	GRSF VRE: Global Record of Stocks and Fisheries	Anton Eibenbroek	Nov 07, 2016 11:29 AM	<div style="width: 100%;"></div>		WP05
<b>Released (11)</b>									
5889	VRE	Released	Immediate	Blue Economy/Blue Skills: AquacultureTrainingLab	Leonardo Candela	Nov 11, 2016 08:52 AM	<div style="width: 100%;"></div>		WP08
4864	VRE	Released	High	BlueBridge RStudio VRE	Maximiliano Assante	Oct 10, 2016 07:15 PM	<div style="width: 100%;"></div>		WP08
3145	VRE	Released	Normal	Create VRE for ICES training course on Social Science Methods for Natural Scientists	Maximiliano Assante	May 19, 2016 09:12 AM	<div style="width: 100%;"></div>	May 02, 2016	WP04
2138	VRE	Released	Normal	Deploy BlueBRIDGE EAB VRE	Leonardo Candela	Feb 22, 2016 01:48 PM	<div style="width: 100%;"></div>	Feb 22, 2016	WP04
1478	VRE	Released	Normal	ICES Training Course in the R Environment (TCRE)	Mike Drew	Feb 22, 2016 01:48 PM	<div style="width: 100%;"></div>	Jan 11, 2016	WP08
1547	VRE	Released	Normal	ICES training course, Data Limited Stock Assessment	Maximiliano Assante	Sep 08, 2016 06:24 PM	<div style="width: 100%;"></div>	Aug 31, 2016	WP08
1546	VRE	Released	Normal	ICES training course, Stock Assessment Advanced	Anna Davies	Oct 24, 2016 04:11 PM	<div style="width: 100%;"></div>	Oct 31, 2016	WP08
5939	VRE	Released	Normal	ICES training course: Stock Assessment Advanced	Anna Davies	Oct 25, 2016 02:09 PM	<div style="width: 100%;"></div>	Oct 31, 2016	WP08
5916	VRE	Released	High	R/PrototypingLab: Deployment	Leonardo Candela	Oct 03, 2016 09:25 AM	<div style="width: 100%;"></div>		WP04
5536	VRE	Released	Normal	Request for ICES training course, Principles and methods of broadband/wideband technologies: application to fisheries acoustics	Anna Davies	Oct 25, 2016 05:56 PM	<div style="width: 100%;"></div>	Oct 28, 2016	WP08
5493	VRE	Released	Normal	Revise FAO Tuna Atlas VRE: Enlarge the pool of DataMiner Algorithms and make SAI available	Roberto Cirilo	Nov 07, 2016 02:41 PM	<div style="width: 100%;"></div>	Oct 17, 2016	WP09
4846	VRE	Released	High	VRE Creation for ICCAT BFT-E	Roberto Cirilo	Sep 22, 2016 04:44 PM	<div style="width: 100%;"></div>	Sep 12, 2016	WP08
4811	VRE	Released	Normal	VRE request for ICES training course on Data Limited Stock Assessment	Maximiliano Assante	Sep 08, 2016 06:24 PM	<div style="width: 100%;"></div>	Aug 31, 2016	WP08
4612	VRE	Released	Normal	VRE request for ICES training course on Design and analysis of statistically sound catch sampling programmes	Maximiliano Assante	Sep 08, 2016 06:24 PM	<div style="width: 100%;"></div>	Aug 31, 2016	WP08
5136	VRE	Released	High	WECAFC-FIRMS: Add TabMax and Detatiner	Anton Eibenbroek	Nov 17, 2016 04:39 PM	<div style="width: 100%;"></div>	Nov 04, 2016	WP09
<b>Removed (5)</b>									
1677	VRE	Removed	Normal	Ecopath VRE	Jeroen Eibenbroek	Oct 16, 2016 09:03 PM	<div style="width: 100%;"></div>	Oct 01, 2016	WP09
1549	VRE	Removed	Normal	ICES training course, Design and analysis of statistically sound catch sampling programmes	Anna Davies	Oct 16, 2016 03:04 PM	<div style="width: 100%;"></div>		WP08
1548	VRE	Removed	Normal	ICES training course, Management Strategy Evaluation	Maximiliano Assante	Sep 08, 2016 05:13 PM	<div style="width: 100%;"></div>	Sep 09, 2016	WP08
1779	VRE	Removed	High	TRD BFT Assessment	Julien Berde	Oct 03, 2016 09:13 AM	<div style="width: 100%;"></div>	Oct 01, 2016	WP08

Figure 1. VRE Plan Report

In the reporting period, **32 tickets have been created<sup>5</sup>**, overall capturing:

- the release/revision of 13 VREs \ VLabs documented by this report: Aquaculture Training Lab (cf. Sec. 3.3), BlueBRIDGE-EAB (cf. Sec. 3.7), FAO Tuna Atlas (cf. Sec. 3.13), ICCAT\_BFT-E (cf. Sec. 3.17), ICES\_DALSA (cf. Sec. 3.19), ICES\_DASC (cf. Sec. 3.20), ICES\_FIACO (cf. Sec. 3.22), ICES\_SA (cf. Sec. 3.24), ICES\_TCRE (cf. Sec. 3.18), ICES\_TCSSM (cf. Sec. 3.23), R Prototyping Lab (cf. Sec. 3.29), RStudio Lab (cf. Sec. 3.30), and WECAFC-FIRMS (cf. Sec. 3.38);
- the deployment of 5 VREs \ VLabs documented by this report: Alieia VRE (cf. Sec. 3.1), Ellinika Psaria VRE (cf. Sec. 3.12), Forky's VRE (cf. Sec. 3.14), GRSF (cf. Sec. 3.15), and SIASPA (cf. Sec. 3.35).

<sup>5</sup> This is below the overall number of VREs \ VLabs operated in the period, simply because of the fact that the procedure based on tickets was defined and approved by MS5 BlueBRIDGE VREs Planning and Procedures (Nov. '15).



### 3 VRES CREATION, DEPLOYMENT AND OPERATION

This section briefly describes the facilities used by VRE creators for the actual deployment of VREs \ VLabs, reports the complete list of deployed and operated VREs \ VLabs, and offers a characterisation of each available VRE \ VLab.

The act of definition and deployment of a new VRE \ VLab is supported by a wizard (cf. Figure 2) that enables authorised users to transform the opened requests according to the procedure described in Sec. 2 into an actual specification and then, automatically, into a working VRE \ VLab made available by the BlueBRIDGE gateway [2]. Through the wizard, the user is requested to specify: (i) the descriptive information characterising the expected VRE \ VLab (i.e. name, description, duration), and (ii) the functionalities and datasets to be made available in the specific VRE \ VLab by selecting among the available ones. The resulting list of functionalities is derived from the feasible functionalities created thanks to the software version and services hosted by the underlying infrastructure (a detailed record of the software resulting from BlueBRIDGE is documented in a dedicated report [11]).



Figure 2. VRE Creation Wizard Screenshots

In the period from September 2015 to November 2016 a total of **38 VREs \ VLabs were created and/or operated** to serve the needs arising in the context of the BlueBRIDGE project (the complete list is in Table 1). In particular, the following 9 VREs / VLabs were inherited by iMarine<sup>6</sup>: *Bay of Bengale Large Marine Ecosystem Hilsa VRE* (cf. Sec. 3.4); *BiodiversityLab* (cf. Sec. 3.5); *BiOnym* (cf. Sec. 3.6); *FAO Tuna Atlas* (cf. Sec. 3.13); *iSearch* (cf. Sec. 3.25); *Scalable Data Mining* (cf. Sec. 3.31); *TabularDataLab* (cf. Sec. 3.36); *Vulnerable Marine Ecosystem (VME) DB* (cf. Sec. 3.37); *WECAFC-FIRMS* (cf. Sec. 3.38). The following 29 VREs / VLabs were original creations of the BlueBRIDGE project: *Alieia VRE* (Blue Economy) (cf. Sec. 3.1); *Aquaculture Atlas Generation* (Blue Environment) (cf. Sec. 3.2); *Aquaculture Training Lab* (Blue Economy/Blue Skills) (cf. Sec. 3.3); *BlueBRIDGE-EAB* (cf. Sec. 3.7); *BlueBRIDGE-PSC* (cf. Sec. 3.8); *BlueBRIDGE Project* (cf. Sec. 3.9); *Blue Commons* (cf. Sec. 3.10); *Blue Uptake* (cf. Sec. 3.11); *Ellinika Psaria VRE* (Blue Economy) (cf. Sec. 3.12); *Forky's VRE* (Blue Economy) (cf. Sec. 3.14); *Global Record of Stocks and Fisheries (GRSF)* (Blue Assessment) (cf. Sec. 3.15); *GRSF Admin* (Blue Assessment) (cf. Sec. 3.16); *ICCAT (ICCAT\_BFT-E)* (Blue Assessment) (cf. Sec. 3.17); *ICES Training Course in the R Environment (ICES\_TCRE)* (Blue Skills) (cf. Sec. 3.18); *ICES Training Course on Data Limited Stock Assessment (ICES\_DALSA)* (Blue Skills) (cf. Sec. 3.19); *ICES Training Course on Design and Analysis of Statistically Sound Catch Sampling Programmes (ICES\_DASC)* (Blue Skills) (cf. Sec. 3.20); *ICES Training Course on Management Strategy Evaluation (ICES\_MSE)* (Blue Skills) (cf. Sec.3.21); *ICES Training Course on Principles and Methods of broadband/wideband technologies: application to Fisheries Acoustics (ICES\_FIACO)* (Blue Skills) (cf. Sec. 3.22); *ICES Training Course on Social Science Methods for Natural Scientists (ICES\_TCSSM)* (Blue Skills) (cf. Sec. 3.23); *ICES Training Course on Stock Assessment Advanced (ICES\_SA)* (Blue Skills) (cf. Sec. 3.24); *Knowledge Bridging* (Blue Skills) (cf. Sec. 3.26); *Performance Evaluation in Aquaculture* (Blue Economy) (cf. Sec. 3.27); *Protected Area Impact Maps* (Blue Environment) (cf. Sec. 3.28); *R Prototyping Lab* (cf. Sec. 3.29); *RStudio Lab* (cf. Sec. 3.30); *Stock Assessment* (Blue Assessment) (cf. Sec. 3.32); *Stocks & Fisheries Knowledge Base* (Blue Assessment) (cf. Sec. 3.33); *Strategic Investment Analysis* (Blue Economy) (cf. Sec. 3.34); *Strategic Investment Analysis and Scientific Planning/Alerting VRE (SIASPA)* (Blue Economy) (cf. Sec. 3.35).

In Figure 3, the number of VREs and VLabs operated per month is reported. During the period, the total number of VREs operated remained mostly stable, i.e. 9 VREs conceived to support the project activities and tasks were created at the beginning of the project and remained active for the entire period, two additional

<sup>6</sup> <http://www.i-marine.eu>

ones were created later, one in October '15 (BlueBRIDGE-PSC) and one in March '16 (BlueBRIDGE-EAB). Regarding V Labs, the 9 inherited by iMarine were the only ones available before July 2016. From August on, new V Labs began being deployed thanks to the new technology and facilities produced and released by BlueBRIDGE [11].

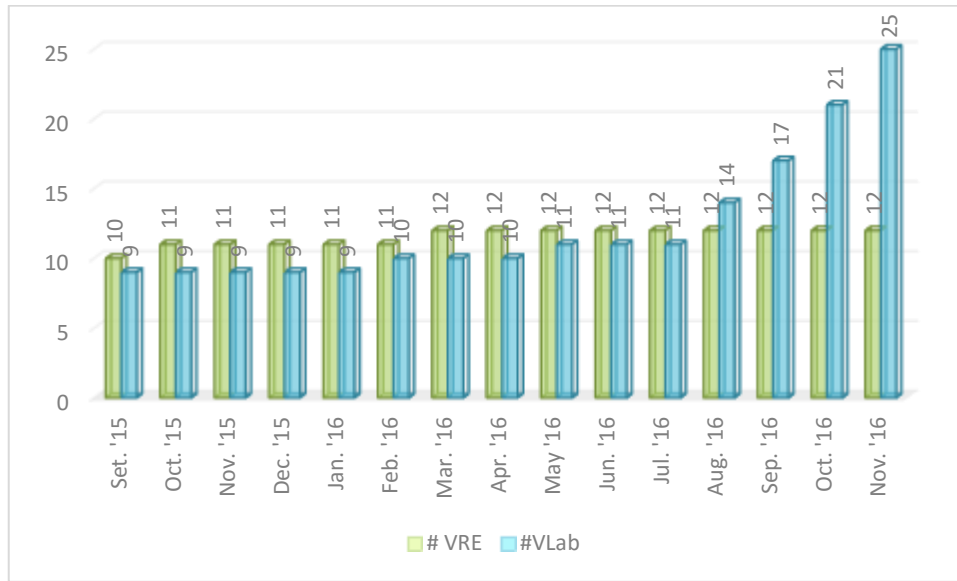


Figure 3. Number of VREs and V Labs supported by BlueBRIDGE

In Figure 4, the overall number of users benefitting from the facilities offered by the existing VREs / V Labs is reported, i.e. in November '16 the existing VREs \ V Labs are serving **more than 1500 users**. Detailed figures per VRE \ V Lab are reported in the VRE \ V Lab dedicated sections of this document. During the reporting period, the number of users almost doubled (+ 706 users).

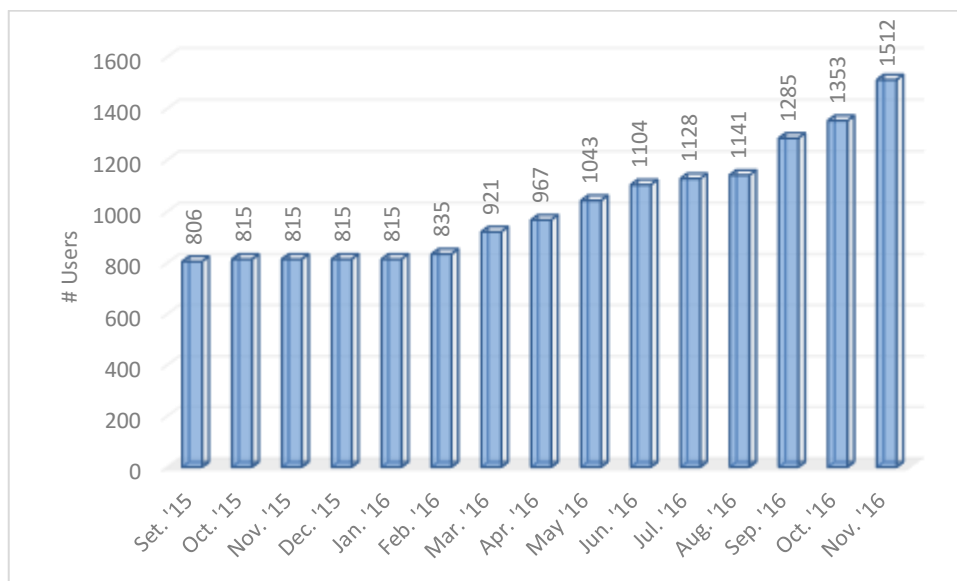


Figure 4. Number of users served by BlueBRIDGE VREs and V Labs

By analysing the email addresses of the users (which is what they are using to log in the VREs \ V Labs), it can be observed that: 55.43 % of the users is exploiting an email address that can be attributed to national domains (e.g., .it, .fr, .gr), 30.80 % of the users is exploiting an email address that can be attributed to commercial domains, while the remaining 13.77 % of the users is exploiting an email address belonging to .org, .edu, .gov domains. The users exploiting an email address that can be assimilated to national domains are spread across 22 countries. The top 10 countries are: Italy (13.04 %), France (8.70%), Greece (8.33 %), Denmark (4.35%), Spain (3.99 %), UK (2.90%), Norway (2.54%), Ireland (2.54%), Sweden (1.45%), Chile (1.09 %). The total number of recognised organisations \ institutions is 80. The top 10 organisations \ institutions are National Research Council of Italy (7.61%); Food and Agriculture Organization of the United Nations - FAO

(5.07%); International Council for the Exploration of the Sea - ICES (4.35%); Institut de recherche pour le développement - IRD (3.99%); National Oceanic and Atmospheric Administration - NOAA (3.26%); Marine Institute Foras na Mara - Marine.ie (2.17%); Educational Departments (2.17%); Institute of Marine Research - IMR (1.45%); French Research Institute for Exploitation of the Sea - Ifremer (1.45%); AZTI (1.09%). The top 10 organisations represent 1/3 of the total number of users.

The operation of VREs and V Labs requires the management of requests for support, of issues and malfunctions. Figure 5 reports the tickets closed per month for these typologies of tickets. During the reporting period, a total of **559 of such tickets have been resolved** (244 requests for support and 315 requests for incidents and bugs).

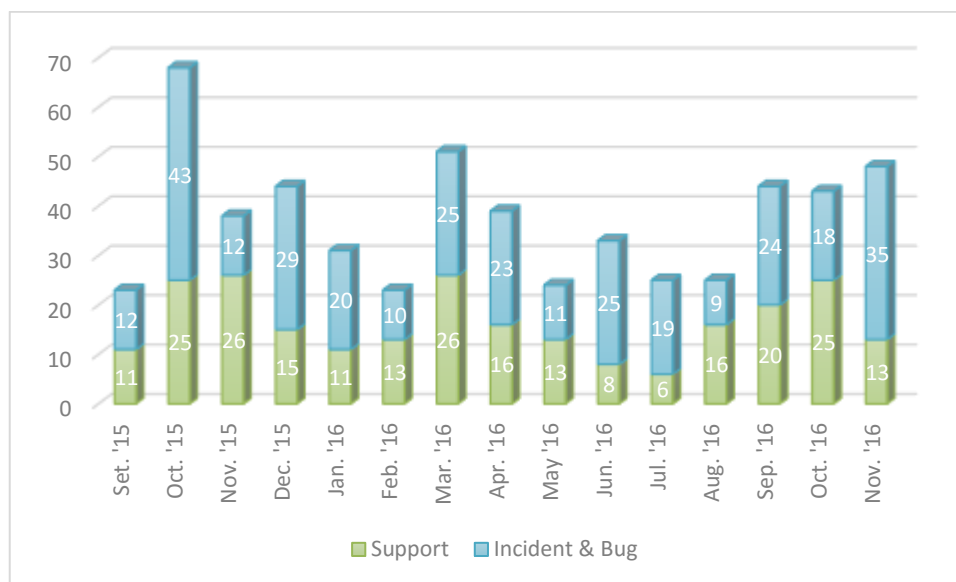


Figure 5. Tickets closed per Month

Table 1 reports the complete list of VREs (12) and V Labs (26) created in the period from September 2015 to November 2016.

Table 1. BlueBRIDGE Virtual Research Environments and Virtual Laboratories

VRE / VLab Name	Type	Start date	State	# Users
Alieia VRE	VLab	Oct. '16	Available	9
Aquaculture Atlas Generation	VRE	Nov. '16	Operational	21
Aquaculture Training Lab	VLab	Nov. '16	Operational	33
Bay of Bengale Large Marine Ecosystem Hilsa WG	VLab	Sep. '15	Operational	4
Biodiversity Lab	VLab	Sep. '15	Operational	327
Bionym	VLab	Sep. '15	Operational	81
BlueBRIDGE-EAB	VRE	Mar. '16	Operational	17
BlueBRIDGE-PSC	VRE	Sep. '15	Operational	9
BlueBRIDGE Project	VRE	Sep. '15	Operational	90
Blue Commons	VRE	Sep. '15	Operational	33
Blue Uptake	VRE	Sep. '15	Operational	34
Ellinika Psaria VRE	VLab	Oct. '16	Available	9
FAO Tuna Atlas	VLab	Sep. '15	Operational	21
Forky's VRE	VLab	Oct. '16	Available	11

VRE / VLab Name	Type	Start date	State	# Users
Global Record of Stocks and Fisheries (GRSF)	VLab	Oct' 16	Available	5
GRSF Admin	VLab	Nov. '16	Available	7
ICCAT (ICCAT_BFT-E)	VLab	Aug. '16	Operational	30
ICES Training Course in the R Environment (ICES_TCRE)	VLab	Dec. '15	Operational	36
ICES Training Course on Data Limited Stock Assessment (ICES_DALSA)	VLab	Aug. '16	Operational	27
ICES Training Course on Design and Analysis of Statistically Sound Catch Sampling Programmes (ICES_DASC)	VLab	Aug.'16	Operational	18
ICES Training Course on Management Strategy Evaluation (ICES_MSE)	VLab	n/a	Dismissed	n/a
ICES Training Course on Principles and Methods of broadband/wideband technologies: application to Fisheries Acoustics (ICES_FIACO)	VLab	Oct. '16	Operational	29
ICES Training Course on Social Science Methods for Natural Scientists (ICES_TCSSM)	VLab	Apr. '16	Operational	30
ICES Training Course on Stock Assessment Advanced (ICES_SA)	VLab	Oct. '16	Operational	27
iSearch	VLab	Sep. '15	Operational	51
Knowledge Bridging	VRE	Sep. '15	Operational	24
Performance Evaluation in Aquaculture	VRE	Sep. '15	Operational	22
Protected Area Impact Maps	VRE	Sep. '15	Operational	22
R Prototyping Lab	VLab	Sep. '16	Operational	30
RStudio Lab	VLab	Sep. '16	Operational	21
Scalable Data Mining	VLab	Sep. '15	Operational	115
Stock Assessment	VRE	Sep. '15	Operational	54
Stocks & Fisheries Knowledge Base	VRE	Sep. '15	Operational	34
Strategic Investment Analysis	VRE	Sep. '15	Operational	22
Strategic Investment Analysis and Scientific Planning/Alerting VRE (SIASPA)	VLab	Nov. '16	Available	6
Tabular Data Lab	VLab	Sep. '15	Operational	152
Vulnerable Marine Ecosystem (VME) DB	VLab	Sep. '15	Operational	17
WECAFC-FIRMS	VLab	Sep. '15	Operational	20

A brief description of each available VRE / VLab is reported in the following sections.

All the VREs are provided with:

- A **shared workspace** to enable every user to store and organise the information objects he/she is interested in working with. In addition to that, the user is allowed to collaborate with other users by sharing objects and messages;
- A **VRE Management facility** to enable authorized users (i.e. VRE Managers) to manage other users using or wanting to access the VRE. VRE Managers can (i) authorize users for access to the VRE, (ii)

assign or withdraw roles to users, (iii) remove users, and (iv) send communications to the current users;

- A **social networking facility** to enable users to use the common facilities typical of social networks – e.g., posting news, commenting on posted news – yet adapted to the settings of working environments like those characterising BlueBRIDGE. Users can post news as well as applications;
- A **notification facility** to alert users on relevant activities as they happen. These notifications offer a sense of anticipation and create a productivity boost. Users receive an alert (through a priori selected channels, e.g., email, web portal, twitter) notifying them when something of interest has happened in their VRE(s);
- A **members facility** to provide users with a list of VRE co-workers, i.e. the list of members partaking in the VRE and contributing to it;
- A **messaging facility** to provide users with a common email environment as-a-Service. The distinguishing feature is represented by its integration with the rest, e.g., it is possible to send any information object residing in the workspace (regardless of how “big” and “complex” it may be) as an attachment without consuming bandwidth.

### 3.1 ALIEIA VRE

This Virtual Research Environment (actually a VLab) was conceived to provide the Alieia aquaculture company members with a set of aquafarming assessment tools enabling them to perform evaluation growth analysis and techno economic investment analysis. Access to this working environment is restricted to Alieia members only.

The Alieia VLab is available at: <https://i-marine.d4science.org/web/alieivre>

This VLab stems from the Blue Economy VREs [8] and it is currently in “**available**” status, i.e. it is working and waiting for uptake by the Alieia company.

A screenshot of the VLab is available in Figure 6: it shows the home page and the menu items for accessing the VLab facilities.

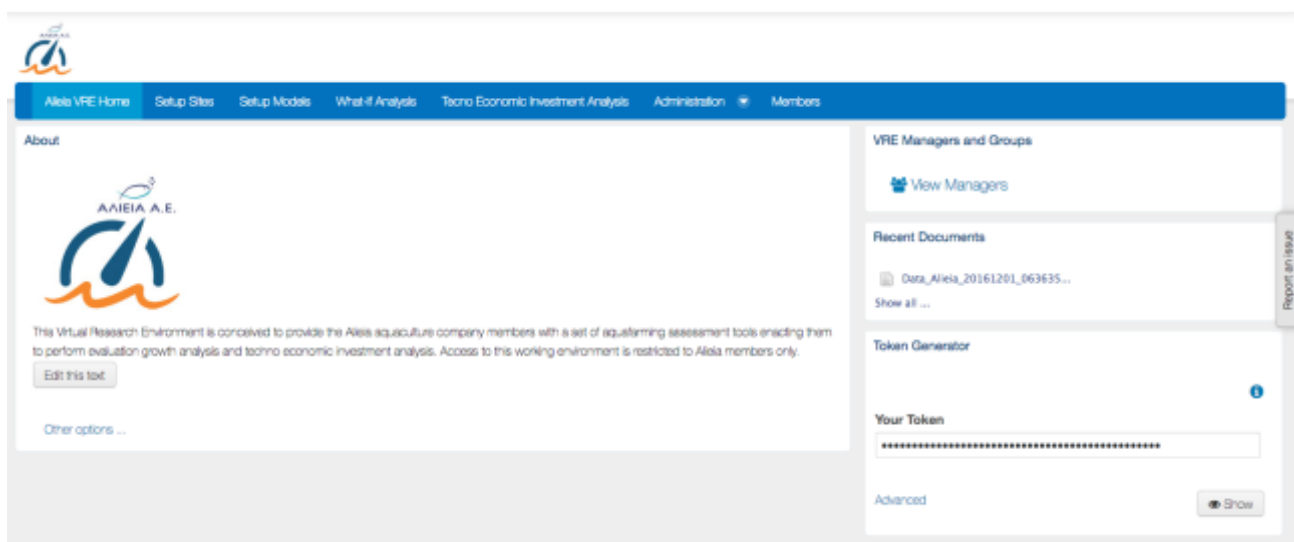


Figure 6. Alieia VRE \ VLab Home Page Screenshot

In addition to the basic functionality, namely a workspace for sharing objects of interest and a user management facility for managing membership, this VLab is specifically equipped with the following functionalities:

- *Setup site*: a facility to create one or more profiles representing a site of interest (an installation of aquafarm facilities) by specifying its geographic location, the oxygen rate, the current rate, and the average temperature per half of each month along the year;
- *Setup model*: a facility to create one or more simulation models estimating the KPIs for the growth of a species based on the historic samplings data. KPIs include Feed Conversion Rate (FCR), Growth Rate per Day (GPD), Specific Growth Rate (SGR), Suggested Feeding Rate (SFR), and Mortality Rate (MR) [8]. Each model is characterised by the site, the name of the species of interest, the broodstock quality, the feed quality, whether the broodstock is improved genetically, and a series of datasets recording monthly sampling data;
- *What-if analysis*: a facility enabling users to perform what-if analysis by using a model among the defined ones. This facility produces an estimation of the main KPIs according to the selected model given the initial stock count, the initial fish weight, and the period of interest. Users are provided with an estimation of main KPIs including Average Weight, Life To Date (LTD) Growth, LTD SGR, LTD Biological and Economical FCR, and LTD Mortality. Moreover, graphs reporting Weight, FCR comparing with the global trend of FCR for benchmarking purposes, and Food Consumption graphs for the specific time period can be produced;
- *Techno-economic investment analysis*: a facility enabling users to perform a techno economic estimation analysis of a given aquafarming task by selecting a production model and a series of economic indicators including feed price, fry price and selling price. The facility provides the user with a series of financial indicators and statistics including Net Present Value (NPV), Internal Rate of Return (IRR), Earnings Before Interest, Taxes, Depreciation and Amortization (EBITDA), Earnings Before Interest After Taxes (EBIAT) [8].

Figure 7 reports the total amount of operations performed in the context of this VLab. Operations include service tasks needed to maintain the VLab operational as well as human tasks. This VLab is not in an operational state yet, thus the large majority of operations have been performed during the deployment and testing of the VLab that occurred from October '16 through November '16.



Figure 7. Alieia VRE \ VLab Operations by Month

### 3.2 AQUACULTURE ATLAS GENERATION

This Virtual Research Environment was conceived to support the activity and discussions occurring in the context of the Task 7.1 [9], i.e. on how to apply SARTOOL and related software to analyse Earth Observation



(Copernicus) datasets through a human validation of output and produce OGC compliant data. The VRE discusses on how to produce aquaculture products (maps of human activity and natural zones) contributing to an aquaculture atlas compliant with FAO National Aquaculture Sector Overview (NASO) standards. Aquaculture sector scientists, managers, farmers and decision makers that are in charge of the validation, thanks to the VRE will be equipped with: (a) open data combining performance, environment, regional and socio-economic datasets, (b) a framework to support performance analysis and benchmarking, and (c) a fundamental baseline set of indicators and models providing the performance metrics in question.

The Aquaculture Atlas Generation VRE is available at: <https://i-marine.d4science.org/web/aquacultureatlasgeneration>

This VRE stems from the Blue Environment VRE [9]. It has been in “*operational*” state since **September ’15** and is currently serving **21 users**.

A screenshot of the VRE is available in Figure 8; it shows the home page and the menu items for accessing the VRE facilities.

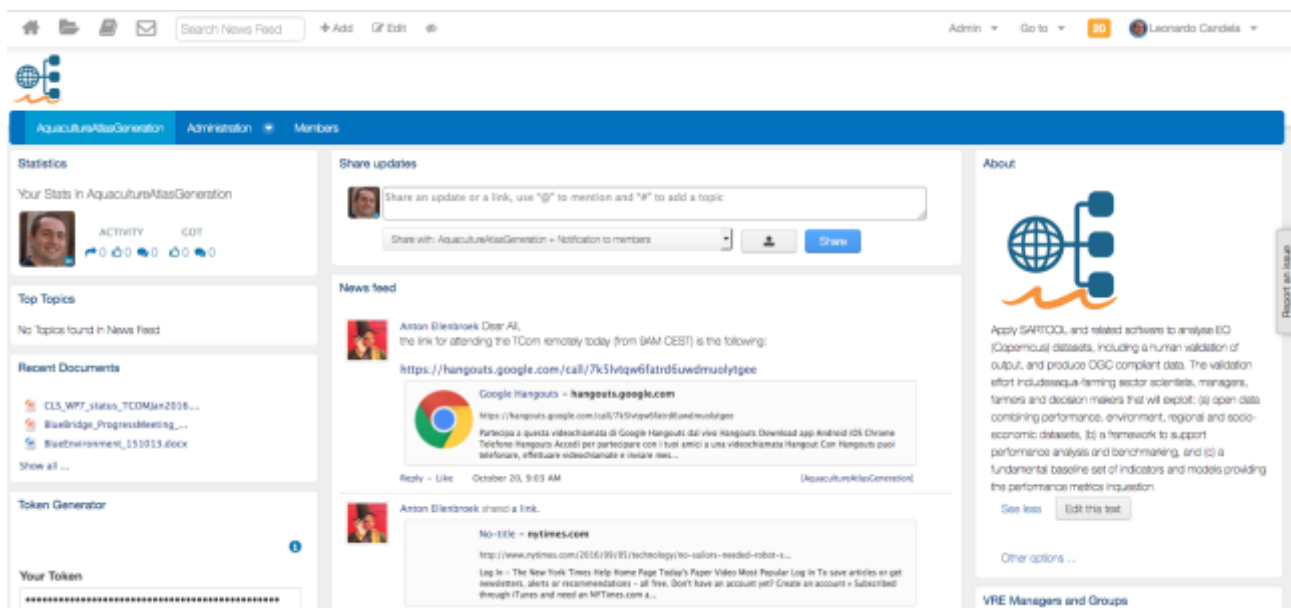


Figure 8. Aquaculture Atlas Generation VRE \ VLab Home Page Screenshot

This VRE is actually equipped with the basic VRE facilities, i.e. a workspace for sharing objects of interest, a social networking area for supporting the discussions among members, and a user management facility for managing membership.

Figure 9 reports the total amount of operations performed in the context of this VRE. Operations include service tasks needed to maintain the VRE operational as well as human tasks, e.g. actions performed by the users via the GUI leading to the invocation of services.

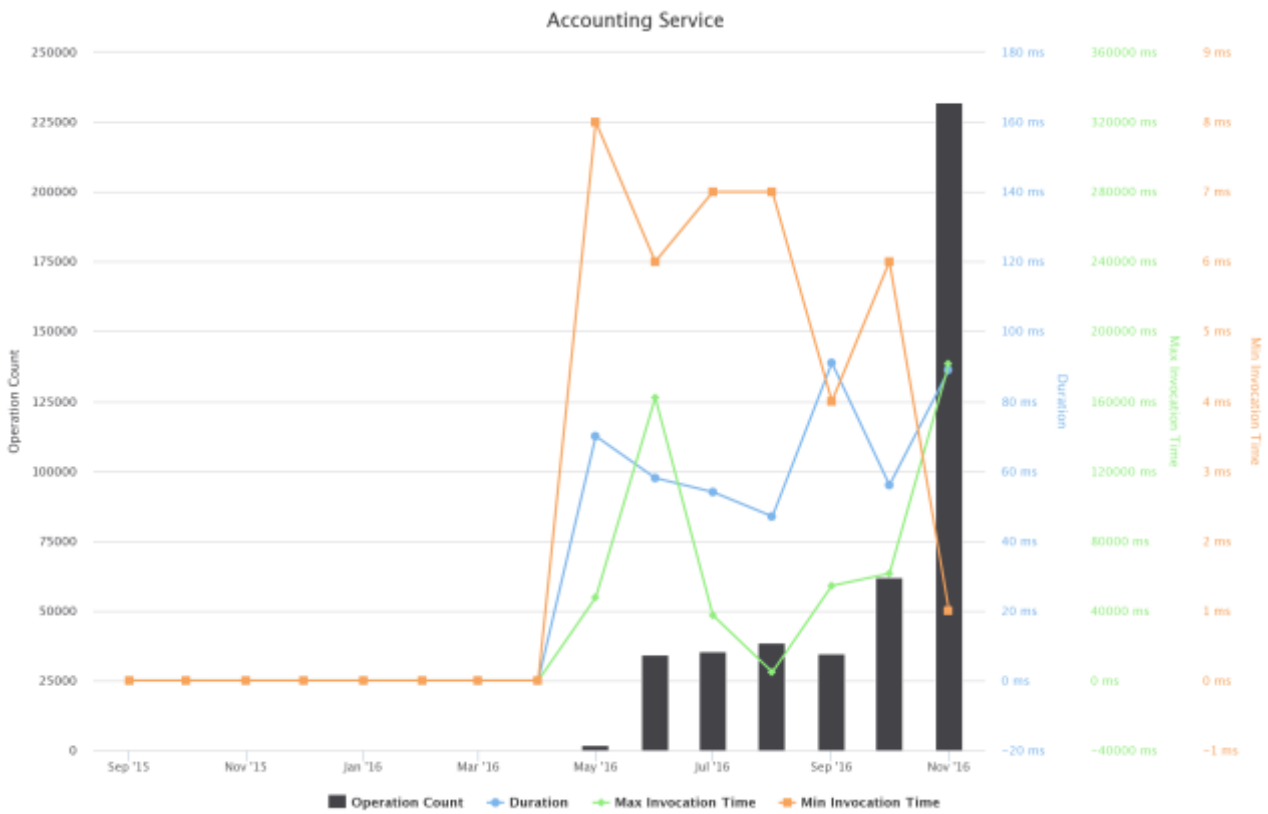


Figure 9. Aquaculture Atlas Generation VRE \ VLab Operations by Month

### 3.3 AQUACULTURE TRAINING LAB

This Virtual Research Environment (actually VLab) was conceived to provide its users with a set of aquafarming assessment tools enabling them to perform evaluation growth analysis and techno economic investment analysis. Access to this working environment is restricted to authorized members only.

