Appendix I

SAM Results

Standard Assessment Methodology (SAM) Analysis Appendix for the Environmental Assessment/Initial Study of 13 Bank Erosion Sites for the Sacramento River Bank Protection Project

Draft

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1 INTRODUCTION

This Appendix provides the background data, assumptions, analyses and assessment of habitat compensation requirements for the following federally protected fish species of considered by the Standardized Assessment Methodology (SAM) as part of a pre-construction analysis of 13 bank repair sites for the Sacramento River Bank Protection Project (SRBPP):

Species/ESUs	**Federal Status**
Chinook salmon (*Oncorhynchus tshawytscha*)	
Central Valley spring-run ESU	Threatened
Central Valley fall-run ESU	Species of concern
Central Valley late fall-run ESU	Species of concern
Sacramento River winter-run ESU	Endangered
Central Valley steelhead DPS (*Oncorhynchus mykiss*)	Threatened
Delta smelt (*Hypomesus transpacificus*)	Threatened

1.1 Background

The SAM (USACE 2004) was developed by the U.S. Army Corps of Engineers (USACE) and Stillwater Sciences, in consultation with an interagency working group (IWG) that included representatives from state and federal resource agencies (CDFG, NMFS, USFWS), the California State Reclamation Board (now the Central Valley Flood Protection Board) and the California Department of Water Resources. The SAM allows agencies to quantitatively assess the potential effects of bank protection and stream restoration projects to ensure that these activities do not jeopardize Chinook salmon, steelhead, and delta smelt, or destroy or adversely modify their critical habitat. The SAM can also determine suitable compensation for habitat loss, by evaluating the benefits of certain design features (e.g., planted emergent vegetation) to target fish species.

1.2 SAM Modeling Approach

In general, the SAM quantifies habitat values in terms of bank line- or area-weighted species responses. These responses are calculated by combining indices of habitat quality (i.e., fish response indices) with quantity (bank length or wetted area) for each season, target year, and relevant species/life stage. The SAM employs six habitat variables to characterize near-shore and floodplain habitats of listed fish species:

- ***bank slope***—average bank slope along each average seasonal water surface elevation;

- ***floodplain availability***—ratio of wetted channel and floodplain area during the 2-year flood (Q2) to the wetted channel area during average winter and spring flows;
- ***bank substrate size***—the median particle diameter of the bank (i.e., D_{50}) along each average seasonal water surface elevation;
- ***instream structure***—percent of shoreline coverage of instream woody material (IWM) along each average seasonal water surface elevation;
- ***aquatic vegetation***—percent of shoreline coverage of aquatic or riparian vegetation along each average seasonal water surface elevation; and
- ***overhanging shad***e—percent of the shoreline coverage of shade along each average seasonal water surface elevation.

The SAM does not directly model changes in the above variables. Instead, habitat changes are estimated separately by the user and entered into an input data file to an electronic calculation template (ECT) developed within an MS Access database to track species responses to project actions over time. Changes in habitat variables may be fixed in time, such as installation of revetment at a particular slope and substrate size. In other circumstances, habitat evolution over time may be represented by more gradual changes in variables such as changes in floodplain inundation due to meander migration or changes in shade due to growth of planted vegetation. Typically, habitat evolution modeling is restricted to shade estimates from riparian growth models, but the SAM accommodates any number of other habitat modeling approaches such as meander migration modeling or IWM recruitment modeling.

Once a particular time series of habitat variable estimates are developed and entered into an ECT input file, fish responses are calculated using previously developed relationships between habitat variables and species/life stage responses (USACE 2004). The response indices vary from 0 to 1, with 0 representing unsuitable conditions and 1 representing optimal conditions for survival, growth, and/or reproduction. For a given site and scenario (e.g., with- or without-project), the ECT uses these relationships to determine the response of individual species and life stages to the measured or predicted values of each variable for each season and target year; the ECT then multiplies these values together to generate an overall species response index. This index is then multiplied by the linear distance or area of bank to which it applies; the product is then integrated through time, generating a weighted species response index (expressed as feet or square feet) in each year of the analysis. The weighted species response index provides a common metric that can be used to quantify habitat values over time, compare project design alternatives to existing conditions, and evaluate the effectiveness of on-site and off-site habitat compensation actions.

1.3 13 Bank Repair Sites Considered in SAM Analysis

The SAM was used to assess potential habitat related impacts resulting from with-project conditions at 13 bank repair sites planned for construction within the SRBPP

action area (Table 1). Bank repairs at these sites will be implemented by USACE and the Central Valley Flood Protection Board (CVFCB) to prevent ongoing stream bank erosion. The sites will be repaired under three separate contracts to be implemented between summer 2008 and fall 2009, and are grouped as follows:

- Contract 1 (Summer/Fall 2008):
  Steamboat Slough RM 16.6R, Cache Slough RM 21.8R, and Sacramento River RMs 49.7L and 52.3L

- Contract 2 (Summer/Fall 2008):
  Sacramento River RMs 53.5R and 177.8R and Lower American River RM 0.3L and 2.8L

- Contract 3 (Summer/Fall 2009):
  Sacramento River RMs 16.8L, 42.7R, 55.2L, and 77.2L and Feather River RM 28.5R

2 HABITAT ANALYSIS

Following procedures described in the SAM document (USACE 2004), planned construction activities at each site were translated into habitat variables for existing and with-project conditions in each of four seasons using available data sources (e.g., USACE 2008a). The relevant habitat conditions to encode the conceptual response models for the focus fish species from the present to the future (t = 0, 1, 5, 15, 25, and 50 yrs), and under existing and with-project conditions are described below.

2.1 Study Reach Extent and Project Descriptions

The overall SRBPP action area spans more than 30,000 square miles. This area has a south-to-north extent along the Sacramento River from the town of Collinsville (RM 0) upstream to Chico Landing at RM 194, including the lower reaches of Mud, Deer, and Elder Creeks. The action area has a west-to-east extent from Cache Creek to the lower reaches of the American River (RM 0–23), Feather River (RM 0–61), Yuba River (RM 0–11), and Bear River (RM 0–17), as well as a number of flood bypasses and distributaries. Using the reach designations included in USFWS (2001) and the SRBPP's programmatic biological assessment (USACE 2007a), the action area has been divided into four regions, organized south to north by the location of the downstream terminus of each watercourse with the mainstem Sacramento River. The four regions and the number of project sites within each are as follows:

- Region 1a (Sacramento River RM 0–20): 3 sites
- Region 1b (Sacramento River RM 20–80): 8 sites
- Region 2 (Sacramento River RM 80–143): 1 site
- Region 3 (Sacramento River RM 143–194): 1 site

In addition to placing rock revetment at each of the 13 sites to prevent levee failure, all sites will receive a number of habitat enhancements to mitigate for potential short- and longer-term construction-related effects on critical habitat for listed fish species (Table 2). The on-site mitigation features planned for the 13 sites vary depending on location within the SRBPP action area; however several features, such as planted seasonally flooded benches with anchored IWM, are to be included throughout. The planned bank protection measures include: 1) protection of the bank toe and upper slopes with rock; 2) establishment of a bench above the mean summer water level (MSWL) to provide aquatic habitat during lower and higher river stages in winter and spring; 3) placement of IWM for aquatic habitat; and 4) installation of pole and container plantings to stabilize the bank and provide riparian and shaded riverine aquatic (SRA) habitat. An inundated wetland bench below the MSWL to provide year-round aquatic habitat will be constructed at several sites located within or near the Delta and at the Feather River site. The on-site mitigation features installed at each site are summarized in Table 2.

2.2 Existing and With-Project Habitat Variable Estimates

The existing (pre-project) bank characteristics used in this SAM analysis were summarized based on on-site survey data collected by Ayres Associates (Ayres), Parus Consulting (Parus), and Stillwater Sciences (Stillwater) during initial site visits and subsequent site characterization field surveys (USACE 2008a).

With-project bank characteristics used in this SAM analysis are based on site designs prepared by Ayres Associates (Ayres 2008) and presented in this Environmental Assessment / Initial Study document. The site-specific timing by year (water year) and season of installed bank repair features, including rock placement, soil and IWM installation, and vegetation plantings, were considered in this analysis for the with-project conditions (Table 1). All sites to be constructed under Contracts 1 and 2 will be repaired during summer/fall 2008, while the sites under Contract 3 will be repaired during summer/fall 2009.

Tables 5 through 30 summarize the SAM input data that were used to characterize existing and with-project conditions at each site. Data sources and a comparison of each habitat variable under existing and with-project conditions are discussed below.

2.3 Hydraulic Data Analysis

2.3.1 Water surface elevations

Average fall, winter, spring, and summer water surface elevations (seasonal shoreline elevations) for the project sites were estimated by Ayres using HEC-RAS modeling from daily flow data measured in the Sacramento River at USGS gage locations listed below:

- Sacramento River RM 48 (USGS 11447650 at Freeport)
- Sacramento River RM 78.5 (USGS 11425500 at Verona)
- American River RM 22.2 (USGS 11446500 at Fair Oaks)
- Yuba River (USGS 11421000 at Marysville)

Seasonal water surface elevations, including the 2-year flood (Q2), at all sites are summarized in Tables 5-30.

2.3.2 Wetted areas

Wetted area estimates for each project site (Tables 5-30) were obtained from site descriptions provided by USACE and represent the total planform area of the project footprint. For the purposes of determination of the Floodplain Inundation ratio (discussed below), however, GIS software was used with average shoreline elevations determined by Ayres (discussed above) to estimate wetted surface areas of the river

(measured from the centerline of the river) to the bank-line intersection of a digital elevation model of the site topography.

Because of the small changes in channel cross-sections at the 13 sites, it is assumed herein that the with-project wetted-areas would be the same as existing areas, which is consistent with assumptions made during previous SAM analysis for the SRBPP (USACE 2006a, 2007a, 2008b).

2.3.3 Shoreline length

Shoreline lengths within the project limits at each site were defined as the total length of continuous shoreline (defined by the water's edge or corresponding contour line) corresponding to each average seasonal flow (USACE 2004). Bank lengths presented in Table 1 for each site were provided by Ayres (Ayres 2008, USACE 2008a), which were calculated as the straight-line distance between a site's upstream and downstream end points. In the following SAM analysis, GIS analysis was performed to better estimate the wetted bank-line length based on seasonal variation in water surface elevation, topographic variations, and river bend curvature at each site. A bank-line length was produced per season for each site (Tables 5-30).

Based on the project descriptions, no significant changes in shoreline length are expected under with-project conditions.

2.3.4 Bank slope

In the SAM, bank slope serves as an indicator of the availability of shallow-water habitat and is obtained from point estimates of bank slope (horizontal change to vertical change; dH:dV) along each seasonal shoreline (i.e., the line where the water surface intersects the bank on average in fall, winter, spring, and summer) (USACE 2004). For existing (pre-project) conditions, GIS software was used with the DEM topography at each site to estimate the bank slope corresponding to each seasonal shoreline to a depth of approximately 3 feet. Bank slope values at the 13 sites ranged from 1.6:1 to 4.7:1 (32 deg to 12 deg), which are indicative of a moderate bank slope.

The with-project bank slopes at each site were obtained from design drawings provided by Ayres and range between 3:1 to 10:1 depending on whether the seasonal water surface elevation is above or below a riparian or wetland bench, if present. For the sites planned to have a wetland bench (Steamboat Slough RM 16.6R, Sacramento River RMs 16.8L and 52.3L, Cache Slough RM 21.8R, and Feather River RM 28.5R), the bank slopes will range between 4:1 to 10:1, which are indicative of a moderate to shallow bank slope. The remainder of the sites that are planned to have riparian benches will have shallow bank slopes when inundated during winter and spring (10:1) and moderate bank slopes (3:1) during summer and fall when the water surface elevations are below the riparian bench surface.

In comparison to existing conditions, all of the sites have shallower winter/spring bank slopes and ten sites have shallower summer/fall bank slopes. The shallower with-

project bank slopes at the majority of the sites indicate improved shallow water habitat quality based on preferences of the relevant focus species/life stages to less steep bank slopes. The three sites with steeper bank slopes in summer and fall, and therefore would have diminished shallow water habitat quality relative to existing conditions, are Sacramento River RMs 42.7R and 53.5R and Lower American River RM 0.3L.

2.3.5 Floodplain inundation ratio

In the SAM, floodplain habitat availability is considered important for juvenile life stages and is defined by areas that are flooded by the 2-year flood event (Q2) and measured by calculating a Floodplain Inundation Ratio (USACE 2004). This ratio is calculated by dividing the wetted channel and inundated floodplain areas during the 2-year flood event (A_{Q2}) by the wetted channel area (A_{Qavg}) during average winter and spring flows. The amount of available floodplain habitat is consequently proportional to the ratio's positive deviation from unity (i.e., values greater than 1). At all 13 sites, it is assumed that the inundation ratios during summer and fall are equal to one, while the high flows of winter and spring drive inundation ratios that are relatively greater due to seasonal inundation of channel and floodplain areas. Because the sites are adjacent to flood-containing levees placed closely to the active channel, the existing inundation ratios in winter and spring are only slightly greater than 1, and range up to approximately 1.2 which is indicative of a narrowly confined channel between the levees. Therefore, no changes in the estimated inundation ratio and habitat values under with-project conditions were applied in the assessment (Tables 5-30).

2.3.6 Bank substrate size

Bank substrate size is directly affected by bank revetment and is considered an important determinant of predation risk and growth for nearly all life stages of the focus fish species (USACE 2004). Therefore, the relevant life stages are positively affected by smaller sizes of bank substrates and negatively affected by larger sizes of bank substrate. For this assessment, bank substrate size represents the median particle size (D_{50} in inches) within the submerged portion of the bank immediately below (0-3 ft) the average seasonal water surface level.

For existing conditions used in the SAM analysis, bank-length weighted estimates of substrate size were determined by Stillwater during field surveys conducted in January 2008 (Tables 5-30). The dominant substrate sizes at the winter/spring and summer/fall waterlines ranged between fine silts and sands, or natural substrate, up to coarse rock revetment having an approximate 20 inch diameter. Natural substrates were assigned a size value of 0.25 inch. During the recent field surveys, it was found that the majority of sites were presently un-revetted and contained fine bank substrates at the seasonal waterlines (D_{50}=0.25 in.), while five sites (Steamboat Slough RM 16.6R, Sacramento River RMs 16.8L, 42.7R, 49.7L, and half of Feather River RM 28.5R) contained rock, cobble, or concrete rubble revetment ranging in size between 4 and 20 inches in diameter. Although not incorporated in the SAM analysis, the existing bank revetment observations differ slightly from data contained in the USACE revetment database (USACE 2007b), whereby the bank segments at ten of the 13 project sites had been previously revetted

when the bank revetment surveys were conducted (e.g., 2002-2006). The ten sites are Steamboat Slough RM 16.6R (large rock), Sacramento River RMs 16.8L (large rock), 42.7R (large rock), 49.7L (50% revetted with large rock), 53.5R (large rubble), 55.2L (medium rock), 77.2L (large rubble and medium rock), and 177.8R (medium cobble), Lower American River RM 2.8L (large cobble), and Feather River RM 28.5R (50% revetted with medium cobble).

Under with-project conditions, rock revetment will be placed initially during summer and immediately followed by soil placement upon the wetland and riparian benches and the upper bank surfaces. In this assessment, the rock size is assumed to average 16 inches (D50) and 0.25 inch for soil. The bank substrate size assigned at a site during a given season depends on whether the seasonal waterline lies above or below a soil-capped bench. Sites planned to have a wetland bench installed will comprise fine (0.25 inch) substrate year-round, while sites with only a riparian bench will provide fine substrate during winter/spring when the bench is inundated, but will provide coarse substrate when the summer/fall waterline intersects the exposed rock revetment below the bench.

In comparison with existing conditions, the with-project bank substrate sizes in winter and spring will be either the same or finer than existing substrate sizes. The finer substrate sizes at many sites during the high flow seasons indicate a potential improvement in habitat quality with respect to this habitat variable. During the lower flow seasons of summer and fall, the waterline at several sites will intersect the rock revetment installed below the riparian bench surface. As a result, seven sites (Sacramento River RMs 42.7R, 53.5R, 55.2L, 77.2L, and 177.8R, and Lower American River RMs 0.3L and 2.8L) will have relatively coarser bank substrates during summer and fall under with-project conditions. Therefore, habitat quality at these sites will be diminished with respect to this habitat variable.

2.3.7 Instream structure

Instream structure is defined as instream woody material (IWM, excluding live bank vegetation) that is partially or fully submerged during average seasonal flows (USACE 2004). IWM is to be installed at nearly all sites because it provides hiding and resting cover for focus fish and their predators, in addition to affecting invertebrate food production. Within the SAM bank-line cover of IWM along the shorelines is assumed to be proportional to habitat quality for most life stages of the focus fish species. This habitat variable was measured by estimating the percent of shoreline at each site that is occupied by IWM within the inundation zone associated with each average seasonal flow under existing and with-project conditions. Existing IWM coverage was estimated by Parus during field surveys and ranges from none to approximately 40% of a site's total length (Table 5-30).

During project construction, the existing IWM will be initially cleared from the bank during summer and new IWM will be installed during fall following the placement of rock revetment. This will result in the temporary loss of all existing IWM during the summer season at the project sites. Nearly all sites will ultimately have IWM installed on

the wetland or riparian bench in order to become inundated year-round and, therefore, to offer instream structure habitat values to the focus fish species/life stages. The installed IWM will primarily consist of large woody trees anchored directly into the rock and soil revetment. Three sites—Lower American River RMs 0.3L and 2.8L and Feather River RM 28.5R—will also receive willow branch fascines to be installed on and below the riparian or wetland bench. The two Lower American River sites will therefore provide greater IWM cover (40%) when higher flow stages inundate the riparian benches during winter and spring and relatively lower IWM cover (10%) from the willow fascines throughout the remainder of the year. Although the longevity of these IWM features has not been validated through extensive monitoring at previously constructed bank repair sites (USACE 2008c), the assessment assumes the amount of IWM present after construction would not change significantly during the 50-year project planning period.

The amount of IWM installed at a particular site will vary throughout the action area. Generally, all sites upstream of the Delta will receive 80% bank-line cover of IWM to be available as instream structure year-round. However, this SAM analysis proceeds assuming only 40% cover because the species response curves show no gains above 40% cover. At the sites located within the Delta (Steamboat Slough RM 16.6R, Sacramento River 16.8L, and Cache Slough 21.8R), the amount of installed IWM is limited by restrictions placed on instream structure installation downstream of RM 30. This design limitation is based on previous concerns raised by members of the IWG about potentially adverse effects upon delta smelt due to increased habitat suitability for ambush predators. Accordingly, the IWM to be re-installed at the three Delta sites may only replace existing cover proportions. Two of the sites presently contain between approximately 10-20% IWM cover, while Sacramento River RM 16.8L contains approximately 3% bank-line cover in winter and spring. The SAM analysis for these three sites applies the planned IWM installation cover percentages to delta smelt only. For salmonids, the SAM uses a cover percentage of 40% which exceeds the IWM cover to be actually installed at each of the sites. The balance will be effectively credited following IWG discussions in November 2006 by allowing excess IWM cover generated off-site from the difference in actual (80%) and modeled (40%) cover at the near Delta sites (Appendix I, USACE 2006a).

Comparisons between existing and with-project IWM cover percentages reveal that nearly all sites will receive an increase during all seasons, indicating improved habitat quality with respect to this habitat variable. The one exception is at site Sacramento River RM 42.7R, which will have a slight reduction in IWM cover from 43% to 40% during winter/spring based on the SAM input tables. However, the SAM analysis will not predict any reduction in habitat quality at this site with respect to this habitat variable because the species response curves show no losses when with-project bank-line proportions are equal to or greater than 40% cover. Further, the actual IWM cover to be installed at this site (80%) will be substantially greater than the existing cover proportions.

2.3.8 Aquatic vegetation

Aquatic vegetation is defined as aquatic or live riparian vegetation that is partially or fully submerged during average seasonal flows (USACE 2004). Floating, submerged, and emergent aquatic vegetation serve as hiding cover and an invertebrate food production base for both focus fish and their predators. Habitat quality is therefore considered to benefit proportionally with the relative amount of aquatic vegetation along a shoreline. Existing coverage was estimated by Stillwater during field surveys conducted in January 2008. The range of bank-line cover ranges from approximately 13% to 63% and is dependent on the relative position to the seasonal waterline (Table 5-30).

Similar to IWM, any existing emergent or ground cover vegetation will be initially cleared from the banks of the 13 sites during construction. The riparian bench and upper banks, including any wetland benches if present, will be revegetated during fall following the placement of rock revetment and soil. In the SAM analysis, it is assumed that aquatic vegetation cover is generally greater during winter and spring than during summer and fall because the revegetated riparian bench, if present, will be in direct contact with the seasonal high flows, thus providing relatively higher bank-line coverage. Wetland benches will also be revegetated and will afford year-round aquatic vegetation cover where installed (Steamboat Slough RM 16.6R, Sacramento River RMs 16.8L and 52.3L, Cache Slough RM 21.8R, and Feather River RM 28.5R).

In comparison with existing conditions, all sites will experience an initial reduction in bank-line cover of aquatic vegetation due to construction-related effects and an expected growth delay with replanted vegetation on the bank repair structure. In winter and spring, with-project bank-line cover will recover and begin to exceed existing coverage by Year 5 at the latest at nearly all sites. Sites with a wetland bench will additionally exceed existing coverage by Year 5 during summer and fall. These coverage increases will result in improved habitat quality at these sites with respect to this habitat variable. At all sites without a wetland bench, a long-term loss of existing aquatic vegetation will occur during summer and fall because vegetation will be absent below the riparian bench surface where the seasonal waterline will intersect the bank repair structure. Therefore, habitat quality at these sites will be diminished with respect to this habitat variable.

2.3.9 Shade

Shade is represented by overhead canopy cover and is measured by estimating the percent of shoreline in which riparian vegetation extends over the water during average seasonal flows. Overhanging shade is considered to benefit habitat quality by providing hiding cover and food availability for the focus fish species. The existing overhead shade cover at each site was determined by GIS analysis using a digitized canopy shapefile layer superimposed upon the seasonal shoreline positions. The shade cover proportions for the 13 sites range from zero up to 100%. Generally, greater shade cover occurs during summer when full tree canopies are present (Tables 5-30).

Based on the project descriptions and general planting plans (Tables 3 and 4), it is assumed that all mature trees that currently shade the seasonal shorelines at each site would be maintained under with-project conditions. Initial (Year 0) shade values are conservatively estimated at 25% of existing conditions due to a combination of two factors. First, the bank repair structure will serve to shift the bank line intersection of the seasonal water surfaces towards the channel centerline and away from the existing vegetation. Second, revetment placement will remove all mid- and low-canopy shade that remains with some losses to mature trees as well.

Canopy growth of all retained and planted trees is expected at each site. A time series of overhanging shade is estimated for the sites using riparian growth modeling of restricted and unrestricted planting plans (Tables 3 and 4) and riparian growth models presented in the SAM document (USACE 2004). Published data from floodplain restoration sites in California indicate that a reasonable survival rate after 3 years is 65 percent (Alpert et al. 1999, Morris 1993). Tree density and cover was adjusted for expected mortality due to inter-species competition and other factors. The growth modeling was used in this SAM analysis to estimate the shade evolution at the 13 sites based on the existing shade coverage and planting plans. Even with these plantings, the combined shade of existing and planted trees means that little or no riparian shade be present for several years (i.e., 5-10) following project implementation, since it is unlikely that plantings will reach minimum canopy diameters required to achieve shading benefits of rearing juveniles along the riverbank. In the longer-term, expected increases in canopy widths of existing trees as well as trees and shrubs planted on the constructed benches and upper slopes would eventually result in nearly 100% shading of the summer-fall shoreline. This indicates a substantial improvement to habitat quality with respect to this habitat variable at all sites year-round despite an initial reduction of cover before Year 15.

3 BIOLOGICAL SIMULATION AND ASSESSMENT

Following the procedures outlined in the SAM Users Manual (USACE 2006b), the electronic calculation template (ECT version 2.6) was used to quantify the responses of the focus fish species and life stages to with-project conditions over a 50-year project period relative to the species and life stage responses under without-project (existing) conditions. As described above, modified conceptual response models were updated within the ECT and used to calculate a time series of the relative response indices for each pre-project and with-project scenario developed above. Biological responses of each focus fish species life stage were predicted within each habitat unit (project site) and for each time step based on habitat variable values and fish residency determined from reach specific timing tables (USACE 2004). The following focus fish species were considered in the subsequent analyses:

- **Chinook salmon** *(Oncorhynchus tshawytscha)*
  - Central Valley spring-run
  - Central Valley fall-run
  - Central Valley late fall-run
  - Sacramento River winter-run
- **Central Valley steelhead** *(Oncorhynchus mykiss)*
- **Delta smelt** *(Hypomesus transpacificus)*

Although RM 20 is considered the upstream extent of the salt and freshwater mixing zone (X2) that is preferred delta smelt habitat (USFWS 1994), critical habitat for delta smelt extends to RM 60, just above the confluence of the American River. For this reason, the SAM assesses the potential for occurrence of delta smelt at those bank repair sites located within Regions 1a and 1b from RM 0 to 80 (USACE 2004).

The ECT automatically includes or excludes particular life stages of the focus fish by assessing the river mile locations of each bank repair site, with the encoded timing tables. In general, as calculated using the ECT, positive differences between the pre-project and with-project responses are assessed as a net benefit for the focus fish species (i.e., the bank repair action produced superior conditions than pre-project conditions). Negative differences indicate the bank repair actions produced inferior conditions when compared with pre-project conditions; they generally require additional habitat compensation.

3.1 Modifications to Parameters and Species Response Curve

Following a review and evaluation of the SAM results for delta smelt at other bank protection sites (Jones & Stokes 2005), several recommendations were presented to the IWG in late 2006 to improve the SAM's accuracy in characterizing the habitat values for delta smelt within their designated critical habitat (RM 0–80). Delta smelt are present in Regions 1a and 1b; spawning, incubation, and juvenile rearing life stages are

susceptible to changes in existing habitat conditions of all bank attributes, except shade during winter, spring, and summer. In the original USACE (2004) SAM and ECT (version 2.5), habitat values for juvenile rearing and adult life stages responding to bank cover attributes were assumed to decrease, because habitat suitability for ambush predators increased (USACE 2004). However, recent discussions within the IWG indicate that due to their generally pelagic life history strategy, only spawning and the earliest early larval life stages of delta smelt would be sensitive to changes in bank-line habitat variables. Accordingly, ECT version 2.5 response curves for juvenile smelt were changed for ECT version 2.6 to match those for spawning and adult responses. Specifically, the juvenile smelt responses were set equal to one, indicating no sensitivity to the bank-line cover attributes of IWM %, Aquatic Vegetation %, or Shade %.

3.2 Results Summary by Region and Species

Based upon the habitat variable estimates described above, this section describes the SAM results for the 13 bank repair sites within each region. For the relevant species and life stages within each region, the habitat responses are dependent on the differences between existing and with-project conditions. In general, the SAM results indicate short-term (i.e., Years 1-5) and some long-term (i.e., greater than Year 5) deficits in habitat for salmonids and delta smelt at many sites, followed by recovery and net positive responses for most salmonid and delta smelt life stages at most sites over the modeled 50-year period. The initial (Year 0) removal or reduction of several habitat variables during project-construction at many sites (e.g., removal of existing IWM and aquatic vegetation during rock revetment placement) drove the short-term habitat deficits modeled by the SAM. The majority of habitat deficits would potentially occur during summer and fall at sites having only a riparian bench due to the long-term increase of bank substrate size and loss of existing aquatic vegetation at the low flow waterline (i.e., summer/fall) intersection of the bank repair structure below the planted riparian bench.

For the following summary of SAM results, the 13 bank repair sites have been organized by their associated region within the SRBPP action area. The potential effects on the focus fish species life stages are presented below. The discussion focuses on the cumulative results per region rather than the specific results from each site. In the case where the cumulative habitat responses for a given region indicate long-term deficits, off-site compensation would be required despite any long-term habitat benefits occurring within another region (i.e., within Regions 1a and 2). Relative response comparisons for each of the 13 bank repair sites are presented on a bank-line weighted basis (Tables 31 through 43 and Figures 1 through 37), and a wetted-area weighted basis (Tables 44 through 56 and Figures 38 through 74). Cumulative relative response results for each region, as discussed below, are presented in Tables 57 through 64 and Figures 75 through 94.

3.2.1 Region 1a (Sacramento River RM 0-20)

In Region 1a, the only bank repair design implemented at the 3 sites (Steamboat Slough RM 16.6R, Sacramento River RM 16.8L, and Cache Slough RM 21.8R) includes

a planted wetland bench with replacement of IWM to existing bank-line proportions. Generally, in comparison to existing habitat conditions at the three sites in this region, the wetland bench design will provide superior on-site habitat mitigation features. The features include increased shallow water habitat (i.e., less-steep bank slope), similar or decreased bank substrate size, replacement or credited IWM cover (40% for salmonids), and increased bank-line cover of aquatic vegetation overhead shade.

3.2.1.1 Salmon and steelhead

The SAM results indicate that all salmonid life stages would potentially exhibit positive habitat responses by WY 2009 (Year 1) during fall, winter, and spring and would be followed by long-term positive habitat gains through the modeled time period (Tables 57 and 61; Figures 75, 76, 85, and 86). The exceptions are holding habitat for adult steelhead in winter and spring and habitat for migrating adult Chinook salmon and steelhead in spring which would exhibit short-term habitat deficits, but would quickly recover by WY 2010 (Year 2) and be followed by long-term positive habitat gains. In summer, habitat responses for all salmonid life stages would have short-term deficits related to the reduction in habitat quality during project construction (e.g., IWM and aquatic vegetation removal). The responses in summer would recover to pre-project conditions by WY 2012 (Year 4) at the latest for all salmonid life stages, and would exhibit continued positive habitat gains through Year 50.

The long-term positive responses signify that the on-site habitat mitigation features installed at the three bank repair sites in Region 1a would be substantially improved compared to the existing conditions. At all three sites, the with-project features would afford relatively increased shallow water habitat (i.e., less-steep bank slope), finer or similar bank substrate size, increased aquatic vegetation cover (by Year 5 at the latest), and increased overhead shade cover (by Year 15 at the latest). Habitat responses for all salmonid life stages would also benefit from off-site compensation to instream cover (40%) credited from excess IWM (80%) installed at other bank repair sites upstream of RM 30 (Section 2.3.7). An initial reduction in aquatic vegetation cover in summer and overhead shade in all seasons would occur, but would be sufficiently off-set by the other habitat mitigation features to be installed at three sites in this region.

3.2.1.2 Delta smelt

Habitat responses modeled for the delta smelt life stages during winter and spring exhibit positive values by WY 2009 (Year 1), followed by long-term positive habitat gains through Year 50 (Tables 57 and 61; Figures 77 and 87). Similar to the salmonid responses, the positive delta smelt responses would be driven by the improved habitat conditions following bank repair activities, including increased shallow water habitat (i.e., less-steep bank slope), replacement of existing IWM cover, and increase in aquatic vegetation cover at all three sites in this region.

In summer, the SAM results indicate that the delta smelt life stages would potentially exhibit a long-term habitat deficit as a result of construction-related impacts to

habitat quality. Recovery to pre-project conditions would occur by WY 2012 (Year 4) followed by long-term positive habitat gains through Year 50. This deficit is driven by the temporary loss of existing instream structure and aquatic vegetation associated with bank repair construction in this season. The overall improvement in habitat values and eventual recovery to net habitat gains over the modeled time period is attributed to the increased shallow water habitat (i.e., less-steep bank slope), replacement of existing IWM cover, and eventual increase in aquatic vegetation cover.

3.2.2 Region 1b (Sacramento River RM 20-80)

Region 1b will host eight of the 13 sites; the majority of bank repair sites in the SRBPP action area under this project. Generally, the with-project conditions for all habitat variables at the majority of sites in this region will be superior to the existing conditions during winter and spring, while with-project conditions in summer and fall will be inferior to those under existing conditions (Tables 58 and 62; Figures 78, 79, 80, 88, 89, and 90). The bank repair designs planned for the sites in this region are the planted riparian bench (seven sites) and the planted wetland and riparian benches (Sacramento River RM 52.3L). The planted riparian bench design will generally improve habitat conditions when inundated during winter and spring due to an increase in shallow water habitat (i.e., less-steep bank slope), finer bank substrate size, and increased bank-line cover of aquatic vegetation and overhead shade. In contrast, most sites will experience an increase in bank slope and bank substrate size and decrease in aquatic vegetation cover during the lower flow seasons of summer and fall when the shoreline is positioned below the riparian bench surface.

At the Sacramento River sites, both bank repair designs will include IWM installed above and below the summer/fall waterline to provide instream structure year-round for the benefit of the relevant focus species/life stages. The two Lower American River sites (RMs 0.3L and 2.8L) will also provide year-round IWM cover, but with substantially less during summer and fall (10%) because only the willow fascines will remain submerged during these seasons. The addition of IWM at all sites will improve habitat conditions at most sites, with respect to this habitat variable.

3.2.2.1 Salmon and steelhead

The SAM results indicate potential positive habitat responses for all salmonid life stages during winter and spring, and followed by long-term positive habitat gains through Year 50. The positive habitat responses during winter and spring for all life stages are driven by the on-site mitigation features afforded by the inundation of the planted riparian benches at all eight sites in this region. These beneficial habitat features include shallow bank slope, finer bank substrate size, and high bank-line cover of IWM, aquatic vegetation, and overhead shade. Because the majority of sites would experience relatively improved habitat conditions following bank repair construction, any potential short- or long-term habitat deficits experienced at two sites—Sacramento River RMs 49.7L and 52.3L—are effectively compensated by habitat benefits at other sites within the adjacent programmatic region.

In fall, the adult salmonid habitat responses would exhibit positive values instantly by WY 2009 (Year 1) followed by continued habitat gains. The long-term positive values are driven by increased IWM cover beginning in Fall WY 2009 (Year 1) and overhead shade cover, which would exceed existing levels by approximately WY 2023 (Year 15). Adult responses in summer are similar, except a short-term habitat deficit (<Year 3) would occur in response to the temporary removal of existing instream structure during project construction.

Habitat responses for juvenile salmonids and Chinook salmon emigrating as smolts, as modeled by the SAM, would potentially exhibit long-term deficits during summer and fall. Juvenile habitat deficits would eventually recover to pre-project conditions by WY 2043 (Year 35) at the latest, while habitat deficits for Chinook salmon smolts would persist through the modeled time period. The negative responses for both of these life stages are driven by the reduction in habitat quality associated with the summer/fall waterline intersection below the planted riparian bench at nearly every site in this region. At many sites, the on-site habitat mitigation features present below the riparian bench surface would provide relatively inferior habitat quality, which includes decreased shallow water habitat (i.e., steeper bank slope), coarser bank substrate size, and loss of existing aquatic vegetation cover, despite the positive contributions to habitat quality from increased IWM and overhead shade cover. The one site in this region to provide positive juvenile and smolt habitat values during summer and fall throughout the entire modeled time period (Years 1-50) is Sacramento River RM 52.3L, which will include a planted wetland and riparian bench. The year-round inundation of the wetland bench at this site will effectively offer equal or greater habitat quality to the focus species/life stages compared with existing conditions. The positive responses from this site also benefit the cumulative responses for Region 1b.

3.2.2.2 Delta smelt

The SAM results indicate that the delta smelt life stages would exhibit positive habitat responses instantly by WY 2009 (Year 1) during winter and spring with continued gains through the modeled time period. These responses are driven by increased shallow water habitat (i.e., less-steep bank slope) and increased bank-line cover of IWM and aquatic vegetation at many of the sites in this region.

In summer, long-term delta smelt habitat deficits would potentially occur due to the general reduction in shallow water habitat (i.e., steeper bank slope) and loss of aquatic vegetation at many sites. The addition of greater IWM cover at most sites and of increased aquatic vegetation growth on the wetland bench at Sacramento River RM 52.3L would eventually drive habitat response increases and recovery of the delta smelt life stages to exceed pre-project conditions by WY 2046 (Year 38).

3.2.3 Region 2 (Sacramento River RM 80-143)

Only one of the 13 bank repair sites will be located in Region 2: Feather River RM 28.5R. The planned design for this site will include a planted wetland bench with anchored large woody trees and willow branch fascines. Despite an initial reduction in

overhead shade cover following construction, the planted wetland bench with IWM will provide year-round improvement to all habitat variables (Tables 59 and 63; Figures 81, 82, 91, and 92). SAM results are presented below for various life stages of Chinook salmon and steelhead, but no delta smelt life stages were modeled in Region 2 because most delta smelt occur downstream of RM 20 (Moyle 2002).

3.2.3.1 Salmon and steelhead

The SAM results indicate that all salmonid life stages would potentially exhibit positive habitat responses by WY 2010 (Year 1) during all seasons and would be followed by positive habitat gains through Year 50. These positive responses are driven by the relatively improved habitat quality that would occur under with-project conditions. Specifically, in comparison to existing conditions, the planted wetland bench with anchored IWM will provide year-round shallow water habitat (i.e., less-steep bank slope), finer bank substrate size, and substantial increases in bank-line cover of IWM, aquatic vegetation, and overhead shade. Only aquatic vegetation and overhead shade cover will be reduced initially during and shortly after project construction, but will be sufficiently off-set by the other aforementioned habitat variables.

3.2.4 Region 3 (Sacramento River RM 143-194)

Region 3 contains only one of the 13 bank repair sites: Sacramento River RM 177.8R. A planted riparian bench will be constructed at this site which will also include anchored large woody trees for IWM cover. As discussed for the sites in Region 1b, the planted riparian bench design may not offer adequate habitat benefits to the focus species/life stages during summer and fall when the seasonally low waterline will lie below the bench surface and is exposed to an un-vegetated, moderate bank slope (2:1), with coarse revetment (D_{50}=16 inches). During winter and spring, higher flows will inundate the bench and on-site habitat mitigation features will offer improved habitat conditions compared with existing conditions at the site (Tables 60 and 64; Figures 83, 84, 93, and 94). SAM results are presented below for various life stages of Chinook salmon and steelhead, but no delta smelt life stages are modeled in Region 3 because no delta smelt are present here (Moyle 2002).

3.2.4.1 Salmon and steelhead

Based on the SAM results, habitat responses for all salmonid life stages in winter and spring would exhibit positive values by WY 2009 (Year 1) followed by long-term positive gains through Year 50. These responses are driven by the overall improvement of habitat quality under the with-project conditions. When inundated, the planted riparian bench offers slightly increased shallow water habitat (i.e., slightly less-steep bank slope), similar bank substrate size, and substantial increases in bank-line cover of IWM, aquatic vegetation, and overhead shade.

During summer and fall, adult salmonid habitat responses would also exhibit positive values by WY 2009 (Year 1). This life stage will benefit from the increased bank-line cover of IWM and overhead shade, which will both exceed existing cover

proportions by Fall WY 2009 (Year 1). Despite the increases in these two habitat variables, low-magnitude long-term juvenile and smolt habitat deficits will potentially occur as a result of coarser bank substrate, loss of aquatic vegetation, and initial reduction of overhead shade when the summer/fall waterline intersects the bank repair structure below the bench surface. Continued growth of the shade-providing tree canopy will eventually drive the habitat responses for these two life stages to recover to pre-project conditions by WY 2018 (Year 10), at the latest, followed by positive habitat gains through Year 50.

3.3 Results Summary for All Regions Combined and by Species

Based on the SAM results presented above for each of the four regions in the SRBPP action area, short- and long-term would potentially occur in Regions 1b and 3 for Chinook salmon, steelhead, and delta smelt. The results from all four regions were combined to compensate for the long-term deficits. Generally, the habitat deficits modeled in Regions 1b and 3 are effectively off-set by the habitat gains within the adjacent Regions 1a and 2. Both of these regions will exclusively contain sites with planted wetland benches that offer year-round habitat benefits to the focus species/life stages. The SAM results are summarized below for the focus species/life stages and are presented in Tables 65 and 66 and Figures 95 through 100.

3.3.1 Salmon and steelhead

The cumulative SAM results for all 13 sites indicate that all salmonid life stages would potentially exhibit positive habitat responses by WY 2009 (Year 1) in all seasons followed by long-term positive habitat gains through Year 50. Exceptions are potential short-term adult Chinook salmon and juvenile and smolt Chinook salmon and juvenile steelhead deficits during summer. These deficits are specifically driven by the initial reduction in IWM at all sites during project construction in summer. Recovery to pre-project conditions in summer would occur by WY 2011 (Year 3) at the latest for these life stages followed by long-term habitat gains.

3.3.2 Delta smelt

Cumulative delta smelt habitat responses during winter and spring, as modeled by the SAM, exhibit positive values by WY 2009 (Year 1) followed by continued gains through Year 50. Similar to the salmonid responses, the inundation of the planted wetland and riparian benches during winter and spring offer sufficient improvements to habitat quality under with-project conditions, including increased shallow water habitat (i.e., less steep bank slope), finer bank substrate size, and increased bank-line cover of IWM, aquatic vegetation, and overhead shade.

In summer, long-term delta smelt habitat deficits would potentially occur due to the initial reduction in IWM cover, but would be off-set by the eventual installation of IWM in addition to the habitat benefits stemming from the wetland bench sites. The

recovery of this initial deficit would occur by WY 2013 (Year 5) and would be followed by continued habitat gains through Year 50.

4 DISCUSSION AND CONCLUSIONS

The combined SAM results for the 13 bank repair sites to be constructed under three separate contracts between summer 2008 and fall 2009 indicate that there would be no long-term effects on fall, winter, spring, and summer habitat upon any life stage of special-status Chinook salmon and steelhead (Tables 65 and 66; Figures 95 through 100). During all seasons, the project is expected to provide long-term increases in habitat for all salmonid life stages—juvenile rearing, smolt outmigration, and adult migration and habitat. Short-term habitat losses would potentially occur during summer for adult and juvenile Chinook salmon and juvenile steelhead, but would recover to pre-project conditions by Year 3, at the latest, followed by long-term positive habitat gains throughout the modeled time period (WY 2058). Although short- and long-term deficits would occur at some of the individual sites, specifically those in Region 1b, positive habitat values resulting at several sites, including all sites located in Regions 1a and 2, would sufficiently compensate for any such project-related deficits based on the SAM model results. Therefore, no further on-site or off-site habitat mitigation measures for the benefit of Chinook salmon or steelhead life stages would be required to compensate for project-related effects in the action area.

Based on the SAM results, all positive salmonid habitat values are generally due to an improvement to the existing habitat variables, as preferred by the focus life stages, under with-project conditions at most sites. In winter and spring, the overall positive responses at all sites are driven by the features of the planted riparian bench design which, when inundated, will offer relatively increased shallow water habitat (i.e., less-steep bank slope), finer bank substrate size, and increased bank-line cover of instream structure, aquatic vegetation, and overhead shade. During the lower flow conditions in summer and fall, the sites exhibiting positive habitat values by WY 2009 (Year 1) would be those having a planted wetland bench and anchored instream structure (i.e., all sites within Regions 1a and 2). Any short- or long-term deficits during summer and fall would occur at sites having a riparian bench design constructed (e.g., seven of eight sites in Region 1b and the only site in Region 3), which would not offer sufficient instream structure or shade where the summer/fall low flow waterline intersects the relatively steep, coarse, and un-vegetated lower bank below the planted bench surface.

Similar to the modeled habitat responses for salmonids, no long-term effects would occur for delta smelt life stages during winter and spring, which would exhibit positive habitat responses following project construction (Year 1). In summer, habitat deficits for projects located within Region 1b would potentially occur but would recover to and exceed pre-project conditions by WY 2013 (Year 5) with continued positive habitat gains through the modeled time period. Although the project-related impacts are not expected to be significant due to the typical restricted downstream distribution of delta smelt, SAM results indicate that off-site mitigation would be required to off-set potentially significant long-term impacts on spawning and incubation and juvenile rearing habitat. Because delta smelt are restricted to waters with suitable salinity, prior USFWS (2001) recommendations indicate that potential mitigation sites should be

located within the lower reaches of the SRBPP (RM 0–80). Within this reach, areas downstream of RM 20 (i.e., Region 1a) are likely to be the most used by delta smelt (Moyle 2002).

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Tables

Table 1
Summary of the 13 planned bank repair sites located within the SRBPP action area.

Contract	Waterbody	Site	Region	Approximate Site Length (feet) [1]	General Project Design
1 (Summer-Fall 2008)	Steamboat Slough	RM 16.6R	1a	410	Wetland Bench
	Cache Slough	RM 21.8R	1a	950	Wetland Bench
	Sacramento River (RM 20-80)	RM 49.7L	1b	250	Riparian Bench
		RM 52.3L	1b	1,160	Wetland and Riparian Benches
2 (Summer-Fall 2008)	Lower American River	RM 0.3L	1b	340	Riparian Bench
		RM 2.8L	1b	320	Riparian Bench
	Sacramento River (RM 20-80)	RM 53.5R	1b	450	Riparian Bench
	Sacramento River (RM 143-194)	RM 177.8R	3	1,000	Riparian Bench
3 (Summer-Fall 2009)	Sacramento River (RM 0-20)	RM 16.8L	1a	650	Wetland Bench
	Sacramento River (RM 20-80)	RM 42.7R	1b	190	Riparian Bench
		RM 55.2L	1b	690	Riparian Bench
		RM 77.2L	1b	450	Riparian Bench
	Feather River	RM 28.5R	2	1,180	Wetland Bench
Total		13 Sites		8,040	

[1] Site lengths for the 13 sites provided by Ayres Associates (Ayres 2008). Lengths were calculated as the straight line distance between the upstream and downstream ends of each site, which slightly underestimates the true site lengths that factor channel curvature, bank topography, and seasonal water surface elevations.

Table 2
Summary of planned on-site mitigation features at project sites.

Site	Riparian Bench	Wetland Bench	Aquatic Vegetation		Bank Slope (dH:dV)		Substrate Type		Anchored Wood		Overhead Shade Retention [2]	Planting Plan
			Riparian Bench Flooded (Win/Spr)	Wetland Bench Flooded (Year-round)	Avg Across Revetment	Bench Areas	Above Bench (Win/Spr)	Below Bench (Sum/Fall)	Above Bench (Win/Spr)	Below Bench (Sum/Fall)		
SB 16.6R	No	Yes	No	Yes	3:1	6:1	Soil	Soil	Yes [1]	Yes [1]	Yes	Restricted
CS 21.8R	No	Yes	No	Yes	3:1	10:1	Soil	Soil	Yes [1]	Yes [1]	Yes	Un-restricted
SAC 49.7L	Yes	No	Yes	No	3:1	10:1	Soil	Rock	Yes	Yes	Yes	Un-restricted
SAC 52.3L	Yes	Yes	Yes	Yes	3:1	10:1	Soil	Soil	Yes	Yes	Yes	Un-restricted
LA 0.3L	Yes	No	Yes	No	3:1	10:1	Soil	Rock	Yes	Yes [3]	Yes	Un-restricted
LA 2.8L	Yes	No	Yes	No	3:1	10:1	Soil	Rock	Yes	Yes [3]	Yes	Un-restricted
SAC 53.5R	Yes	No	Yes	No	3:1	10:1	Soil	Rock	Yes	Yes	Yes	Restricted
SAC 177.8R	Yes	No	Yes	No	3:1	10:1	Soil	Rock	Yes	Yes	Yes	Restricted
SAC 16.8L	No	Yes	No	Yes	3:1	6:1	Soil	Soil	Yes [1]	Yes [1]	Yes	Restricted
SAC 42.7R	Yes	No	Yes	No	3:1	10:1	Soil	Rock	Yes	Yes	Yes	Restricted
SAC 55.2L	Yes	No	Yes	No	3:1	10:1	Soil	Rock	Yes	Yes	Yes	Un-restricted
SAC 77.2L	Yes	No	Yes	No	3:1	10:1	Soil	Rock	Yes	Yes	Yes	Un-restricted
F 28.5R	No	Yes	No	Yes	3:1	10:1	Soil	Soil	Yes	Yes	Yes	Un-restricted

[1] Installed IWM cover same as existing proportions.

[2] With-project overhead shade coverage is initially less than existing conditions due to the projection of the shoreline away from existing trees on the levee slope and/or removal of existing trees.

[3] Installed IWM at the summer/fall waterline will consist of willow branch fascines.

Table 3
Generalized planting plan used for shade modeling.

Species	Common Name	Restricted [1]	Unrestricted [2]
Acer negundo	box elder		15
Alnus rhombifolia	white alder		74
Fraxinus latifolia	Oregon ash		23
Platanus racemosa	Western sycamore		28
Populus fremontii	Fremont cottonwood		5
Quercus lobata	Valley oak		23
Salix gooddingii	Goodding's willow		5
Salix laevigata	red willow	427	483
Salix lasiolepis	arroyo willow		50
Rosa californica	California wild rose		10
Salix exigua	Narrowleaf willow	860	725
	Total per ha (hex)	1,283	1,443

[1] Restricted planting plan includes planting zones: Zone 1 (herbaceous cover planted 15 feet from levee road); Zone 2A (shrub cover planted on upper bank slope includes hoary coffeeberry and coyote brush); and 2B (small trees cover planted on lower bank slope and riparian bench includes buttonbush, sandbar willow, red willow, and California mugwort).

[2] Unrestricted planting plan includes planting zones: Zone 3A (overstory cover planted on upper bank slope includes valley oak, western sycamore, Oregon ash, and box elder); Zone 3B (overstory cover planted on lower bank slope includes box elder, Fremont cottonwood, western sycamore, Goodding's black willow, arroyo willow, yellow willow, and mule fat); and 3C (overstory cover planted on riparian bench includes buttonbush, sandbar willow, red willow, California mugwort, and white alder).

Table 4
Modeled shade evolution for the 13 planned bank repair sites.

a) Shade estimates for restricted planting plan at:

Sacramento River RMs: 16.8L, 42.7R, 53.5R, and 177.8L;
Steamboat Slough RM 16.6R.

Approx. setback of planting zone to water (ft) *	Fall	Winter	Spring	Summer
Zone 2B	5	0	0	5
Year				
0	0%	0%	0%	0%
1	0%	0%	1%	0%
5	0%	5%	14%	0%
15	61%	18%	55%	61%
25	96%	22%	66%	96%
50	98%	25%	75%	98%

b) Shade estimates for unrestricted planting plan at:

Sacramento River RMs: 49.7L, 52.3L, 55.2L, and 77.2L;
Cache Slough RM 21.8R;
Lower American River RMs: 0.3L and 2.8L;
Feather River RM 28.5R.

Approx. setback of planting zone to water (ft) *	Fall	Winter	Spring	Summer
Zone 3A	25	15	15	25
Zone 3B	20	10	10	20
Zone 3C	5	0	0	5
Year				
0	0%	0%	0%	0%
1	0%	0%	1%	0%
5	0%	4%	13%	0%
15	68%	22%	65%	68%
25	100%	23%	70%	100%
50	100%	25%	75%	100%

* Setback length is the approximate average distance from the seasonal shoreline to the planting zone where overhanging branches would be present.

Table 5
SAM data summary of existing conditions at site Steamboat Slough RM 16.6R.

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet) [1]	1.9	2.9	2.6	2.1
Wetted Area (square feet) [2]	124,650	126,050	125,600	124,875
Shoreline Length (feet) [2]	520	530	520	521
Bank Slope (dH:dV) [2]	3.1	2.9	2.8	3.1
Floodplain Inundation Ratio (AQ2:AQavg) [2]	1	1.02	1.03	1
Bank Substrate Size (D50 in inches) [3]	16	16	16	16
Instream Structure (% shoreline) [4]	11	17	17	11
Vegetation (% shoreline) [3]	13	88	88	13
Shade (% shoreline) [5]	8	2	6	8

[1] Water surface elevations provided by Ayres Associates utilizing nearby stream gauge data and HEC-RAS modelling.

[2] Attributes developed in GIS by Stillwater Sciences using seasonal water surface elevations and bathymetric and topographic survey data provided by Ayres Associates.

[3] Attribute surveyed by Stillwater Sciences following the field data collection protocol for the USACE riprap database (USFWS 2002, Appendix B USACE 2007).

[4] Attribute surveyed by Parus Consulting following the field data collection protocol for the USACE mitigation monitoring plan for riparian and aquatic habitat (USACE 2006c).

[5] Attribute coverage determined from GIS analysis using digitized canopy overlaying seasonal shoreline positions.

Table 6

SAM data summary of project conditions at site Steamboat Slough RM 16.6R.

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	1.9	2.9	2.6	2.1
Wetted Area (square feet)	124,650	126,050	125,600	124,875
Shoreline Length (feet)	520	530	520	521
Bank Slope (dH:dV)				
WY 2008	3.1	2.9	2.8	6
WY 2009-2058	6	6	6	6
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.02	1.03	1
Bank Substrate Size (D50 in inches)				
WY 2008	16	16	16	0.25
WY 2009-2058	0.25	0.25	0.25	0.25
Instream Structure (% shoreline) *				
WY 2008	11	17	17	0
WY 2009-2058	40 (11)	40 (17)	40 (17)	40 (11)
Vegetation (% shoreline)				
WY 2008	13	88	88	0
WY 2009	25	25	50	50
WY 2013	90	90	90	90
WY 2023	100	100	100	100
WY 2033	100	100	100	100
WY 2058	100	100	100	100
Shade (% shoreline)				
WY 2008	8	2	6	2
WY 2009	2	1	2	2
WY 2013	2	5	16	2
WY 2023	62	19	57	62
WY 2033	98	22	67	98
WY 2058	100	25	76	100

WY = water year; spans fall, winter, spring and summer; rock and soil placement assumed during Summer WY 2008 and IWM installation and revegetation planting assumed during Fall WY 2009.

* The final design implementation for those sites upstream of RM 30 includes 80% bank line cover of IWM. However, SAM analyses for these sites uses 40% cover because the species response curves show no significant gains above 40% cover. Accordingly, the difference in actual (80%) and modeled (40%) cover is credited from the near Delta sites above RM 30 to those downstream of RM 30, which show IWM at a 40% cover for salmonids. IWM cover modeled for delta smelt at a given Delta site below RM 30 is the same as the baseline seasonal values from that site.

Table 7
SAM data summary of existing conditions at site Cache Slough RM 21.8R.

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet) [1]	1.9	2.9	2.6	2.1
Wetted Area (square feet) [2]	367,500	369,950	369,775	368,525
Shoreline Length (feet) [2]	1,370	1,383	1,380	1,363
Bank Slope (dH:dV) [2]	3.0	2.5	2.6	2.8
Floodplain Inundation Ratio (AQ2:AQavg) [2]	1	1.02	1.02	1
Bank Substrate Size (D50 in inches) [3]	0.25	0.25	0.25	0.25
Instream Structure (% shoreline) [4]	13	23	23	13
Vegetation (% shoreline) [3]	63	63	63	63
Shade (% shoreline) [5]	55	17	51	63

[1] Water surface elevations provided by Ayres Associates utilizing nearby stream gauge data and HEC-RAS modelling.

[2] Attributes developed in GIS by Stillwater Sciences using seasonal water surface elevations and bathymetric and topographic survey data provided by Ayres Associates.

[3] Attribute surveyed by Stillwater Sciences following the field data collection protocol for the USACE riprap database (USFWS 2002, Appendix B USACE 2007).

[4] Attribute surveyed by Parus Consulting following the field data collection protocol for the USACE mitigation monitoring plan for riparian and aquatic habitat (USACE 2006c).

[5] Attribute coverage determined from GIS analysis using digitized canopy overlaying seasonal shoreline positions.

Table 8

SAM data summary of project conditions at site Cache Slough RM 21.8R.

