Cold Water Refuges

Technical Details

Cold water refuges are reported for the 100m slices; in the GIS attribute table these data are reported in the field *CLDO_2015* and in the Excel spreadsheet they are reported in the column *Cold Water Refuge 2011-2016*. In each file format, the value of 1 indicates that between 2011 and 2016 at least one data point collected in the corresponding 100m slice met the definition of cold water refuge (explained below). The value of zero means that data collected in that 100m slice did not meet the definition of cold water *OR* that no data were collected in that 100m slice. Cold water refuges are not present on all 20 PDF maps and, as a result, do not appear on the corresponding list of map layers on all 20 PDFs when viewed in Adobe Acrobat.

The Data

The data used to identify Cold Water Refuges were collected by Stan Gregory, Randy Wildman (Professor Emeritus and retired respectively, Department of Fisheries and Wildlife, Oregon State University) and their field crews from 2011 through 2016. The start and end dates for the summer data collection varied from year to year but the data reported here are for the months of July and August only. These are the months in which the mainstem Willamette River water temperature most frequently exceeds the requirements of native fish species and the time of year when the presence of cold water refuges can be key to their survival. The maximum daily summer temperature in the Willamette mainstem typically occurs between 7 and 8 PM. Cold water refuges occur only in sloughs and side channels by virtue of their temperature difference relative to the mainstem maximum (OAR 340-041-0002(10)). The data for each slough and side channel were collected between 11AM and 6PM. The daily maximum temperature in the mainstem was estimated from two sources: a) data collected by USGS gaging stations in 2014 and 2015; b) a longitudinal array of OSU data loggers in years 2011-2016. The field data were received as an Excel file with latitude, longitude and a suite of attributes for each data collection location. The latitude/ longitude were used to create a spatially referenced point file (GIS shapefile) with the field collected data associated with each point.

The Determination of Cold Water Refuge

Cold water refuges in the Willamette River occur in sloughs and side channels, where subsurface water emerges and exchanges slowly with the mainstem river. Cold water refuges are defined here as locations where, in the months of July and August, the slough or side channel temperature is 2 degrees C colder than the daily maximum temperature of the associated mainstem Willamette River and the concentration of dissolved oxygen is 4.0 mg/L or greater. The 4.0 mg/L represents a concentration at which native fish can survive, but this should not be confused with optimal dissolved oxygen for native fish.

Cold Water Refuges in the SLICES

The data points that met the determination of cold water refuge were intersected with the 100m slices using GIS. Slices that intersect with one or more cold water refuge data points are identified with a value of 1 in the GIS attribute table and Excel spreadsheet, and are represented with a white outline in the PDF maps. A value of 1 identifies a 100m slice as containing one or more cold water refuge data points from 2011 - 2016. There are instances where a single 100m slice contains more than one cold water refuge point (multiple points collected in the same year or points collected in different years in the same 100m slice) but this distinction is not represented in the data provided here.