Coorong Hydrodynamic and Ruppia Dashboarding User Guide

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Coorong Hydrodynamic and Ruppia Dashboarding User Guide

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Disclaimer

Acknowledgements

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1   Introduction

The hydrodynamics of the Murray Mouth and Coorong are influence by external forcing, many of these forces are environmental including climatic conditions and tidal influences. There are several management options which can influence the hydrodynamics of the Coorong: barrage flows, controlled releases from the South East Drainage network and dredging of the Murray mouth. A 1-D hydrodynamic model developed by CSIRO (Jöhnk & Webster 2014) can be used to assess potential management options.

This document provides documentation on the operation of the Coorong Hydrodynamic Dashboard. The dashboard was developed by SMK to provide a graphical user interface to interact with the 1D Coorong Hydrodynamic Model for the setup, running and viewing results.

The Coorong Hydrodynamic model utilises text-based input and output files. These files can be cumbersome to manipulate, visualize and compare data.

The dashboard was commissioned by Major Projects Branch to assist with the negotiating and planning of the delivery of environmental water, and management of the Coorong, and Lakes Alexandrina and Albert. This will enable managers and non-modellers to examine the implications of strategies for the delivery of water to and through the site on the ecological character of the Coorong, and therefore implement preferred strategies.

The dashboard was developed in the R programming language using a *Shiny* web interface to display input and results data. Input data for barrage flow and South East flows in addition to mouth depth, simulation period and initial conditions can be generated, and the model run from within the dashboard. This document describes the installation and running of the dashboard, where Jöhnk and Webster (2014) is the reference for the application of the CHM model.

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2 Installation

The Ruppia Dashboard has been developed in the R Studio environment. It consists of an R project file and a number of associated files. There are a number of hard coded file locations. Consequently files need to be copied to the correct location. The dashboard requires an installation of R (version 3.2.2 or later) and R Studio (version 0.99.489 or later). Both software tools are freely available online.

The Ruppia Dashboard zip file should be extracted to "*C:\CHM\RuppiaDashboard*".

Handling the necessary R packages on systems without write privileges to the "Program Files" folder can be problematic. This can be solved by changing the R library path on startup. This is achieved by typing in the console **.libPaths("C:/CHM/library")**. When running for the first time run the "*LoadLibrary.R*" script to install the all the required packages to the R library.

To run the Dashboard the R project file needs to be loaded. To do that, launch "*RuppiaDashboard.Rproj*" and open either Server.R or Ui.R. Launch Shiny by clicking on the "Run App" button, click yes, to install updated version of shiny package. When viewing the dashboard the location of the dashboard can be run in a separate window by clicking on the drop down box shown below.
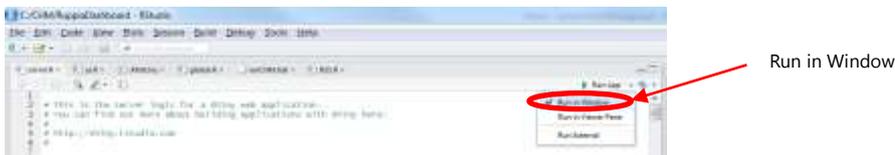