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	1.9	2.9	2.6	2.1
Wetted Area (square feet)	367,500	369,950	369,775	368,525
Shoreline Length (feet)	1,370	1,383	1,380	1,363
Bank Slope (dH:dV)				
WY 2008	3.0	2.5	2.6	10
WY 2009-2058	10	4	4	10
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.02	1.02	1
Bank Substrate Size (D50 in inches)				
WY 2008	0.25	0.25	0.25	0.25
WY 2009-2058	0.25	0.25	0.25	0.25
Instream Structure (% shoreline) *				
WY 2008	13	23	23	0
WY 2009-2058	40 (13)	40 (23)	40 (23)	40 (13)
Vegetation (% shoreline)				
WY 2008	63	63	63	0
WY 2009	25	25	50	50
WY 2013	90	90	90	90
WY 2023	100	100	100	100
WY 2033	100	100	100	100
WY 2058	100	100	100	100
Shade (% shoreline)				
WY 2008	55	17	51	16
WY 2009	14	5	14	16
WY 2013	14	9	26	16
WY 2023	82	26	78	84
WY 2033	100	27	83	100
WY 2058	100	29	88	100

WY = water year; spans fall, winter, spring and summer; rock and soil placement assumed during Summer WY 2008 and IWM installation and revegetation planting assumed during Fall WY 2009.

* The final design implementation for those sites upstream of RM 30 includes 80% bank line cover of IWM. However, SAM analyses for these sites uses 40% cover because the species response curves show no significant gains above 40% cover. Accordingly, the difference in actual (80%) and modeled (40%) cover is credited from the near Delta sites above RM 30 to those downstream of RM 30, which show IWM at a 40% cover for salmonids. IWM cover modeled for delta smelt at a given Delta site below RM 30 is the same as the baseline seasonal values from that site.

Table 9
SAM data summary of existing conditions at site Sacramento River RM 49.7L.

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet) [1]	3.4	5.5	4.7	3.8
Wetted Area (square feet) [2]	70,700	72,600	72,275	71,350
Shoreline Length (feet) [2]	365	366	376	371
Bank Slope (dH:dV) [2]	2.5	1.7	1.9	2.7
Floodplain Inundation Ratio (AQ2:AQavg) [2]	1	1.10	1.10	1
Bank Substrate Size (D50 in inches) [3]	16	16	16	16
Instream Structure (% shoreline) [3,4]	5	32	32	5
Vegetation (% shoreline) [3]	38	38	38	38
Shade (% shoreline) [5]	25	12	33	35

[1] Water surface elevations provided by Ayres Associates utilizing nearby stream gauge data and HEC-RAS modelling.

[2] Attributes developed in GIS by Stillwater Sciences using seasonal water surface elevations and bathymetric and topographic survey data provided by Ayres Associates.

[3] Attribute surveyed by Stillwater Sciences following the field data collection protocol for the USACE riprap database (USFWS 2002, Appendix B USACE 2007).

[4] Attribute surveyed by Parus Consulting following the field data collection protocol for the USACE mitigation monitoring plan for riparian and aquatic habitat (USACE 2006c).

[5] Attribute coverage determined from GIS analysis using digitized canopy overlaying seasonal shoreline positions.

Table 10

SAM data summary of project conditions at site Sacramento River RM 49.7L.

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	3.4	5.5	4.7	3.8
Wetted Area (square feet)	70,700	72,600	72,275	71,350
Shoreline Length (feet)	365	366	376	371
Bank Slope (dH:dV)				
WY 2008	2.5	1.7	1.9	3
WY 2009-2058	3	10	10	3
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.10	1.10	1
Bank Substrate Size (D50 in inches)				
WY 2008	16	16	16	16
WY 2009-2058	16	0.25	0.25	16
Instream Structure (% shoreline) *				
WY 2008	5	32	32	0
WY 2009-2058	40	40	40	40
Vegetation (% shoreline)				
WY 2008	38	38	38	0
WY 2009	0	25	50	0
WY 2013	0	85	85	0
WY 2023	0	85	85	0
WY 2033	0	85	85	0
WY 2058	0	85	85	0
Shade (% shoreline)				
WY 2008	25	12	33	9
WY 2009	6	3	9	9
WY 2013	6	7	22	9
WY 2023	75	25	73	77
WY 2033	100	26	78	100
WY 2058	100	28	83	100

WY = water year; spans fall, winter, spring and summer; rock and soil placement assumed during Summer WY 2008 and IWM installation and revegetation planting assumed during Fall WY 2009.

* The final design implementation for those sites between RM 30 and RM 60 include 80% bank line cover of IWM. However, SAM analyses for these sites uses 40% cover because the species response curves show no significant gains above 40% cover. Accordingly, the difference in actual (80%) and modeled (40%) cover is credited from the near Delta sites above RM 30 to those downstream of RM 30.

Table 11
SAM data summary of existing conditions at site Sacramento River RM 52.3L.

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet) [1]	3.6	6	5.1	4.1
Wetted Area (square feet) [2]	350,800	363,050	360,325	354,925
Shoreline Length (feet) [2]	1,488	1,487	1,497	1,487
Bank Slope (dH:dV) [2]	4.7	2.0	2.1	2.9
Floodplain Inundation Ratio (AQ2:AQavg) [2]	1	1.10	1.11	1
Bank Substrate Size (D50 in inches) [3]	0.25	0.25	0.25	0.25
Instream Structure (% shoreline) [3,4]	6	18	18	6
Vegetation (% shoreline) [3]	38	63	63	38
Shade (% shoreline) [5]	100	25	75	100

[1] Water surface elevations provided by Ayres Associates utilizing nearby stream gauge data and HEC-RAS modelling.

[2] Attributes developed in GIS by Stillwater Sciences using seasonal water surface elevations and bathymetric and topographic survey data provided by Ayres Associates.

[3] Attribute surveyed by Stillwater Sciences following the field data collection protocol for the USACE riprap database (USFWS 2002, Appendix B USACE 2007).

[4] Attribute surveyed by Parus Consulting following the field data collection protocol for the USACE mitigation monitoring plan for riparian and aquatic habitat (USACE 2006c).

[5] Attribute coverage determined from GIS analysis using digitized canopy overlaying seasonal shoreline positions.

Table 12

SAM data summary of project conditions at site Sacramento River RM 52.3L.

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	3.6	6	5.1	4.1
Wetted Area (square feet)	350,800	363,050	360,325	354,925
Shoreline Length (feet)	1,488	1,487	1,497	1,487
Bank Slope (dH:dV)				
WY 2008	4.7	2.0	2.1	10
WY 2009-2058	10	10	10	10
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.10	1.11	1
Bank Substrate Size (D50 in inches)				
WY 2008	0.25	0.25	0.25	0.25
WY 2009-2058	0.25	0.25	0.25	0.25
Instream Structure (% shoreline) *				
WY 2008	6	18	18	0
WY 2009-2058	40	40	40	40
Vegetation (% shoreline)				
WY 2008	38	63	63	0
WY 2009	25	25	50	50
WY 2013	90	90	90	90
WY 2023	100	100	100	100
WY 2033	100	100	100	100
WY 2058	100	100	100	100
Shade (% shoreline)				
WY 2008	100	25	75	25
WY 2009	25	7	20	25
WY 2013	25	11	32	25
WY 2023	93	28	84	93
WY 2033	100	29	89	100
WY 2058	100	31	94	100

WY = water year; spans fall, winter, spring and summer; rock and soil placement assumed during Summer WY 2008 and IWM installation and revegetation planting assumed during Fall WY 2009.

* The final design implementation for those sites between RM 30 and RM 60 include 80% bank line cover of IWM. However, SAM analyses for these sites uses 40% cover because the species response curves show no significant gains above 40% cover. Accordingly, the difference in actual (80%) and modeled (40%) cover is credited from the near Delta sites above RM 30 to those downstream of RM 30.

Table 13
SAM data summary of existing conditions at site Lower American River RM 0.3L.

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet) [1]	4.4	7.6	6.6	5.2
Wetted Area (square feet) [2]	57,891	62,009	60,723	58,921
Shoreline Length (feet) [2]	435	441	441	435
Bank Slope (dH:dV) [2]	3.7	3.6	3.6	3.6
Floodplain Inundation Ratio (AQ2:AQavg) [2]	1	1.23	1.19	1
Bank Substrate Size (D50 in inches) [3]	0.25	0.25	0.25	0.25
Instream Structure (% shoreline) [4]	1	1	1	1
Vegetation (% shoreline) [3]	38	38	38	38
Shade (% shoreline) [5]	99	25	75	100

[1] Water surface elevations provided by Ayres Associates utilizing nearby stream gauge data and HEC-RAS modelling.

[2] Attributes developed in GIS by Stillwater Sciences using seasonal water surface elevations and bathymetric and topographic survey data provided by Ayres Associates.

[3] Attribute surveyed by Stillwater Sciences following the field data collection protocol for the USACE riprap database (USFWS 2002, Appendix B USACE 2007).

[4] Attribute surveyed by Parus Consulting following the field data collection protocol for the USACE mitigation monitoring plan for riparian and aquatic habitat (USACE 2006c).

[5] Attribute coverage determined from GIS analysis using digitized canopy overlaying seasonal shoreline positions.

Table 14

SAM data summary of project conditions at site Lower American River RM 0.3L.

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	4.4	7.6	6.6	5.2
Wetted Area (square feet)	57,891	62,009	60,723	58,921
Shoreline Length (feet)	435	441	441	435
Bank Slope (dH:dV)				
WY 2008	3.7	3.6	3.6	3
WY 2009-2058	3	10	10	3
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.23	1.19	1
Bank Substrate Size (D50 in inches)				
WY 2008	0.25	0.25	0.25	16
WY 2009-2058	16	0.25	0.25	16
Instream Structure (% shoreline) *				
WY 2008	1	1	1	0
WY 2009-2058	10	40	40	10
Vegetation (% shoreline)				
WY 2008	38	38	38	0
WY 2009	0	25	50	0
WY 2013	0	85	85	0
WY 2023	0	85	85	0
WY 2033	0	85	85	0
WY 2058	0	85	85	0
Shade (% shoreline)				
WY 2008	99	25	75	25
WY 2009	25	7	20	25
WY 2013	25	11	32	25
WY 2023	93	28	84	93
WY 2033	100	29	89	100
WY 2058	100	31	94	100

WY = water year; spans fall, winter, spring and summer; rock and soil placement assumed during Summer WY 2008 and IWM installation and revegetation planting assumed during Fall WY 2009.

* IWM installed below the summer/fall waterline includes willow fascines only.

Table 15
SAM data summary of existing conditions at site Lower American River RM 2.8L.

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet) [1]	4.6	7.7	6.7	5.4
Wetted Area (square feet) [2]	52,274	54,510	53,789	52,851
Shoreline Length (feet) [2]	425	425	425	420
Bank Slope (dH:dV) [2]	2.0	2.1	2.1	2.1
Floodplain Inundation Ratio (AQ2:AQavg) [2]	1	1.15	1.12	1
Bank Substrate Size (D50 in inches) [3]	0.25	0.25	0.25	0.25
Instream Structure (% shoreline) [4]	8	13	13	8
Vegetation (% shoreline) [3]	38	38	38	38
Shade (% shoreline) [5]	84	21	64	85

[1] Water surface elevations provided by Ayres Associates utilizing nearby stream gauge data and HEC-RAS modelling.

[2] Attributes developed in GIS by Stillwater Sciences using seasonal water surface elevations and bathymetric and topographic survey data provided by Ayres Associates.

[3] Attribute surveyed by Stillwater Sciences following the field data collection protocol for the USACE riprap database (USFWS 2002, Appendix B USACE 2007).

[4] Attribute surveyed by Parus Consulting following the field data collection protocol for the USACE mitigation monitoring plan for riparian and aquatic habitat (USACE 2006c).

[5] Attribute coverage determined from GIS analysis using digitized canopy overlaying seasonal shoreline positions.

Table 16

SAM data summary of project conditions at site Lower American River RM 2.8L.

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	4.6	7.7	6.7	5.4
Wetted Area (square feet)	52,274	54,510	53,789	52,851
Shoreline Length (feet)	425	425	425	420
Bank Slope (dH:dV)				
WY 2008	2.0	2.1	2.1	3
WY 2009-2058	3	10	10	3
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.15	1.12	1
Bank Substrate Size (D50 in inches)				
WY 2008	0.25	0.25	0.25	16
WY 2009-2058	16	0.25	0.25	16
Instream Structure (% shoreline) *				
WY 2008	8	13	13	0
WY 2009-2058	10	40	40	10
Vegetation (% shoreline)				
WY 2008	38	38	38	0
WY 2009	0	25	50	0
WY 2013	0	85	85	0
WY 2023	0	85	85	0
WY 2033	0	85	85	0
WY 2058	0	85	85	0
Shade (% shoreline)				
WY 2008	84	21	64	21
WY 2009	21	6	17	21
WY 2013	21	10	29	21
WY 2023	89	27	81	90
WY 2033	100	28	86	100
WY 2058	100	30	91	100

WY = water year; spans fall, winter, spring and summer; rock and soil placement assumed during Summer WY 2008 and IWM installation and revegetation planting assumed during Fall WY 2009.

* IWM installed below the summer/fall waterline includes willow fascines only.

Table 17
SAM data summary of existing conditions at site Sacramento River RM 53.5R.

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet) [1]	3.7	6.2	5.4	4.3
Wetted Area (square feet) [2]	93,000	97,125	95,750	93,950
Shoreline Length (feet) [2]	530	509	494	515
Bank Slope (dH:dV) [2]	3.8	3.7	3.8	3.8
Floodplain Inundation Ratio (AQ2:AQavg) [2]	1	1.14	1.15	1
Bank Substrate Size (D50 in inches) [3]	0.25	0.25	0.25	0.25
Instream Structure (% shoreline) [4]	0	0	0	0
Vegetation (% shoreline) [3]	13	38	38	13
Shade (% shoreline) [5]	31	10	26	30

[1] Water surface elevations provided by Ayres Associates utilizing nearby stream gauge data and HEC-RAS modelling.

[2] Attributes developed in GIS by Stillwater Sciences using seasonal water surface elevations and bathymetric and topographic survey data provided by Ayres Associates.

[3] Attribute surveyed by Stillwater Sciences following the field data collection protocol for the USACE riprap database (USFWS 2002, Appendix B USACE 2007).

[4] Attribute surveyed by Parus Consulting following the field data collection protocol for the USACE mitigation monitoring plan for riparian and aquatic habitat (USACE 2006c).

[5] Attribute coverage determined from GIS analysis using digitized canopy overlaying seasonal shoreline positions.

Table 18

SAM data summary of project conditions at site Sacramento River RM 53.5R.

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	3.7	6.2	5.4	4.3
Wetted Area (square feet)	93,000	97,125	95,750	93,950
Shoreline Length (feet)	530	509	494	515
Bank Slope (dH:dV)				
WY 2008	3.8	3.7	3.8	3
WY 2009-2058	3	10	10	3
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.14	1.15	1
Bank Substrate Size (D50 in inches)				
WY 2008	0.25	0.25	0.25	16
WY 2009-2058	16	0.25	0.25	16
Instream Structure (% shoreline) *				
WY 2008	0	0	0	0
WY 2009-2058	40	40	40	40
Vegetation (% shoreline)				
WY 2008	13	38	38	0
WY 2009	0	25	50	0
WY 2013	0	85	85	0
WY 2023	0	85	85	0
WY 2033	0	85	85	0
WY 2058	0	85	85	0
Shade (% shoreline)				
WY 2008	31	10	26	8
WY 2009	8	3	8	8
WY 2013	8	7	21	8
WY 2023	68	21	62	68
WY 2033	100	24	73	100
WY 2058	100	27	82	100

WY = water year; spans fall, winter, spring and summer; rock and soil placement assumed during Summer WY 2008 and IWM installation and revegetation planting assumed during Fall WY 2009.

* The final design implementation for those sites between RM 30 and RM 60 include 80% bank line cover of IWM. However, SAM analyses for these sites uses 40% cover because the species response curves show no significant gains above 40% cover. Accordingly, the difference in actual (80%) and modeled (40%) cover is credited from the near Delta sites above RM 30 to those downstream of RM 30.

Table 19
SAM data summary of existing conditions at site Sacramento River RM 177.8R.

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet) [1]	84.4	87.3	86.7	86
Wetted Area (square feet) [2]	155,775	163,425	161,925	159,900
Shoreline Length (feet) [2]	1,192	1,185	1,191	1,190
Bank Slope (dH:dV) [2]	1.87	2.06	2.06	2.08
Floodplain Inundation Ratio (AQ2:AQavg) [2]	1	1.21	1.22	1
Bank Substrate Size (D50 in inches) [3]	0.25	0.25	0.25	0.25
Instream Structure (% shoreline) [4]	0	0	0	0
Vegetation (% shoreline) [3]	13	63	63	13
Shade (% shoreline) [5]	0	0	0	0

[1] Water surface elevations provided by Ayres Associates utilizing nearby stream gauge data and HEC-RAS modelling.

[2] Attributes developed in GIS by Stillwater Sciences using seasonal water surface elevations and bathymetric and topographic survey data provided by Ayres Associates.

[3] Attribute surveyed by Stillwater Sciences following the field data collection protocol for the USACE riprap database (USFWS 2002, Appendix B USACE 2007).

[4] Attribute surveyed by Parus Consulting following the field data collection protocol for the USACE mitigation monitoring plan for riparian and aquatic habitat (USACE 2006c).

[5] Attribute coverage determined from GIS analysis using digitized canopy overlaying seasonal shoreline positions.

Table 20

SAM data summary of project conditions at site Sacramento River RM 177.8R.

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	84.4	87.3	86.7	86
Wetted Area (square feet)	155,775	163,425	161,925	159,900
Shoreline Length (feet)	1,192	1,185	1,191	1,190
Bank Slope (dH:dV)				
WY 2008	1.9	2.1	2.1	3
WY 2009-2058	3	3	3	3
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.21	1.22	1
Bank Substrate Size (D50 in inches)				
WY 2008	0.25	0.25	0.25	16
WY 2009-2058	16	0.25	0.25	16
Instream Structure (% shoreline)				
WY 2008	0	0	0	0
WY 2009-2058	40	40	40	40
Vegetation (% shoreline)				
WY 2008	13	63	63	0
WY 2009	0	25	50	0
WY 2013	0	85	85	0
WY 2023	0	85	85	0
WY 2033	0	85	85	0
WY 2058	0	85	85	0
Shade (% shoreline)				
WY 2008	0	0	0	0
WY 2009	0	0	1	0
WY 2013	0	5	14	0
WY 2023	61	18	55	61
WY 2033	96	22	66	96
WY 2058	98	25	75	98

WY = water year; spans fall, winter, spring and summer; rock and soil placement assumed during Summer WY 2008 and IWM installation and revegetation planting assumed during Fall WY 2009.

Table 21
SAM data summary of existing conditions at site Sacramento River RM 16.8L.

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet) [1]	1.9	2.9	2.6	2.1
Wetted Area (square feet) [2]	96,525	98,075	97,700	96,775
Shoreline Length (feet) [2]	759	760	755	759
Bank Slope (dH:dV) [2]	1.8	1.6	1.7	1.8
Floodplain Inundation Ratio (AQ2:AQavg) [2]	1	1.03	1.03	1
Bank Substrate Size (D50 in inches) [3]	20	20	20	20
Instream Structure (% shoreline) [4]	0	3	3	0
Vegetation (% shoreline) [3]	13	13	13	13
Shade (% shoreline) [5]	69	20	58	72

[1] Water surface elevations provided by Ayres Associates utilizing nearby stream gauge data and HEC-RAS modelling.

[2] Attributes developed in GIS by Stillwater Sciences using seasonal water surface elevations and bathymetric and topographic survey data provided by Ayres Associates.

[3] Attribute surveyed by Stillwater Sciences following the field data collection protocol for the USACE riprap database (USFWS 2002, Appendix B USACE 2007).

[4] Attribute surveyed by Parus Consulting following the field data collection protocol for the USACE mitigation monitoring plan for riparian and aquatic habitat (USACE 2006c).

[5] Attribute coverage determined from GIS analysis using digitized canopy overlaying seasonal shoreline positions.

Table 22

SAM data summary of project conditions at site Sacramento River RM 16.8L.

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	1.9	2.9	2.6	2.1
Wetted Area (square feet)	96,525	98,075	97,700	96,775
Shoreline Length (feet)	759	760	755	759
Bank Slope (dH:dV)				
WY 2009	1.8	1.6	1.7	6
WY 2010-2059	6	6	6	6
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.03	1.03	1
Bank Substrate Size (D50 in inches)				
WY 2009	20	20	20	0.25
WY 2010-2059	0.25	0.25	0.25	0.25
Instream Structure (% shoreline) *				
WY 2009	0	3	3	0
WY 2010-2059	40 (0)	40 (3)	40 (3)	40 (0)
Vegetation (% shoreline)				
WY 2009	13	13	13	0
WY 2010	25	25	50	50
WY 2014	90	90	90	90
WY 2024	100	100	100	100
WY 2034	100	100	100	100
WY 2059	100	100	100	100
Shade (% shoreline)				
WY 2009	69	20	58	18
WY 2010	17	5	16	18
WY 2014	17	10	29	18
WY 2024	78	23	70	78
WY 2034	100	27	80	100
WY 2059	100	30	89	100

WY = water year; spans fall, winter, spring and summer; rock and soil placement assumed during Summer WY 2009 and IWM installation and revegetation planting assumed during Fall WY 2010.

* The final design implementation for those sites upstream of RM 30 includes 80% bank line cover of IWM. However, SAM analyses for these sites uses 40% cover because the species response curves show no significant gains above 40% cover. Accordingly, the difference in actual (80%) and modeled (40%) cover is credited from the near Delta sites above RM 30 to those downstream of RM 30, which show IWM at a 40% cover for salmonids. IWM cover modeled for delta smelt at a given Delta site below RM 30 is the same as the baseline seasonal values from that site.

Table 23
SAM data summary of existing conditions at site Sacramento River RM 42.7L.

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet) [1]	2.9	5.3	4.5	3.5
Wetted Area (square feet) [2]	35,800	37,550	37,125	36,425
Shoreline Length (feet) [2]	270	265	265	270
Bank Slope (dH:dV) [2]	4.1	2.5	2.8	3.7
Floodplain Inundation Ratio (AQ2:AQavg) [2]	1	1.09	1.10	1
Bank Substrate Size (D50 in inches) [3]	6	6	6	6
Instream Structure (% shoreline) [4]	24	43	43	24
Vegetation (% shoreline) [3]	38	63	63	38
Shade (% shoreline) [5]	9	9	10	9

[1] Water surface elevations provided by Ayres Associates utilizing nearby stream gauge data and HEC-RAS modelling.

[2] Attributes developed in GIS by Stillwater Sciences using seasonal water surface elevations and bathymetric and topographic survey data provided by Ayres Associates.

[3] Attribute surveyed by Stillwater Sciences following the field data collection protocol for the USACE riprap database (USFWS 2002, Appendix B USACE 2007).

[4] Attribute surveyed by Parus Consulting following the field data collection protocol for the USACE mitigation monitoring plan for riparian and aquatic habitat (USACE 2006c).

[5] Attribute coverage determined from GIS analysis using digitized canopy overlaying seasonal shoreline positions. Shade cover estimate included shoreline coverage from a 25-foot wide dock structure.

Table 24

SAM data summary of project conditions at site Sacramento River RM 42.7R.

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	2.9	5.3	4.5	3.5
Wetted Area (square feet)	35,800	37,550	37,125	36,425
Shoreline Length (feet)	270	265	265	270
Bank Slope (dH:dV)				
WY 2009	4.1	2.5	2.8	3
WY 2010-2059	3	10	10	3
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.09	1.10	1
Bank Substrate Size (D50 in inches)				
WY 2009	6	6	6	16
WY 2010-2059	16	0.25	0.25	16
Instream Structure (% shoreline) *				
WY 2009	24	43	43	0
WY 2010-2059	40	40	40	40
Vegetation (% shoreline)				
WY 2009	38	63	63	0
WY 2010	0	25	50	0
WY 2014	0	85	85	0
WY 2024	0	85	85	0
WY 2034	0	85	85	0
WY 2059	0	85	85	0
Shade (% shoreline)				
WY 2009	9	9	10	9
WY 2010	9	10	11	9
WY 2014	9	14	24	9
WY 2024	70	28	65	70
WY 2034	100	31	76	100
WY 2059	100	34	85	100

WY = water year; spans fall, winter, spring and summer; rock and soil placement assumed during Summer WY 2009 and IWM installation and revegetation planting assumed during Fall WY 2010.

* The final design implementation for those sites between RM 30 and RM 60 include 80% bank line cover of IWM. However, SAM analyses for these sites uses 40% cover because the species response curves show no significant gains above 40% cover. Accordingly, the difference in actual (80%) and modeled (40%) cover is credited from the near Delta sites above RM 30 to those downstream of RM 30.

Table 25
SAM data summary of existing conditions at site Sacramento River RM 55.2L.

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet) [1]	3.9	6.5	5.6	4.5
Wetted Area (square feet) [2]	108,725	112,725	111,325	109,600
Shoreline Length (feet) [2]	900	920	920	912
Bank Slope (dH:dV) [2]	2.1	1.9	2.1	2.1
Floodplain Inundation Ratio (AQ2:AQavg) [2]	1	1.19	1.20	1
Bank Substrate Size (D50 in inches) [3]	0.25	0.25	0.25	0.25
Instream Structure (% shoreline) [3,4]	9	11	11	9
Vegetation (% shoreline) [3]	38	63	63	38
Shade (% shoreline) [5]	87	23	67	88

[1] Water surface elevations provided by Ayres Associates utilizing nearby stream gauge data and HEC-RAS modelling.

[2] Attributes developed in GIS by Stillwater Sciences using seasonal water surface elevations and bathymetric and topographic survey data provided by Ayres Associates.

[3] Attribute surveyed by Stillwater Sciences following the field data collection protocol for the USACE riprap database (USFWS 2002, Appendix B USACE 2007).

[4] Attribute surveyed by Parus Consulting following the field data collection protocol for the USACE mitigation monitoring plan for riparian and aquatic habitat (USACE 2006c).

[5] Attribute coverage determined from GIS analysis using digitized canopy overlaying seasonal shoreline positions.

Table 26

SAM data summary of project conditions at site Sacramento River RM 55.2L.

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	3.9	6.5	5.6	4.5
Wetted Area (square feet)	108,725	112,725	111,325	109,600
Shoreline Length (feet)	900	920	920	912
Bank Slope (dH:dV)				
WY 2009	2.1	1.9	2.1	3
WY 2010-2059	3	10	10	3
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.19	1.20	1
Bank Substrate Size (D50 in inches)				
WY 2009	0.25	0.25	0.25	16
WY 2010-2059	16	0.25	0.25	16
Instream Structure (% shoreline) *				
WY 2009	9	11	11	0
WY 2010-2059	40	40	40	40
Vegetation (% shoreline)				
WY 2009	38	63	63	0
WY 2010	0	25	50	0
WY 2014	0	85	85	0
WY 2024	0	85	85	0
WY 2034	0	85	85	0
WY 2059	0	85	85	0
Shade (% shoreline)				
WY 2009	87	23	67	22
WY 2010	22	6	18	22
WY 2014	22	10	30	22
WY 2024	90	27	82	90
WY 2034	100	29	87	100
WY 2059	100	31	92	100

WY = water year; spans fall, winter, spring and summer; rock and soil placement assumed during Summer WY 2009 and IWM installation and revegetation planting assumed during Fall WY 2010.

* The final design implementation for those sites between RM 30 and RM 60 include 80% bank line cover of IWM. However, SAM analyses for these sites uses 40% cover because the species response curves show no significant gains above 40% cover. Accordingly, the difference in actual (80%) and modeled (40%) cover is credited from the near Delta sites above RM 30 to those downstream of RM 30.

Table 27
SAM data summary of existing conditions at site Sacramento River RM 77.2L.

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet) [1]	10.5	15.2	13.5	11.7
Wetted Area (square feet) [2]	110,600	114,650	113,175	111,475
Shoreline Length (feet) [2]	505	510	540	514
Bank Slope (dH:dV) [2]	2.0	2.0	2.0	2.0
Floodplain Inundation Ratio (AQ2:AQavg) [2]	1	1.08	1.10	1
Bank Substrate Size (D50 in inches) [3]	0.25	0.25	0.25	0.25
Instream Structure (% shoreline) [4]	0	0	0	0
Vegetation (% shoreline) [3]	38	63	63	38
Shade (% shoreline) [5]	15	16	37	22

[1] Water surface elevations provided by Ayres Associates utilizing nearby stream gauge data and HEC-RAS modelling.

[2] Attributes developed in GIS by Stillwater Sciences using seasonal water surface elevations and bathymetric and topographic survey data provided by Ayres Associates.

[3] Attribute surveyed by Stillwater Sciences following the field data collection protocol for the USACE riprap database (USFWS 2002, Appendix B USACE 2007).

[4] Attribute surveyed by Parus Consulting following the field data collection protocol for the USACE mitigation monitoring plan for riparian and aquatic habitat (USACE 2006c).

[5] Attribute coverage determined from GIS analysis using digitized canopy overlaying seasonal shoreline positions.

Table 28

SAM data summary of project conditions at site Sacramento River RM 77.2L.

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	10.5	15.2	13.5	11.7
Wetted Area (square feet)	110,600	114,650	113,175	111,475
Shoreline Length (feet)	505	510	540	514
Bank Slope (dH:dV)				
WY 2009	2.0	2.0	2.0	3
WY 2010-2059	3	10	10	3
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.08	1.10	1
Bank Substrate Size (D50 in inches)				
WY 2009	0.25	0.25	0.25	16
WY 2010-2059	16	0.25	0.25	16
Instream Structure (% shoreline)				
WY 2009	0	0	0	0
WY 2010-2059	40	40	40	40
Vegetation (% shoreline)				
WY 2009	38	63	63	0
WY 2010	0	25	50	0
WY 2014	0	85	85	0
WY 2024	0	85	85	0
WY 2034	0	85	85	0
WY 2059	0	85	85	0
Shade (% shoreline)				
WY 2009	15	16	37	5
WY 2010	4	4	10	5
WY 2014	4	9	23	5
WY 2024	72	26	74	74
WY 2034	100	27	79	100
WY 2059	100	29	84	100

WY = water year; spans fall, winter, spring and summer; rock and soil placement assumed during Summer WY 2009 and IWM installation and revegetation planting assumed during Fall WY 2010.

Table 29
SAM data summary of existing conditions at site Feather River RM 28.5R.

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet) [1]	36	36.4	36.4	37.5
Wetted Area (square feet) [2]	146,025	147,175	147,175	149,750
Shoreline Length (feet) [2]	1,645	1,640	1,632	1,650
Bank Slope (dH:dV) [2]	2.2	2.1	2.1	1.9
Floodplain Inundation Ratio (AQ2:AQavg) [2]	1	1.17	1.17	1
Bank Substrate Size (D50 in inches) [3]	4	4	4	4
Instream Structure (% shoreline) [4]	3	7	7	3
Vegetation (% shoreline) [3]	25	25	25	25
Shade (% shoreline) [5]	3	3	3	3

[1] Water surface elevations provided by Ayres Associates utilizing nearby stream gauge data and HEC-RAS modelling.

[2] Attributes developed in GIS by Stillwater Sciences using seasonal water surface elevations and bathymetric and topographic survey data provided by Ayres Associates.

[3] Attribute surveyed by Stillwater Sciences following the field data collection protocol for the USACE riprap database (USFWS 2002, Appendix B USACE 2007).

[4] Attribute surveyed by Parus Consulting following the field data collection protocol for the USACE mitigation monitoring plan for riparian and aquatic habitat (USACE 2006c).

[5] Attribute coverage determined from GIS analysis using digitized canopy overlaying seasonal shoreline positions.

Table 30

SAM data summary of project conditions at site Feather River RM 28.5R.

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	36	36.4	36.4	37.5
Wetted Area (square feet)	146,025	147,175	147,175	149,750
Shoreline Length (feet)	1,645	1,640	1,632	1,650
Bank Slope (dH:dV)				
WY 2009	2.2	2.1	2.1	10
WY 2010-2059	10	10	10	10
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.17	1.17	1
Bank Substrate Size (D50 in inches)				
WY 2009	4	4	4	0.25
WY 2010-2059	0.25	0.25	0.25	0.25
Instream Structure (% shoreline) *				
WY 2009	3	7	7	0
WY 2010-2059	40	40	40	40
Vegetation (% shoreline)				
WY 2009	25	25	25	0
WY 2010	25	25	50	50
WY 2014	90	90	90	90
WY 2024	100	100	100	100
WY 2034	100	100	100	100
WY 2059	100	100	100	100
Shade (% shoreline)				
WY 2009	3	3	3	1
WY 2010	1	1	2	1
WY 2014	1	5	14	1
WY 2024	69	23	66	69
WY 2034	101	24	71	101
WY 2059	101	26	76	101

WY = water year; spans fall, winter, spring and summer; rock and soil placement assumed during Summer WY 2009 and IWM installation and revegetation planting assumed during Fall WY 2010.

* IWM installed below the summer/fall waterline includes willow fascines only.

Table 31
SAM results showing bank-line weighted relative response (feet) at site Steamboat Slough RM 16.6R.

Focus Fish Species and Scenario	Fall (September-November)					Winter (December-February)					Spring (March-May)					Summer (June-August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2009 (Year 1)	8		13	50		6		12	33		5		12	42		-6		11	52	
WY 2013 (Year 5)	15		23	101		12		24	77		12		30	92		12		23	110	
WY 2023 (Year 15)	24		42	140		17		35	109		21		49	122		23		42	143	
WY 2033 (Year 25)	32		56	160		20		42	123		27		59	133		31		56	162	
WY 2058 (Year 50)	39		68	175		23		48	136		31		67	142		39		68	176	
Central Valley fall-run chinook salmon																				
WY 2008 (Year 0)	0		0	0				0	0		0			0		0			0	
WY 2009 (Year 1)	8		13	50				12	33		5			42		-6			52	
WY 2013 (Year 5)	15		23	101				24	77		12			92		12			110	
WY 2023 (Year 15)	24		42	140				35	109		21			122		23			143	
WY 2033 (Year 25)	32		56	160				42	123		27			133		31			162	
WY 2058 (Year 50)	39		68	175				48	136		31			142		39			176	
Central Valley late fall-run chinook salmon																				
WY 2008 (Year 0)	0			0		0			0		0		0	0					0	
WY 2009 (Year 1)	8			50		6			33		5		12	42					52	
WY 2013 (Year 5)	15			101		12			77		12		30	92					110	
WY 2023 (Year 15)	24			140		17			109		21		49	122					143	
WY 2033 (Year 25)	32			160		20			123		27		59	133					162	
WY 2058 (Year 50)	39			175		23			136		31		67	142					176	
Sacramento River winter-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0		
WY 2009 (Year 1)	8		13	50		6		12	33		5		12	42		-6		11		
WY 2013 (Year 5)	15		23	101		12		24	77		12		30	92		12		23		
WY 2023 (Year 15)	24		42	140		17		35	109		21		49	122		23		42		
WY 2033 (Year 25)	32		56	160		20		42	123		27		59	133		31		56		
WY 2058 (Year 50)	39		68	175		23		48	136		31		67	142		39		68		
Central Valley steelhead																				
WY 2008 (Year 0)	0		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0
WY 2009 (Year 1)	18		20	41	18	12		19	29	11	11		19	32	11	-10		17	33	-10
WY 2013 (Year 5)	32		37	77	32	25		38	61	26	26		44	68	26	27		37	80	27
WY 2023 (Year 15)	49		61	104	49	35		52	82	43	43		68	91	43	47		61	105	47
WY 2033 (Year 25)	62		78	120	62	41		61	92	51	51		80	101	51	61		78	120	61
WY 2058 (Year 50)	73		93	132	73	47		70	101	59	59		91	108	59	72		93	132	72
Delta Smelt																				
WY 2008 (Year 0)	0				0	0	0	0		0	0	0	0		0	0	0	0		0
WY 2009 (Year 1)	0				0	0	12	12		0	0	15	15		0	0	-38	-38		0
WY 2013 (Year 5)	0				0	0	23	23		0	0	26	26		0	0	31	31		0
WY 2023 (Year 15)	0				0	0	27	27		0	0	28	28		0	0	43	43		0
WY 2033 (Year 25)	0				0	0	28	28		0	0	28	28		0	0	45	45		0
WY 2058 (Year 50)	0				0	0	29	29		0	0	29	29		0	0	47	47		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table 32
SAM results showing bank-line weighted relative response (feet) at site Cache Slough RM 21.8R.

Focus Fish Species and Scenario	Fall (September-November)					Winter (December-February)					Spring (March-May)					Summer (June-August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2009 (Year 1)	3		10	24		-1		-1	-24		-10		-7	12		-56		-29	-79	
WY 2013 (Year 5)	5		21	78		2		5	-1		-11		1	46		-8		22	97	
WY 2023 (Year 15)	23		57	140		13		29	64		6		31	83		17		61	154	
WY 2033 (Year 25)	39		84	168		20		44	93		18		47	96		33		87	179	
WY 2058 (Year 50)	51		105	189		27		57	117		27		60	105		46		107	197	
Central Valley fall-run chinook salmon																				
WY 2008 (Year 0)	0		0	0				0	0		0			0		0			0	
WY 2009 (Year 1)	3		10	24				-1	-24		-10			12		-56			-79	
WY 2013 (Year 5)	5		21	78				5	-1		-11			46		-8			97	
WY 2023 (Year 15)	23		57	140				29	64		6			83		17			154	
WY 2033 (Year 25)	39		84	168				44	93		18			96		33			179	
WY 2058 (Year 50)	51		105	189				57	117		27			105		46			197	
Central Valley late fall-run chinook salmon																				
WY 2008 (Year 0)	0			0		0			0		0		0	0					0	
WY 2009 (Year 1)	3			24		-1			-24		-10		-7	12					-79	
WY 2013 (Year 5)	5			78		2			-1		-11		1	46					97	
WY 2023 (Year 15)	23			140		13			64		6		31	83					154	
WY 2033 (Year 25)	39			168		20			93		18		47	96					179	
WY 2058 (Year 50)	51			189		27			117		27		60	105					197	
Sacramento River winter-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0		
WY 2009 (Year 1)	3		10	24		-1		-1	-24		-10		-7	12		-56		-29		
WY 2013 (Year 5)	5		21	78		2		5	-1		-11		1	46		-8		22		
WY 2023 (Year 15)	23		57	140		13		29	64		6		31	83		17		61		
WY 2033 (Year 25)	39		84	168		20		44	93		18		47	96		33		87		
WY 2058 (Year 50)	51		105	189		27		57	117		27		60	105		46		107		
Central Valley steelhead																				
WY 2008 (Year 0)	0		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0
WY 2009 (Year 1)	19		14	21	19	-1		-1	-12	-12	-12		-9	-1	-12	-84		-45	-82	-84
WY 2013 (Year 5)	34		28	51	34	4		8	-1	-9	-9		1	15	-9	14		27	52	14
WY 2023 (Year 15)	63		71	90	63	26		37	38	18	18		37	42	18	55		75	97	55
WY 2033 (Year 25)	86		103	113	86	40		57	59	34	34		57	54	34	79		106	119	79
WY 2058 (Year 50)	104		129	131	104	53		73	76	46	46		72	63	46	98		131	136	98
Delta Smelt																				
WY 2008 (Year 0)	0				0	0	0	0		0	0	0	0		0	0	0	0		0
WY 2009 (Year 1)	0				0	0	19	19		0	0	27	27		0	0	-145	-145		0
WY 2013 (Year 5)	0				0	0	42	42		0	0	47	47		0	0	48	48		0
WY 2023 (Year 15)	0				0	0	50	50		0	0	51	51		0	0	81	81		0
WY 2033 (Year 25)	0				0	0	52	52		0	0	52	52		0	0	87	87		0
WY 2058 (Year 50)	0				0	0	53	53		0	0	52	52		0	0	92	92		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table 33
SAM results showing bank-line weighted relative response (feet) at site Sacramento River RM 49.7L.

Focus Fish Species and Scenario	Fall (September-November)					Winter (December-February)					Spring (March-May)					Summer (June-August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2009 (Year 1)	8		-2	-10		-1		9	22		-3		9	30		-2		-8	-37	
WY 2013 (Year 5)	14		-4	-18		-1		18	51		-4		21	64		11		-6	-24	
WY 2023 (Year 15)	20		-1	-13		2		26	74		1		34	81		18		-3	-17	
WY 2033 (Year 25)	25		1	-9		4		32	83		4		41	86		24		-1	-13	
WY 2058 (Year 50)	30		2	-6		5		36	91		7		46	90		28		1	-10	
Central Valley fall-run chinook salmon																				
WY 2008 (Year 0)	0		0					0	0		0		0	0		0				
WY 2009 (Year 1)	8		-2					9	22		-3		0	30		-2				
WY 2013 (Year 5)	14		-4					18	51		-4		0	64		11				
WY 2023 (Year 15)	20		-1					26	74		1		0	81		18				
WY 2033 (Year 25)	25		1					32	83		4		0	86		24				
WY 2058 (Year 50)	30		2					36	91		7		0	90		28				
Central Valley late fall-run chinook salmon																				
WY 2008 (Year 0)	0			0		0			0		0		0							
WY 2009 (Year 1)	8			-10		-1			22		-3		9							
WY 2013 (Year 5)	14			-18		-1			51		-4		21							
WY 2023 (Year 15)	20			-13		2			74		1		34							
WY 2033 (Year 25)	25			-9		4			83		4		41							
WY 2058 (Year 50)	30			-6		5			91		7		46							
Sacramento River winter-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0		
WY 2009 (Year 1)	8		-2	-10		-1		9	22		-3		9	30		-2		-8		
WY 2013 (Year 5)	14		-4	-18		-1		18	51		-4		21	64		11		-6		
WY 2023 (Year 15)	20		-1	-13		2		26	74		1		34	81		18		-3		
WY 2033 (Year 25)	25		1	-9		4		32	83		4		41	86		24		-1		
WY 2058 (Year 50)	30		2	-6		5		36	91		7		46	90		28		1		
Central Valley steelhead																				
WY 2008 (Year 0)	0		0		0	0		0	0	0	0		0	0	0	0		0		0
WY 2009 (Year 1)	18		-3		18	-3		13	19	-6	-6		13	21	-6	1		-13		1
WY 2013 (Year 5)	32		-6		32	-3		26	40	-7	-7		30	44	-7	27		-9		27
WY 2023 (Year 15)	43		-2		43	3		37	54	1	1		45	56	1	41		-5		41
WY 2033 (Year 25)	51		2		51	7		44	61	6	6		53	61	6	49		-1		49
WY 2058 (Year 50)	58		4		58	10		49	67	10	10		59	65	10	55		2		55
Delta Smelt																				
WY 2008 (Year 0)	0				0	0	0	0		0	0	0	0		0	0	0	0		0
WY 2009 (Year 1)	0				0	0	20	20		0	0	22	22		0	0	-58	-58		0
WY 2013 (Year 5)	0				0	0	38	38		0	0	39	39		0	0	-36	-36		0
WY 2023 (Year 15)	0				0	0	42	42		0	0	42	42		0	0	-32	-32		0
WY 2033 (Year 25)	0				0	0	43	43		0	0	43	43		0	0	-31	-31		0
WY 2058 (Year 50)	0				0	0	44	44		0	0	43	43		0	0	-31	-31		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table 34
SAM results showing bank-line weighted relative response (feet) at site Sacramento River RM 52.3L.

Focus Fish Species and Scenario	Fall (September-November)					Winter (December-February)					Spring (March-May)					Summer (June-August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2009 (Year 1)	21		32	77		2		17	17		-6		27	77		-24		9	27	
WY 2013 (Year 5)	38		60	178		6		38	79		-5		63	162		29		74	226	
WY 2023 (Year 15)	56		89	238		18		70	155		12		100	201		53		108	278	
WY 2033 (Year 25)	69		109	256		26		89	187		22		117	213		67		129	296	
WY 2058 (Year 50)	79		124	271		32		107	212		31		131	222		78		145	309	
Central Valley fall-run chinook salmon																				
WY 2008 (Year 0)	0		0					0	0		0			0		0				
WY 2009 (Year 1)	21		32					17	17		-6			77		-24				
WY 2013 (Year 5)	38		60					38	79		-5			162		29				
WY 2023 (Year 15)	56		89					70	155		12			201		53				
WY 2033 (Year 25)	69		109					89	187		22			213		67				
WY 2058 (Year 50)	79		124					107	212		31			222		78				
Central Valley late fall-run chinook salmon																				
WY 2008 (Year 0)	0			0		0			0		0		0							
WY 2009 (Year 1)	21			77		2			17		-6		27							
WY 2013 (Year 5)	38			178		6			79		-5		63							
WY 2023 (Year 15)	56			238		18			155		12		100							
WY 2033 (Year 25)	69			256		26			187		22		117							
WY 2058 (Year 50)	79			271		32			212		31		131							
Sacramento River winter-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0		
WY 2009 (Year 1)	21		32	77		2		17	17		-6		27	77		-24		9		
WY 2013 (Year 5)	38		60	178		6		38	79		-5		63	162		29		74		
WY 2023 (Year 15)	56		89	238		18		70	155		12		100	201		53		108		
WY 2033 (Year 25)	69		109	256		26		89	187		22		117	213		67		129		
WY 2058 (Year 50)	79		124	271		32		107	212		31		131	222		78		145		
Central Valley steelhead																				
WY 2008 (Year 0)	0		0		0	0		0	0	0	0		0	0	0	0		0		0
WY 2009 (Year 1)	68		41		68	7		22	23	3	3		32	51	3	-1		3		-1
WY 2013 (Year 5)	122		75		122	19		51	64	17	17		76	106	17	108		92		108
WY 2023 (Year 15)	151		110		151	43		89	111	43	43		118	135	43	146		134		146
WY 2033 (Year 25)	169		134		169	57		113	133	57	57		139	146	57	166		159		166
WY 2058 (Year 50)	183		152		183	70		134	152	68	68		155	154	68	181		178		181
Delta Smelt																				
WY 2008 (Year 0)	0				0	0	0	0		0	0	0	0		0	0	0	0		0
WY 2009 (Year 1)	0				0	0	89	89		0	0	95	95		0	0	-23	-23		0
WY 2013 (Year 5)	0				0	0	167	167		0	0	171	171		0	0	219	219		0
WY 2023 (Year 15)	0				0	0	185	185		0	0	184	184		0	0	260	260		0
WY 2033 (Year 25)	0				0	0	189	189		0	0	186	186		0	0	268	268		0
WY 2058 (Year 50)	0				0	0	192	192		0	0	188	188		0	0	274	274		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table 35
SAM results showing bank-line weighted relative response (feet) at site Lower American River RM 0.3L.

Focus Fish Species and Scenario	Fall (September-November)					Winter (December-February)					Spring (March-May)					Summer (June-August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2009 (Year 1)	3		-11	-36		14		9	24		12		14	43		-5		-23	-80	
WY 2013 (Year 5)	5		-20	-65		26		20	57		23		30	83		3		-22	-73	
WY 2023 (Year 15)	9		-20	-69		31		30	82		30		42	98		9		-21	-71	
WY 2033 (Year 25)	13		-20	-68		34		36	92		34		47	101		12		-20	-70	
WY 2058 (Year 50)	15		-20	-68		36		42	100		36		52	104		15		-19	-69	
Central Valley fall-run chinook salmon																				
WY 2008 (Year 0)	0		0					0	0		0			0		0				
WY 2009 (Year 1)	3		-11					9	24		12			43		-5				
WY 2013 (Year 5)	5		-20					20	57		23			83		3				
WY 2023 (Year 15)	9		-20					30	82		30			98		9				
WY 2033 (Year 25)	13		-20					36	92		34			101		12				
WY 2058 (Year 50)	15		-20					42	100		36			104		15				
Central Valley late fall-run chinook salmon																				
WY 2008 (Year 0)	0			0		0			0		0		0							
WY 2009 (Year 1)	3			-36		14			24		12		14							
WY 2013 (Year 5)	5			-65		26			57		23		30							
WY 2023 (Year 15)	9			-69		31			82		30		42							
WY 2033 (Year 25)	13			-68		34			92		34		47							
WY 2058 (Year 50)	15			-68		36			100		36		52							
Sacramento River winter-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0		
WY 2009 (Year 1)	3		-11	-36		14		9	24		12		14	43		-5		-23		
WY 2013 (Year 5)	5		-20	-65		26		20	57		23		30	83		3		-22		
WY 2023 (Year 15)	9		-20	-69		31		30	82		30		42	98		9		-21		
WY 2033 (Year 25)	13		-20	-68		34		36	92		34		47	101		12		-20		
WY 2058 (Year 50)	15		-20	-68		36		42	100		36		52	104		15		-19		
Central Valley steelhead																				
WY 2008 (Year 0)	0		0		0	0		0	0	0	0		0	0	0	0		0		0
WY 2009 (Year 1)	10		-18		10	30		13	21	30	30		18	30	30	0		-38		0
WY 2013 (Year 5)	17		-32		17	56		27	44	57	57		38	58	57	16		-36		16
WY 2023 (Year 15)	24		-32		24	66		40	60	68	68		52	69	68	24		-33		24
WY 2033 (Year 25)	29		-31		29	71		48	67	73	73		59	72	73	28		-32		28
WY 2058 (Year 50)	32		-31		32	75		54	73	77	77		64	75	77	32		-31		32
Delta Smelt																				
WY 2008 (Year 0)	0				0	0	0	0		0	0	0	0		0	0	0	0		0
WY 2009 (Year 1)	0				0	0	56	56		0	0	58	58		0	0	-57	-57		0
WY 2013 (Year 5)	0				0	0	103	103		0	0	104	104		0	0	-39	-39		0
WY 2023 (Year 15)	0				0	0	112	112		0	0	112	112		0	0	-36	-36		0
WY 2033 (Year 25)	0				0	0	114	114		0	0	114	114		0	0	-36	-36		0
WY 2058 (Year 50)	0				0	0	115	115		0	0	115	115		0	0	-35	-35		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table 36
SAM results showing bank-line weighted relative response (feet) at site Lower American River RM 2.8L.

Focus Fish Species and Scenario	Fall (September-November)					Winter (December-February)					Spring (March-May)					Summer (June-August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2009 (Year 1)	-5		-11	-39		3		7	14		1		9	30		-20		-24	-86	
WY 2013 (Year 5)	-9		-20	-71		7		14	38		3		21	61		-12		-23	-79	
WY 2023 (Year 15)	-5		-21	-74		11		24	62		9		32	74		-6		-21	-77	
WY 2033 (Year 25)	-2		-20	-74		13		30	71		12		38	78		-2		-20	-75	
WY 2058 (Year 50)	1		-20	-74		15		35	79		15		42	81		1		-20	-74	
Central Valley fall-run chinook salmon																				
WY 2008 (Year 0)	0		0					0	0		0			0		0				
WY 2009 (Year 1)	-5		-11					7	14		1			30		-20				
WY 2013 (Year 5)	-9		-20					14	38		3			61		-12				
WY 2023 (Year 15)	-5		-21					24	62		9			74		-6				
WY 2033 (Year 25)	-2		-20					30	71		12			78		-2				
WY 2058 (Year 50)	1		-20					35	79		15			81		1				
Central Valley late fall-run chinook salmon																				
WY 2008 (Year 0)	0			0		0			0		0		0							
WY 2009 (Year 1)	-5			-39		3			14		1		9							
WY 2013 (Year 5)	-9			-71		7			38		3		21							
WY 2023 (Year 15)	-5			-74		11			62		9		32							
WY 2033 (Year 25)	-2			-74		13			71		12		38							
WY 2058 (Year 50)	1			-74		15			79		15		42							
Sacramento River winter-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0		
WY 2009 (Year 1)	-5		-11	-39		3		7	14		1		9	30		-20		-24		
WY 2013 (Year 5)	-9		-20	-71		7		14	38		3		21	61		-12		-23		
WY 2023 (Year 15)	-5		-21	-74		11		24	62		9		32	74		-6		-21		
WY 2033 (Year 25)	-2		-20	-74		13		30	71		12		38	78		-2		-20		
WY 2058 (Year 50)	1		-20	-74		15		35	79		15		42	81		1		-20		
Central Valley steelhead																				
WY 2008 (Year 0)	0		0		0	0		0	0	0	0		0	0	0	0		0		0
WY 2009 (Year 1)	-5		-18		-5	8		9	12	6	6		11	19	6	-29		-39		-29
WY 2013 (Year 5)	-10		-33		-10	17		20	28	15	15		26	38	15	-14		-37		-14
WY 2023 (Year 15)	-4		-34		-4	25		32	42	24	24		39	48	24	-6		-35		-6
WY 2033 (Year 25)	0		-32		0	29		39	49	28	28		46	52	28	-1		-33		-1
WY 2058 (Year 50)	4		-32		4	33		45	55	32	32		51	55	32	4		-32		4
Delta Smelt																				
WY 2008 (Year 0)	0				0	0	0	0		0	0	0	0		0	0	0	0		0
WY 2009 (Year 1)	0				0	0	30	30		0	0	32	32		0	0	-83	-83		0
WY 2013 (Year 5)	0				0	0	56	56		0	0	58	58		0	0	-66	-66		0
WY 2023 (Year 15)	0				0	0	62	62		0	0	63	63		0	0	-63	-63		0
WY 2033 (Year 25)	0				0	0	63	63		0	0	64	64		0	0	-63	-63		0
WY 2058 (Year 50)	0				0	0	64	64		0	0	64	64		0	0	-62	-62		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table 37
SAM results showing bank-line weighted relative response (feet) at site Sacramento River RM 53.5R.

Focus Fish Species and Scenario	Fall (September-November)					Winter (December-February)					Spring (March-May)					Summer (June-August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2009 (Year 1)	17		-7	-18		20		12	32		17		12	40		12		-17	-56	
WY 2013 (Year 5)	31		-13	-32		37		25	74		34		28	85		30		-14	-38	
WY 2023 (Year 15)	41		-10	-27		43		36	105		43		46	109		40		-11	-28	
WY 2033 (Year 25)	49		-8	-21		47		43	118		48		55	117		47		-8	-22	
WY 2058 (Year 50)	55		-5	-17		50		50	129		52		62	123		53		-5	-17	
Central Valley fall-run chinook salmon																				
WY 2008 (Year 0)	0		0					0	0		0			0		0				
WY 2009 (Year 1)	17		-7					12	32		17			40		12				
WY 2013 (Year 5)	31		-13					25	74		34			85		30				
WY 2023 (Year 15)	41		-10					36	105		43			109		40				
WY 2033 (Year 25)	49		-8					43	118		48			117		47				
WY 2058 (Year 50)	55		-5					50	129		52			123		53				
Central Valley late fall-run chinook salmon																				
WY 2008 (Year 0)	0			0		0			0		0		0							
WY 2009 (Year 1)	17			-18		20			32		17		12							
WY 2013 (Year 5)	31			-32		37			74		34		28							
WY 2023 (Year 15)	41			-27		43			105		43		46							
WY 2033 (Year 25)	49			-21		47			118		48		55							
WY 2058 (Year 50)	55			-17		50			129		52		62							
Sacramento River winter-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0		
WY 2009 (Year 1)	17		-7	-18		20		12	32		17		12	40		12		-17		
WY 2013 (Year 5)	31		-13	-32		37		25	74		34		28	85		30		-14		
WY 2023 (Year 15)	41		-10	-27		43		36	105		43		46	109		40		-11		
WY 2033 (Year 25)	49		-8	-21		47		43	118		48		55	117		47		-8		
WY 2058 (Year 50)	55		-5	-17		50		50	129		52		62	123		53		-5		
Central Valley steelhead																				
WY 2008 (Year 0)	0		0		0	0		0	0	0	0		0	0	0	0		0		0
WY 2009 (Year 1)	38		-12		38	40		18	29	36	36		17	30	36	28		-29		28
WY 2013 (Year 5)	68		-21		68	75		36	61	71	71		39	62	71	64		-24		64
WY 2023 (Year 15)	85		-17		85	88		50	81	88	88		60	81	88	82		-17		82
WY 2033 (Year 25)	96		-13		96	94		59	90	95	95		70	88	95	94		-13		94
WY 2058 (Year 50)	106		-9		106	100		67	98	102	102		79	93	102	103		-9		103
Delta Smelt																				
WY 2008 (Year 0)	0				0	0	0	0		0	0	0	0		0	0	0	0		0
WY 2009 (Year 1)	0				0	0	69	69		0	0	69	69		0	0	-28	-28		0
WY 2013 (Year 5)	0				0	0	126	126		0	0	125	125		0	0	4	4		0
WY 2023 (Year 15)	0				0	0	138	138		0	0	134	134		0	0	9	9		0
WY 2033 (Year 25)	0				0	0	140	140		0	0	136	136		0	0	10	10		0
WY 2058 (Year 50)	0				0	0	142	142		0	0	137	137		0	0	11	11		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table 38
SAM results showing bank-line weighted relative response (feet) at site Sacramento River RM 177.8R.

