Prey Biomass Model
Requirements Document

Inputs

Two input files are needed to generate the model results. The first input is Water Depth measured in centimeters. The second input is Salinity measured in parts per thousand. Both of these inputs are a series of time steps of maps. All of these maps (in both inputs) must have the exact same shape, scale, geographical location, and coordinate system for the model to work as formulated in this document. Both inputs must cover the same time steps, and the interval between these time steps must be exactly one day, with no time steps between the first and last missing (in other words, the inputs should be contiguous). There must be at least 300 days of input data for outputs to be generated. All inputs must have data whose values are in the units enumerated above for the formulation of the model containing in this document to be directly implementable as it exists. If any of the above is not true, this document must be reformulated to take the differences into account before the model can be adapted.

Outputs

A number of outputs will be produced by the model. Some of these outputs are model results, while other outputs exist to verify both the model results and examine the causes and factors which led to the results. The outputs to be produced by the model are listed in and generally described by the following table:

Output	**Inputs**
90-Day Low Salinity Day Count	Salinity
Mean 300-Day Depth	Water Depth
90-Day Depth Standard Deviation	Water Depth
60-Day Low Depth Day Count	Water Depth
Continuous High Depth Day Count	Water Depth
Raw Biomass	Water Depth, 90-Day Low Salinity Day Count, Mean 300-Day Depth, 90-Day Depth Standard Deviation, 60-Day Low Depth Day Count, Continuous High Depth Day Count
Biomass Index	Raw Biomass

The **Output** column contains the name of the output to be produced. The method by which each of these is to be produced is described in the Process section. The **Inputs** column lists the items which comprise the output (e. g. the 90-Day Low Salinity Day Count is a function of the Salinity data, and whenever the Salinity data is changed, the 90-Day Low Salinity Day Count will also change). All of these outputs will be on sets of time steps which are (either proper or improper) subsets of the set of time steps of the inputs. All of these outputs are maps that have the same exact shape, scale, geographical location, and coordinate system as the input layers.

For the purposes of output validation, all inputs used should be recorded alongside the outputs.

90-Day Low Salinity Day Count

The 90-Day Low Salinity Day Count is a function of the Salinity input. A single map is produced for each day of the Salinity input after the 89th day of the Salinity time series. This output contains cells whose values are a count of the total number of days in the last 90 days (including the day for which the output is being generated) during which the cell had a Salinity less than 5 parts per thousand.

Mean 300-Day Depth

The Mean 300-Day Depth is a function of the Water Depth input. A single map is produced for each day of the Water Depth input after the 299th day of the Water Depth time series. This output contains cells whose values are the arithmetic mean of the values in that cell in the Water Depth time series for the last 300 days (including the day for which the output is being generated).

90-Day Depth Standard Deviation

The 90-Day Depth Standard Deviation is a function of the Water Depth input. A single map is produced for each day of the Water Depth input after the 89th day of the Water Depth time series. This output contains cells whose values are the standard deviation of all values in that cell in the Water Depth time series for the last 90 days (including the day for which the output is being generated).

60-Day Low Depth Day Count

The 60-Day Low Depth Day Count is a function of the Water Depth input. A single map is produced for each day of the Water Depth input after the 59th day of the Water Depth time series. This output contains cells whose values are a count of the total number of days in the last 60 days (including the day for which the output is being generated) during which the cell had a Water Depth less than 5 centimeters.

Continuous High Depth Day Count

The Continuous High Depth Day Count is a function of the Water Depth input. A single map is produced for each day of the Water Depth input. This output contains cells whose values are a count of the total number of days directly prior to the day for which the output is being generated during which the cell continuously had a Water Depth greater than 13.1 centimeters. In other words, the output for the first day should be zero, and the output for every day thereafter should have a value of zero if the cell has a Water Depth less than or equal to 13.1 centimeters on the previous day, or the cell should have a value equal to the Continuous High Depth Day Count output for the previous day plus one, if the cell for the previous day has a Water Depth greater than 13.1 centimeters.

Raw Biomass

The Raw Biomass is a function of the Water Depth input and the 90-Day Low Salinity Day Count, Mean 300-Day Depth, 90-Day Depth Standard Deviation, 60-Day Low Depth Day Count, and Continuous High Depth Day Count outputs. A single map is produced for each day after the 299th day of the Water Depth time series. This output is equal to:

$$
\begin{aligned}
& 0.0013 \cdot \text{90-Day Low Salinity Day Count} \\
+\ & 0.037 \cdot \text{Mean 300-Day Depth} \\
+\ & -0.041 \cdot \text{90-Day Depth Standard Deviation} \\
+\ & -0.02 \cdot \text{Water Depth input} \\
+\ & -0.01 \cdot \text{60-Day Low Depth Day Count} \\
+\ & 0.0013 \cdot \text{Continuous High Depth Day Count} \\
+\ & 1.01
\end{aligned}
$$

where each parameter is the output or input for the day for which the Raw Biomass is being calculated, where all additions and multiplications are performed cell-wise.

Biomass Index

The Biomass Index is a function of the Raw Biomass output. A single map is produced for each day of the Raw Biomass. Each cell of the Biomass Index is equal to:

$$\frac{r-n}{m-n}$$

where r is the cell in the Raw Biomass, n is the minimum Raw Biomass value in all cells for all days, and m is the maximum Raw Biomass value in all cells for all days.