Figure 2.1: Dashboard run location
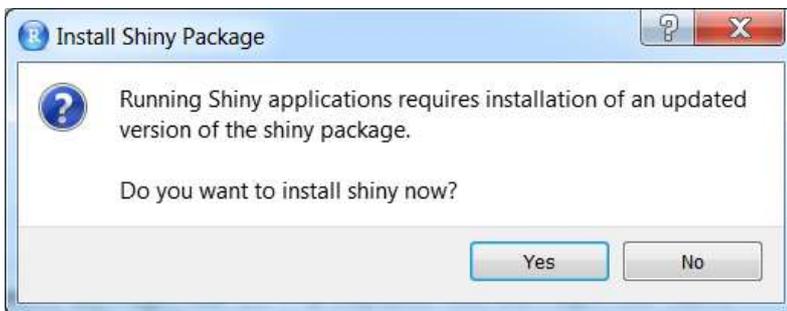
Figure 2.2: Package updating: close the popup box upon successful installation of packages.
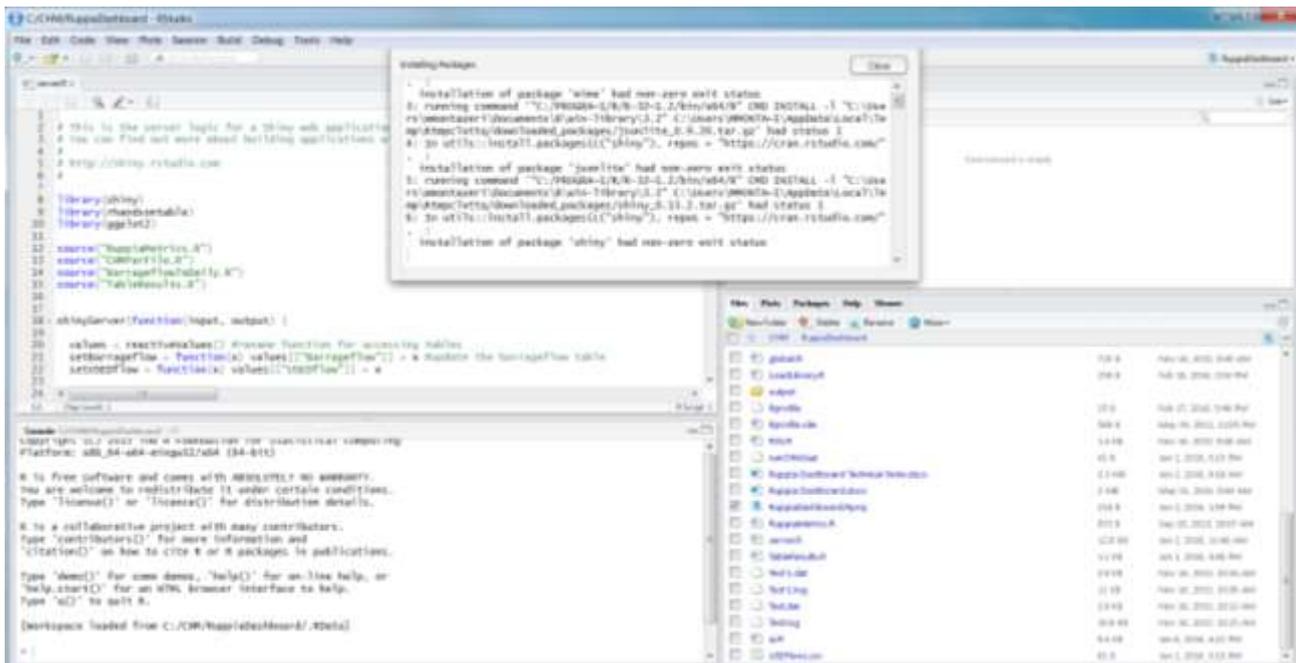
Figure 2.3: R Studio layout

3   CHM Dashboard

The user interface includes a table of contents on the left of the page, the table of contents can be toggled on and off with a button located on the header bar. Pages can be accessed by clicking on the relevant tab in the table of contents. The dashboard has three tabs, the first *input* tab is for model are setup and running, the second *output* page is to load output files and plots heatmaps of the Coorong salinity, water level and habitat assessment, the third is *Statistics* which provides statistics of the modelling results.