Focus Fish Species and Scenario	Fall (September-November)					Winter (December-February)					Spring (March-May)					Summer (June-August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
WY 2008 (Year 0)	0		0			0		0	0		0		0	0		0		0		
WY 2009 (Year 1)	51		-1			51		23	70		52		25	95		51		-8		
WY 2013 (Year 5)	92		-1			95		47	162		102		60	210		92		-3		
WY 2023 (Year 15)	119		8			111		68	231		128		99	280		119		7		
WY 2033 (Year 25)	139		16			119		81	261		142		120	306		138		15		
WY 2058 (Year 50)	156		23			127		94	288		154		138	325		156		22		
Central Valley fall-run chinook salmon																				
WY 2008 (Year 0)	0		0					0	0		0			0		0				
WY 2009 (Year 1)	51		-1					23	70		52			95		51				
WY 2013 (Year 5)	92		-1					47	162		102			210		92				
WY 2023 (Year 15)	119		8					68	231		128			280		119				
WY 2033 (Year 25)	139		16					81	261		142			306		138				
WY 2058 (Year 50)	156		23					94	288		154			325		156				
Central Valley late fall-run chinook salmon																				
WY 2008 (Year 0)	0			0		0			0		0		0							
WY 2009 (Year 1)	51			0		51			70		52		25							
WY 2013 (Year 5)	92			-1		95			162		102		60							
WY 2023 (Year 15)	119			25		111			231		128		99							
WY 2033 (Year 25)	139			47		119			261		142		120							
WY 2058 (Year 50)	156			63		127			288		154		138							
Sacramento River winter-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2009 (Year 1)	51		-1	0		51		23	70		52		25	95		51		-8	-51	
WY 2013 (Year 5)	92		-1	-1		95		47	162		102		60	210		92		-3	-14	
WY 2023 (Year 15)	119		8	25		111		68	231		128		99	280		119		7	18	
WY 2033 (Year 25)	139		16	47		119		81	261		142		120	306		138		15	40	
WY 2058 (Year 50)	156		23	63		127		94	288		154		138	325		156		22	57	
Central Valley steelhead																				
WY 2008 (Year 0)	0		0	0	0	0		0	0	0			0	0	0	0		0	0	0
WY 2009 (Year 1)	103		-2	0	103	103		37	68	104			40	80	104	102		-18	-52	102
WY 2013 (Year 5)	185		-3	0	185	191		75	140	205			92	170	205	184		-8	-14	184
WY 2023 (Year 15)	234		13	28	234	224		104	186	255			144	224	255	233		10	20	233
WY 2033 (Year 25)	267		26	51	267	240		121	207	277			170	246	277	267		24	45	267
WY 2058 (Year 50)	295		37	69	295	255		139	227	297			193	264	297	295		35	63	295

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table 39
SAM results showing bank-line weighted relative response (feet) at site Sacramento River RM 16.8L.

Focus Fish Species and Scenario	Fall (September-November)					Winter (December-February)					Spring (March-May)					Summer (June-August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
WY 2009 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2010 (Year 1)	22		33	109		21		25	92		17		32	121		11		35	141	
WY 2014 (Year 5)	40		61	216		40		48	190		34		67	231		38		63	238	
WY 2024 (Year 15)	52		81	259		48		64	240		45		88	265		51		82	268	
WY 2034 (Year 25)	60		94	274		52		73	258		51		98	274		59		95	280	
WY 2059 (Year 50)	67		105	286		56		83	273		57		106	281		66		105	289	
Central Valley fall-run chinook salmon																				
WY 2009 (Year 0)	0		0	0				0	0		0			0		0			0	
WY 2010 (Year 1)	22		33	109				25	92		17			121		11			141	
WY 2014 (Year 5)	40		61	216				48	190		34			231		38			238	
WY 2024 (Year 15)	52		81	259				64	240		45			265		51			268	
WY 2034 (Year 25)	60		94	274				73	258		51			274		59			280	
WY 2059 (Year 50)	67		105	286				83	273		57			281		66			289	
Central Valley late fall-run chinook salmon																				
WY 2009 (Year 0)	0			0		0			0		0		0	0					0	
WY 2010 (Year 1)	22			109		21			92		17		32	121					141	
WY 2014 (Year 5)	40			216		40			190		34		67	231					238	
WY 2024 (Year 15)	52			259		48			240		45		88	265					268	
WY 2034 (Year 25)	60			274		52			258		51		98	274					280	
WY 2059 (Year 50)	67			286		56			273		57		106	281					289	
Sacramento River winter-run chinook salmon																				
WY 2009 (Year 0)	0		0	0		0		0	0		0		0	0		0		0		
WY 2010 (Year 1)	22		33	109		21		25	92		17		32	121		11		35		
WY 2014 (Year 5)	40		61	216		40		48	190		34		67	231		38		63		
WY 2024 (Year 15)	52		81	259		48		64	240		45		88	265		51		82		
WY 2034 (Year 25)	60		94	274		52		73	258		51		98	274		59		95		
WY 2059 (Year 50)	67		105	286		56		83	273		57		106	281		66		105		
Central Valley steelhead																				
WY 2009 (Year 0)	0		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0
WY 2010 (Year 1)	54		48	90	54	46		39	78	42	42		47	91	42	39		51	105	39
WY 2014 (Year 5)	97		88	168	97	86		75	153	83	83		94	172	83	94		91	179	94
WY 2024 (Year 15)	117		113	198	117	103		96	185	103	103		121	198	103	116		115	202	116
WY 2034 (Year 25)	129		130	210	129	111		107	198	112	112		133	206	112	128		131	213	128
WY 2059 (Year 50)	139		142	219	139	119		119	209	119	119		143	213	119	138		143	221	138
Delta Smelt																				
WY 2009 (Year 0)	0				0	0	0	0		0	0	0	0		0	0	0	0		0
WY 2010 (Year 1)	0				0	0	42	42		0	0	45	45		0	0	16	16		0
WY 2014 (Year 5)	0				0	0	79	79		0	0	81	81		0	0	66	66		0
WY 2024 (Year 15)	0				0	0	87	87		0	0	87	87		0	0	74	74		0
WY 2034 (Year 25)	0				0	0	89	89		0	0	88	88		0	0	76	76		0
WY 2059 (Year 50)	0				0	0	90	90		0	0	89	89		0	0	77	77		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table 40
SAM results showing bank-line weighted relative response (feet) at site Sacramento River RM 42.7R.

Focus Fish Species and Scenario	Fall (September-November)					Winter (December-February)					Spring (March-May)					Summer (June-August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
WY 2009 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2010 (Year 1)	2		-7	-28		0		4	1		0		4	7		-8		-15	-66	
WY 2014 (Year 5)	3		-13	-50		0		9	11		1		11	18		1		-14	-57	
WY 2024 (Year 15)	7		-12	-51		2		14	22		5		19	28		6		-12	-52	
WY 2034 (Year 25)	10		-11	-49		3		17	27		7		23	31		10		-10	-49	
WY 2059 (Year 50)	13		-10	-47		4		20	31		9		27	33		13		-9	-46	
Central Valley fall-run chinook salmon																				
WY 2009 (Year 0)	0		0					0	0		0		0	0		0				
WY 2010 (Year 1)	2		-7					4	1		0		0	7		-8				
WY 2014 (Year 5)	3		-13					9	11		1		0	18		1				
WY 2024 (Year 15)	7		-12					14	22		5		0	28		6				
WY 2034 (Year 25)	10		-11					17	27		7		0	31		10				
WY 2059 (Year 50)	13		-10					20	31		9		0	33		13				
Central Valley late fall-run chinook salmon																				
WY 2009 (Year 0)	0			0		0			0		0		0							
WY 2010 (Year 1)	2			-28		0			1		0		4							
WY 2014 (Year 5)	3			-50		0			11		1		11							
WY 2024 (Year 15)	7			-51		2			22		5		19							
WY 2034 (Year 25)	10			-49		3			27		7		23							
WY 2059 (Year 50)	13			-47		4			31		9		27							
Sacramento River winter-run chinook salmon																				
WY 2009 (Year 0)	0		0	0		0		0	0		0		0	0		0		0		
WY 2010 (Year 1)	2		-7	-28		0		4	1		0		4	7		-8		-15		
WY 2014 (Year 5)	3		-13	-50		0		9	11		1		11	18		1		-14		
WY 2024 (Year 15)	7		-12	-51		2		14	22		5		19	28		6		-12		
WY 2034 (Year 25)	10		-11	-49		3		17	27		7		23	31		10		-10		
WY 2059 (Year 50)	13		-10	-47		4		20	31		9		27	33		13		-9		
Central Valley steelhead																				
WY 2009 (Year 0)	0		0		0	0		0	0	0	0		0	0	0	0		0		0
WY 2010 (Year 1)	3		-11		3	0		5	5	0	0		5	7	0	-17		-25		-17
WY 2014 (Year 5)	6		-20		6	1		11	12	3	3		14	16	3	2		-22		2
WY 2024 (Year 15)	13		-19		13	4		17	20	9	9		23	24	9	11		-19		11
WY 2034 (Year 25)	18		-16		18	6		21	23	12	12		28	27	12	17		-16		17
WY 2059 (Year 50)	22		-15		22	8		24	26	15	15		32	29	15	22		-14		22
Delta Smelt																				
WY 2009 (Year 0)	0				0	0	0	0		0	0	0	0		0	0	0	0		0
WY 2010 (Year 1)	0				0	0	10	10		0	0	10	10		0	0	-82	-82		0
WY 2014 (Year 5)	0				0	0	19	19		0	0	18	18		0	0	-65	-65		0
WY 2024 (Year 15)	0				0	0	22	22		0	0	20	20		0	0	-62	-62		0
WY 2034 (Year 25)	0				0	0	22	22		0	0	20	20		0	0	-62	-62		0
WY 2059 (Year 50)	0				0	0	23	23		0	0	20	20		0	0	-61	-61		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table 41
SAM results showing bank-line weighted relative response (feet) at site Sacramento River RM 55.2L.

Focus Fish Species and Scenario	Fall (September-November)					Winter (December-February)					Spring (March-May)					Summer (June-August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
WY 2009 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2010 (Year 1)	7		-21	-62		10		17	27		4		23	62		-26		-50	-167	
WY 2014 (Year 5)	12		-37	-112		19		36	79		12		51	127		6		-43	-134	
WY 2024 (Year 15)	23		-36	-116		28		57	129		24		77	154		21		-39	-124	
WY 2034 (Year 25)	31		-34	-114		33		70	149		31		89	162		30		-36	-119	
WY 2059 (Year 50)	38		-32	-112		37		81	166		37		99	169		38		-33	-116	
Central Valley fall-run chinook salmon																				
WY 2009 (Year 0)	0		0					0	0		0			0		0				
WY 2010 (Year 1)	7		-21					17	27		4			62		-26				
WY 2014 (Year 5)	12		-37					36	79		12			127		6				
WY 2024 (Year 15)	23		-36					57	129		24			154		21				
WY 2034 (Year 25)	31		-34					70	149		31			162		30				
WY 2059 (Year 50)	38		-32					81	166		37			169		38				
Central Valley late fall-run chinook salmon																				
WY 2009 (Year 0)	0			0		0			0		0		0							
WY 2010 (Year 1)	7			-62		10			27		4		23							
WY 2014 (Year 5)	12			-112		19			79		12		51							
WY 2024 (Year 15)	23			-116		28			129		24		77							
WY 2034 (Year 25)	31			-114		33			149		31		89							
WY 2059 (Year 50)	38			-112		37			166		37		99							
Sacramento River winter-run chinook salmon																				
WY 2009 (Year 0)	0		0	0		0		0	0		0		0	0		0		0		
WY 2010 (Year 1)	7		-21	-62		10		17	27		4		23	62		-26		-50		
WY 2014 (Year 5)	12		-37	-112		19		36	79		12		51	127		6		-43		
WY 2024 (Year 15)	23		-36	-116		28		57	129		24		77	154		21		-39		
WY 2034 (Year 25)	31		-34	-114		33		70	149		31		89	162		30		-36		
WY 2059 (Year 50)	38		-32	-112		37		81	166		37		99	169		38		-33		
Central Valley steelhead																				
WY 2009 (Year 0)	0		0		0	0		0	0	0	0		0	0	0	0		0		0
WY 2010 (Year 1)	28		-33		28	24		23	28	20	20		28	43	20	-26		-80		-26
WY 2014 (Year 5)	50		-59		50	46		48	65	44	44		63	87	44	40		-69		40
WY 2024 (Year 15)	67		-57		67	63		74	96	63	63		93	108	63	65		-61		65
WY 2034 (Year 25)	79		-53		79	73		90	111	73	73		107	116	73	78		-55		78
WY 2059 (Year 50)	88		-50		88	81		103	123	81	81		119	122	81	88		-51		88
Delta Smelt																				
WY 2009 (Year 0)	0				0	0	0	0		0	0	0	0		0	0	0	0		0
WY 2010 (Year 1)	0				0	0	74	74		0	0	77	77		0	0	-170	-170		0
WY 2014 (Year 5)	0				0	0	137	137		0	0	138	138		0	0	-114	-114		0
WY 2024 (Year 15)	0				0	0	151	151		0	0	148	148		0	0	-105	-105		0
WY 2034 (Year 25)	0				0	0	154	154		0	0	150	150		0	0	-103	-103		0
WY 2059 (Year 50)	0				0	0	156	156		0	0	152	152		0	0	-102	-102		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table 42
SAM results showing bank-line weighted relative response (feet) at site Sacramento River RM 77.2L

Focus Fish Species and Scenario	Fall (September-November)					Winter (December-February)					Spring (March-May)					Summer (June-August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
WY 2009 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2010 (Year 1)	19		-3	-21		18		14	33		17		16	49		14		-12	-69	
WY 2014 (Year 5)	34		-6	-38		34		27	75		34		36	101		32		-9	-52	
WY 2024 (Year 15)	44		-3	-32		41		39	106		44		55	124		43		-5	-40	
WY 2034 (Year 25)	52		0	-25		44		47	119		49		64	132		50		-2	-33	
WY 2059 (Year 50)	59		3	-20		47		53	129		54		72	138		57		0	-28	
Central Valley fall-run chinook salmon																				
WY 2009 (Year 0)	0		0					0	0		0			0		0				
WY 2010 (Year 1)	19		-3					14	33		17			49		14				
WY 2014 (Year 5)	34		-6					27	75		34			101		32				
WY 2024 (Year 15)	44		-3					39	106		44			124		43				
WY 2034 (Year 25)	52		0					47	119		49			132		50				
WY 2059 (Year 50)	59		3					53	129		54			138		57				
Central Valley late fall-run chinook salmon																				
WY 2009 (Year 0)	0			0		0			0		0		0							
WY 2010 (Year 1)	19			-21		18			33		17		16							
WY 2014 (Year 5)	34			-38		34			75		34		36							
WY 2024 (Year 15)	44			-32		41			106		44		55							
WY 2034 (Year 25)	52			-25		44			119		49		64							
WY 2059 (Year 50)	59			-20		47			129		54		72							
Sacramento River winter-run chinook salmon																				
WY 2009 (Year 0)	0		0	0		0		0	0		0		0	0		0		0		
WY 2010 (Year 1)	19		-3	-21		18		14	33		17		16	49		14		-12		
WY 2014 (Year 5)	34		-6	-38		34		27	75		34		36	101		32		-9		
WY 2024 (Year 15)	44		-3	-32		41		39	106		44		55	124		43		-5		
WY 2034 (Year 25)	52		0	-25		44		47	119		49		64	132		50		-2		
WY 2059 (Year 50)	59		3	-20		47		53	129		54		72	138		57		0		
Central Valley steelhead																				
WY 2009 (Year 0)	0		0		0	0		0	0	0	0		0	0	0	0		0		0
WY 2010 (Year 1)	38		-6		38	38		20	32	38	38		23	39	38	30		-22		30
WY 2014 (Year 5)	69		-11		69	71		40	66	74	74		49	78	74	66		-17		66
WY 2024 (Year 15)	88		-6		88	84		55	86	91	91		72	97	91	85		-10		85
WY 2034 (Year 25)	101		-1		101	90		64	95	99	99		83	104	99	98		-5		98
WY 2059 (Year 50)	111		4		111	96		72	103	106	106		91	110	106	108		-1		108
Delta Smelt																				
WY 2009 (Year 0)	0				0	0	0	0		0	0	0	0		0	0	0	0		0
WY 2010 (Year 1)	0				0	0	77	77		0	0	84	84		0	0	-26	-26		0
WY 2014 (Year 5)	0				0	0	141	141		0	0	152	152		0	0	5	5		0
WY 2024 (Year 15)	0				0	0	153	153		0	0	163	163		0	0	11	11		0
WY 2034 (Year 25)	0				0	0	156	156		0	0	166	166		0	0	12	12		0
WY 2059 (Year 50)	0				0	0	158	158		0	0	167	167		0	0	12	12		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table 43
SAM results showing bank-line weighted relative response (feet) at site Feather River RM 28.5R.

Focus Fish Species and Scenario	Fall (September-November)					Winter (December-February)					Spring (March-May)					Summer (June-August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
WY 2009 (Year 0)	0		0			0		0	0		0		0	0		0		0		
WY 2010 (Year 1)	55		39			40		40	117		41		43	155		39		35		
WY 2014 (Year 5)	99		72			76		81	265		84		101	332		96		75		
WY 2024 (Year 15)	134		136			96		122	375		118		171	437		134		140		
WY 2034 (Year 25)	161		185			107		147	423		136		209	475		161		189		
WY 2059 (Year 50)	183		224			116		169	461		152		239	504		184		228		
Central Valley fall-run chinook salmon																				
WY 2009 (Year 0)	0		0					0	0		0			0		0				
WY 2010 (Year 1)	55		39					40	117		41			155		39				
WY 2014 (Year 5)	99		72					81	265		84			332		96				
WY 2024 (Year 15)	134		136					122	375		118			437		134				
WY 2034 (Year 25)	161		185					147	423		136			475		161				
WY 2059 (Year 50)	183		224					169	461		152			504		184				
Central Valley late fall-run chinook salmon																				
WY 2009 (Year 0)	0			0		0			0		0		0							
WY 2010 (Year 1)	55			128		40			117		41		43							
WY 2014 (Year 5)	99			267		76			265		84		101							
WY 2024 (Year 15)	134			390		96			375		118		171							
WY 2034 (Year 25)	161			457		107			423		136		209							
WY 2059 (Year 50)	183			508		116			461		152		239							
Sacramento River winter-run chinook salmon																				
WY 2009 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2010 (Year 1)	55		39	128		40		40	117		41		43	155		39		35	117	
WY 2014 (Year 5)	99		72	267		76		81	265		84		101	332		96		75	302	
WY 2024 (Year 15)	134		136	390		96		122	375		118		171	437		134		140	411	
WY 2034 (Year 25)	161		185	457		107		147	423		136		209	475		161		189	475	
WY 2059 (Year 50)	183		224	508		116		169	461		152		239	504		184		228	524	
Central Valley steelhead																				
WY 2009 (Year 0)	0		0	0	0	0		0	0	0			0	0	0	0		0	0	0
WY 2010 (Year 1)	114		61	114	114	87		60	101	88			64	118	88	86		52	87	86
WY 2014 (Year 5)	205		111	218	205	164		120	208	179			145	248	179	200		115	236	200
WY 2024 (Year 15)	270		191	305	270	204		172	279	241			230	326	241	268		196	320	268
WY 2034 (Year 25)	314		251	358	314	225		203	311	272			275	358	272	314		257	372	314
WY 2059 (Year 50)	350		298	398	350	243		230	339	296			310	383	296	351		304	412	351

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table 44
SAM results showing wetted-area weighted relative response (square feet) at site Steamboat Slough RM 16.6R.

Focus Fish Species and Scenario	Fall (September-November)					Winter (December-February)					Spring (March-May)					Summer (June-August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2009 (Year 1)	1,944		3,063	12,023		1,381		2,830	7,822		1,210		2,977	10,054		-1,487		2,576	12,517	
WY 2013 (Year 5)	3,499		5,583	24,298		2,796		5,772	18,207		2,995		7,141	22,207		2,818		5,548	26,407	
WY 2023 (Year 15)	5,759		10,043	33,504		3,948		8,306	25,983		5,180		11,731	29,576		5,541		10,032	34,205	
WY 2033 (Year 25)	7,637		13,474	38,329		4,659		9,899	29,334		6,442		14,200	32,220		7,513		13,472	38,754	
WY 2058 (Year 50)	9,325		16,237	41,972		5,381		11,534	32,323		7,603		16,249	34,237		9,273		16,242	42,190	
Central Valley fall-run chinook salmon																				
WY 2008 (Year 0)	0		0	0				0	0		0			0		0			0	
WY 2009 (Year 1)	1,944		3,063	12,023				2,830	7,822		1,210			10,054		-1,487			12,517	
WY 2013 (Year 5)	3,499		5,583	24,298				5,772	18,207		2,995			22,207		2,818			26,407	
WY 2023 (Year 15)	5,759		10,043	33,504				8,306	25,983		5,180			29,576		5,541			34,205	
WY 2033 (Year 25)	7,637		13,474	38,329				9,899	29,334		6,442			32,220		7,513			38,754	
WY 2058 (Year 50)	9,325		16,237	41,972				11,534	32,323		7,603			34,237		9,273			42,190	
Central Valley late fall-run chinook salmon																				
WY 2008 (Year 0)	0			0		0			0		0		0	0					0	
WY 2009 (Year 1)	1,944			12,023		1,381			7,822		1,210		2,977	10,054					12,517	
WY 2013 (Year 5)	3,499			24,298		2,796			18,207		2,995		7,141	22,207					26,407	
WY 2023 (Year 15)	5,759			33,504		3,948			25,983		5,180		11,731	29,576					34,205	
WY 2033 (Year 25)	7,637			38,329		4,659			29,334		6,442		14,200	32,220					38,754	
WY 2058 (Year 50)	9,325			41,972		5,381			32,323		7,603		16,249	34,237					42,190	
Sacramento River winter-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0		
WY 2009 (Year 1)	1,944		3,063	12,023		1,381		2,830	7,822		1,210		2,977	10,054		-1,487		2,576		
WY 2013 (Year 5)	3,499		5,583	24,298		2,796		5,772	18,207		2,995		7,141	22,207		2,818		5,548		
WY 2023 (Year 15)	5,759		10,043	33,504		3,948		8,306	25,983		5,180		11,731	29,576		5,541		10,032		
WY 2033 (Year 25)	7,637		13,474	38,329		4,659		9,899	29,334		6,442		14,200	32,220		7,513		13,472		
WY 2058 (Year 50)	9,325		16,237	41,972		5,381		11,534	32,323		7,603		16,249	34,237		9,273		16,242		
Central Valley steelhead																				
WY 2008 (Year 0)	0		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0
WY 2009 (Year 1)	4,250		4,900	9,739	4,250	2,927		4,528	6,899	2,584	2,584		4,680	7,728	2,584	-2,300		4,143	7,972	-2,300
WY 2013 (Year 5)	7,650		8,930	18,560	7,650	5,947		9,081	14,511	6,344	6,344		10,706	16,545	6,344	6,352		8,874	19,095	6,352
WY 2023 (Year 15)	11,719		14,546	24,963	11,719	8,342		12,469	19,435	10,311	10,311		16,437	22,057	10,311	11,303		14,526	25,122	11,303
WY 2033 (Year 25)	14,850		18,776	28,738	14,850	9,772		14,494	21,765	12,378	12,378		19,407	24,307	12,378	14,614		18,769	28,826	14,614
WY 2058 (Year 50)	17,473		22,200	31,633	17,473	11,188		16,533	23,924	14,157	14,157		21,877	26,070	14,157	17,373		22,203	31,668	17,373
Delta Smelt																				
WY 2008 (Year 0)	0				0	0	0	0		0	0	0	0		0	0	0	0		0
WY 2009 (Year 1)	0				0	0	2,812	2,812		0	0	3,506	3,506		0	0	-9,085	-9,085		0
WY 2013 (Year 5)	0				0	0	5,588	5,588		0	0	6,311	6,311		0	0	7,478	7,478		0
WY 2023 (Year 15)	0				0	0	6,478	6,478		0	0	6,785	6,785		0	0	10,244	10,244		0
WY 2033 (Year 25)	0				0	0	6,656	6,656		0	0	6,879	6,879		0	0	10,797	10,797		0
WY 2058 (Year 50)	0				0	0	6,789	6,789		0	0	6,950	6,950		0	0	11,212	11,212		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table 45
SAM results showing wetted-area weighted relative response (square feet) at site Cache Slough RM 21.8R.

Focus Fish Species and Scenario	Fall (September-November)					Winter (December-February)					Spring (March-May)					Summer (June-August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2009 (Year 1)	753		2,809	6,405		-188		-205	-6,543		-2,622		-1,879	3,101		-15,059		-7,805	-21,408	
WY 2013 (Year 5)	1,356		5,549	20,793		439		1,462	-215		-2,940		227	12,367		-2,121		5,817	26,092	
WY 2023 (Year 15)	6,284		15,161	37,540		3,379		7,660	17,170		1,733		8,227	22,162		4,658		16,368	41,707	
WY 2033 (Year 25)	10,384		22,539	45,024		5,359		11,773	24,966		4,705		12,608	25,604		8,968		23,543	48,368	
WY 2058 (Year 50)	13,730		28,219	50,646		7,095		15,359	31,256		7,155		15,999	28,196		12,426		29,045	53,371	
Central Valley fall-run chinook salmon																				
WY 2008 (Year 0)	0		0	0				0	0		0			0		0			0	
WY 2009 (Year 1)	753		2,809	6,405				-205	-6,543		-2,622			3,101		-15,059			-21,408	
WY 2013 (Year 5)	1,356		5,549	20,793				1,462	-215		-2,940			12,367		-2,121			26,092	
WY 2023 (Year 15)	6,284		15,161	37,540				7,660	17,170		1,733			22,162		4,658			41,707	
WY 2033 (Year 25)	10,384		22,539	45,024				11,773	24,966		4,705			25,604		8,968			48,368	
WY 2058 (Year 50)	13,730		28,219	50,646				15,359	31,256		7,155			28,196		12,426			53,371	
Central Valley late fall-run chinook salmon																				
WY 2008 (Year 0)	0			0		0			0		0		0	0					0	
WY 2009 (Year 1)	753			6,405		-188			-6,543		-2,622		-1,879	3,101					-21,408	
WY 2013 (Year 5)	1,356			20,793		439			-215		-2,940		227	12,367					26,092	
WY 2023 (Year 15)	6,284			37,540		3,379			17,170		1,733		8,227	22,162					41,707	
WY 2033 (Year 25)	10,384			45,024		5,359			24,966		4,705		12,608	25,604					48,368	
WY 2058 (Year 50)	13,730			50,646		7,095			31,256		7,155		15,999	28,196					53,371	
Sacramento River winter-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0		
WY 2009 (Year 1)	753		2,809	6,405		-188		-205	-6,543		-2,622		-1,879	3,101		-15,059		-7,805		
WY 2013 (Year 5)	1,356		5,549	20,793		439		1,462	-215		-2,940		227	12,367		-2,121		5,817		
WY 2023 (Year 15)	6,284		15,161	37,540		3,379		7,660	17,170		1,733		8,227	22,162		4,658		16,368		
WY 2033 (Year 25)	10,384		22,539	45,024		5,359		11,773	24,966		4,705		12,608	25,604		8,968		23,543		
WY 2058 (Year 50)	13,730		28,219	50,646		7,095		15,359	31,256		7,155		15,999	28,196		12,426		29,045		
Central Valley steelhead																				
WY 2008 (Year 0)	0		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0
WY 2009 (Year 1)	5,030		3,831	5,543	5,030	-249		-252	-3,327	-3,176	-3,176		-2,345	-224	-3,176	-22,825		-12,289	-22,236	-22,825
WY 2013 (Year 5)	9,054		7,552	13,567	9,054	1,197		2,038	-250	-2,411	-2,411		228	3,886	-2,411	3,718		7,176	14,014	3,718
WY 2023 (Year 15)	16,985		19,010	24,272	16,985	6,994		9,986	10,280	4,905	4,905		9,970	11,183	4,905	14,927		20,147	26,200	14,927
WY 2033 (Year 25)	23,133		27,761	30,401	23,133	10,804		15,159	15,799	9,110	9,110		15,286	14,415	9,110	21,415		28,723	32,170	21,415
WY 2058 (Year 50)	28,003		34,542	35,035	28,003	14,086		19,639	20,372	12,455	12,455		19,417	16,872	12,455	26,499		35,341	36,678	26,499
Delta Smelt																				
WY 2008 (Year 0)	0				0	0	0	0		0	0	0	0		0	0	0	0		0
WY 2009 (Year 1)	0				0	0	5,195	5,195		0	0	7,147	7,147		0	0	-39,196	-39,196		0
WY 2013 (Year 5)	0				0	0	11,237	11,237		0	0	12,683	12,683		0	0	13,053	13,053		0
WY 2023 (Year 15)	0				0	0	13,480	13,480		0	0	13,622	13,622		0	0	21,777	21,777		0
WY 2033 (Year 25)	0				0	0	13,928	13,928		0	0	13,810	13,810		0	0	23,522	23,522		0
WY 2058 (Year 50)	0				0	0	14,265	14,265		0	0	13,951	13,951		0	0	24,831	24,831		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table 46
SAM results showing wetted-area weighted relative response (square feet) at site Sacramento River RM 49.7L.

Focus Fish Species and Scenario	Fall (September-November)					Winter (December-February)					Spring (March-May)					Summer (June-August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2009 (Year 1)	1,478		-390	-1,900		-231		1,714	4,360		-650		1,739	5,830		-397		-1,481	-7,067	
WY 2013 (Year 5)	2,660		-704	-3,423		-258		3,487	10,212		-788		4,088	12,249		2,086		-1,118	-4,639	
WY 2023 (Year 15)	3,947		-261	-2,594		310		5,218	14,701		206		6,579	15,499		3,546		-590	-3,296	
WY 2033 (Year 25)	4,927		134	-1,776		704		6,265	16,560		844		7,871	16,577		4,526		-197	-2,463	
WY 2058 (Year 50)	5,749		442	-1,161		1,050		7,174	18,057		1,371		8,872	17,389		5,338		108	-1,837	
Central Valley fall-run chinook salmon																				
WY 2008 (Year 0)	0		0					0	0		0			0		0				
WY 2009 (Year 1)	1,478		-390					1,714	4,360		-650			5,830		-397				
WY 2013 (Year 5)	2,660		-704					3,487	10,212		-788			12,249		2,086				
WY 2023 (Year 15)	3,947		-261					5,218	14,701		206			15,499		3,546				
WY 2033 (Year 25)	4,927		134					6,265	16,560		844			16,577		4,526				
WY 2058 (Year 50)	5,749		442					7,174	18,057		1,371			17,389		5,338				
Central Valley late fall-run chinook salmon																				
WY 2008 (Year 0)	0			0		0			0		0		0							
WY 2009 (Year 1)	1,478			-1,900		-231			4,360		-650		1,739							
WY 2013 (Year 5)	2,660			-3,423		-258			10,212		-788		4,088							
WY 2023 (Year 15)	3,947			-2,594		310			14,701		206		6,579							
WY 2033 (Year 25)	4,927			-1,776		704			16,560		844		7,871							
WY 2058 (Year 50)	5,749			-1,161		1,050			18,057		1,371		8,872							
Sacramento River winter-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0		
WY 2009 (Year 1)	1,478		-390	-1,900		-231		1,714	4,360		-650		1,739	5,830		-397		-1,481		
WY 2013 (Year 5)	2,660		-704	-3,423		-258		3,487	10,212		-788		4,088	12,249		2,086		-1,118		
WY 2023 (Year 15)	3,947		-261	-2,594		310		5,218	14,701		206		6,579	15,499		3,546		-590		
WY 2033 (Year 25)	4,927		134	-1,776		704		6,265	16,560		844		7,871	16,577		4,526		-197		
WY 2058 (Year 50)	5,749		442	-1,161		1,050		7,174	18,057		1,371		8,872	17,389		5,338		108		
Central Valley steelhead																				
WY 2008 (Year 0)	0		0		0	0		0	0	0	0		0	0	0	0		0		0
WY 2009 (Year 1)	3,392		-613		3,392	-513		2,603	3,765	-1,185	-1,185		2,536	4,035	-1,185	236		-2,487		236
WY 2013 (Year 5)	6,105		-1,105		6,105	-586		5,218	7,937	-1,389	-1,389		5,720	8,377	-1,389	5,285		-1,761		5,285
WY 2023 (Year 15)	8,336		-363		8,336	538		7,424	10,792	204	204		8,716	10,829	204	7,792		-868		7,792
WY 2033 (Year 25)	9,915		298		9,915	1,304		8,708	12,113	1,146	1,146		10,234	11,801	1,146	9,349		-210		9,349
WY 2058 (Year 50)	11,180		817		11,180	1,965		9,813	13,199	1,896	1,896		11,413	12,539	1,896	10,588		303		10,588
Delta Smelt																				
WY 2008 (Year 0)	0				0	0	0	0		0	0	0	0		0	0	0	0		0
WY 2009 (Year 1)	0				0	0	4,023	4,023		0	0	4,208	4,208		0	0	-11,217	-11,217		0
WY 2013 (Year 5)	0				0	0	7,564	7,564		0	0	7,570	7,570		0	0	-6,852	-6,852		0
WY 2023 (Year 15)	0				0	0	8,418	8,418		0	0	8,134	8,134		0	0	-6,125	-6,125		0
WY 2033 (Year 25)	0				0	0	8,589	8,589		0	0	8,247	8,247		0	0	-5,979	-5,979		0
WY 2058 (Year 50)	0				0	0	8,717	8,717		0	0	8,331	8,331		0	0	-5,870	-5,870		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table 47
SAM results showing wetted-area weighted relative response (square feet) at site Sacramento River RM 52.3L.

Focus Fish Species and Scenario	Fall (September-November)					Winter (December-February)					Spring (March-May)					Summer (June-August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2009 (Year 1)	4,996		7,605	18,254		448		4,050	4,183		-1,544		6,383	18,616		-5,609		2,236	6,365	
WY 2013 (Year 5)	8,993		14,044	41,863		1,541		9,281	19,199		-1,257		15,237	38,921		6,966		17,731	53,935	
WY 2023 (Year 15)	13,253		20,895	56,009		4,395		17,008	37,883		2,820		23,978	48,399		12,698		25,854	66,408	
WY 2033 (Year 25)	16,297		25,580	60,458		6,277		21,843	45,606		5,369		28,241	51,231		16,062		30,832	70,542	
WY 2058 (Year 50)	18,625		29,132	63,797		7,923		26,027	51,789		7,467		31,527	53,361		18,630		34,604	73,644	
Central Valley fall-run chinook salmon																				
WY 2008 (Year 0)	0		0					0	0		0			0		0				
WY 2009 (Year 1)	4,996		7,605					4,050	4,183		-1,544			18,616		-5,609				
WY 2013 (Year 5)	8,993		14,044					9,281	19,199		-1,257			38,921		6,966				
WY 2023 (Year 15)	13,253		20,895					17,008	37,883		2,820			48,399		12,698				
WY 2033 (Year 25)	16,297		25,580					21,843	45,606		5,369			51,231		16,062				
WY 2058 (Year 50)	18,625		29,132					26,027	51,789		7,467			53,361		18,630				
Central Valley late fall-run chinook salmon																				
WY 2008 (Year 0)	0			0		0			0		0		0							
WY 2009 (Year 1)	4,996			18,254		448			4,183		-1,544		6,383							
WY 2013 (Year 5)	8,993			41,863		1,541			19,199		-1,257		15,237							
WY 2023 (Year 15)	13,253			56,009		4,395			37,883		2,820		23,978							
WY 2033 (Year 25)	16,297			60,458		6,277			45,606		5,369		28,241							
WY 2058 (Year 50)	18,625			63,797		7,923			51,789		7,467		31,527							
Sacramento River winter-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0		
WY 2009 (Year 1)	4,996		7,605	18,254		448		4,050	4,183		-1,544		6,383	18,616		-5,609		2,236		
WY 2013 (Year 5)	8,993		14,044	41,863		1,541		9,281	19,199		-1,257		15,237	38,921		6,966		17,731		
WY 2023 (Year 15)	13,253		20,895	56,009		4,395		17,008	37,883		2,820		23,978	48,399		12,698		25,854		
WY 2033 (Year 25)	16,297		25,580	60,458		6,277		21,843	45,606		5,369		28,241	51,231		16,062		30,832		
WY 2058 (Year 50)	18,625		29,132	63,797		7,923		26,027	51,789		7,467		31,527	53,361		18,630		34,604		
Central Valley steelhead																				
WY 2008 (Year 0)	0		0		0	0		0	0	0	0		0	0	0	0		0		0
WY 2009 (Year 1)	15,954		9,611		15,954	1,793		5,460	5,654	798	798		7,771	12,336	798	-231		800		-231
WY 2013 (Year 5)	28,717		17,776		28,717	4,755		12,396	15,691	4,082	4,082		18,302	25,530	4,082	25,780		22,004		25,780
WY 2023 (Year 15)	35,577		25,966		35,577	10,382		21,850	27,094	10,338	10,338		28,476	32,551	10,338	34,904		32,040		34,904
WY 2033 (Year 25)	39,846		31,515		39,846	13,949		27,630	32,570	13,756	13,756		33,446	35,183	13,756	39,659		38,005		39,659
WY 2058 (Year 50)	43,119		35,749		43,119	17,014		32,600	37,072	16,469	16,469		37,293	37,181	16,469	43,299		42,551		43,299
Delta Smelt																				
WY 2008 (Year 0)	0				0	0	0	0		0	0	0	0		0	0	0	0		0
WY 2009 (Year 1)	0				0	0	21,785	21,785		0	0	22,853	22,853		0	0	-5,445	-5,445		0
WY 2013 (Year 5)	0				0	0	40,743	40,743		0	0	41,114	41,114		0	0	52,382	52,382		0
WY 2023 (Year 15)	0				0	0	45,221	45,221		0	0	44,174	44,174		0	0	62,036	62,036		0
WY 2033 (Year 25)	0				0	0	46,117	46,117		0	0	44,787	44,787		0	0	63,967	63,967		0
WY 2058 (Year 50)	0				0	0	46,789	46,789		0	0	45,246	45,246		0	0	65,415	65,415		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table 48
SAM results showing wetted-area weighted relative response (square feet) at site Lower American River RM 0.3L.

Focus Fish Species and Scenario	Fall (September-November)					Winter (December-February)					Spring (March-May)					Summer (June-August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2009 (Year 1)	334		-1,475	-4,812		1,962		1,327	3,331		1,637		1,927	5,881		-663		-3,150	-10,818	
WY 2013 (Year 5)	601		-2,654	-8,662		3,657		2,752	8,010		3,203		4,125	11,496		421		-2,998	-9,934	
WY 2023 (Year 15)	1,216		-2,717	-9,124		4,396		4,228	11,559		4,143		5,756	13,435		1,179		-2,838	-9,607	
WY 2033 (Year 25)	1,687		-2,648	-9,108		4,768		5,117	12,946		4,623		6,521	13,969		1,682		-2,724	-9,435	
WY 2058 (Year 50)	2,048		-2,595	-9,096		5,087		5,885	14,054		5,015		7,109	14,372		2,067		-2,638	-9,305	
Central Valley fall-run chinook salmon																				
WY 2008 (Year 0)	0		0					0	0		0			0		0				
WY 2009 (Year 1)	334		-1,475					1,327	3,331		1,637			5,881		-663				
WY 2013 (Year 5)	601		-2,654					2,752	8,010		3,203			11,496		421				
WY 2023 (Year 15)	1,216		-2,717					4,228	11,559		4,143			13,435		1,179				
WY 2033 (Year 25)	1,687		-2,648					5,117	12,946		4,623			13,969		1,682				
WY 2058 (Year 50)	2,048		-2,595					5,885	14,054		5,015			14,372		2,067				
Central Valley late fall-run chinook salmon																				
WY 2008 (Year 0)	0			0		0			0		0		0							
WY 2009 (Year 1)	334			-4,812		1,962			3,331		1,637		1,927							
WY 2013 (Year 5)	601			-8,662		3,657			8,010		3,203		4,125							
WY 2023 (Year 15)	1,216			-9,124		4,396			11,559		4,143		5,756							
WY 2033 (Year 25)	1,687			-9,108		4,768			12,946		4,623		6,521							
WY 2058 (Year 50)	2,048			-9,096		5,087			14,054		5,015		7,109							
Sacramento River winter-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0		
WY 2009 (Year 1)	334		-1,475	-4,812		1,962		1,327	3,331		1,637		1,927	5,881		-663		-3,150		
WY 2013 (Year 5)	601		-2,654	-8,662		3,657		2,752	8,010		3,203		4,125	11,496		421		-2,998		
WY 2023 (Year 15)	1,216		-2,717	-9,124		4,396		4,228	11,559		4,143		5,756	13,435		1,179		-2,838		
WY 2033 (Year 25)	1,687		-2,648	-9,108		4,768		5,117	12,946		4,623		6,521	13,969		1,682		-2,724		
WY 2058 (Year 50)	2,048		-2,595	-9,096		5,087		5,885	14,054		5,015		7,109	14,372		2,067		-2,638		
Central Valley steelhead																				
WY 2008 (Year 0)	0		0		0	0		0	0	0	0		0	0	0	0		0		0
WY 2009 (Year 1)	1,293		-2,354		1,293	4,192		1,888	2,915	4,087	4,087		2,505	4,131	4,087	39		-5,102		39
WY 2013 (Year 5)	2,328		-4,238		2,328	7,806		3,862	6,204	7,803	7,803		5,260	8,003	7,803	2,127		-4,812		2,127
WY 2023 (Year 15)	3,210		-4,309		3,210	9,286		5,673	8,431	9,384	9,384		7,176	9,465	9,384	3,191		-4,519		3,191
WY 2033 (Year 25)	3,821		-4,176		3,821	9,998		6,731	9,427	10,065	10,065		8,067	9,965	10,065	3,842		-4,312		3,842
WY 2058 (Year 50)	4,291		-4,073		4,291	10,600		7,637	10,243	10,602	10,602		8,757	10,344	10,602	4,341		-4,154		4,341
Delta Smelt																				
WY 2008 (Year 0)	0				0	0	0	0		0	0	0	0		0	0	0	0		0
WY 2009 (Year 1)	0				0	0	7,875	7,875		0	0	7,991	7,991		0	0	-7,782	-7,782		0
WY 2013 (Year 5)	0				0	0	14,449	14,449		0	0	14,387	14,387		0	0	-5,342	-5,342		0
WY 2023 (Year 15)	0				0	0	15,774	15,774		0	0	15,456	15,456		0	0	-4,936	-4,936		0
WY 2033 (Year 25)	0				0	0	16,039	16,039		0	0	15,670	15,670		0	0	-4,854	-4,854		0
WY 2058 (Year 50)	0				0	0	16,238	16,238		0	0	15,830	15,830		0	0	-4,793	-4,793		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table 49
SAM results showing wetted-area weighted relative response (square feet) at site Lower American River RM 2.8L.

Focus Fish Species and Scenario	Fall (September-November)					Winter (December-February)					Spring (March-May)					Summer (June-August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2009 (Year 1)	-617		-1,394	-4,845		439		857	1,747		109		1,118	3,757		-2,458		-2,987	-10,776	
WY 2013 (Year 5)	-1,110		-2,509	-8,720		902		1,851	4,910		437		2,624	7,672		-1,489		-2,860	-9,993	
WY 2023 (Year 15)	-632		-2,553	-9,142		1,388		3,083	7,917		1,131		4,086	9,358		-766		-2,697	-9,643	
WY 2033 (Year 25)	-187		-2,475	-9,092		1,686		3,843	9,144		1,545		4,807	9,860		-272		-2,578	-9,441	
WY 2058 (Year 50)	163		-2,416	-9,055		1,945		4,502	10,130		1,885		5,364	10,238		114		-2,488	-9,290	
Central Valley fall-run chinook salmon																				
WY 2008 (Year 0)	0		0					0	0		0			0		0				
WY 2009 (Year 1)	-617		-1,394					857	1,747		109			3,757		-2,458				
WY 2013 (Year 5)	-1,110		-2,509					1,851	4,910		437			7,672		-1,489				
WY 2023 (Year 15)	-632		-2,553					3,083	7,917		1,131			9,358		-766				
WY 2033 (Year 25)	-187		-2,475					3,843	9,144		1,545			9,860		-272				
WY 2058 (Year 50)	163		-2,416					4,502	10,130		1,885			10,238		114				
Central Valley late fall-run chinook salmon																				
WY 2008 (Year 0)	0			0		0			0		0		0							
WY 2009 (Year 1)	-617			-4,845		439			1,747		109		1,118							
WY 2013 (Year 5)	-1,110			-8,720		902			4,910		437		2,624							
WY 2023 (Year 15)	-632			-9,142		1,388			7,917		1,131		4,086							
WY 2033 (Year 25)	-187			-9,092		1,686			9,144		1,545		4,807							
WY 2058 (Year 50)	163			-9,055		1,945			10,130		1,885		5,364							
Sacramento River winter-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0		
WY 2009 (Year 1)	-617		-1,394	-4,845		439		857	1,747		109		1,118	3,757		-2,458		-2,987		
WY 2013 (Year 5)	-1,110		-2,509	-8,720		902		1,851	4,910		437		2,624	7,672		-1,489		-2,860		
WY 2023 (Year 15)	-632		-2,553	-9,142		1,388		3,083	7,917		1,131		4,086	9,358		-766		-2,697		
WY 2033 (Year 25)	-187		-2,475	-9,092		1,686		3,843	9,144		1,545		4,807	9,860		-272		-2,578		
WY 2058 (Year 50)	163		-2,416	-9,055		1,945		4,502	10,130		1,885		5,364	10,238		114		-2,488		
Central Valley steelhead																				
WY 2008 (Year 0)	0		0		0	0		0	0	0	0		0	0	0	0		0		0
WY 2009 (Year 1)	-651		-2,274		-651	1,076		1,181	1,516	815	815		1,413	2,367	815	-3,626		-4,919		-3,626
WY 2013 (Year 5)	-1,172		-4,093		-1,172	2,174		2,525	3,575	1,898	1,898		3,253	4,835	1,898	-1,765		-4,670		-1,765
WY 2023 (Year 15)	-530		-4,141		-530	3,150		4,040	5,428	3,014	3,014		4,964	6,089	3,014	-727		-4,374		-727
WY 2033 (Year 25)	50		-3,993		50	3,722		4,951	6,303	3,593	3,593		5,803	6,558	3,593	-69		-4,159		-69
WY 2058 (Year 50)	502		-3,879		502	4,212		5,735	7,022	4,052	4,052		6,454	6,915	4,052	441		-3,994		441
Delta Smelt																				
WY 2008 (Year 0)	0				0	0	0	0		0	0	0	0		0	0	0	0		0
WY 2009 (Year 1)	0				0	0	3,884	3,884		0	0	4,102	4,102		0	0	-10,507	-10,507		0
WY 2013 (Year 5)	0				0	0	7,231	7,231		0	0	7,387	7,387		0	0	-8,318	-8,318		0
WY 2023 (Year 15)	0				0	0	7,988	7,988		0	0	7,937	7,937		0	0	-7,954	-7,954		0
WY 2033 (Year 25)	0				0	0	8,140	8,140		0	0	8,047	8,047		0	0	-7,881	-7,881		0
WY 2058 (Year 50)	0				0	0	8,253	8,253		0	0	8,129	8,129		0	0	-7,826	-7,826		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table 50
SAM results showing wetted-area weighted relative response (square feet) at site Sacramento River RM 53.5R.

Focus Fish Species and Scenario	Fall (September-November)					Winter (December-February)					Spring (March-May)					Summer (June-August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2009 (Year 1)	3,070		-1,257	-3,086		3,802		2,278	6,073		3,316		2,250	7,719		2,145		-3,084	-10,170	
WY 2013 (Year 5)	5,527		-2,263	-5,554		7,073		4,682	14,179		6,527		5,479	16,505		5,411		-2,621	-7,005	
WY 2023 (Year 15)	7,253		-1,817	-4,669		8,297		6,802	20,081		8,349		8,897	21,124		7,289		-1,922	-5,154	
WY 2033 (Year 25)	8,516		-1,342	-3,711		8,896		8,126	22,524		9,275		10,662	22,644		8,597		-1,390	-3,986	
WY 2058 (Year 50)	9,625		-962	-2,987		9,487		9,477	24,685		10,115		12,112	23,801		9,740		-967	-3,105	
Central Valley fall-run chinook salmon																				
WY 2008 (Year 0)	0		0					0	0		0			0		0				
WY 2009 (Year 1)	3,070		-1,257					2,278	6,073		3,316			7,719		2,145				
WY 2013 (Year 5)	5,527		-2,263					4,682	14,179		6,527			16,505		5,411				
WY 2023 (Year 15)	7,253		-1,817					6,802	20,081		8,349			21,124		7,289				
WY 2033 (Year 25)	8,516		-1,342					8,126	22,524		9,275			22,644		8,597				
WY 2058 (Year 50)	9,625		-962					9,477	24,685		10,115			23,801		9,740				
Central Valley late fall-run chinook salmon																				
WY 2008 (Year 0)	0			0		0			0		0		0							
WY 2009 (Year 1)	3,070			-3,086		3,802			6,073		3,316		2,250							
WY 2013 (Year 5)	5,527			-5,554		7,073			14,179		6,527		5,479							
WY 2023 (Year 15)	7,253			-4,669		8,297			20,081		8,349		8,897							
WY 2033 (Year 25)	8,516			-3,711		8,896			22,524		9,275		10,662							
WY 2058 (Year 50)	9,625			-2,987		9,487			24,685		10,115		12,112							
Sacramento River winter-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0		
WY 2009 (Year 1)	3,070		-1,257	-3,086		3,802		2,278	6,073		3,316		2,250	7,719		2,145		-3,084		
WY 2013 (Year 5)	5,527		-2,263	-5,554		7,073		4,682	14,179		6,527		5,479	16,505		5,411		-2,621		
WY 2023 (Year 15)	7,253		-1,817	-4,669		8,297		6,802	20,081		8,349		8,897	21,124		7,289		-1,922		
WY 2033 (Year 25)	8,516		-1,342	-3,711		8,896		8,126	22,524		9,275		10,662	22,644		8,597		-1,390		
WY 2058 (Year 50)	9,625		-962	-2,987		9,487		9,477	24,685		10,115		12,112	23,801		9,740		-967		
Central Valley steelhead																				
WY 2008 (Year 0)	0		0		0	0		0	0	0	0		0	0	0	0		0		0
WY 2009 (Year 1)	6,581		-2,069		6,581	7,702		3,390	5,572	7,004	7,004		3,207	5,792	7,004	5,033		-5,300		5,033
WY 2013 (Year 5)	11,845		-3,724		11,845	14,355		6,874	11,642	13,707	13,707		7,499	12,103	13,707	11,661		-4,366		11,661
WY 2023 (Year 15)	14,885		-2,985		14,885	16,838		9,593	15,392	16,979	16,979		11,588	15,611	16,979	14,961		-3,180		14,961
WY 2033 (Year 25)	16,913		-2,193		16,913	18,024		11,220	17,116	18,449	18,449		13,649	16,971	18,449	17,064		-2,289		17,064
WY 2058 (Year 50)	18,588		-1,555		18,588	19,163		12,853	18,702	19,697	19,697		15,350	18,031	19,697	18,797		-1,575		18,797
Delta Smelt																				
WY 2008 (Year 0)	0				0	0	0	0		0	0	0	0		0	0	0	0		0
WY 2009 (Year 1)	0				0	0	13,149	13,149		0	0	13,405	13,405		0	0	-5,055	-5,055		0
WY 2013 (Year 5)	0				0	0	24,094	24,094		0	0	24,135	24,135		0	0	692	692		0
WY 2023 (Year 15)	0				0	0	26,273	26,273		0	0	25,928	25,928		0	0	1,650	1,650		0
WY 2033 (Year 25)	0				0	0	26,709	26,709		0	0	26,287	26,287		0	0	1,841	1,841		0
WY 2058 (Year 50)	0				0	0	27,036	27,036		0	0	26,556	26,556		0	0	1,985	1,985		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table 51
SAM results showing wetted-area weighted relative response (square feet) at site Sacramento River RM 177.8R.

Focus Fish Species and Scenario	Fall (September-November)					Winter (December-February)					Spring (March-May)					Summer (June-August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
WY 2008 (Year 0)	0		0			0		0	0		0		0	0		0		0		
WY 2009 (Year 1)	6,694		-79			7,082		3,181	9,630		7,082		3,386	12,934		6,871		-1,061		
WY 2013 (Year 5)	12,049		-143			13,125		6,469	22,291		13,834		8,115	28,546		12,368		-447		
WY 2023 (Year 15)	15,544		1,099			15,331		9,333	31,859		17,467		13,430	38,099		15,956		940		
WY 2033 (Year 25)	18,105		2,149			16,400		11,141	36,012		19,291		16,324	41,576		18,585		2,040		
WY 2058 (Year 50)	20,405		2,999			17,450		13,002	39,735		20,944		18,734	44,230		20,946		2,930		
Central Valley fall-run chinook salmon																				
WY 2008 (Year 0)	0		0					0	0		0			0		0				
WY 2009 (Year 1)	6,694		-79					3,181	9,630		7,082			12,934		6,871				
WY 2013 (Year 5)	12,049		-143					6,469	22,291		13,834			28,546		12,368				
WY 2023 (Year 15)	15,544		1,099					9,333	31,859		17,467			38,099		15,956				
WY 2033 (Year 25)	18,105		2,149					11,141	36,012		19,291			41,576		18,585				
WY 2058 (Year 50)	20,405		2,999					13,002	39,735		20,944			44,230		20,946				
Central Valley late fall-run chinook salmon																				
WY 2008 (Year 0)	0			0		0			0		0		0							
WY 2009 (Year 1)	6,694			-61		7,082			9,630		7,082		3,386							
WY 2013 (Year 5)	12,049			-110		13,125			22,291		13,834		8,115							
WY 2023 (Year 15)	15,544			3,330		15,331			31,859		17,467		13,430							
WY 2033 (Year 25)	18,105			6,101		16,400			36,012		19,291		16,324							
WY 2058 (Year 50)	20,405			8,196		17,450			39,735		20,944		18,734							
Sacramento River winter-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2009 (Year 1)	6,694		-79	-61		7,082		3,181	9,630		7,082		3,386	12,934		6,871		-1,061	-6,868	
WY 2013 (Year 5)	12,049		-143	-110		13,125		6,469	22,291		13,834		8,115	28,546		12,368		-447	-1,931	
WY 2023 (Year 15)	15,544		1,099	3,330		15,331		9,333	31,859		17,467		13,430	38,099		15,956		940	2,431	
WY 2033 (Year 25)	18,105		2,149	6,101		16,400		11,141	36,012		19,291		16,324	41,576		18,585		2,040	5,442	
WY 2058 (Year 50)	20,405		2,999	8,196		17,450		13,002	39,735		20,944		18,734	44,230		20,946		2,930	7,717	
Central Valley steelhead																				
WY 2008 (Year 0)	0		0	0	0	0		0	0	0			0	0	0	0		0	0	0
WY 2009 (Year 1)	13,401		-248	-21	13,401	14,188		5,160	9,335	14,206			5,462	10,906	14,206	13,756		-2,394	-7,038	13,756
WY 2013 (Year 5)	24,122		-446	-38	24,122	26,371		10,352	19,335	27,852			12,567	23,085	27,852	24,761		-1,076	-1,934	24,761
WY 2023 (Year 15)	30,554		1,644	3,669	30,554	30,887		14,342	25,624	34,635			19,521	30,477	34,635	31,363		1,323	2,724	31,363
WY 2033 (Year 25)	34,915		3,425	6,684	34,915	33,041		16,746	28,594	37,711			23,166	33,503	37,711	35,840		3,201	5,990	35,840
WY 2058 (Year 50)	38,556		4,872	9,005	38,556	35,109		19,175	31,351	40,330			26,207	35,874	40,330	39,577		4,726	8,500	39,577

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table 52
SAM results showing wetted-area weighted relative response (square feet) at site Sacramento River RM 16.8L.