The Aquaculture Training Lab is available at: <https://i-marine.d4science.org/web/aquaculturetraininglab>

This VLab stems from the Blue Economy VREs [8]. It has been in **operational** state from **November '16** and it is currently serving **33 users**.

A screenshot of the VLab is available in Figure 10; it shows the home page and the menu items for accessing the VLab facilities.

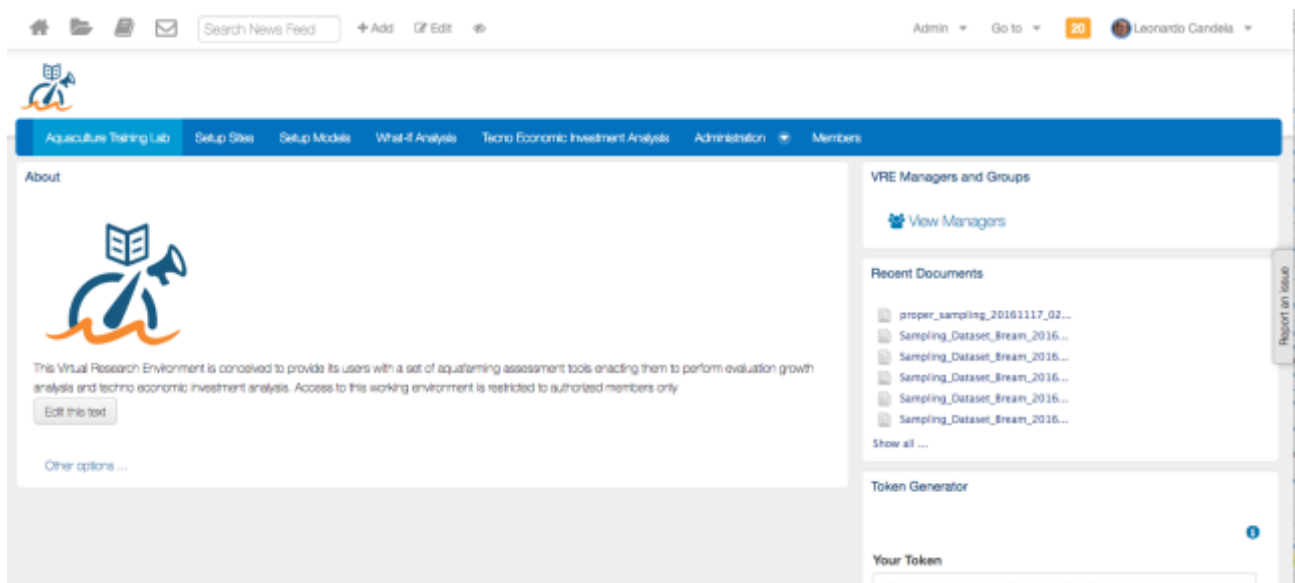


Figure 10. Aquaculture Training Lab VRE \ VLab Home Page Screenshot



In addition to the basic functionality, as a workspace for sharing objects of interest and a user management facility for managing membership, this VLab is specifically equipped with the following capabilities:

- *Setup site*: a facility to create one or more profiles representing a site of interest (an installation of aquafarm facilities) by specifying its geographic location, the oxygen rate, the current rate, and the average temperature per half of each month along the year;
- *Setup model*: a facility to create one or more simulation models estimating the KPIs for the growth of a species based on the historic samplings data. KPIs include Feed Conversion Rate (FCR), Growth Rate per Day (GPD), Specific Growth Rate (SGR), Suggested Feeding Rate (SFR), and Mortality Rate (MR) [8]. Each model is characterised by the site, the name of the species of interest, the broodstock quality, the feed quality, whether the broodstock is improved genetically, and a series of datasets recording monthly sampling data;
- *What-if analysis*: a facility enabling users to perform what-if analysis by using a model among the defined ones. This facility produces an estimation of the main KPIs according to the selected model given the initial stock count, the initial fish weight, and the period of interest. Users are provided with an estimation of main KPIs including Average Weight, Life To Date (LTD) Growth, LTD SGR, LTD Biological and Economical FCR, and LTD Mortality. Moreover, graphs reporting Weight, FCR comparing with the global trend of FCR for benchmarking purposes and Food Consumption graph in the specific time period can be produced;
- *Techno-economic investment analysis*: a facility enabling users to perform a techno economic estimation analysis of a given aquafarming task by selecting a production model and a series of economic indicators including feed price, fry price and selling price. The facility provides the user with a series of financial indicators and statistics including Net Present Value (NPV), Internal Rate of Return (IRR), Earnings Before Interest, Taxes, Depreciation and Amortization (EBITDA), Earnings Before Interest Alter Taxes (EBIAT) [8].

Figure 11 reports the total amount of operations performed in the context of this VRE. Operations include service tasks needed to maintain the VRE operational as well as human tasks, e.g. actions performed by the users via the GUI leading to the invocation of services.

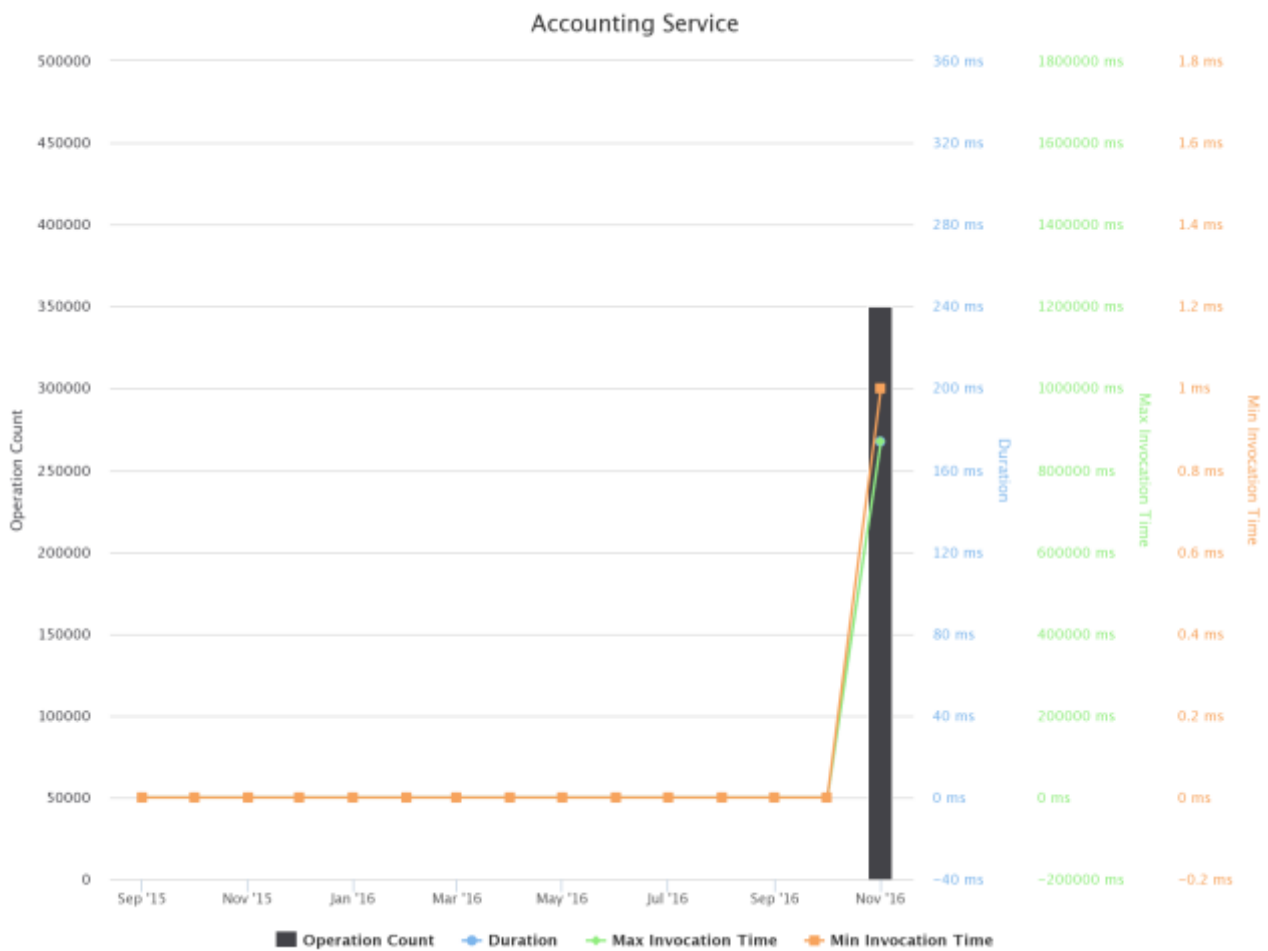


Figure 11. Aquaculture Training Lab VRE \ VLab Operations by Month

### 3.4 BAY OF BENGAL LARGE MARINE ECOSYSTEM HILSA ASSESSMENT WG VRE

The BOBLME Hilsa Assessment Working Group VRE provides data and technical information to the members of the Hilsa Assessment Working Group (Hilsa AWG). This group is called to perform stock assessment for the Hilsa fish species, and it is convened on an ad-hoc base. The members need a facility to upload, share, harmonize and standardize their tabular data of fisheries from BOBLME countries that can be nation-wide or from a specific region. Such datasets are quite diverse in quality and quantity. After uploading and preparing their data, they also need a facility for the analysis; typically, R based stock assessment software. The group counts some 15 members and is led by a consultant contracted through the BOB-LME project<sup>7</sup>. Currently the project is awaiting approval of its second phase.

The VRE is not a part of the BOBLME project, and it is offered as a service for feasibility testing. In fact, every time the working group is convened there may be different persons and institutes that need to evaluate if the environment is suitable for the group specific tasks and operation policies. The accessibility and sharing of data in the VRE remains a responsibility of the Hilsa AWG.

The Bay of Bengale Large Marine Ecosystem Hilsa Assessment WG is available at [https://i-marine.d4science.org/web/BOBLME\\_HilsaAWG](https://i-marine.d4science.org/web/BOBLME_HilsaAWG)

<sup>7</sup> <http://www.boblme.org/>

This BOBLME was inherited by iMarine thus it has been **operational** since **September 2015** from the perspective of BlueBRIDGE. It is currently serving **4 users**<sup>8</sup>.

A screenshot of the VLab is available in Figure 12; it shows the home page and the menu items for accessing the VLab facilities.

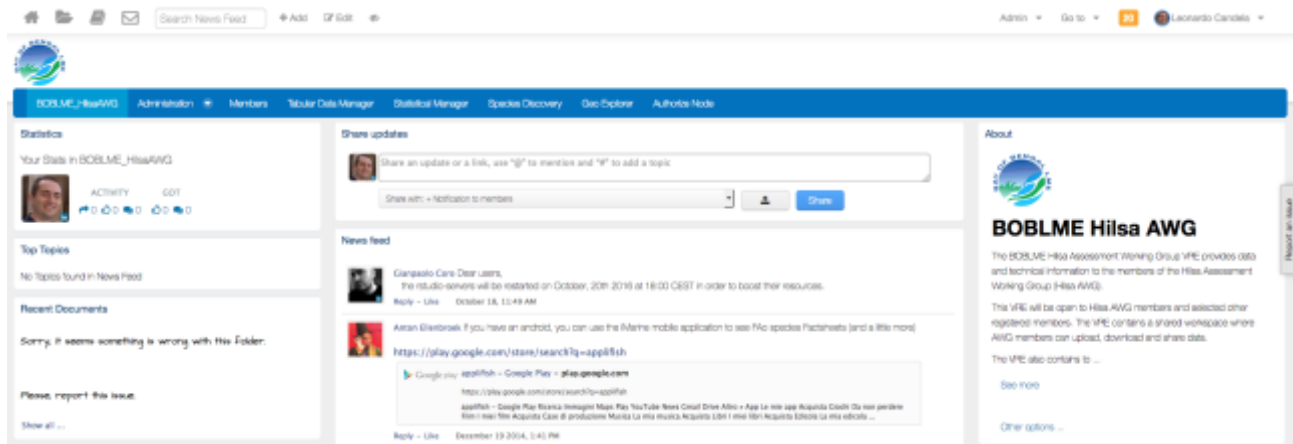


Figure 12. BOBLME Hilsa Assessment Working Group VRE \ VLab Home Page Screenshot

In addition to the basic functionality, as a workspace for sharing objects of interest, a social networking area for supporting the discussions among members and a user management facility for managing membership, this VLab is specifically equipped with the following capabilities:

- **Tabular Data management:** a facility enabling users to import, curate and manage tabular data. This feature can support data managers during the whole life cycle of data management from data capture to publication and visualisation. It enables data managers to import and transform datasets (CSV, SDMX, JSON) into tabular resources (i.e. tabular data having proper types associated with columns eventually referring to code lists) and reference datasets (code lists) representing recognized value instances of the elements the dataset is about (e.g., species, zones, countries). This functionality guarantees that the tabular resources are compliant with the defined types and code lists. Besides the curation, the facility supports the analysis of the data by enabling a user to (i) perform operations like grouping and filtering, (ii) producing charts and GIS maps (if the data have geographic features), (iii) analysing the data via an R environment as well as via the data analytics facilities (see below). Finally, the environment supports the publishing of tabular resources in the infrastructure by equipping them with rich metadata so that such resources can be used in other application contexts;
- **Species Data Discovery:** a facility enabling users to discover and manage species data products (occurrence data and taxonomic data) from a number of heterogeneous providers (including (a) GBIF and speciesLink for occurrences data, (b) ASFIS, BrazilianFlora, CatalogueOfLife, IRMNG, IT IS, NCBI, WoRDS, WoRMS for taxonomic data) in a seamless way. Once discovered, objects can be stored in the workspace for future uses;
- **Geospatial Data View:** a facility enabling users to discover and visualize GIS layers (e.g. species distribution maps) that have been generated and published. This facility relies on the GeoExplorer portlet and make it possible to effectively exploit the generated maps and perform comparisons and analysis of the diverse distributions by enabling maps overlay, transects production and values inspection;
- **Data Analytics at scale:** a facility enabling users to benefit from the offering of the DataMiner service and interactively execute a large array of data analytics tasks on datasets. These algorithms range from approaches to produce a species distribution map by means of either an expert system or a

<sup>8</sup> This figure sounds very low yet this is not a real issue because the VRE will be “re-activated” once the stock assessment activities under the BOBLME project umbrella will resume. In fact, the BOBLME project currently has no activities, it is awaiting approval of its second phase which was delayed.

machine learning model (e.g. Neural Networks) to approaches for analysing climatic changes and their effects on species distribution, approaches for estimating similarities among habitats, approaches for stock assessment (e.g. CSMY [10]). As of November '16 this environment has been configured to give access to more than **100 diverse algorithms**.

The major changes occurred in this VRE with respect to the version developed and operated by iMarine derive from the exploitation of the latest services and facilities resulting from BlueBRIDGE developments. In particular, this VLab is benefitting from the new data analytics framework and its support for Open Science practices as well as from the revised version of tabular data management.

Figure 13 reports the total amount of operations performed in the context of this VRE. Operations include service tasks needed to maintain the VRE operational as well as human tasks.

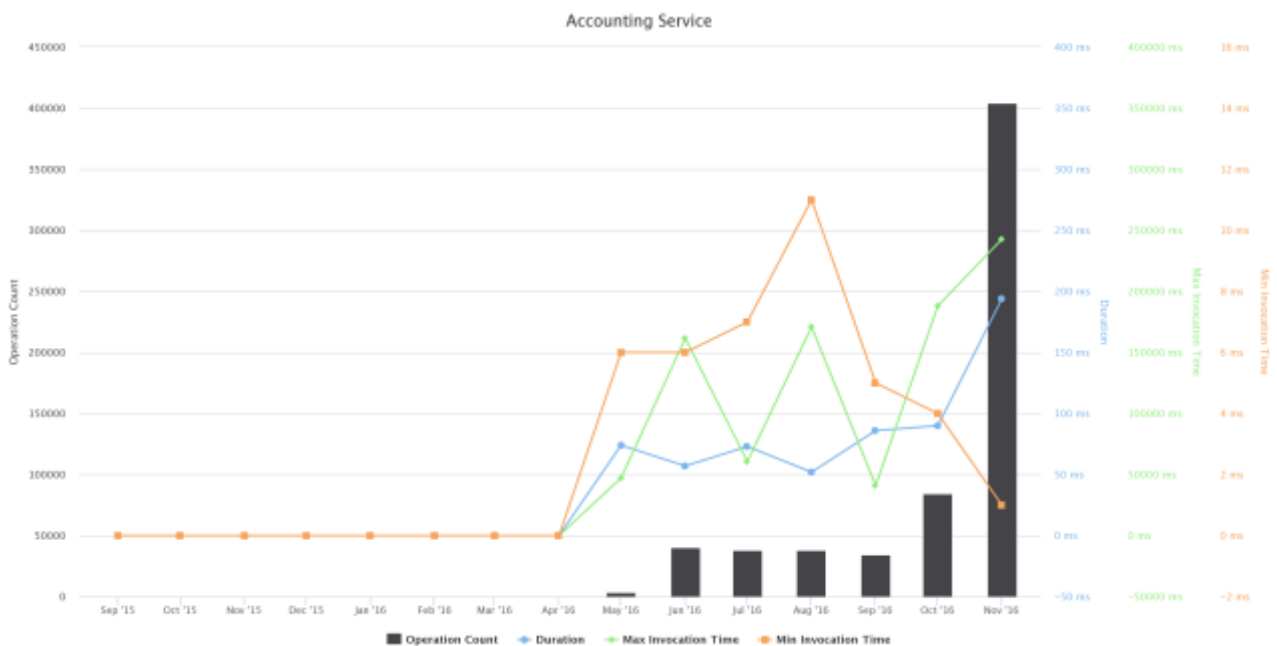


Figure 13. BOBLME Hilsa Assessment Working Group VRE \ VLab Operations per Month

### 3.5 BIODIVERSITY LAB

The Biodiversity Lab is a VLab designed to provide a collection of applications that allow scholars to perform complete experiments involving single individuals or groups of marine species. The VRE allows to: (a) inspect species maps; (b) produce a species distribution map by means of either an expert system (AquaMaps) or a machine learning model (e.g. Neural Networks); (c) analyse species observation trends; (d) inspect species occurrence data; (e) inspect species descriptions and characteristics; (f) perform analysis of climatic changes and of its effect on species distribution; (g) produce GIS maps for geo-spatial datasets; (h) discover Taxa names; (i) cluster occurrence data; and (l) estimate similarities among habitats.

The Biodiversity Lab VLab is available at <https://i-marine.d4science.org/web/biodiversitylab/>

This VLab was inherited by iMarine and thus it has been **operational** since **September 2015** from the perspective of BlueBRIDGE. It is currently serving **327 users**.

A screenshot of the VLab is available in Figure 14; it shows the home page and the menu items for accessing the VLab facilities.

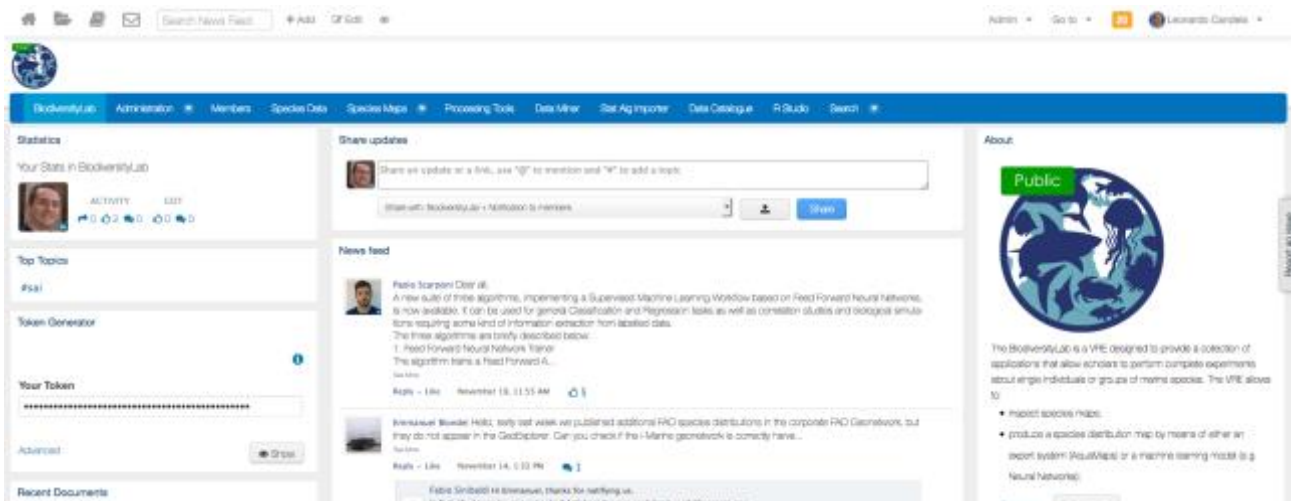


Figure 14. Biodiversity Lab VRE \ VLab Home Page Screenshot

In addition to the basic functionality, as a workspace for sharing objects of interest, a social networking area for supporting the discussions among members and a user management facility for managing membership, this VLab is specifically equipped with the following capabilities:

- *Species Data Discovery*: a facility enabling users to discover and manage species data products (occurrence data and taxonomic data) from a number of heterogeneous providers (including (a) GBIF and speciesLink for occurrences data, and (b) ASFIS, BrazilianFlora, CatalogueOfLife, IRMNG, IT IS, NCBI, WoRDS, WoRMS for taxonomic data) in a seamless way. Once discovered, objects can be stored in the workspace for future uses;
- *Species View*: a facility enabling users to discover and browse species products (namely species distribution maps). This facility supports discovery mechanisms ranging from simple search based on species names to very specific search criterion, and it offers a comprehensive set of products visualisation approaches;
- *Geospatial Data View*: a facility enabling users to discover and visualize GIS layers, e.g. species distribution maps that have been generated and published. This facility relies on the GeoExplorer portlet, and makes it possible to effectively exploit the generated maps and to perform comparisons and analysis of the diverse distributions by enabling map overlay, transects production and values inspection;
- *Data Analytics at scale*: a facility enabling users to benefit from the offerings of the DataMiner service and interactively execute a large array of data analytics tasks on datasets. These algorithms range from approaches to produce a species distribution map by means of either an expert system or a machine learning model (e.g. Neural Networks) to approaches for analysing climatic changes and their effects on species distribution, approaches for estimating similarities among habitats, and approaches for stock assessment (e.g. CSMY [10]). As of November '16 this environment has been configured to give access to more than **100 diverse algorithms**;
- *Algorithm Importer*: a facility enabling users to transform R-based algorithms and methods into DataMiner algorithms [5], i.e. methods that can be executed by the data analytics platform. This transformation assists in annotating the code, thus making it possible for Data Miner to properly execute it;
- *Data Catalogue*: a facility enabling users to access the BlueBRIDGE products catalogue. This catalogue currently gives access to **48.2k products** (namely species distribution maps).
- *R Studio as-a-Service*: a facility enabling users to access a fully-fledged RStudio® working environment directly from the VRE. This environment is integrated with the rest of VRE \ VLab facilities, e.g. it is possible to use files from the workspace and to store new files in the workspace;

- *Semantic-based data discovery*: a facility enabling users to search and browse the MarineTLO Data Warehouse [14].

The major changes occurred in this VRE with respect to the version developed and operated by iMarine derive from the exploitation of the latest services and facilities resulting from BlueBRIDGE developments. In particular, this VLab is benefitting from the new data analytics framework and its support for Open Science practices, the facility to support the integration of new algorithms \ methods, the data catalogue, and the RStudio® integration.

Figure 15 reports the total amount of operations performed in the context of this VRE. Operations include service tasks needed to maintain the VRE operational as well as human tasks.

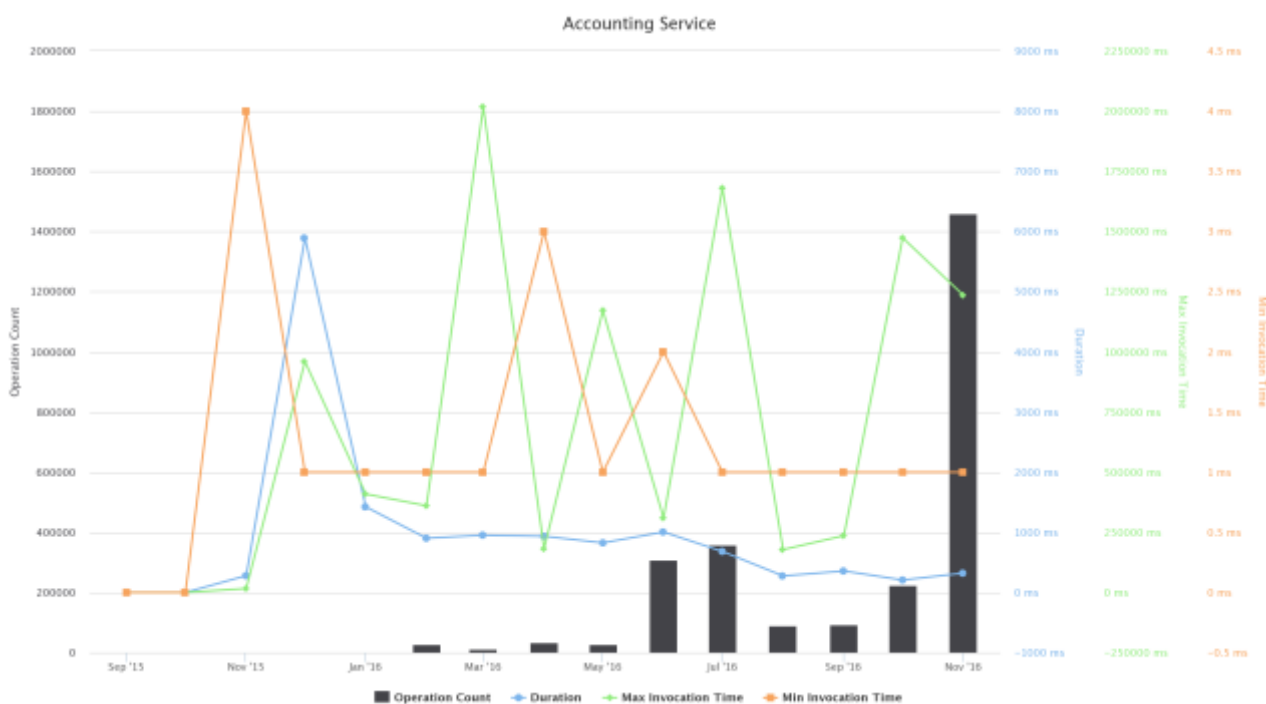


Figure 15. Biodiversity Lab VRE \ VLab Operations by Month

### 3.6 BIONYM

The BiOnym VLab provides its users with a service" developed in the iMarine context to compare a set of scientific names against taxonomic reference lists including recognised ones like Catalogue of Life. The goal of the comparison is to check the “correctness” of the set of scientific names with respect to the target tax names and possibly to suggest their correct spelling.

The BiOnym VLab is available at <https://i-marine.d4science.org/web/bionym>

This VLab was inherited by iMarine, and thus it is considered *operational* since *September 2015* from the perspective of BlueBRIDGE. It is currently serving **81 users**.

A screenshot of the VLab is available in Figure 16; it shows the home page and the menu items for accessing the VLab facilities.

Figure 16. BiOnym VRE \ VLab Home Page Screenshot

In addition to the basic functionality, as a workspace for sharing objects of interest, a social networking area for supporting the discussions among members and a user management facility for managing membership, this VLab is specifically equipped with the following capabilities:

- *Taxa Name Processing*: a facility enabling users to execute various BiOnym workflows [15], namely: (a) *BiOnym* to activate several taxa names matching algorithms; (b) *BiOnym Biodiv* that applies in sequence the following Matchers: GSay (thr:0.6, maxRes:10), FuzzyMatcher (thr:0.6, maxRes:10), Levenshtein (thr:0.4, maxRes:10), Trigram (thr:0.4, maxRes:10); and (c) *BiOnym Local* a fast version of BiOnym.

The major changes occurred in this VRE with respect to the version developed and operated by iMarine derive from the exploitation of the latest services and facilities resulting from BlueBRIDGE developments. In particular, this VLab is benefitting from the new data analytics framework and its support for Open Science practices for executing the BiOnym algorithms.

Figure 17 reports the total amount of operations performed in the context of this VRE. Operations include service tasks needed to maintain the VRE operational as well as human tasks.





Figure 17. BiOnym VRE \ VLab Operations by Month

### 3.7 BLUEBRIDGE-EAB

This VRE is dedicated to supporting the activity of the BlueBRIDGE External Advisory Board (EAB). This board serves as a tremendous ally in the quest for superior project governance by providing non-binding but informed guidance. It is composed of key internationally-recognised experts. By this environment, members of the EAB are regularly informed on project progress.

The BlueBRIDGE-EAB is available at: <https://i-marine.d4science.org/web/bluebridge-eab>

This VRE has been in **operational** status since **March '16** and it is currently serving **17 users**.

A screenshot of the VRE is provided in Figure 18; it shows the home page and the menu items for accessing the VLab facilities.

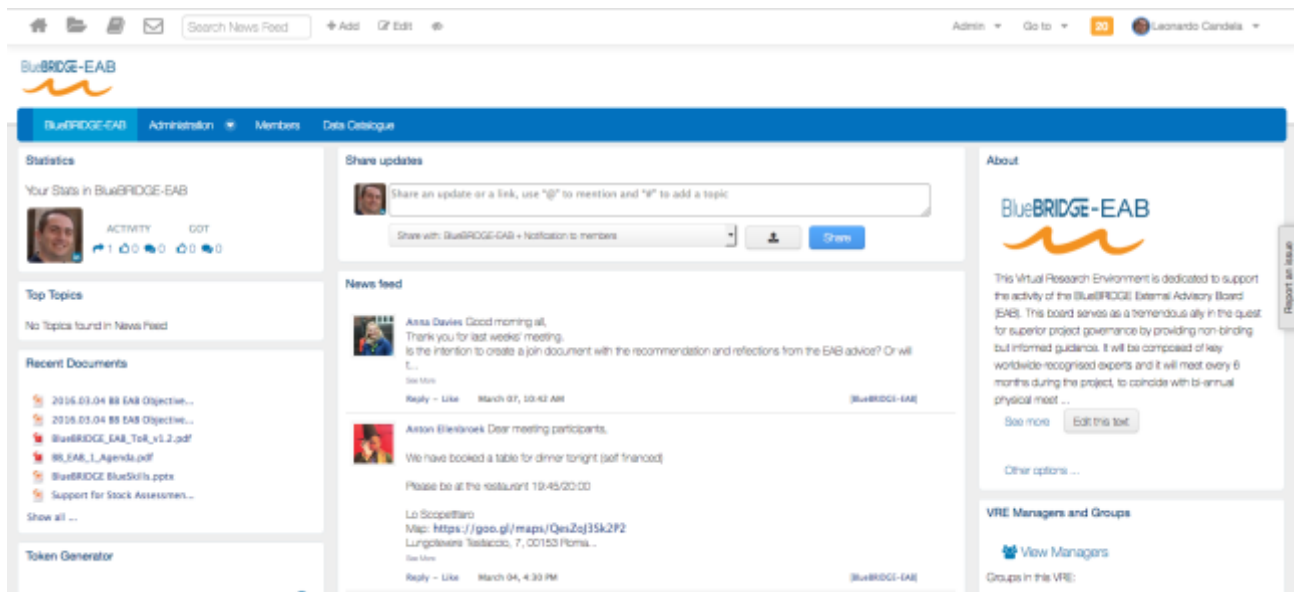


Figure 18. BlueBRIDGE-EAB VRE \ VLab Home Page Screenshot

In addition to the basic functionality, as a workspace for sharing objects of interest, a social networking area for supporting the discussions among members and a user management facility for managing membership, this VRE is specifically equipped with the following capabilities:



- *Data Catalogue*: a facility enabling EAB members to access the BlueBRIDGE products catalogue. This catalogue currently gives access to **48.2k products** (namely species distribution maps).

The rationale leading to making the data catalogue available is based on the fact that by having it available EAB members are acquainted with the “products” published by the project and can comment on them. In the future, the project might decide to make available by this VRE specific services and facilities to collect feedback and advices on them.

Figure 19 reports the total amount of operations performed in the context of this VRE. Operations include service tasks needed to maintain the VRE operational as well as human tasks.