Table of Contents   Show/Hide Table of Contents
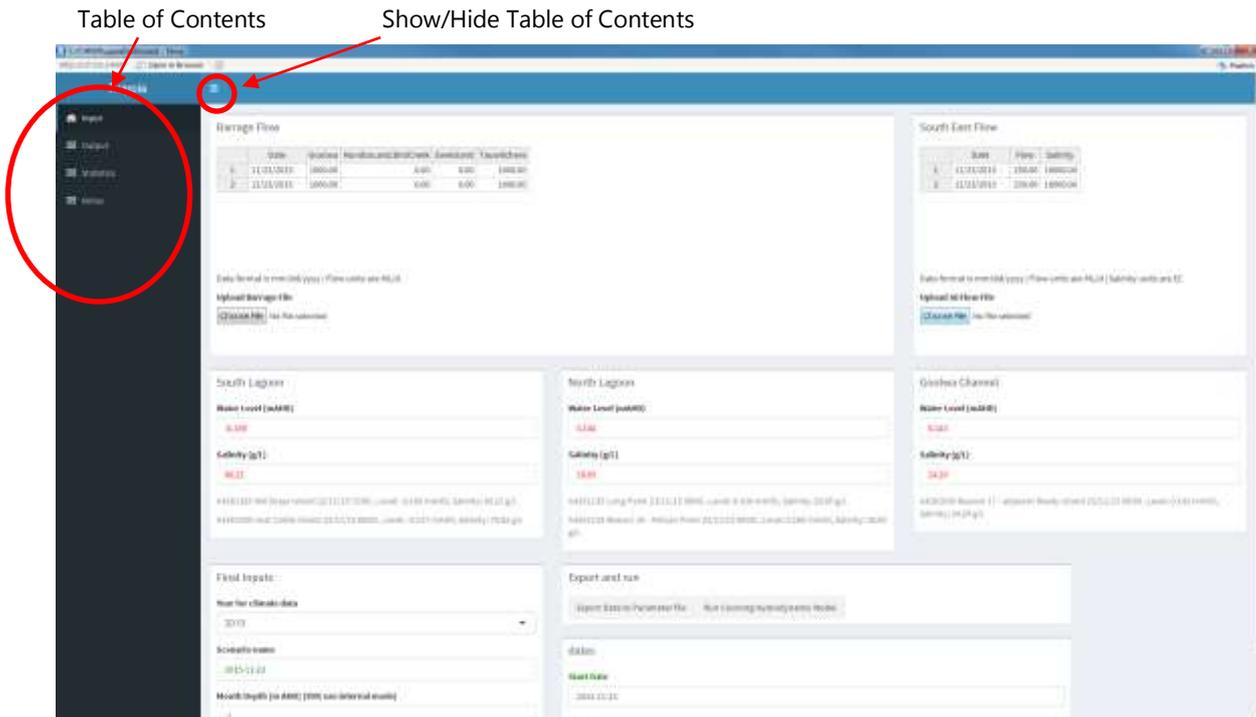
Figure 3.1: Dashboard layout

3.1   Input

The input tab allows users to enter model conditions and run the 1D-CHM model. This is split into eight sections. Barrage Flow, South East Flows, Goolwa Channel, Coorong North and South Lagoon initial conditions, Final Inputs, Dates and Export and Run.

Barrage Release

The Barrage releases are entered ether via an interactive table or uploaded from a .csv file by the user. Barrage information includes releases from Goolwa, Ewe Island and Tauwichere Barrages, Boundary Creek and Mundoo Barrages are combined into a single input. Barrage releases units are megalitres per day. The barrage flow input is attributed to the day and month of all years within the date range. Daily barrage flows are linearly interpolated between entered dates.

Barrage flow data

Import barrage flow from file

Figure 3.2: Barrage releases

Additional dates can be entered by right clicking, date selection can be entered by the date selection or entered manually in the mm/dd/yyyy format.

Right click on cell to add new row
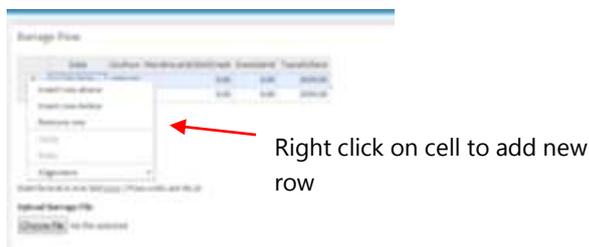
Figure 3.3: Modifying barrage release table

Barrage release *.csv files can be uploaded by clicking the button. The file format must be in the format Box 1 below. If an incorrect File Format is entered, the dashboard may need to be restarted.