Focus Fish Species and Scenario	Fall (September-November)					Winter (December-February)					Spring (March-May)					Summer (June-August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
WY 2009 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2010 (Year 1)	2,843		4,235	13,925		2,725		3,165	11,898		2,160		4,161	15,611		1,436		4,418	17,941	
WY 2014 (Year 5)	5,118		7,706	27,420		5,125		6,232	24,577		4,372		8,612	29,898		4,841		7,973	30,297	
WY 2024 (Year 15)	6,609		10,278	32,980		6,175		8,273	30,908		5,848		11,411	34,304		6,507		10,450	34,114	
WY 2034 (Year 25)	7,652		11,988	34,904		6,725		9,469	33,250		6,625		12,685	35,506		7,575		12,114	35,651	
WY 2059 (Year 50)	8,532		13,323	36,351		7,272		10,669	35,272		7,332		13,715	36,416		8,469		13,412	36,808	
Central Valley fall-run chinook salmon																				
WY 2009 (Year 0)	0		0	0				0	0		0			0		0			0	
WY 2010 (Year 1)	2,843		4,235	13,925				3,165	11,898		2,160			15,611		1,436			17,941	
WY 2014 (Year 5)	5,118		7,706	27,420				6,232	24,577		4,372			29,898		4,841			30,297	
WY 2024 (Year 15)	6,609		10,278	32,980				8,273	30,908		5,848			34,304		6,507			34,114	
WY 2034 (Year 25)	7,652		11,988	34,904				9,469	33,250		6,625			35,506		7,575			35,651	
WY 2059 (Year 50)	8,532		13,323	36,351				10,669	35,272		7,332			36,416		8,469			36,808	
Central Valley late fall-run chinook salmon																				
WY 2009 (Year 0)	0			0		0			0		0		0	0					0	
WY 2010 (Year 1)	2,843			13,925		2,725			11,898		2,160		4,161	15,611					17,941	
WY 2014 (Year 5)	5,118			27,420		5,125			24,577		4,372		8,612	29,898					30,297	
WY 2024 (Year 15)	6,609			32,980		6,175			30,908		5,848		11,411	34,304					34,114	
WY 2034 (Year 25)	7,652			34,904		6,725			33,250		6,625		12,685	35,506					35,651	
WY 2059 (Year 50)	8,532			36,351		7,272			35,272		7,332		13,715	36,416					36,808	
Sacramento River winter-run chinook salmon																				
WY 2009 (Year 0)	0		0	0		0		0	0		0		0	0		0		0		
WY 2010 (Year 1)	2,843		4,235	13,925		2,725		3,165	11,898		2,160		4,161	15,611		1,436		4,418		
WY 2014 (Year 5)	5,118		7,706	27,420		5,125		6,232	24,577		4,372		8,612	29,898		4,841		7,973		
WY 2024 (Year 15)	6,609		10,278	32,980		6,175		8,273	30,908		5,848		11,411	34,304		6,507		10,450		
WY 2034 (Year 25)	7,652		11,988	34,904		6,725		9,469	33,250		6,625		12,685	35,506		7,575		12,114		
WY 2059 (Year 50)	8,532		13,323	36,351		7,272		10,669	35,272		7,332		13,715	36,416		8,469		13,412		
Central Valley steelhead																				
WY 2009 (Year 0)	0		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0
WY 2010 (Year 1)	6,833		6,163	11,386	6,833	5,903		4,972	10,113	5,487	5,487		6,053	11,739	5,487	5,004		6,514	13,345	5,004
WY 2014 (Year 5)	12,299		11,210	21,365	12,299	11,087		9,656	19,739	10,753	10,753		12,224	22,282	10,753	12,005		11,580	22,768	12,005
WY 2024 (Year 15)	14,849		14,419	25,124	14,849	13,235		12,344	23,842	13,328	13,328		15,674	25,639	13,328	14,780		14,647	25,738	14,780
WY 2034 (Year 25)	16,415		16,483	26,709	16,415	14,309		13,833	25,510	14,479	14,479		17,204	26,709	14,479	16,371		16,651	27,136	16,371
WY 2059 (Year 50)	17,682		18,106	27,912	17,682	15,346		15,304	27,012	15,456	15,456		18,450	27,534	15,456	17,651		18,226	28,198	17,651
Delta Smelt																				
WY 2009 (Year 0)	0				0	0	0	0		0	0	0	0		0	0	0	0		0
WY 2010 (Year 1)	0				0	0	5,483	5,483		0	0	5,797	5,797		0	0	2,021	2,021		0
WY 2014 (Year 5)	0				0	0	10,192	10,192		0	0	10,439	10,439		0	0	8,399	8,399		0
WY 2024 (Year 15)	0				0	0	11,245	11,245		0	0	11,217	11,217		0	0	9,465	9,465		0
WY 2034 (Year 25)	0				0	0	11,456	11,456		0	0	11,372	11,372		0	0	9,678	9,678		0
WY 2059 (Year 50)	0				0	0	11,614	11,614		0	0	11,489	11,489		0	0	9,838	9,838		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table 53
SAM results showing wetted-area weighted relative response (square feet) at site Sacramento River RM 42.7R.

Focus Fish Species and Scenario	Fall (September-November)					Winter (December-February)					Spring (March-May)					Summer (June-August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
WY 2009 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2010 (Year 1)	220		-934	-3,701		-12		557	173		3		562	938		-1,139		-2,034	-8,875	
WY 2014 (Year 5)	395		-1,680	-6,659		54		1,220	1,508		209		1,527	2,566		130		-1,845	-7,629	
WY 2024 (Year 15)	915		-1,579	-6,702		291		1,921	3,179		710		2,683	3,860		841		-1,584	-6,963	
WY 2034 (Year 25)	1,360		-1,417	-6,438		457		2,355	3,818		1,014		3,276	4,297		1,329		-1,388	-6,553	
WY 2059 (Year 50)	1,750		-1,287	-6,239		628		2,789	4,368		1,295		3,761	4,630		1,753		-1,232	-6,244	
Central Valley fall-run chinook salmon																				
WY 2009 (Year 0)	0		0					0	0		0			0		0				
WY 2010 (Year 1)	220		-934					557	173		3			938		-1,139				
WY 2014 (Year 5)	395		-1,680					1,220	1,508		209			2,566		130				
WY 2024 (Year 15)	915		-1,579					1,921	3,179		710			3,860		841				
WY 2034 (Year 25)	1,360		-1,417					2,355	3,818		1,014			4,297		1,329				
WY 2059 (Year 50)	1,750		-1,287					2,789	4,368		1,295			4,630		1,753				
Central Valley late fall-run chinook salmon																				
WY 2009 (Year 0)	0			0		0			0		0		0							
WY 2010 (Year 1)	220			-3,701		-12			173		3		562							
WY 2014 (Year 5)	395			-6,659		54			1,508		209		1,527							
WY 2024 (Year 15)	915			-6,702		291			3,179		710		2,683							
WY 2034 (Year 25)	1,360			-6,438		457			3,818		1,014		3,276							
WY 2059 (Year 50)	1,750			-6,239		628			4,368		1,295		3,761							
Sacramento River winter-run chinook salmon																				
WY 2009 (Year 0)	0		0	0		0		0	0		0		0	0		0		0		
WY 2010 (Year 1)	220		-934	-3,701		-12		557	173		3		562	938		-1,139		-2,034		
WY 2014 (Year 5)	395		-1,680	-6,659		54		1,220	1,508		209		1,527	2,566		130		-1,845		
WY 2024 (Year 15)	915		-1,579	-6,702		291		1,921	3,179		710		2,683	3,860		841		-1,584		
WY 2034 (Year 25)	1,360		-1,417	-6,438		457		2,355	3,818		1,014		3,276	4,297		1,329		-1,388		
WY 2059 (Year 50)	1,750		-1,287	-6,239		628		2,789	4,368		1,295		3,761	4,630		1,753		-1,232		
Central Valley steelhead																				
WY 2009 (Year 0)	0		0		0	0		0	0	0	0		0	0	0	0		0		0
WY 2010 (Year 1)	452		-1,463		452	-19		707	671	12	12		715	965	12	-2,308		-3,312		-2,308
WY 2014 (Year 5)	813		-2,632		813	120		1,547	1,771	410	410		1,903	2,304	410	274		-2,937		274
WY 2024 (Year 15)	1,666		-2,454		1,666	569		2,395	2,801	1,233	1,233		3,264	3,336	1,233	1,510		-2,496		1,510
WY 2034 (Year 25)	2,355		-2,183		2,355	872		2,908	3,269	1,682	1,682		3,954	3,753	1,682	2,286		-2,168		2,286
WY 2059 (Year 50)	2,927		-1,965		2,927	1,175		3,416	3,694	2,070	2,070		4,522	4,078	2,070	2,923		-1,906		2,923
Delta Smelt																				
WY 2009 (Year 0)	0				0	0	0	0		0	0	0	0		0	0	0	0		0
WY 2010 (Year 1)	0				0	0	1,435	1,435		0	0	1,428	1,428		0	0	-11,024	-11,024		0
WY 2014 (Year 5)	0				0	0	2,745	2,745		0	0	2,576	2,576		0	0	-8,795	-8,795		0
WY 2024 (Year 15)	0				0	0	3,100	3,100		0	0	2,769	2,769		0	0	-8,424	-8,424		0
WY 2034 (Year 25)	0				0	0	3,171	3,171		0	0	2,808	2,808		0	0	-8,350	-8,350		0
WY 2059 (Year 50)	0				0	0	3,224	3,224		0	0	2,837	2,837		0	0	-8,294	-8,294		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table 54
SAM results showing wetted-area weighted relative response (square feet) at site Sacramento River RM 55.2L.

Focus Fish Species and Scenario	Fall (September-November)					Winter (December-February)					Spring (March-May)					Summer (June-August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
WY 2009 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2010 (Year 1)	825		-2,511	-7,492		1,187		2,056	3,336		544		2,742	7,496		-3,173		-5,972	-20,109	
WY 2014 (Year 5)	1,486		-4,515	-13,479		2,368		4,352	9,669		1,469		6,212	15,315		699		-5,222	-16,059	
WY 2024 (Year 15)	2,790		-4,405	-13,955		3,404		6,969	15,819		2,922		9,303	18,671		2,544		-4,652	-14,865	
WY 2034 (Year 25)	3,792		-4,114	-13,738		4,022		8,566	18,317		3,771		10,803	19,662		3,657		-4,268	-14,315	
WY 2059 (Year 50)	4,574		-3,891	-13,574		4,560		9,947	20,318		4,469		11,960	20,407		4,522		-3,976	-13,902	
Central Valley fall-run chinook salmon																				
WY 2009 (Year 0)	0		0					0	0		0			0		0				
WY 2010 (Year 1)	825		-2,511					2,056	3,336		544			7,496		-3,173				
WY 2014 (Year 5)	1,486		-4,515					4,352	9,669		1,469			15,315		699				
WY 2024 (Year 15)	2,790		-4,405					6,969	15,819		2,922			18,671		2,544				
WY 2034 (Year 25)	3,792		-4,114					8,566	18,317		3,771			19,662		3,657				
WY 2059 (Year 50)	4,574		-3,891					9,947	20,318		4,469			20,407		4,522				
Central Valley late fall-run chinook salmon																				
WY 2009 (Year 0)	0			0		0			0		0		0							
WY 2010 (Year 1)	825			-7,492		1,187			3,336		544		2,742							
WY 2014 (Year 5)	1,486			-13,479		2,368			9,669		1,469		6,212							
WY 2024 (Year 15)	2,790			-13,955		3,404			15,819		2,922		9,303							
WY 2034 (Year 25)	3,792			-13,738		4,022			18,317		3,771		10,803							
WY 2059 (Year 50)	4,574			-13,574		4,560			20,318		4,469		11,960							
Sacramento River winter-run chinook salmon																				
WY 2009 (Year 0)	0		0	0		0		0	0		0		0	0		0		0		
WY 2010 (Year 1)	825		-2,511	-7,492		1,187		2,056	3,336		544		2,742	7,496		-3,173		-5,972		
WY 2014 (Year 5)	1,486		-4,515	-13,479		2,368		4,352	9,669		1,469		6,212	15,315		699		-5,222		
WY 2024 (Year 15)	2,790		-4,405	-13,955		3,404		6,969	15,819		2,922		9,303	18,671		2,544		-4,652		
WY 2034 (Year 25)	3,792		-4,114	-13,738		4,022		8,566	18,317		3,771		10,803	19,662		3,657		-4,268		
WY 2059 (Year 50)	4,574		-3,891	-13,574		4,560		9,947	20,318		4,469		11,960	20,407		4,522		-3,976		
Central Valley steelhead																				
WY 2009 (Year 0)	0		0		0	0		0	0	0	0		0	0	0	0		0		0
WY 2010 (Year 1)	3,369		-3,932		3,369	2,890		2,823	3,447	2,471	2,471		3,446	5,216	2,471	-3,177		-9,626		-3,177
WY 2014 (Year 5)	6,065		-7,072		6,065	5,686		5,920	7,957	5,318	5,318		7,670	10,534	5,318	4,814		-8,236		4,814
WY 2024 (Year 15)	8,148		-6,870		8,148	7,773		9,127	11,804	7,674	7,674		11,266	13,091	7,674	7,784		-7,279		7,784
WY 2034 (Year 25)	9,572		-6,387		9,572	8,961		11,031	13,598	8,860	8,860		13,004	14,035	8,860	9,389		-6,644		9,389
WY 2059 (Year 50)	10,676		-6,015		10,676	9,974		12,666	15,071	9,799	9,799		14,350	14,751	9,799	10,627		-6,157		10,627
Delta Smelt																				
WY 2009 (Year 0)	0				0	0	0	0		0	0	0	0		0	0	0	0		0
WY 2010 (Year 1)	0				0	0	9,075	9,075		0	0	9,274	9,274		0	0	-20,451	-20,451		0
WY 2014 (Year 5)	0				0	0	16,838	16,838		0	0	16,695	16,695		0	0	-13,747	-13,747		0
WY 2024 (Year 15)	0				0	0	18,546	18,546		0	0	17,937	17,937		0	0	-12,629	-12,629		0
WY 2034 (Year 25)	0				0	0	18,888	18,888		0	0	18,186	18,186		0	0	-12,406	-12,406		0
WY 2059 (Year 50)	0				0	0	19,144	19,144		0	0	18,372	18,372		0	0	-12,238	-12,238		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table 55
SAM results showing wetted-area weighted relative response (square feet) at site Sacramento River RM 77.2L

Focus Fish Species and Scenario	Fall (September-November)					Winter (December-February)					Spring (March-May)					Summer (June-August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
WY 2009 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2010 (Year 1)	4,104		-723	-4,664		4,155		3,065	7,346		3,620		3,415	10,239		2,987		-2,542	-14,874	
WY 2014 (Year 5)	7,387		-1,302	-8,395		7,722		6,146	16,924		7,102		7,625	21,064		6,850		-2,026	-11,199	
WY 2024 (Year 15)	9,740		-565	-7,017		9,199		8,878	23,891		9,240		11,508	26,083		9,245		-1,139	-8,780	
WY 2034 (Year 25)	11,420		101	-5,537		9,929		10,503	26,708		10,340		13,476	27,702		10,890		-465	-7,208	
WY 2059 (Year 50)	12,838		621	-4,423		10,553		11,909	28,969		11,239		14,999	28,921		12,268		59	-6,026	
Central Valley fall-run chinook salmon																				
WY 2009 (Year 0)	0		0					0	0		0			0		0				
WY 2010 (Year 1)	4,104		-723					3,065	7,346		3,620			10,239		2,987				
WY 2014 (Year 5)	7,387		-1,302					6,146	16,924		7,102			21,064		6,850				
WY 2024 (Year 15)	9,740		-565					8,878	23,891		9,240			26,083		9,245				
WY 2034 (Year 25)	11,420		101					10,503	26,708		10,340			27,702		10,890				
WY 2059 (Year 50)	12,838		621					11,909	28,969		11,239			28,921		12,268				
Central Valley late fall-run chinook salmon																				
WY 2009 (Year 0)	0			0		0			0		0		0							
WY 2010 (Year 1)	4,104			-4,664		4,155			7,346		3,620		3,415							
WY 2014 (Year 5)	7,387			-8,395		7,722			16,924		7,102		7,625							
WY 2024 (Year 15)	9,740			-7,017		9,199			23,891		9,240		11,508							
WY 2034 (Year 25)	11,420			-5,537		9,929			26,708		10,340		13,476							
WY 2059 (Year 50)	12,838			-4,423		10,553			28,969		11,239		14,999							
Sacramento River winter-run chinook salmon																				
WY 2009 (Year 0)	0		0	0		0		0	0		0		0	0		0		0		
WY 2010 (Year 1)	4,104		-723	-4,664		4,155		3,065	7,346		3,620		3,415	10,239		2,987		-2,542		
WY 2014 (Year 5)	7,387		-1,302	-8,395		7,722		6,146	16,924		7,102		7,625	21,064		6,850		-2,026		
WY 2024 (Year 15)	9,740		-565	-7,017		9,199		8,878	23,891		9,240		11,508	26,083		9,245		-1,139		
WY 2034 (Year 25)	11,420		101	-5,537		9,929		10,503	26,708		10,340		13,476	27,702		10,890		-465		
WY 2059 (Year 50)	12,838		621	-4,423		10,553		11,909	28,969		11,239		14,999	28,921		12,268		59		
Central Valley steelhead																				
WY 2009 (Year 0)	0		0		0	0		0	0	0	0		0	0	0	0		0		0
WY 2010 (Year 1)	8,394		-1,358		8,394	8,556		4,508	7,263	7,935	7,935		4,766	8,204	7,935	6,515		-4,740		6,515
WY 2014 (Year 5)	15,108		-2,444		15,108	15,916		8,942	14,868	15,413	15,413		10,352	16,441	15,413	14,329		-3,683		14,329
WY 2024 (Year 15)	19,263		-1,227		19,263	18,878		12,404	19,426	19,122	19,122		15,012	20,376	19,122	18,519		-2,172		18,519
WY 2034 (Year 25)	22,034		-112		22,034	20,297		14,386	21,462	20,806	20,806		17,322	21,871	20,806	21,197		-1,037		21,197
WY 2059 (Year 50)	24,261		767		24,261	21,494		16,089	23,132	22,136	22,136		19,116	23,005	22,136	23,342		-149		23,342
Delta Smelt																				
WY 2009 (Year 0)	0				0	0	0	0		0	0	0	0		0	0	0	0		0
WY 2010 (Year 1)	0				0	0	17,312	17,312		0	0	17,706	17,706		0	0	-5,644	-5,644		0
WY 2014 (Year 5)	0				0	0	31,661	31,661		0	0	31,877	31,877		0	0	1,175	1,175		0
WY 2024 (Year 15)	0				0	0	34,468	34,468		0	0	34,244	34,244		0	0	2,311	2,311		0
WY 2034 (Year 25)	0				0	0	35,029	35,029		0	0	34,718	34,718		0	0	2,539	2,539		0
WY 2059 (Year 50)	0				0	0	35,450	35,450		0	0	35,073	35,073		0	0	2,709	2,709		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table 56
SAM results showing wetted-area weighted relative response (square feet) at site Feather River RM 28.5R.

Focus Fish Species and Scenario	Fall (September-November)					Winter (December-February)					Spring (March-May)					Summer (June-August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
WY 2009 (Year 0)	0		0			0		0	0		0		0	0		0		0		
WY 2010 (Year 1)	4,859		3,498			3,626		3,592	10,522		3,699		3,857	13,942		3,523		3,185		
WY 2014 (Year 5)	8,746		6,382			6,860		7,292	23,800		7,565		9,125	29,974		8,677		6,793		
WY 2024 (Year 15)	11,927		12,084			8,613		10,979	33,695		10,636		15,403	39,377		12,134		12,678		
WY 2034 (Year 25)	14,277		16,438			9,558		13,232	37,929		12,302		18,853	42,866		14,583		17,150		
WY 2059 (Year 50)	16,280		19,855			10,374		15,197	41,350		13,665		21,541	45,495		16,666		20,660		
Central Valley fall-run chinook salmon																				
WY 2009 (Year 0)	0		0					0	0		0			0		0				
WY 2010 (Year 1)	4,859		3,498					3,592	10,522		3,699			13,942		3,523				
WY 2014 (Year 5)	8,746		6,382					7,292	23,800		7,565			29,974		8,677				
WY 2024 (Year 15)	11,927		12,084					10,979	33,695		10,636			39,377		12,134				
WY 2034 (Year 25)	14,277		16,438					13,232	37,929		12,302			42,866		14,583				
WY 2059 (Year 50)	16,280		19,855					15,197	41,350		13,665			45,495		16,666				
Central Valley late fall-run chinook salmon																				
WY 2009 (Year 0)	0			0		0			0		0		0							
WY 2010 (Year 1)	4,859			11,400		3,626			10,522		3,699		3,857							
WY 2014 (Year 5)	8,746			23,667		6,860			23,800		7,565		9,125							
WY 2024 (Year 15)	11,927			34,611		8,613			33,695		10,636		15,403							
WY 2034 (Year 25)	14,277			40,582		9,558			37,929		12,302		18,853							
WY 2059 (Year 50)	16,280			45,075		10,374			41,350		13,665		21,541							
Sacramento River winter-run chinook salmon																				
WY 2009 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2010 (Year 1)	4,859		3,498	11,400		3,626		3,592	10,522		3,699		3,857	13,942		3,523		3,185	10,614	
WY 2014 (Year 5)	8,746		6,382	23,667		6,860		7,292	23,800		7,565		9,125	29,974		8,677		6,793	27,398	
WY 2024 (Year 15)	11,927		12,084	34,611		8,613		10,979	33,695		10,636		15,403	39,377		12,134		12,678	37,280	
WY 2034 (Year 25)	14,277		16,438	40,582		9,558		13,232	37,929		12,302		18,853	42,866		14,583		17,150	43,135	
WY 2059 (Year 50)	16,280		19,855	45,075		10,374		15,197	41,350		13,665		21,541	45,495		16,666		20,660	47,541	
Central Valley steelhead																				
WY 2009 (Year 0)	0		0	0	0	0		0	0	0			0	0	0	0		0	0	0
WY 2010 (Year 1)	10,106		5,376	10,076	10,106	7,770		5,354	9,039	7,931			5,731	10,685	7,931	7,806		4,682	7,913	7,806
WY 2014 (Year 5)	18,190		9,811	19,364	18,190	14,716		10,748	18,678	16,176			13,077	22,323	16,176	18,143		10,429	21,386	18,143
WY 2024 (Year 15)	23,927		16,913	27,084	23,927	18,335		15,464	24,997	21,756			20,734	29,369	21,756	24,367		17,802	29,030	24,367
WY 2034 (Year 25)	27,892		22,251	31,757	27,892	20,231		18,241	27,953	24,496			24,801	32,315	24,496	28,501		23,295	33,768	28,501
WY 2059 (Year 50)	31,095		26,462	35,308	31,095	21,842		20,641	30,390	26,667			27,975	34,557	26,667	31,837		27,627	37,368	31,837

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table 57
SAM results showing cumulative bank-line weighted relative response (feet) for bank repair sites within Region 1a (3 sites).

Focus Fish Species and Scenario	Fall (September-November)					Winter (December-February)					Spring (March-May)					Summer (June-August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2009 (Year 1)	11		23	74		5		11	8		-5		5	53		-62		-18	-27	
WY 2013 (Year 5)	59		103	383		52		76	254		33		93	359		40		105	437	
WY 2023 (Year 15)	98		177	536		76		126	410		72		166	469		90		182	563	
WY 2033 (Year 25)	130		234	601		91		158	473		95		203	503		123		237	619	
WY 2058 (Year 50)	157		277	649		105		188	526		115		233	528		151		280	662	
Central Valley fall-run chinook salmon																				
WY 2008 (Year 0)	0		0	0				0	0		0			0		0			0	
WY 2009 (Year 1)	11		23	74				11	8		-5			53		-62			-27	
WY 2013 (Year 5)	59		103	383				76	254		33			359		40			437	
WY 2023 (Year 15)	98		177	536				126	410		72			469		90			563	
WY 2033 (Year 25)	130		234	601				158	473		95			503		123			619	
WY 2058 (Year 50)	157		277	649				188	526		115			528		151			662	
Central Valley late fall-run chinook salmon																				
WY 2008 (Year 0)	0			0		0			0		0		0	0					0	
WY 2009 (Year 1)	11			74		5			8		-5		5	53					-27	
WY 2013 (Year 5)	59			383		52			254		33		93	359					437	
WY 2023 (Year 15)	98			536		76			410		72		166	469					563	
WY 2033 (Year 25)	130			601		91			473		95		203	503					619	
WY 2058 (Year 50)	157			649		105			526		115		233	528					662	
Sacramento River winter-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0		
WY 2009 (Year 1)	11		23	74		5		11	8		-5		5	53		-62		-18		
WY 2013 (Year 5)	59		103	383		52		76	254		33		93	359		40		105		
WY 2023 (Year 15)	98		177	536		76		126	410		72		166	469		90		182		
WY 2033 (Year 25)	130		234	601		91		158	473		95		203	503		123		237		
WY 2058 (Year 50)	157		277	649		105		188	526		115		233	528		151		280		
Central Valley steelhead																				
WY 2008 (Year 0)	0		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0
WY 2009 (Year 1)	36		35	61	36	11		18	17	-1	-1		11	31	-1	-94		-28	-49	-94
WY 2013 (Year 5)	160		151	289	160	112		117	206	96	96		134	248	96	131		152	305	131
WY 2023 (Year 15)	227		242	390	227	163		184	303	163	163		224	330	163	216		247	402	216
WY 2033 (Year 25)	276		310	442	276	192		224	347	197	197		270	360	197	268		314	451	268
WY 2058 (Year 50)	316		363	482	316	218		261	386	224	224		305	384	224	309		366	489	309
Delta Smelt																				
WY 2008 (Year 0)	0				0	0	0	0		0	0	0	0		0	0	0	0		0
WY 2009 (Year 1)	0				0	0	31	31		0	0	41	41		0	0	-183	-183		0
WY 2013 (Year 5)	0				0	0	142	142		0	0	152	152		0	0	142	142		0
WY 2023 (Year 15)	0				0	0	164	164		0	0	165	165		0	0	197	197		0
WY 2033 (Year 25)	0				0	0	169	169		0	0	168	168		0	0	208	208		0
WY 2058 (Year 50)	0				0	0	172	172		0	0	170	170		0	0	216	216		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table 58
SAM results showing cumulative bank-line weighted relative response (feet) for bank repair sites within Region 1b (8 sites).

Focus Fish Species and Scenario	Fall (September-November)					Winter (December-February)					Spring (March-May)					Summer (June-August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2009 (Year 1)	44		1	-26		38		53	108		20		70	220		-38		-62	-231	
WY 2013 (Year 5)	127		-52	-202		127		181	445		95		254	684		96		-58	-235	
WY 2023 (Year 15)	193		-16	-145		174		292	730		166		401	865		181		-5	-133	
WY 2033 (Year 25)	247		17	-104		203		362	844		207		474	920		237		31	-86	
WY 2058 (Year 50)	290		42	-74		227		423	936		241		531	960		282		59	-51	
Central Valley fall-run chinook salmon																				
WY 2008 (Year 0)	0		0					0	0		0			0		0				
WY 2009 (Year 1)	44		1					53	108		20			220		-38				
WY 2013 (Year 5)	127		-52					181	445		95			684		96				
WY 2023 (Year 15)	193		-16					292	730		166			865		181				
WY 2033 (Year 25)	247		17					362	844		207			920		237				
WY 2058 (Year 50)	290		42					423	936		241			960		282				
Central Valley late fall-run chinook salmon																				
WY 2008 (Year 0)	0			0		0			0		0		0							
WY 2009 (Year 1)	44			-26		38			108		20		70							
WY 2013 (Year 5)	127			-202		127			445		95		254							
WY 2023 (Year 15)	193			-145		174			730		166		401							
WY 2033 (Year 25)	247			-104		203			844		207		474							
WY 2058 (Year 50)	290			-74		227			936		241		531							
Sacramento River winter-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0		
WY 2009 (Year 1)	44		1	-26		38		53	108		20		70	220		-38		-62		
WY 2013 (Year 5)	127		-52	-202		127		181	445		95		254	684		96		-58		
WY 2023 (Year 15)	193		-16	-145		174		292	730		166		401	865		181		-5		
WY 2033 (Year 25)	247		17	-104		203		362	844		207		474	920		237		31		
WY 2058 (Year 50)	290		42	-74		227		423	936		241		531	960		282		59		
Central Valley steelhead																				
WY 2008 (Year 0)	0		0		0	0		0	0	0	0		0	0	0	0		0		0
WY 2009 (Year 1)	127		-10		127	83		76	104	69	69		91	151	69	-1		-115		-1
WY 2013 (Year 5)	351		-104		351	277		253	370	265	265		325	480	265	302		-122		302
WY 2023 (Year 15)	462		-58		462	373		391	546	384	384		498	615	384	443		-47		443
WY 2033 (Year 25)	541		-12		541	427		475	628	443	443		584	665	443	527		4		527
WY 2058 (Year 50)	604		24		604	473		548	695	490	490		650	703	490	592		43		592
Delta Smelt																				
WY 2008 (Year 0)	0				0	0	0	0		0	0	0	0		0	0	0	0		0
WY 2009 (Year 1)	0				0	0	265	265		0	0	276	276		0	0	-250	-250		0
WY 2013 (Year 5)	0				0	0	778	778		0	0	798	798		0	0	-99	-99		0
WY 2023 (Year 15)	0				0	0	865	865		0	0	865	865		0	0	-20	-20		0
WY 2033 (Year 25)	0				0	0	882	882		0	0	878	878		0	0	-5	-5		0
WY 2058 (Year 50)	0				0	0	894	894		0	0	887	887		0	0	6	6		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table 59
SAM results showing cumulative bank-line weighted relative response (feet) for bank repair sites within Region 2 (Feather River RM 28.5R).

Focus Fish Species and Scenario	Fall (September-November)					Winter (December-February)					Spring (March-May)					Summer (June-August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
WY 2009 (Year 0)	0		0			0		0	0		0		0	0		0		0		
WY 2010 (Year 1)	55		39			40		40	117		41		43	155		39		35		
WY 2014 (Year 5)	99		72			76		81	265		84		101	332		96		75		
WY 2024 (Year 15)	134		136			96		122	375		118		171	437		134		140		
WY 2034 (Year 25)	161		185			107		147	423		136		209	475		161		189		
WY 2059 (Year 50)	183		224			116		169	461		152		239	504		184		228		
Central Valley fall-run chinook salmon																				
WY 2009 (Year 0)	0		0					0	0		0			0		0				
WY 2010 (Year 1)	55		39					40	117		41			155		39				
WY 2014 (Year 5)	99		72					81	265		84			332		96				
WY 2024 (Year 15)	134		136					122	375		118			437		134				
WY 2034 (Year 25)	161		185					147	423		136			475		161				
WY 2059 (Year 50)	183		224					169	461		152			504		184				
Central Valley late fall-run chinook salmon																				
WY 2009 (Year 0)	0			0		0			0		0		0							
WY 2010 (Year 1)	55			128		40			117		41		43							
WY 2014 (Year 5)	99			267		76			265		84		101							
WY 2024 (Year 15)	134			390		96			375		118		171							
WY 2034 (Year 25)	161			457		107			423		136		209							
WY 2059 (Year 50)	183			508		116			461		152		239							
Sacramento River winter-run chinook salmon																				
WY 2009 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2010 (Year 1)	55		39	128		40		40	117		41		43	155		39		35	117	
WY 2014 (Year 5)	99		72	267		76		81	265		84		101	332		96		75	302	
WY 2024 (Year 15)	134		136	390		96		122	375		118		171	437		134		140	411	
WY 2034 (Year 25)	161		185	457		107		147	423		136		209	475		161		189	475	
WY 2059 (Year 50)	183		224	508		116		169	461		152		239	504		184		228	524	
Central Valley steelhead																				
WY 2009 (Year 0)	0		0	0	0	0		0	0	0			0	0	0	0		0	0	0
WY 2010 (Year 1)	114		61	114	114	87		60	101	88			64	118	88	86		52	87	86
WY 2014 (Year 5)	205		111	218	205	164		120	208	179			145	248	179	200		115	236	200
WY 2024 (Year 15)	270		191	305	270	204		172	279	241			230	326	241	268		196	320	268
WY 2034 (Year 25)	314		251	358	314	225		203	311	272			275	358	272	314		257	372	314
WY 2059 (Year 50)	350		298	398	350	243		230	339	296			310	383	296	351		304	412	351

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table 60
SAM results showing cumulative bank-line weighted relative response (feet) for bank repair sites within Region 3 (Sacramento River RM 177.8R).

Focus Fish Species and Scenario	Fall (September-November)					Winter (December-February)					Spring (March-May)					Summer (June-August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
WY 2008 (Year 0)	0		0			0		0	0		0		0	0		0		0		
WY 2009 (Year 1)	51		-1			51		23	70		52		25	95		51		-8		
WY 2013 (Year 5)	92		-1			95		47	162		102		60	210		92		-3		
WY 2023 (Year 15)	119		8			111		68	231		128		99	280		119		7		
WY 2033 (Year 25)	139		16			119		81	261		142		120	306		138		15		
WY 2058 (Year 50)	156		23			127		94	288		154		138	325		156		22		
Central Valley fall-run chinook salmon																				
WY 2008 (Year 0)	0		0					0	0		0			0		0				
WY 2009 (Year 1)	51		-1					23	70		52			95		51				
WY 2013 (Year 5)	92		-1					47	162		102			210		92				
WY 2023 (Year 15)	119		8					68	231		128			280		119				
WY 2033 (Year 25)	139		16					81	261		142			306		138				
WY 2058 (Year 50)	156		23					94	288		154			325		156				
Central Valley late fall-run chinook salmon																				
WY 2008 (Year 0)	0			0		0			0		0		0							
WY 2009 (Year 1)	51			0		51			70		52		25							
WY 2013 (Year 5)	92			-1		95			162		102		60							
WY 2023 (Year 15)	119			25		111			231		128		99							
WY 2033 (Year 25)	139			47		119			261		142		120							
WY 2058 (Year 50)	156			63		127			288		154		138							
Sacramento River winter-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2009 (Year 1)	51		-1	0		51		23	70		52		25	95		51		-8	-51	
WY 2013 (Year 5)	92		-1	-1		95		47	162		102		60	210		92		-3	-14	
WY 2023 (Year 15)	119		8	25		111		68	231		128		99	280		119		7	18	
WY 2033 (Year 25)	139		16	47		119		81	261		142		120	306		138		15	40	
WY 2058 (Year 50)	156		23	63		127		94	288		154		138	325		156		22	57	
Central Valley steelhead																				
WY 2008 (Year 0)	0		0	0	0	0		0	0	0			0	0	0	0		0	0	0
WY 2009 (Year 1)	103		-2	0	103	103		37	68	104			40	80	104	102		-18	-52	102
WY 2013 (Year 5)	185		-3	0	185	191		75	140	205			92	170	205	184		-8	-14	184
WY 2023 (Year 15)	234		13	28	234	224		104	186	255			144	224	255	233		10	20	233
WY 2033 (Year 25)	267		26	51	267	240		121	207	277			170	246	277	267		24	45	267
WY 2058 (Year 50)	295		37	69	295	255		139	227	297			193	264	297	295		35	63	295

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table 61
SAM results showing cumulative wetted-area weighted relative response (square feet) for bank repair sites within Region 1a (3 sites).

Focus Fish Species and Scenario	Fall (September-November)					Winter (December-February)					Spring (March-May)					Summer (June-August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2009 (Year 1)	2,697		5,872	18,428		1,193		2,626	1,279		-1,411		1,097	13,155		-16,545		-5,230	-8,891	
WY 2013 (Year 5)	9,831		18,600	71,110		8,160		13,159	41,039		4,177		15,439	63,163		5,326		19,118	81,897	
WY 2023 (Year 15)	18,492		35,203	103,689		13,421		24,074	73,687		12,641		31,163	85,840		16,541		36,582	109,771	
WY 2033 (Year 25)	25,600		47,888	118,131		16,705		31,067	87,399		17,719		39,411	93,261		23,982		49,024	122,682	
WY 2058 (Year 50)	31,568		57,749	128,933		19,736		37,549	98,813		22,075		45,943	98,835		30,150		58,675	132,350	
Central Valley fall-run chinook salmon																				
WY 2008 (Year 0)	0		0	0				0	0		0			0		0			0	
WY 2009 (Year 1)	2,697		5,872	18,428				2,626	1,279		-1,411			13,155		-16,545			-8,891	
WY 2013 (Year 5)	9,831		18,600	71,110				13,159	41,039		4,177			63,163		5,326			81,897	
WY 2023 (Year 15)	18,492		35,203	103,689				24,074	73,687		12,641			85,840		16,541			109,771	
WY 2033 (Year 25)	25,600		47,888	118,131				31,067	87,399		17,719			93,261		23,982			122,682	
WY 2058 (Year 50)	31,568		57,749	128,933				37,549	98,813		22,075			98,835		30,150			132,350	
Central Valley late fall-run chinook salmon																				
WY 2008 (Year 0)	0			0		0			0		0		0	0					0	
WY 2009 (Year 1)	2,697			18,428		1,193			1,279		-1,411		1,097	13,155					-8,891	
WY 2013 (Year 5)	9,831			71,110		8,160			41,039		4,177		15,439	63,163					81,897	
WY 2023 (Year 15)	18,492			103,689		13,421			73,687		12,641		31,163	85,840					109,771	
WY 2033 (Year 25)	25,600			118,131		16,705			87,399		17,719		39,411	93,261					122,682	
WY 2058 (Year 50)	31,568			128,933		19,736			98,813		22,075		45,943	98,835					132,350	
Sacramento River winter-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0		
WY 2009 (Year 1)	2,697		5,872	18,428		1,193		2,626	1,279		-1,411		1,097	13,155		-16,545		-5,230		
WY 2013 (Year 5)	9,831		18,600	71,110		8,160		13,159	41,039		4,177		15,439	63,163		5,326		19,118		
WY 2023 (Year 15)	18,492		35,203	103,689		13,421		24,074	73,687		12,641		31,163	85,840		16,541		36,582		
WY 2033 (Year 25)	25,600		47,888	118,131		16,705		31,067	87,399		17,719		39,411	93,261		23,982		49,024		
WY 2058 (Year 50)	31,568		57,749	128,933		19,736		37,549	98,813		22,075		45,943	98,835		30,150		58,675		
Central Valley steelhead																				
WY 2008 (Year 0)	0		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0
WY 2009 (Year 1)	9,280		8,731	15,282	9,280	2,678		4,276	3,572	-592	-592		2,335	7,504	-592	-25,125		-8,146	-14,264	-25,125
WY 2013 (Year 5)	28,661		27,346	52,658	28,661	17,803		20,327	33,037	14,154	14,154		22,463	41,790	14,154	21,639		27,317	55,272	21,639
WY 2023 (Year 15)	43,303		47,638	74,086	43,303	28,411		34,589	53,293	28,361	28,361		41,835	58,704	28,361	40,757		49,000	76,833	40,757
WY 2033 (Year 25)	54,293		62,882	85,741	54,293	34,811		43,394	62,960	35,892	35,892		51,799	65,369	35,892	52,294		64,016	88,049	52,294
WY 2058 (Year 50)	63,131		74,812	94,548	63,131	40,598		51,458	71,274	42,049	42,049		59,720	70,466	42,049	61,497		75,740	96,527	61,497
Delta Smelt																				
WY 2008 (Year 0)	0				0	0	0	0		0	0	0	0		0	0	0	0		0
WY 2009 (Year 1)	0				0	0	8,008	8,008		0	0	10,653	10,653		0	0	-48,281	-48,281		0
WY 2013 (Year 5)	0				0	0	26,636	26,636		0	0	29,151	29,151		0	0	28,537	28,537		0
WY 2023 (Year 15)	0				0	0	31,154	31,154		0	0	31,604	31,604		0	0	41,454	41,454		0
WY 2033 (Year 25)	0				0	0	32,016	32,016		0	0	32,060	32,060		0	0	43,990	43,990		0
WY 2058 (Year 50)	0				0	0	32,653	32,653		0	0	32,396	32,396		0	0	45,884	45,884		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table 62
SAM results showing cumulative wetted-area weighted relative response (square feet) for bank repair sites within Region 1b (8 sites).

Focus Fish Species and Scenario	Fall (September-November)					Winter (December-February)					Spring (March-May)					Summer (June-August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2009 (Year 1)	9,262		3,089	3,612		6,420		10,226	19,694		2,867		13,417	41,803		-6,982		-8,466	-32,467	
WY 2013 (Year 5)	25,682		-1,375	-12,239		22,631		33,035	81,521		16,316		45,623	123,287		20,511		-1,048	-13,077	
WY 2023 (Year 15)	37,997		6,820	2,488		31,439		53,513	134,031		29,159		72,136	155,922		36,067		10,230	7,684	
WY 2033 (Year 25)	47,599		13,747	10,934		36,638		66,359	155,230		36,635		85,418	165,770		46,252		17,743	16,987	
WY 2058 (Year 50)	55,320		19,027	17,231		41,201		77,617	172,252		42,816		95,661	173,090		54,379		23,453	23,901	
Central Valley fall-run chinook salmon																				
WY 2008 (Year 0)	0		0					0	0		0			0		0				
WY 2009 (Year 1)	9,262		3,089					10,226	19,694		2,867			41,803		-6,982				
WY 2013 (Year 5)	25,682		-1,375					33,035	81,521		16,316			123,287		20,511				
WY 2023 (Year 15)	37,997		6,820					53,513	134,031		29,159			155,922		36,067				
WY 2033 (Year 25)	47,599		13,747					66,359	155,230		36,635			165,770		46,252				
WY 2058 (Year 50)	55,320		19,027					77,617	172,252		42,816			173,090		54,379				
Central Valley late fall-run chinook salmon																				
WY 2008 (Year 0)	0			0		0			0		0		0							
WY 2009 (Year 1)	9,262			3,612		6,420			19,694		2,867		13,417							
WY 2013 (Year 5)	25,682			-12,239		22,631			81,521		16,316		45,623							
WY 2023 (Year 15)	37,997			2,488		31,439			134,031		29,159		72,136							
WY 2033 (Year 25)	47,599			10,934		36,638			155,230		36,635		85,418							
WY 2058 (Year 50)	55,320			17,231		41,201			172,252		42,816		95,661							
Sacramento River winter-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0		
WY 2009 (Year 1)	9,262		3,089	3,612		6,420		10,226	19,694		2,867		13,417	41,803		-6,982		-8,466		
WY 2013 (Year 5)	25,682		-1,375	-12,239		22,631		33,035	81,521		16,316		45,623	123,287		20,511		-1,048		
WY 2023 (Year 15)	37,997		6,820	2,488		31,439		53,513	134,031		29,159		72,136	155,922		36,067		10,230		
WY 2033 (Year 25)	47,599		13,747	10,934		36,638		66,359	155,230		36,635		85,418	165,770		46,252		17,743		
WY 2058 (Year 50)	55,320		19,027	17,231		41,201		77,617	172,252		42,816		95,661	173,090		54,379		23,453		
Central Valley steelhead																				
WY 2008 (Year 0)	0		0		0	0		0	0	0	0		0	0	0	0		0		0
WY 2009 (Year 1)	26,568		2,301		26,568	14,249		14,521	19,421	11,518	11,518		17,432	28,662	11,518	1,452		-17,009		1,452
WY 2013 (Year 5)	69,199		-7,194		69,199	49,314		46,296	67,850	46,015	46,015		58,383	86,415	46,015	61,356		-8,635		61,356
WY 2023 (Year 15)	89,776		3,318		89,776	66,945		71,790	100,457	67,404	67,404		89,698	110,879	67,404	87,120		6,817		87,120
WY 2033 (Year 25)	104,185		12,646		104,185	76,936		87,256	115,570	78,145	78,145		105,200	119,970	78,145	102,383		17,054		102,383
WY 2058 (Year 50)	115,465		19,815		115,465	85,541		100,701	128,048	86,666	86,666		117,202	126,813	86,666	114,273		24,888		114,273
Delta Smelt																				
WY 2008 (Year 0)	0				0	0	0	0		0	0	0	0		0	0	0	0		0
WY 2009 (Year 1)	0				0	0	50,717	50,717		0	0	52,559	52,559		0	0	-40,007	-40,007		0
WY 2013 (Year 5)	0				0	0	143,578	143,578		0	0	144,342	144,342		0	0	10,216	10,216		0
WY 2023 (Year 15)	0				0	0	159,603	159,603		0	0	156,472	156,472		0	0	25,843	25,843		0
WY 2033 (Year 25)	0				0	0	162,608	162,608		0	0	158,728	158,728		0	0	28,852	28,852		0
WY 2058 (Year 50)	0				0	0	164,824	164,824		0	0	160,390	160,390		0	0	31,087	31,087		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table 63
SAM results showing cumulative wetted-area weighted relative response (square feet) for bank repair sites within Region 2 (Feather River RM 28.5R).

Focus Fish Species and Scenario	Fall (September-November)					Winter (December-February)					Spring (March-May)					Summer (June-August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
WY 2009 (Year 0)	0		0			0		0	0		0		0	0		0		0		
WY 2010 (Year 1)	4,859		3,498			3,626		3,592	10,522		3,699		3,857	13,942		3,523		3,185		
WY 2014 (Year 5)	8,746		6,382			6,860		7,292	23,800		7,565		9,125	29,974		8,677		6,793		
WY 2024 (Year 15)	11,927		12,084			8,613		10,979	33,695		10,636		15,403	39,377		12,134		12,678		
WY 2034 (Year 25)	14,277		16,438			9,558		13,232	37,929		12,302		18,853	42,866		14,583		17,150		
WY 2059 (Year 50)	16,280		19,855			10,374		15,197	41,350		13,665		21,541	45,495		16,666		20,660		
Central Valley fall-run chinook salmon																				
WY 2009 (Year 0)	0		0					0	0		0			0		0				
WY 2010 (Year 1)	4,859		3,498					3,592	10,522		3,699			13,942		3,523				
WY 2014 (Year 5)	8,746		6,382					7,292	23,800		7,565			29,974		8,677				
WY 2024 (Year 15)	11,927		12,084					10,979	33,695		10,636			39,377		12,134				
WY 2034 (Year 25)	14,277		16,438					13,232	37,929		12,302			42,866		14,583				
WY 2059 (Year 50)	16,280		19,855					15,197	41,350		13,665			45,495		16,666				
Central Valley late fall-run chinook salmon																				
WY 2009 (Year 0)	0			0		0			0		0		0							
WY 2010 (Year 1)	4,859			11,400		3,626			10,522		3,699		3,857							
WY 2014 (Year 5)	8,746			23,667		6,860			23,800		7,565		9,125							
WY 2024 (Year 15)	11,927			34,611		8,613			33,695		10,636		15,403							
WY 2034 (Year 25)	14,277			40,582		9,558			37,929		12,302		18,853							
WY 2059 (Year 50)	16,280			45,075		10,374			41,350		13,665		21,541							
Sacramento River winter-run chinook salmon																				
WY 2009 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2010 (Year 1)	4,859		3,498	11,400		3,626		3,592	10,522		3,699		3,857	13,942		3,523		3,185	10,614	
WY 2014 (Year 5)	8,746		6,382	23,667		6,860		7,292	23,800		7,565		9,125	29,974		8,677		6,793	27,398	
WY 2024 (Year 15)	11,927		12,084	34,611		8,613		10,979	33,695		10,636		15,403	39,377		12,134		12,678	37,280	
WY 2034 (Year 25)	14,277		16,438	40,582		9,558		13,232	37,929		12,302		18,853	42,866		14,583		17,150	43,135	
WY 2059 (Year 50)	16,280		19,855	45,075		10,374		15,197	41,350		13,665		21,541	45,495		16,666		20,660	47,541	
Central Valley steelhead																				
WY 2009 (Year 0)	0		0	0	0	0		0	0	0			0	0	0	0		0	0	0
WY 2010 (Year 1)	10,106		5,376	10,076	10,106	7,770		5,354	9,039	7,931			5,731	10,685	7,931	7,806		4,682	7,913	7,806
WY 2014 (Year 5)	18,190		9,811	19,364	18,190	14,716		10,748	18,678	16,176			13,077	22,323	16,176	18,143		10,429	21,386	18,143
WY 2024 (Year 15)	23,927		16,913	27,084	23,927	18,335		15,464	24,997	21,756			20,734	29,369	21,756	24,367		17,802	29,030	24,367
WY 2034 (Year 25)	27,892		22,251	31,757	27,892	20,231		18,241	27,953	24,496			24,801	32,315	24,496	28,501		23,295	33,768	28,501
WY 2059 (Year 50)	31,095		26,462	35,308	31,095	21,842		20,641	30,390	26,667			27,975	34,557	26,667	31,837		27,627	37,368	31,837

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table 64
SAM results showing cumulative wetted-area weighted relative response (square feet) for bank repair sites within Region 3 (Sacramento River RM 177.8R).

Focus Fish Species and Scenario	Fall (September-November)					Winter (December-February)					Spring (March-May)					Summer (June-August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
WY 2008 (Year 0)	0		0			0		0	0		0		0	0		0		0		
WY 2009 (Year 1)	6,694		-79			7,082		3,181	9,630		7,082		3,386	12,934		6,871		-1,061		
WY 2013 (Year 5)	12,049		-143			13,125		6,469	22,291		13,834		8,115	28,546		12,368		-447		
WY 2023 (Year 15)	15,544		1,099			15,331		9,333	31,859		17,467		13,430	38,099		15,956		940		
WY 2033 (Year 25)	18,105		2,149			16,400		11,141	36,012		19,291		16,324	41,576		18,585		2,040		
WY 2058 (Year 50)	20,405		2,999			17,450		13,002	39,735		20,944		18,734	44,230		20,946		2,930		
Central Valley fall-run chinook salmon																				
WY 2008 (Year 0)	0		0					0	0		0			0		0				
WY 2009 (Year 1)	6,694		-79					3,181	9,630		7,082			12,934		6,871				
WY 2013 (Year 5)	12,049		-143					6,469	22,291		13,834			28,546		12,368				
WY 2023 (Year 15)	15,544		1,099					9,333	31,859		17,467			38,099		15,956				
WY 2033 (Year 25)	18,105		2,149					11,141	36,012		19,291			41,576		18,585				
WY 2058 (Year 50)	20,405		2,999					13,002	39,735		20,944			44,230		20,946				
Central Valley late fall-run chinook salmon																				
WY 2008 (Year 0)	0			0		0			0		0		0							
WY 2009 (Year 1)	6,694			-61		7,082			9,630		7,082		3,386							
WY 2013 (Year 5)	12,049			-110		13,125			22,291		13,834		8,115							
WY 2023 (Year 15)	15,544			3,330		15,331			31,859		17,467		13,430							
WY 2033 (Year 25)	18,105			6,101		16,400			36,012		19,291		16,324							
WY 2058 (Year 50)	20,405			8,196		17,450			39,735		20,944		18,734							
Sacramento River winter-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2009 (Year 1)	6,694		-79	-61		7,082		3,181	9,630		7,082		3,386	12,934		6,871		-1,061	-6,868	
WY 2013 (Year 5)	12,049		-143	-110		13,125		6,469	22,291		13,834		8,115	28,546		12,368		-447	-1,931	
WY 2023 (Year 15)	15,544		1,099	3,330		15,331		9,333	31,859		17,467		13,430	38,099		15,956		940	2,431	
WY 2033 (Year 25)	18,105		2,149	6,101		16,400		11,141	36,012		19,291		16,324	41,576		18,585		2,040	5,442	
WY 2058 (Year 50)	20,405		2,999	8,196		17,450		13,002	39,735		20,944		18,734	44,230		20,946		2,930	7,717	
Central Valley steelhead																				
WY 2008 (Year 0)	0		0	0	0	0		0	0	0			0	0	0	0		0	0	0
WY 2009 (Year 1)	13,401		-248	-21	13,401	14,188		5,160	9,335	14,206			5,462	10,906	14,206	13,756		-2,394	-7,038	13,756
WY 2013 (Year 5)	24,122		-446	-38	24,122	26,371		10,352	19,335	27,852			12,567	23,085	27,852	24,761		-1,076	-1,934	24,761
WY 2023 (Year 15)	30,554		1,644	3,669	30,554	30,887		14,342	25,624	34,635			19,521	30,477	34,635	31,363		1,323	2,724	31,363
WY 2033 (Year 25)	34,915		3,425	6,684	34,915	33,041		16,746	28,594	37,711			23,166	33,503	37,711	35,840		3,201	5,990	35,840
WY 2058 (Year 50)	38,556		4,872	9,005	38,556	35,109		19,175	31,351	40,330			26,207	35,874	40,330	39,577		4,726	8,500	39,577

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table 65
SAM results showing cumulative bank-line weighted relative response (feet) for all bank repair sites.

Focus Fish Species and Scenario	Fall (September-November)					Winter (December-February)					Spring (March-May)					Summer (June-August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2009 (Year 1)	106		23	49		94		87	187		67		100	368		-49		-88	-258	
WY 2013 (Year 5)	373		120	181		347		380	1,104		309		498	1,562		320		117	202	
WY 2023 (Year 15)	541		297	391		456		604	1,739		481		830	2,044		519		316	430	
WY 2033 (Year 25)	674		449	497		519		747	1,998		579		1,004	2,201		658		470	534	
WY 2058 (Year 50)	786		565	575		575		874	2,210		661		1,139	2,317		772		588	611	
Central Valley fall-run chinook salmon																				
WY 2008 (Year 0)	0		0	0				0	0		0			0		0			0	
WY 2009 (Year 1)	106		23	74				87	187		67			368		-49			-27	
WY 2013 (Year 5)	373		120	383				380	1,104		309			1,562		320			437	
WY 2023 (Year 15)	541		297	536				604	1,739		481			2,044		519			563	
WY 2033 (Year 25)	674		449	601				747	1,998		579			2,201		658			619	
WY 2058 (Year 50)	786		565	649				874	2,210		661			2,317		772			662	
Central Valley late fall-run chinook salmon																				
WY 2008 (Year 0)	0			0		0			0		0		0	0					0	
WY 2009 (Year 1)	106			48		94			187		67		100	53					-27	
WY 2013 (Year 5)	373			430		347			1,104		309		498	359					437	
WY 2023 (Year 15)	541			795		456			1,739		481		830	469					563	
WY 2033 (Year 25)	674			996		519			1,998		579		1,004	503					619	
WY 2058 (Year 50)	786			1,145		575			2,210		661		1,139	528					662	
Sacramento River winter-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2009 (Year 1)	106		23	48		94		87	187		67		100	368		-49		-88	-51	
WY 2013 (Year 5)	373		120	430		347		380	1,104		309		498	1,562		320		117	274	
WY 2023 (Year 15)	541		297	795		456		604	1,739		481		830	2,044		519		316	418	
WY 2033 (Year 25)	674		449	996		519		747	1,998		579		1,004	2,201		658		470	512	
WY 2058 (Year 50)	786		565	1,145		575		874	2,210		661		1,139	2,317		772		588	580	
Central Valley steelhead																				
WY 2008 (Year 0)	0		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0
WY 2009 (Year 1)	266		22	61	266	198		131	188	173	68		142	262	173	8		-161	-101	8
WY 2013 (Year 5)	894		151	498	894	738		558	911	735	361		684	1,129	735	810		133	517	810
WY 2023 (Year 15)	1,185		378	715	1,185	960		846	1,308	1,037	546		1,088	1,489	1,037	1,154		397	733	1,154
WY 2033 (Year 25)	1,396		572	848	1,396	1,082		1,022	1,492	1,187	639		1,296	1,628	1,187	1,372		594	865	1,372
WY 2058 (Year 50)	1,564		721	948	1,564	1,189		1,178	1,647	1,306	714		1,457	1,733	1,306	1,546		747	963	1,546
Delta Smelt																				
WY 2008 (Year 0)	0				0	0	0	0		0	0	0	0		0	0	0	0		0
WY 2009 (Year 1)	0				0	0	296	296		0	0	318	318		0	0	-433	-433		0
WY 2013 (Year 5)	0				0	0	919	919		0	0	949	949		0	0	44	44		0
WY 2023 (Year 15)	0				0	0	1,030	1,030		0	0	1,031	1,031		0	0	177	177		0
WY 2033 (Year 25)	0				0	0	1,050	1,050		0	0	1,046	1,046		0	0	203	203		0
WY 2058 (Year 50)	0				0	0	1,065	1,065		0	0	1,057	1,057		0	0	222	222		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

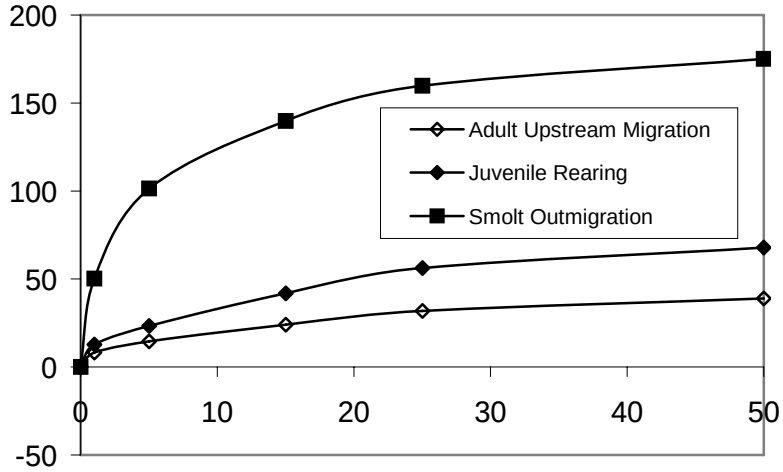
Table 66
SAM results showing cumulative wetted-area weighted relative response (square feet) for all bank repair sites.