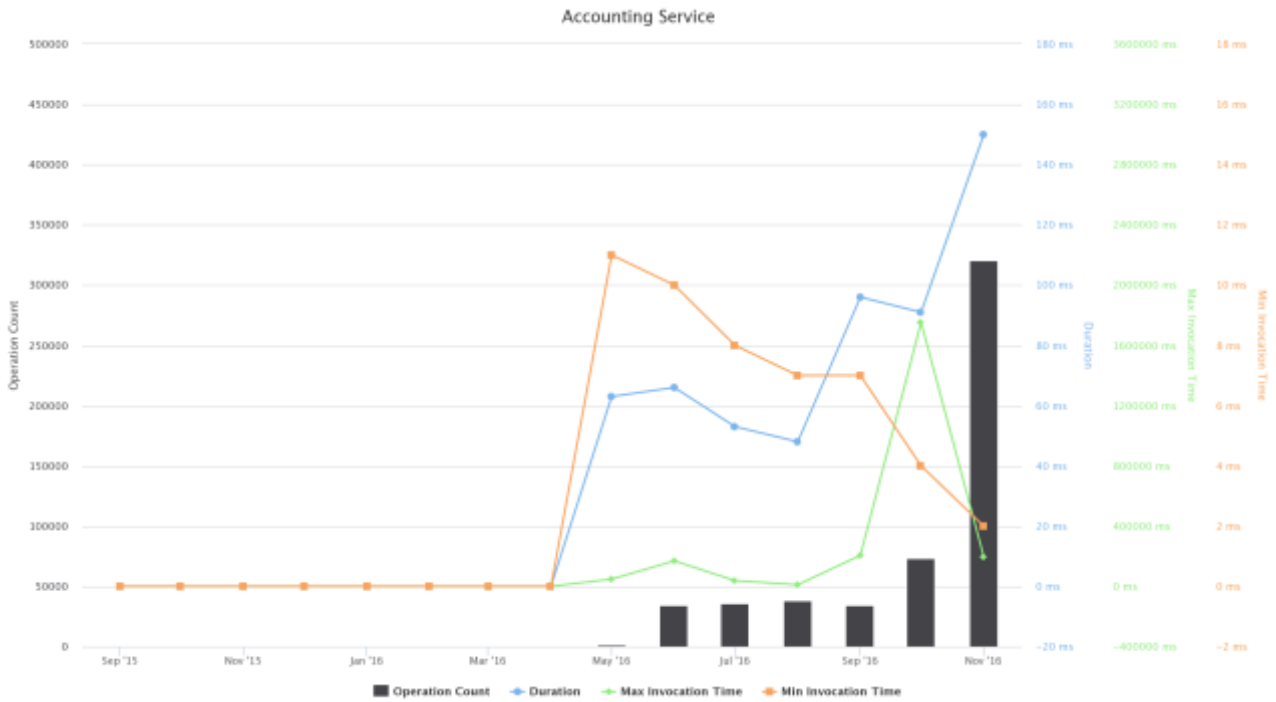


Figure 19. BlueBRIDGE EAB VRE \ VLab Operations per Month

### 3.8 BLUEBRIDGE-PSC

This VRE is dedicated to supporting the Activity of the BlueBRIDGE Project Steering Committee (PSC) members.

The BLUEBRIDGE-PSC VRE is available at <https://i-marine.d4science.org/web/bluebridge-psc>

This VRE has been in **operational** status since **October '15** and it is currently serving **9 users**, namely the BlueBRIDGE PSC members.

A screenshot of the VRE is in Figure 20; it shows the home page and the menu items for accessing the VLab facilities.



Figure 20. BlueBRIDGE-PSC VRE \ VLab Home Page Screenshot

This VRE is equipped with the basic VRE facilities, and primarily works as a workspace for sharing objects of interest, a social networking area for supporting the discussions among members and a user management facility for managing membership.

Figure 21 reports the total amount of operations performed in the context of this VRE. Operations include service tasks needed to maintain the VRE operational as well as human tasks.

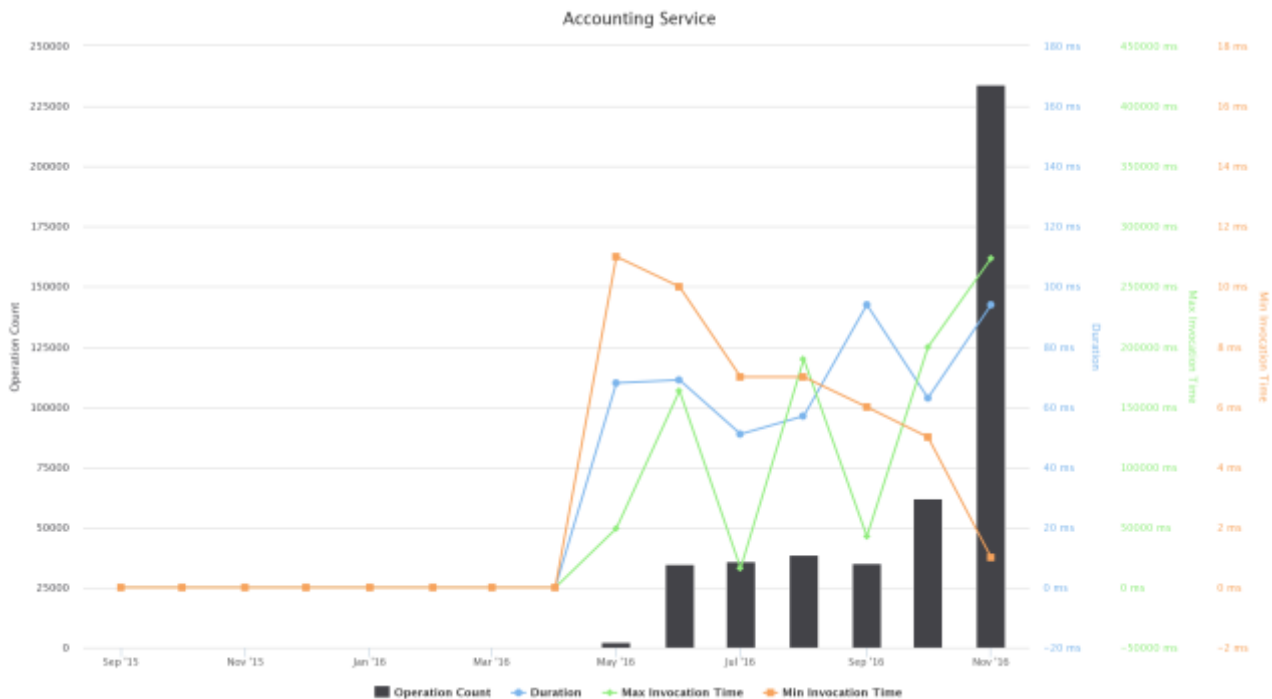


Figure 21. BlueBRIDGE PSC VRE \ VLab Operations per Month

### 3.9 BLUEBRIDGE PROJECT

This VRE was devised to support the BlueBRIDGE project activities and discussions. Only members of the BlueBRIDGE consortium have access to this VRE.

The BLUEBRIDGE Project VRE is available at <https://i-marine.d4science.org/web/bluebridgeproject>

This VRE has been in **operational** status since **September '15** and it is currently serving **90 users**, namely the BlueBRIDGE Consortium members.

A screenshot of the VRE is provided in Figure 22, it shows the home page and the menu items for accessing the VRE facilities.

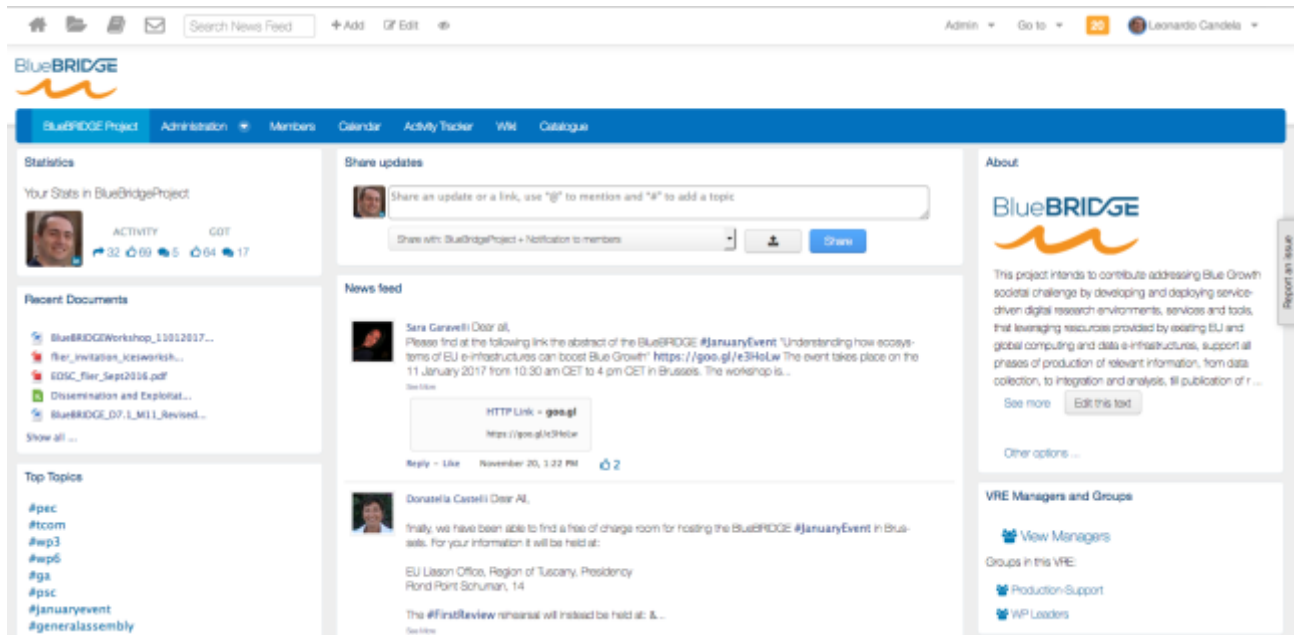


Figure 22. BlueBRIDGE VRE \ VLab Home Page Screenshot

In addition to the basic functionality, as a workspace for sharing objects of interest, a social networking area for supporting the discussions among members and a user management facility for managing membership, this VRE is specifically equipped with the following capabilities:

- *BlueBRIDGE Wiki*: a facility enabling users to access the project Wiki;
- *BlueBRIDGE Issue Tracking System*: a facility enabling users to access the project issue tracking system;
- *Data Catalogue*: a facility enabling users to access the BlueBRIDGE products catalogue. This catalogue currently gives access to **48.2k products** (namely species distribution maps).

Figure 23 reports the total amount of operations performed in the context of this VRE. Operations include service tasks needed to maintain the VRE operational as well as human tasks.

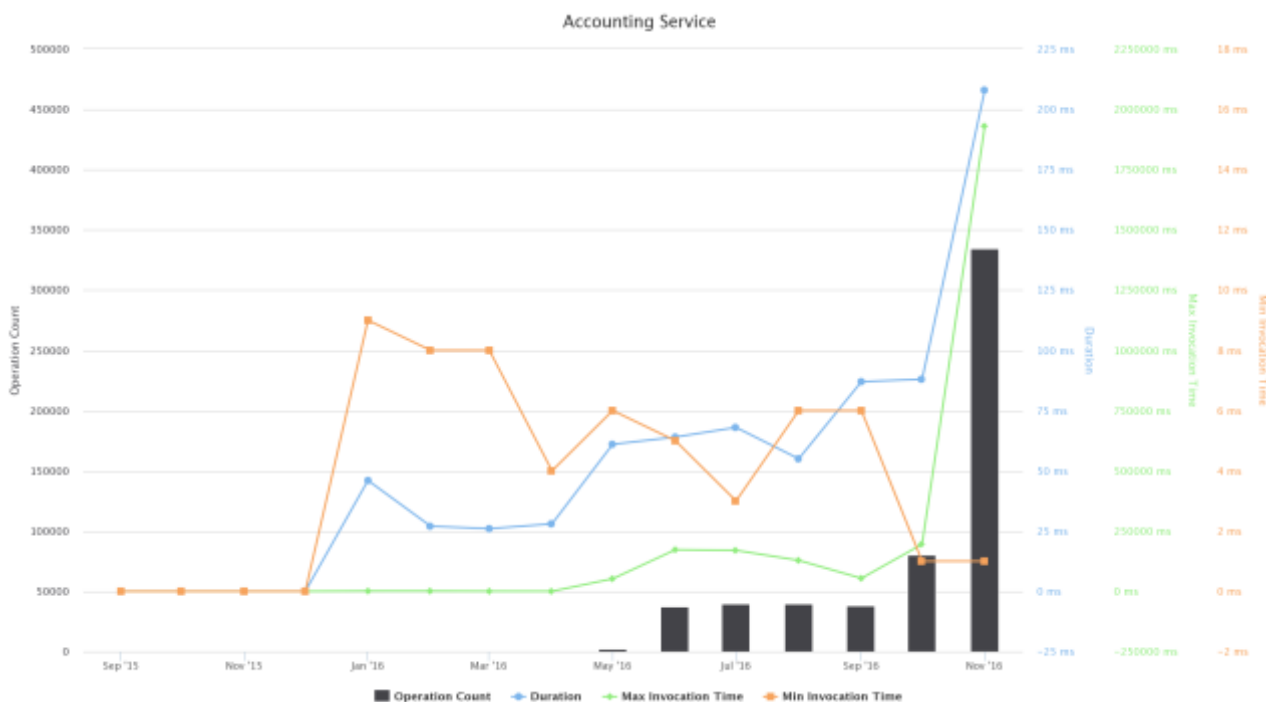


Figure 23. BlueBRIDGE VRE \ VLab Operations per Month

### 3.10 BLUE COMMONS

Blue Commons is dedicated to the members of WP4, WP9 and WP10. They are in charge of developing, releasing and operating the VRE facilities requested by WP5-8 as well as of extending and consolidating the gCube technology enabling the integration of existing infrastructures (including computing and data infrastructures) into a coherent and organised federation that can be easily managed by guaranteeing the operation autonomy of the single resources.

The Blue Commons VRE is available at <https://i-marine.d4science.org/web/bluecommons>

This VRE has been in **operational** status since **September '15** and it is currently serving **33 users**.

A screenshot of the VRE is provided in Figure 24, it shows the home page and the menu items for accessing the VLab facilities.

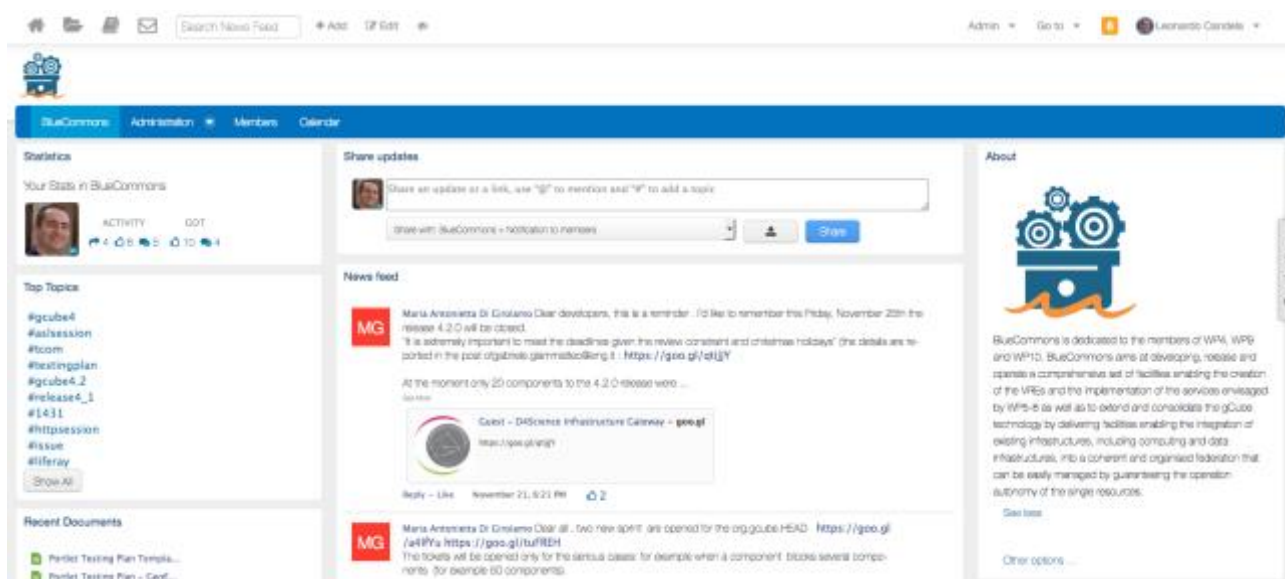


Figure 24. Blue Commons VRE \ VLab Home Page Screenshot

This VRE is equipped with VRE basic facilities, as a workspace for sharing objects of interest, a social networking area for supporting the discussions among members and a user management facility for managing membership.

Figure 25 reports the total amount of operations performed in the context of this VRE. Operations include service tasks needed to maintain the VRE operational as well as human tasks.

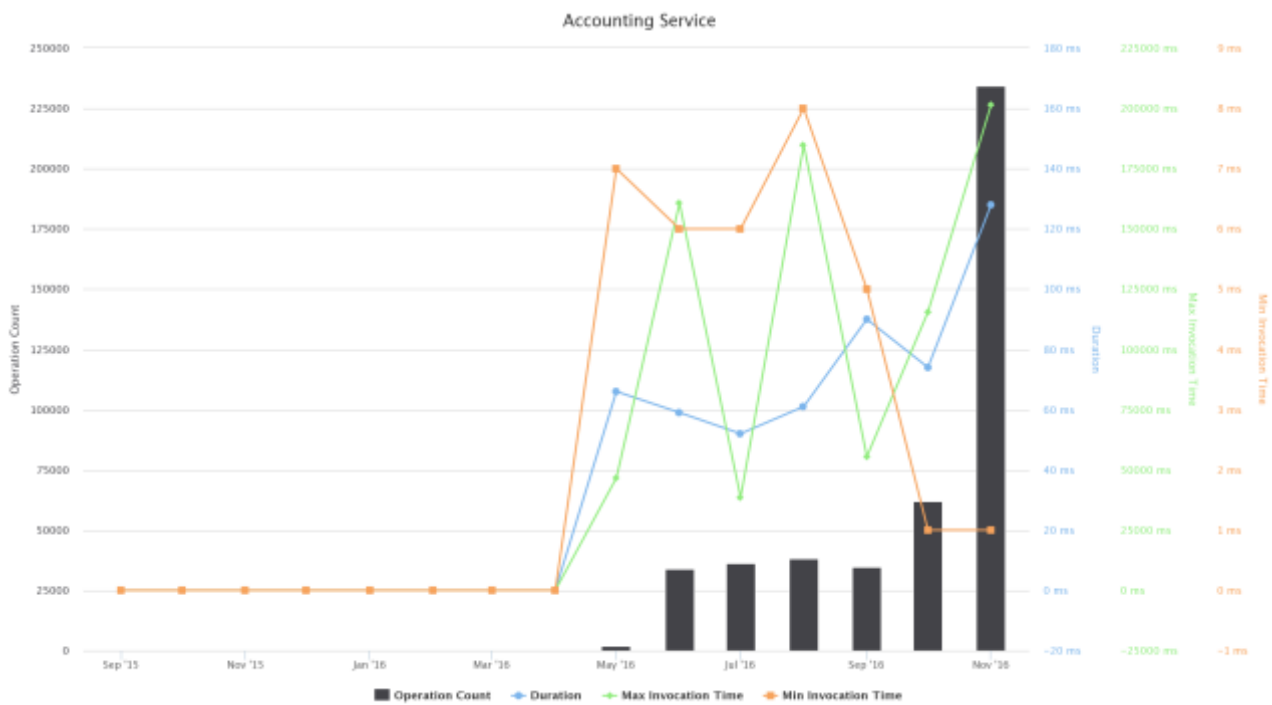


Figure 25. Blue Commons VRE \ VLab Operations per Month

### 3.11 BLUE UPTAKE

This Virtual Research Environment was conceived to support the BlueBRIDGE Blue Uptake activity, the goal of which is to raise awareness of BlueBRIDGE and its offer.

The Blue Uptake VRE is available at <https://i-marine.d4science.org/web/blueuptake>

This VRE has been in **operational** status since **September '15** and it is currently serving **34 users**.

A screenshot of the VRE is in Figure 26; it shows the home page and the menu items for accessing the VRE facilities.

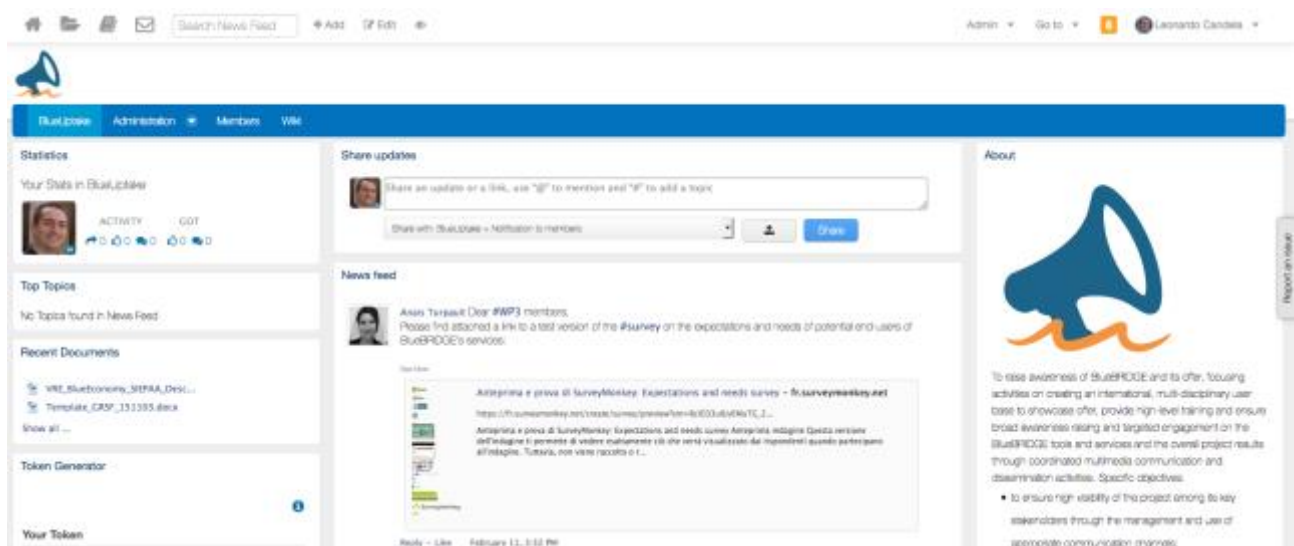


Figure 26. Blue Uptake VRE \ VLab Home Page Screenshot

In addition to the basic functionality, as a workspace for sharing objects of interest, a social networking area for supporting the discussions among members and a user management facility for managing membership, this VRE is specifically equipped with the following capabilities:

- *BlueBRIDGE Wiki*: a facility enabling users to access the project Wiki;

Figure 27 reports the total amount of operations performed in the context of this VRE. Operations include service tasks needed to maintain the VRE operational as well as human tasks.

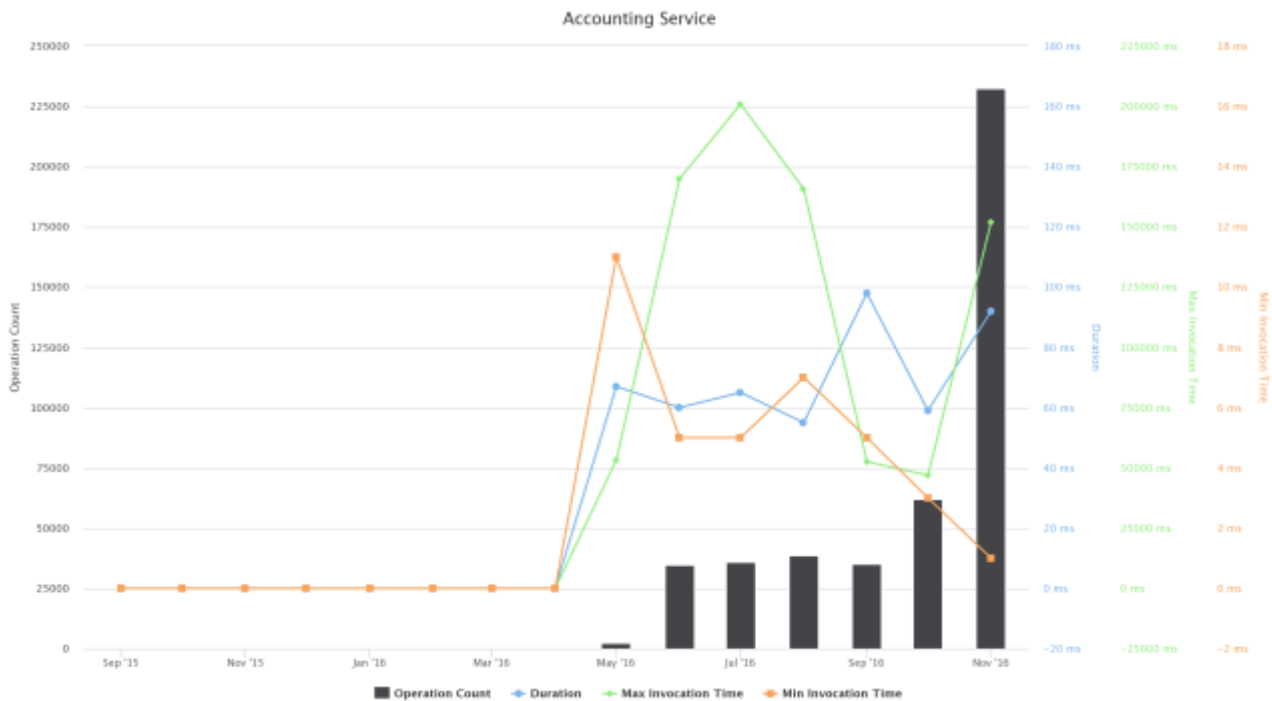


Figure 27. Blue Uptake VRE \ VLab Operations per Month

### 3.12 ELLINIKA PSARIA VRE

This VRE was conceived to provide the Ellinika Psaria aquaculture company members with a set of aquafarming assessment tools enabling them to perform evaluation growth analysis and techno economic investment analysis. Access to this working environment is restricted to Ellinika Psaria members only.

The Ellinika Psaria VRE is available at <https://i-marine.d4science.org/web/ellinikapsariavre>

This VLab stems from the Blue Economy VREs [8] and is currently in “available” status, i.e. it is working and waiting for uptake by the Ellinka Psaria company.

A screenshot of the VLab is provided in Figure 28; it shows the home page and the menu items for accessing the VLab facilities.

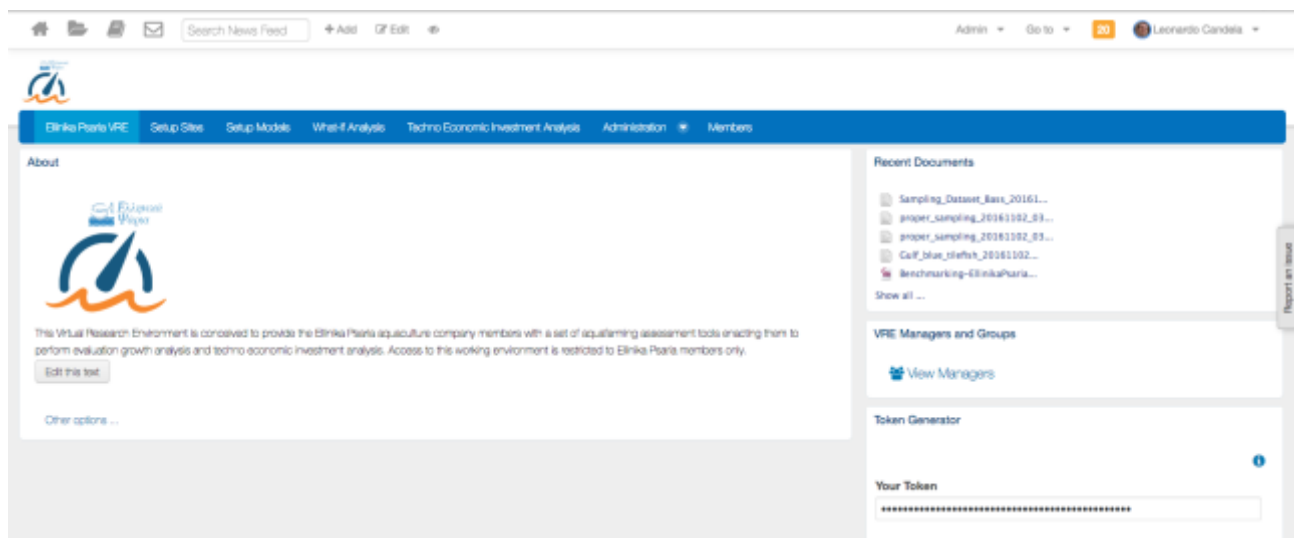


Figure 28. Ellinika Psaria VRE \ VLab Home Page Screenshot

In addition to the basic functionalities, this VLab is specifically equipped with the following capabilities:

- **Setup site:** a facility to create one or more profiles representing a site of interest (an installation of aquafarm facilities) by specifying its geographic location, the oxygen rate, the current rate, and the average temperature per half of each month throughout the year;
- **Setup model:** a facility to create one or more simulation models to estimate the KPIs for the growth of a species based on the historic samplings data. KPIs include Feed Conversion Rate (FCR), Growth Rate per Day (GPD), Specific Growth Rate (SGR), Suggested Feeding Rate (SFR), and Mortality Rate (MR) [8]. Each model is characterised by the site, the name of the species of interest, the broodstock quality, the feed quality, whether the broodstock is improved genetically, and a series of datasets recording monthly sampling data;
- **What-if analysis:** a facility enabling users to perform what-if analysis by using a model among the defined ones. This facility produces an estimation of the main KPIs according to the selected model given the initial stock count, the initial fish weight, and the period of interest. Users are provided with an estimation of main KPIs including Average Weight, Life to Date (LTD) Growth, LTD SGR, LTD Biological and Economical FCR, and LTD Mortality. Moreover, graphs reporting Weight, FCR comparing with the global trend of FCR for benchmarking purposes and Food Consumption graph in the specific time period can be generated;
- **Techno-economic investment analysis:** a facility enabling users to perform a techno economic estimation analysis of a given aquafarming task by selecting a production model and a series of economic indicators including feed price, fry price and selling price. The facility provides the user with a series of financial indicators and statistics including Net Present Value (NPV), Internal Rate of Return (IRR), Earnings Before Interest, Taxes, Depreciation and Amortization (EBITDA), Earnings Before Interest Alter Taxes (EBIAT) [8].

Figure 29 reports the total amount of operations performed in the context of this VLab. Operations include service tasks needed to maintain the VLab operational as well as human tasks. This VLab is not in an operational state yet, and thus the large majority of operations have been performed during the deployment and testing of the VLab that happened from October '16 up to November '16.



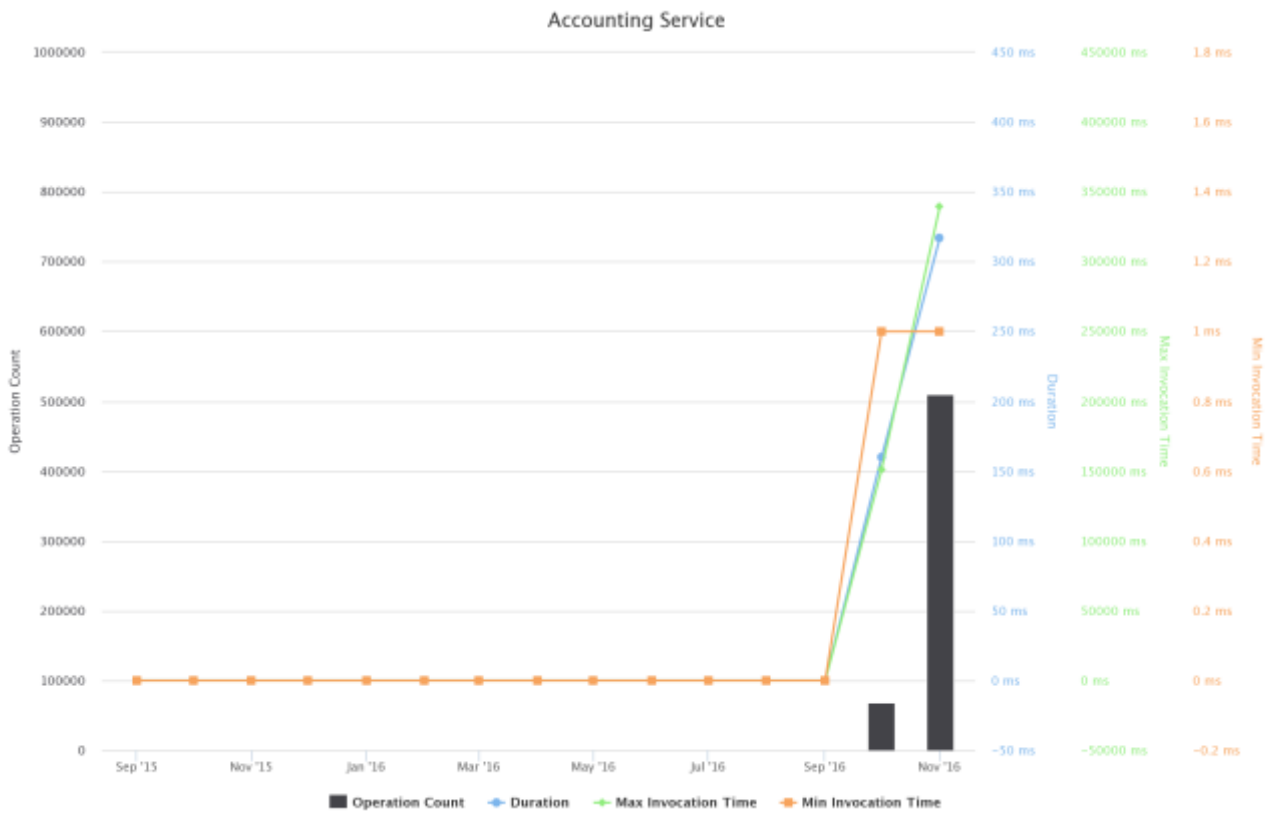


Figure 29. Ellinika Psaria VRE \ VLab Operations by Month

### 3.13 FAO TUNA ATLAS

The FAO Tuna Atlas VLab offers tools to centralize, harmonize and standardize multiple data source on tuna and bill-fish catches to feed 2 FAO tools: (a) the Atlas of Tuna and Billfish Catches, and (b) the global tuna catches by stock.

The FAO Tuna Atlas VRE is available at [https://i-marine.d4science.org/web/fao\\_tunaatlas](https://i-marine.d4science.org/web/fao_tunaatlas)

This VLab is inherited by iMarine, and thus it is considered **operational** status since September 2015 from the perspective of BlueBRIDGE. It is currently serving **21 users**.

A screenshot of the VLab is provided in Figure 30; it shows the home page and the menu items for accessing the VLab facilities.