Upper South East

Box 1. Barrage release .csv file format

"","Date","Goolwa","Mundoo.and.BndCreek","EweIsland"," Tauwitchere"

"1",2015-11-16,1000,0,0,1000

"2",2015-11-06,1001,0,0,1001

Upper South East inflow information is entered for flow (megalitres per day) and salinity (µS/cm). As with barrage releases flow information can be entered or a *.csv file can be uploaded. The File format must be in the correct file format, Box 2.

Upper South East Information

Import Upper South East Information from file
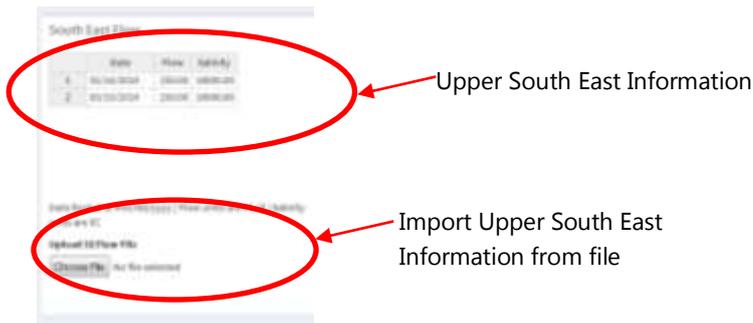
Figure 3.4: Upper South East flows

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Box 2. Upper South East flow .csv file format

"","Date","Flow","Salinity"