Focus Fish Species and Scenario	Fall (September-November)					Winter (December-February)					Spring (March-May)					Summer (June-August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2009 (Year 1)	18,653		8,882	22,040		14,695		16,033	30,603		8,538		17,900	67,892		-16,657		-14,757	-41,358	
WY 2013 (Year 5)	56,066		23,265	58,871		50,495		59,530	166,681		41,437		77,462	242,826		46,560		24,190	68,820	
WY 2023 (Year 15)	83,603		54,505	106,178		68,651		97,538	272,568		69,632		131,561	318,644		80,324		59,710	117,455	
WY 2033 (Year 25)	105,416		79,938	129,065		79,238		121,650	316,297		85,839		159,786	343,253		103,230		85,666	139,668	
WY 2058 (Year 50)	123,533		99,560	146,165		88,743		143,319	352,075		99,471		181,823	361,596		122,098		105,647	156,251	
Central Valley fall-run chinook salmon																				
WY 2008 (Year 0)	0		0	0				0	0		0			0		0			0	
WY 2009 (Year 1)	18,653		8,882	18,428				16,033	30,603		8,538			67,892		-16,657			-8,891	
WY 2013 (Year 5)	56,066		23,265	71,110				59,530	166,681		41,437			242,826		46,560			81,897	
WY 2023 (Year 15)	83,603		54,505	103,689				97,538	272,568		69,632			318,644		80,324			109,771	
WY 2033 (Year 25)	105,416		79,938	118,131				121,650	316,297		85,839			343,253		103,230			122,682	
WY 2058 (Year 50)	123,533		99,560	128,933				143,319	352,075		99,471			361,596		122,098			132,350	
Central Valley late fall-run chinook salmon																				
WY 2008 (Year 0)	0			0		0			0		0		0	0					0	
WY 2009 (Year 1)	18,653			21,979		14,695			30,603		8,538		17,900	13,155					-8,891	
WY 2013 (Year 5)	56,066			80,926		50,495			166,681		41,437		77,462	63,163					81,897	
WY 2023 (Year 15)	83,603			143,122		68,651			272,568		69,632		131,561	85,840					109,771	
WY 2033 (Year 25)	105,416			175,373		79,238			316,297		85,839		159,786	93,261					122,682	
WY 2058 (Year 50)	123,533			199,344		88,743			352,075		99,471		181,823	98,835					132,350	
Sacramento River winter-run chinook salmon																				
WY 2008 (Year 0)	0		0	0		0		0	0		0		0	0		0		0	0	
WY 2009 (Year 1)	18,653		8,882	21,979		14,695		16,033	30,603		8,538		17,900	67,892		-16,657		-14,757	-6,868	
WY 2013 (Year 5)	56,066		23,265	80,926		50,495		59,530	166,681		41,437		77,462	242,826		46,560		24,190	24,238	
WY 2023 (Year 15)	83,603		54,505	143,122		68,651		97,538	272,568		69,632		131,561	318,644		80,324		59,710	38,737	
WY 2033 (Year 25)	105,416		79,938	175,373		79,238		121,650	316,297		85,839		159,786	343,253		103,230		85,666	48,209	
WY 2058 (Year 50)	123,533		99,560	199,344		88,743		143,319	352,075		99,471		181,823	361,596		122,098		105,647	55,168	
Central Valley steelhead																				
WY 2008 (Year 0)	0		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0
WY 2009 (Year 1)	49,249		10,784	15,260	49,249	31,115		23,957	32,329	25,133	10,926		25,229	47,072	25,133	-9,918		-27,549	-21,302	-9,918
WY 2013 (Year 5)	139,667		29,209	71,117	139,667	107,599		87,125	137,733	103,238	60,170		105,385	172,163	103,238	125,253		27,677	73,851	125,253
WY 2023 (Year 15)	186,931		68,657	104,066	186,931	144,270		135,738	203,885	151,705	95,766		171,116	228,933	151,705	182,950		74,060	107,804	182,950
WY 2033 (Year 25)	221,020		100,855	123,886	221,020	164,895		165,454	234,885	176,069	114,037		204,707	250,972	176,069	218,742		107,206	127,507	218,742
WY 2058 (Year 50)	248,181		125,876	138,788	248,181	183,052		191,919	261,007	195,665	128,715		231,037	267,663	195,665	247,116		132,892	142,322	247,116
Delta Smelt																				
WY 2008 (Year 0)	0				0	0	0	0		0	0	0	0		0	0	0	0		0
WY 2009 (Year 1)	0				0	0	58,724	58,724		0	0	63,212	63,212		0	0	-88,287	-88,287		0
WY 2013 (Year 5)	0				0	0	170,214	170,214		0	0	173,493	173,493		0	0	38,753	38,753		0
WY 2023 (Year 15)	0				0	0	190,757	190,757		0	0	188,076	188,076		0	0	67,298	67,298		0
WY 2033 (Year 25)	0				0	0	194,624	194,624		0	0	190,788	190,788		0	0	72,842	72,842		0
WY 2058 (Year 50)	0				0	0	197,477	197,477		0	0	192,786	192,786		0	0	76,971	76,971		0

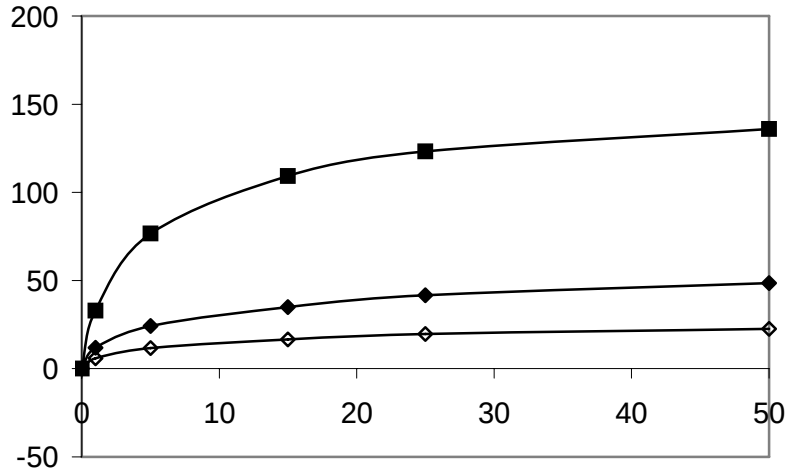
Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Figures

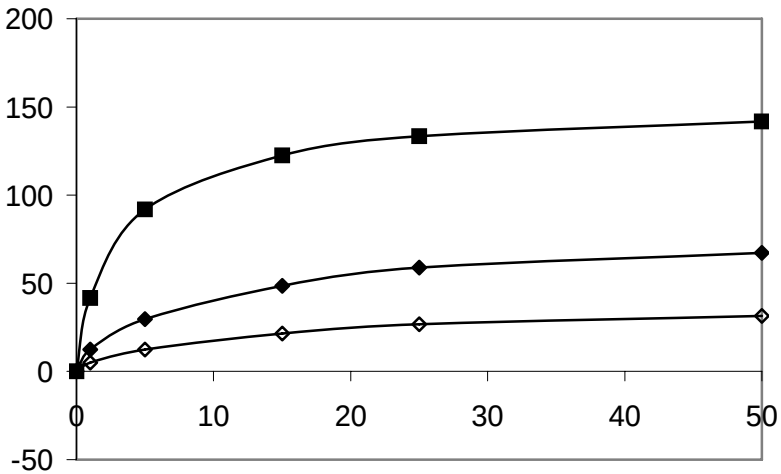
FALL



WINTER



SPRING



SUMMER

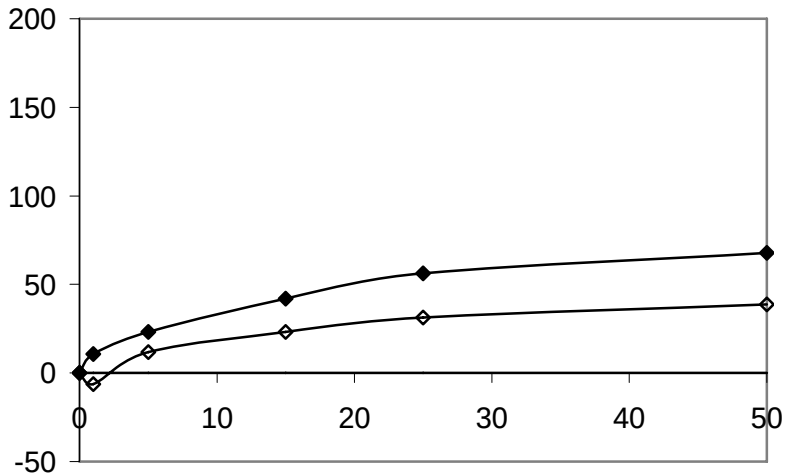
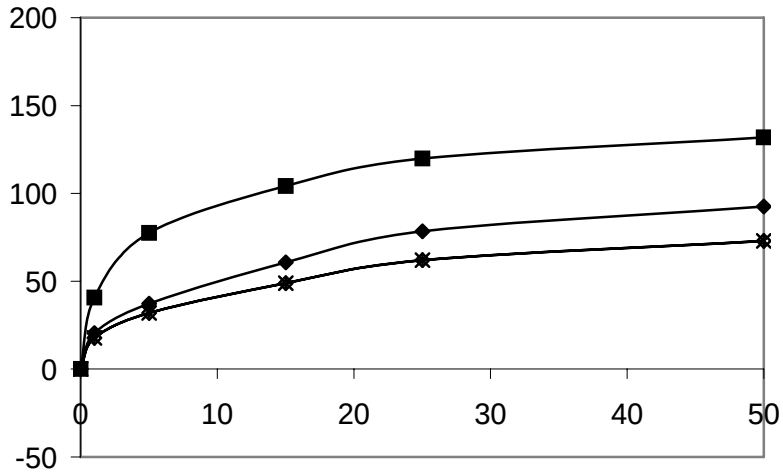
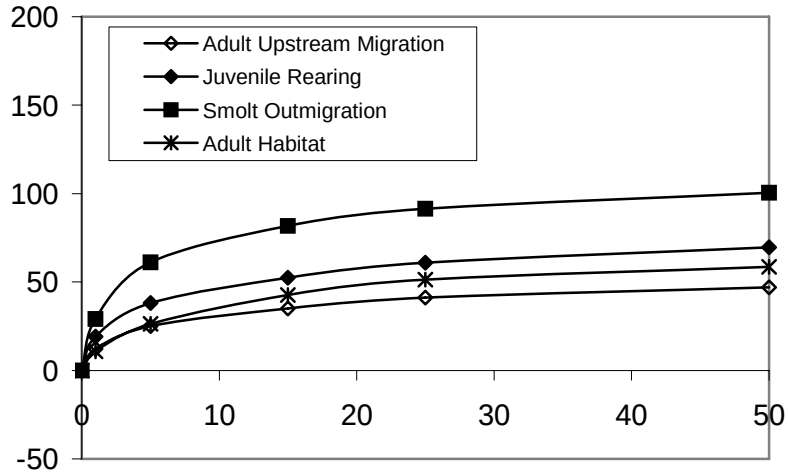


Figure 1. SAM results showing bank-line weighted relative response (feet) for Chinook salmon (Winter-run shown) at Site Steamboat Slough RM 16.6R.

FALL



WINTER



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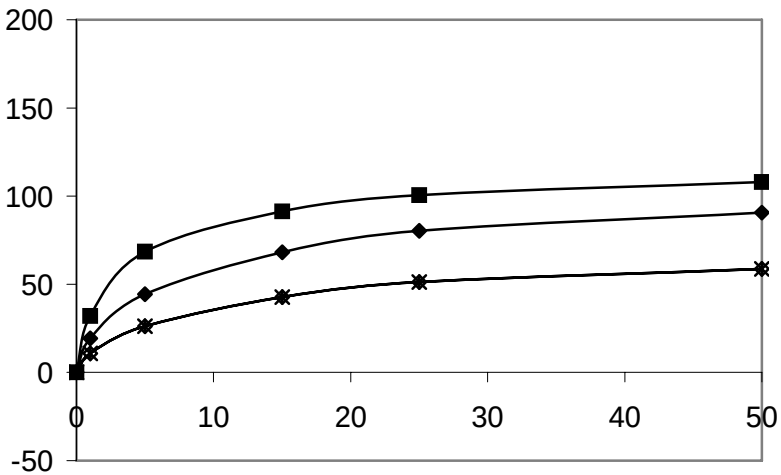


SUMMER

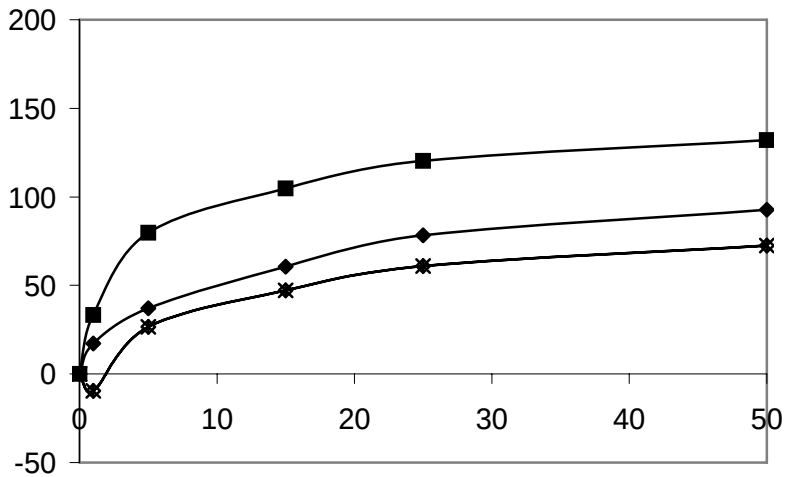


Figure 2. SAM results showing bank-line weighted relative response (feet) for Central Valley steelhead at Site Steamboat Slough RM 16.6R.

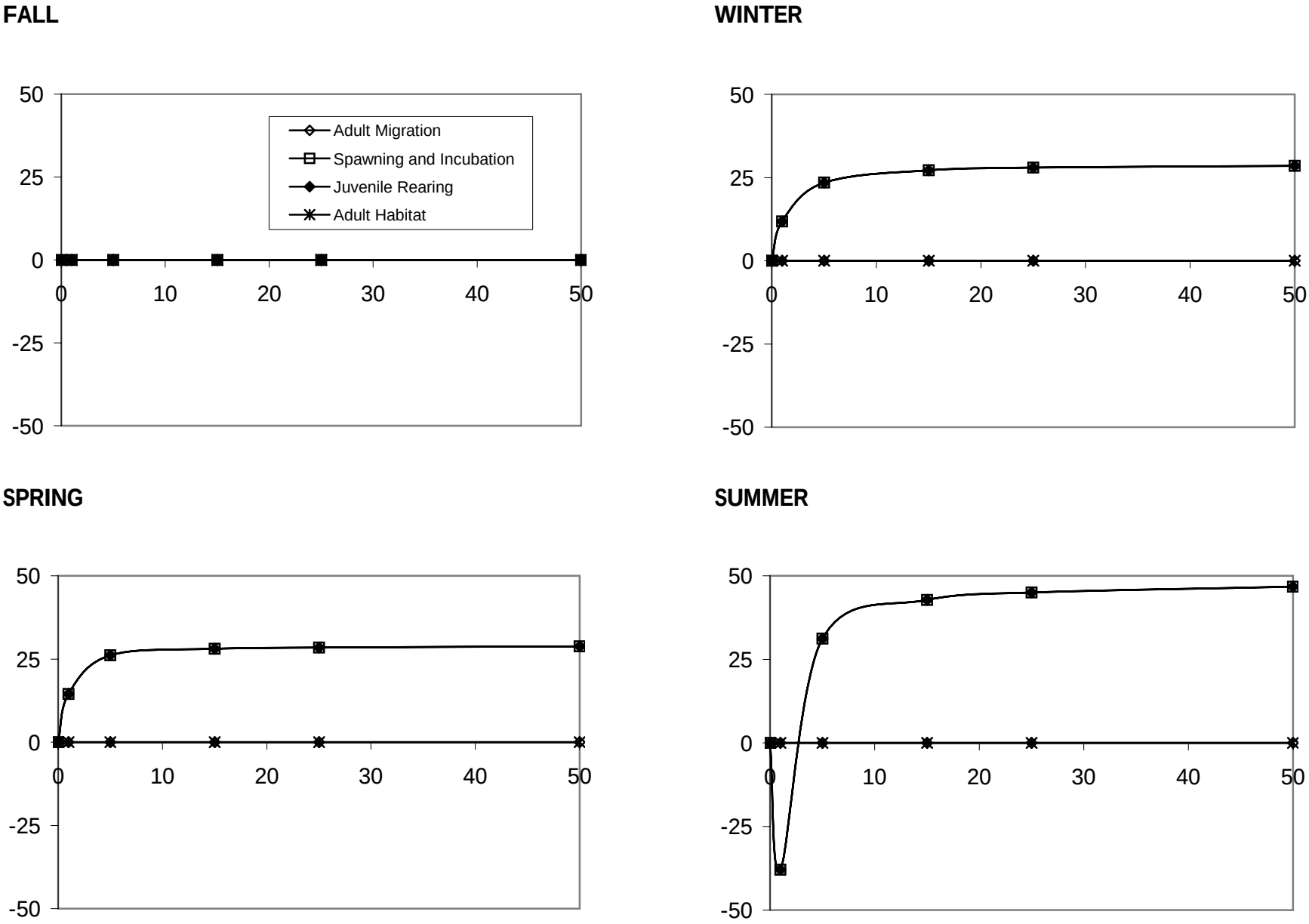
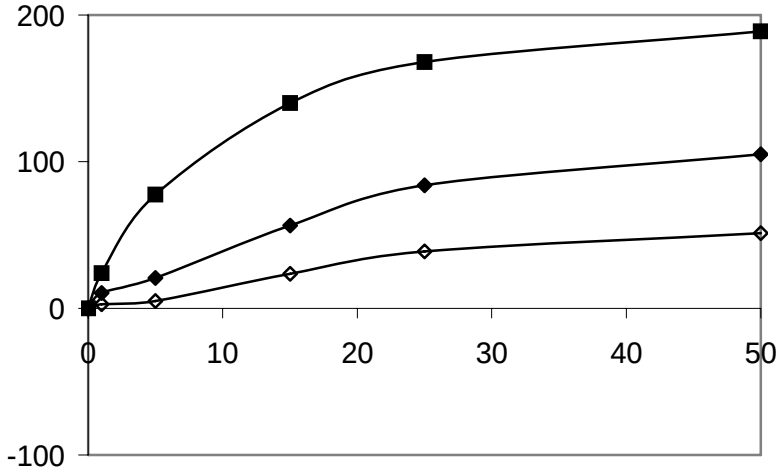
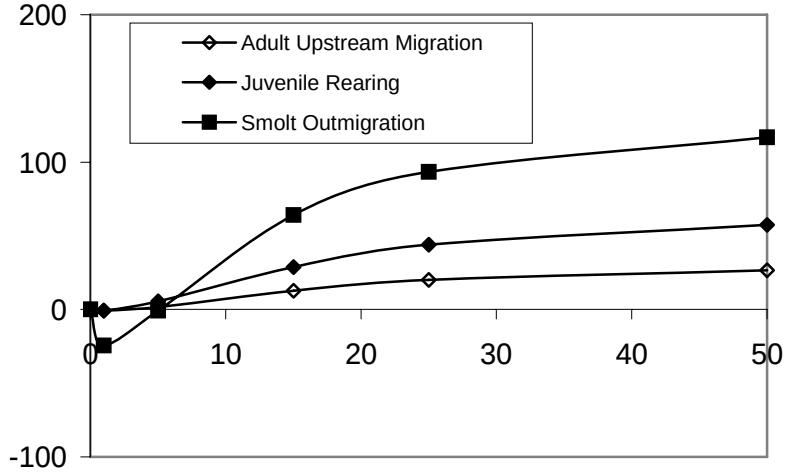


Figure 3. SAM results showing bank-line weighted relative response (feet) for delta smelt at Site Steamboat Slough RM 16.6R.

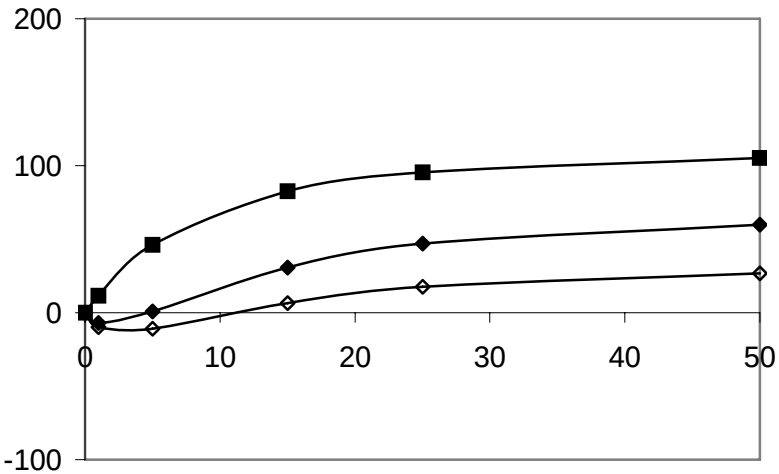
FALL



WINTER



SPRING



SUMMER

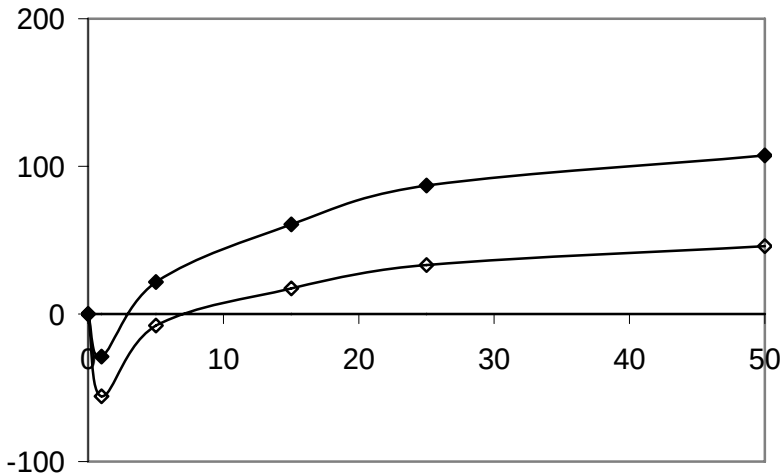
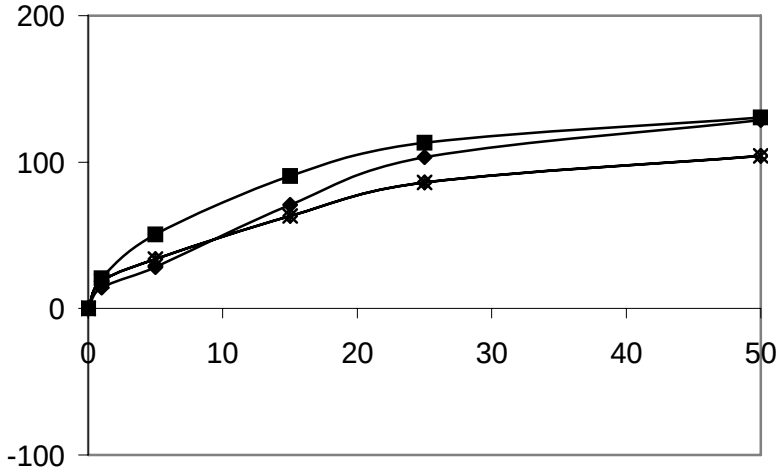
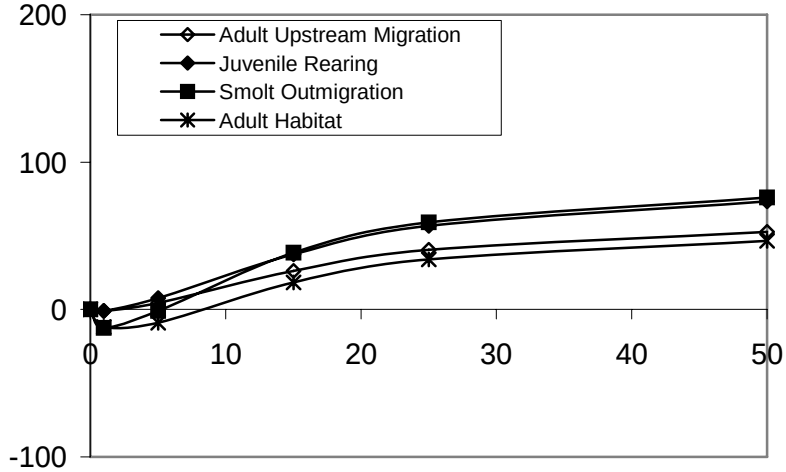


Figure 4. SAM results showing bank-line weighted relative response (feet) for Chinook salmon (Winter-run shown) at Site Cache Slough RM 21.8R.

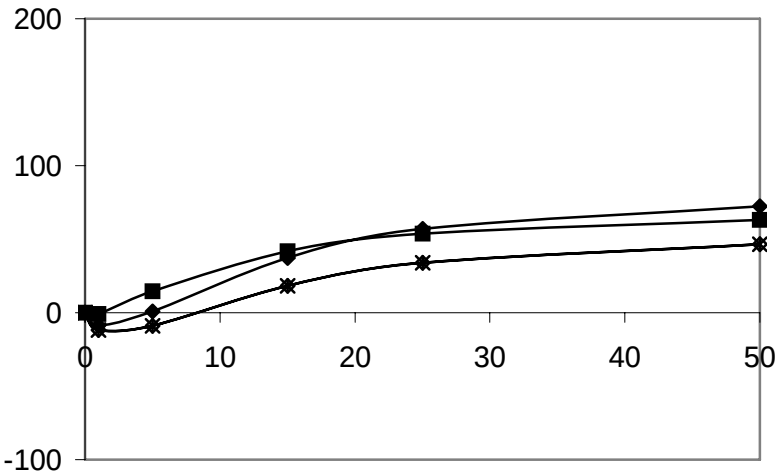
FALL



WINTER



SPRING



SUMMER

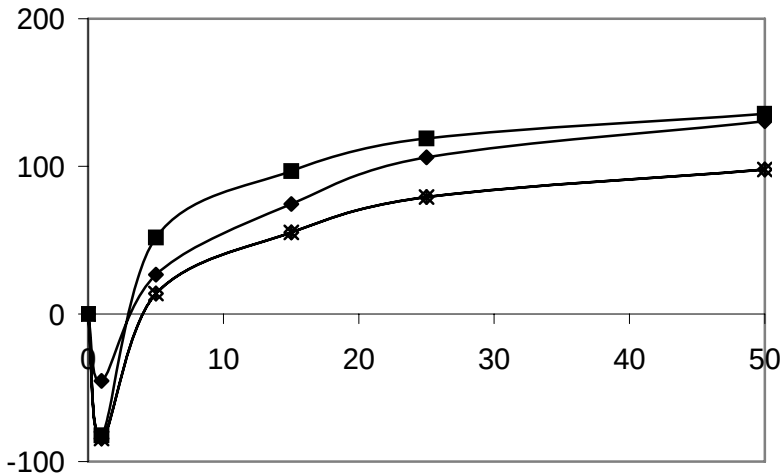
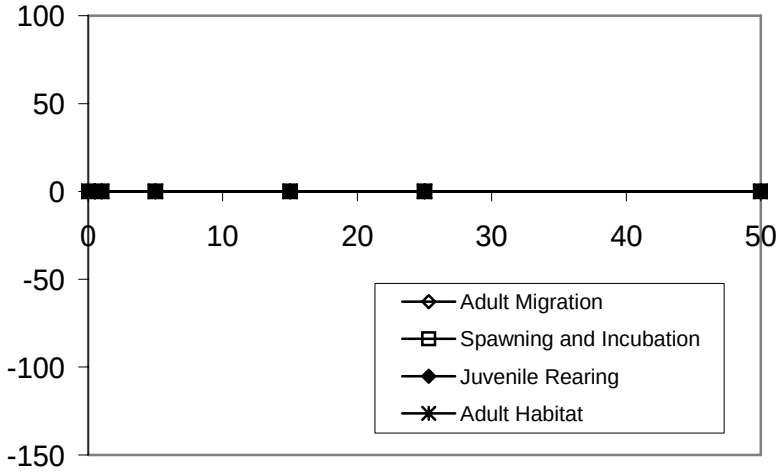
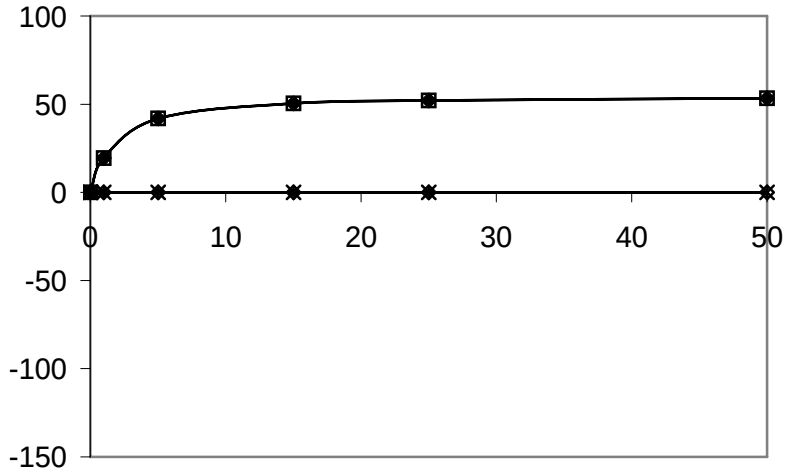


Figure 5. SAM results showing bank-line weighted relative response (feet) for Central Valley steelhead at Site Cache Slough RM 21.8R.

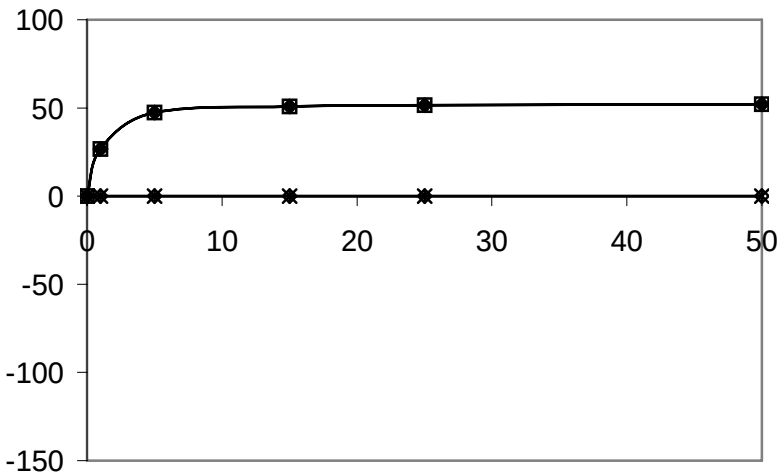
FALL



WINTER



SPRING



SUMMER

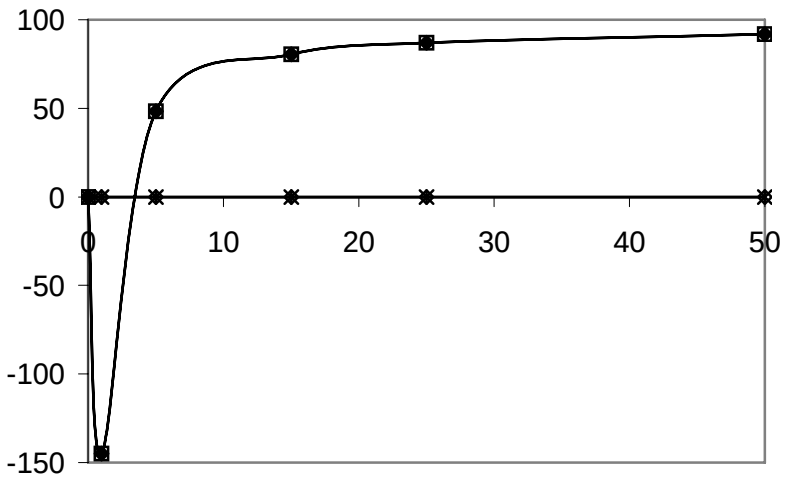
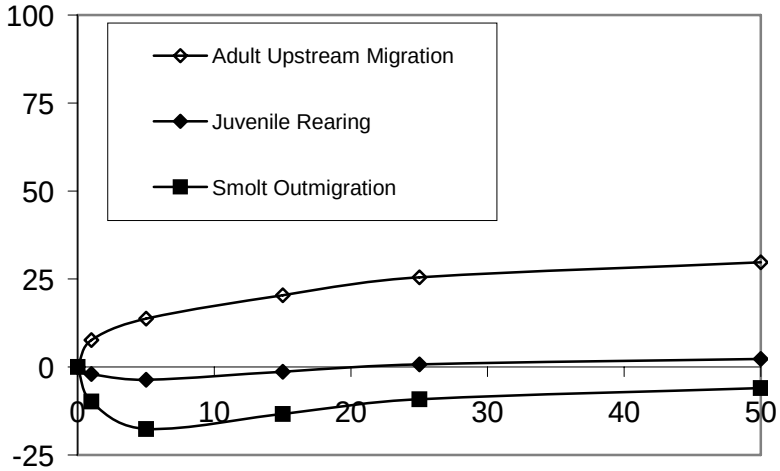
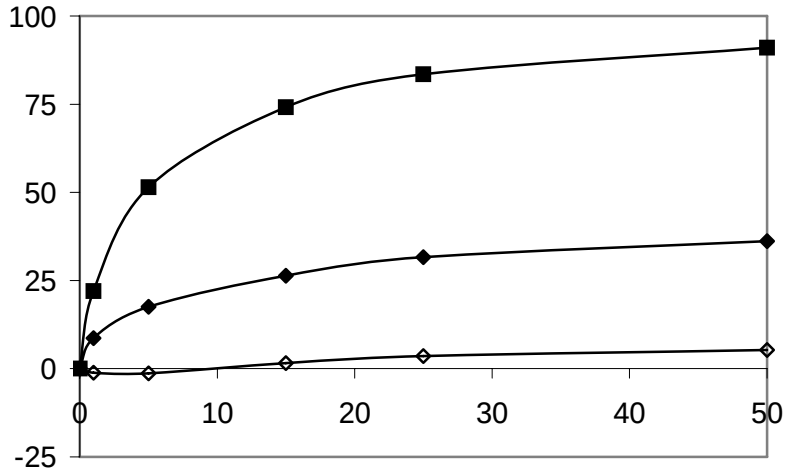


Figure 6. SAM results showing bank-line weighted relative response (feet) for delta smelt at Site Cache Slough RM 21.8R.

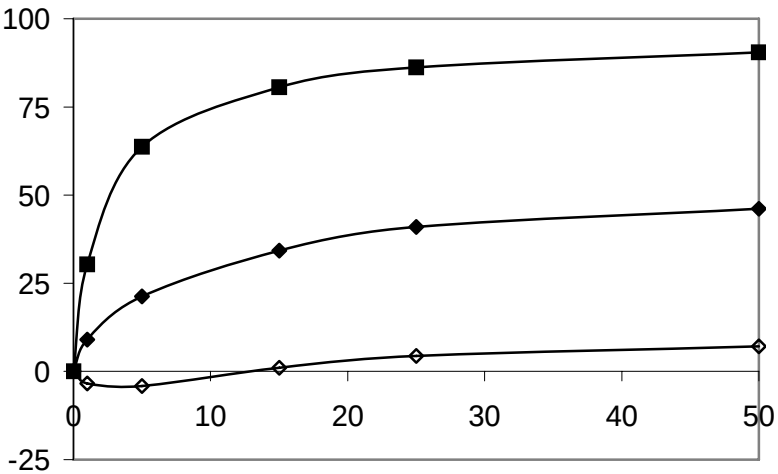
FALL



WINTER



SPRING



SUMMER

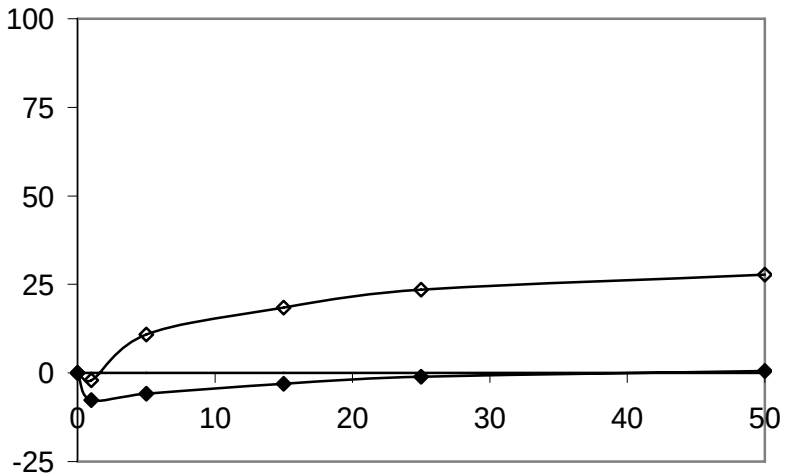
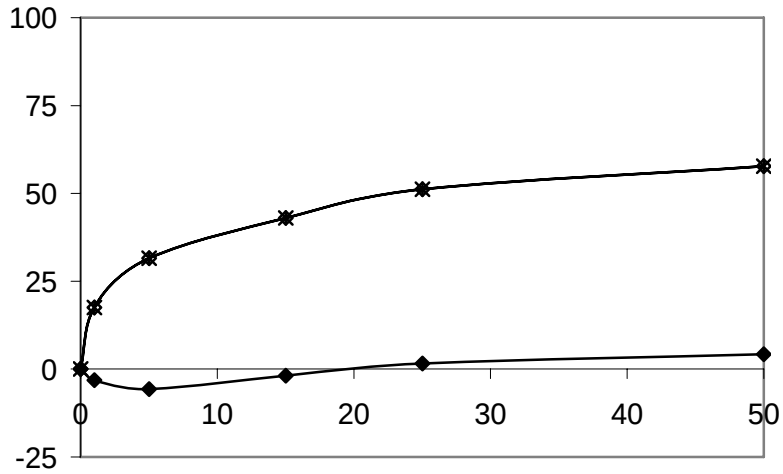
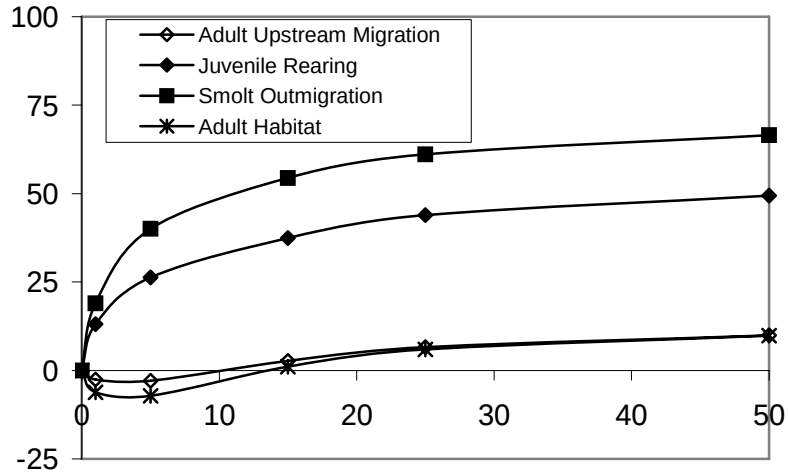


Figure 7. SAM results showing bank-line weighted relative response (feet) for Chinook salmon (Winter-run shown) at Site Sacramento River RM 49.7L.

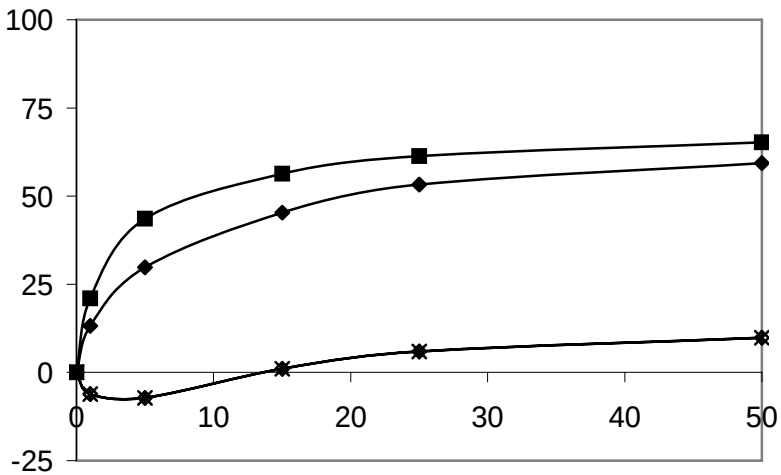
FALL



WINTER



SPRING



SUMMER

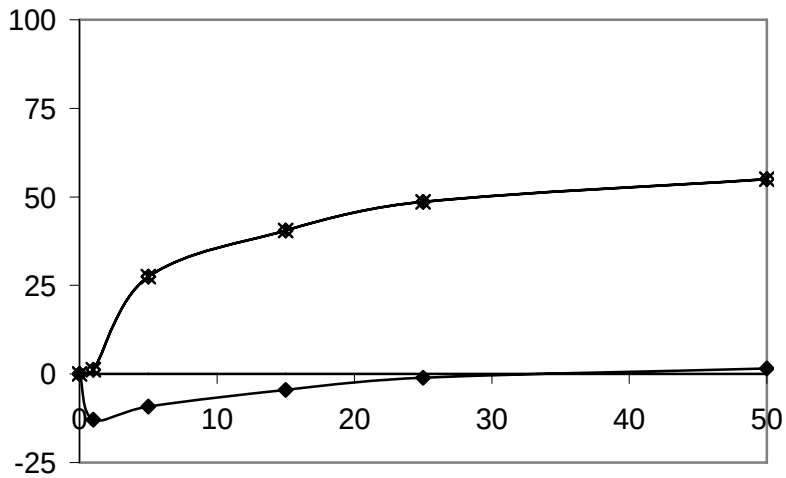
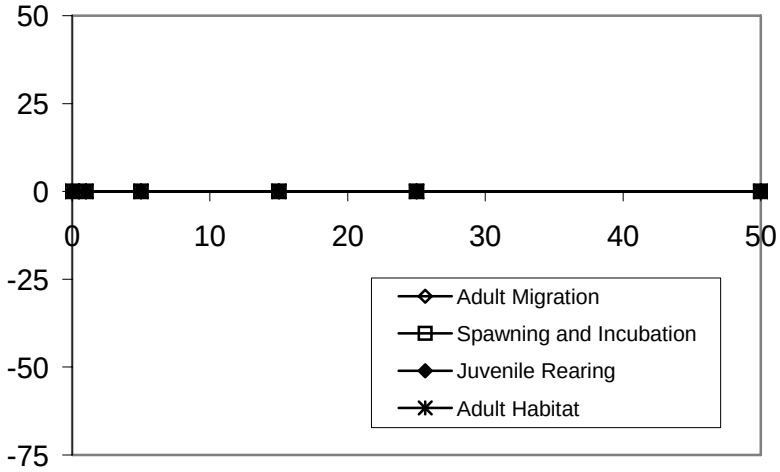
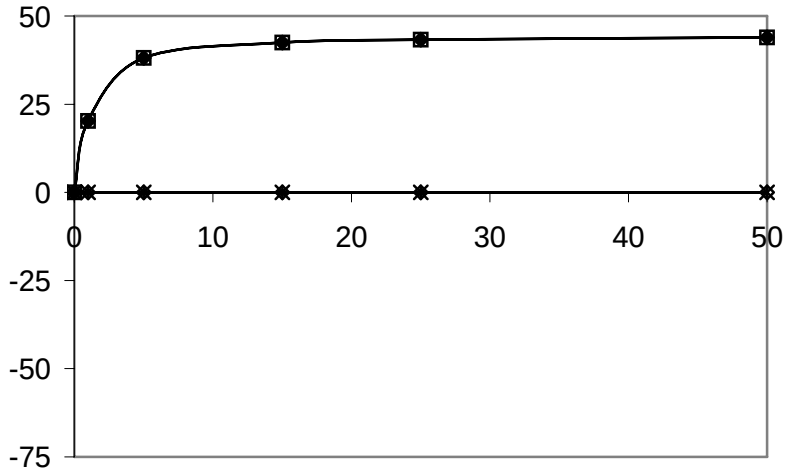


Figure 8. SAM results showing bank-line weighted relative response (feet) for Central Valley steelhead at Site Sacramento River RM 49.7L.

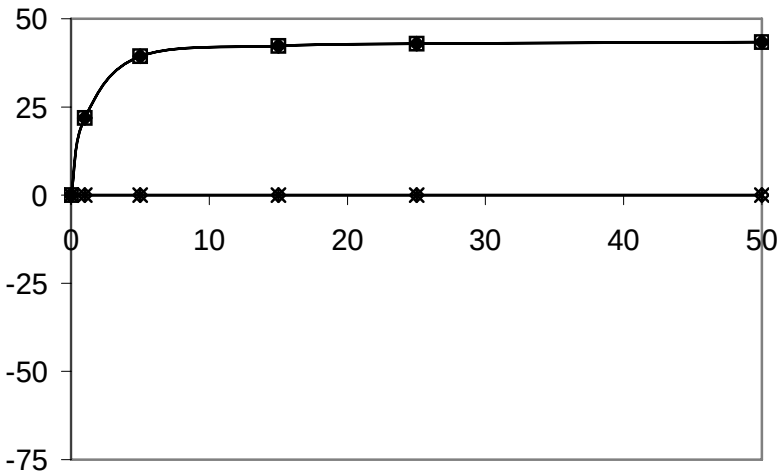
FALL



WINTER



SPRING



SUMMER

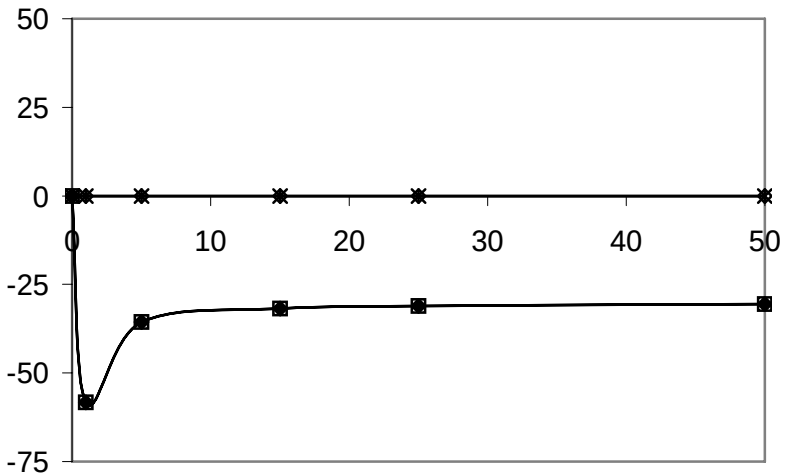
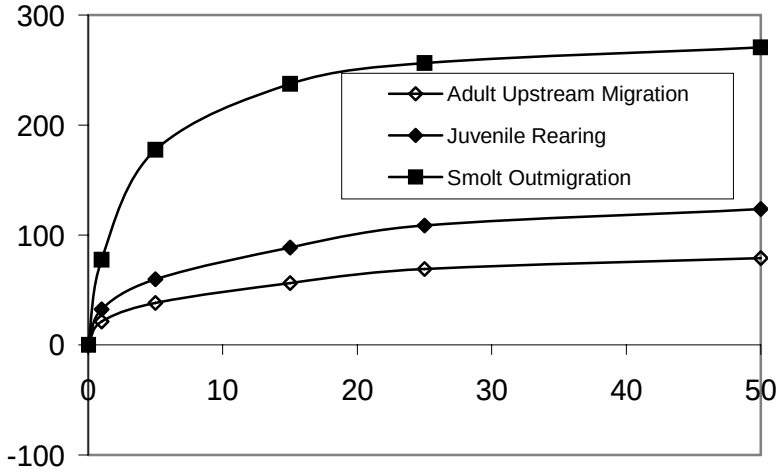
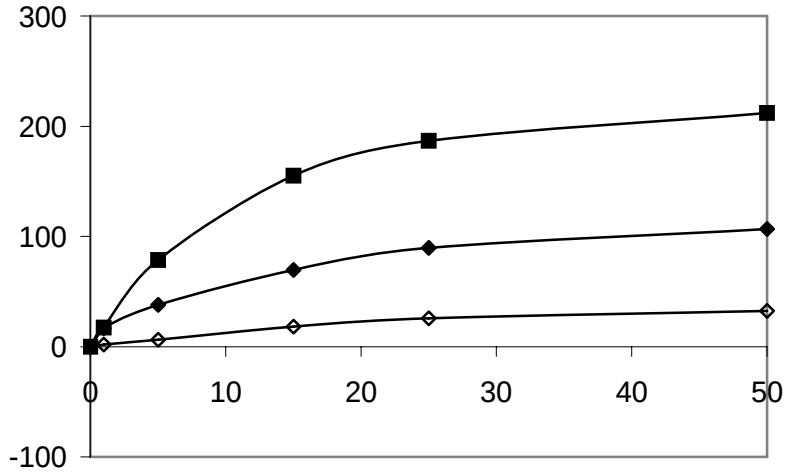


Figure 9. SAM results showing bank-line weighted relative response (feet) for delta smelt at Site Sacramento River RM 49.7L.

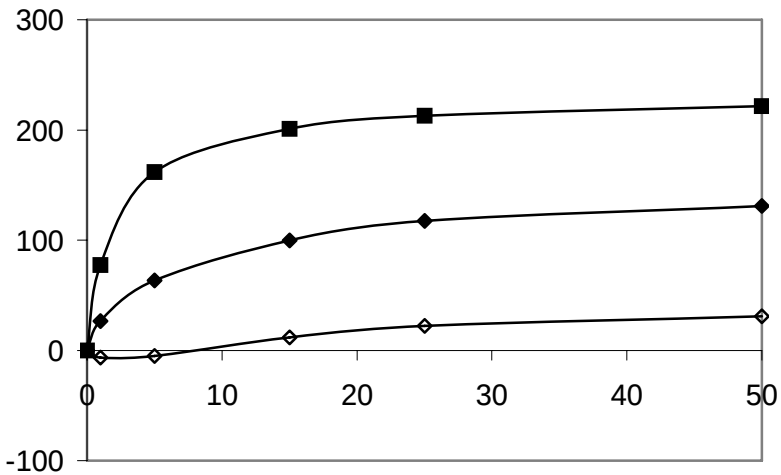
FALL



WINTER



SPRING



SUMMER

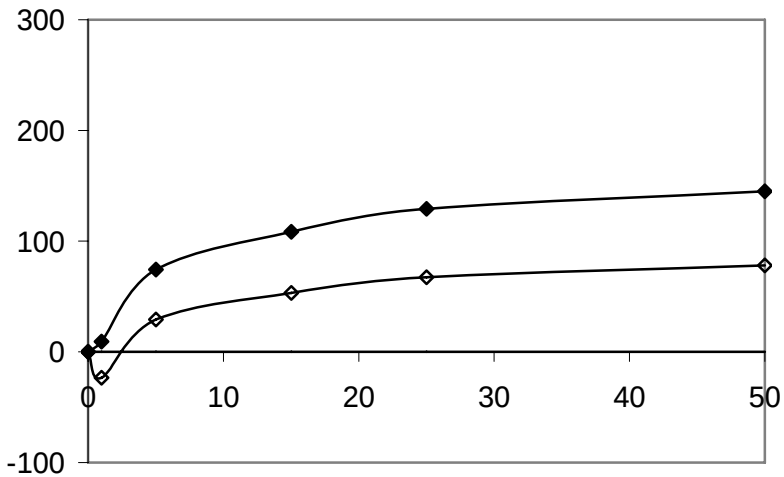
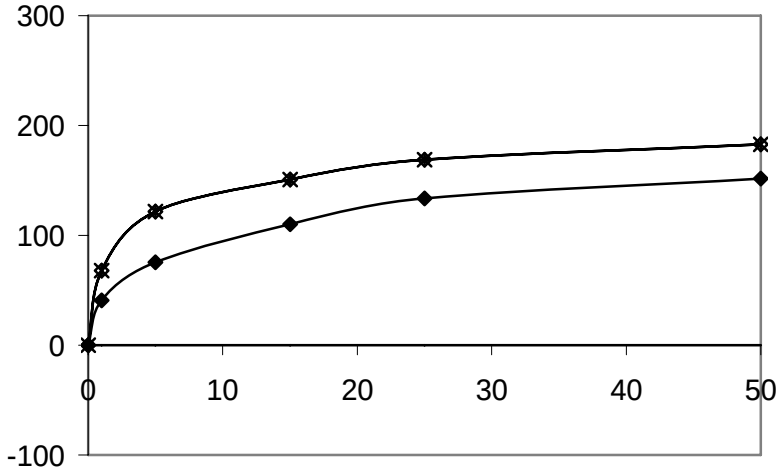
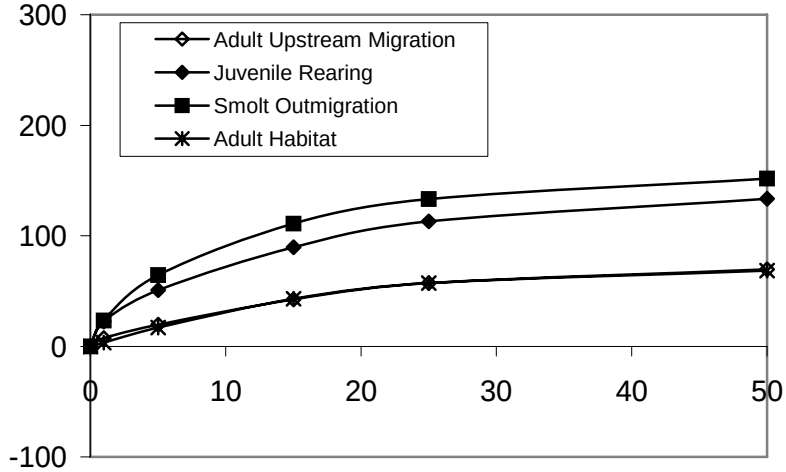


Figure 10. SAM results showing bank-line weighted relative response (feet) for Chinook salmon (Winter-run shown) at Site Sacramento River RM 52.3L.