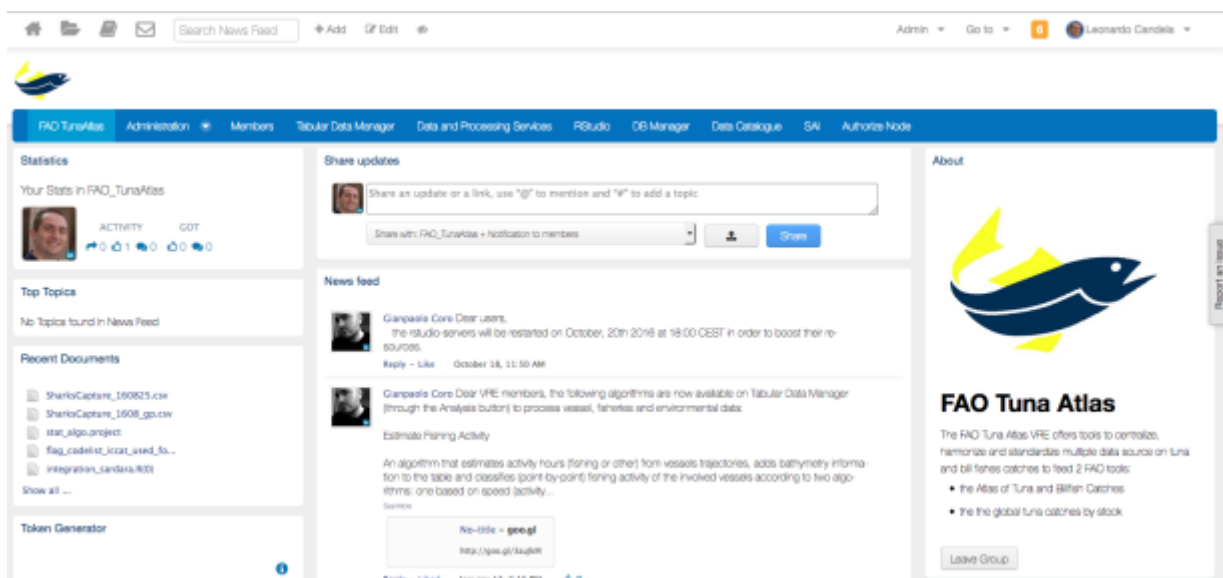


Figure 30. FAO Tuna Atlas VRE \ VLab Home Page Screenshot



In addition to the basic functionality, as a workspace for sharing objects of interest, a social networking area for supporting the discussions among members and a user management facility for managing membership, this VLab is specifically equipped with the following capabilities:

- *Tabular Data management*: a facility enabling users to import, curate and manage tabular data. This feature can support data managers during the whole life cycle of data management from data capture to publication and visualisation. It enables data managers to import and transform datasets (CSV, SDMX, JSON) into tabular resources (i.e. tabular data having proper types associated with columns eventually referring to code lists) and reference datasets (code lists) representing recognized value instances of the elements the dataset is about (e.g., species, zones, countries). This functionality guarantees that the tabular resources are compliant with the defined types and code lists. Besides the curation, the facility supports the analysis of the data by enabling a user to (i) perform operations like grouping and filtering, (ii) producing charts and GIS maps (if the data have geographic features), (iii) analysing the data via an R environment as well as via the data analytics facilities (see below). Finally, the environment supports the publishing of tabular resources in the infrastructure by equipping them with rich metadata so that such resources can be used in other application contexts;
- *Data Analytics at scale*: a facility enabling users to benefit from the offering of the DataMiner service and to interactively execute a large array of data analytics tasks on datasets. The supported tasks include methods for accessing and manipulating Tuna Atlas data, methods for accessing data from a relational database, and methods for performing specific geospatial transformations (e.g. transforming FAO Ocean Area CWP codes value in longitude, latitude and resolution). As of November '16 this environment has been configured to give access to more than **20 diverse algorithms**;
- *Algorithm Importer*: a facility enabling users to transform R-based algorithms and methods into DataMiner algorithms [5], i.e. methods that can be executed by the data analytics platform. This transformation assists in annotating the code to make it possible for Data Miner to properly execute it;
- *Data Catalogue*: a facility enabling users to access the BlueBRIDGE products catalogue. This catalogue currently gives access to 48.2k products (namely species distribution maps).
- *R Studio as-a-Service*: a facility enabling users to access a fully-fledged RStudio® working environment directly from the VRE. This environment is integrated with the rest of VRE \ VLab facilities, e.g. it is possible to use files from the workspace and to store new files within the workspace.

The major changes occurred in this VRE with respect to the version developed and operated by iMarine derive from the exploitation of the latest services and facilities resulting from BlueBRIDGE developments. In particular, this VLab is benefitting from the new data analytics framework and its support for Open Science practices, the facility to support the integration of new algorithms \ methods, the data catalogue, and the RStudio® integration.

Figure 31 reports the total amount of operations performed in the context of this VRE. Operations include service tasks needed to maintain the VRE operational as well as human tasks.

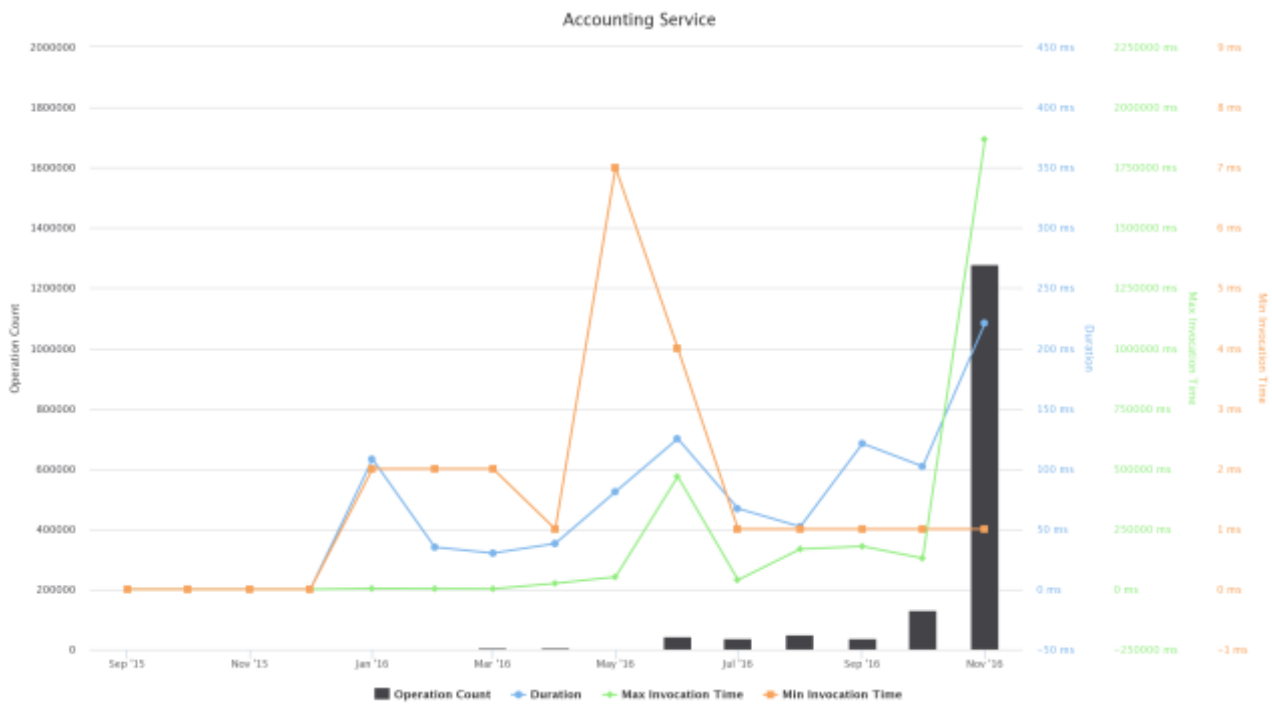


Figure 31. FAO Tuna Atlas VRE \ VLab Operations per Month

### 3.14 FORKY'S VRE

This VLab is conceived to provide the Forky's aquaculture company members with a set of aquafarming assessment tools enabling them to perform evaluation growth analysis and techno economic investment analysis. Access to this working environment is restricted to Forky's members only.

The Forky's VRE is available at <https://i-marine.d4science.org/web/forkysvre>

This VLab stems from the Blue Economy VREs [8] and it is currently in "available" status, i.e. it is working and waiting for uptake by the Ellinka Psaria company.

A screenshot of the VLab is in Figure 32; it shows the home page and the menu items for accessing the VLab facilities.

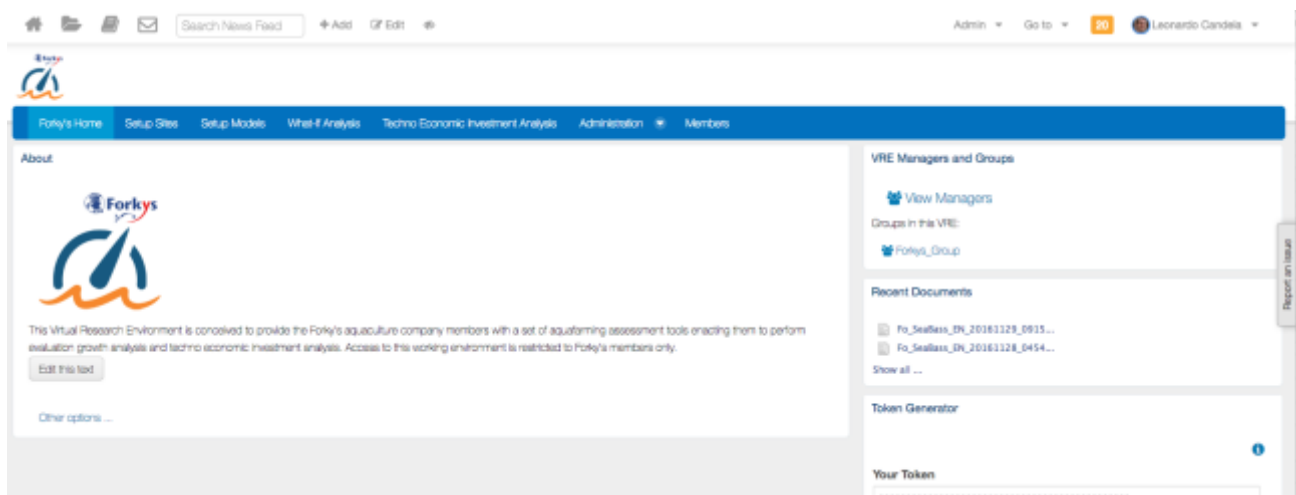


Figure 32. Forky's VRE \ VLab Home Page Screenshot

In addition to the basic functionality, as a workspace for sharing objects of interest and a user management facility for managing membership, this VLab is specifically equipped with the following capabilities:

- *Setup site*: a facility to create one or more profiles representing a site of interest (an installation of aquafarm facilities) by specifying its geographic location, the oxygen rate, the current rate, and the average temperature per half of each month throughout the year;
- *Setup model*: a facility to create one or more simulation models estimating the KPIs for the growth of a species based on the historic samplings data. KPIs include Feed Conversion Rate (FCR), Growth Rate per Day (GPD), Specific Growth Rate (SGR), Suggested Feeding Rate (SFR), and Mortality Rate (MR) [8]. Each model is characterised by the site, the name of the species of interest, the broodstock quality, the feed quality, whether the broodstock is improved genetically, and a series of datasets recording monthly sampling data;
- *What-if analysis*: a facility enabling users to perform what-if analysis by using a model among the defined ones. This facility produces an estimation of the main KPIs according to the selected model given the initial stock count, the initial fish weight, and the period of interest. Users are provided with an estimation of main KPIs including Average Weight, Life To Date (LTD) Growth, LTD SGR, LTD Biological and Economical FCR, and LTD Mortality. Moreover, graphs reporting Weight, FCR comparing with the global trend of FCR for benchmarking purposes and Food Consumption graph in the specific time period can be generated;
- *Techno-economic investment analysis*: a facility enabling users to perform a techno economic estimation analysis of a given aquafarming task by selecting a production model and a series of economic indicators including feed price, fry price and selling price. The facility provides the user with a series of financial indicators and statistics including Net Present Value (NPV), Internal Rate of Return (IRR), Earnings Before Interest, Taxes, Depreciation and Amortization (EBITDA), Earnings Before Interest Alter Taxes (EBIAT) [8].

Figure 33 reports the total amount of operations performed in the context of this VLab. Operations include service tasks needed to maintain the VLab operational as well as human tasks. This VLab is not in operational state yet, and thus the large majority of operations were performed during the deployment and testing of the VLab that took place October '16 to November '16.

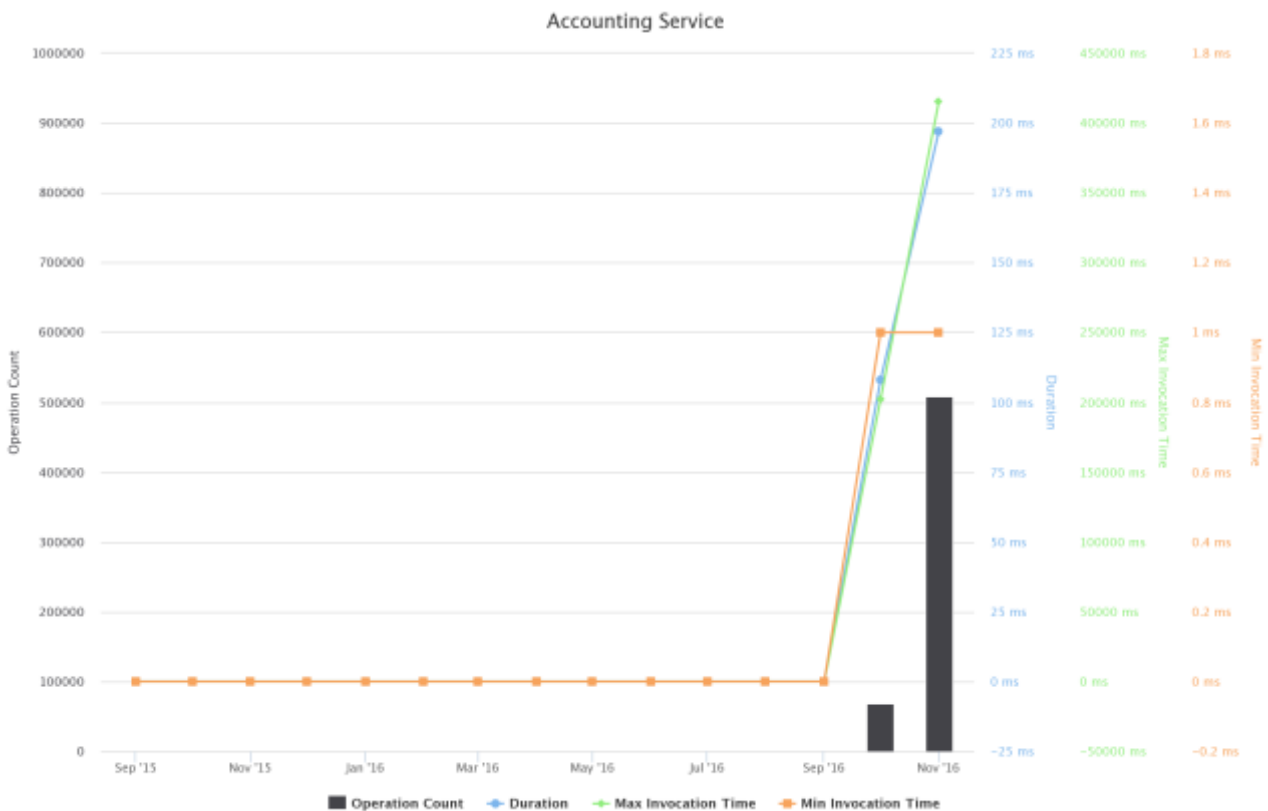


Figure 33. Forky's VRE \ VLab Operations by Month

### 3.15 GLOBAL RECORD OF STOCKS AND FISHERIES (GRSF)

The main purpose of this VLab is to provide scientists with an environment and tools for **accessing stocks and fisheries information** in an integrated and uniform way. To this end, an innovative and unifying registry containing such information is made available: the **Global Registry of Stocks and Fisheries** [7]. It integrates data about stocks, fisheries and their corresponding details, coming from different sources (including FIRMS <http://firms.fao.org/firms/en> - RAM Legacy Stock Assessment Database <http://ramlegacy.org> - FishSource <http://www.fishsource.com>) and offers authoritative records about them, i.e., the GRSF records. The GRSF records made available by this VLab are produced by relying on the GRSF Admin VLab (cf. Sec. 3.16).

The VLab is available at <https://i-marine.d4science.org/web/grsf>

This VLab stems from the Blue Assessment VREs [7] and it is currently in “**available**” status, i.e. it is working and waiting for the official release.

A screenshot of the VLab is provided in Figure 34; it shows the home page and the menu items for accessing the VLab facilities.

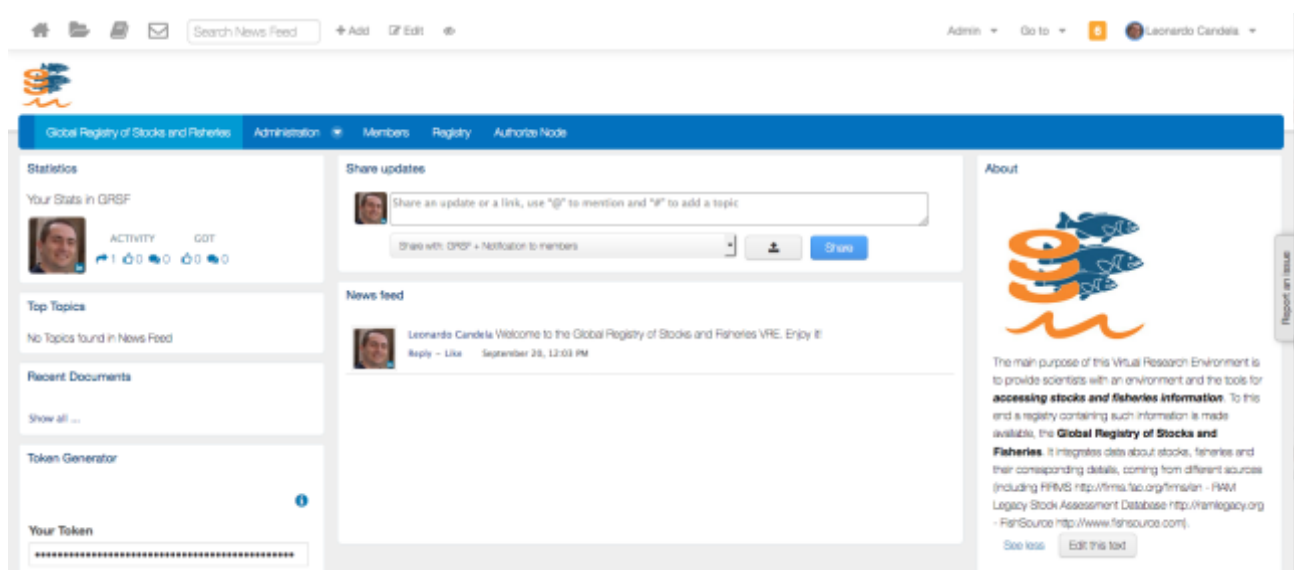


Figure 34. GRSF VRE \ VLab Home Page Screenshot

In addition to the basic functionality, as a workspace for sharing objects of interest, a social networking area for supporting the discussions among members and a user management facility for managing membership, this VRE is specifically equipped with:

- **GRSF Catalogue:** a facility enabling users to have access (via search and browse) to the current version of the catalogue of records on stocks and fisheries resulting from the integration of data coming from different sources (including FIRMS <http://firms.fao.org/firms/en> - RAM Legacy Stock Assessment Database <http://ramlegacy.org> - FishSource <http://www.fishsource.com>);

Figure 35 reports the total amount of operations performed in the context of this VLab. Operations include service tasks needed to maintain the VLab operational as well as human tasks. This VLab is not in operational state yet, and thus the large majority of operations have been performed during the deployment and testing of the VLab that happened from October '16 to November '16.

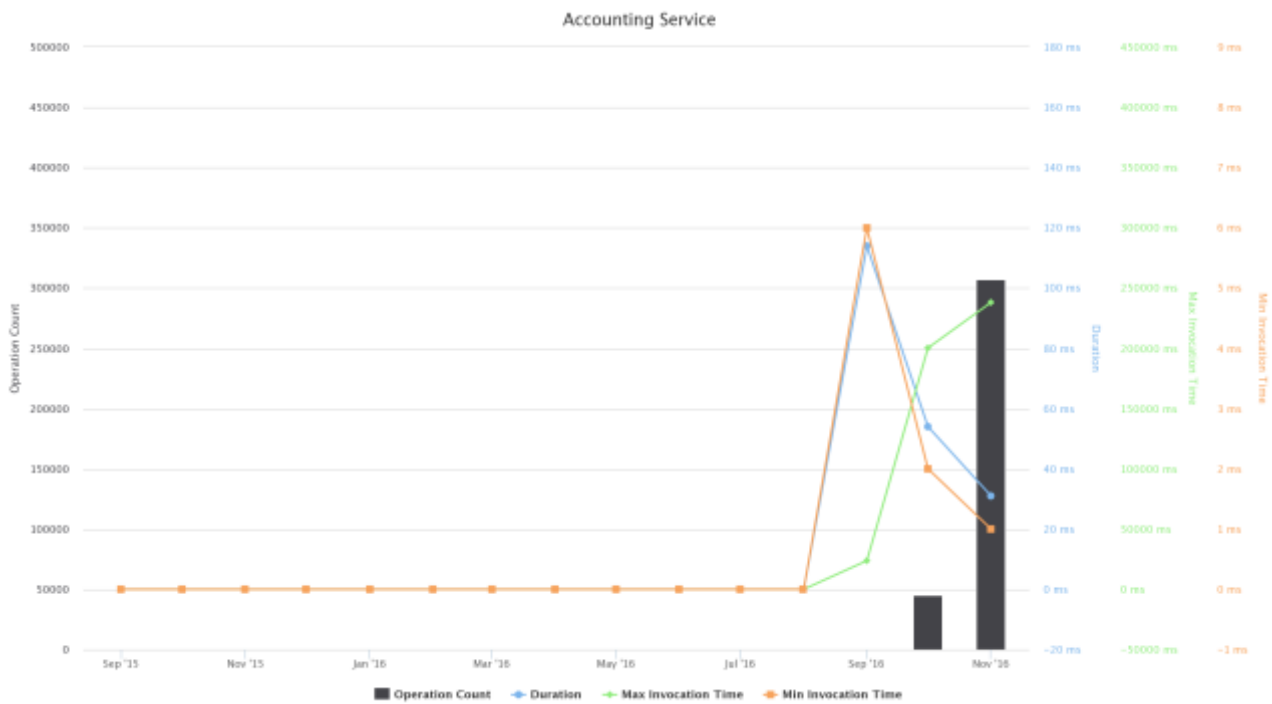


Figure 35. GRSF VRE \ VLab Operations per Month

### 3.16 GRSF ADMIN

The main purpose of this VLab is to provide scientists and practitioners with an environment and the tools for building an integrated catalogue on **stocks and fisheries information**, i.e. for defining the authoritative version of the stocks and fisheries records made available by the GRSF VLab (cf. Sec. 3.15). To this end, it is mainly equipped with a registry containing the “under development version” of such information to be disseminated by the GRSF VRE when ready (cf. Sec. 3.15) and an approve / reject facility enabling experts to assess the candidate records to decide whether they are suitable for publication or not.

The GRSF Admin VLab is available at [https://i-marine.d4science.org/web/grsf\\_admin](https://i-marine.d4science.org/web/grsf_admin)

This VLab stems from the Blue Assessment VREs [7], and it is currently in “available” status, i.e. it is working and waiting for the official release.

A screenshot of the VLab is provided in Figure 36, it shows the home page and the menu items for accessing the VLab facilities.

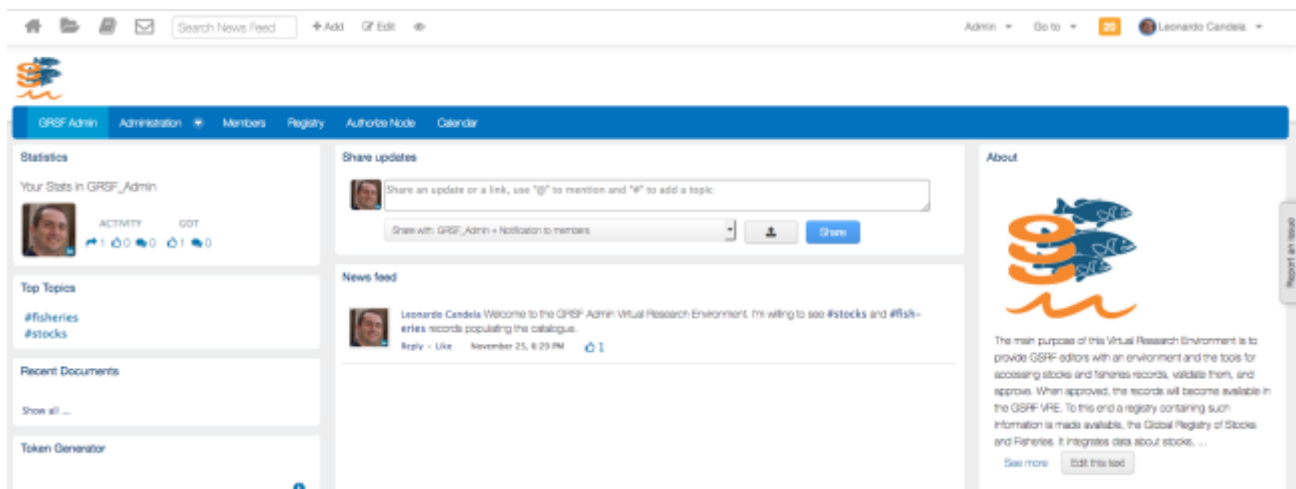


Figure 36. GRSF Admin VRE \ VLab Home Page Screenshot

In addition to the basic facilities, as a workspace for sharing objects of interest, a social networking area for supporting the discussions among members and a user management facility for managing membership, this VRE is specifically equipped with:

- GRSF Catalogue (development version): a facility enabling users to have access (by search and browse) to the current version of the catalogue records on stocks and fisheries (i.e. candidate records) resulting from the integration of data coming from different sources (including FIRMS <http://firms.fao.org/firms/en> - RAM Legacy Stock Assessment Database <http://ramlegacy.org> - FishSource <http://www.fishsource.com>). Users are allowed to annotate every single record by either approving or rejecting them.

Figure 37 reports the total amount of operations performed in the context of this VLab. Operations include service tasks needed to maintain the VLab operational as well as human tasks. This VLab is not in operational state yet, and thus the large majority of operations have been performed during the deployment and testing of the VLab that happened in November '16.



Figure 37. GRSF Admin VRE \ VLab Operations per Month

### 3.17 ICCAT (ICCAT\_BFT-E)

ICCAT BFT-E is the stock assessment VLab dedicated to the International Commission for the Conservation of Atlantic Tunas.

The ICCAT BFT-E VLab is available at [https://i-marine.d4science.org/web/iccat\\_bft-e](https://i-marine.d4science.org/web/iccat_bft-e)

This VLab stems from the Blue Assessment VREs [7]. It has been in “operational” status since **August '16**, and it is currently serving **30 users**.

A screenshot of the VLab is provided in Figure 38; it shows the home page and the menu items for accessing the VLab facilities.

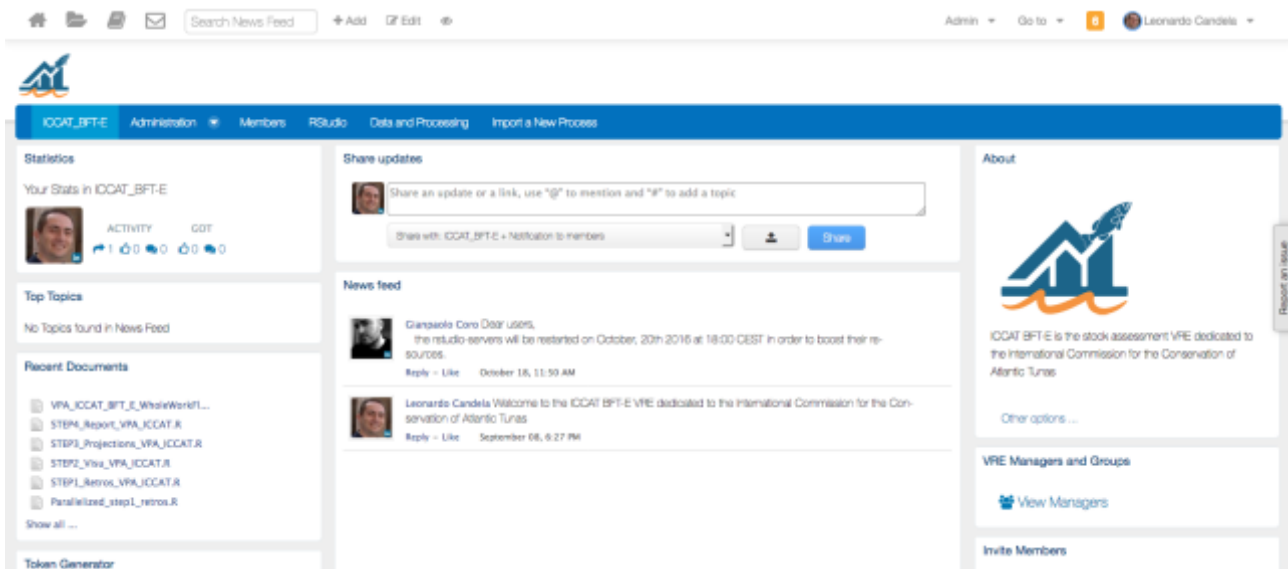


Figure 38. ICCAT\_BFT-E VRE \ VLab Home Page Screenshot

In addition to the basic functionality, as a workspace for sharing objects of interest, a social networking area for supporting the discussions among members and a user management facility for managing membership, this VRE is specifically equipped with:

- *Data Analytics at scale*: a facility enabling users to benefit from the offering of the DataMiner service and interactively execute a large array of data analytics tasks on datasets. These algorithms include the various steps of stock assessment workflow based on Virtual Population Analysis (VPA). As of November '16, this environment has been configured to give access to **6 VPA algorithms** [7]: Step 1 VPA ICCAT BFT-E Retros, Step 1 VPA ICCAT BFT-E Retros Parallelized, Step 2 VPA ICCAT BFT-E Visualisation, Step 3 VPA ICCAT BFT-E Projection, Step 4 VPA ICCAT BFT-E Report, Whole VPA ICCAT BFT-E;
- *Algorithm Importer*: a facility enabling users to transform R-based algorithms and methods into DataMiner algorithms [5], i.e. methods that can be executed by the data analytics platform. This transformation assists in annotating the code, thus making it possible for Data Miner to properly executing it;
- *R Studio as-a-Service*: a facility enabling users to access a fully-fledged RStudio® working environment directly from the VRE. This environment is integrated with the rest of VRE \ VLab facilities, e.g. it is possible to use files from the workspace and to store new files into the workspace.

Figure 39 reports the total amount of operations performed in the context of this VRE. Operations include service tasks needed to maintain the VRE operational as well as human tasks.

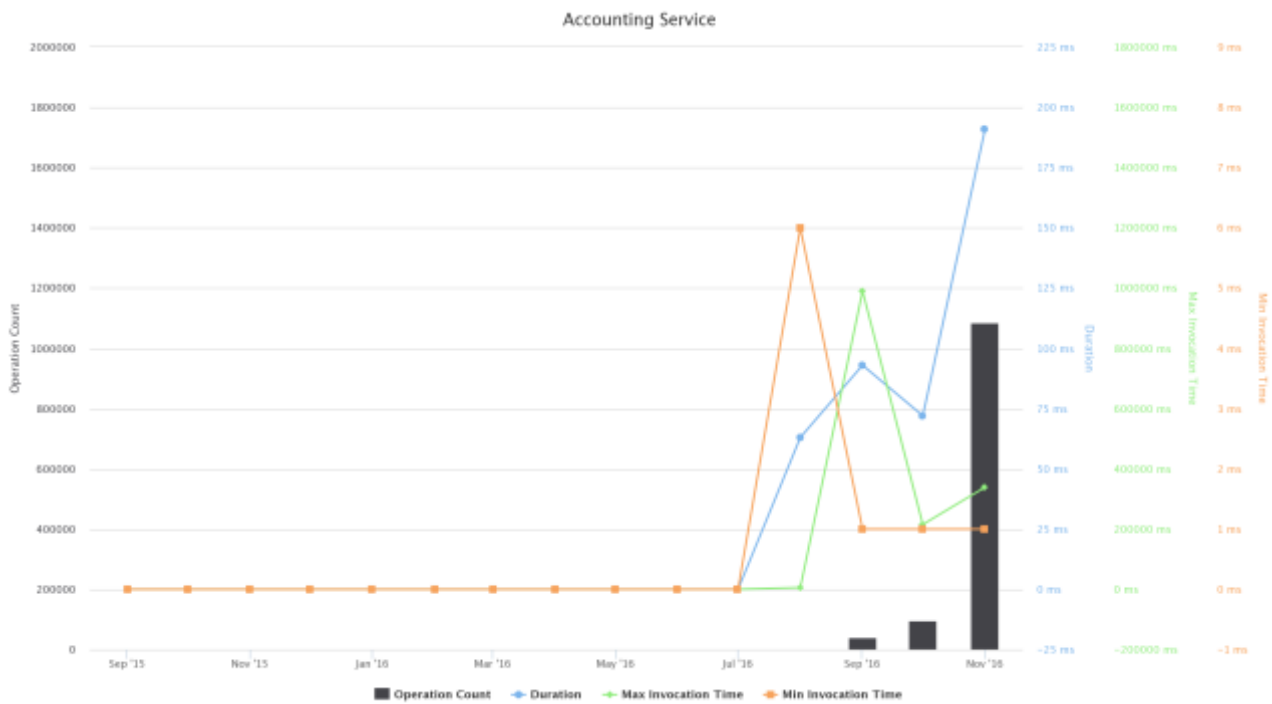


Figure 39. ICCAT BFT-E VRE \ VLab Operations per Month

3.18 ICES TRAINING COURSE IN THE R ENVIRONMENT (ICES\_TCRE)

A VLab that supported the ICES Training Course in the R Environment (TCRENV), ICES HQ, Denmark, 29 February - 4 March 2016, Instructors: Einar Hjorleifsson, Iceland and Bjarki Thor Elvarsson, Iceland. Training Coordinator: Anna Davies and Support Secretary: Lise Cronne. Course started on Monday 29 February at 9:00 and ended on Friday 4 March at 16:00

The objective of the course was to provide participants with a solid foundation in efficient use of the R environment using various typical and familiar fisheries data sets (landings data, catch data, survey data and tagging data) as case examples. Emphasis was put on data munging and literate programming starting with 'raw' data (individual stations, individual fish measurements) and culminating with deliverance of publishable output produced from a single coded document file.