"1",2016-02-18,250,18000

"2",2016-03-19,250,18000
```

Salinity and Water Level and Initial Condition Information

Current salinity and water level information is downloaded from WaterConnect RSS feed. Internet connection is required to connect to the WaterConnect site and use the dashboard. Water level and salinity values can be overridden with user defined inputs.

Salinity and Water Level information. Data is collected from water connect RSS feed.

Data for individual sites
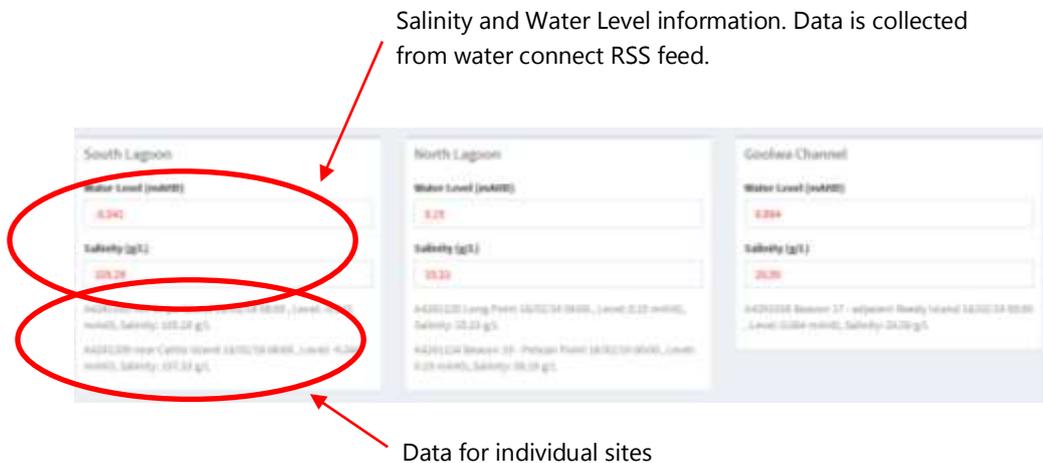
Figure 3.5: Model initial conditions

Additional Inputs

The historical climate conditions are selected via the *Year for Climate* Data box. The starting day and month are entered in the *start date* box. The length of the run is provided by number of days between the start and end dates. The output file names are defined by the scenario name which defaults to the current date. Murray Mouth depth can be set to a constant value used throughout the simulation (typical values range from -1 to -1.5 m AHD for low flow conditions). Internal mouth depth calculation mode based on modelled conditions can be used by entering 999 as the mouth depth, in this case the initial mouth depth is hard coded in the CHM to start at -2 m AHD. Note that the CHM mouth depth is fixed for the period where dredging occurred during the Millennium Drought (2002–10).

Year of climate data used

Scenario Name: Defaults to current date

Mouth Depth

Figure 3.6: Scenario setup

Figure 3.7: Setup and run CHM model

The 1-D CHM can take a number of minutes to run. Model completion can determined in RStudio Console once the simulation ended message is displayed.

Figure 3.8: Console CHM Run Screen

Model can be run outside of the Shiny environment by running **runCHM.bat** file directly. The "ScenarioName".log file can be used to determine any errors to the model.

3.2   Output

The results viewer allows users to upload and view graphical representations of results. The results are presented as heatmaps with daily data at kilometre increments. The results can be viewed for either the entire Coorong or the North or South Lagoon separately. Salinity and water levels values representing the input assessment threshold values for "habitat suitability" assessment can be selected by the user.