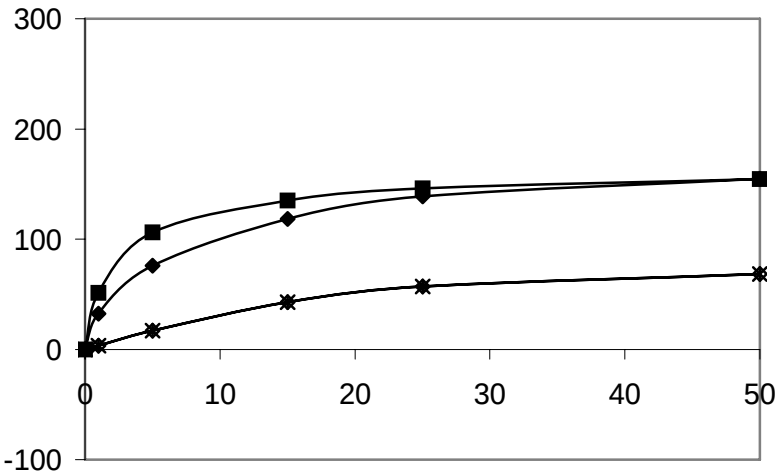
FALL



WINTER



SPRING



SUMMER

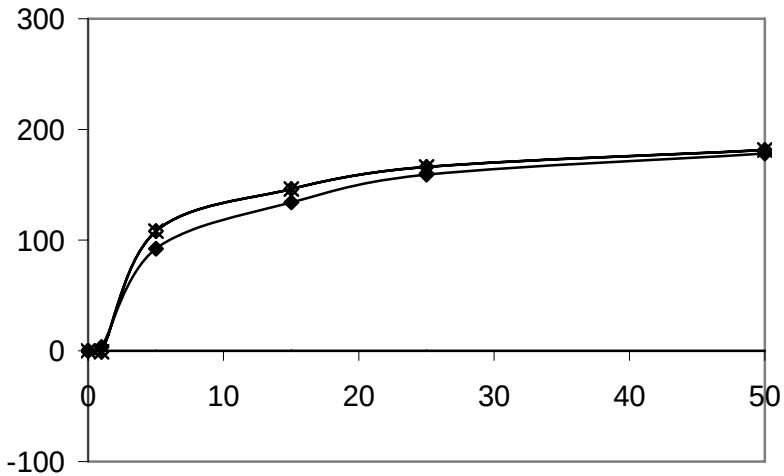
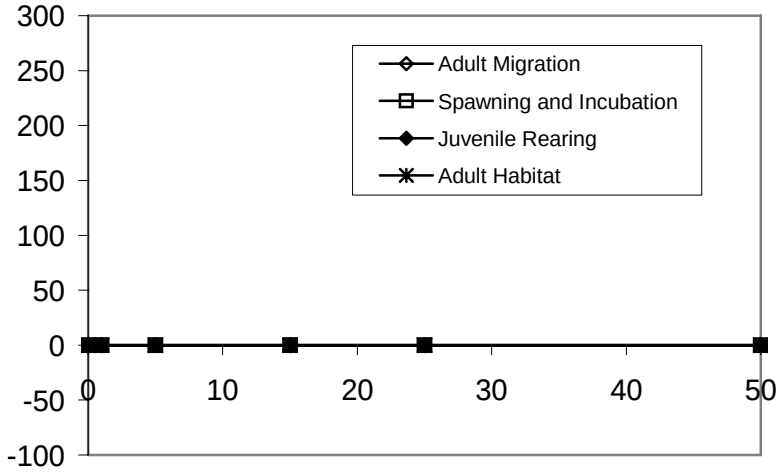
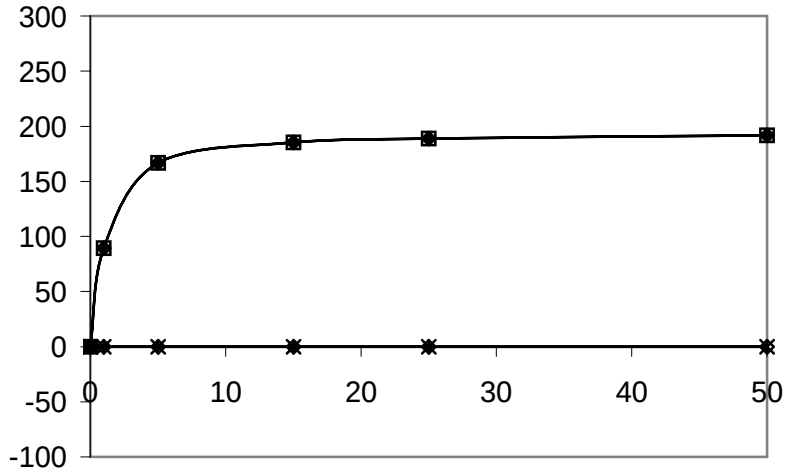


Figure 11. SAM results showing bank-line weighted relative response (feet) for Central Valley steelhead at Site Sacramento River RM 52.3L.

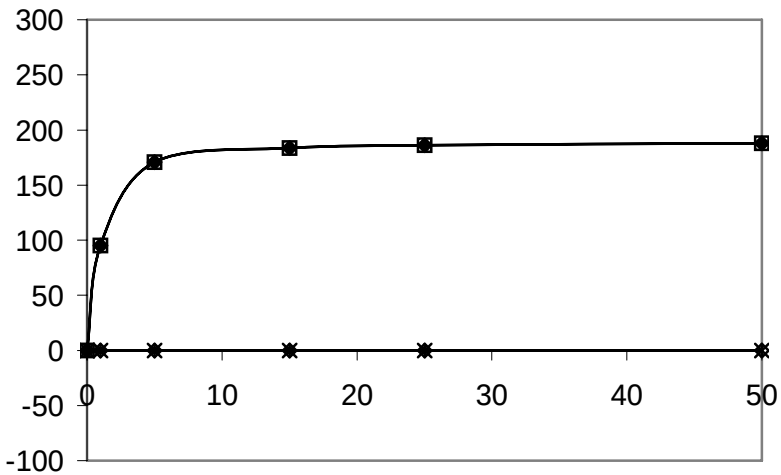
FALL



WINTER



SPRING



SUMMER

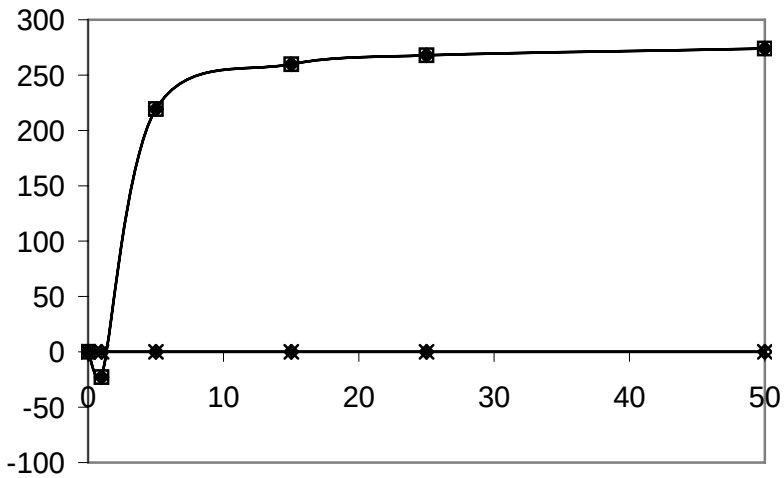
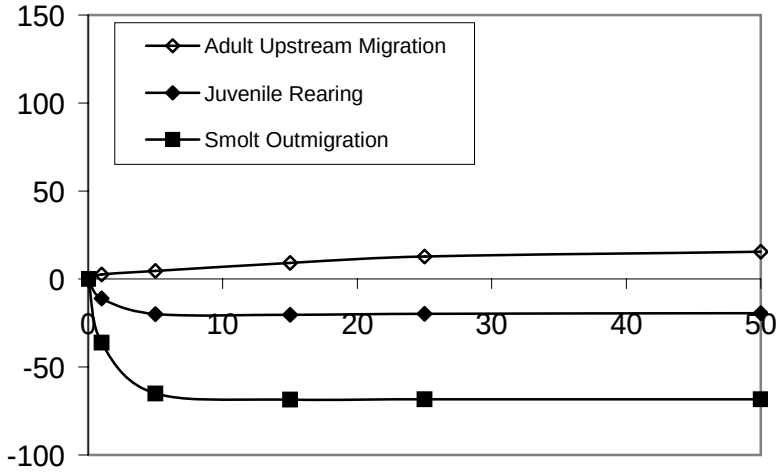
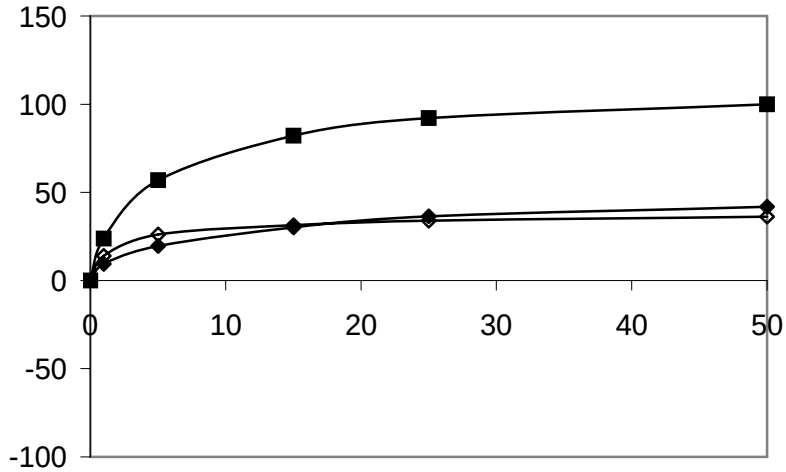


Figure 12. SAM results showing bank-line weighted relative response (feet) for delta smelt at Site Sacramento River RM 52.3L.

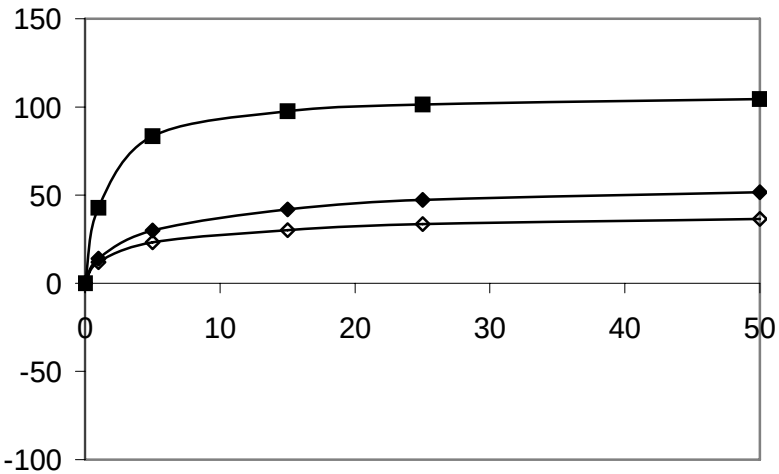
FALL



WINTER



SPRING



SUMMER

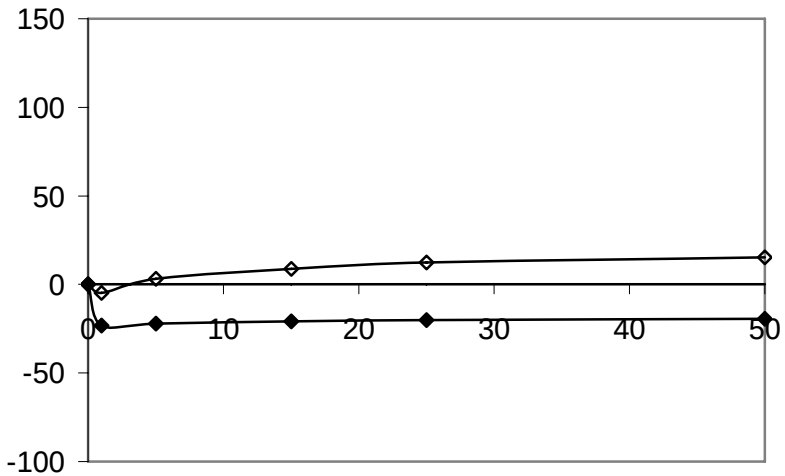


Figure 13. SAM results showing bank-line weighted relative response (feet) for Chinook salmon (Winter-run shown) at Site Lower American River RM 0.3L.

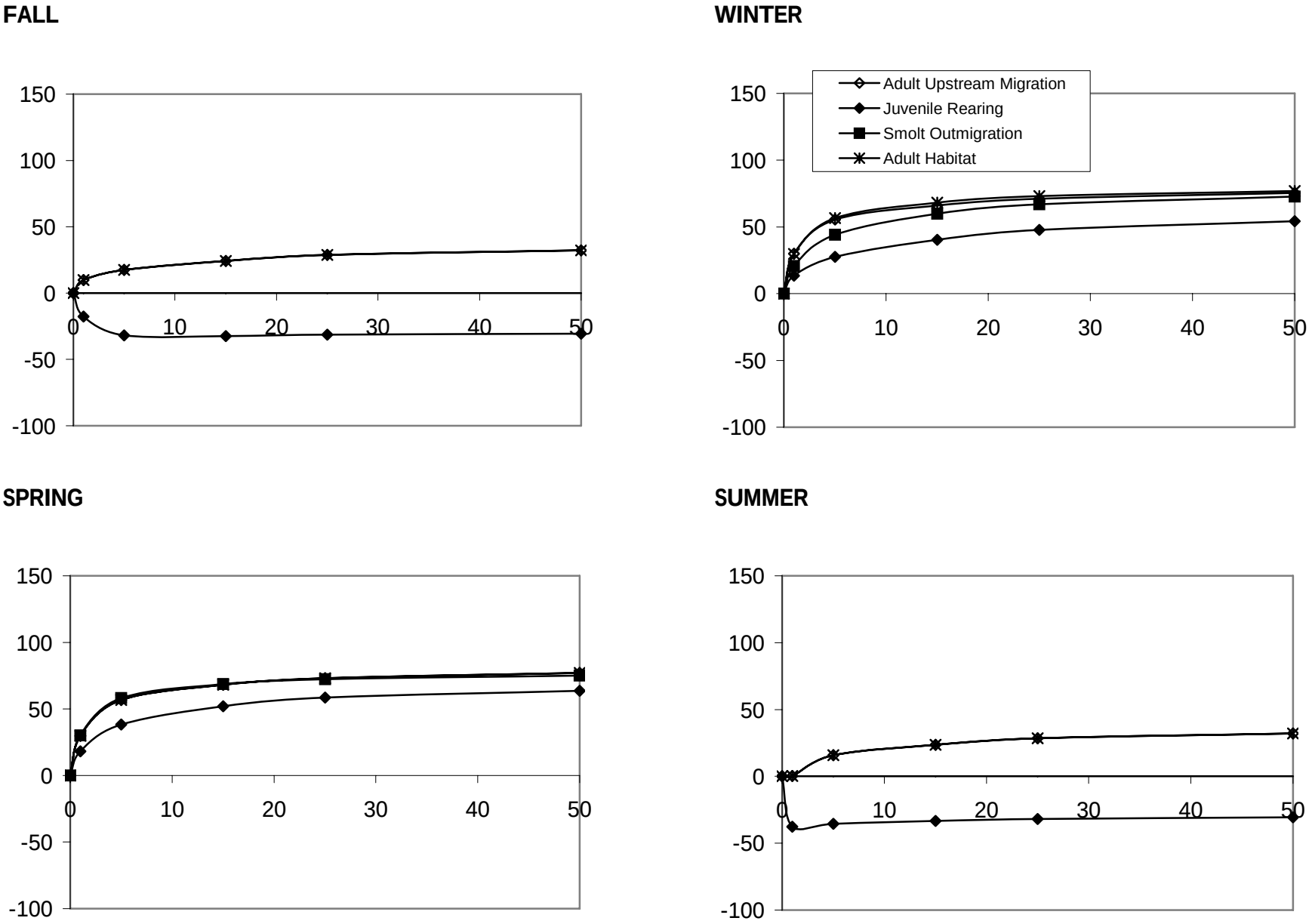
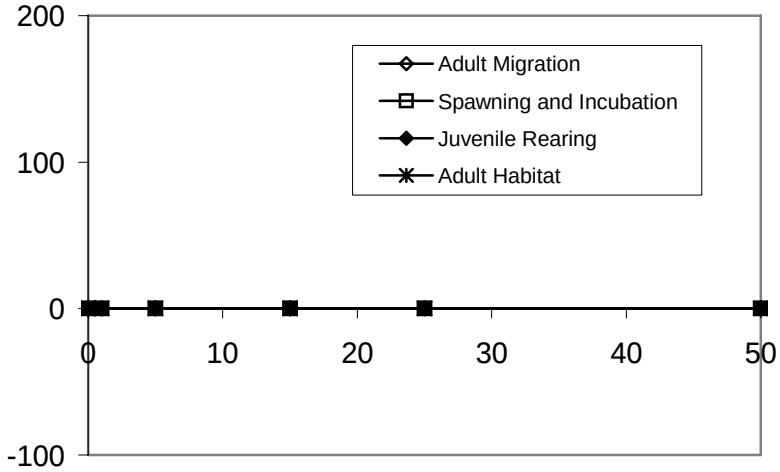
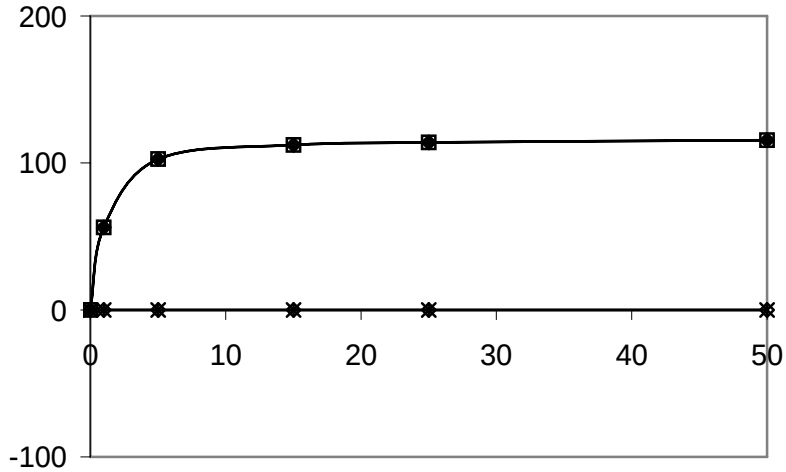


Figure 14. SAM results showing bank-line weighted relative response (feet) for Central Valley steelhead at Site Lower American River RM 0.3L.

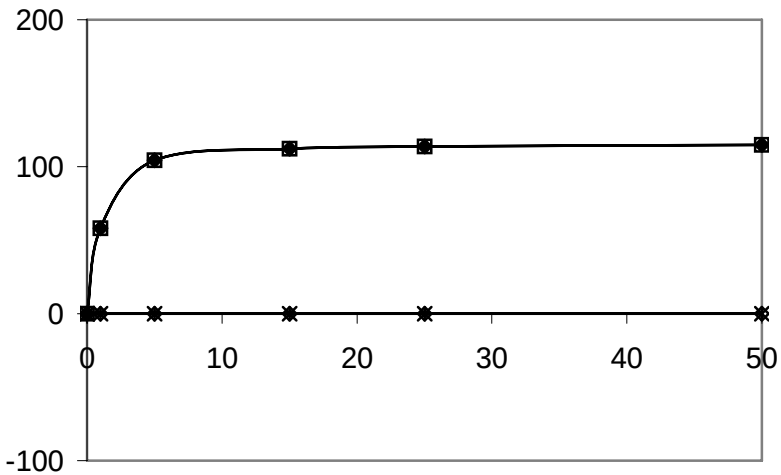
FALL



WINTER



SPRING



SUMMER

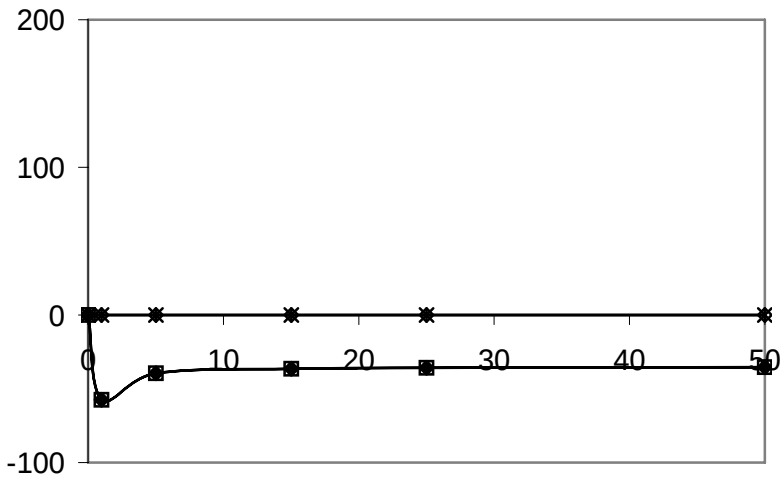
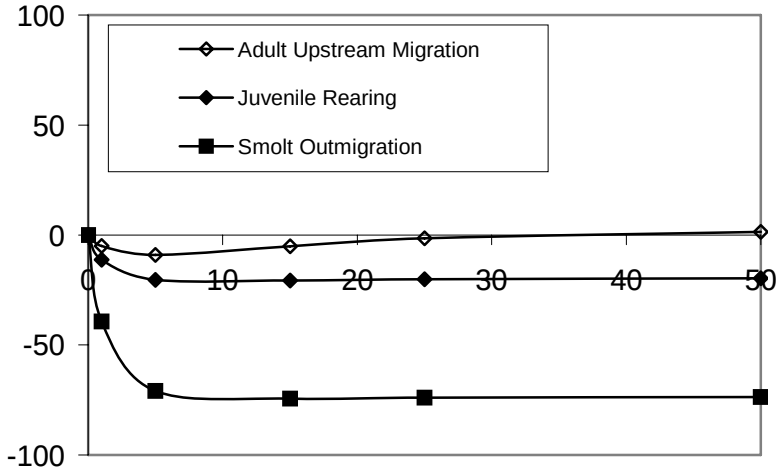
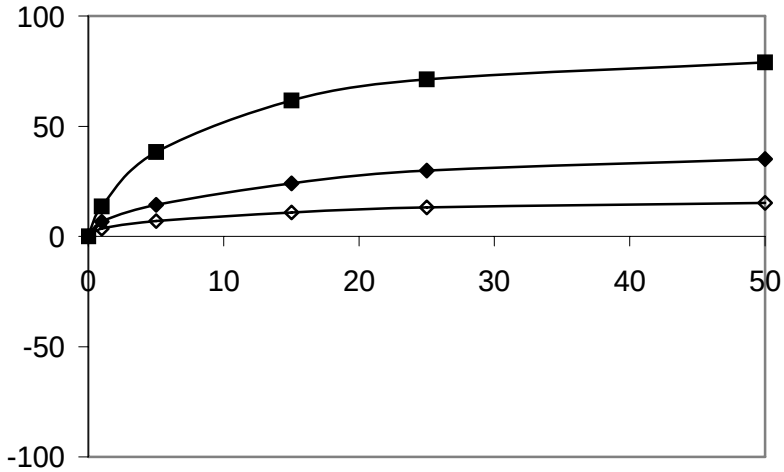


Figure 15. SAM results showing bank-line weighted relative response (feet) for delta smelt at Site Lower American River RM 0.3L.

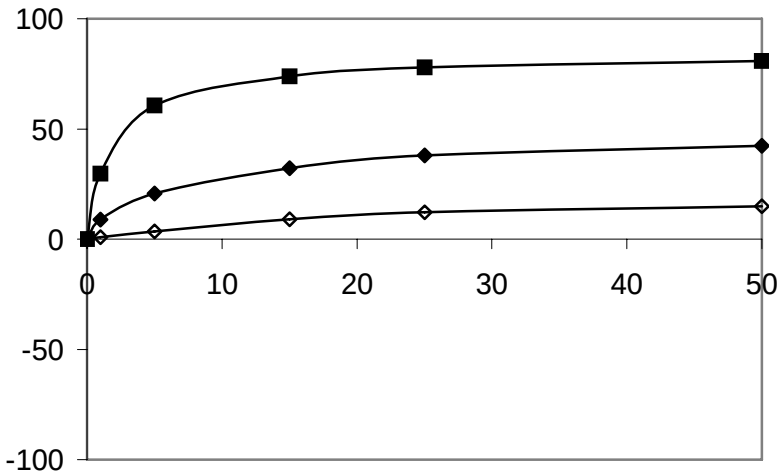
FALL



WINTER



SPRING



SUMMER

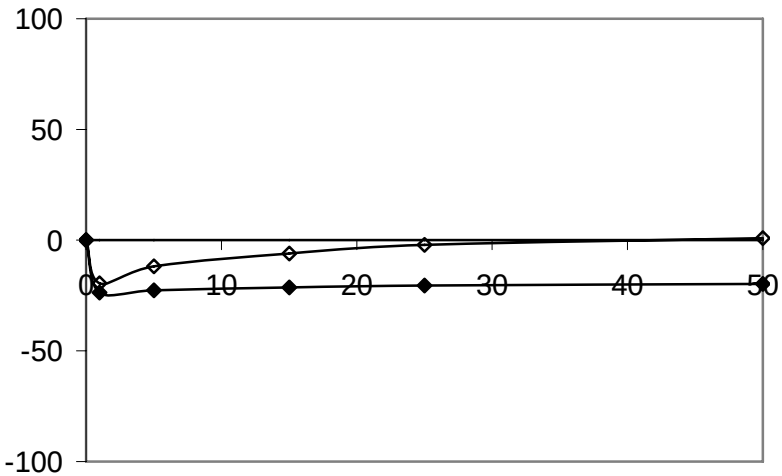
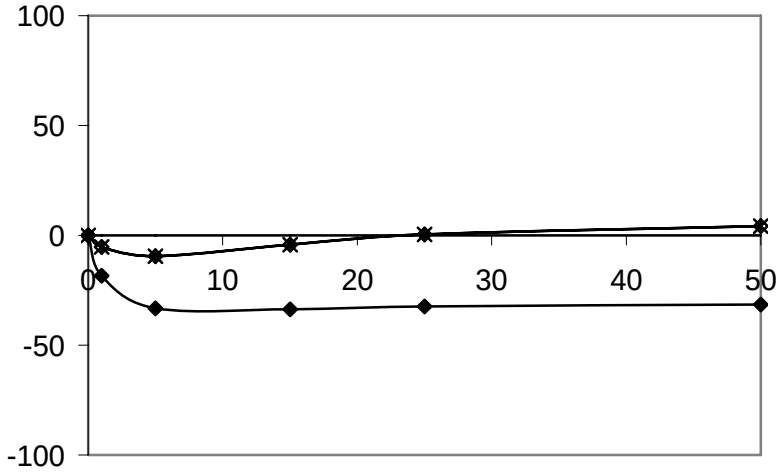
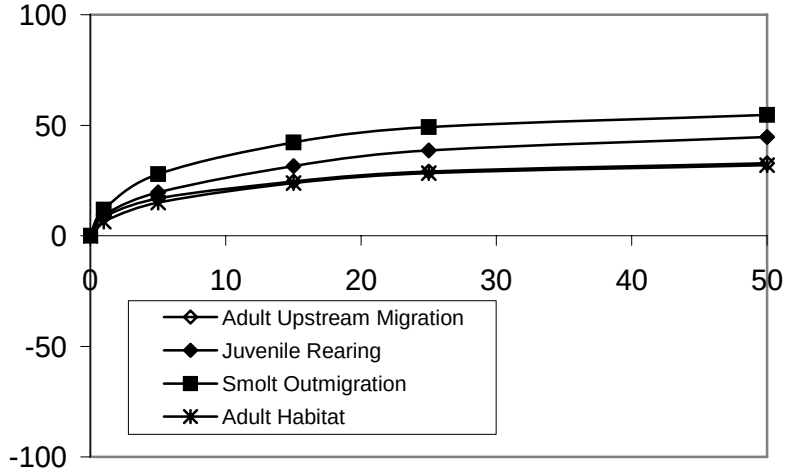


Figure 16. SAM results showing bank-line weighted relative response (feet) for Chinook salmon (Winter-run shown) at Site Lower American River RM 2.8L.

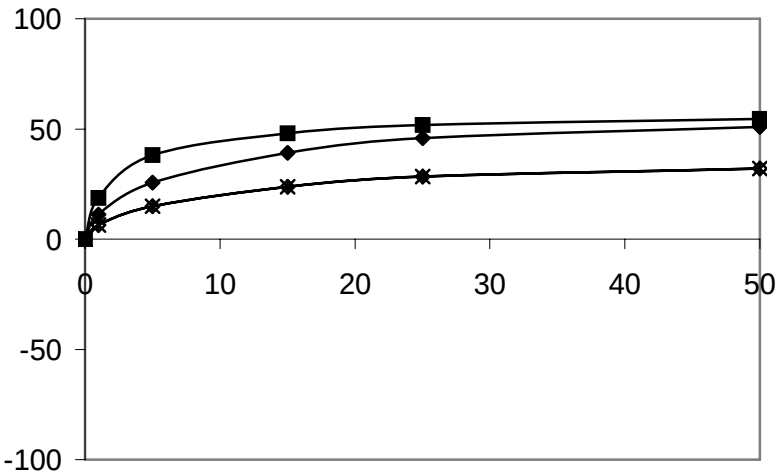
FALL



WINTER



SPRING



SUMMER

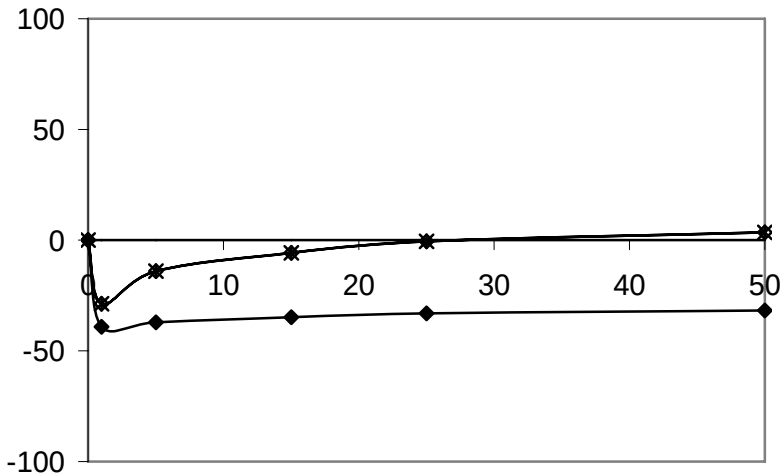
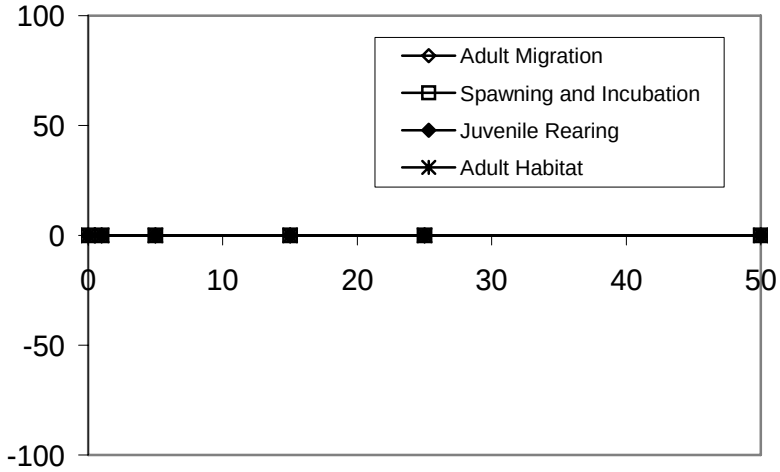
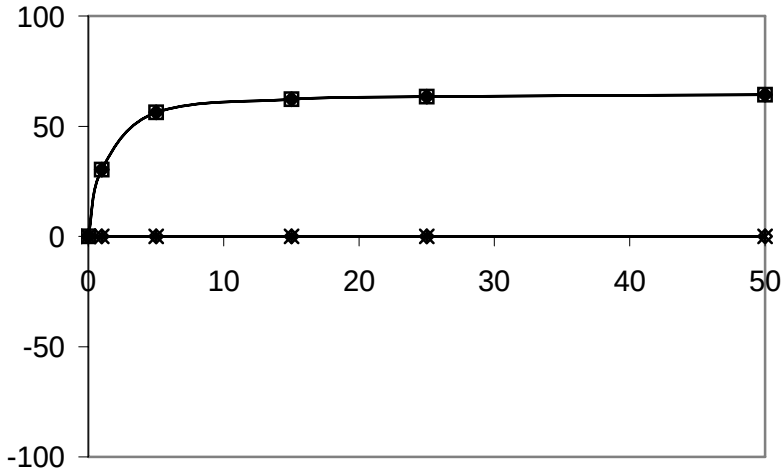


Figure 17. SAM results showing bank-line weighted relative response (feet) for Central Valley steelhead at Site Lower American River RM 2.8L.

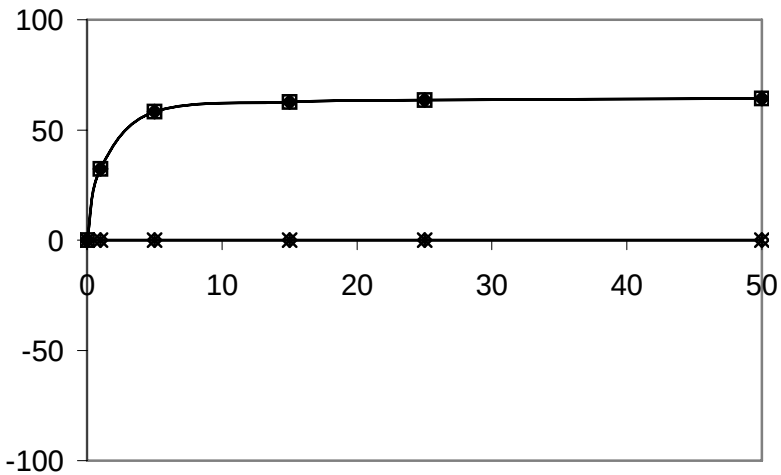
FALL



WINTER



SPRING



SUMMER

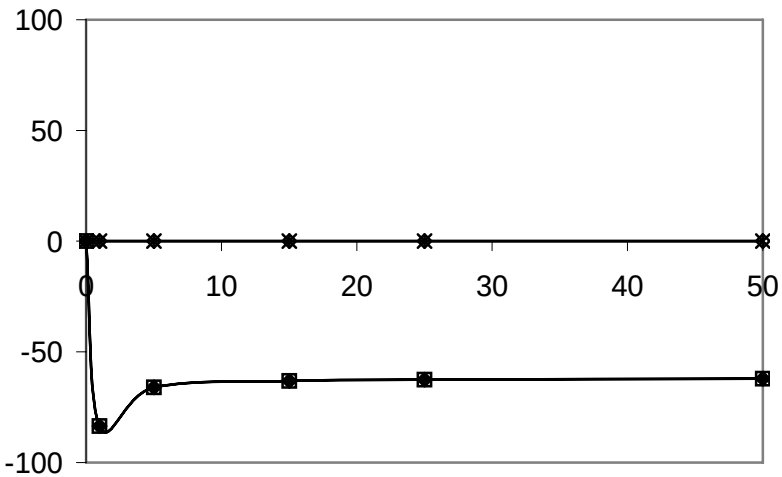
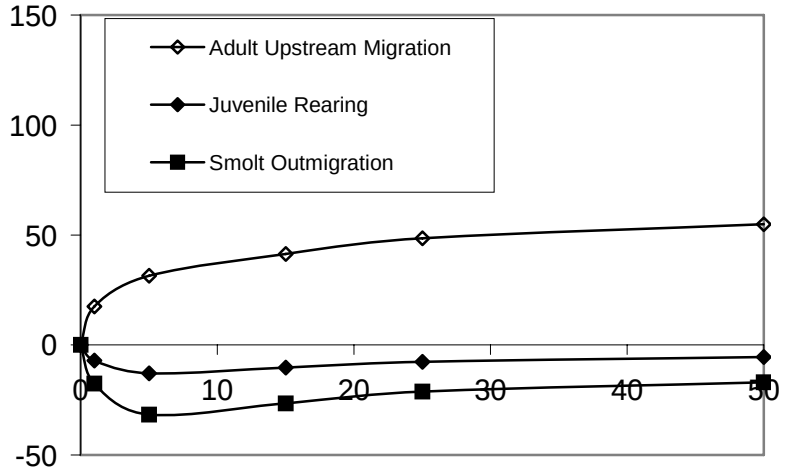
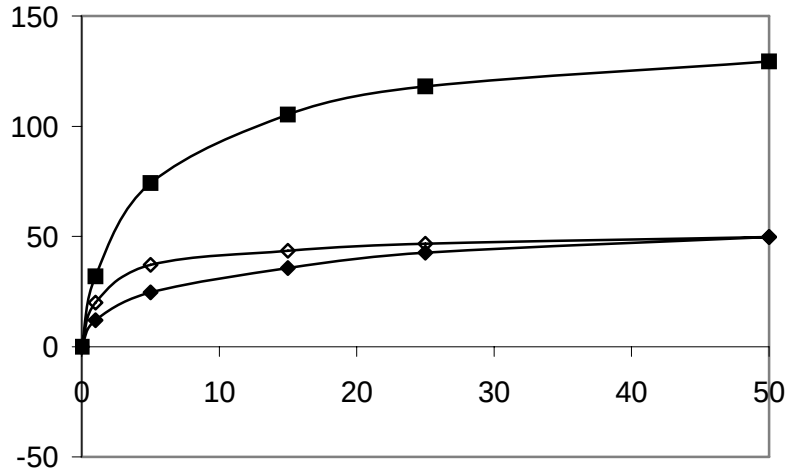


Figure 18. SAM results showing bank-line weighted relative response (feet) for delta smelt at Site Lower American River RM 2.8L.

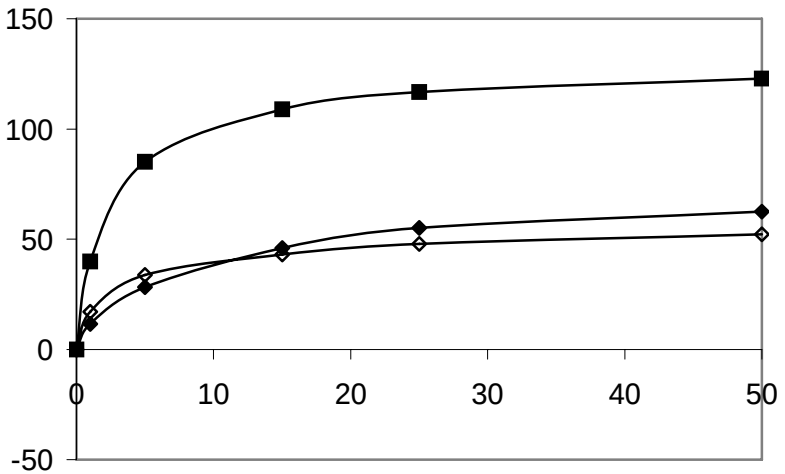
FALL



WINTER



SPRING



SUMMER

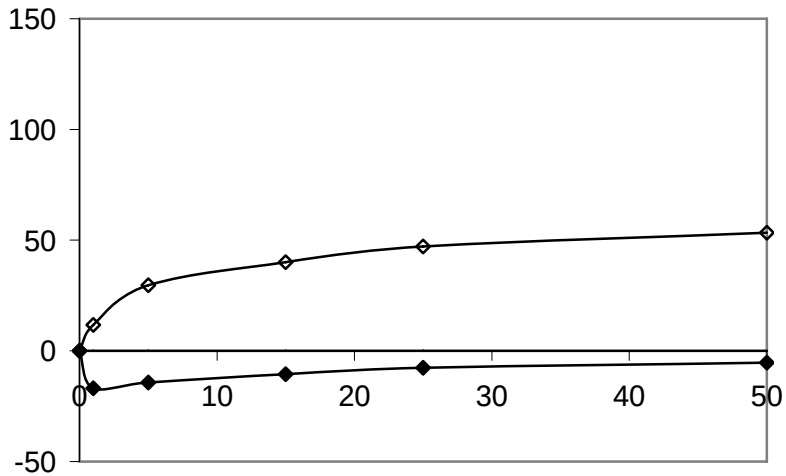


Figure 19. SAM results showing bank-line weighted relative response (feet) for Chinook salmon (Winter-run shown) at Site Sacramento River RM 53.5R.

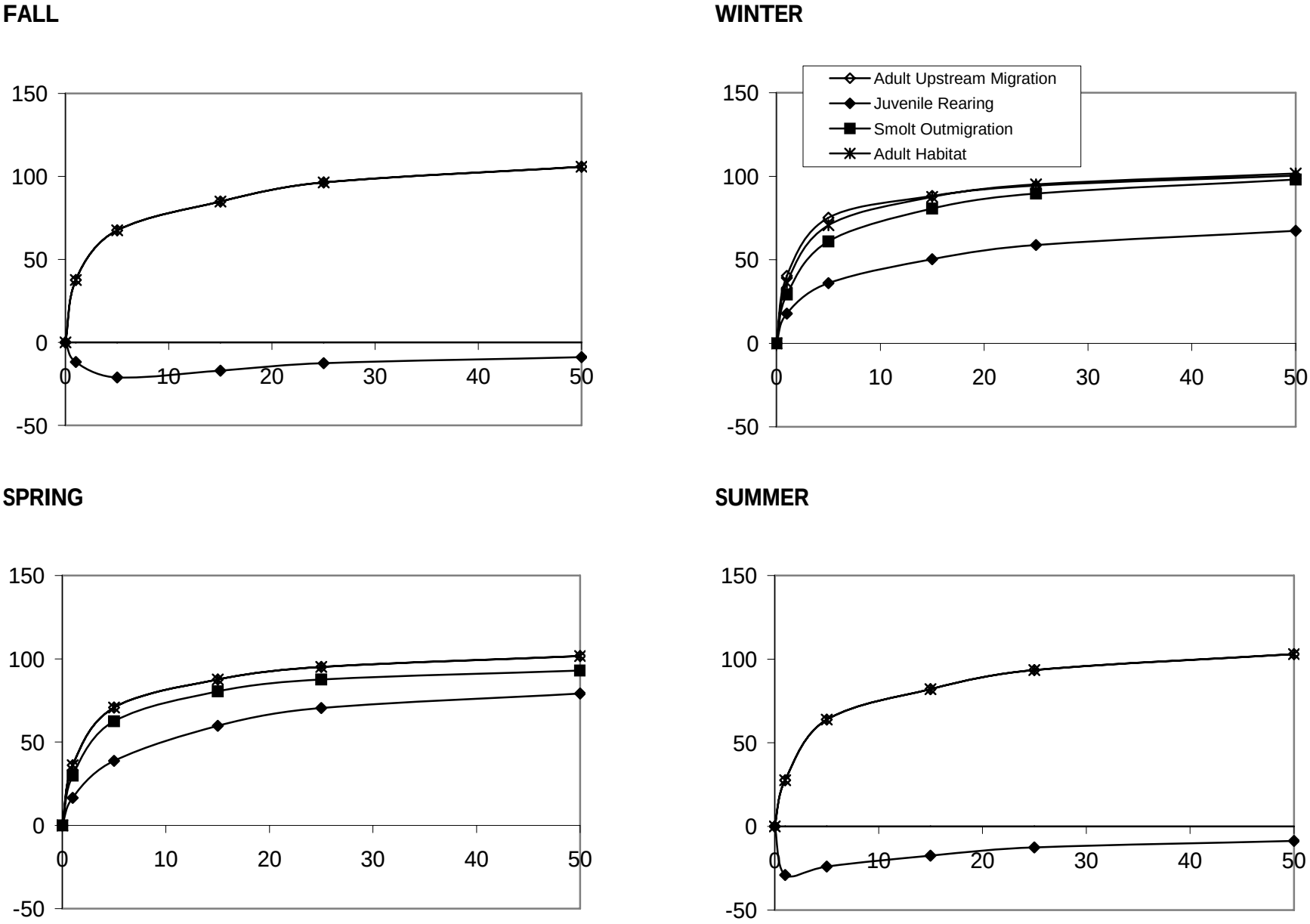
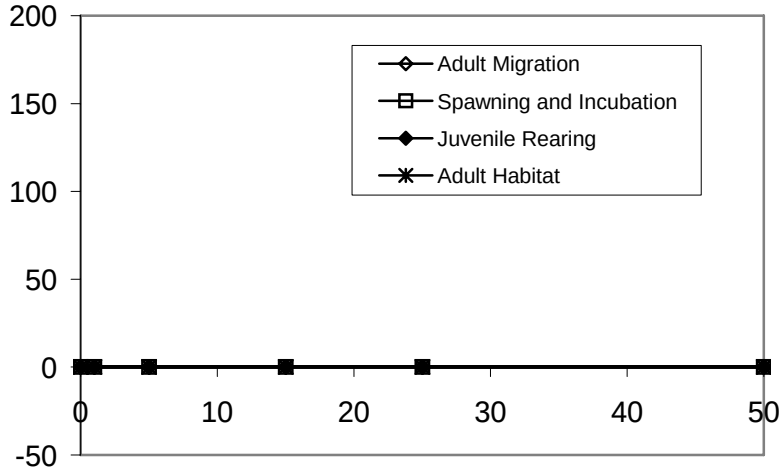
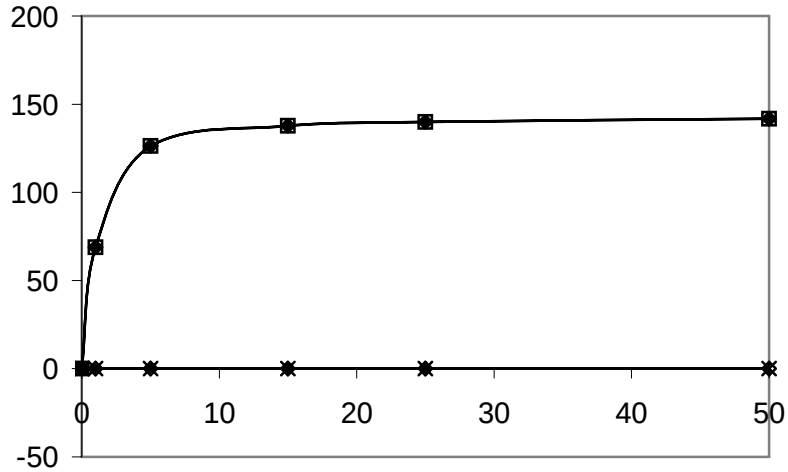


Figure 20. SAM results showing bank-line weighted relative response (feet) for Central Valley steelhead at Site Sacramento River RM 53.5R.

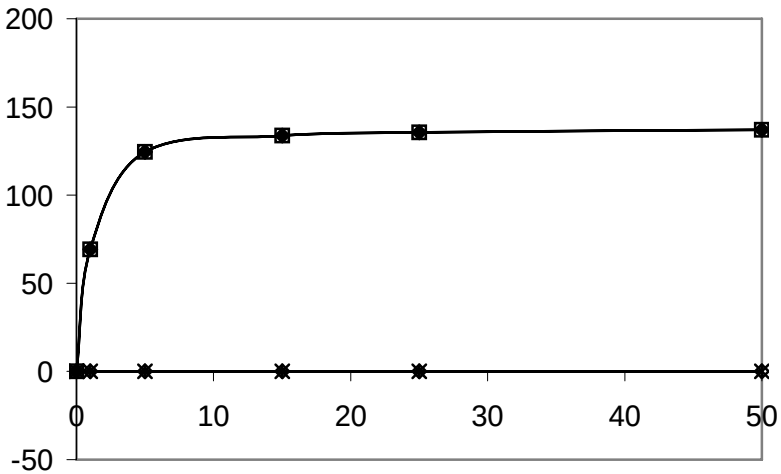
FALL



WINTER



SPRING



SUMMER

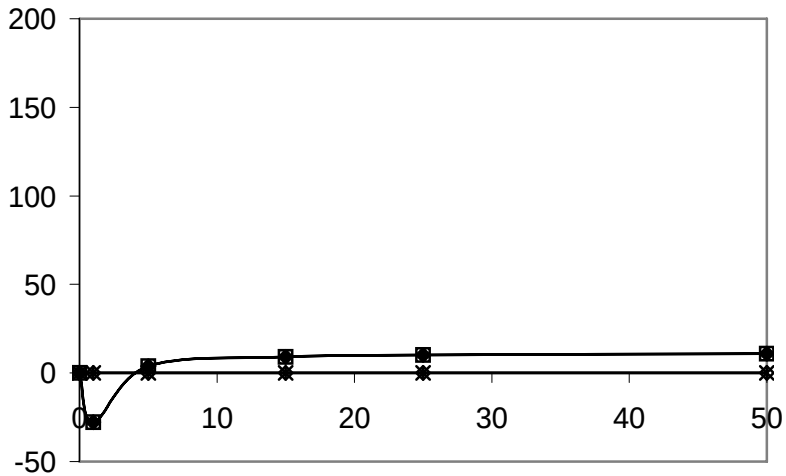
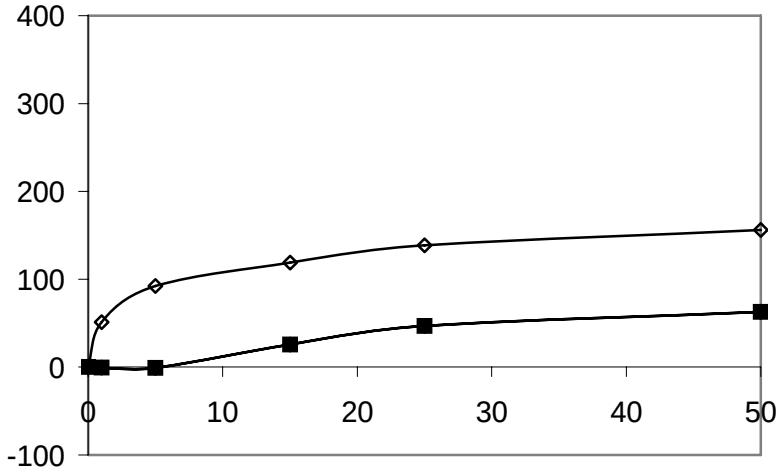
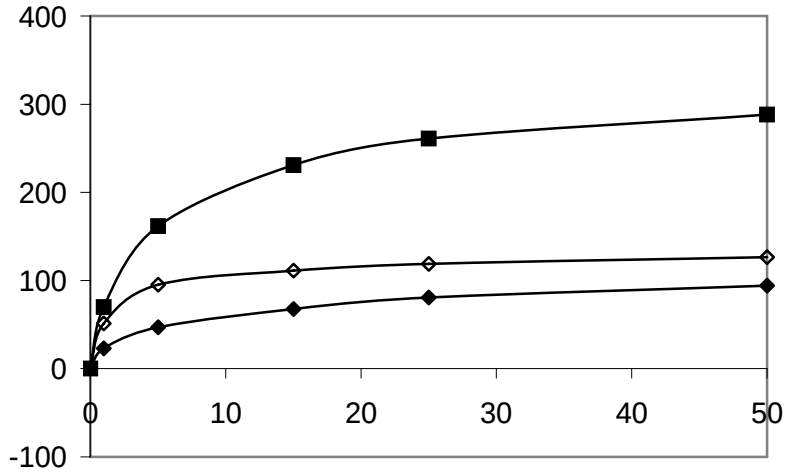


Figure 21. SAM results showing bank-line weighted relative response (feet) for delta smelt at Site Sacramento River RM 53.5R.

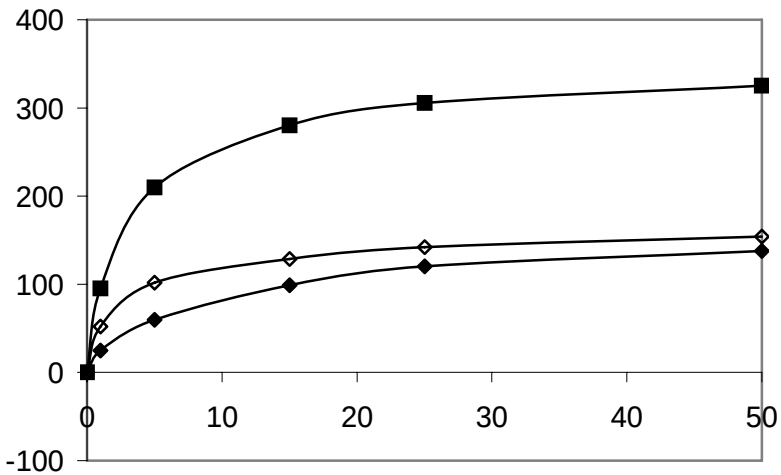
FALL



WINTER



SPRING



SUMMER

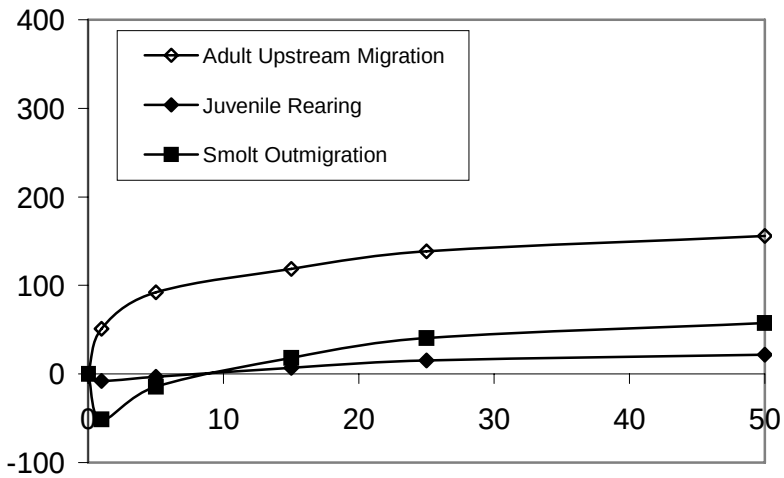
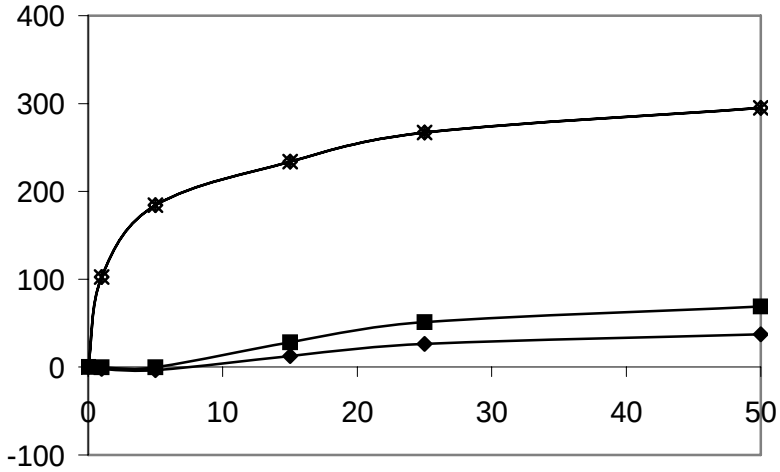
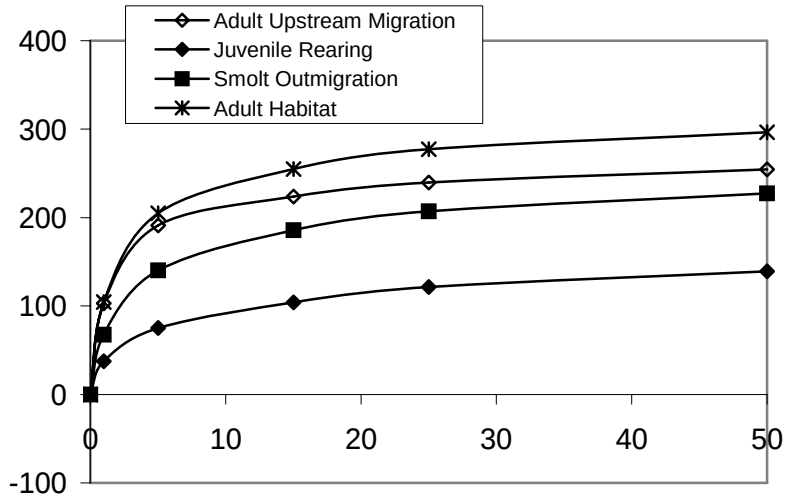


Figure 22. SAM results showing bank-line weighted relative response (feet) for Chinook salmon (Winter-run shown) at Site Sacramento River RM 177.8R.