This VRE provides access to processing as well as to data preparation and sharing facilities, including: an online R development environment (RStudio), data mining algorithms, a tabular data management application, GIS maps of environmental and biological data, access to biodiversity occurrence records and taxonomic data from major data providers (e.g. OBIS, GBIF, WoRMS, Catalog of Life), state-of-the-art stock assessment models and sharing tools (Workspace, Social Networking).

The ICES\_TCRE VRE is available at [https://i-marine.d4science.org/web/ices\\_tcre](https://i-marine.d4science.org/web/ices_tcre)

This VLab stems from the Blue Skills needs [6]. It has been in “operational” status since **February '16**, and it is currently serving **36 users**.

A screenshot of the VLab is provided in Figure 40, it shows the home page and the menu items for accessing the VLab facilities.



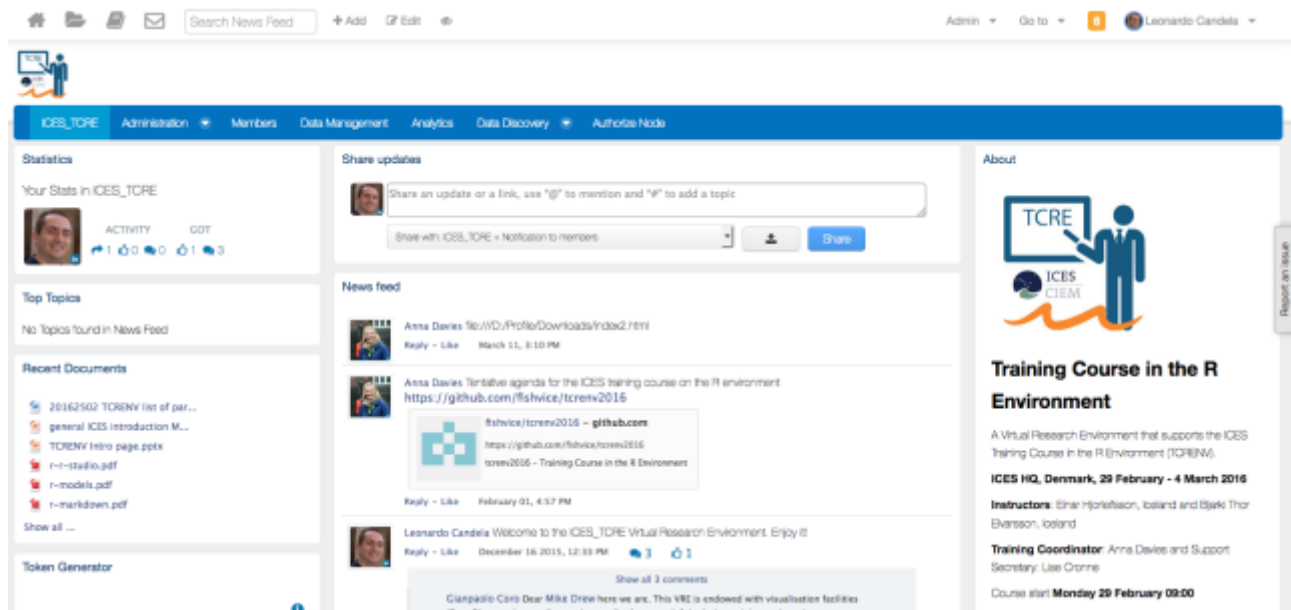


Figure 40. ICES\_TCIRE VRE \ VLab Home Page Screenshot

In addition to the basic functionality, as a workspace for sharing objects of interest, a social networking area for supporting the discussions among members and a user management facility for managing membership, this VRE is specifically equipped with:

- **Tabular Data management:** a facility enabling users to import, curate and manage tabular data. This feature can support data managers during the whole life cycle of data management from data capture to publication and visualisation. It enables data managers to import and transform datasets (CSV, SDMX, JSON) into tabular resources (i.e. tabular data having proper types associated with columns eventually referring to code lists) and reference datasets (code lists) representing recognized value instances of the elements the dataset is about (e.g., species, zones, countries). This functionality guarantees that the tabular resources are compliant with the defined types and code lists. Besides the curation, the facility supports the analysis of the data by enabling a user to (i) perform operations like grouping and filtering, (ii) producing charts and GIS maps (if the data have geographic features), (iii) analysing the data via an R environment as well as via the data analytics facilities (see below). Finally, the environment supports the publishing of tabular resources in the infrastructure by equipping them with rich metadata so that such resources can be used in other application contexts;
- **Data Analytics at scale:** a facility enabling users to benefit from the offering of the DataMiner service and interactively execute a large array of data analytics tasks on datasets. These algorithms range from data clustering and anomalies detection methods (e.g. DBScan and KMeans) to algorithms for manipulating datasets from the geospatial perspective (e.g. transform FAO Area Code in latitude and longitude). As of November '16, this environment has been configured to give access to **22 diverse algorithms**;
- **Species Data Discovery:** a facility enabling users to discover and manage species data products (occurrence data and taxonomic data) from a number of heterogeneous providers (including (a) GBIF and speciesLink for occurrences data, and (b) ASFIS, BrazilianFlora, CatalogueOfLife, IRMNG, IT IS, NCBI, WoRDS, WoRMS for taxonomic data) in a seamless way. Once discovered, objects can be stored in the workspace for future uses;
- **Geospatial Data View:** a facility enabling users to discover and visualize GIS layers, e.g. species distribution maps, Sea Surface Temperature, that have been generated and/or published. This facility relies on the GeoExplorer portlet and makes it possible to effectively exploit the generated maps and perform comparisons and analysis of the diverse distributions by enabling maps overlay, transects production and values inspection.

Figure 41 reports the total amount of operations performed in the context of this VLab. Operations include service tasks needed to maintain the VRE operational as well as human tasks.

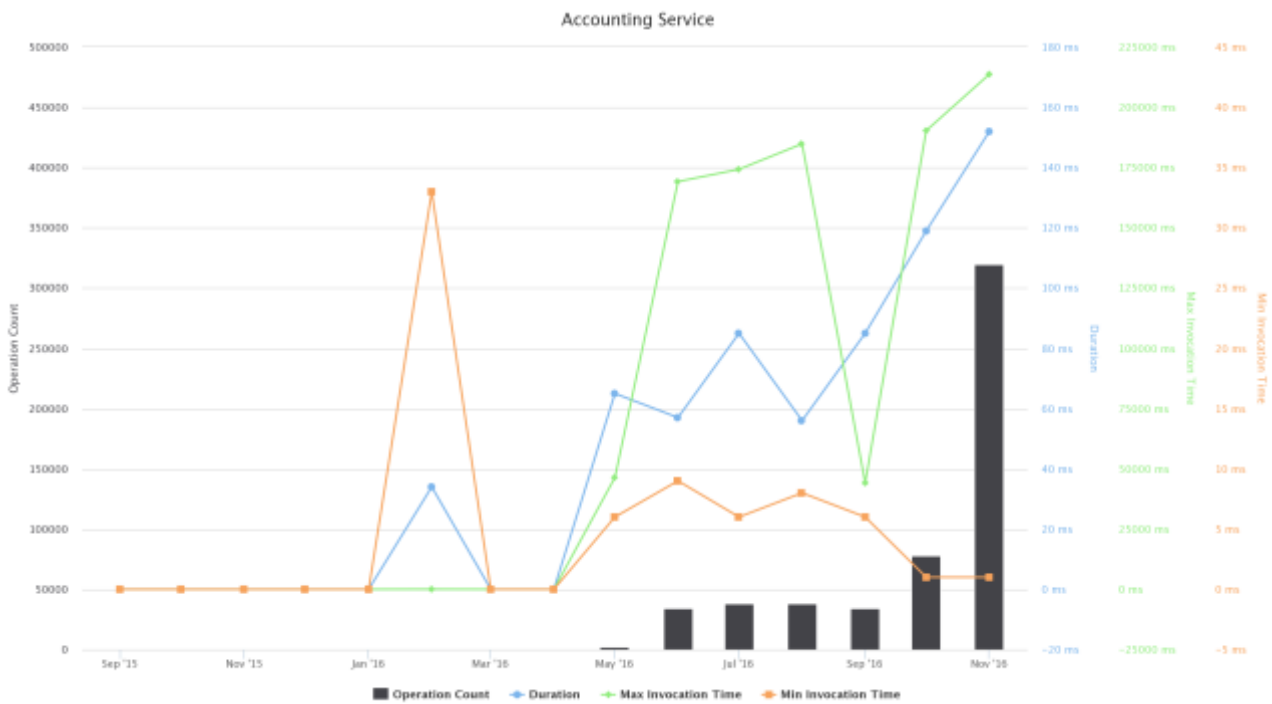


Figure 41. ICES\_TCRE VRE \ VLab Operations per Month

3.19 ICES TRAINIGN COURSE ON DATA LIMITED STOCK ASSESSMENT (ICES\_DALSA)

This VLab was conceived and used to support the ICES training course on Data Limited Stock Assessment, Date: 12 - 16 September, Location: Reykjavik, Iceland.

This course was intended to enable participants to identify data information content and how they interact in a variety of assessment settings – from data-limited to data-rich. Students were also taught to recognize a diverse range of data-limited assessment methodologies and the data needs for each. In addition, they were able to understand each method's assumptions, benefits, limitations, and prior applications and performances.

The ICES\_DALSA VLab is available at [https://i-marine.d4science.org/web/ices\\_dalsa](https://i-marine.d4science.org/web/ices_dalsa)

This VLab stems from the Blue Skills needs [6]. It has been in “operational” status since **August '16**, and it is currently serving **27 users**.

A screenshot of the VLab is provided in Figure 42, it shows the home page and the menu items for accessing the VLab facilities.

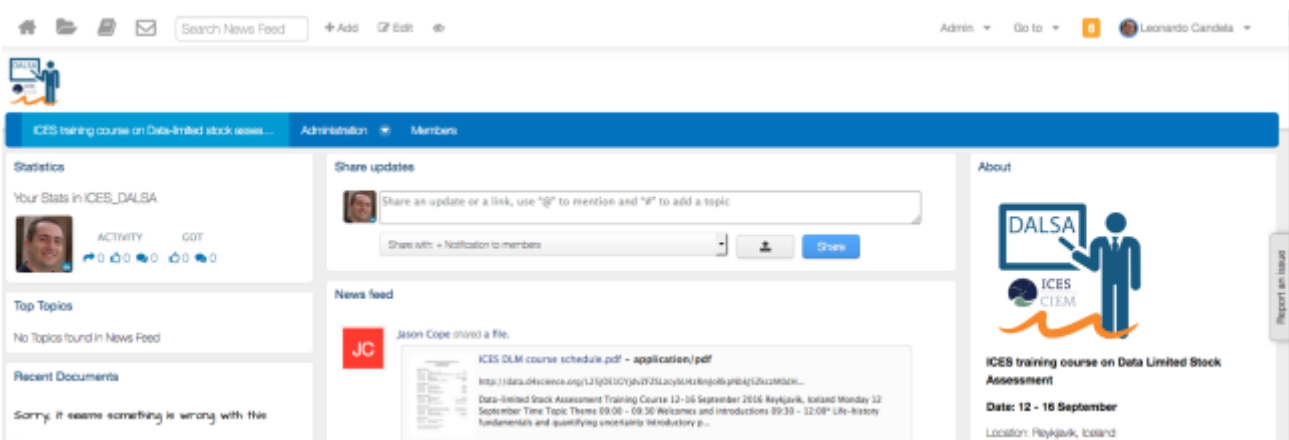


Figure 42. ICES\_DALSA VRE \ VLab Home Page Screenshot

This VLab is not equipped with any facility other than the basic ones, as a workspace for sharing objects of interest, a social networking area for supporting the discussions among members and a user management facility for managing membership.

Figure 43 reports the total amount of operations performed in the context of this VRE. Operations include service tasks needed to maintain the VRE operational as well as human tasks.

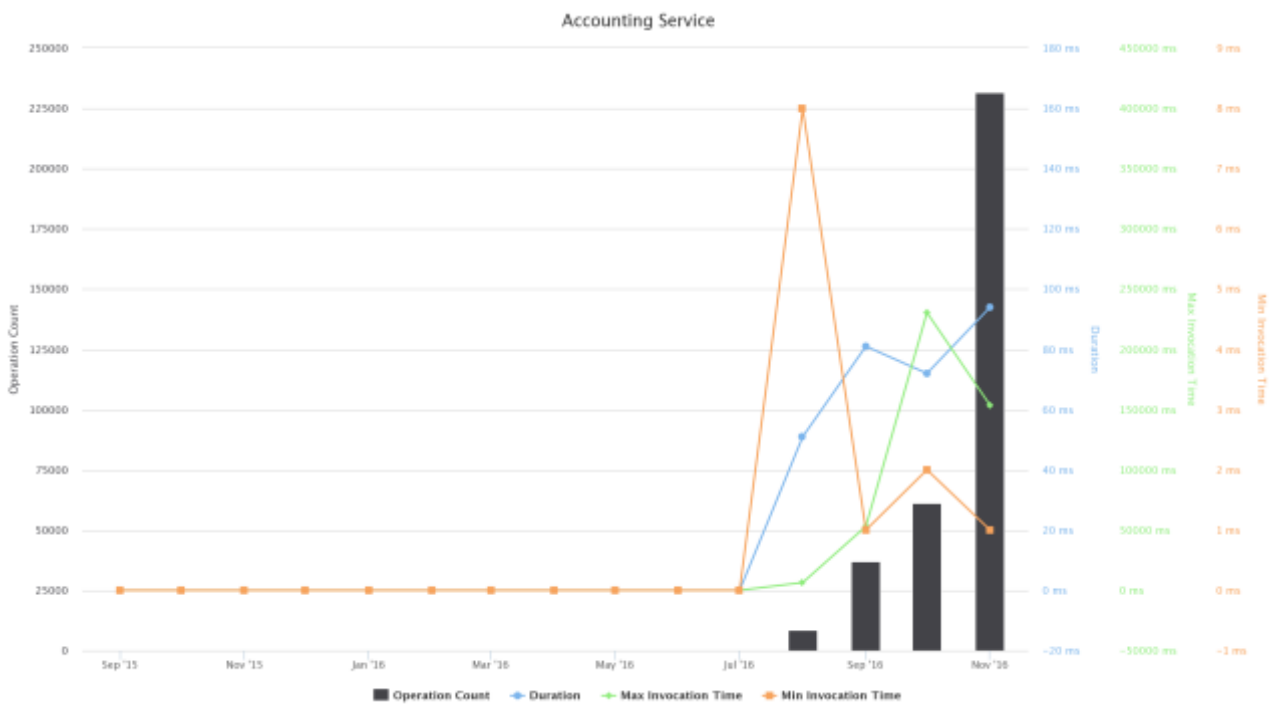


Figure 43. ICES\_DALSA VRE \ VLab Operations by Month

3.20 ICES TRAINING COURSE ON DESIGN AND ANALYSIS OD STATISTICALLY SOUND CATCH SAMPLING PROGRAMMES (ICES\_DASC)

This VLab was conceived and used to support the ICES training course on Design and analysis of statistically sound catch sampling programmes, 12–16 September 2016 ICES, Copenhagen. Instructors: Denmark Jon Helge Vølstad, Institute of Marine Research, Norway Mary Christman, Courtesy Professor of the University of Florida, USA.

The ICES\_DASC VRE is available at [https://i-marine.d4science.org/web/ices\\_dasc](https://i-marine.d4science.org/web/ices_dasc)

This VLab stems from the Blue Skills needs [6]. It has been in “operational” status since **August '16**, and it is currently serving **18 users**.

A screenshot of the VLab is in Figure 44, it shows the home page and the menu items for accessing the VLab facilities.

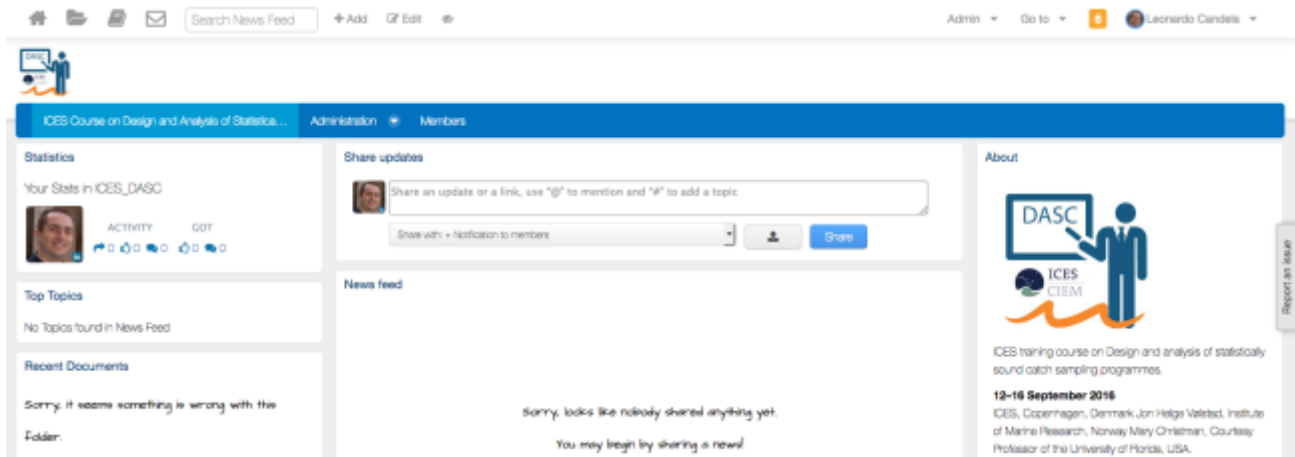


Figure 44. ICES\_DASC VRE \ VLab Home Page Screenshot

This VLab is not equipped with any facility other than the basic ones, as a workspace for sharing objects of interest, a social networking area for supporting the discussions among members and a user management facility for managing membership.

Figure 45 reports the total amount of operations performed in the context of this VRE. Operations include service tasks needed to maintain the VRE operational as well as human tasks.

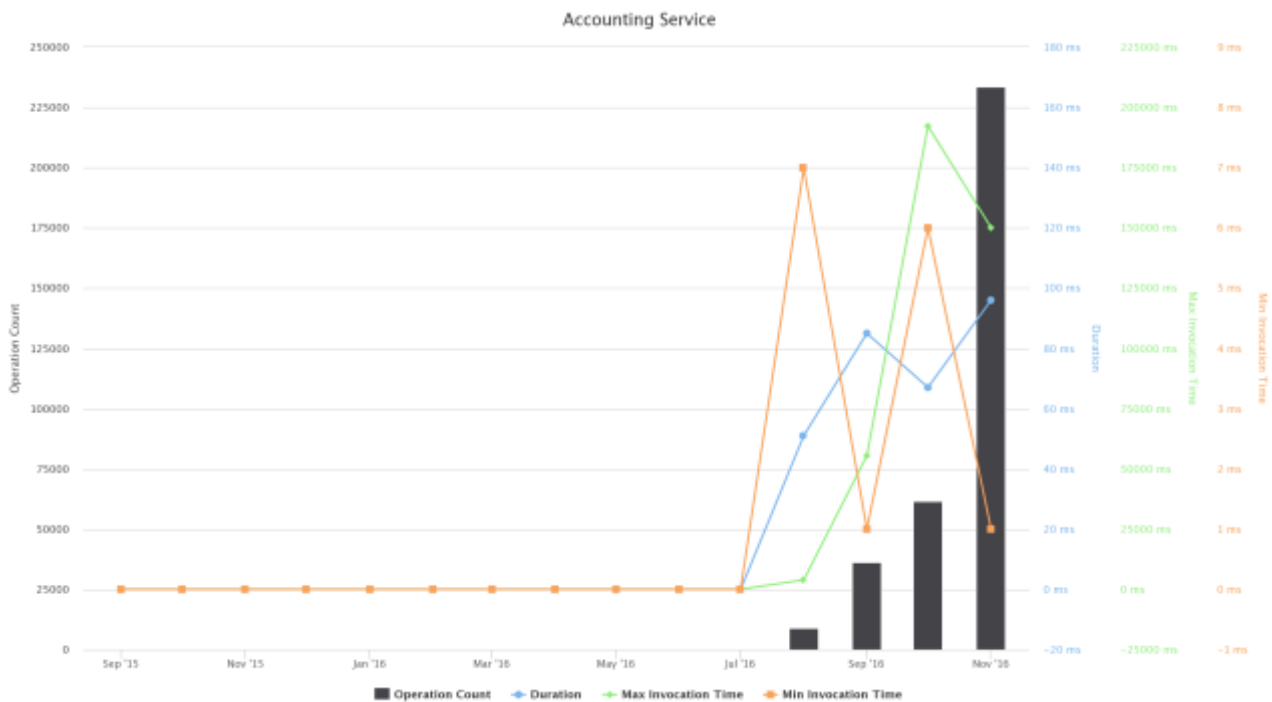


Figure 45. ICES\_DASC VRE \ VLab Operations per Month

### 3.21 ICES TRAINING COURSE ON MANAGEMENT STRATEGY EVALUATION (ICES\_MSE)

This VLab was created to support an ICES Course on Management Strategy Evaluation (MSE). MSE is an essential tool for evaluating management plans against management objectives, including whether such plans are consistent with the ICES precautionary approach, and taking appropriate account of uncertainty. The main objective of this course was to provide a general introduction to Management Strategy Evaluation by covering a range of topics with associated case studies and practical sessions, thereby equipping participants with the knowledge, skills and quantitative tools to undertake MSE on their own fisheries resources.

This VLab stems from the Blue Skills needs [6]. It was created at the beginning of September '16 and almost immediately removed since the course was cancelled. In case the course will be scheduled in the future, the VLab need to be created again.

### 3.22 ICES TRAINING COURSE ON PRINCIPLES AND METHODS OF BROADBAND/WIDEBAND TECHNOLOGIES: APPLICATION TO FISHERIES ACOUSTICS (ICES\_FIACO)

This VLab was conceived and used to support the ICES training course “Principles and methods of broadband/wideband technologies: application to fisheries acoustics”, 8 – 12 December 2016, Bergen, Norway. Course instructors: Dezhang Chu, Northwest Fisheries Science Center (NWFSC), NOAA/NMFS, USA; Lars N. Andersen, Simrad-Kongsberg Maritime, Norway; Gavin J. Macaulay, Institute of Marine Research (IMR), Norway; Egil Ona, Institute of Marine Research (IMR), Norway Rolf J. Korneliussen, Institute of Marine Research (IMR), Norway. Support: Anna Davies, conference and training coordinator, Lise Cronne, Science Programme Assisting Secretary.

The ICES\_FIACO VLab is available at [https://i-marine.d4science.org/web/ices\\_fiaco](https://i-marine.d4science.org/web/ices_fiaco)

This VLab stems from the Blue Skills needs [6]. It has been in “*operational*” status since **October '16**, and it is currently serving **29 users**.

A screenshot of the VLab is in Figure 46, it shows the home page and the menu items for accessing the VLab facilities.

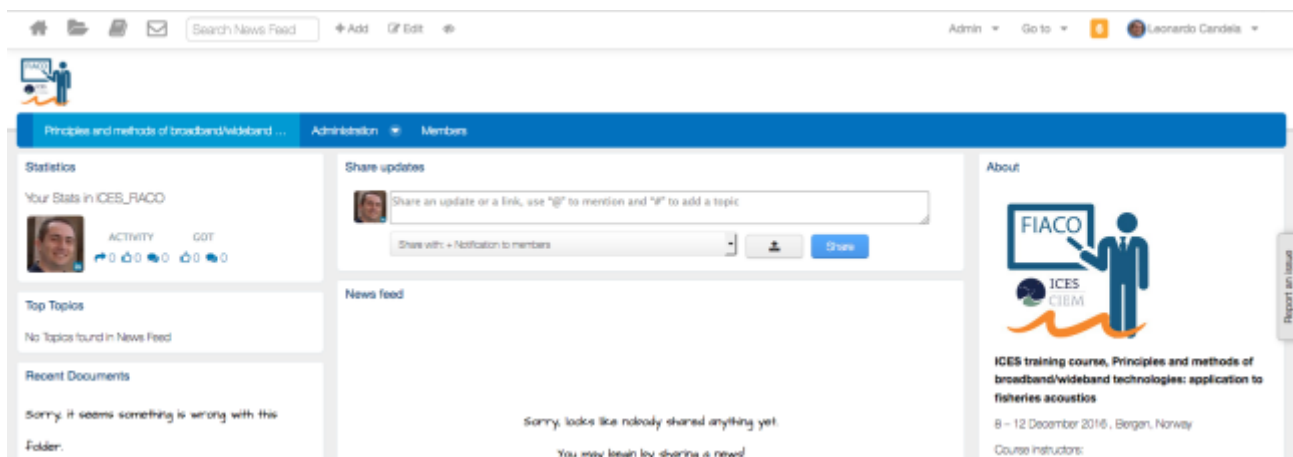


Figure 46. ICES\_FIACO VRE \ VLab Home Page Screenshot

This VLab is not equipped with any facility other than the basic ones, as a workspace for sharing objects of interest, a social networking area for supporting the discussions among members and a user management facility for managing membership.

Figure 47 reports the total amount of operations performed in the context of this VLab. Operations include service tasks needed to maintain the VRE operational as well as human tasks.

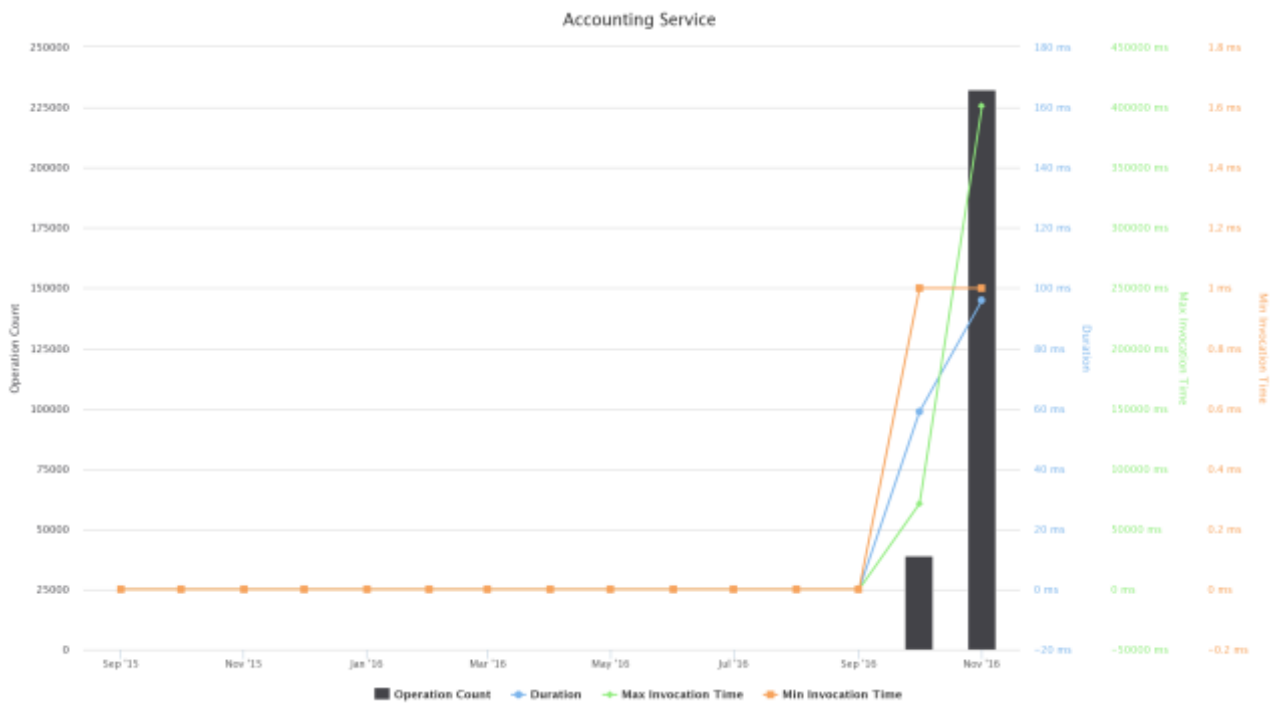


Figure 47. ICES\_FIACO VRE \ VLab Operations per Month

3.23 ICES TRAINING COURSE ON SOCIAL SCIENCE METHODS FOR NATURAL SCIENTISTS (ICES\_TCSSM)

This VLab was conceived and used to support the ICES training course on Social Science Methods for Natural Scientists, 26-28 May 2016, Faculté Victor Segalen, Brest, France. Instructors: Marloes Kraan and Maiken Bjørkan. Training coordinator: Anna Davies. Supporting secretary: Lise Cronne

Course objective: Through gaining new skills, participants were better able to work effectively with stakeholders in (cooperative) research projects, as well as having a better appreciation of the strengths and application of the social sciences in fisheries research.

The ICES\_TCSSM VLab is available at [https://i-marine.d4science.org/web/ices\\_tcsm](https://i-marine.d4science.org/web/ices_tcsm)

This VLab stems from the Blue Skills needs [6]. It has been in “operational” status since **May '16**, and it is currently serving **30 users**.

A screenshot of the VLab is provided in Figure 48; it shows the home page and the menu items for accessing the VLab facilities.

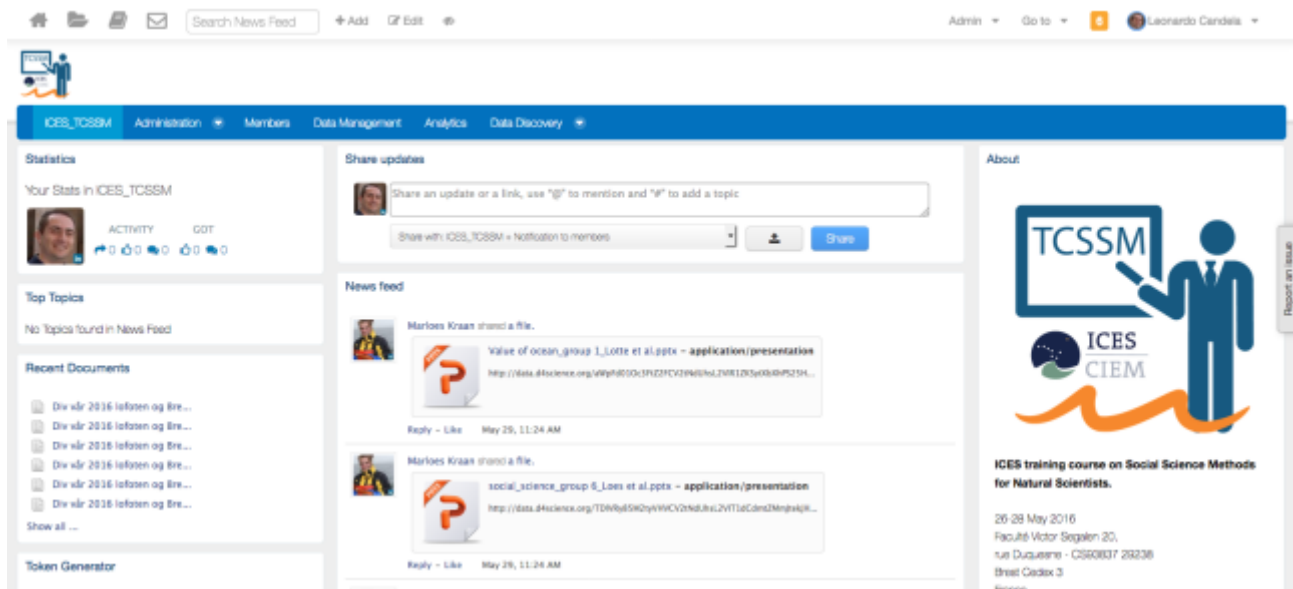


Figure 48. ICES\_TCSSM VRE \ VLab Home Page Screenshot

In addition to the basic functionalities, as a workspace for sharing objects of interest, a social networking area for supporting the discussions among members and a user management facility for managing membership, this VRE is specifically equipped with:

- **Tabular Data management:** a facility enabling users to import, curate and manage tabular data. This feature can support data managers during the whole life cycle of data management from data capture to publication and visualisation. It enables data managers to import and transform datasets (CSV, SDMX, JSON) into tabular resources (i.e. tabular data having proper types associated with columns eventually referring to code lists) and reference datasets (code lists) representing recognized value instances of the elements the dataset is about (e.g., species, zones, countries). This functionality guarantees that the tabular resources are compliant with the defined types and code lists. Besides the curation, the facility supports the analysis of the data by enabling a user to (i) perform operations like grouping and filtering, (ii) producing charts and GIS maps (if the data have geographic features), (iii) analysing the data via an R environment as well as via the data analytics facilities (see below). Finally, the environment supports the publishing of tabular resources in the infrastructure by equipping them with rich metadata so that such resources can be used in other application contexts;
- **Data Analytics at scale:** a facility enabling users to benefit from the offering of the DataMiner service and interactively execute a large array of data analytics tasks on datasets. These algorithms range from data clustering and anomalies detection methods (e.g. DBScan and KMeans) to algorithms for manipulating datasets from the geospatial perspective (e.g. transform FAO Area Code in latitude and longitude). As of November '16, this environment has been configured to give access to **more than 110 diverse algorithms**;
- **Species Data Discovery:** a facility enabling users to discover and manage species data products (occurrence data and taxonomic data) from a number of heterogeneous providers (including (a) GBIF and speciesLink for occurrences data, and (b) ASFIS, BrazilianFlora, CatalogueOfLife, IRMNG, IT IS, NCBI, WoRDS, WoRMS for taxonomic data) in a seamless way. Once discovered, objects can be stored in the workspace for future uses;
- **Geospatial Data View:** a facility enabling users to discover and visualize GIS layers, e.g. species distribution maps, Sea Surface Temperature, that have been generated and/or published. This facility relies on the GeoExplorer portlet and makes it possible to effectively exploit the generated maps and perform comparisons and analysis of the diverse distributions by enabling maps overlay, transects production and values inspection.

Figure 49 reports the total amount of operations performed in the context of this VRE. Operations include service tasks needed to maintain the VRE operational as well as human tasks.