Select salinity output file from output directory
"ScenarioName"_d_all_NS.sal

Select water level output file from output directory
"ScenarioName"_d_all_NS.eta

Once files are uploaded shown by blue bar
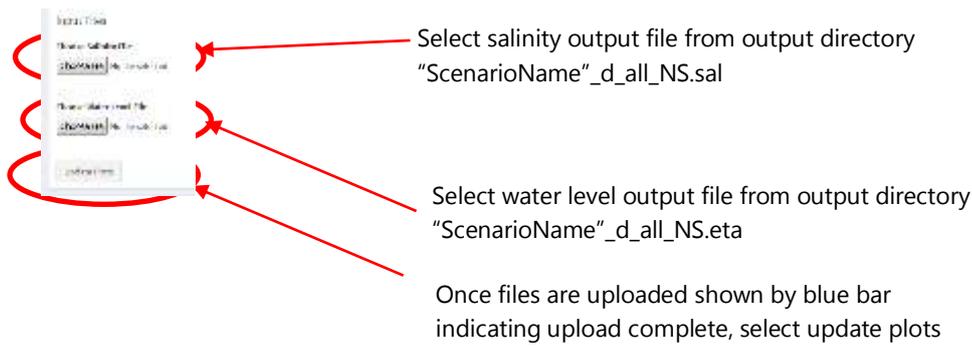indicating upload complete, select update plots

Figure 3.9: Input file selection

Results for salinity and water level are loaded separately. File names follow the "ScenarioName"_d_all_NS.sal and "ScenarioName"_d_all_NS.eta format for salinity and water level outputs, respectively. Salinity and water level results files must be from the same model run. Following the input of results files or change of assessment parameters charts are manually updated using the update chart button.

Display Parameters

Assessment threshold values are used to control salinity and water level water level contour gradient and input values for the daily habitat assessment thresholds values. Users can also select the extent of the output. Contours are drawn at each of the assessment thresholds.
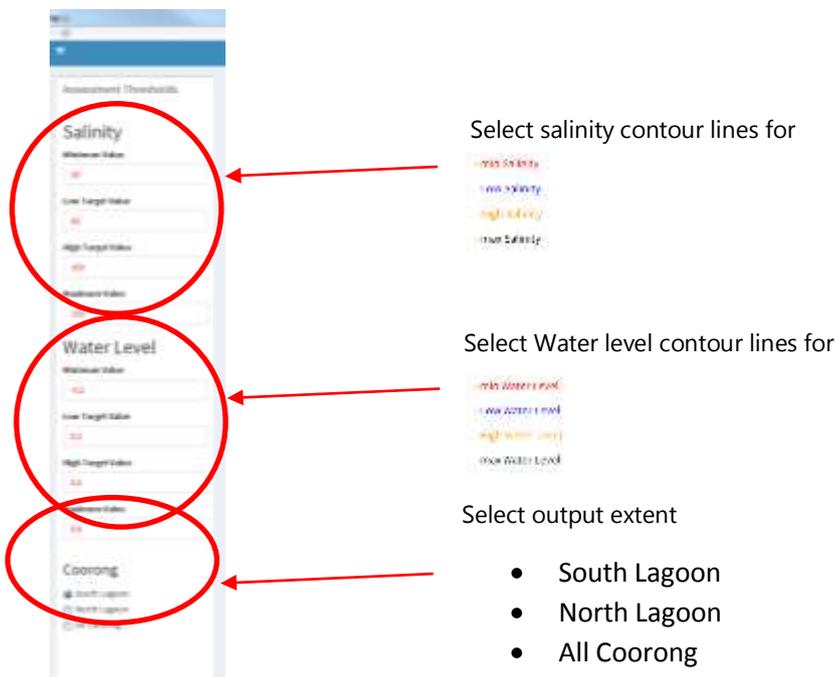

Select salinity contour lines for

Select Water level contour lines for

Select output extent

- South Lagoon
- North Lagoon
- All Coorong

Figure 3.10: Assessment thresholds

Output Display

Heatmaps display salinity, water level and a combined output based on the input thresholds termed a "daily habitat assessment". Salinity and water level is displayed with dark green values representing values between the low and high target values. Purple represents values above or below the minimum/maximum values. The coloured contour lines assist in distinguishing between high and low values.
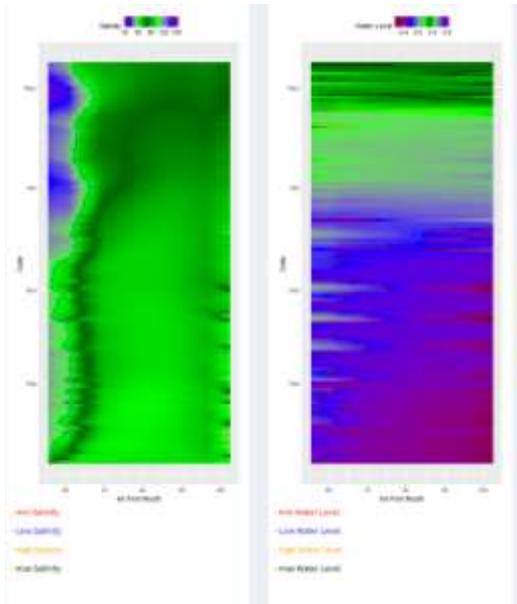

Figure 3.11: Salinity and water level heatmaps

For the daily habitat assessment output, the minimum and maximum value input is intended to represent the lowest and highest salinity/water level values where some benefit is observed. The low and high target values are the values bound optimal salinity/water level conditions. Users should consider target levels for the habitat assessment. The habitat assessment value is calculated from the