# *Ruppia* and fish Habitat model – User manual v.0.1

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## Model basics

The intention of this model is to provide survival probabilities for *Ruppia* and fish species in the Coorong depending on water level and salinity along the Coorong lagoon. Probabilities are according to threshold values for water level and salinities over a specified period.

The habitat model is based on output from the Coorong Hydrodynamic model CHM 2.x, which supplies water levels and salinities. The *Ruppia*/fish model reads the files produced by CHM.

Parameters and thresholds for *Ruppia* and seven common fish species in the Coroong are currently hardwired into the code.

## Setting up the model

Set-up assumes that the CHM model (here v2.2.6) is already installed and operational.

1. Place the executables (FishThreshold.exe and Ruppia\_opt.exe) into the ./exe folder
2. Place the CHM\_Habitat1.bat, CHM\_Habitat2.bat and Parameter\_Habitat0001.dat into the root folder of your model directory. You might wish to change any of these files reflecting your own settings; these files are only for demonstration purposes.

## Running the model

The habitat model is based on an existing run using CHM 2.x

1. In a command line window go to the root folder for your CHM runs and execute  
   > CHM\_Habitat1.bat  
   to generate an example run of CHM (here the standard run for 1963 – 2014).  
   Output will be stored in ./output, only the \*.eta and \*.sal files will be used subsequently.
2. Execute  
   > CHM\_Habitat2.bat  
   for the Ruppia/fish model.

Ruppia\_opt.exe will calculate probabilities for *Ruppia* (for all intermediate stages, e.g. \*.pGerm for survival after germination stage, or \*.pSPB for the final survival probability replenishing the seed bank. The life cycle for *Ruppia* is assume to be over a full calendar year starting in January.  
The same program will also calculate habitat probabilities for the seven fish species, \*pFsh1 to \*.pFsh7 and the intermediate probabilities in cold and warm half-years specified by \_c or \_w appended to the file name. The life cycle looked at here is over a water year, i.e. starting in July.

FishThreshold.exe does the equivalent as the previous, but in a slightly different way. It calculates the distance from the Murray Mouth (be aware that for simulation reasons the actual start is further west to the Murray Mouth) of the possible occurrence of a fish species. It thus gives only a single output value, the distance, per day, while Ruppia\_opt.exe will output a probability of habitat suitability at each point along the lagoon for each year.

## Output files

Output is given as a probability value between (and including) 0 and 1 for habitat suitability for life cycle stages and seed bank replenishment of Ruppia as well as for habitat suitability of seven fish species. All these files consist of

Line 1-7: Header containing specific run information

Line 8: Nr, Nt  
Nr = number of cells along the Coorong (running from top=Murray Mouth to bottom)  
Nt = number of years simulated (running from left to right)

Line 9: Labels for the Nc columns

Line 10- …: Simulation output  
Col1: Location = cell number (~1km)  
Col2 - …: Probabilities for specific years

or in case of the output of distances from FishThreshold.exe:

Line 1-7: Header containing specific run information

Line 8: Nt, Nc  
Nt = number of time steps simulated  
Nc = number of columns in the file

Line 9: Labels for the columns

Line 10- …: Output values   
Col1: Day number in simulation  
Col2: Date  
Col3: Distance from Murray Mouth suitable for fish habitat [km]

## Parameters

The parameters used for *Ruppia* and fish species are as follows

//- Parameter -------------------------------------------------------------

startGerm = 121; // germination start (1. May)

endGerm = 181; // germination end (30.June)

devGerm = 15; // 15 days of optimal conditions for germination

thrSalGerm = 85; // thresholds for max salinity and min water level

thrEtaGerm = 0.2;

nGerm = endGerm-startGerm+1;

// Problem: overlapping periods

// Solution1: ignore, each period is associated with its own probability

startSprout = 121; // sprouting start (1. May)

endSprout = 181; // sprouting end (30.June)

devSprout = 15; // 15 days of optimal conditions for sprouting

thrSalSprout = 125; // thresholds for max salinity and min water level

thrEtaSprout = 0.2;

nSprout = endSprout-startSprout+1;

// Problem: no development time, thus condition must hold over full period

// Solution: less rigid: probability to survive = number of days conditions met

startSeed = 152; // Seedling start (1. June)

endSeed = 212; // Seedling end (30.July)

devSeed = 1; // each individual day increases survival probability

thrSalSeed = 100; // thresholds for max salinity and min water level

thrEtaSeed = 0.2;

nSeed = endSeed-startSeed+1;

// as above

startJuv = 182; // Juvenile start (1. July)

endJuv = 304; // Juvenile end (31.October)

devJuv = 1; // each individual day increases survival probability

thrSalJuv = 100; // thresholds for max salinity and min water level

thrEtaJuv = 0.2;

nJuv = endJuv-startJuv+1;

startAdult = 274; // Adult start (1. October)

endAdult = 365; // Adult end (31.December)

devAdult = 1; // each individual day increases survival probability

thrSalAdult = 100; // thresholds for max salinity and min water level

thrEtaAdult = 0.2;

nAdult = endAdult-startAdult+1;

//- 7 fish species -----------------------------------------------------

// Fish 1 = Mulloway

strcpy(nameFsh1,"Mulloway");

thrSalFsh1\_w = 51.1; // thresholds for max salinity

thrSalFsh1\_c = 60.3; // thresholds for max salinity

// Fish 2 = Mulloway

strcpy(nameFsh2,"Tamar goby");

thrSalFsh2\_w = 66.3; // thresholds for max salinity

thrSalFsh2\_c = 67.7; // thresholds for max salinity

// Fish 3 = Mulloway

strcpy(nameFsh3,"Black bream");

thrSalFsh3\_w = 81.8; // thresholds for max salinity

thrSalFsh3\_c = 78.6; // thresholds for max salinity

// Fish 4 = Mulloway

strcpy(nameFsh4,"Greenback flounder");

thrSalFsh4\_w = 72.9; // thresholds for max salinity

thrSalFsh4\_c = 81.1; // thresholds for max salinity

// Fish 5 = Mulloway

strcpy(nameFsh5,"Yelloweye mullet");

thrSalFsh5\_w = 68.3; // thresholds for max salinity

thrSalFsh5\_c = 83.8; // thresholds for max salinity

// Fish 6 = Mulloway

strcpy(nameFsh6,"Congolli");

thrSalFsh6\_w = 86.9; // thresholds for max salinity

thrSalFsh6\_c = 89.5; // thresholds for max salinity

// Fish 7 = Mulloway

strcpy(nameFsh7,"Smallmouthed hardyhead");

thrSalFsh7\_w = 97.1; // thresholds for max salinity

thrSalFsh7\_c = 99.5; // thresholds for max salinity