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Australian Institute of Marine Science

ISP009-2021-2022: Provision of ongoing technical support for GHHP Data and Information Management System

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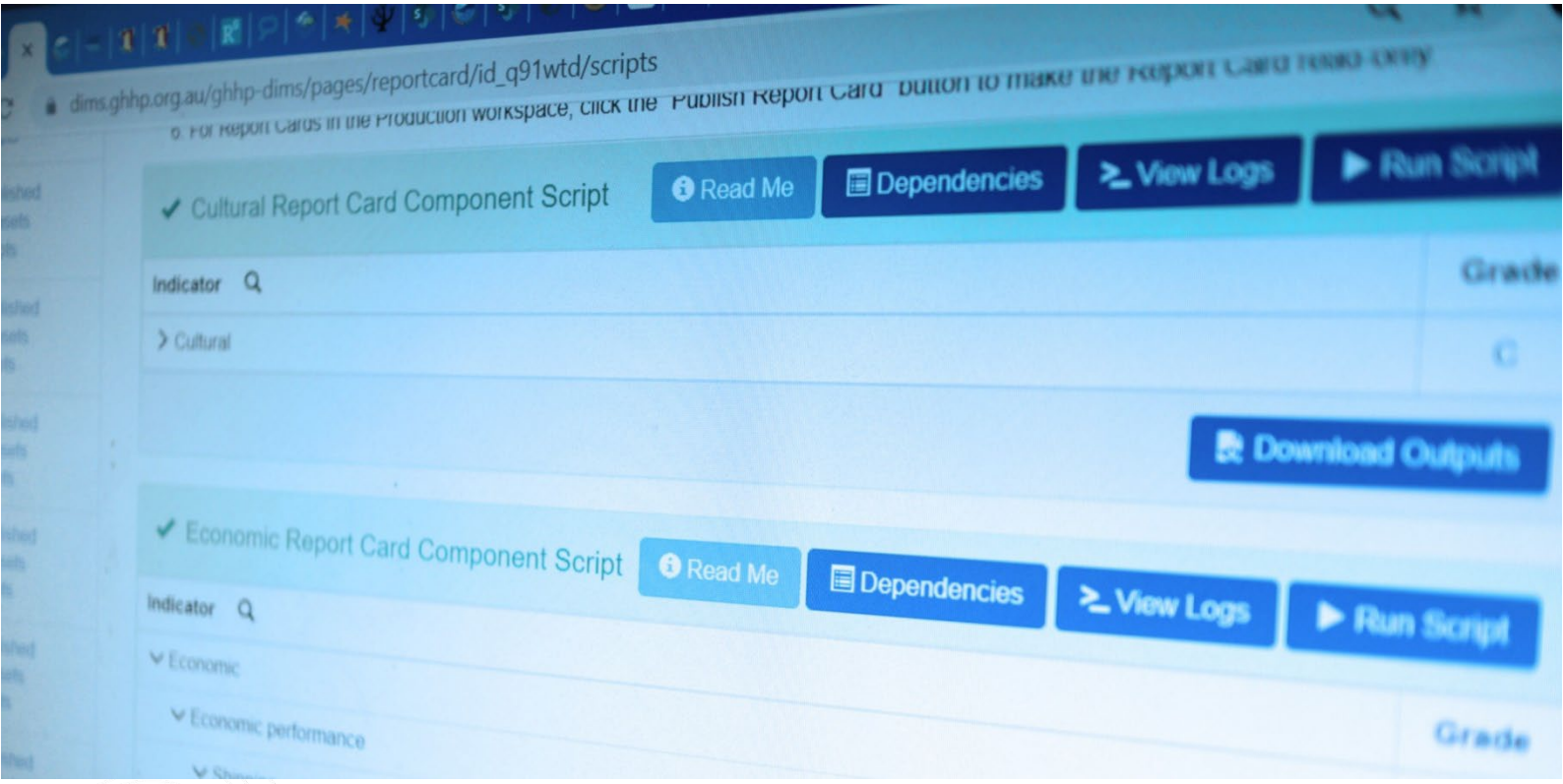

Final project report prepared for Gladstone Healthy Harbour Partnership.