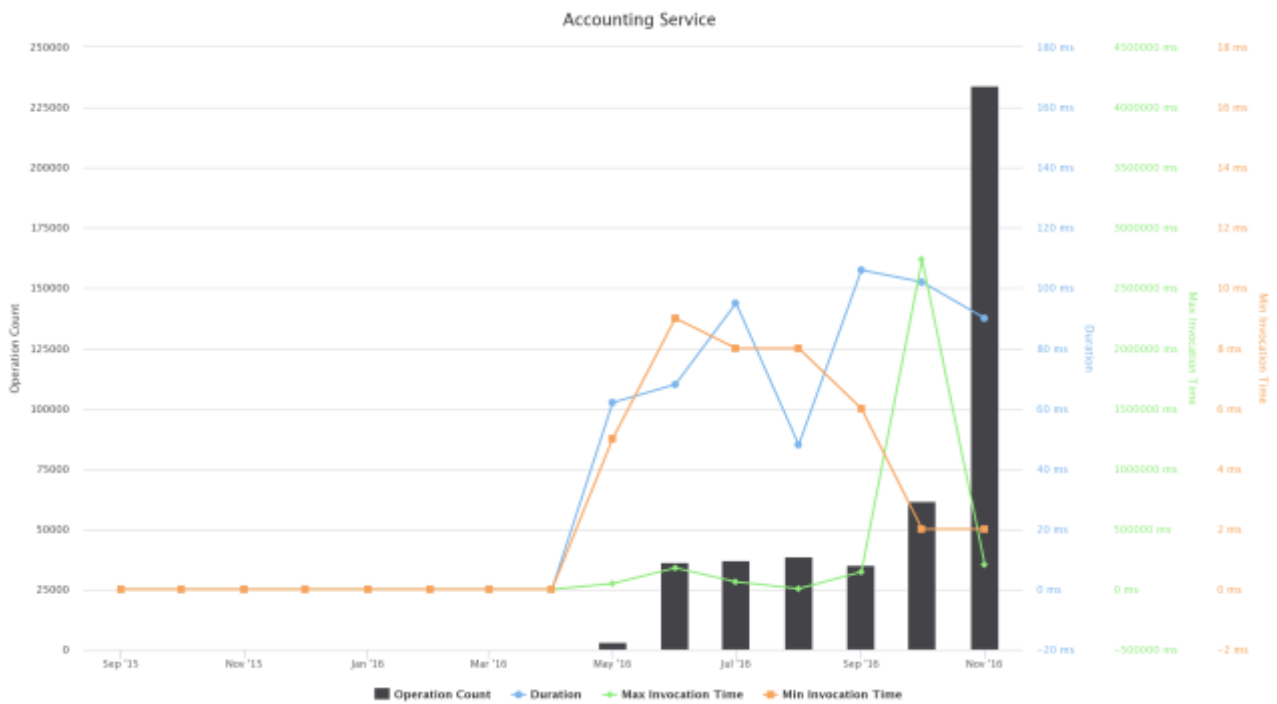


Figure 49. ICES\_TCSSM VRE \ VLab Operations per Month

3.24 ICES TRAINING COURSE ON STOCK ASSESSMENT ADVANCED (ICES\_SA)

This VLab was conceived and used to support the ICES training course on Stock Assessment Advanced, 28 November – 2 December, ICES HQ, Copenhagen, Denmark. Course instructors: Jan Jaap Poos, Wageningen IMARES (The Netherlands) and Richard Hillary, CSIRO Marine and Atmospheric Research (Australia)

The ICES\_SA VRE is available at [https://i-marine.d4science.org/web/ices\\_sa](https://i-marine.d4science.org/web/ices_sa)

This VLab stems from the Blue Skills needs [6]. It has been in “operational” status since **October '16**, and it is currently serving **27 users**.

A screenshot of the VLab is provided in Figure 50; it shows the home page and the menu items for accessing the VLab facilities.



Figure 50. ICES\_SA VRE \ VLab Home Page Screenshot

In addition to the basic functionalities, as a workspace for sharing objects of interest, a social networking area for supporting the discussions among members and a user management facility for managing membership, this VRE is specifically equipped with:



- *R Studio as-a-Service*: a facility enabling users to access a fully-fledged RStudio® working environment directly from the VRE. This environment is integrated with the rest of VRE \ VLab facilities, e.g. it is possible to use files from the workspace and to store new files into the workspace.

Figure 51 reports the total amount of operations performed in the context of this VRE. Operations include service tasks needed to maintain the VRE operational as well as human tasks.

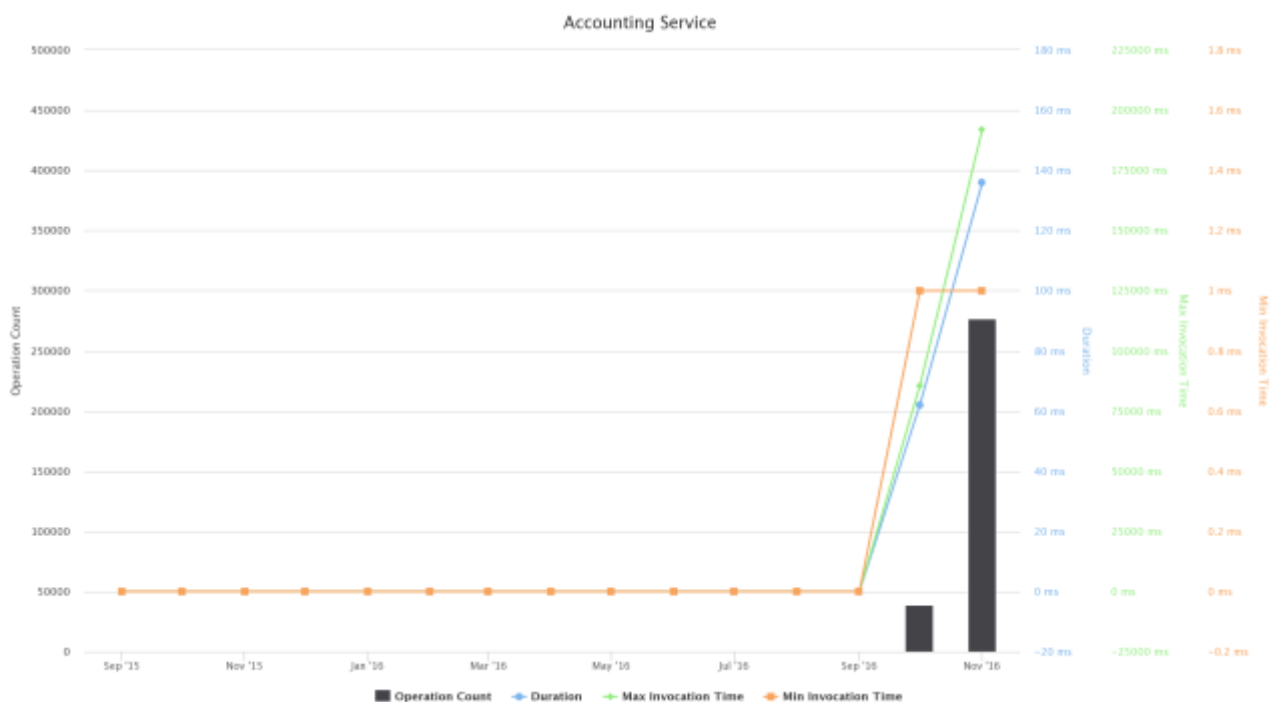


Figure 51. ICES\_SA VRE \ VLab Operations per Month

### 3.25 ISEARCH

The iSearch Virtual Research Environment (actually a VLab) is for providing its users with an environment dedicated to showcase the data discovery facilities, in particular the IR and semantic based ones.

The iSearch VLab is available at <https://i-marine.d4science.org/web/isearch>

This VLab was inherited by iMarine, and thus it has been *operational* status since **September 2015**, from the perspective of BlueBRIDGE. It is currently serving **51 users**.

A screenshot of the VLab is provided in Figure 52; it shows the home page and the menu items for accessing the VLab facilities.

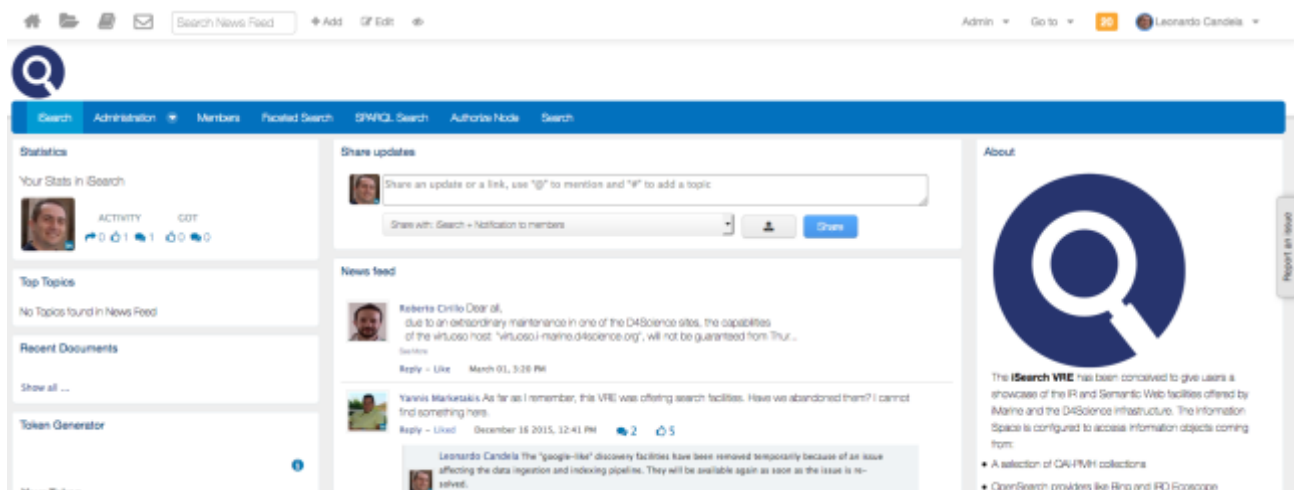


Figure 52. iSearch VRE \ Vlab Home Page Screenshot

In addition to the basic functionalities, as a workspace for sharing objects of interest, a social networking area for supporting the discussions among members and a user management facility for managing membership, this VLab is specifically equipped with the following capabilities:

- *Keyword-based data discovery*<sup>9</sup>: a facility enabling users to specify their Google-like queries, search for objects in the VRE information space and visualise the resulting objects;
- *Data Ingestion Console*<sup>10</sup>: a facility enabling authorized users to populate the VRE information space by harvesting objects from repositories compliant with OAI-PMH protocol;
- *Semantic-based data discovery*: a facility enabling users to search and browse the MarineTLO Data Warehouse [14].

The major changes occurred in this VLab with respect to the version developed and operated by iMarine derive from the exploitation of the latest services and facilities resulting from BlueBRIDGE developments. In particular, the VLab is now exploiting the new version of the keyword-based data discovery and the data ingestion console.

Figure 53 reports the total amount of operations performed in the context of this VRE. Operations include service tasks needed to maintain the VRE operational as well as human tasks.

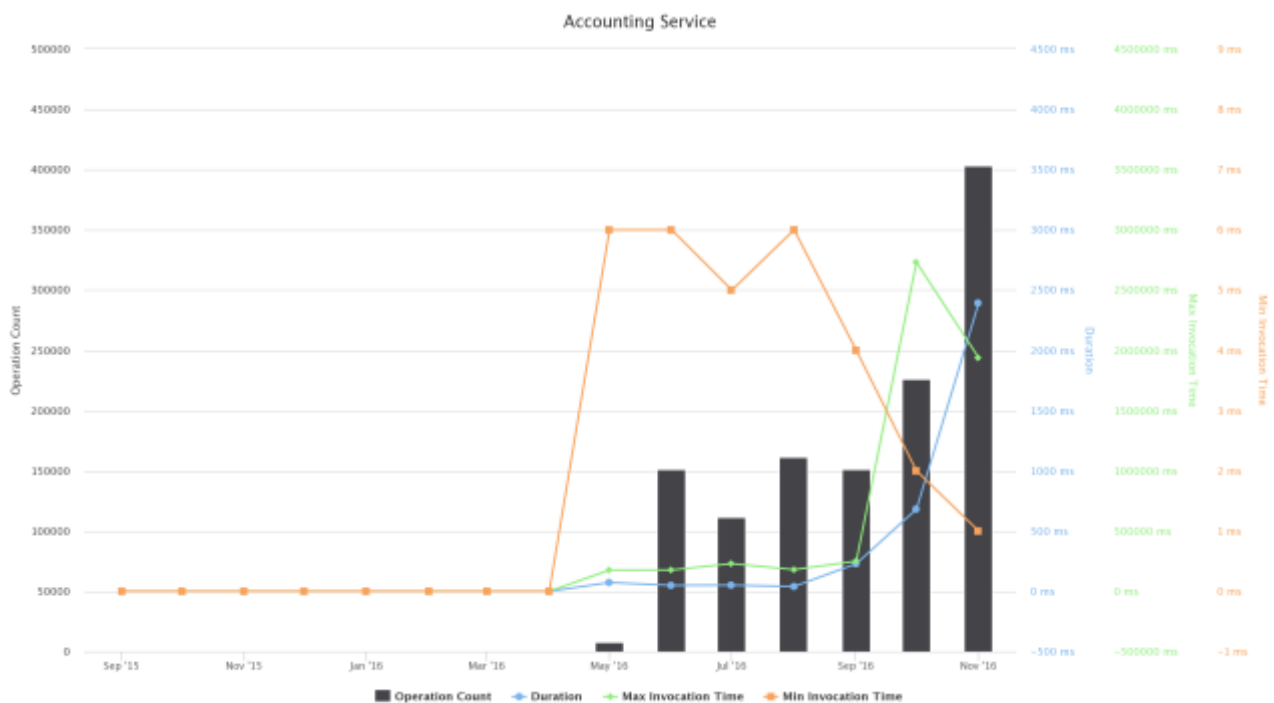


Figure 53. iSearch VRE \ VLab Operations per Month

### 3.26 KNOWLEDGE BRIDGING

This VRE was created to support the discussions and activity of the Blue Skills pillar, i.e. WP8 [6]. In particular the VRE is supporting project members in planning courses, discussing experiences resulting from courses, sharing material prepared for supporting courses, exploiting current tools and facilities to assess the fitness for purpose with respect to a planned course.

The Knowledge Bridging VRE is available at <https://i-marine.d4science.org/web/knowledgebridging>

This VRE stems from the Blue Skills needs [6]. It has been in “*operational*” status since **September '15** and it is currently serving **24 users**.

<sup>9</sup> This is a facility that has been re-engineered in the context of BlueBRIDGE [11].

<sup>10</sup> This is a facility that has been re-engineered in the context of BlueBRIDGE [11].

A screenshot of the VRE is provided in Figure 54, it shows the home page users are presented with including the menu items for accessing the VRE facilities.

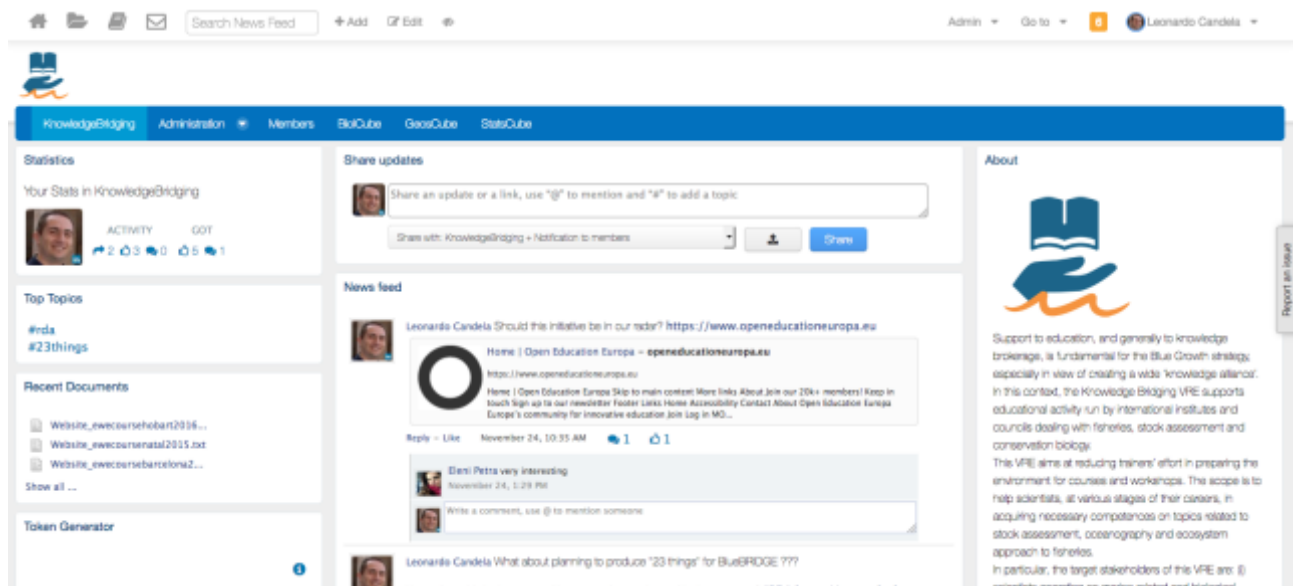


Figure 54. Knowledge Bridging VRE \ VLab Home Page Screenshot

In addition to the basic functionalities, as a workspace for sharing objects of interest, a social networking area for supporting the discussions among members and a user management facility for managing membership, this VRE is specifically equipped with the following capabilities being prototypical examples of facilities to use in courses:

- *Species Data Discovery*: a facility enabling users to discover and manage species data products (occurrence data and taxonomic data) from a number of heterogeneous providers (including (a) GBIF and speciesLink for occurrences data, and (b) ASFIS, BrazilianFlora, CatalogueOfLife, IRMNG, IT IS, NCBI, WoRDS, WoRMS for taxonomic data) in a seamless way. Once discovered, objects can be stored in the workspace for future uses;
- *Data Analytics at scale*: a facility enabling users to benefit from the offering of the DataMiner service and interactively execute a large array of data analytics tasks on datasets. These algorithms range from data clustering and anomalies detection methods (e.g. DBScan and KMeans) to algorithms for manipulating datasets from the geospatial perspective (e.g. transform FAO Area Code in latitude and longitude). As of November '16, this environment has been configured to give access to more than **20 diverse algorithms**;
- *Geospatial Data View*: a facility enabling users to discover and visualize GIS layers, e.g. species distribution maps, Sea Surface Temperature, that have been generated and/or published. This facility relies on the GeoExplorer portlet and makes it possible to effectively exploit the generated maps and perform comparisons and analysis of the diverse distributions by enabling maps overlay, transects production and values inspection.

Figure 55 reports the total amount of operations performed in the context of this VRE. Operations include service tasks needed to maintain the VRE operational as well as human tasks.

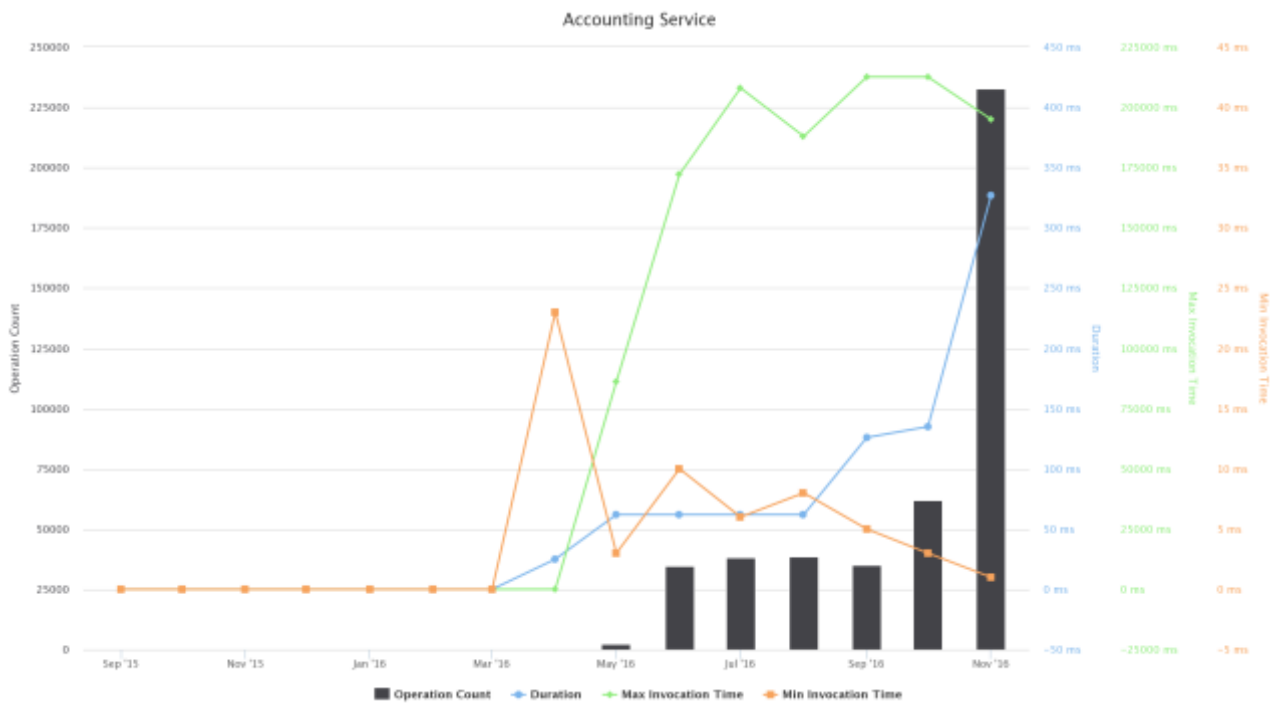


Figure 55. Knowledge Bridging VRE \ VLab Operations per Month

### 3.27 PERFORMANCE EVALUATION IN AQUACULTURE

This VRE is created to support the discussions and activities of Task 6.1 [8]. It captures and confronts the dual challenge of understanding (a) the performance of an aqua-farming operation, allowing on one hand investors and entrepreneurs to conform to environmental rules and optimize the use of resources (monetary and non-monetary ones) and (b) the pressure on investment and on environment produced by such operations, so that scientists and policy makers can craft guidelines or even regulations, taking into account the economic interest of those operations.

The Performance Evaluation in Aquaculture VRE is available at <https://i-marine.d4science.org/web/performanceevaluationinaquaculture>

This VLab stems from the Blue Economy VREs [8]. It has been in “operational” status since **September '15**, and it is currently serving **22 users**.

A screenshot of the VLab is provided in Figure 56, it shows the home page users are presented with including the menu items for accessing the VLab facilities.

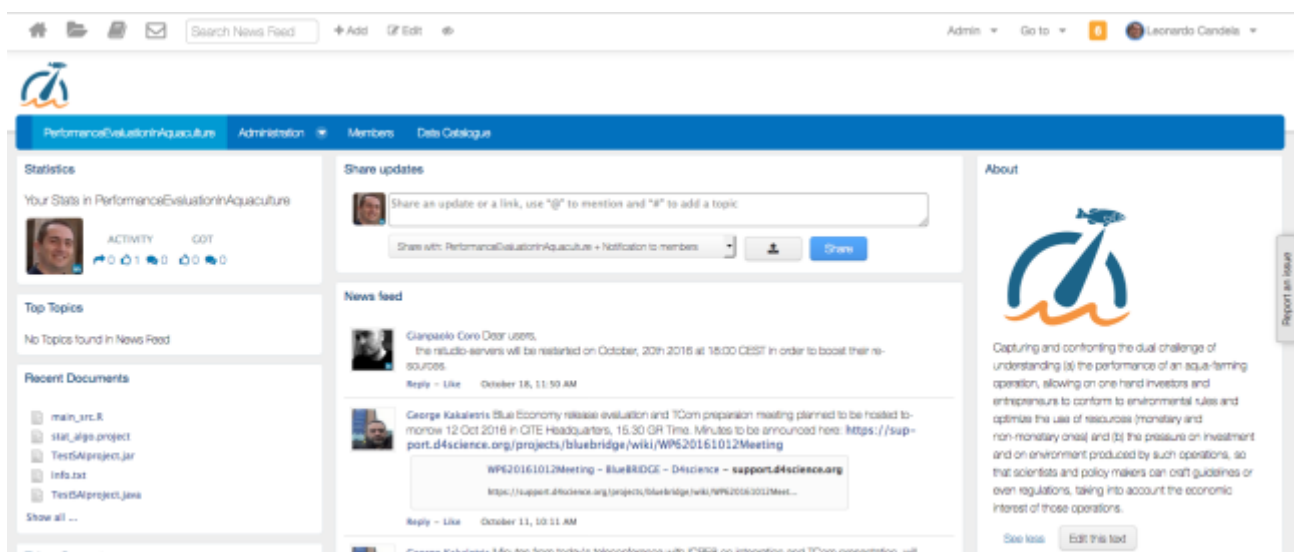


Figure 56. Performance Evaluation in Aquaculture VRE \ VLab Home Page Screenshot

In addition to the basic functionalities, as a workspace for sharing objects of interest, a social networking area for supporting the discussions among members and a user management facility for managing membership, this VRE is specifically equipped with the following capabilities:

- *Data Catalogue*: a facility enabling users to access the BlueBRIDGE products catalogue. This catalogue currently gives access to **48.2k products** (namely species distribution maps).

Figure 57 reports the total amount of operations performed in the context of this VRE. Operations include service tasks needed to maintain the VRE operational as well as human tasks.

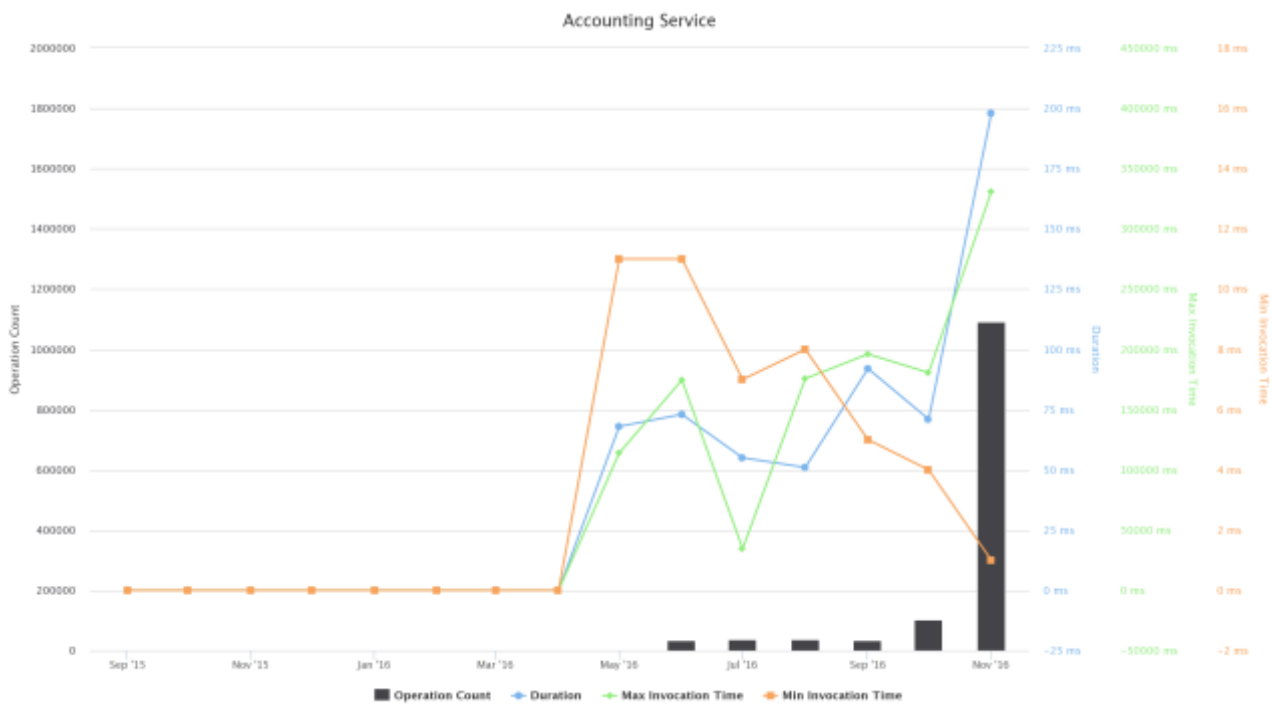


Figure 57. Performance Evaluation in Aquaculture VRE \ VLab Operations per Month

### 3.28 PROTECTED AREA IMPACT MAPS

This VRE is created to support the discussions and activities of Task 7.2 [9], i.e. to develop and discuss solution aiming at supporting spatial planning projects by providing existing rich analytical data platforms with additional EO based information products related to human impacts on natural systems, with an initial focus on Natura2000 sites and Marine Protected Areas.

The Protected Area Impact Maps VRE is available at <https://i-marine.d4science.org/web/protectedareaimpactmaps>

This VRE stems from the Blue Environment VRE [9]. It has been in “operational” state since **September '15**, and is currently serving **22 users**.

A screenshot of the VLab is in Figure 58, it shows the home page and the menu items for accessing the VLab facilities.

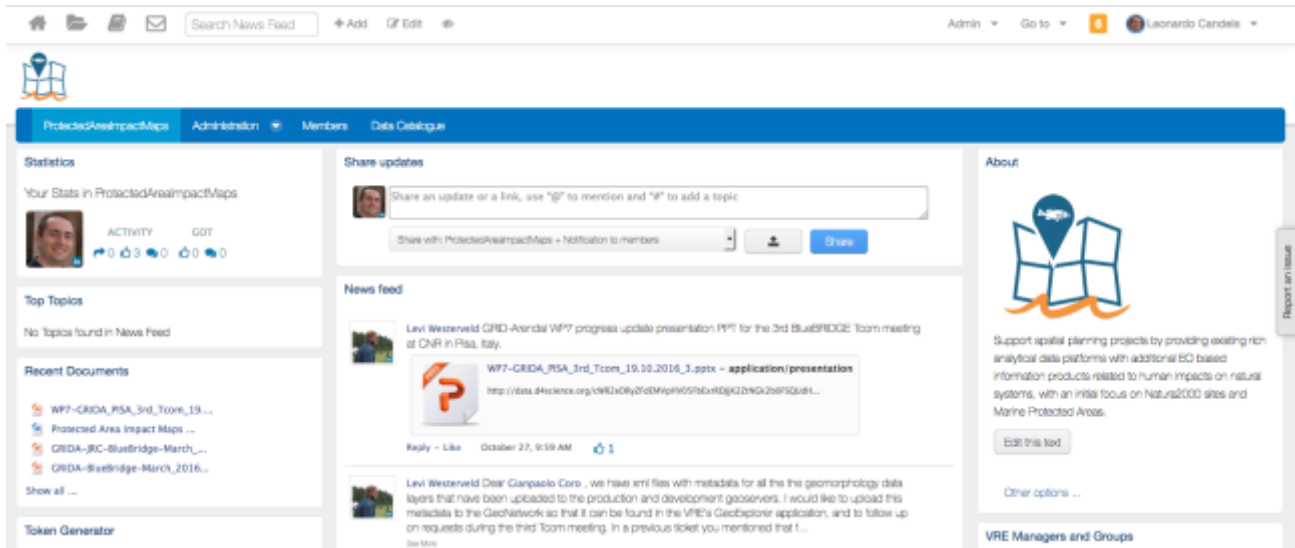


Figure 58. Protected Area Impact Maps VRE \ VLab Home Page Screenshot

In addition to the basic functionalities, as a workspace for sharing objects of interest, a social networking area for supporting the discussions among members and a user management facility for managing membership, this VRE is specifically equipped with the following capabilities:

- *Data Catalogue*: a facility enabling users to access the BlueBRIDGE products catalogue. This catalogue currently gives access to **48.2k products** (namely species distribution maps).

Figure 59 reports the total amount of operations performed in the context of this VRE. Operations include service tasks needed to maintain the VRE operational as well as human tasks.



Figure 59. Protected Area Impact Maps MRE \ VLab Operations per Month

### 3.29 R PROTOTYPING LAB

This VLab was conceived to provide its users with a complete development and integration environment for R. In particular, the environment is powered by RStudio®, an open source development environment including a code editor, and debugging and visualization tools. Moreover, it is powered by the gCube data analytics platform enabling users to (i) integrate R algorithms into the platform, (ii) execute integrated algorithms by benefitting from a distributed computing infrastructure, and (iii) automatically generate

research objects out of any computation. Finally, it is integrated with social networking facilities and a shared workspace, enabling VRE members to put in place collaborative working practices.

The R Prototyping Lab VLab is available at <https://i-marine.d4science.org/web/rprototypinglab>

This VLab has been in **operational** status since **September '16**, and it is currently serving **37 users**.

A screenshot of the VLab is in Figure 60, it shows the home page and the menu items for accessing the VLab facilities.

