# Appendix 11L    Sturgeon Delta Analyses

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## 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[1]. 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 |

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| Year | Year-Class Index | March–July Delta Outflow (cfs) | April–May Delta Outflow (cfs) |
|------|------------------|--------------------------------|-------------------------------|
| 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.
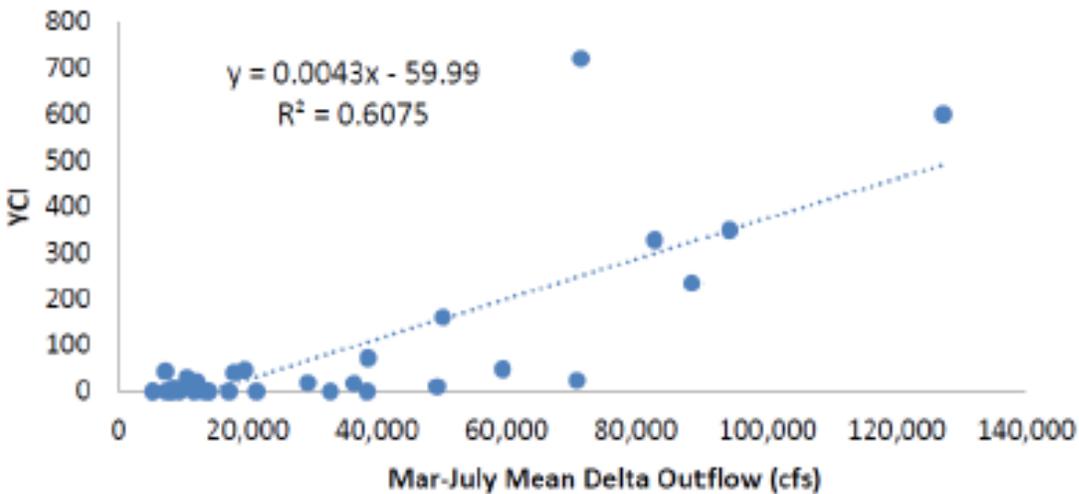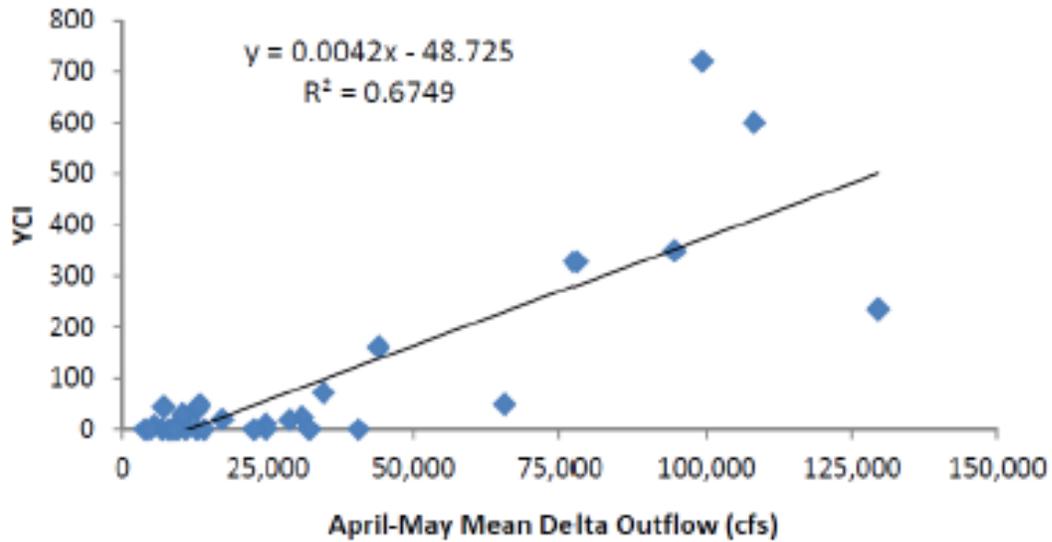
Source: ICF International (2016:5-199).

**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.