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This report should be cited as:
Marc Hammerton, Murray Logan, Gael Lafond (2022) ISP009-2021-2022: Provision of ongoing technical support for GHHP Data and Information Management System. Report prepared for Gladstone Heathy Harbour Partnership. Australian Institute of Marine Science, Location. (7 pp)

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Revision History:		Name	Date	Comments
1	Prepared by:	*Marc Hammerton*	18/05/2022	
	Reviewed by:	*Eric Lawrey*	20/05/2022	Clarified why the 2015 report card scores couldn't be fixed.
	Approved by:	*Insert Program Director's name*	Insert date	

Cover photo:
Screenshot of the GHHP DIMS report card system web interface. Image: E. Lawrey

1 SUMMARY

The GHHP Data and Information Management System (DIMS) is a web-based system for managing the data and scripts used to generate the Gladstone Harbour Report Card (http://ghhp.org.au/). The Australian Institute of Marine Science manages the hosting and maintenance of this system, upgrading software components as needed and making enhancements or adjustments to the report card scripts as requested by GHHP. This project covered one-year of the on-going maintenance of this system and focused on ensuring consistency in the report card trend plots as a one-off task.

2 PROJECT BACKGROUND

The Gladstone Healthy Harbour Partnership (GHHP) Data and Information Management System (DIMS) is a web-based system that helps coordinate the submission and processing of monitoring data associated with the annual GHHP environmental report card for the Gladstone region. This system allows groups performing the monitoring to upload their data into the system. The system performs a range of checks on the monitoring data to ensure consistency and compatibility with the logic of the report card scripts. The algorithms that implement the logic of the report card are implemented as a range of R scripts. The DIMS system allows the GHHP science team to run these scripts on the monitoring data to produce a range of products (trend plots, preview of the report card scores and prepopulated report card templates) that are used to produce the final report card.

The DIMS system was actively developed from 2014 – 2016, with further refinements and additional report card indicators added to the R scripts from 2017 – 2020. This project covers the tasks associated with the maintenance, support, adjustments, and necessary software upgrades of the GHHP Data and Information Management System (DIMS) over the 2021-2022 financial year. This project covers routine maintenance tasks and one-off specified tasks to ensure the continued operation of the system.

The source code for the DIMS system software and the scripts are stored on in private repositories on GitHub at the address: https://github.com/ghhp-dims. The server associated with the DIMS is hosted on the Amazon cloud and managed by the Knowledge System team at AIMS. This server also hosts the GHHP website (http://ghhp.org.au) along with the legacy GHHP e-Portal (http://data.ghhp.org.au/) that hosts a catalogue of 350 metadata records. Additionally, a development server containing a mirror of the GHHP website is maintained to allow the website developer (Bitplex) to develop changes to the website safely prior to putting them on the production website.

3 PROJECT DELIVERABLES

This section outlines each of the project scheduled tasks and the results of what happened during the year.

3.1 Task 1: Project inception meeting

Completed November 2021

This meeting was conducted on 3 November 2021.

3.2 Task 2. Confidence interval calculation

Completed November 2021

- The aim of this task was to have consistency in the information presented in the commonly used report card trend plots.
- The trend plots should be checked to ensure all years are included and the confidence intervals are shown.

We performed an analysis to check for errors in the DIMS regarding missing values and error bars but could not determine any. The analysis showed the main issue with missing error bars is rather an issue with the visualisation: the circle with the grade inside hides small error bars. As discussed with all stakeholders it was decided that fixing this issue would go beyond the scope of this year's contract.

Regarding missing values in the environmental script, we were able to retrieve the values for the years 2016, 2017 and 2018. Unfortunately, we cannot easily re-calculate the values for 2015 because the report card for this year was not processed in the DIMS. The scores for 2015 were manually copied from the technical report into the DIMS and thus we cannot correct for these missing values that were not previously reported on. We therefore marked the missing 2015 data as "won't fix". We have now updated the production report cards (2016, 2017, 2018) to include the missing all-harbour scores for the water and sediment quality measures. Note that we did not need to re-run the report cards, we added the missing values to the final scores.

The only un-addressed issue is the missing harbour trend plots for "Management Strategies and Physical condition". We checked the output of the cultural heritage script and this is not included. We would need to request an update for this script and re-run the script for the previous years to generate the missing values.

The following table details our findings and the changes. The column "Trend Plot" reflects the same information as in the document "2021-06-25-GHHP DIMS-2021-22-ISP009-2021-22 Request for a proposal_Final.docx", while the "Comment" column indicates our findings and actions.

