

# **Appendix 11L Sturgeon Delta Analyses**

# Appendix 11L Sturgeon Delta Analyses

## 11L.1 Introduction

Analyses undertaken for sturgeon included the salvage-density analysis for south Delta entrainment risk (green sturgeon and white sturgeon) and the Delta outflow-year class strength regression analysis (white sturgeon). These analyses are discussed below. The sturgeon analyses for upstream of the Delta are described in Chapter 11, *Aquatic Biological Resources*.

## 11L.2 Salvage-Density Analysis (South Delta Entrainment Risk)

The salvage-density analysis of south Delta entrainment risk weights modeled south Delta exports as a function of historical patterns in sturgeon salvage density. The methods for this analysis are described in Appendix 11Q, *Other Delta Species Analyses*, and the results are presented in Chapter 11.

## 11L.3 Delta Outflow Year-Class Strength Regression Analysis

The analysis of white sturgeon year-class strength as a function of Delta outflow was originally used by ICF International (2016:5-197–5-205). Historical data for white sturgeon year-class index were regressed against historical mean Delta outflow data from March through July and from April through May (Table 11L-1). These regressions (Figure 11L-1) were then applied to the CALSIM modeled data for the No Action Alternative and Alternatives 1–3 using PROC GLM and PROC PLM in SAS/STAT software, Version 9.4 of the SAS System for Windows<sup>1</sup>. The results of the Delta outflow year-class strength analyses are described in Chapter 11.

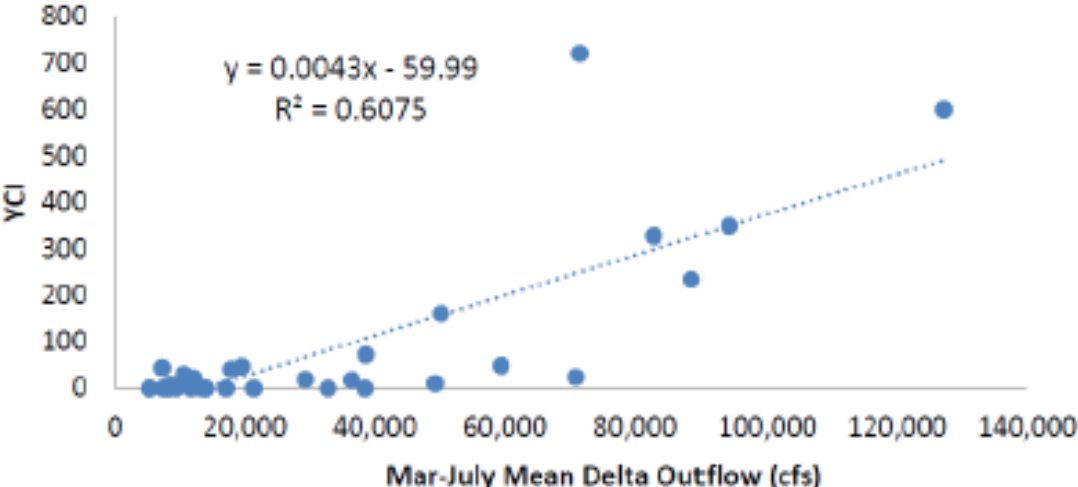
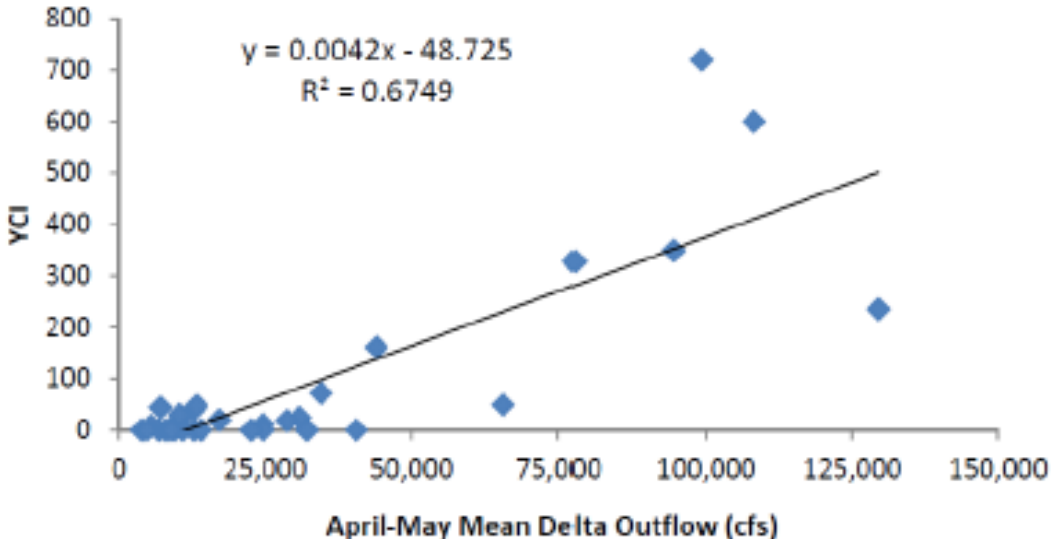
**Table 11L-1. Historical Data Used to Develop Regressions of White Sturgeon Year-Class Strength versus Mean Delta Outflow Data (cfs) for March–July and April–May.**