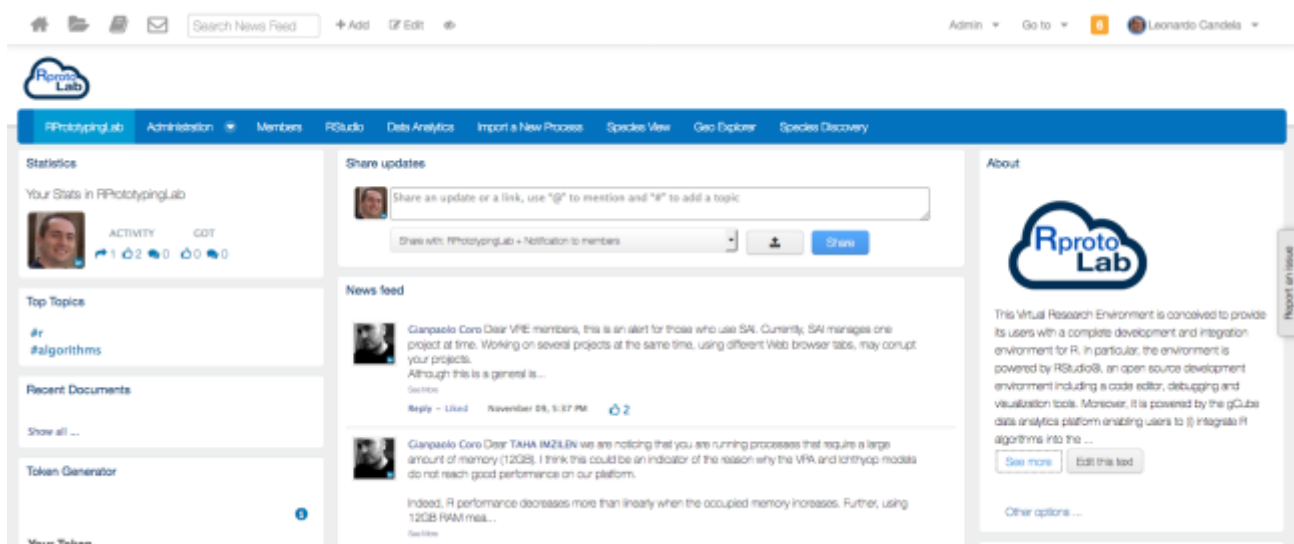


Figure 60. R Prototyping Lab VRE \ VLab Home Page Screenshot

In addition to the basic functionalities, as a workspace for sharing objects of interest, a social networking area for supporting the discussions among members and a user management facility for managing membership, this VRE is specifically equipped with the following capabilities:

- **Species Data Discovery:** a facility enabling users to discover and manage species data products (occurrence data and taxonomic data) from a number of heterogeneous providers (including (a) GBIF and speciesLink for occurrences data, and (b) ASFIS, BrazilianFlora, CatalogueOfLife, IRMNG, IT IS, NCBI, WoRDS, WoRMS for taxonomic data) in a seamless way. Once discovered, objects can be stored in the workspace for future uses;
- **Species View:** a facility enabling users to discover and browse species products (namely species distribution maps). This facility supports discovery mechanisms ranging from simple search based on species names to very specific search criterion, and it offers a comprehensive set of products visualisation approaches;
- **Geospatial Data View:** a facility enabling users to discover and visualize GIS layers, e.g. species distribution maps that have been generated and published. This facility relies on the GeoExplorer portlet and makes it possible to effectively exploit the generated maps and perform comparisons and analysis of the diverse distributions by enabling maps overlay, transects production and values inspection;
- **Data Analytics at scale:** a facility enabling users to benefit from the offering of the DataMiner service and interactively execute a large array of data analytics tasks on datasets. These algorithms range from trajectory simulations based on the Ichthyop model [7] to Virtual Population Analysis (VPA) Algorithms [7], spatial reallocation, ensemble model-based approaches [13]. As of November '16, this environment has been configured to give access to **more than 166 diverse algorithms**;
- **Algorithm Importer:** a facility enabling users to transform R-based algorithms and methods into DataMiner algorithms [5], i.e. methods that can be executed by the data analytics platform. This transformation assists in annotating the code thus making it possible for Data Miner to properly execute it;



- *R Studio as-a-Service*: a facility enabling users to access a fully-fledged RStudio® working environment directly from the VRE. This environment is integrated with the rest of VRE \ VLab facilities, e.g. it is possible to use files from the workspace and to store new files into the workspace.

Figure 61 reports the total amount of operations performed in the context of this VRE. Operations include service tasks needed to maintain the VRE operational as well as human tasks.

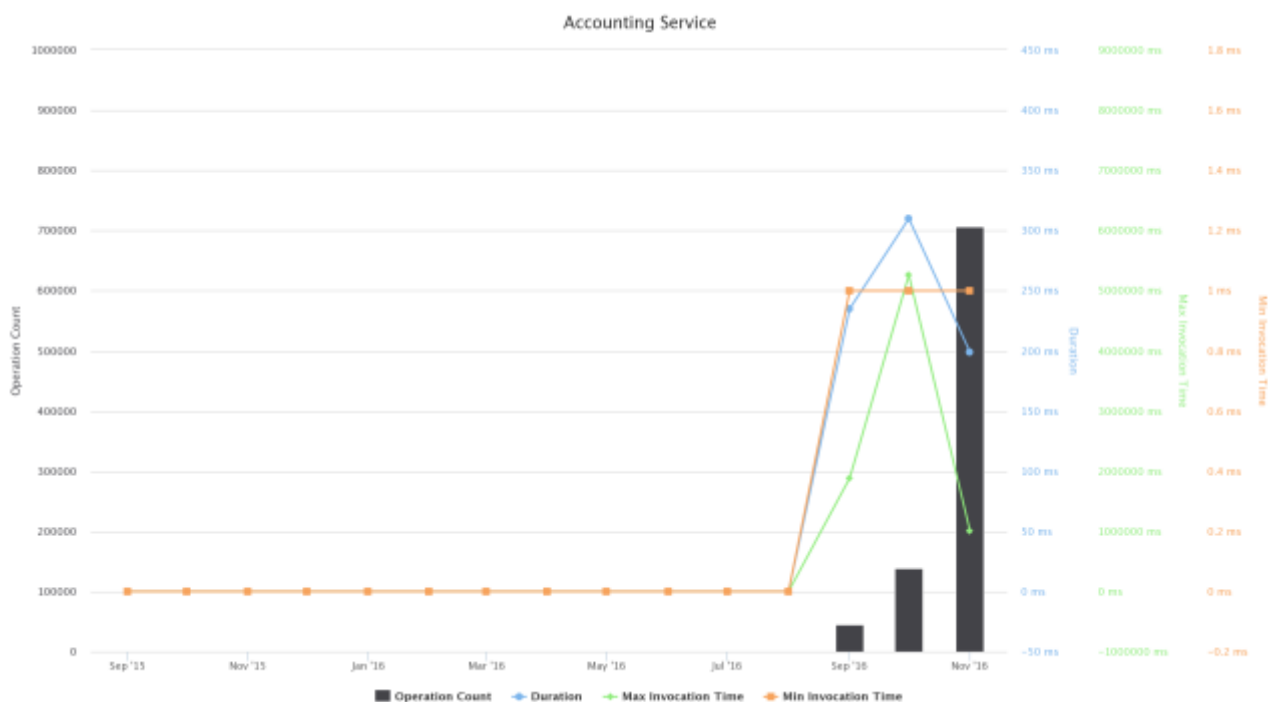


Figure 61. R Prototyping Lab VRE \ VLab Operations per Month

### 3.30 RSTUDIO LAB

This VLab was conceived to provide its users with a development environment for R. This development environment is powered by RStudio® and it is integrated with social networking facilities and a shared workspace, enabling VRE members to put in place collaborative working practices.

The RStudio Lab VLab is available at <https://i-marine.d4science.org/web/rstudiolab/>

This VLab has been in **operational** status since **September '16**, and it is currently serving **27 users**.

A screenshot of the VLab is provided in Figure 62; it shows the home page and the menu items for accessing the VLab facilities.

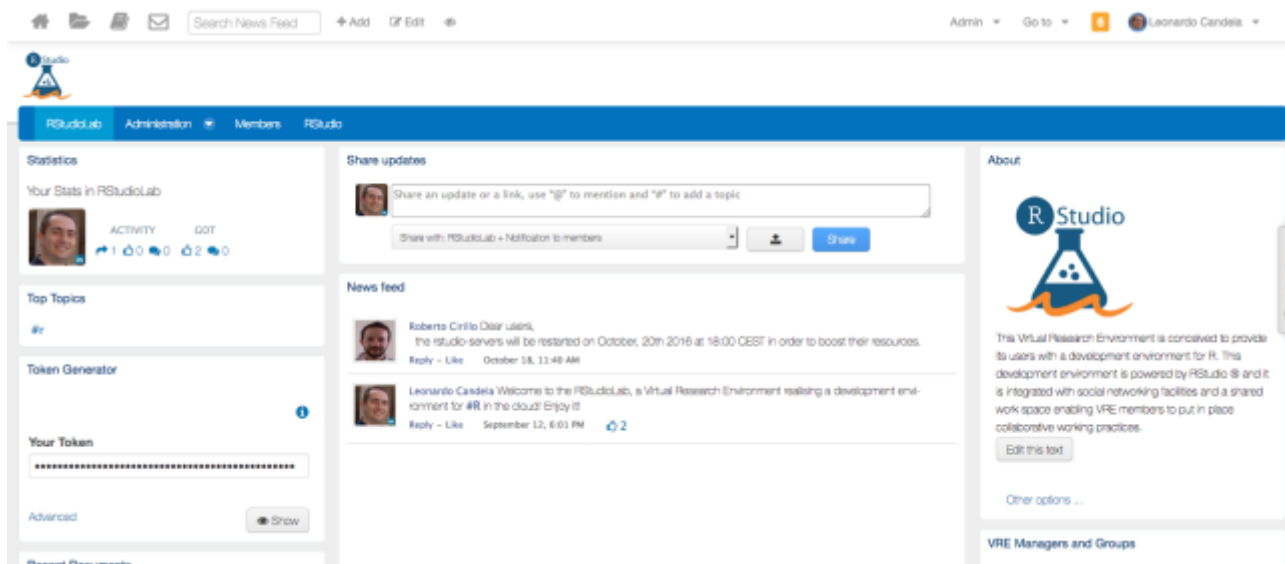


Figure 62. RStudio Lab VRE \ VLab Home Page Screenshot

In addition to the basic functionalities, as a workspace for sharing objects of interest, a social networking area for supporting the discussions among members and a user management facility for managing membership, this VRE is specifically equipped with:

- *R Studio as-a-Service*: a facility enabling users to access a fully-fledged RStudio® working environment directly from the VRE. This environment is integrated with the rest of VRE \ VLab facilities, e.g. it is possible to use files from the workspace and to store new files into the workspace.

Figure 63 reports the total amount of operations performed in the context of this VRE. Operations include service tasks needed to maintain the VRE operational as well as human tasks.

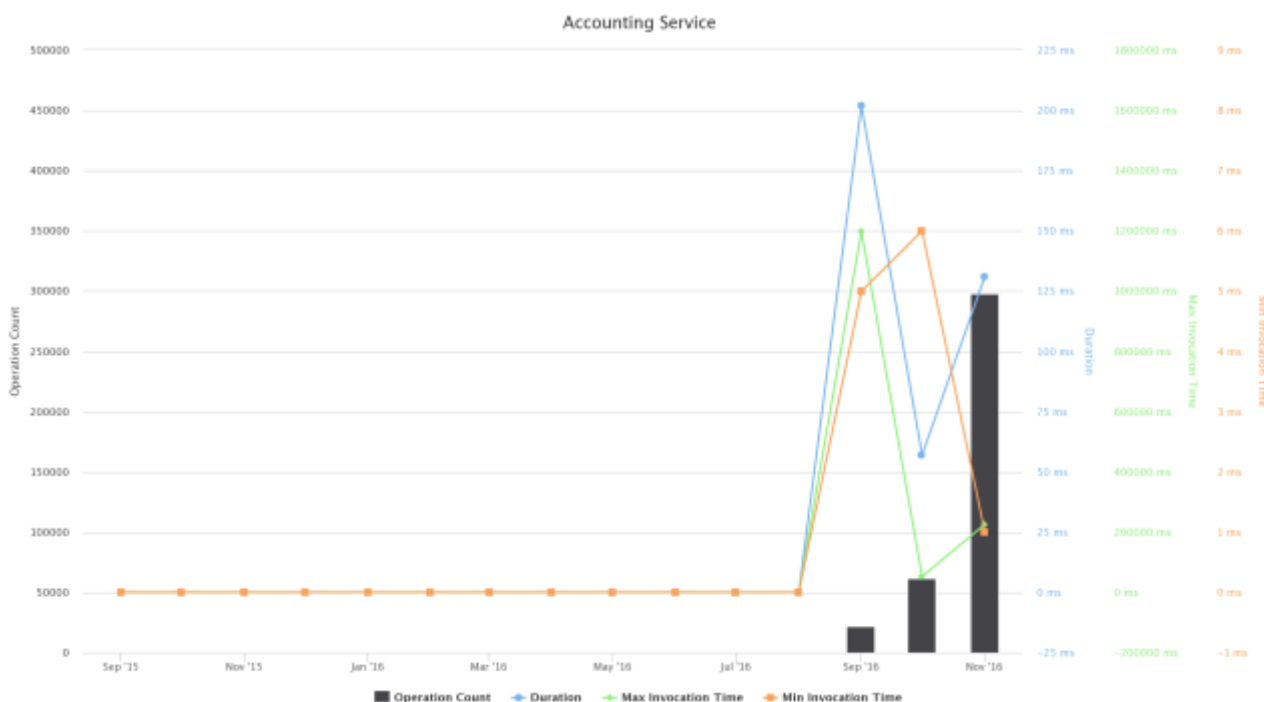


Figure 63. RStudio Lab VRE \ VLab Operations per Month

### 3.31 SCALABLE DATA MINING

Scalable Data Mining is a VLab designed to apply Data Mining techniques to biological data. The algorithms are executed in a distributed fashion on the e-Infrastructure nodes or on local multi-core machines. Scalability is thus meant as distributed data processing but also as services dynamically provided to the users. The

system is scalable in the number of users and in the size of the data to process. Statistical data processing can be applied to perform Niche Modelling or Ecological Modelling experiments. Other applications can use general purpose techniques like Bayesian models. Time series of observations can be managed as well, in order to classify trends, catch anomaly patterns and perform simulations. The idea behind the distributed computation for data mining techniques is to overcome common limitations that can happen when using statistical algorithms: (a) the training and projection procedure timing, (b) the linear or non-linear time increase when the number of data to process increases, (c) the multiple runs needed for reducing overfitting or local minima problems, and (d) the multiple models topologies to be evaluated for assessing the optimal model's configuration.

All the above issues strongly limit the amount of time a scientist can dedicate to the evaluation of the results and to the combination and comparison of the outcomes of different experiments. On the other hand the Statistical Data Mining VRE adds advantages in using a distributed e-Infrastructure endowed with many data sources. Some of these are: (a) efficiency and time saving in computations; (b) availability of a set of data sources containing environmental or species features; (c) reliability of the quality of the features; (d) certification of compliancy between e-Infrastructure data sources and algorithms inputs/outputs; (e) import of users' own files; and (f) sharing of results and users' files.

The Scalable Data Mining VLab is available at <https://i-marine.d4science.org/web/scalabledatamining>

This VLab was inherited by iMarine, and thus it has *operational* since **September 2015**, from the perspective of BlueBRIDGE. It is currently serving **115 users**.

A screenshot of the VLab is provided in Figure 64; it shows the home page and the menu items for accessing the VLab facilities.

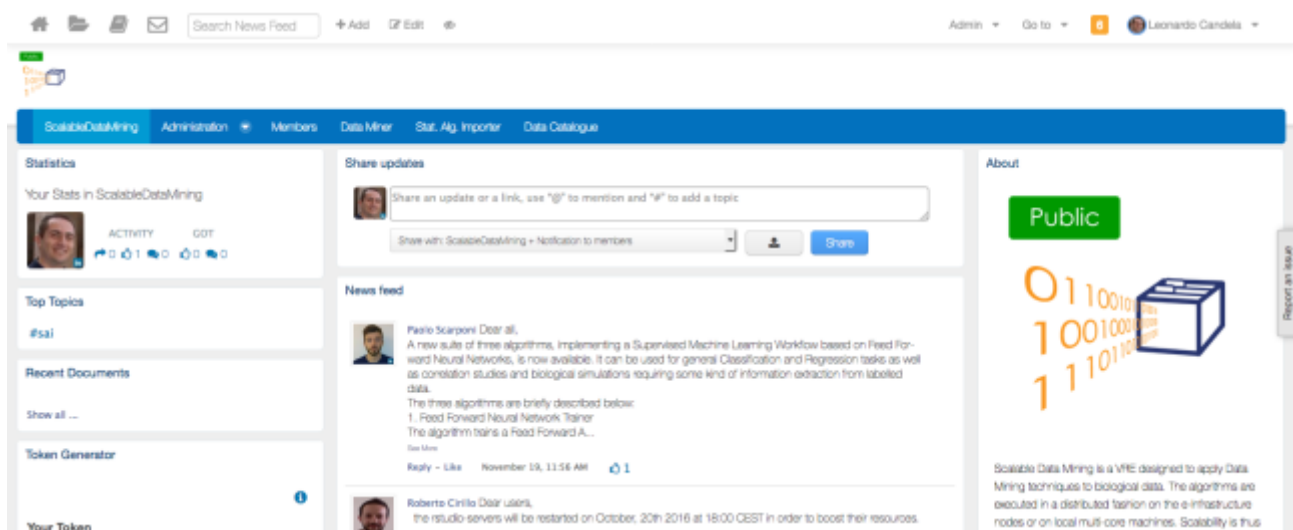


Figure 64. Scalable Data Mining VRE \ VLab Home Page Screenshot

In addition to the basic functionalities, as a workspace for sharing objects of interest, a social networking area for supporting the discussions among members and a user management facility for managing membership, this VRE is specifically equipped with the following capabilities:

- *Data Analytics at scale*: a facility enabling users to benefit from the offering of the DataMiner service and interactively execute a large array of data analytics tasks on datasets. These algorithms range from approaches to produce a species distribution map by means of either an expert system or a machine learning model (e.g. Neural Networks) to approaches for analysing climatic changes and their effects on species distribution. As of November '16 this environment has been configured to give access to more than **70 diverse algorithms**;
- *Algorithm Importer*: a facility enabling users to transform R-based algorithms and methods into DataMiner algorithms [5], i.e. methods that can be executed by the data analytics platform. This transformation assists in annotating the code thus to making it possible for Data Miner to properly execute it;

- *Data Catalogue*: a facility enabling users to access the BlueBRIDGE products catalogue. This catalogue currently give access to **48.2k products** (namely species distribution maps).

The major changes occurred in this VRE with respect to the version developed and operated by iMarine derive from the exploitation of the latest services and facilities resulting from BlueBRIDGE developments. In particular, this VLab is benefitting from the new data analytics framework and its support for Open Science practices, the facility for importing new methods, and the data catalogue.

Figure 65 reports the total amount of operations performed in the context of this VRE. Operations include service tasks needed to maintain the VRE operational as well as human tasks.

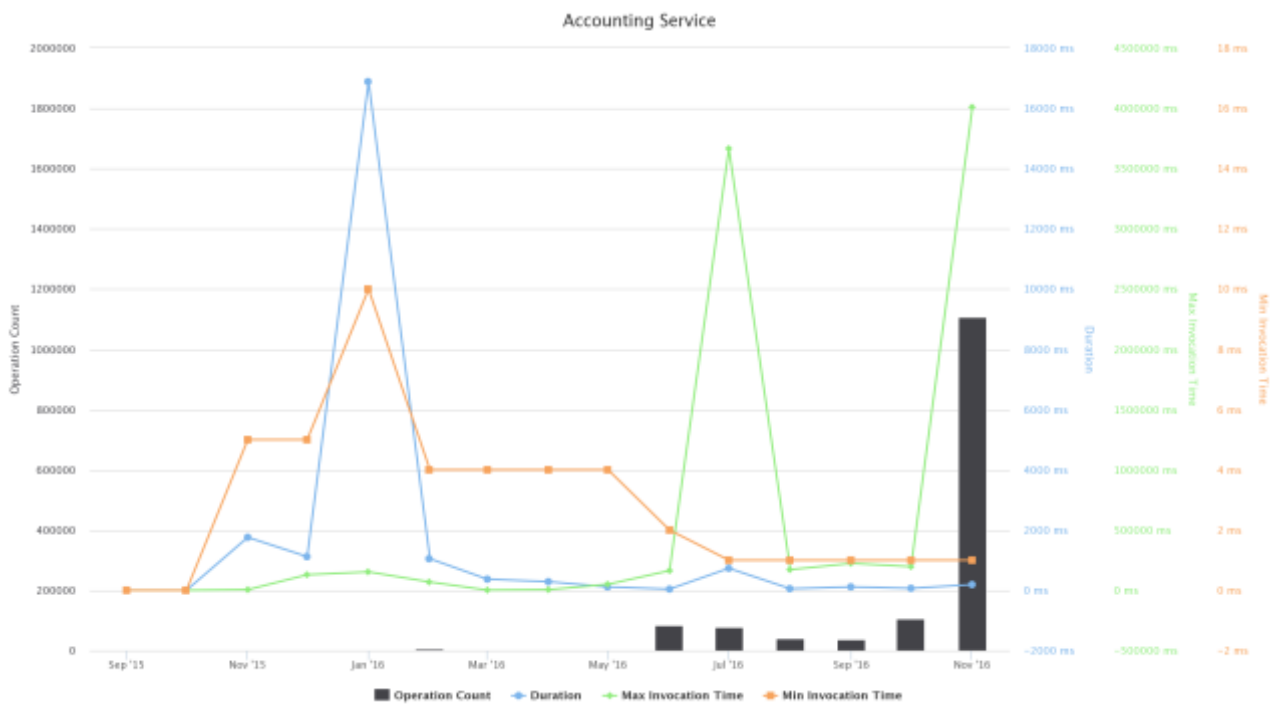


Figure 65. Scalable Data Mining VRE \ VLab Operations per Month

### 3.32 STOCK ASSESSMENT

This VRE has been created to support the activities and discussions occurring in Task 6.1 [7], i.e. to facilitate advanced and collaborative stock assessment methods development where a role based workflow produces stock assessments in several clear steps: from data collation, and harmonization, through model driven analysis and dissemination. Stock assessment methods discussed and developed by this VRE are oriented to serve both resource managers in need of harmonized stock-related information and scientists seeking a powerful infrastructure for new analytical approaches.

The Stock Assessment VRE is available at <https://i-marine.d4science.org/web/stockassessment>

This VRE stems from the Blue Assessment VREs [7]. It has been in **“operational”** status since **September '15**, and it is currently serving **54 users**.

A screenshot of the VRE is provided in Figure 66; it shows the home page and the menu items for accessing the VLab facilities.

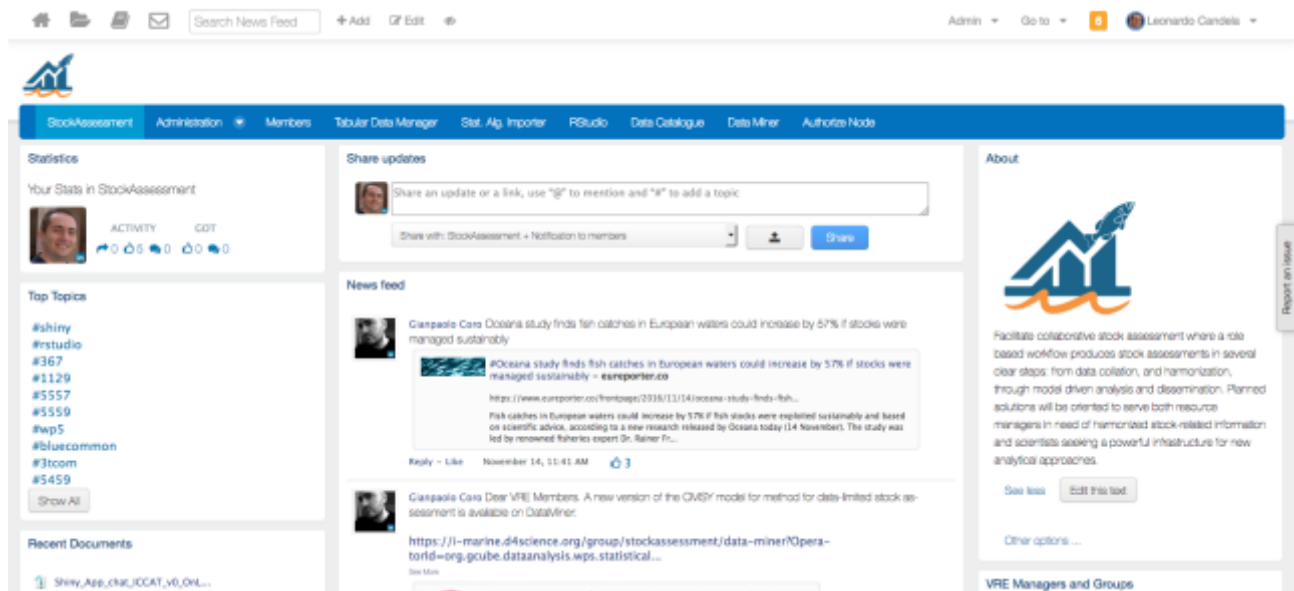


Figure 66. Stock Assessment VRE \ VLab Home Page Screenshot

In addition to the basic functionalities, as a workspace for sharing objects of interest, a social networking area for supporting the discussions among members and a user management facility for managing membership, this VRE is specifically equipped with the following capabilities:

- **Data Analytics at scale:** a facility enabling users to benefit from the offering of the DataMiner service and interactively execute a large array of data analytics tasks on datasets. These algorithms are dedicated to offer a series of stock assessment methods including FAO Maximum Sustainable Yield (MSY)<sup>11</sup>, Virtual Population Analysis (VPA) [7], trajectories simulations based on the Ichthyop model [7], ensemble model-based approaches [13]. As of November '16 this environment has been configured to give access to more than **25 diverse algorithms**;
- **Algorithm Importer:** a facility enabling users to transform R-based algorithms and methods into DataMiner algorithms [5], i.e. methods that can be executed by the data analytics platform. This transformation assists in annotating the code thus to make it possible for Data Miner to properly executing it;
- **R Studio as-a-Service:** a facility enabling users to access a fully-fledged RStudio® working environment directly from the VRE. This environment is integrated with the rest of VRE \ VLab facilities, e.g. it is possible to use files from the workspace and to store new files into the workspace.
- **Tabular Data management:** a facility enabling users to import, curate and manage tabular data. This feature can support data managers during the whole life cycle of data management from data capture to publication and visualisation. It enables data managers to import and transform datasets (CSV, SDMX, JSON) into tabular resources (i.e. tabular data having proper types associated with columns eventually referring to code lists) and reference datasets (code lists) representing recognized value instances of the elements the dataset is about (e.g., species, zones, countries). This functionality guarantees that the tabular resources are compliant with the defined types and code lists. Besides the curation, the facility supports the analysis of the data by enabling a user to (i) perform operations like grouping and filtering, (ii) producing charts and GIS maps (if the data have geographic features), (iii) analysing the data via an R environment as well as via the data analytics facilities (see below). Finally, the environment supports the publishing of tabular resources in the infrastructure by equipping them with rich metadata so that such resources can be used in other application contexts;

<sup>11</sup> An algorithm developed by the Resource Use and Conservation Division of the FAO Fisheries and Aquaculture Department.

- *Data Catalogue*: a facility enabling users to access the BlueBRIDGE products catalogue. This catalogue currently gives access to 48.2k products (namely species distribution maps).

Figure 67 reports the total amount of operations performed in the context of this VRE. Operations include service tasks needed to maintain the VRE operational as well as human tasks.

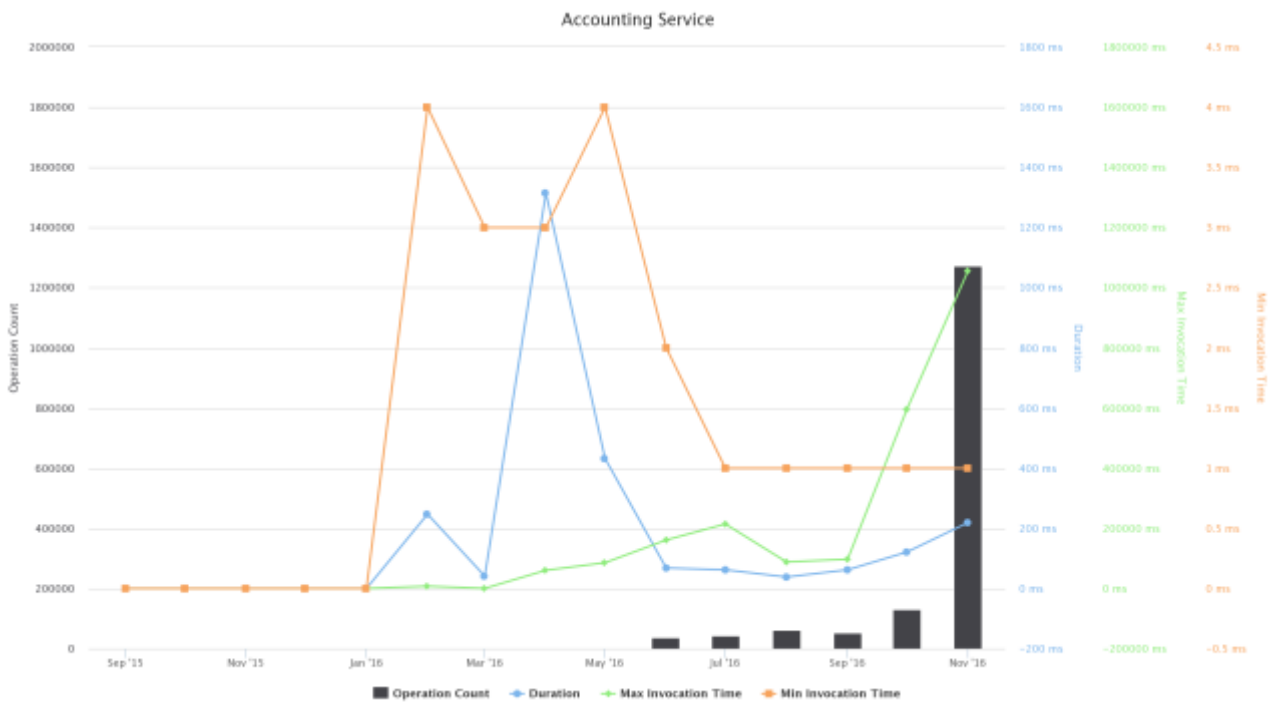


Figure 67. Stock Assessment VRE \ Vlab Operations per Month

### 3.33 STOCKS & FISHERIES KNOWLEDGE BASE

This VRE has been created to support the activities and discussions occurring in Task 5.2 [7], i.e. to define and implement solutions realising a collaborative environment to build and maintain a global knowledge base of stocks and fisheries (i.e. the Global Record of Stocks and Fisheries).

The Stocks and Fisheries KB VRE is available at <https://i-marine.d4science.org/web/stocksandfisherieskb>

This VRE stems from the Blue Assessment VREs [7]. It has been in *“operational”* status since **September '15**, and it is currently serving **34 users**.

A screenshot of the VRE is provided in Figure 68; it shows the home page and the menu items for accessing the VRE facilities.

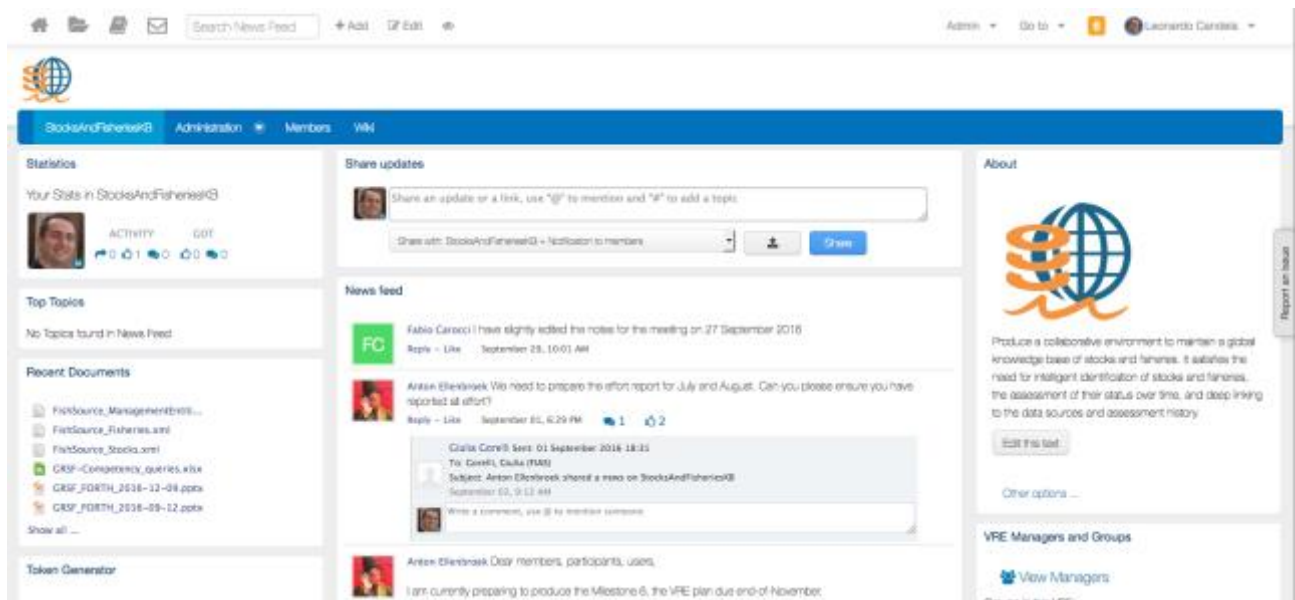


Figure 68. Stock and Fisheries KB VRE \ VLab Home Page Screenshot

In addition to the basic functionalities, as a workspace for sharing objects of interest, a social networking area for supporting the discussions among members and a user management facility for managing membership, this VRE is specifically equipped with the following capabilities:

- *GRSF Wiki*: a facility enabling users to access a dedicated Wiki recording requirements, discussions and decisions characterizing the development of the GRSF knowledge base and the supporting VREs \ V Labs and services;

Figure 69 reports the total amount of operations performed in the context of this VRE. Operations include service tasks needed to maintain the VRE operational as well as human tasks.

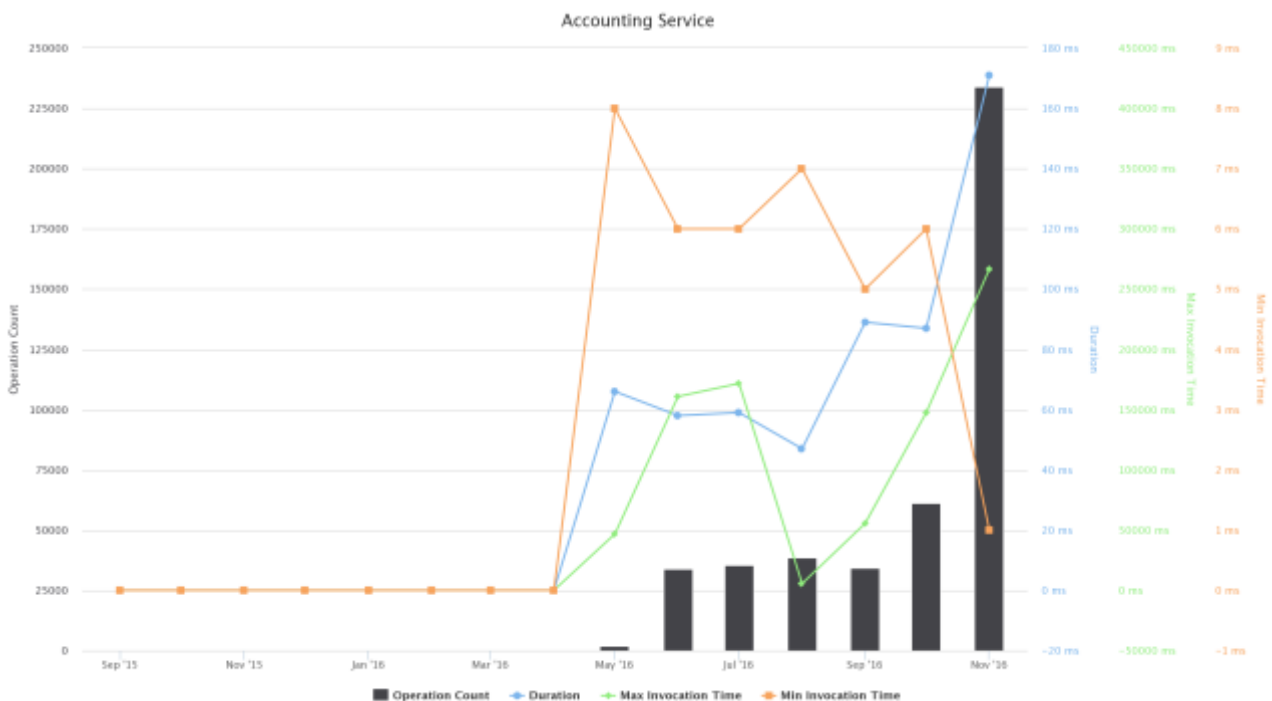


Figure 69. Stocks and Fisheries KB VRE \ VLab Operations per Month

### 3.34 STRATEGIC INVESTMENT ANALYSIS

This VRE has been created to support the activities and discussions occurring in Task 6.2 [8], i.e. to design innovative approaches aiming at satisfying the need for intelligent identification of locations of interest under



an open-ended set of criteria, as required by both investors seeking optimization of intended investments and by scientists seeking areas that are becoming of environmental importance.