Report Card Indicator	Trend Plot	Comment
Environmental	Harbour Score	
Water Quality	Harbour Score Water and Sediment Quality	
	Harbour Score Water Quality	checked, no issue
	Harbour Score Dissolved Metals	2015 missing but won't fix
	Harbour Score Nutrients	2015 missing but won't fix
	Harbour Score Aluminium (only 2019 – 2020 shown)	2016-2018 added, 2015 missing but won't fix
	Harbour Score Copper (only 2019 – 2020 shown)	2016-2018 added, 2015 missing but won't fix
	Harbour Score Lead (only 2019 – 2020 shown)	2016-2018 added, 2015 missing but won't fix
	Harbour Score Manganese (only 2019 – 2020 shown)	2016-2018 added, 2015 missing but won't fix
	Harbour Score Nickel (only 2019 – 2020 shown)	2016-2018 added, 2015 missing but won't fix
	Harbour Score TN (only 2019 – 2020 shown)	2016-2018 added, 2015 missing but won't fix
	Harbour Score pH (only 2019 – 2020 shown)	2016-2018 added, 2015 missing but won't fix
	Harbour Score TP (only 2019 – 2020 shown)	2016-2018 added, 2015 missing but won't fix
	Harbour Score Turbidity (only 2019 – 2020 shown)	2016-2018 added, 2015 missing but won't fix
	Harbour Score Zinc (only 2019 – 2020 shown)	2016-2018 added, 2015 missing but won't fix
Sediment Quality	Harbour Score	checked, no issue
	Harbour Score Metal and Metalloids 2015 missing	2015 missing but won't fix
	Harbour Score Arsenic (only 2019 – 2020 shown)	2016-2018 added, 2015 missing but won't fix
	Harbour Score Cadmium (only 2019 – 2020 shown)	2016-2018 added, 2015 missing but won't fix
	Harbour Score Copper (only 2019 – 2020 shown)	2016-2018 added, 2015 missing but won't fix
	Harbour Score Lead (only 2019 – 2020 shown)	2016-2018 added, 2015 missing but won't fix
	Harbour Score Mercury (only 2019 – 2020 shown)	2016 added, 2017-2018 it was removed, 2015 missing but won't fix
	Harbour Score Nickel (only 2019 – 2020 shown)	2016-2018 added, 2015 missing but won't fix
	Harbour Score Zinc (no error bars)	2016-2018 added, 2015 missing but won't fix
Habitats	Harbour Score Habitats	
Seagrass	Harbour Score Seagrass (no error bars 2020)	checked, no issue
	Harbour Score Area (2015 not shown)	2015 missing but won't fix
	Harbour Score Biomass (2015 not shown)	2015 missing but won't fix
	Harbour Score Area (no error bars)	duplication, probably species composition; 2015 missing but won't fix
Corals	Harbour Score Coral (no error bars 2020)	checked, no issue
	Harbour Score Coral Cover (2015 not shown)	2015 missing but won't fix
	Harbour Score Juvenile Density (2015 not shown)	2015 missing but won't fix
	Harbour Score Macroalgal Cover (2015 not shown)	2015 missing but won't fix
	Harbour Score Change in Hard Coral Cove	
Mangroves	Harbour Score Mangroves (no error bars 2020)	checked, no issue
	Harbour Score Mangrove Canopy Condition	
	Harbour Score Mangrove Extent	
	Harbour Score Mangrove Shoreline Condition	
Fish and Crabs	Harbour Score Fish and Crabs	
Fish Health	Harbour Score Fish Health (no error bars 2020)	checked, no issue

