Stressor-Response Library Help

# About

The stressor-response (SR) library is designed as a public reference archive to house generalizable stressor-response functions for use in the Cumulative Effects Model for Prioritizing Recovery Actions (CEM-PRA). The functions archived in the SR library are also widely applicable to numerous of applications and use cases.

Users of the CEM-PRA tool can select a subset of stressor response functions applicable to their study area and focal species of interest. Selected SR functions can be used to construct a customized stressor-response input workbook for the CEM-PRA tool. The SR library is a valuable resource for reference as it can expedite assessments with shared knowledge of common impact pathways.

Although a suite of default SR functions are available, the SR library will continually be updated with novel SR functions uploaded by the community of users. This help documentation is intended to guide new users through the use of the SR library to acquire pre-existing SR functions for use in the CEM-PRA, and to upload their own custom SR functions.

# Schema

## Data Structure

The current data structure of the stressor-response library consists of a series of Excel workbooks. We plan to convert this structure to a relational database in the near future, where the database will be housed on a public, online platform, and will be available for editing by all CEM-PRA users.

Graphical user interface, text

Description automatically generated

**Figure 1:** Data structure within the SR library, where the table hierarchy starts at the SR Library Main folder (left) and ends at the references and documentation for individual stressor-response functions (right).

### Main Folder

The Main folder is the gateway to the SR library. It contains the primary database and all of the species folders (see below).

### Species Folders

The main SR library is initially divided into folders for each of the currently defined species in the model. If a user develops a stressor-response function for a new species, a new folder/branch should be added to the library.

### Stressor Folders

Stressor folders are located within each of the species’ folders. The stressor folders contain the stressor-response function documentation for a given species and are named as follows:

*SR curve ID\_Stressor ID\_Stressor Name*

### References

Within each of the stressor folders, the references folder contains copies of all the materials cited in the stressor-response function documentation.

## File Structure and Keys

### Primary Database

The primary database acts as the key to the SR library. It contains three tabs: *Stressor*, *Organism* and *Curve*.

The *Stressor* tab outlines all of the stressors contained within the SR library, whether these stressors interact with each other (and if so, the type of interaction), and whether each stressor is relevant to the Joe Model, or to the Population Model. Each stressor is given a stressor\_id number which acts as the primary key within the *Stressor* worksheet and is later referenced by the *Curve* worksheet.

The *Organism* tab contains information about all of the parameterized species and their relative life stages. Each species-life stage combination is given an organism\_id number. The organism\_id field acts as the primary key in the *Organism* worksheet, and is later referenced in the *Curve* worksheet.

The *Curve* tab outlines each of the stressor-response curves found in the SR library. Some curves were used multiple times due to their relevance/applicability for multiple species/life stages. Each unique curve is given its own stressor\_curve\_id to be referenced by the model.

### Species Workbooks

These Excel workbooks contain all the stressor-response curves applicable to a given species (e.g., Coho salmon) at any life stage (e.g., fry, adult). Stressor-response curves within these workbooks are used by the CEM-PRA (Joe Model) to predict mean system capacity as a proportion of the reference condition (0-1) given stressor magnitude.

The first worksheet contained within the Excel workbook must be titled “Main”. This worksheet is used to describe and organize each of the stressor-response curves. It also links each stressor-response curve to the *Primary Database* using the stressor\_id and stressor\_curve\_id. Subsequent worksheets describe each of the stressor-response functions relevant to the target species, where each stressor-response function has its own worksheet. Note that the spelling of the stressor name must be identical between the “Stressors” column in the “Main” worksheet and the worksheet title (on the bottom tab) for each stressor.

### Stressor-Response Documentation

See *Documentation* below.

# Custom Stressor-Response Functions

## Database Updates

### Primary Database

The primary database (Excel workbook) contains detailed information about all of the stressors organisms (species – life stage) and stressor-response curves catalogued within the SR library. When a user adds a new curve to the library, they must update the stressor information (in the *Stressor* tab) and the SR curve information (in the *Curve* tab). If the SR function pertains to a new species or life stage not currently included in the SR library, the user must enter this information in the *Organism* tab.

### Species Workbooks

The species workbooks outline all the stressors, and related stressor-response functions, that are known to impact a given species.

## Documentation

### Stressor and Organism Information

Specifies the name and units of the stressor in the stressor-response function, as well as the common name and life stage of the species of interest.

### Citation

The primary source or source(s) for the stressor-response function.

### Function Information

Specifies the rationale for the design and applicability of the function for the species/system of interest, describes the function, and includes the equation for the function with a description of each parameter used. If values produced by the function are not standardized between 0 and 1, the standardization procedure, and standardized form of the function, should be included in this section.

### Known Covariates and Interactions

Lists any known covariates which interact with the main stressor to affect the target species response. The interaction type (e.g., multiplicative) is also included for known covariates.

### Data Considerations

#### Data Source

Describes whether the SR function is based on an established empirical relationship / empirical data, whether it’s based on mechanistic theory, or whether it’s based on expert opinion. Outlines where the data came from.

#### Data Type

Empirical data, mechanistic theory/estimated.

#### Data Quality

Flags any issues with data quality. Brief description of the quality of the data and confidence in the SR function.

#### Confidence in SR Function

Describes the confidence in the strength and direction of the relationship. Notes whether exact data points are known/unknown. Notes the level of uncertainty.

### Stressor-Response Curve

A plot of the standardized stressor-response curve used in the CEM-PRA. A plot of the raw stressor-response curve (before standardization) is also included (if applicable).

### Stressor-Response Table

Table depicting modelled values for a given set of stressor values using the stressor-response function. Upper and lower limits, and a standard deviation, for the response are also included.

## Quality Checking

### Source/Data Quality

Sources for SR functions should be vetted, and users who populate the SR library should refer to the most up-to-date high quality sources available. The following sources are listed from lowest to highest quality:

* Opinion (expert)
* One relevant study with decent empirical data (quantitative or semi-quantitative)
* Good quality empirical data or a mechanistic theory-based SR function which is well validated in multiple studies and/or systems

### Number of Independent Checks

Users of the CEM-PRA (Joe Model) are encouraged to complete independent checks of stressor-response functions (and associated documentation) and make updates as needed.