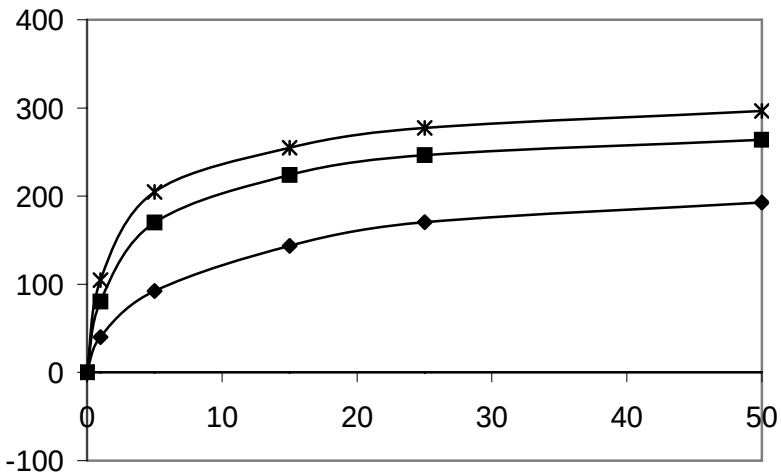
FALL



WINTER



SPRING



SUMMER

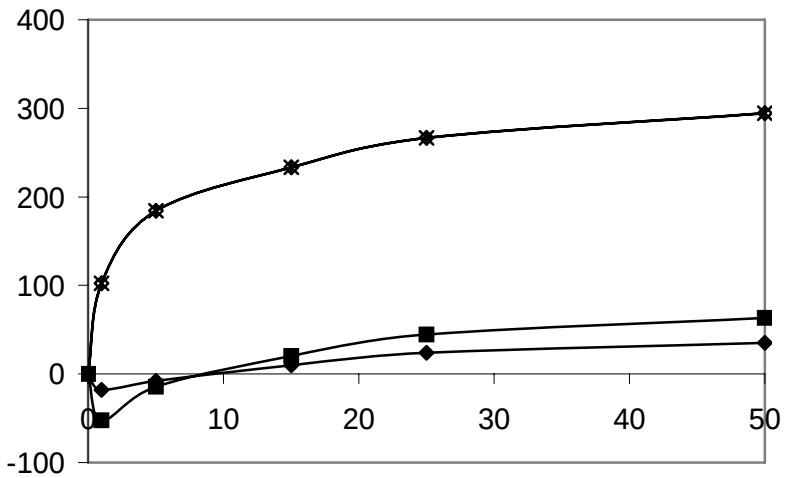
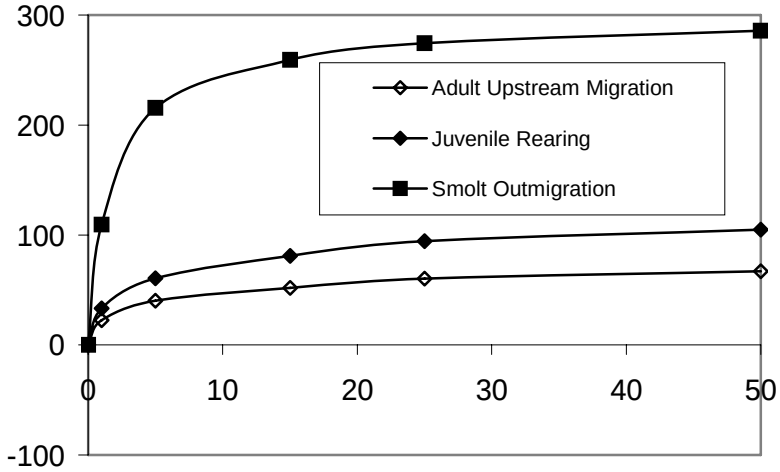
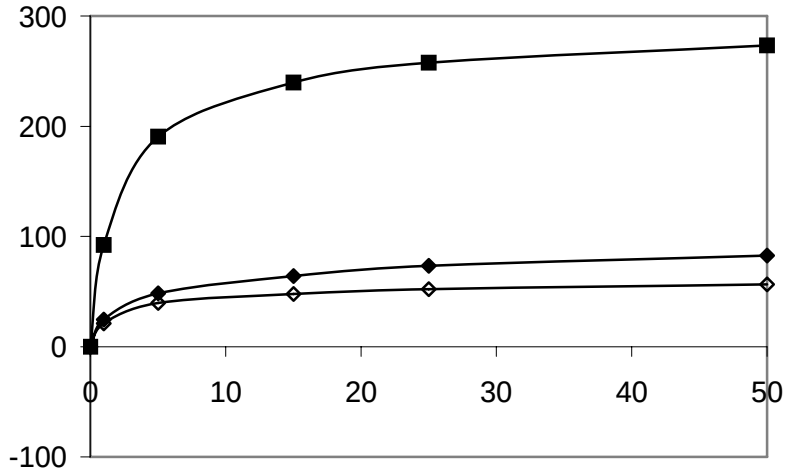


Figure 23. SAM results showing bank-line weighted relative response (feet) for Central Valley steelhead at Site Sacramento River RM 177.8R.

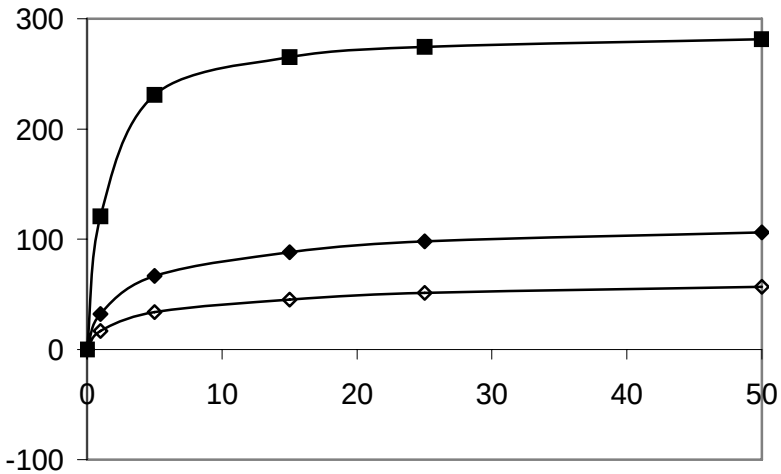
FALL



WINTER



SPRING



SUMMER

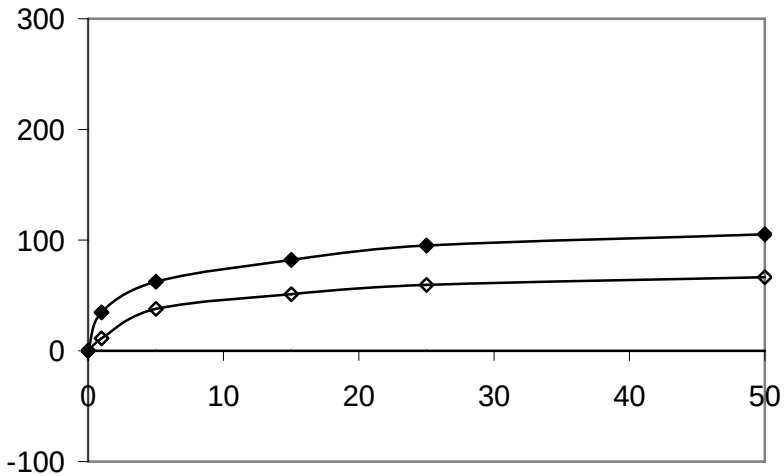
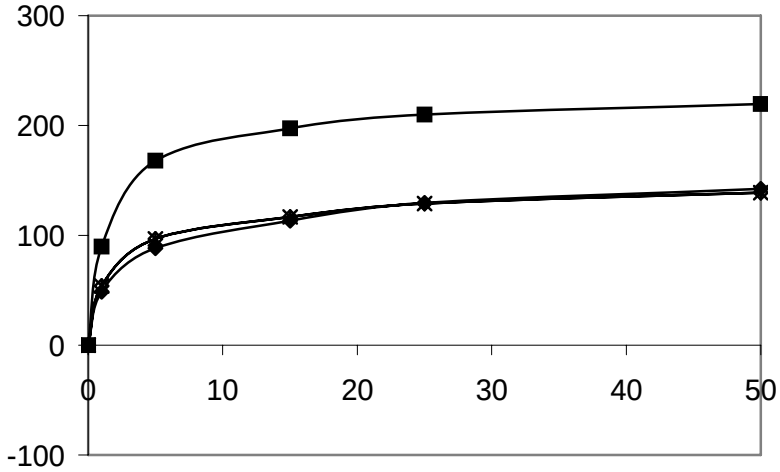
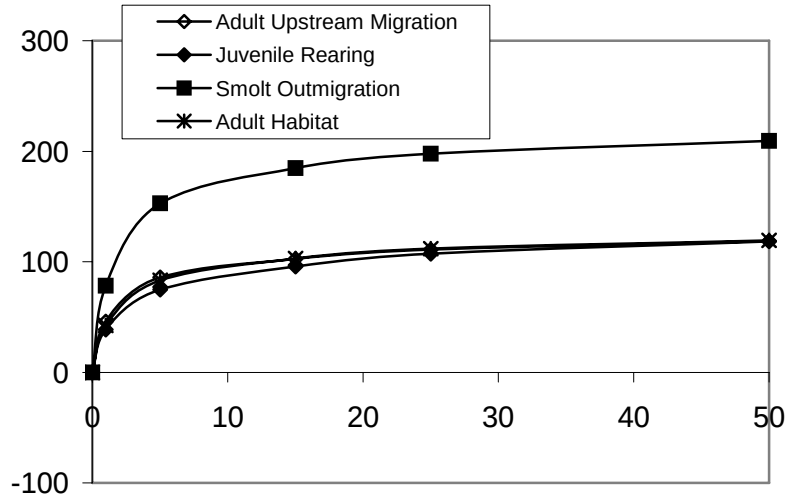


Figure 24. SAM results showing bank-line weighted relative response (feet) for Chinook salmon (Winter-run shown) at Site Sacramento River RM 16.8L.

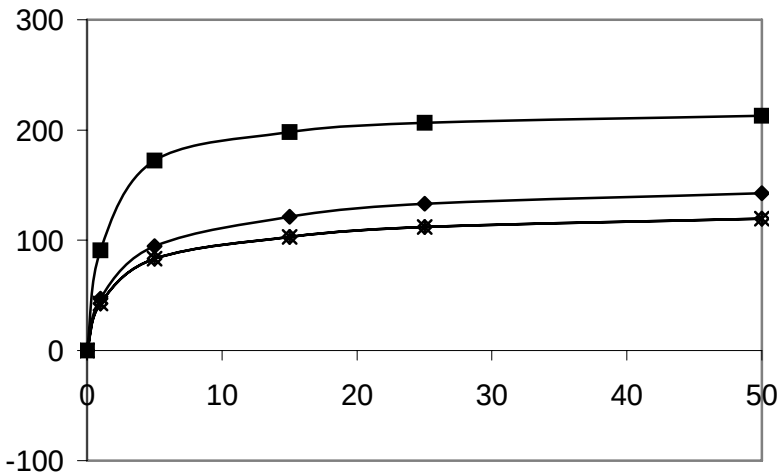
FALL



WINTER



SPRING



SUMMER

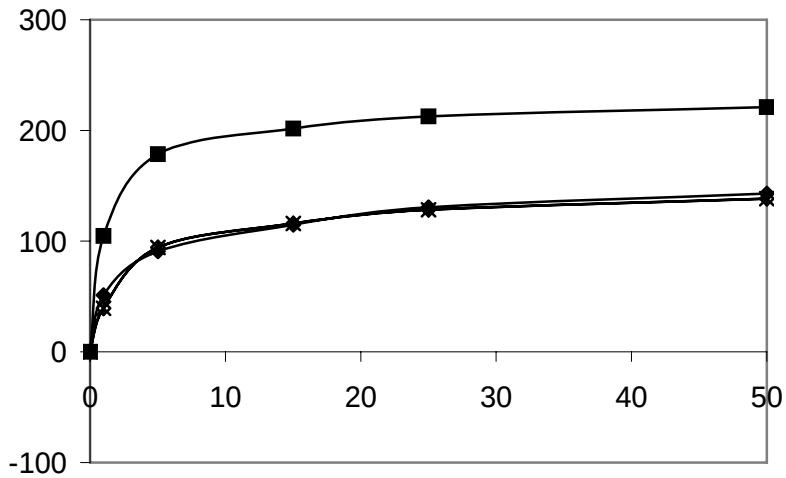
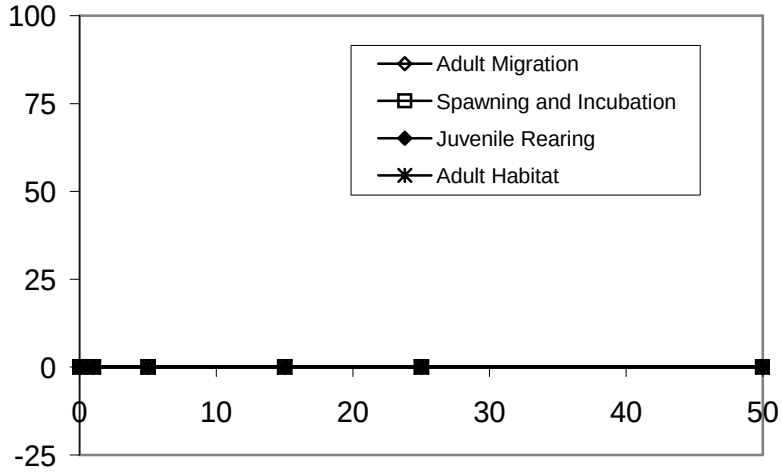
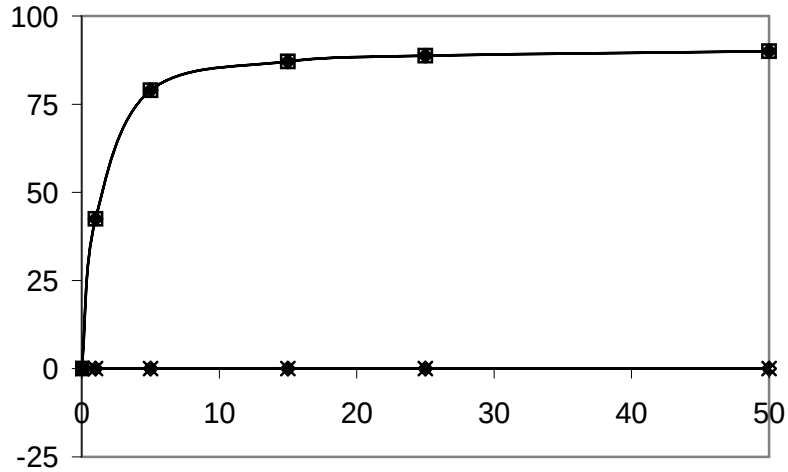


Figure 25. SAM results showing bank-line weighted relative response (feet) for Central Valley steelhead at Site Sacramento River RM 16.8L.

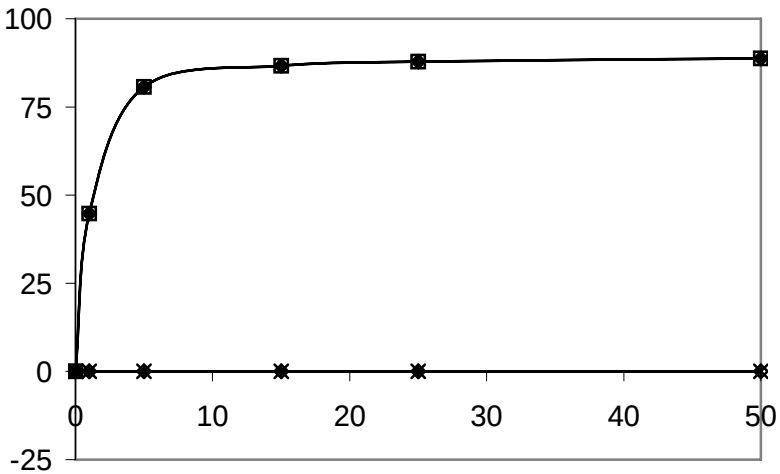
FALL



WINTER



SPRING



SUMMER

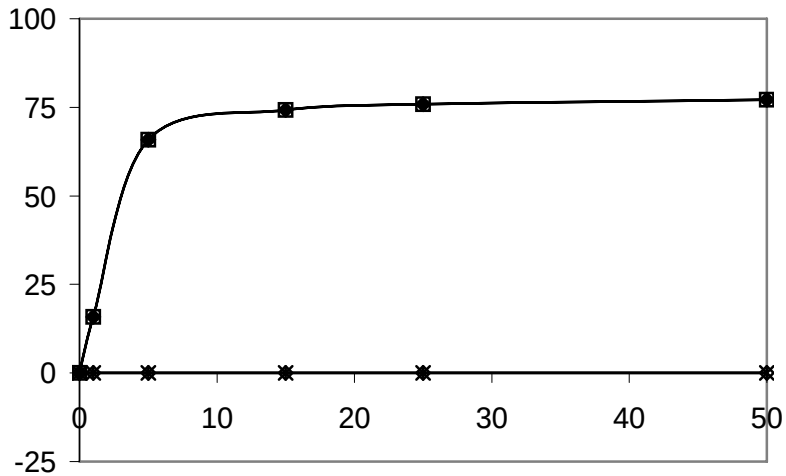


Figure 26. SAM results showing bank-line weighted relative response (feet) for delta smelt at Site Sacramento River RM 16.8L.

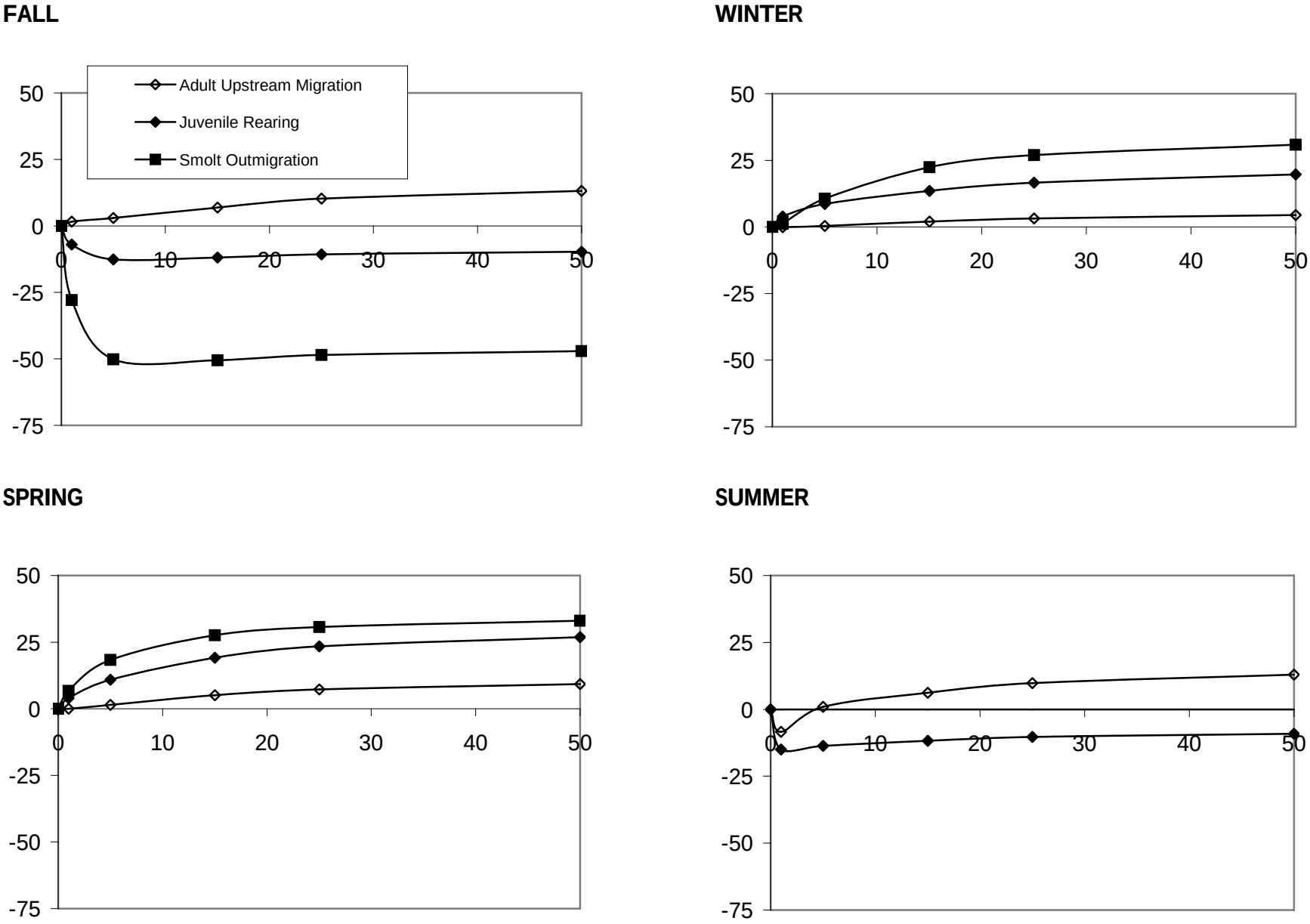
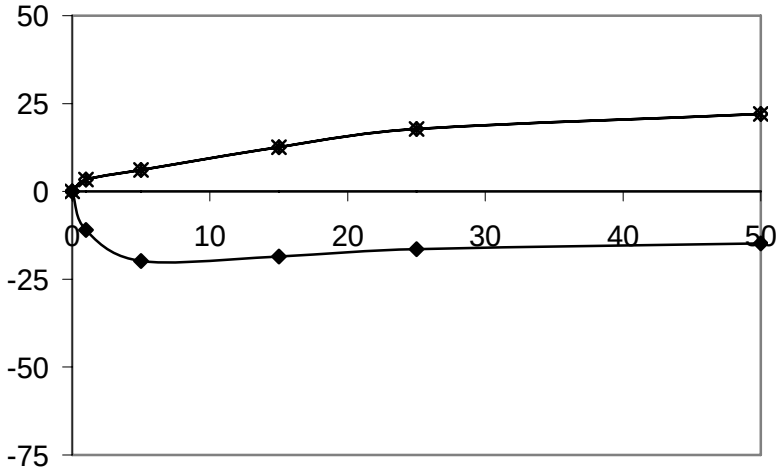
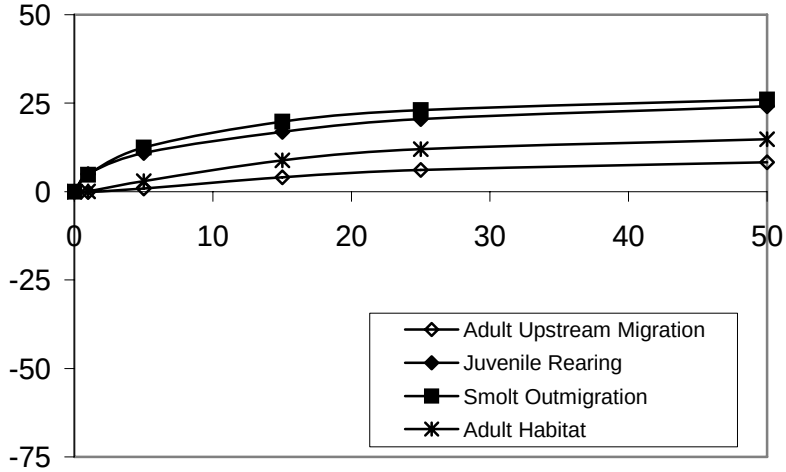


Figure 27. SAM results showing bank-line weighted relative response (feet) for Chinook salmon (Winter-run shown) at Site Sacramento River RM 42.7R.

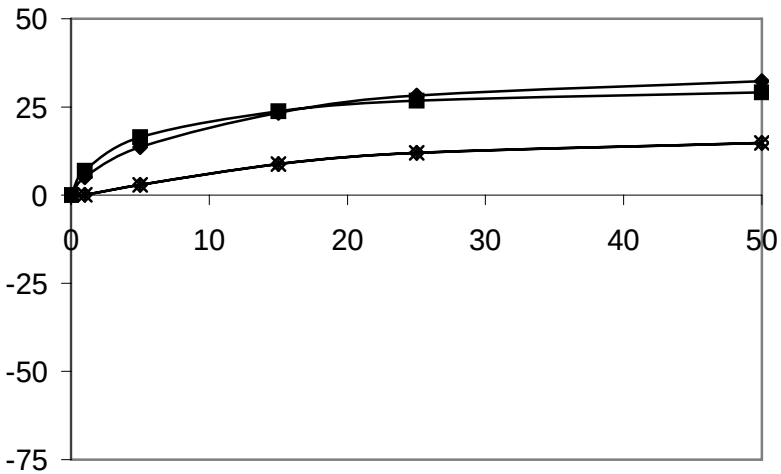
FALL



WINTER



SPRING



SUMMER

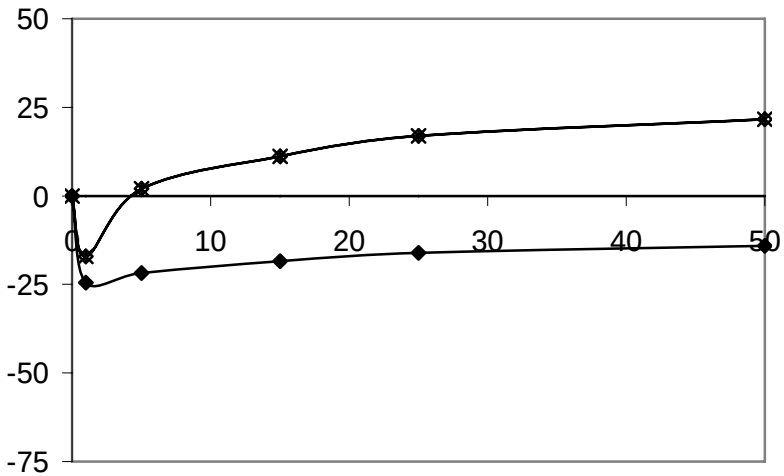
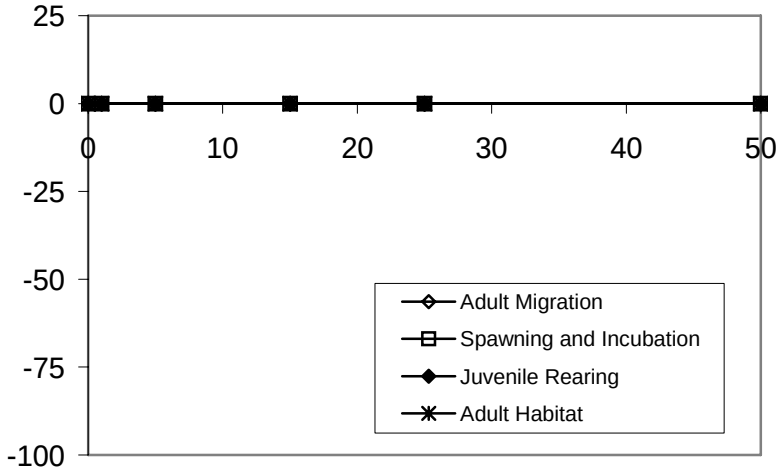
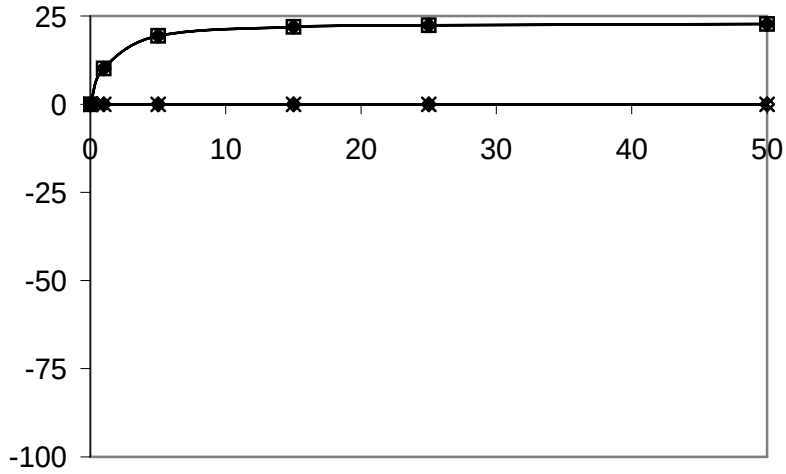


Figure 28. SAM results showing bank-line weighted relative response (feet) for Central Valley steelhead at Site Sacramento River RM 42.7R.

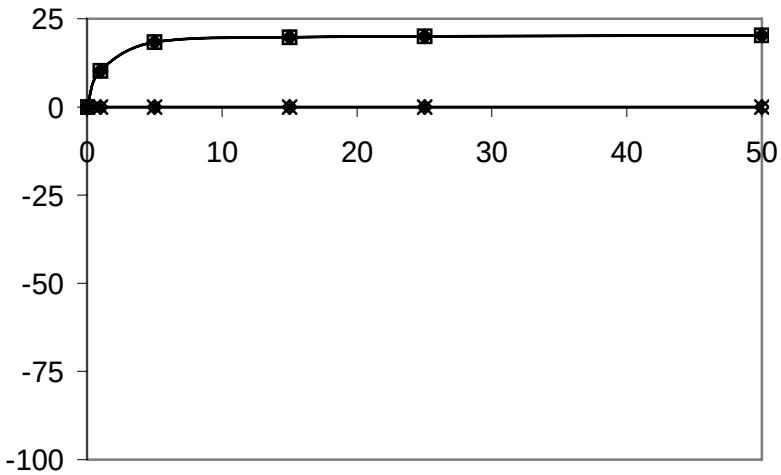
FALL



WINTER



SPRING



SUMMER

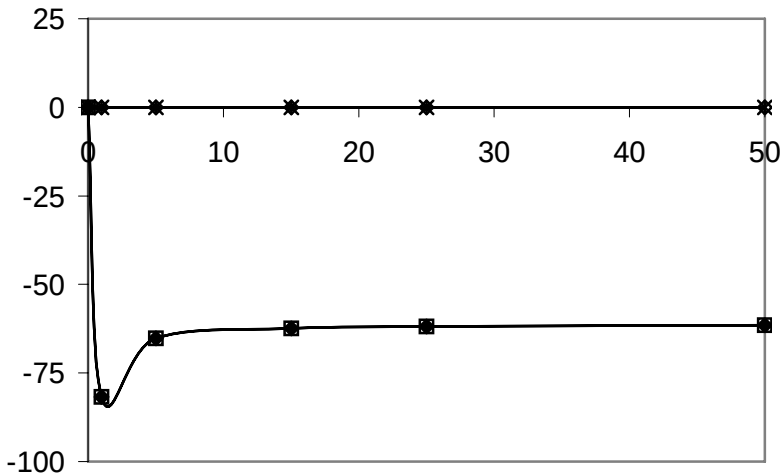
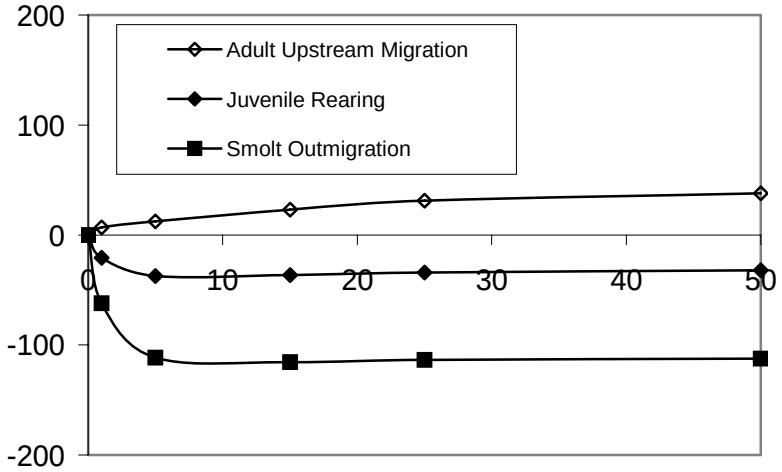
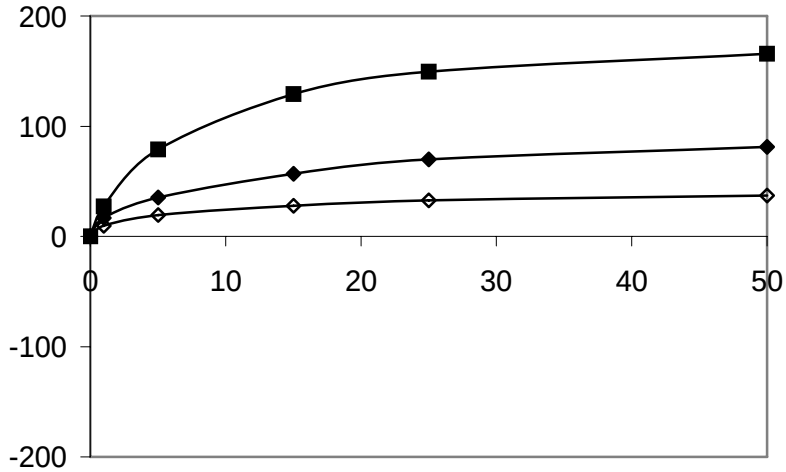


Figure 29. SAM results showing bank-line weighted relative response (feet) for delta smelt at Site Sacramento River RM 42.7R.

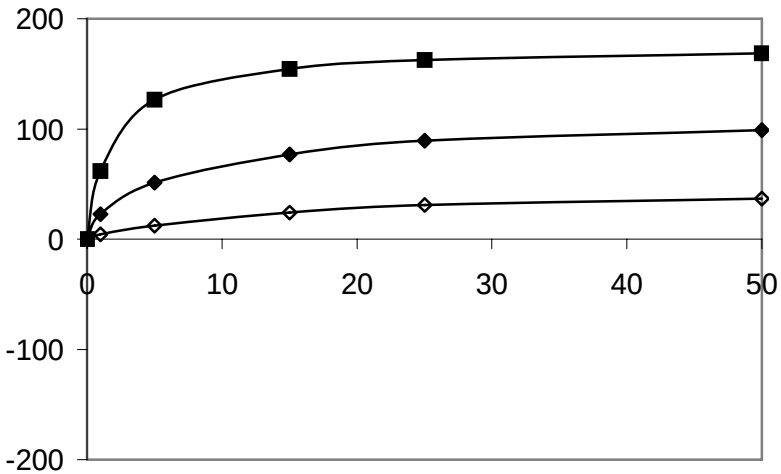
FALL



WINTER



SPRING



SUMMER

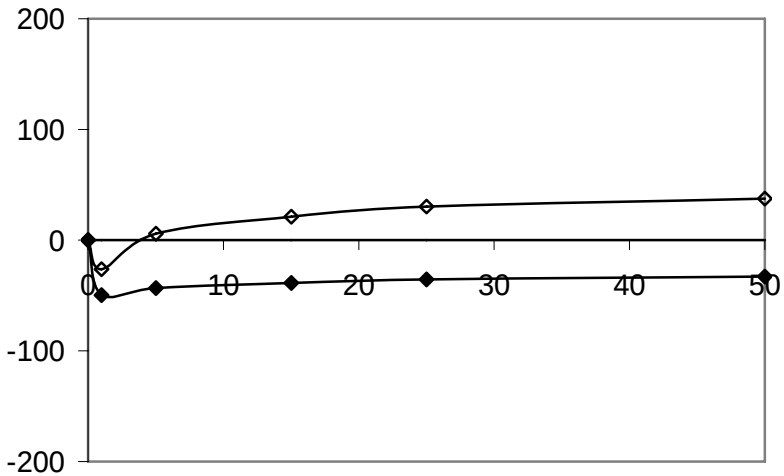
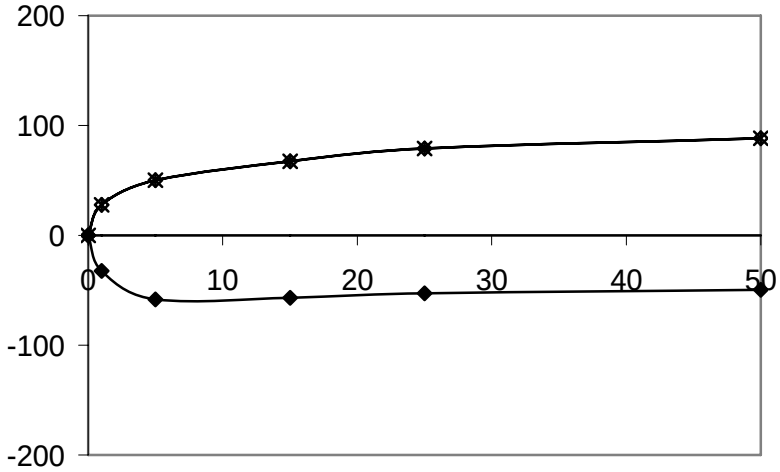
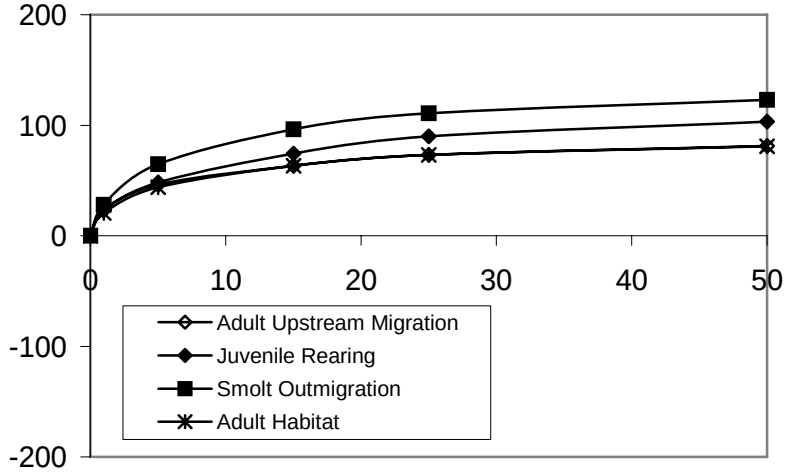


Figure 30. SAM results showing bank-line weighted relative response (feet) for Chinook salmon (Winter-run shown) at Site Sacramento River RM 55.2L.

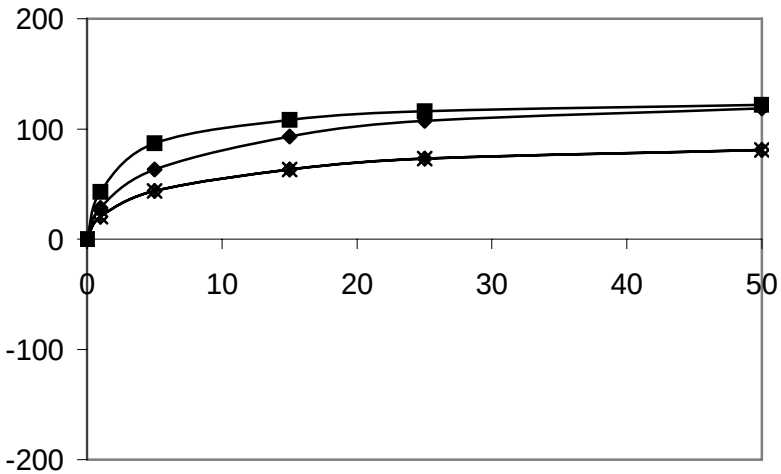
FALL



WINTER



SPRING



SUMMER

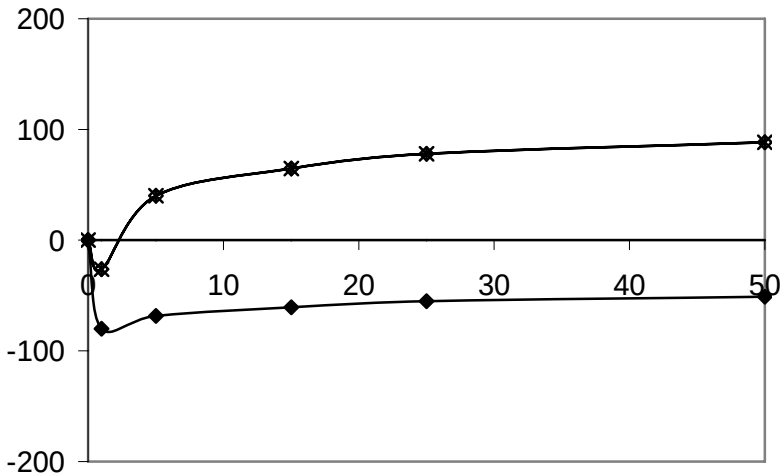
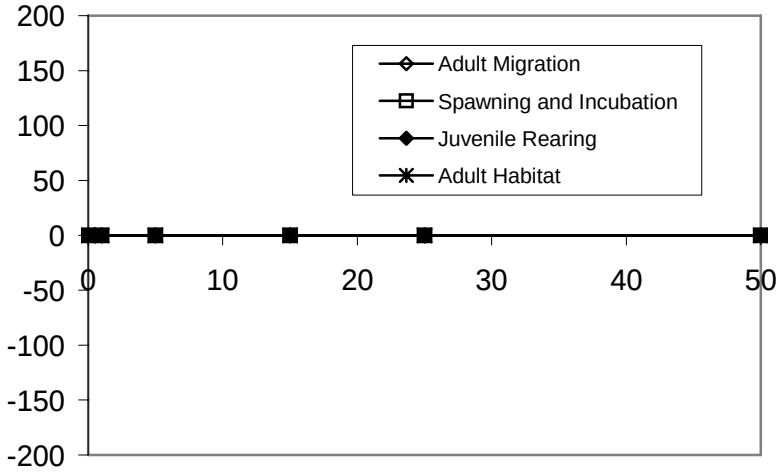
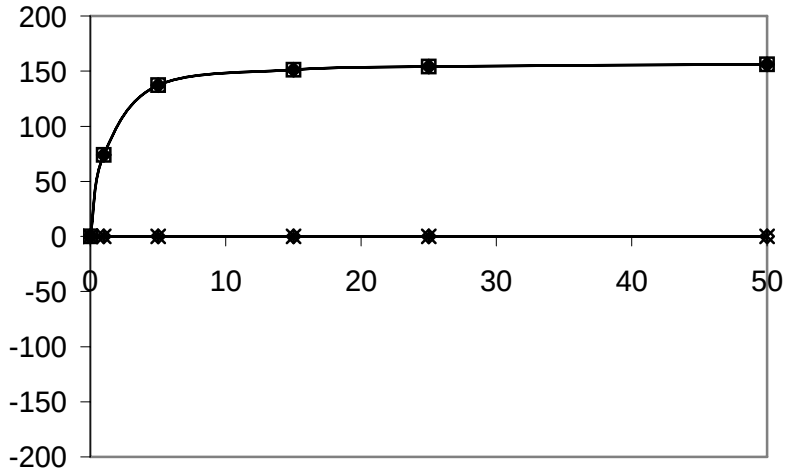


Figure 31. SAM results showing bank-line weighted relative response (feet) for Central Valley steelhead at Site Sacramento River RM 55.2L.

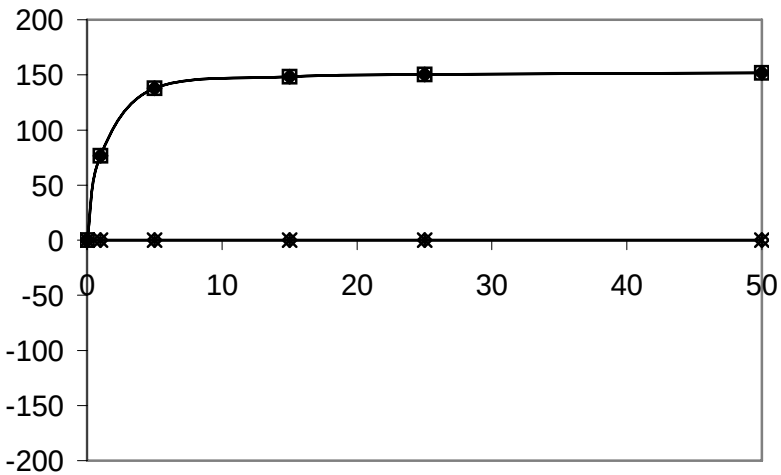
FALL



WINTER



SPRING



SUMMER

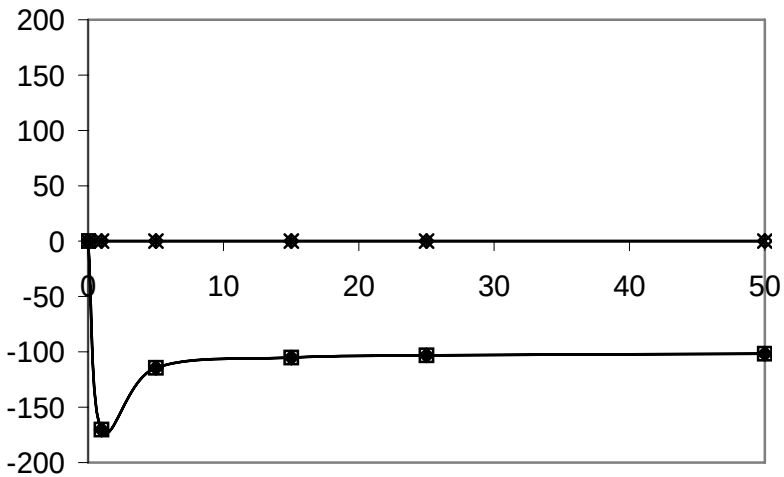
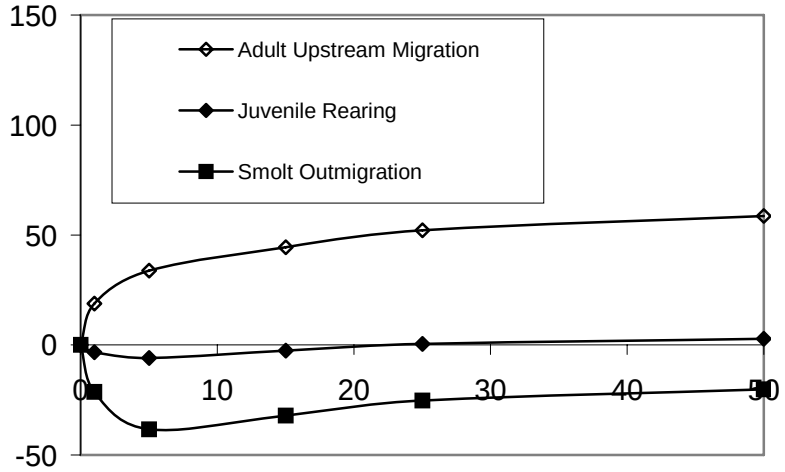
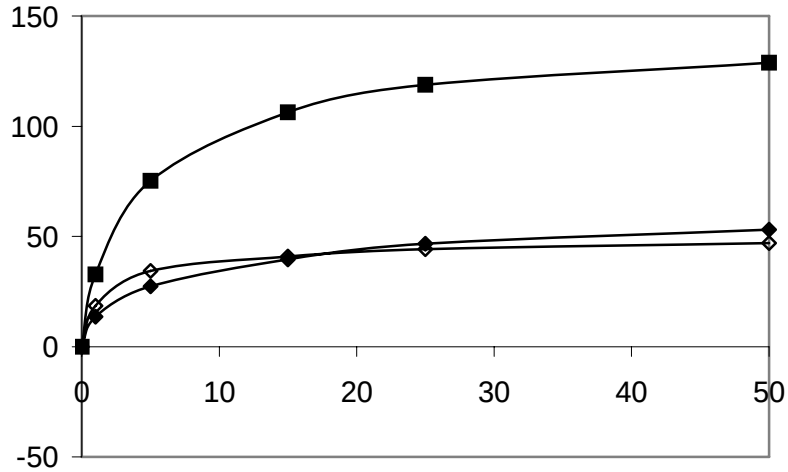


Figure 32. SAM results showing bank-line weighted relative response (feet) for delta smelt at Site Sacramento River RM 55.2L.

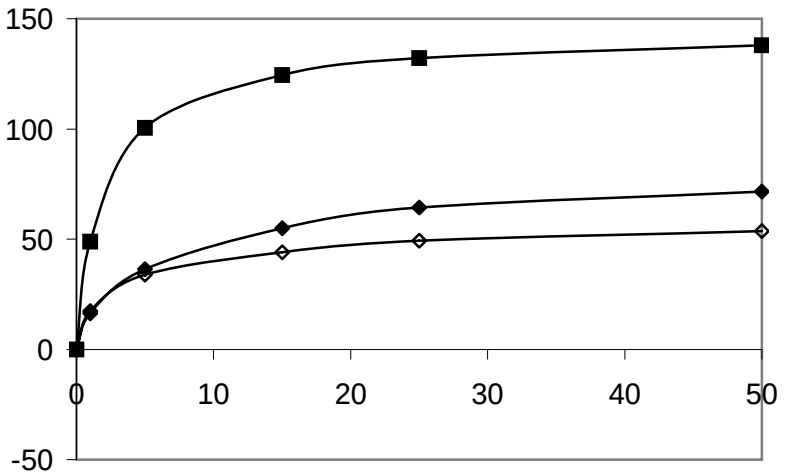
FALL



WINTER



SPRING



SUMMER

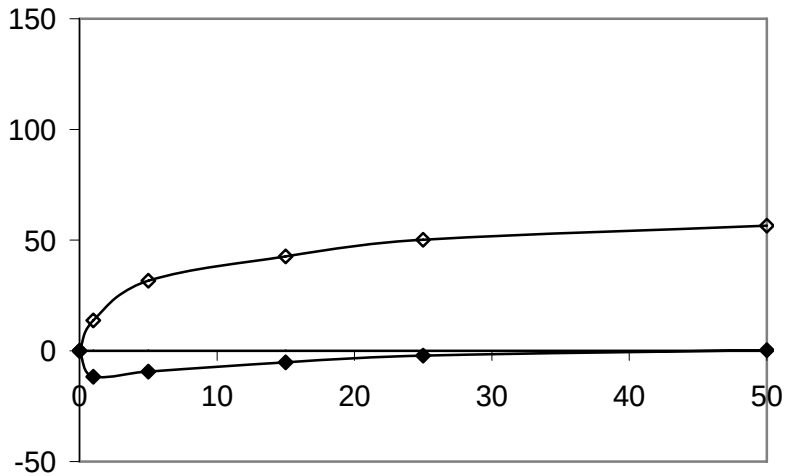
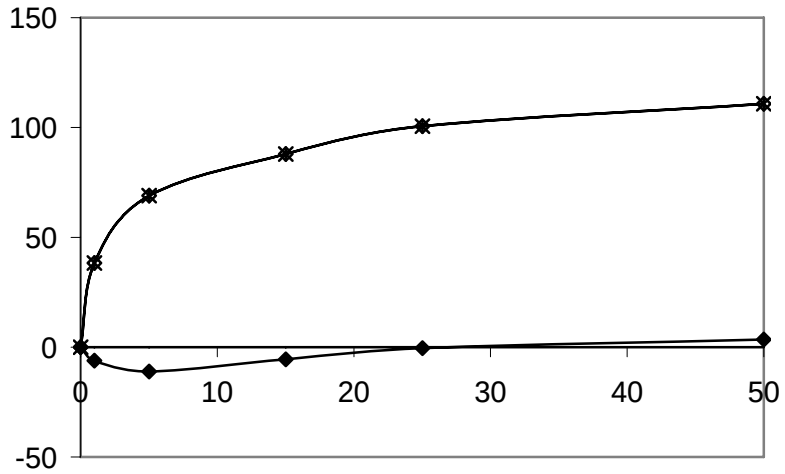
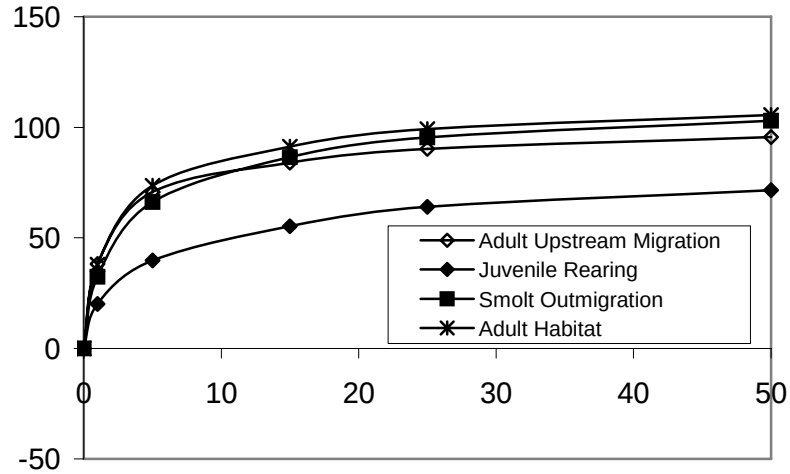


Figure 33. SAM results showing bank-line weighted relative response (feet) for Chinook salmon (Winter-run shown) at Site Sacramento River RM 77.2L.

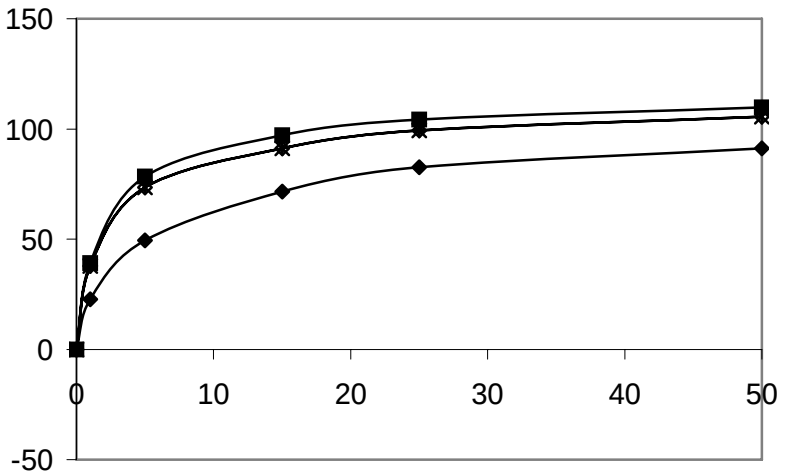
FALL



WINTER



SPRING



SUMMER

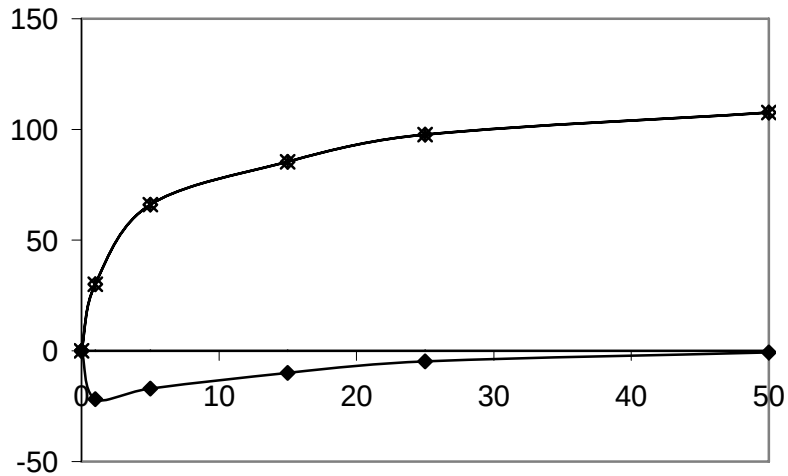
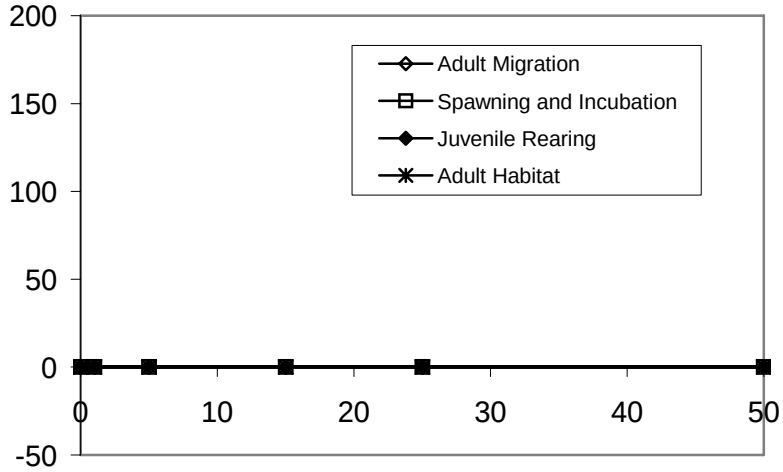
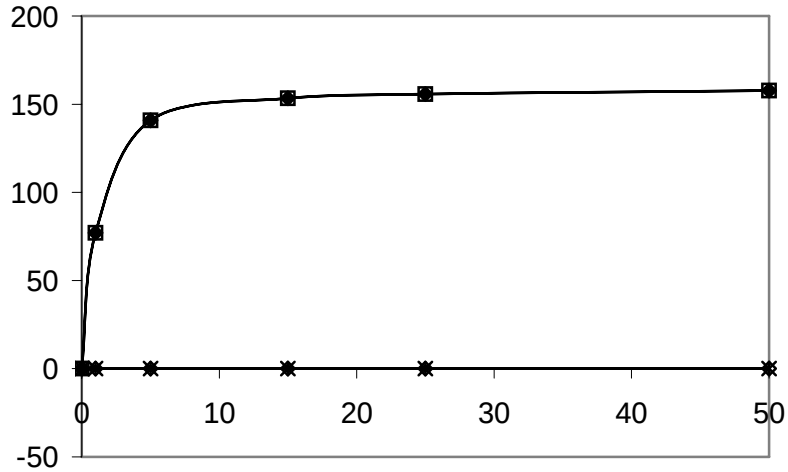


Figure 34. SAM results showing bank-line weighted relative response (feet) for Central Valley steelhead at Site Sacramento River RM 77.2L.

