**How to generate effort and catch estimates using the “CreelEstimates” code repository**

*Background*

This document outlines the steps for estimation of freshwater fishery angler effort and catch from survey data collected during Washington Department of Fish and Wildlife (WDFW) freshwater sportfishing monitoring (creel) projects, using a scripted analysis in the CreelEstimates code repository. It is applicable to creel projects which adhere to study design guidelines outlined in the [Statewide Protocol for Roving Creel Surveys](https://stateofwa.sharepoint.com/:w:/r/sites/DFW-TeamFPFWCreelMonitoringProgram163/_layouts/15/Doc.aspx?sourcedoc=%7B83F2B81F-39FC-49E0-955B-B6E9145AB8B7%7D&file=Protocol%20-%20Statewide%20roving%20creel%20surveys%20(Part%201%20of%202)%20-%20STUDY%20DESIGN%20(in%20progress).docx&action=default&mobileredirect=true).

CreelEstimates is a code repository with a template script that provides a workflow to fetch raw observed data, generate intermediate summaries, produce expanded point estimates and associated uncertainty measures, and output tables and figures. In this framework the process of generating creel estimates relies on three primary data components: index effort counts, census effort counts, and interviews. The direct observations from these data are used to generate total estimates of angler effort and catch, stratified by angler type, day type, section, and time-period (table 1), across open legal fishing days within the specified monitoring period.

Table 1. Fields used to stratify estimates of angler effort and catch in creel surveys using the WDFW Statewide Protocol for Roving Creel Surveys.

|  |  |  |
| --- | --- | --- |
| field | description | options |
| angler type | Categorical assignment of the angler effort and catch based on a combination of observed fishing location and reported means to access the fishery area | bank, boat |
| day type | Specification of the “day type” used to aggregate *n* days within a week | weekday, weekend |
| section | Specification of the spatial domain used to aggregate observations from individual survey locations. A section contains one or more sites where effort counts and interviews occur. | each fishery project specifies the sites and corresponding sections which define the fishery area |
| time-period | Specification of the time step used to aggregate *n* days of observations from creel surveys | varies by estimation method; daily, week, month, "duration" |
| angler type | Categorical assignment of the angler effort and catch based on a combination of observed fishing location and reported means to access the fishery area | bank, boat |

Data used in the scripted analysis is fetched from [data.wa.gov](https://data.wa.gov/browse?q=creel) and filtered to a user-specified fishery (fishery\_name), which describes the geographic boundaries, dates, and one or more fish species of interest. The script currently provides two modeling options to generate creel estimates. The point estimate (PE) method uses “direct expansion estimators”, where total catch is the product of mean daily catch and the total number of days in the monitoring period *N* (Pollock et al. 1994; Thompson 2002; Jones and Pollock 2012). The modified equations to calculate total catch are:

where is the \_\_\_\_ describe components of various equations. Finish this and maybe add brief upsides and limitations to PE

The Bayesian state space (BSS) method is - insert developed description of BSS from Thomas and Kale

The functions used to summarize, aggregate, and model effort and catch in CreelEstimates require formatting consistent with WDFW’s [creel database](https://dfw-fp-r5.s3.us-west-2.amazonaws.com/data-dictionaries/creel_data_dictionary.html#Database_Overview) and “proofed” data (i.e., reviewed for data collection / entry errors). Before proceeding to the instructions portion of this document, review and complete the checklist of analysis preparation steps (table 2).

Table 2. Analysis preparation steps that are require completion before using the CreelEstimates tool.

|  |  |
| --- | --- |
| step | description |
| 1 | The proposed creel project has been reviewed and approved by the Study Design Lead using the Creel Questionnaire |
| 2 | Data is stored in the WDFW creel database and accessible via [data.wa.gov](https://data.wa.gov/browse?q=creel) |
| 3 | The schedule that defined data collection events used a multi-state, stratified, probabilistic approach (see [CreelScheduleGenerator](https://github.com/wdfw-fp/CreelScheduleGenerator) Github repository) |
| 4 | The data of interest is associated with a specific fishery\_name, defined in the database with a fishery\_name, start\_date, and end\_date |
| 5 | Index sites and census sections for the fishery are specified in the fishery\_location\_lut |
| 6 | Closure dates during the monitoring period are specified in the closures table (TBD, proposed table/view name “fishery\_closures\_lut”) |
| 7 | Data has been undergone a QA/QC process and is approved in "Data Proofed" field in Fish Apps |

*Instructions*

The following steps provide an overview of how to generate estimates of effort and catch from creel surveys using the CreelEstimates tool. If additional guidance is needed, contact your Study Design Lead.