adjusted score for water level and salinity. These are values between 0–1 for each variable, as seen in Figure 1, and the habitat assessment values is the product of the scaled water level and salinity values. As such, for both water level and salinity values above or below the minimum value, the resulting habitat score is 0. Values between the high and low target ranges for both variables result in a score of 1. For intermediate values, scores are adjusted linearly interpolated based on the target values. Values at each kilometre and day are calculated by multiplying the adjusted water level and salinity score together.
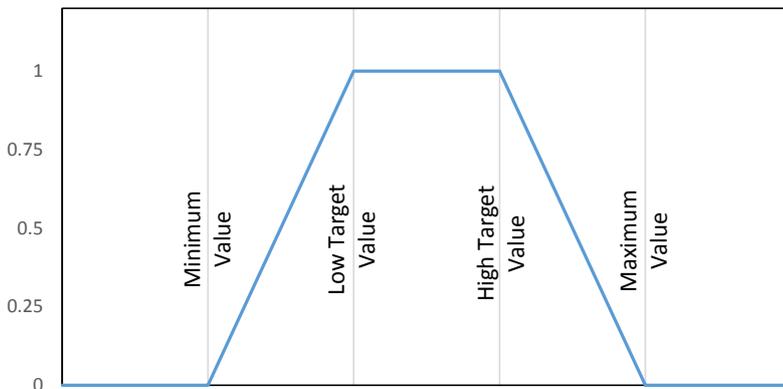

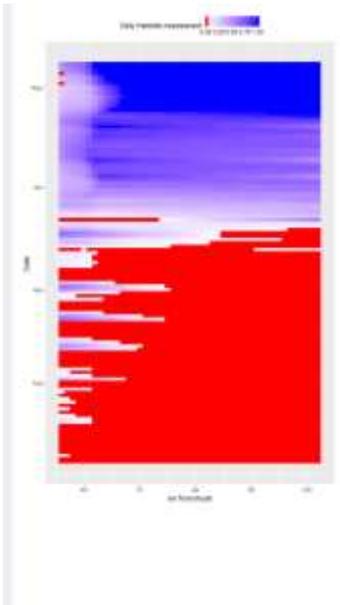**Figure 3.12: Habitat assessment adjustment**

Figure 3.13: Daily habitat assessment heatmap

3.3   Statistics

The summary statistics page provides information for each month of Coorong South Lagoon water level and salinity information. The statistic provide the percentage of time and area where salinities and water levels are below, between and above threshold values. Values need to be updated following the uploading of new results files, achieved by clicking "*Update Table*" button.
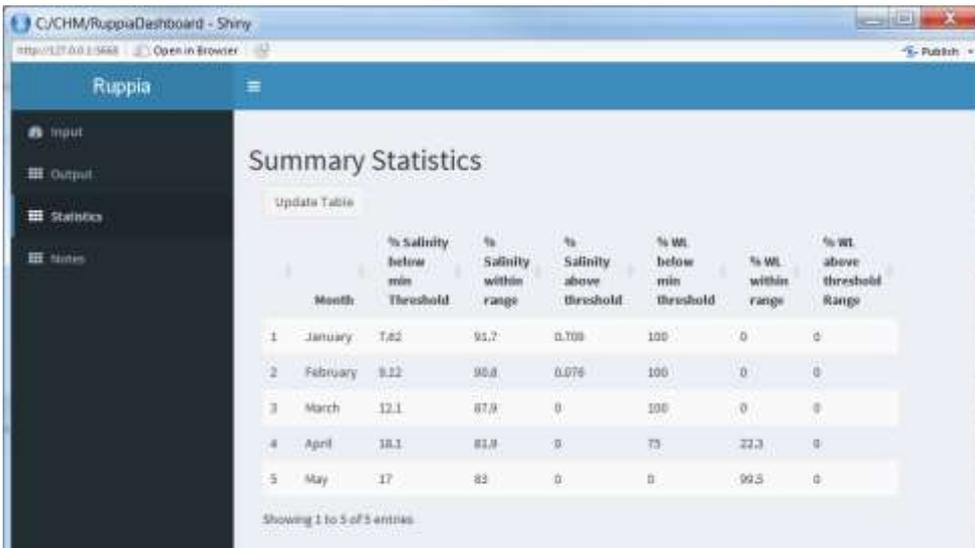
Figure 3.14: Summary statistics

4   Summary

The dashboard provides a tool to assist managers with operations of the Coorong and Lower Lakes, based on assessing the simulated water levels and salinity. Currently, the CLLMM Recovery Project have been developing a range of tools (e.g. refinements to the Coorong 1-D Hydrodynamic model, Coorong and Lakes Dynamic Habitat models, Waterbird Bayesian Belief Network models, and Coorong and Lakes Ecosystem Response Models) as part of the development of an Ecosystem Response Forecasting Tool. Further work could also include these models in the Dashboard to help inform flow delivery and barrage operations to provide an all in one tool to enter management data.

5 References

Jöhnk, K.D., Webster IT (2014) Hydrodynamic Investigations of the Coorong - Development and application strategy: Water for a Healthy Country National Research Flagship.

Government of South Australia

Department of Environment,
Water and Natural Resources