	Harbour Score Fish Health Assessment Index (no error bars)	checked, no issue
	Harbour Score Visual Fish Condition (no error bars)	checked, no issue
Fish Recruitment	Harbour Score Fish Recruitment (Bream) (no error bars 2020).	checked, no issue
Mud Crabs	Harbour Score Mudcrab (no error bars 2020)	checked, no issue
	Harbour Score Abundance	
	Harbour Score Prevalence of Rust Lesions	
	Harbour Score Sex Ratio	
Social	Harbour Score Social	
Harbour Access	Harbour Access	
Harbour Usability	Harbour Usability	
Liveability and Wellbeing	Liveability and Wellbeing	
Cultural	Harbour Score Cultural (no error bars 2018, 2019 and 2020)	checked, no issue
Sense of Place	Harbour Score Sense of Place	
	Appreciation of the Harbour	
	Continuity	
	Place Attachment	
	Pride in the Region	
	Values	
	Well-being	
Cultural Heritage	Harbour Score Cultural Heritage (no error bars)	checked, no issue
	No Harbour Trend Plots for Management Strategies and Physical condition	no trend plot for all harbour
Economic	Harbour Score Economic	
Economic Performance	Economic Performance (no error bars)	checked, no issue
	Commercial Fishing	
	Shipping Activity (no error bars)	checked, no issue
	Tourism (no error bars)	checked, no issue
Economic Stimulus	Economic Stimulus (no error bars 2017)	checked, no issue
	Employment (no error bars 2017)	checked, no issue
	Socio-economic Status (no error bars 2017)	checked, no issue
Economic Value Recreation	Economic Value Recreation	
	Beach Recreation	
	Land-based Recreation	
	Recreational Fishing	
	Water-based Recreation	

3.3 Task 3: Server Administration

Completed June 2022

- Ensure the DIMS server remains online, is backed up and has security patches applied to its software components
- Priority bug fixes
- Minor upgrades to the existing report card scripts

This task maintains the on-going robust operation of the DIMS. It includes keeping the services online, assisting and investigating issues with uploading datasets, but also developing bug fixes for issues identified in the report card scripts or the DIMS software. The following is a summary of these activities for the year:

3.3.1 Routine Operating System Patches

Completed June 2022

Routine Operating System security patches were applied to the server on the Monday of each week. These ensure that all the packages on the server are up to date with the latest security patches. The automated backup system of the server (snapshots in Amazon EC2) was tested during the year by starting one of the backup images to ensure that they would run.

3.3.2 Statamic admin user reset

Completed September 2021

The admin user was deleted from the Statamic system, locking out the GHHP teams. Gael Lafond accessed the Statamic admin interface using the aimsadmin user and created a new admin user for Mac Hansler.

Mac Hansler gained access to the Statamic system and updated the list of users.

3.3.3 Security issue Log4shell (CVE-2021-44228) response

Completed January 2022

Log4Shell was a zero-day vulnerability in Log4j, a popular Java logging framework. The vulnerability potentially allowed attackers to execute arbitrary Java code on servers running Java applications with certain Log4j versions.

As a first response we isolated the GHHP servers from the internet and started investigating if a breach had already occurred. We could not find signs of malicious activity. The second step was to analyse the dependencies of the Java applications and determine whether they use a vulnerable version of Log4j. We then either updated the software or removed the problematic code where no update was available. After we were sure we had no vulnerable versions of Log4J in the Java applications, we re-connected the server to the internet.

3.3.4 Security issue Spring4shell (CVE-2022-22965) response

Completed April 2022

Like the Log4Shell vulnerability, Spring4shell was a zero-day vulnerability in the Java Spring Framework which potentially allowed remote code execution on servers running Java applications using certain versions of the Spring Framework.

Our response was similar to the previous security incident. First, we isolated the servers from the internet and checked if a breach had already occurred. Again, we could not find signs of malicious activity. Then we identified the applications using vulnerable versions of the library and updated these as soon as a fixed version was available. Only after we were sure all applications were sanitised, we re-connected the server to the internet.

3.3.5 Seagrass script issue: current date set to 2020 in pre-processing

Completed April 2022

There had been a copy and paste error to do with assigning years of data. This was benign (and thus unnoticed) from when it occurred (2017) until last year. It is only this year that it has manifested as the code only effects data dated >2021. The offending code has been removed.

3.4 Task 4: Project management, training manual update and final report

Completed June 2022

There were no significant changes to the DIMS Report Card system during this project and so there were no changes to the existing user and developer guides.

All changes to the server administration were documented in the administration log file “Admin-log.txt”, accessible at:

https://nextcloud.dims.ghhp.org.au/apps/files/?dir=/Documentation%20-%20Administrator/Unix%20administration&fileid=38526

4 CONCLUSIONS

This year's project was dominated by the work required to ensure the consistency in the report card trend plots and responding to critical software security incidents. Although most issues regarding the report card trend plots were addressed, some issues remained because they would have taken too much time to fix. These issues should be discussed in future projects. Regarding software security issues, it is reasonable to assume there will be more incidents in the future, and it is important to schedule time to keep software up-to-date and to respond to such incidents.