1. **Clone the “CreelEstimates” repository**
   * The most up-to-date version of CreelEstimates is located on GitHub **here** and is stored as a code [repository](https://docs.github.com/en/repositories/creating-and-managing-repositories/about-repositories)
   * To use CreelEstimates, the repository must be cloned to your local computer (for further details see “[Clone the Repository with RStudio](https://resources.github.com/github-and-rstudio/)” sub-section). The repository can be located anywhere on your computer since you’ll interact with an RMarkdown script file (.Rmd) that runs within a RStudio project file (.Rproj) that uses relative filepaths.
   * Before a repository can be downloaded, a user must have a GitHub account (see “[Prerequisites](https://resources.github.com/github-and-rstudio/)” subsection) and have Git and RStudio installed on their computer (see “[Install Git and RStudio](https://resources.github.com/github-and-rstudio/)”)
2. **Create a new analysis project** 
   * Open the “CreelEstimates” folder
   * Open the “CreelEstimates.Rproj” file

**This section here pending final plan for file structure / user outputs**

Draft option used here:

* open the projects folder
* open “establish\_analysis\_project.R” script. Enter the fishery\_name, start date, and end date for the analysis of interest. Run the script, which will create a project folder and renamed copy of the fw\_creel.Rmd analysis template script
* open newly created analysis script .Rmd

1. **Specify the metadata parameters of the script**
   * In the [YAML](https://yaml.org/spec/) metadata section at the top of the script, enter parameter values which specify the data and analysis control options for the .Rmd script (table 3)

Table 3. Parameters in the YAML metadata section which determine the data fetched from data.wa.gov and analysis controls linked to the study design and methods for a specific creel project.

|  |  |
| --- | --- |
| parameter | description |
| fishery\_name | character string with waterbody area, focal species, year / year-group to describe distinct creel project |
| est\_date\_start | minimum date of observations fetched from data.wa.gov |
| est\_date\_end | maximum date of observations fetched from data.wa.gov |
| est\_catch\_groups | specification of one or more groups of focal species, life stage, mark status, and encounter types of interest |
| person\_count\_type | specification designating method used to count anglers during census surveys, either counting the total number of people in angler groups (“group”) or counting only people observed actively fishing (“angler”) |
| period\_pe | time period for aggregation of observations; for period\_pe options are: “week”, “month", and "duration" |
| period\_bss | time period for aggregation of observations; for period\_bss options are: "day" and "week" |
| days\_wkend | Days assigned to "weekend" day type group (weekend or weekday) |
| index\_count\_types | specification for objects that are counted during index effort counts, either "Vehicle/Trailers Only" or "Bank Angler / Boat Angler" |
| census\_expansion | Option to use either observed census data ("Direct") or assumed values ("Indirect") to calculate the effort bias term ratio |
| min\_fishing\_time | The minimum fishing time per angler group interview that is retained to calculate their catch group specific catch rate |
| dir\_output | directory name in file path where output from script is saved |

1. **Interactively run the project-specific fw\_creel.Rmd script**
   * The CreelEstimates script is broken up into code chunks.
     + Within each chunk, there are rows of code and most of which simply needs to be run (and thus not edited). However, see next bullet.
     + There is also code located within in *R\_functions* and is run behind the scenes. Feel free to open these source files to understand how CreelEstimates is working. This code but should not be edited unless you establish a formal plan to do this using a distributed version control system (i.e., create a branch to CreelEstimates, make edits to the code, commit and push the changes to your branch of the repo, and submit a pull request to tell collaborators about the changes in your branch)
2. **Evaluate output** 
   * **Table with fields and descriptions of output (table \_\_**