| Year | Year-Class Index | March–July Delta Outflow (cfs) | April–May Delta Outflow (cfs) |
|------|------------------|--------------------------------|-------------------------------|
| 1980 | 11               | 49,292                         | 24,652                        |
| 1981 | 22               | 12,075                         | 10,375                        |
| 1982 | 720              | 71,601                         | 99,295                        |
| 1983 | 600              | 127,256                        | 108,220                       |
| 1984 | 41               | 17,849                         | 12,836                        |
| 1985 | 44               | 7,270                          | 7,072                         |

<sup>1</sup> Copyright 2002–2012, SAS Institute Inc. SAS and all other SAS Institute Inc. product or service names are registered trademarks or trademarks of SAS Institute Inc., Cary, NC, USA.

| <b>Year</b> | <b>Year-Class Index</b> | <b>March–July Delta Outflow (cfs)</b> | <b>April–May Delta Outflow (cfs)</b> |
|-------------|-------------------------|---------------------------------------|--------------------------------------|
| 1986        | 24                      | 71,010                                | 30,923                               |
| 1987        | 8                       | 8,530                                 | 5,517                                |
| 1988        | 0                       | 5,272                                 | 7,983                                |
| 1989        | 0                       | 13,940                                | 9,497                                |
| 1990        | 0                       | 5,366                                 | 6,826                                |
| 1991        | 0                       | 7,945                                 | 3,783                                |
| 1992        | 0                       | 7,428                                 | 4,732                                |
| 1993        | 72                      | 38,634                                | 34,585                               |
| 1994        | 0                       | 8,284                                 | 8,044                                |
| 1995        | 349                     | 94,191                                | 94,501                               |
| 1996        | 161                     | 50,216                                | 44,059                               |
| 1997        | 47                      | 19,565                                | 13,266                               |
| 1998        | 328                     | 82,985                                | 77,724                               |
| 1999        | 18                      | 36,428                                | 28,753                               |
| 2000        | 0                       | 38,502                                | 24,678                               |
| 2001        | 0                       | 13,311                                | 10,942                               |
| 2002        | 0                       | 11,725                                | 12,762                               |
| 2003        | 0                       | 21,357                                | 32,159                               |
| 2004        | 19                      | 29,330                                | 17,137                               |
| 2005        | 0                       | 32,782                                | 40,624                               |
| 2006        | 235                     | 88,725                                | 129,578                              |
| 2007        | 30                      | 10,608                                | 10,327                               |
| 2008        | 0                       | 9,425                                 | 8,867                                |
| 2009        | 0                       | 14,055                                | 13,994                               |
| 2010        | 0                       | 17,082                                | 22,611                               |
| 2011        | 49                      | 59,479                                | 65,740                               |

Notes: cfs = cubic feet per second.



Source: ICF International (2016:5-199).

**Figure 11L-1. White Sturgeon Year-Class Index (YCI) for 1980–2011 as function of Mean April–May Delta Outflow (Upper Panel) and Mean March–July Delta Outflow (Lower Panel) in Cubic Feet Per Second (cfs).**

### 11L.4 References Cited

ICF International. 2016. *Biological Assessment for the California WaterFix*. July. (ICF 00237.15.) Sacramento, CA. Prepared for U.S. Department of the Interior, Bureau of Reclamation, Sacramento, CA.