The Strategic Investment Analysis VRE is available at <https://i-marine.d4science.org/web/strategicinvestmentanalysis>

This VRE stems from the Blue Economy VREs [8]. It has been in “operational” status since **September ’15**, and it is currently serving **22 users**.

A screenshot of the VRE is provided in Figure 70, it shows the home page and the menu items for accessing the VRE facilities.

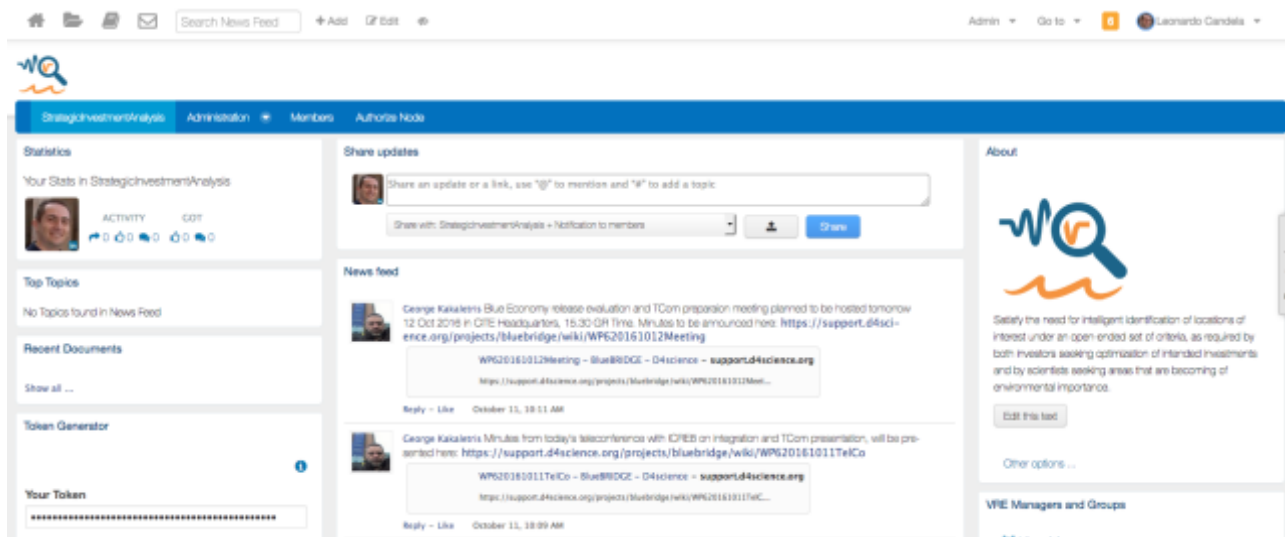


Figure 70. Strategic Investment Analysis VRE \ VLab Home Page Screenshot

This VRE is not equipped with any facility other than the basic ones, as a workspace for sharing objects of interest, a social networking area for supporting the discussions among members and a user management facility for managing membership.

Figure 71 reports the total amount of operations performed in the context of this VRE. Operations include service tasks needed to maintain the VRE operational as well as human tasks.

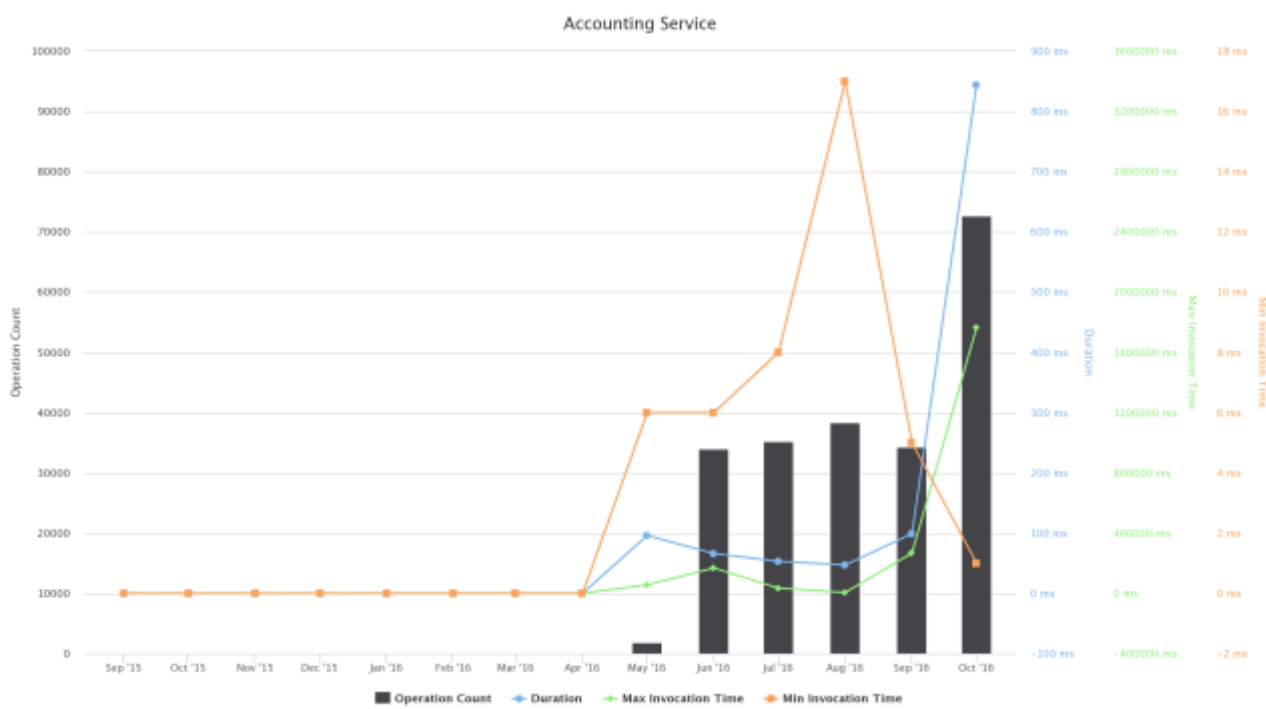


Figure 71. Strategic Investment Analysis VRE \ VLab Operations per Month

### 3.35 STRATEGIC INVESTMENT ANALYSIS AND SCIENTIFIC PLANNING/ALERTING VRE (SIASPA)

Strategic Investment analysis and Scientific Planning/Alerting (SIASPA) VLab offers a geospatial multi-factor optimization and alerting platform for intelligent identification of locations of interest for investors and stakeholders seeking optimization of intended investments and scientists seeking areas that are becoming of environmental importance

The SIASPA VLab is available at <https://i-marine.d4science.org/web/siaspa>

This VLab stems from the Blue Economy VREs [8]. It has been in “**available**” status since November ’16, it is working and the Blue Economy team is carefully testing it before releasing.

A screenshot of the VLab is provided in Figure 72, it shows the home page and the menu items for accessing the VLab facilities.

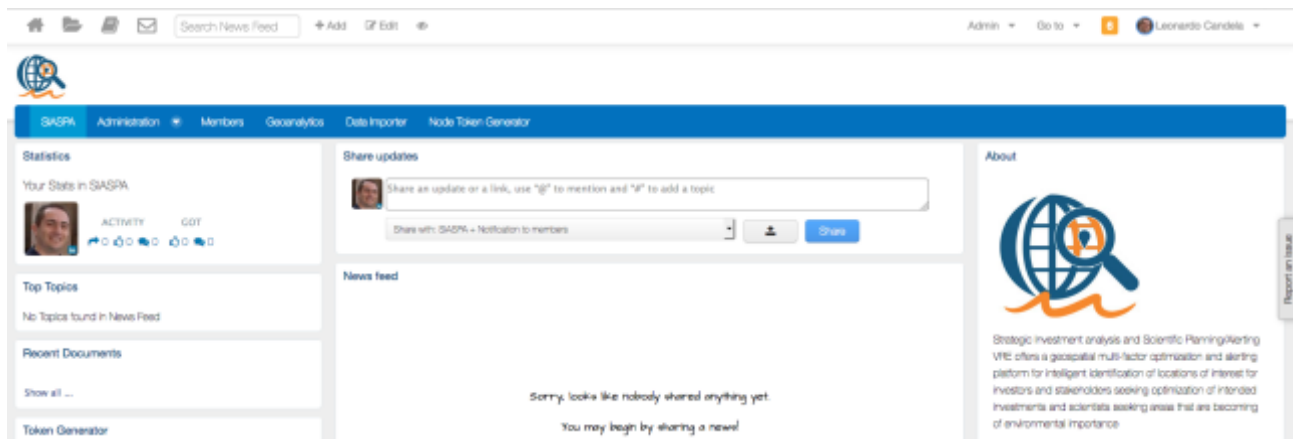


Figure 72. SIASPA VRE \ VLab Home Page Screenshot

In addition to the basic functionalities, as a workspace for sharing objects of interest, a social networking area for supporting the discussions among members and a user management facility for managing membership, this VRE is specifically equipped with the following capabilities:

- *Geoanalytics*: a facility enabling users (e.g. investors, scientists) to efficiently identify strategic locations of interest that meet multifactor selection criteria. It includes project management facilities that let users create projects (i.e. identification tasks) with layer selection and sharing among existing groups or individual users, exploration of existing geospatial datasets and analytics techniques execution on geospatial data in order to guide decision making in aquafarm industry.
- *Data importer*: a facility enabling users to import geospatial data in the geoanalytics platform from various data sources. There is built-in support for importing data from services and formats following open standards such as Web Feature Service (WFS) services and tsv files. In addition, the data importer tool offers a mechanism to inject custom pluggable logic in order to seamlessly support any other possibly available data source. This tool also provides the ability to define taxonomies that can be used by the geoanalytics platform to classify and retrieve geospatial layers.

Figure 73 reports the total amount of operations performed in the context of this VLab. Operations include service tasks needed to maintain the VRE operational as well as human tasks.

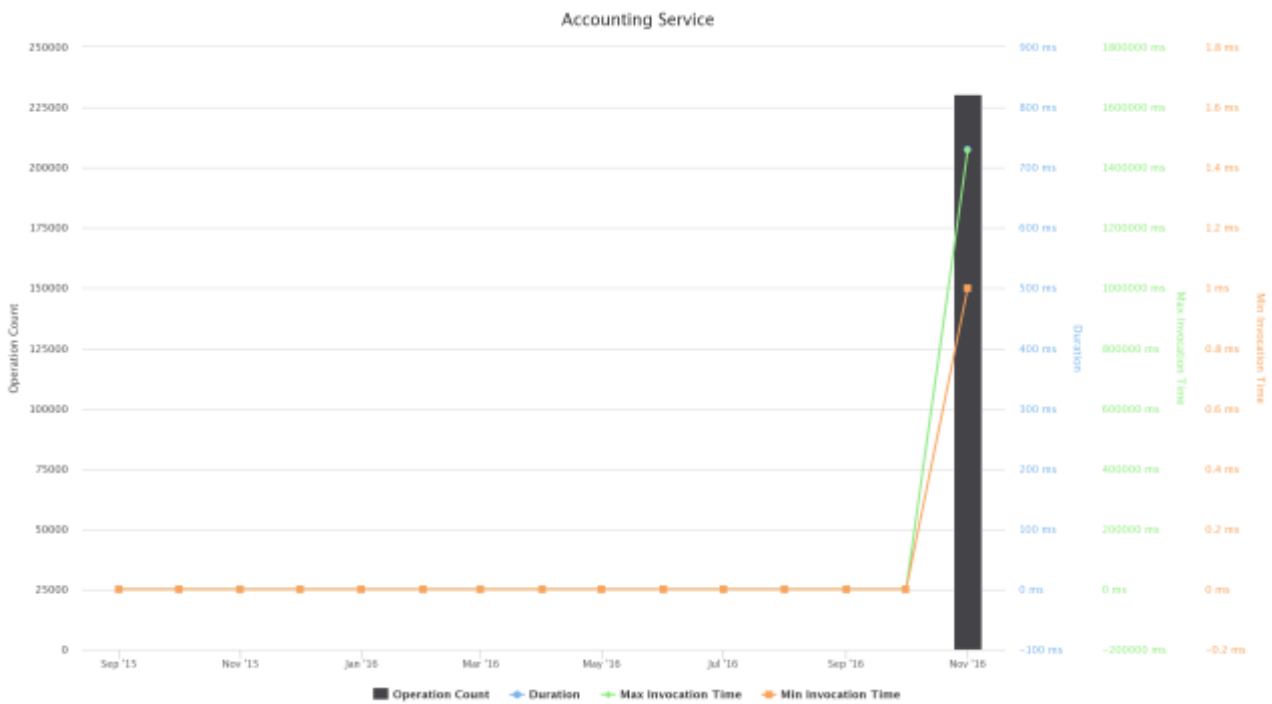


Figure 73. SIASPA VRE \ VLab Operations per Month

### 3.36 TABULAR DATA LAB

The TabularDataLab VLab was conceived to provide its users with a working environment supporting the management of tabular data, i.e. any dataset that can be represented in a table format. In particular, the environment offers a suite to import, curate, analyse and publish tabular data resources in a collaborative way. Moreover, the environment offers a suite to import, curate, and publish code lists in a collaborative way.

The Tabular Data Lab VLab is available at <https://i-marine.d4science.org/web/tabulardatalab>

This VLab is inherited by iMarine thus it has been in **operational** status since **September 2015**, from the perspective of BlueBRIDGE. It is currently serving **152 users**.

A screenshot of the VLab is provided in Figure 74; it shows the home page and the menu items for accessing the VLab facilities.

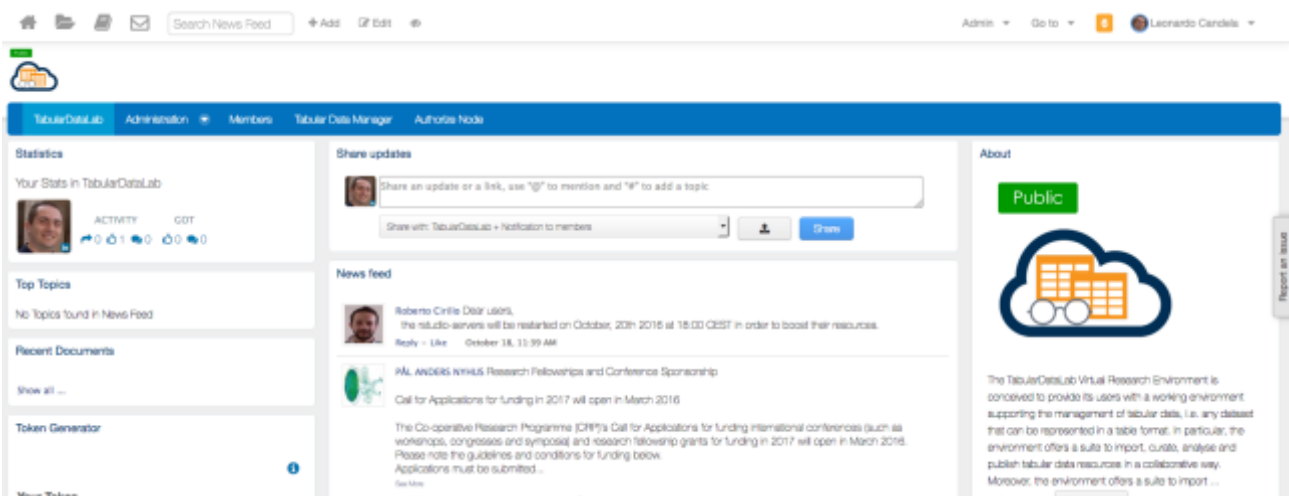


Figure 74. Tabular Data Lab VRE \ VLab Home Page Screenshot

In addition to the basic functionalities, as a workspace for sharing objects of interest, a social networking area for supporting the discussions among members and a user management facility for managing membership, this VRE is specifically equipped with the following capabilities:

- Tabular Data management:** a facility enabling users to import, curate and manage tabular data. This feature can support data managers during the whole life cycle of data management from data capture to publication and visualisation. It enables data managers to import and transform datasets (CSV, SDMX, JSON) into tabular resources (i.e. tabular data having proper types associated with columns eventually referring to code lists) and reference datasets (code lists) representing recognized value instances of the elements the dataset is about (e.g., species, zones, countries). This functionality guarantees that the tabular resources are compliant with the defined types and code lists. Besides the curation, the facility supports the analysis of the data by enabling a user to (i) perform operations like grouping and filtering, (ii) producing charts and GIS maps (if the data have geographic features), (iii) analysing the data via an R environment as well as via the data analytics facilities (see below). Finally, the environment supports the publishing of tabular resources in the infrastructure by equipping them with rich metadata so that such resources can be used in other application contexts;

The major changes occurred in this VRE with respect to the version developed and operated by iMarine derive from the exploitation of the latest services and facilities resulting from BlueBRIDGE developments, namely the enhancements on the basic facilities.

Figure 75 reports the total amount of operations performed in the context of this VLab. Operations include service tasks needed to maintain the VRE operational as well as human tasks.

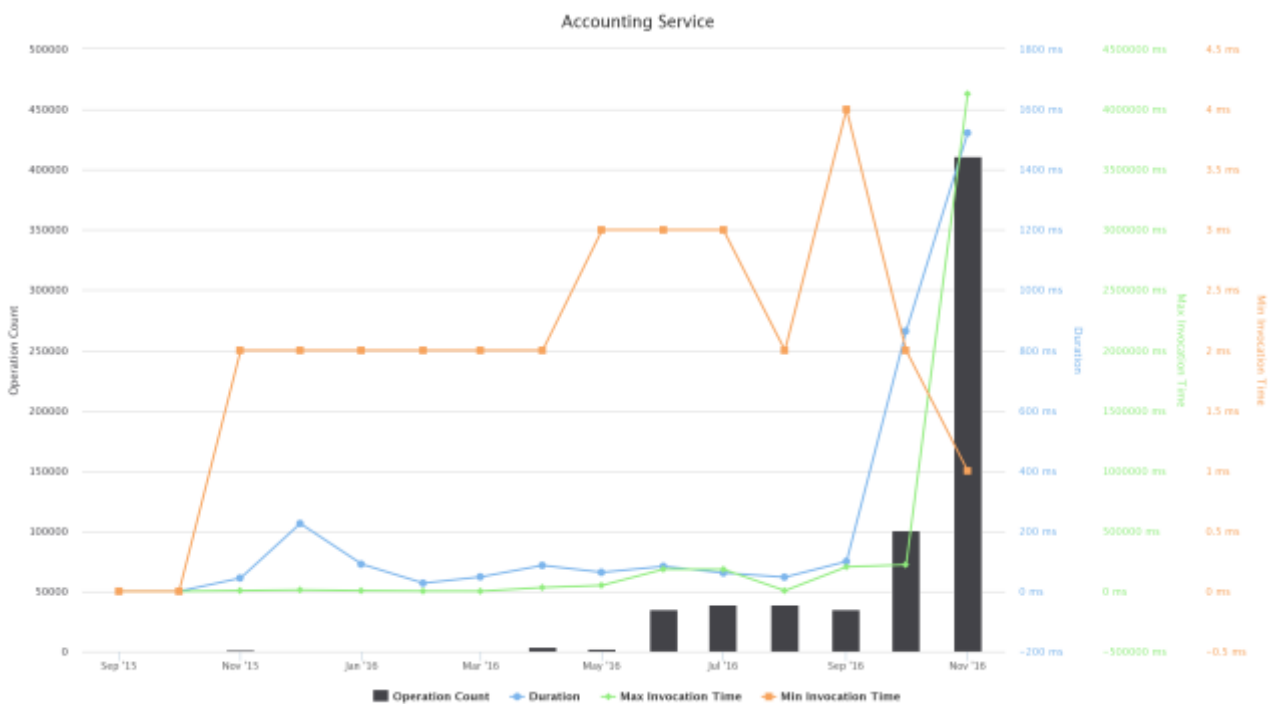


Figure 75. Tabula Data Lab VRE \ VLab Operations per Month

### 3.37 VULNERABLE MARINE ECOSYSTEM (VME) DB

Vulnerable Marine Ecosystems (VMEs) DB is a VRE created to support the development and storage of Fact Sheets on VMEs. The main functionalities is a template-based reporting environment exploited to populate the FAO VME DB<sup>12</sup>.

The VME-DB VLab is available at <https://i-marine.d4science.org/web/vme-db>

This VLab is inherited by iMarine, and thus it has been in **operational** status since **September 2015**, from the perspective of BlueBRIDGE. It is currently serving **20 users**.

<sup>12</sup> <http://www.fao.org/in-action/vulnerable-marine-ecosystems/vme-database/en/>

A screenshot of the VLab is provided in Figure 76; it shows the home page and the menu items for accessing the VLab facilities.

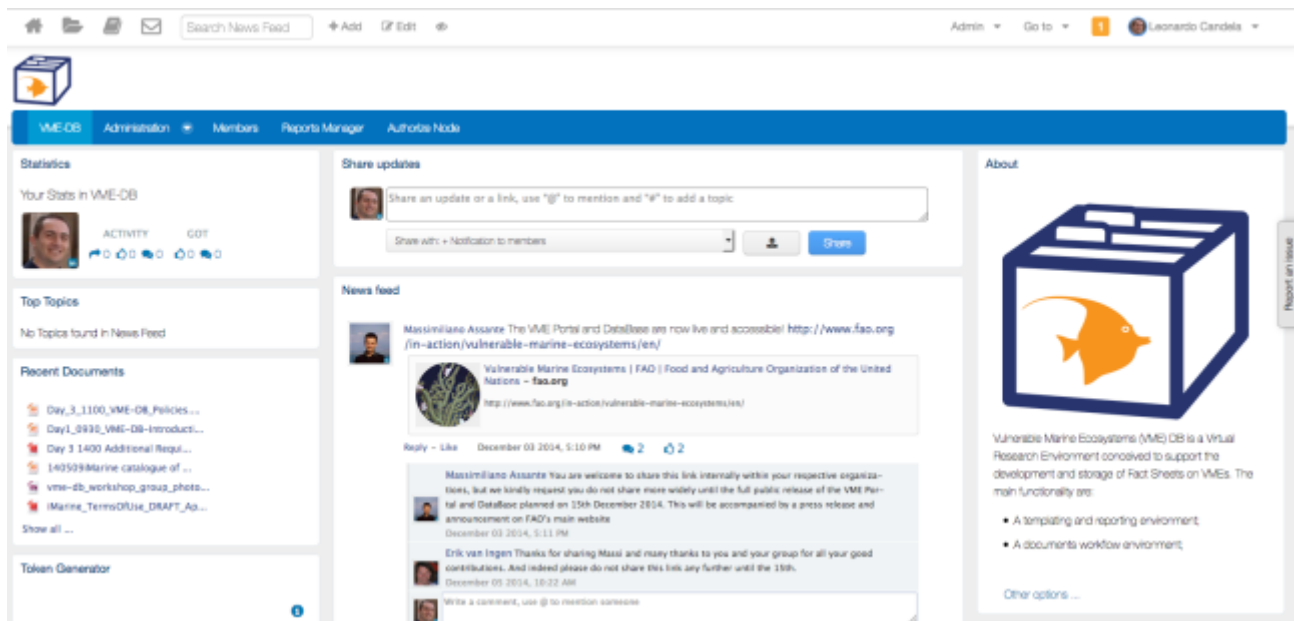


Figure 76. VME-DB VRE \ VLab Home Page Screenshot

In addition to the basic functionalities, as a workspace for sharing objects of interest, a social networking area for supporting the discussions among members and a user management facility for managing membership, this VRE is specifically equipped with the following capabilities:

- Report Management facilities: to enable users to collaboratively produce reports consisting in complex “documents” characterised by well-defined structures (templates). This facility is similar to a Content Management System supporting the population and management of the content of the FAO VME DB, a global inventory of fisheries measures to protect vulnerable marine ecosystems in areas beyond national jurisdiction.

The major changes occurred in this VRE with respect to the version developed and operated by iMarine derive from the exploitation of the latest services and facilities resulting from BlueBRIDGE developments. No major change worth reporting.

Figure 77 reports the total amount of operations performed in the context of this VLab. Operations include service tasks needed to maintain the VRE operational as well as human tasks.



Figure 77. VME-DB VRE \ VLab Operations per Month

### 3.38 WECAFC-FIRMS

WECAFC-FIRMS is a VLab created to support the development of the “WECAFC project 2015-2016 – Strengthening national data collection and regional data sharing through Fisheries and Resources Monitoring Systems (FIRMS) to support priority regional fishery management plans in the Western Central Atlantic Fishery Commission (WECAFC) area”. The VLab is mainly conceived to provide the members of the project with an environment for collecting and curating the data of interest.

The WECAFC-FIRM VLab is available at <https://i-marine.d4science.org/web/wecafc-firms>

This VLab is inherited by iMarine, and thus it has been in **operational** status since **September 2015**, from the perspective of BlueBRIDGE. It is currently serving **17 users**.

A screenshot of the VLab is provided in Figure 78; it shows the home page users and the menu items for accessing the VLab facilities.

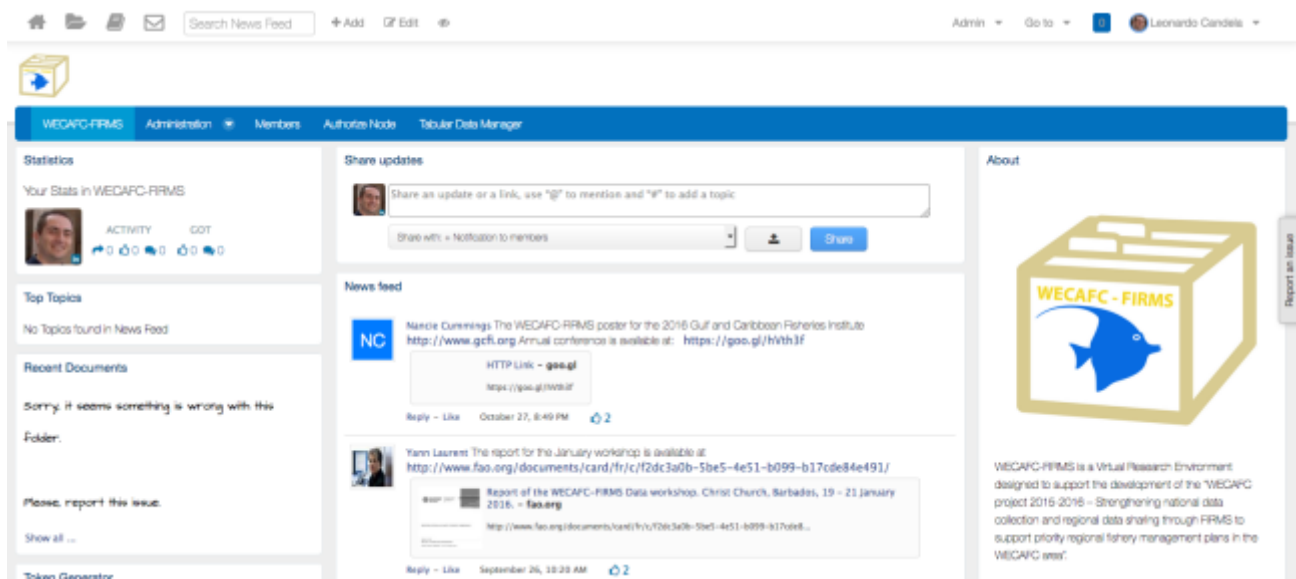


Figure 78. WECAFC-FIRMS VRE \ VLab Home Page Screenshot

In addition to the basic functionalities, as a workspace for sharing objects of interest, a social networking area for supporting the discussions among members and a user management facility for managing membership, this VRE is specifically equipped with the following capabilities:

- Tabular Data management:** a facility enabling users to import, curate and manage tabular data. This feature can support data managers during the whole life cycle of data management from data capture to publication and visualisation. It enables data managers to import and transform datasets (CSV, SDMX, JSON) into tabular resources (i.e. tabular data having proper types associated with columns eventually referring to code lists) and reference datasets (code lists) representing recognized value instances of the elements the dataset is about (e.g., species, zones, countries). This functionality guarantees that the tabular resources are compliant with the defined types and code lists. Besides the curation, the facility supports the analysis of the data by enabling a user to (i) perform operations like grouping and filtering, (ii) producing charts and GIS maps (if the data have geographic features), (iii) analysing the data via an R environment as well as via the data analytics facilities (see below). Finally, the environment supports the publishing of tabular resources in the infrastructure by equipping them with rich metadata so that such resources can be used in other application contexts.

The major changes occurred in this VRE with respect to the version developed and operated by iMarine derive from the exploitation of the latest services and facilities resulting from BlueBRIDGE developments. No major change worth reporting.

Figure 79 reports the total amount of operations performed in the context of this VLab. Operations include service tasks needed to maintain the VRE operational as well as human tasks.

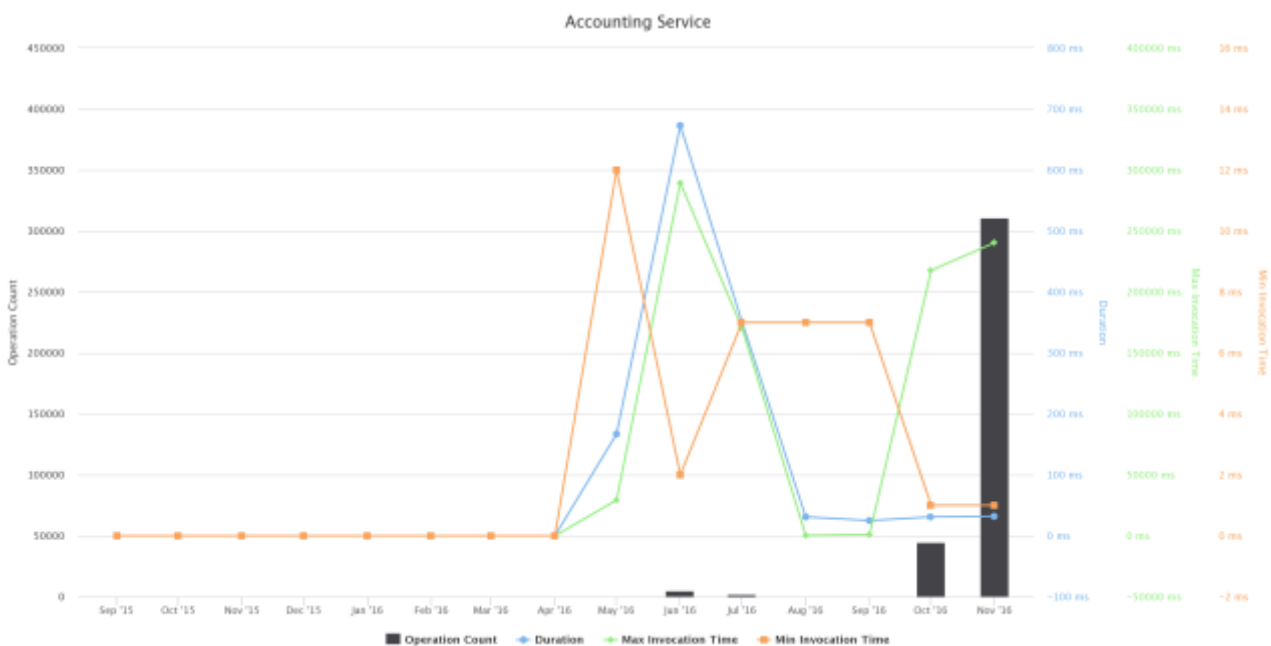


Figure 79. WECAFC-FIRMS VRE \ VLab Operations per Month



#### 4 CONCLUDING REMARKS

Virtual Research Environments and Virtual Laboratories are among the key products to be delivered by the BlueBRIDGE project to meet the needs of its target community and application scenarios. They are “systems” aiming at providing their users with web-based working environments that offer the entire spectrum of facilities (including services, data and computational facilities) needed to accomplish a given task by dynamically relying on the underlying infrastructure.

This deliverable has detailed the Virtual Research Environments and Virtual Laboratories deployed and operated by BlueBRIDGE from September 2015 to November 2016. Overall, 38 VREs have been deployed and operated to serve **more than 1500 users** in total spread across **22 countries** and **80 different organizations**. The top 10 countries are: Italy (13.04 %), France (8.70%), Greece (8.33 %), Denmark (4.35%), Spain (3.99 %), UK (2.90%), Norway (2.54%), Ireland (2.54%), Sweden (1.45%), Chile (1.09 %). The top 10 organisations that are currently exploiting VREs are: National Research Council of Italy (7.61%); Food and Agriculture Organization of the United Nations - FAO (5.07%); International Council for the Exploration of the Sea - ICES (4.35%); Institut de recherche pour le développement - IRD (3.99%); National Oceanic and Atmospheric Administration - NOAA (3.26%); Marine Institute Foras na Mara - Marine.ie (2.17%); Educational Departments (2.17%); Institute of Marine Research - IMR (1.45%); French Research Institute for Exploitation of the Sea - Ifremer (1.45%); Centro tecnológico expert en innivación marina y alimentaria - AZTI (1.09%).

The creation and operation of these 38 VREs required to manage **approximately 600 tickets** (32 tickets for VRE creation\update, 244 requests for support, 315 requests for incidents and bugs).

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