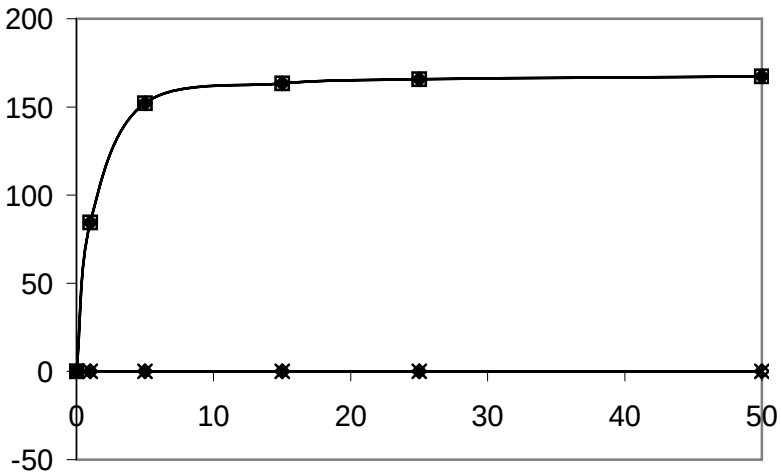
FALL



WINTER



SPRING



SUMMER

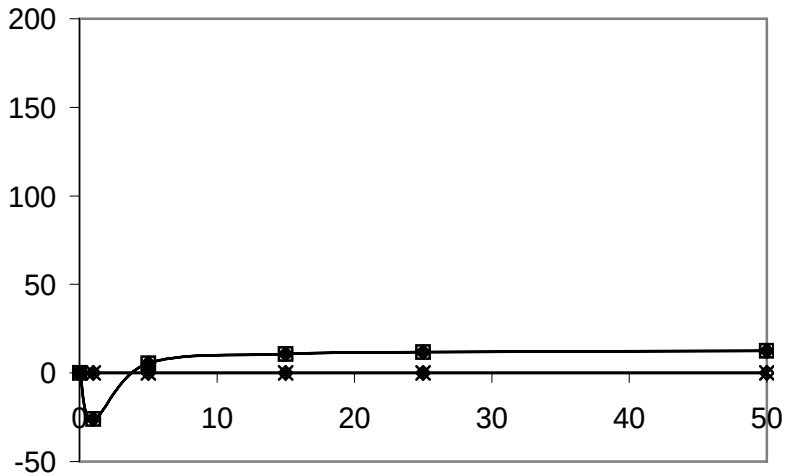
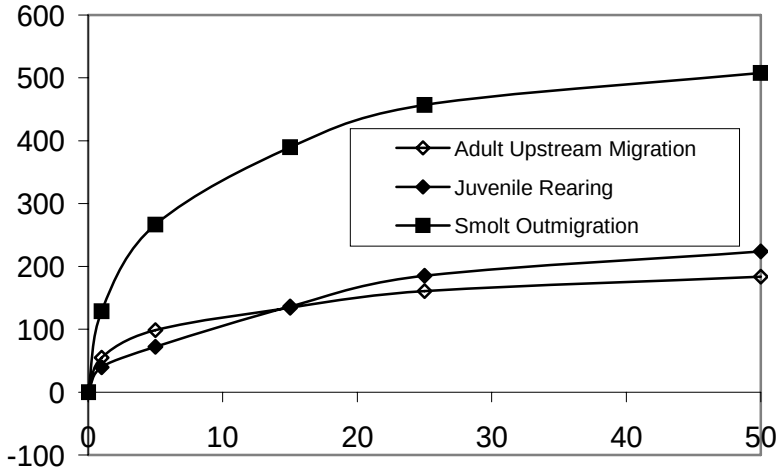
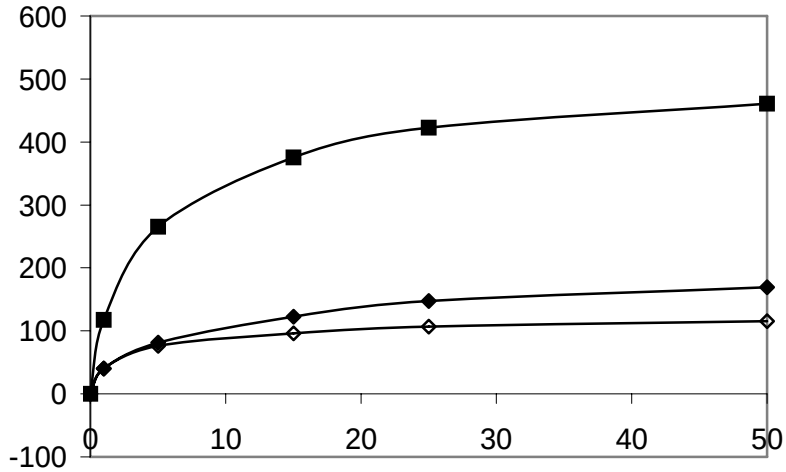


Figure 35. SAM results showing bank-line weighted relative response (feet) for delta smelt at Site Sacramento River RM 77.2L.

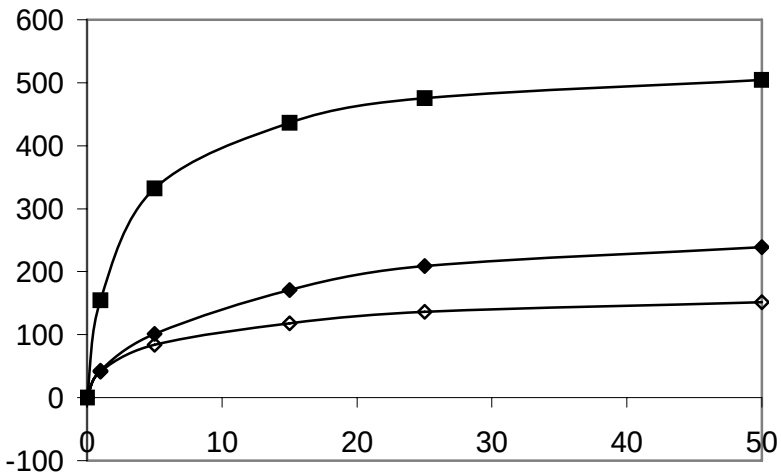
FALL



WINTER



SPRING



SUMMER

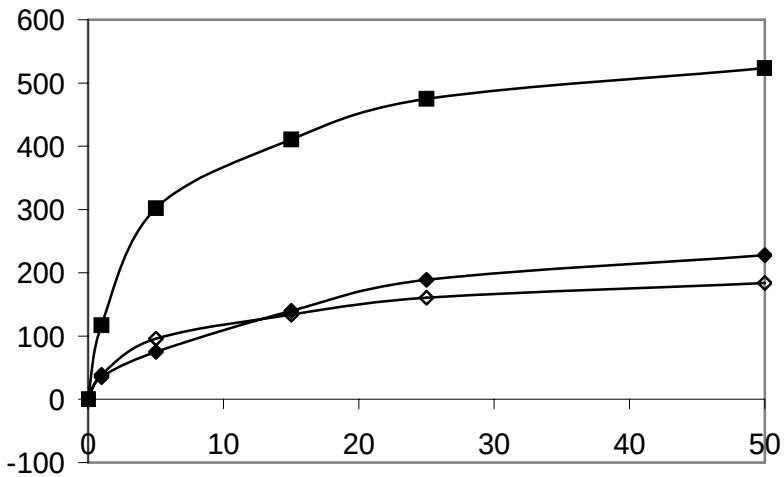
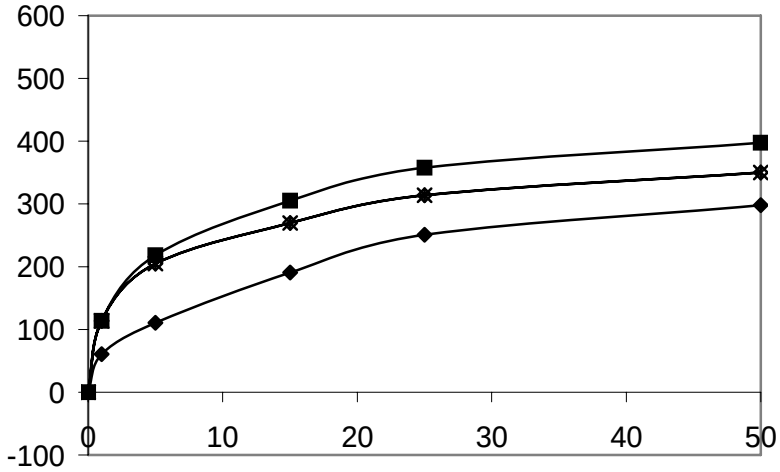
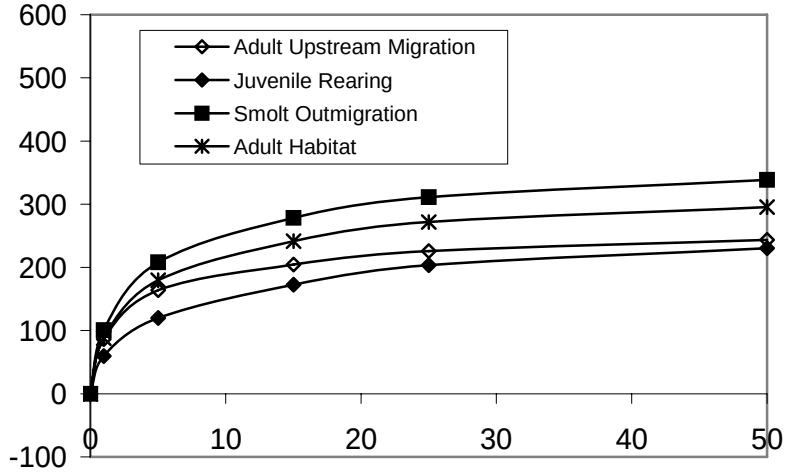


Figure 36. SAM results showing bank-line weighted relative response (feet) for Chinook salmon (Winter-run shown) at Site Feather River RM 28.5R.

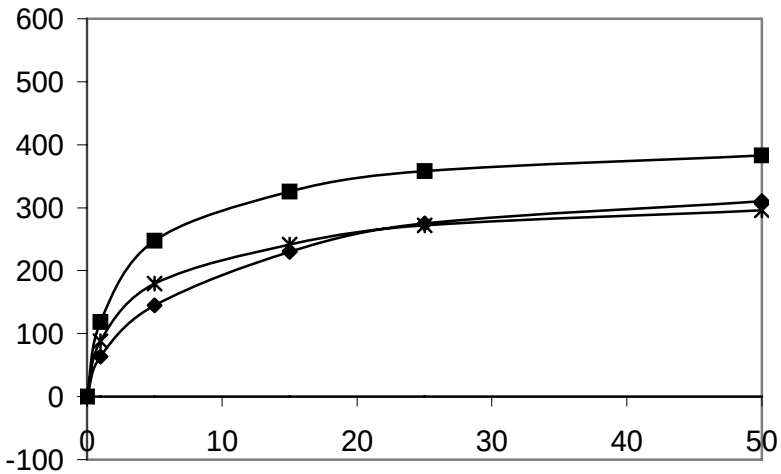
FALL



WINTER



SPRING



SUMMER

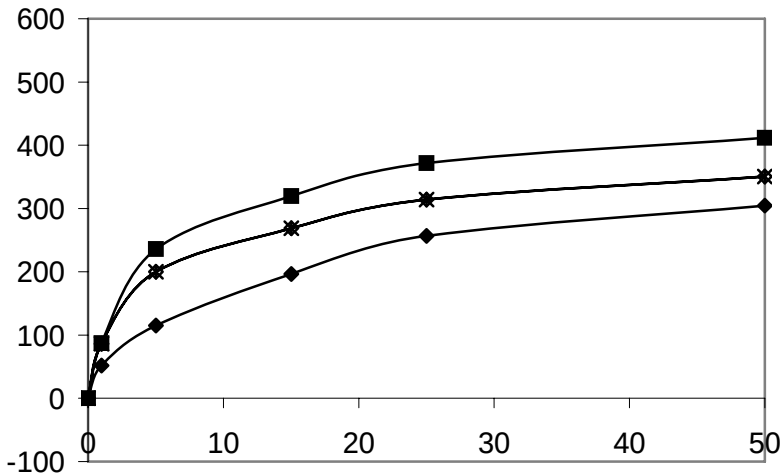
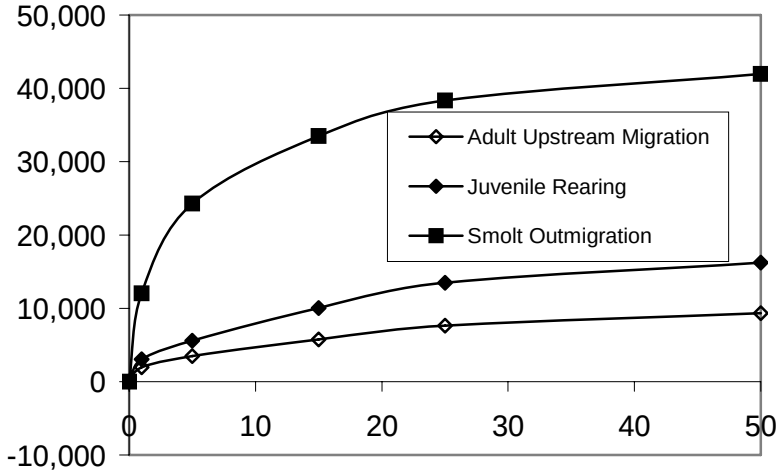
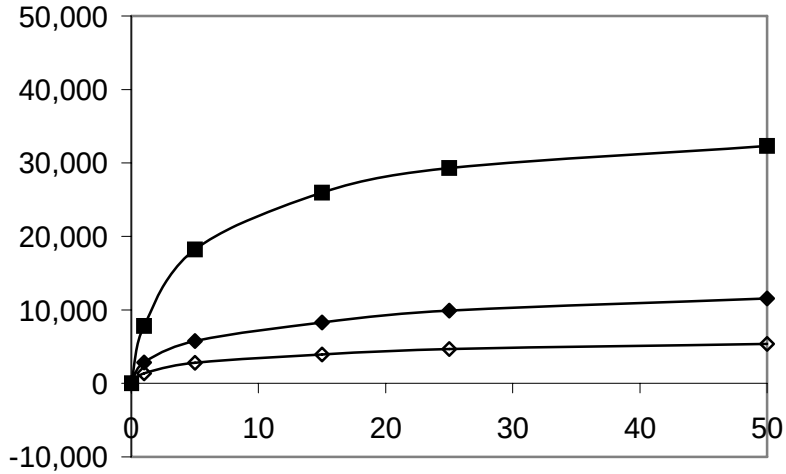


Figure 37. SAM results showing bank-line weighted relative response (feet) for Central Valley steelhead at Site Feather River RM 28.5R.

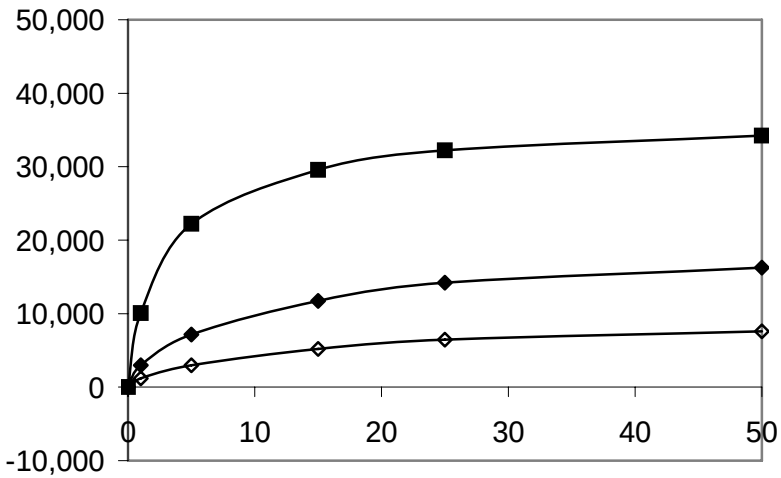
FALL



WINTER



SPRING



SUMMER

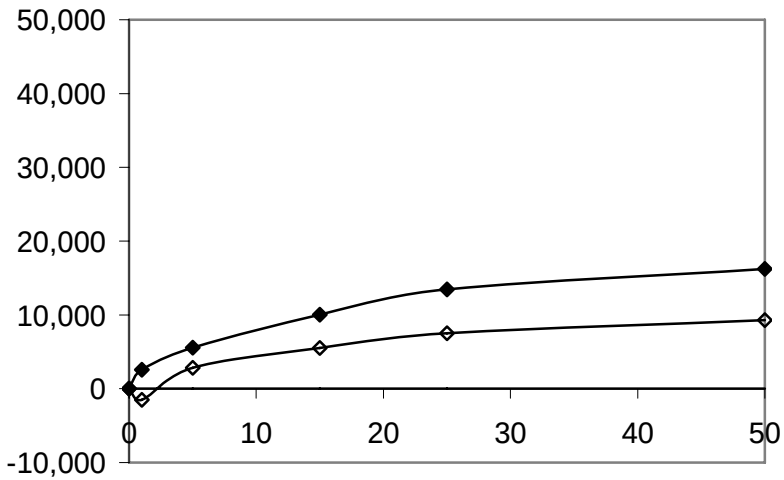
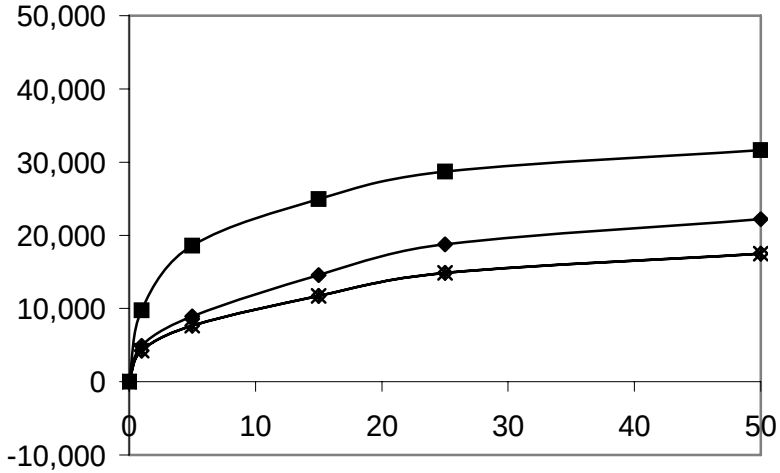
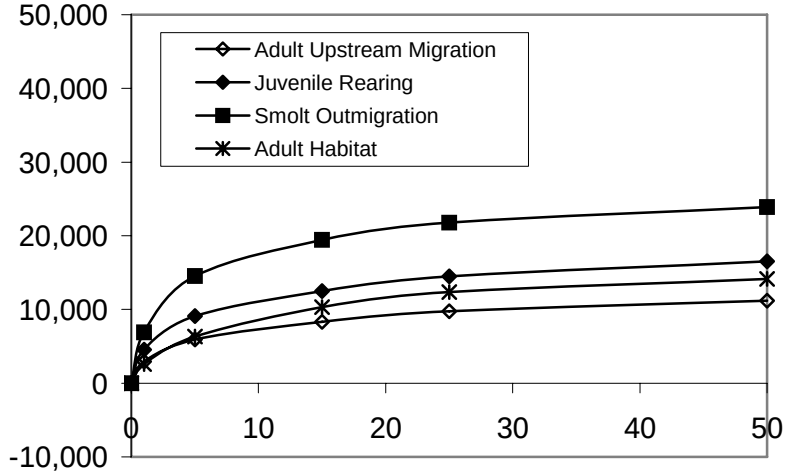


Figure 38. SAM results showing wetted-area weighted relative response (square feet) for Chinook salmon (Winter-run shown) at Site Steamboat Slough RM 16.6R.

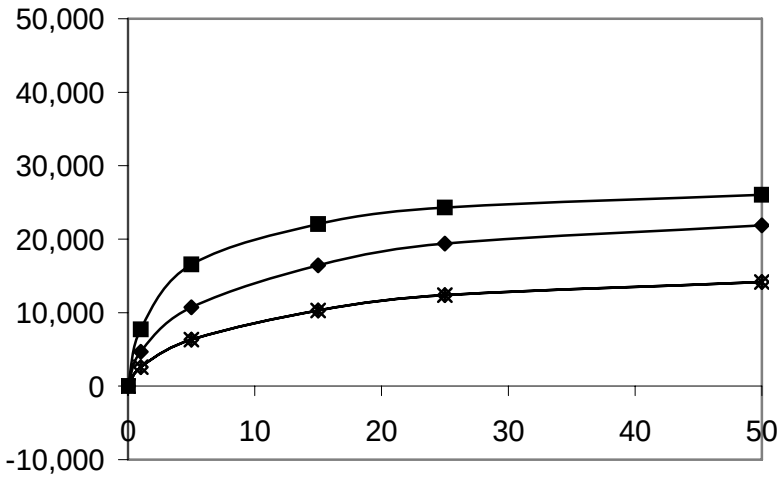
FALL



WINTER



SPRING



SUMMER

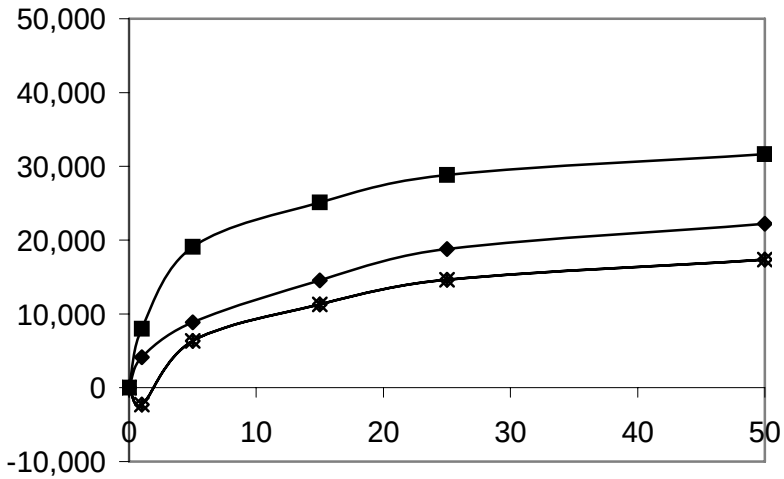


Figure 39. SAM results showing wetted-area weighted relative response (square feet) for Central Valley steelhead at Site Steamboat Slough RM 16.6R.

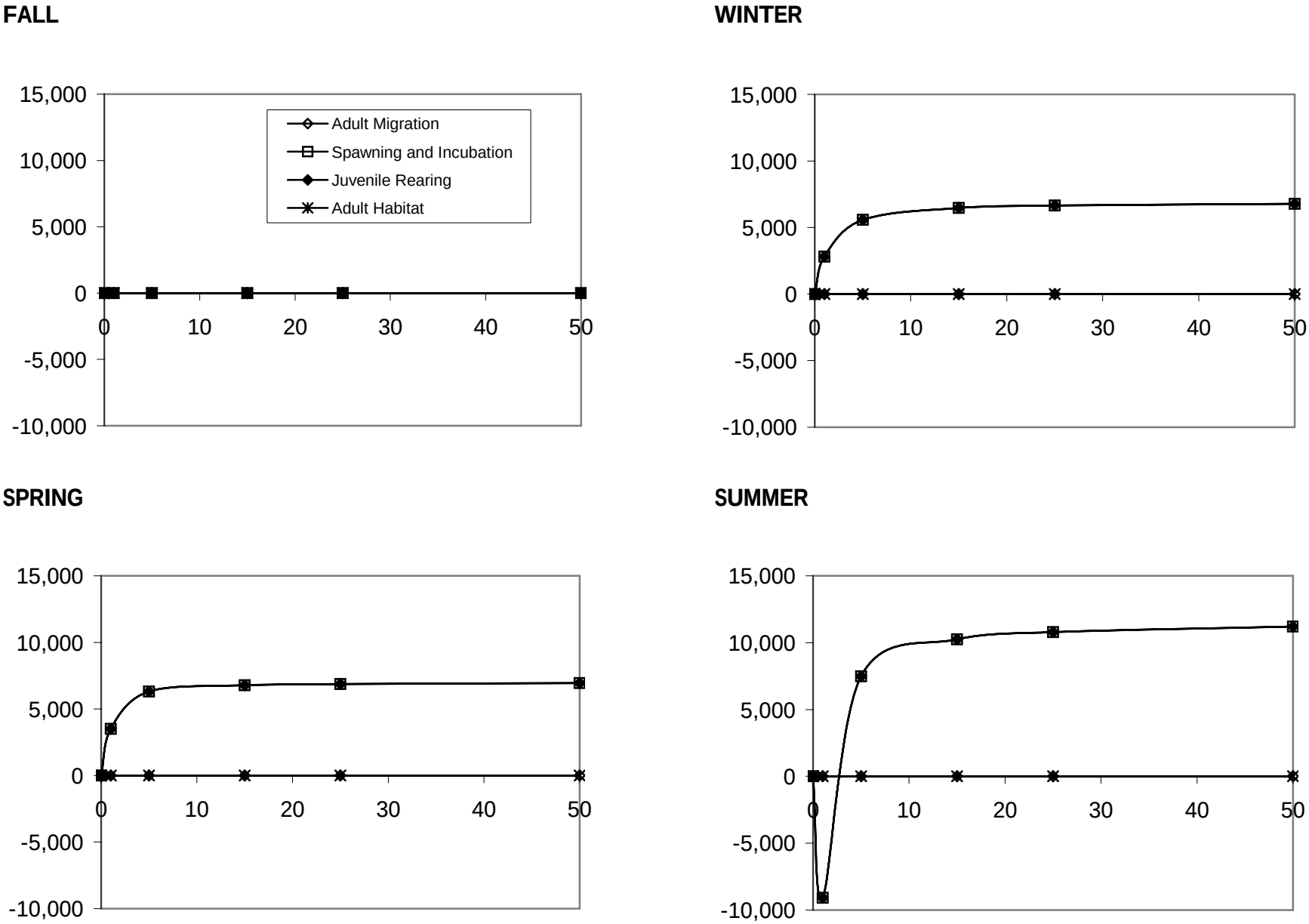
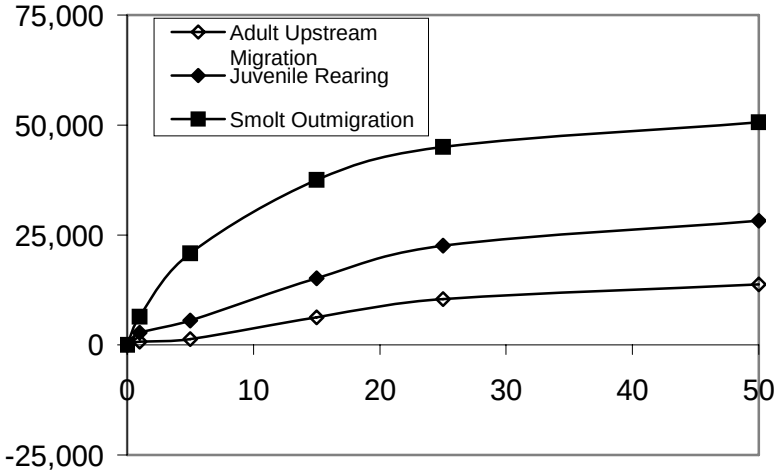
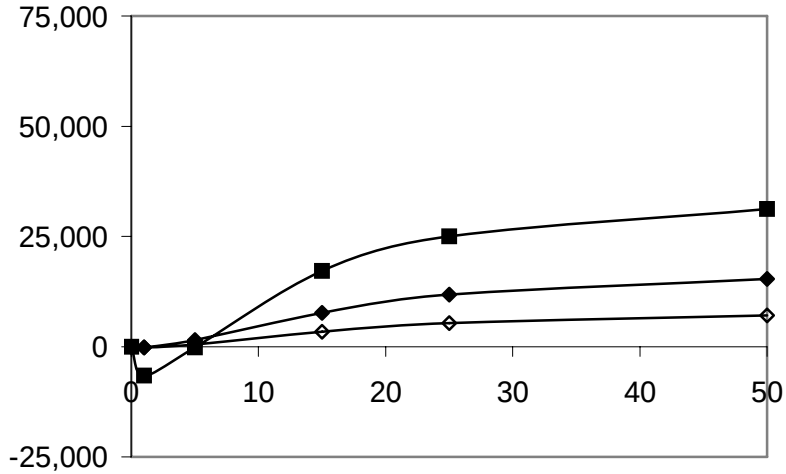


Figure 40. SAM results showing wetted-area weighted relative response (square feet) for delta smelt at Site Steamboat Slough RM 16.6R.

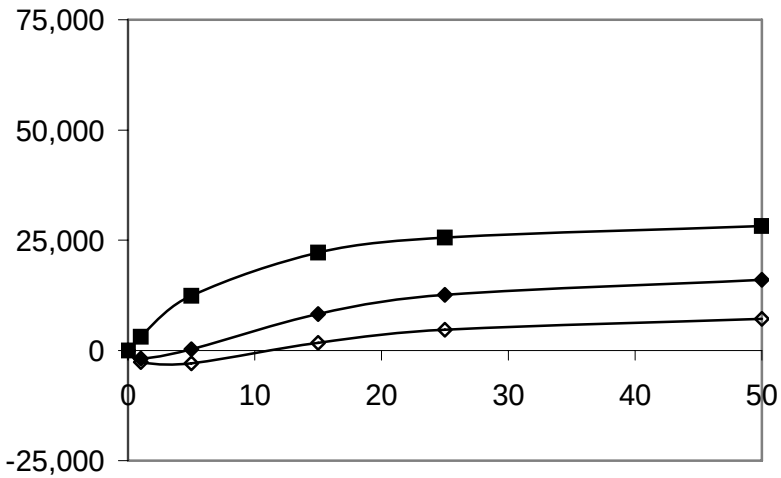
FALL



WINTER



SPRING



SUMMER

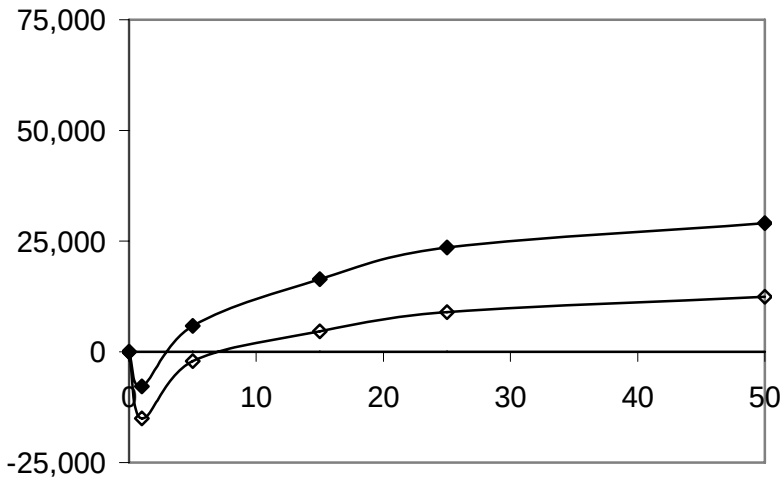


Figure 41. SAM results showing wetted-area weighted relative response (square feet) for Chinook salmon (Winter-run shown) at Site Cache Slough RM 21.8R.

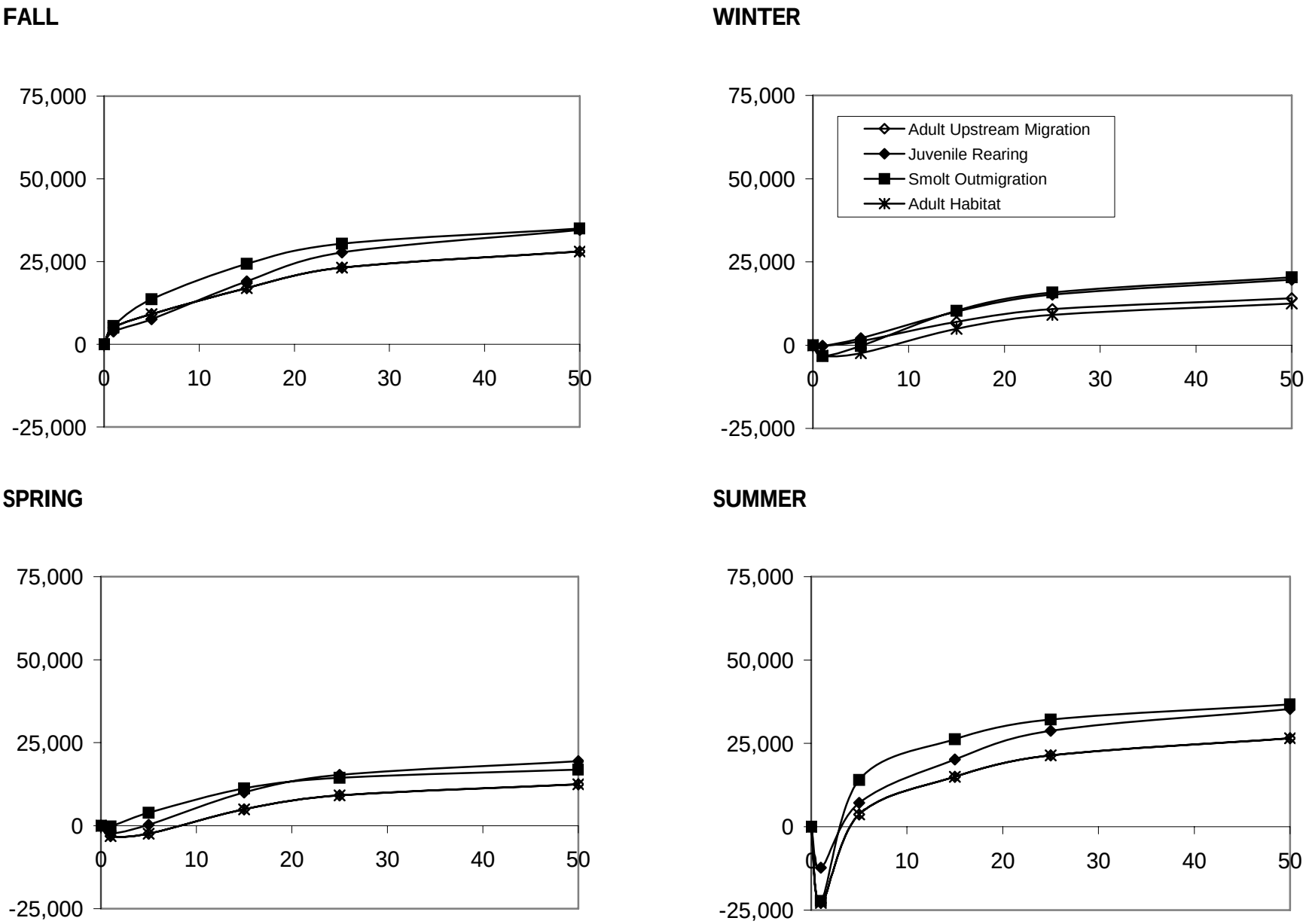
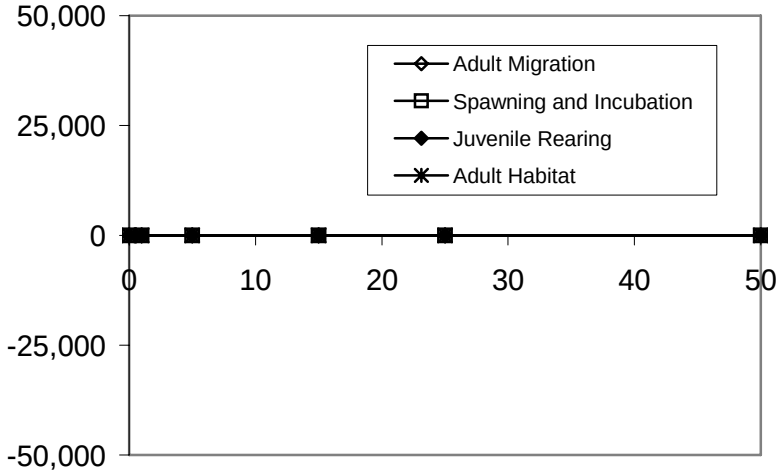
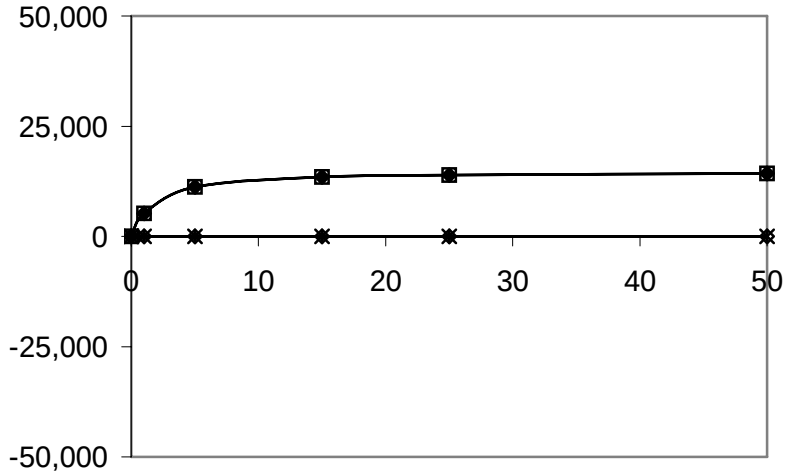


Figure 42. SAM results showing wetted-area weighted relative response (square feet) for Central Valley steelhead at Site Cache Slough RM 21.8R.

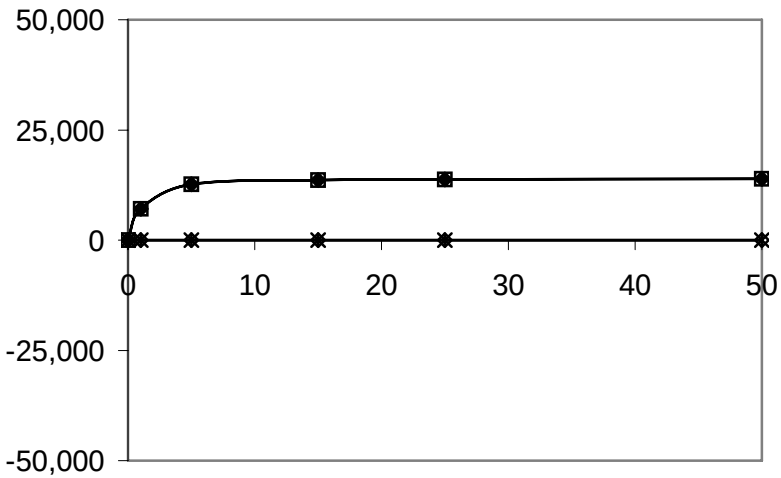
FALL



WINTER



SPRING



SUMMER

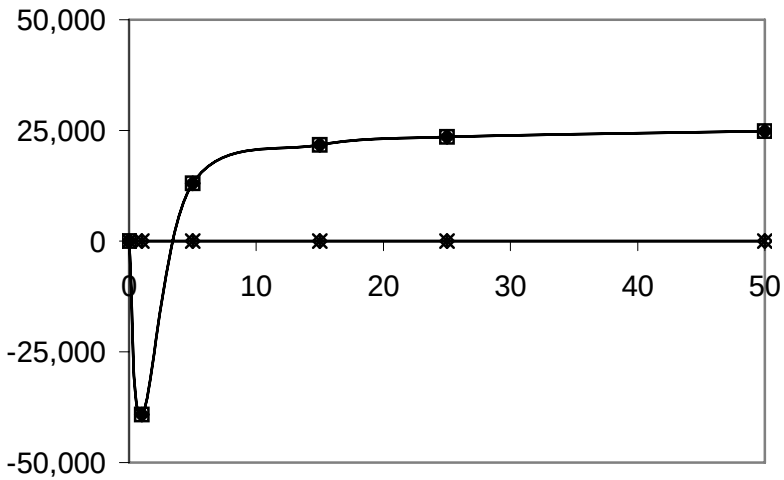
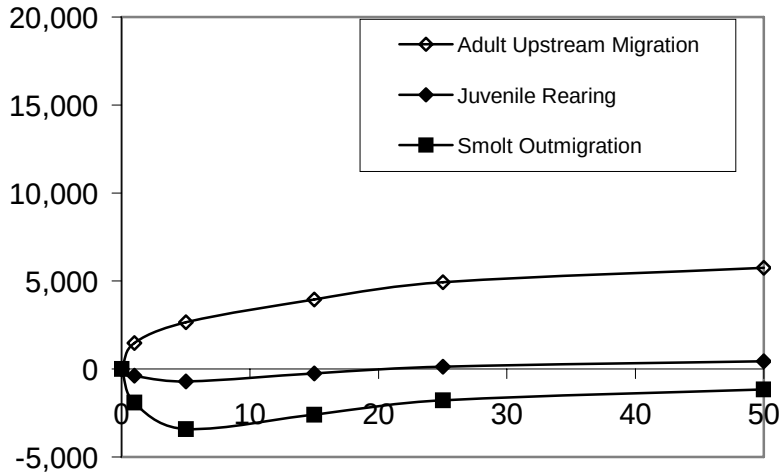
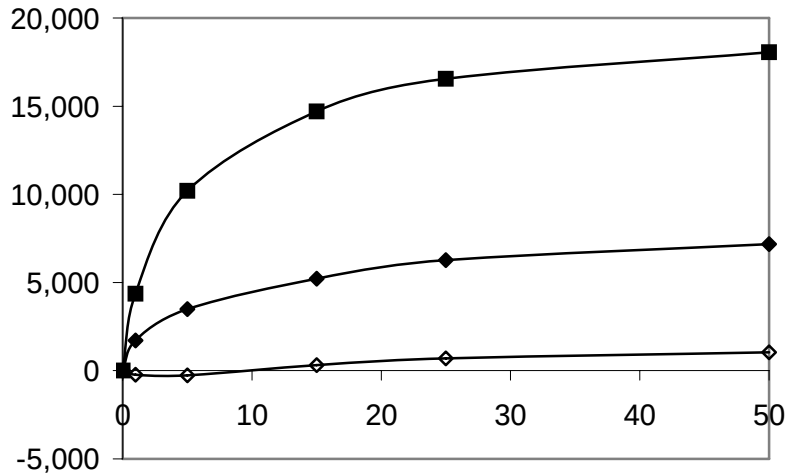


Figure 43. SAM results showing wetted-area weighted relative response (square feet) for delta smelt at Site Cache Slough RM 21.8R.

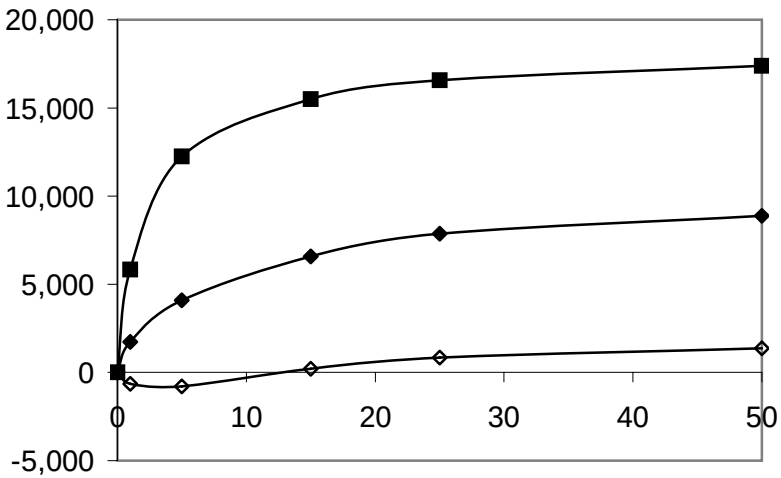
FALL



WINTER



SPRING



SUMMER

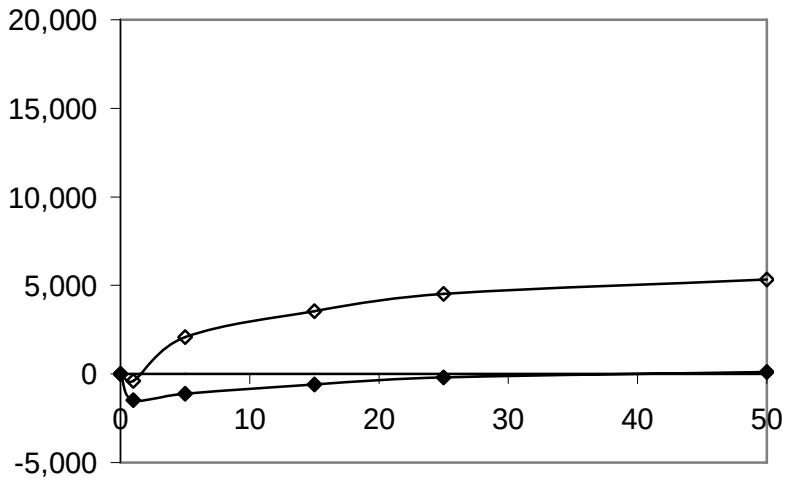
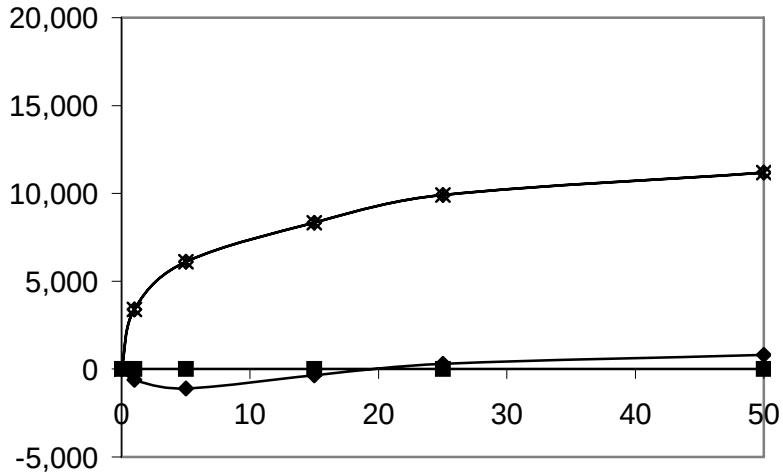
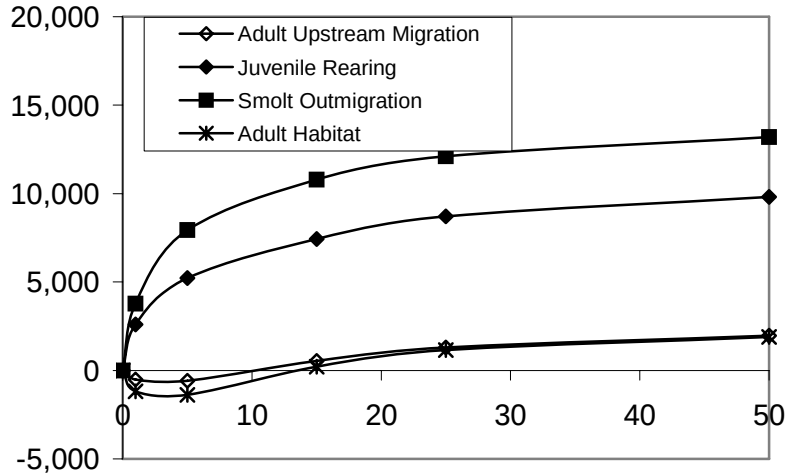


Figure 44. SAM results showing wetted-area weighted relative response (square feet) for Chinook salmon (Winter-run shown) at Site Sacramento River RM 49.7L.

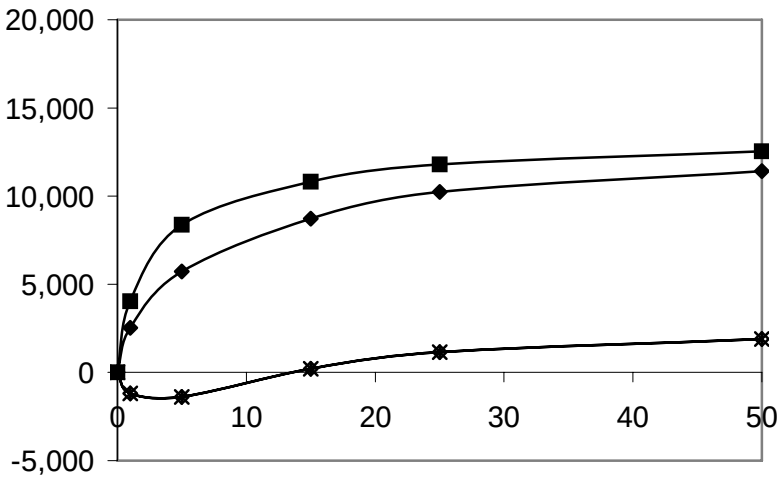
FALL



WINTER



SPRING



SUMMER

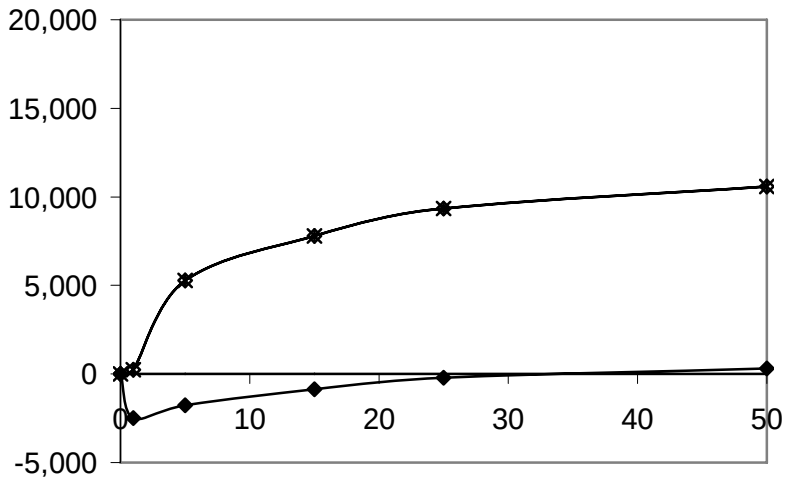
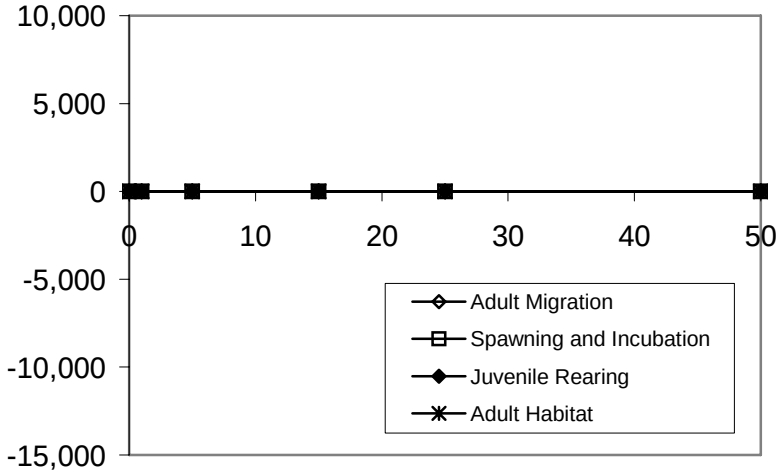
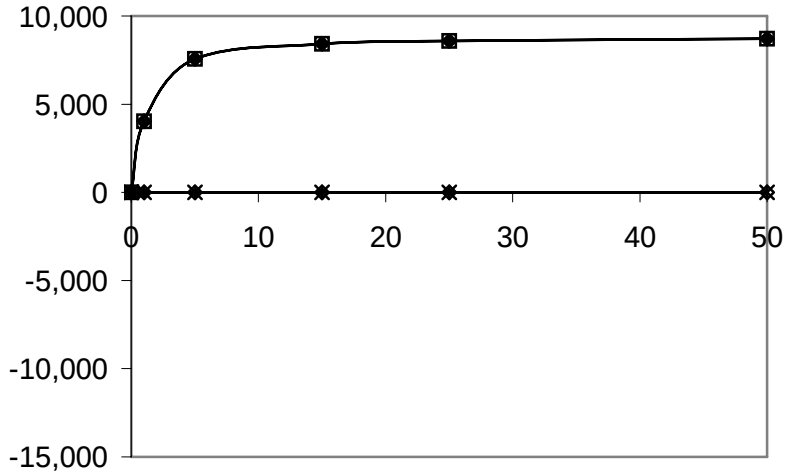


Figure 45. SAM results showing wetted-area weighted relative response (square feet) for Central Valley steelhead at Site Sacramento River RM 49.7L.

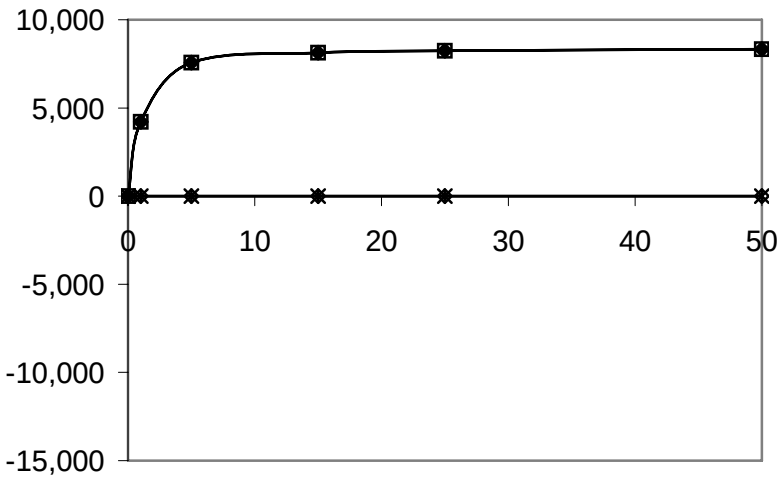
FALL



WINTER



SPRING



SUMMER

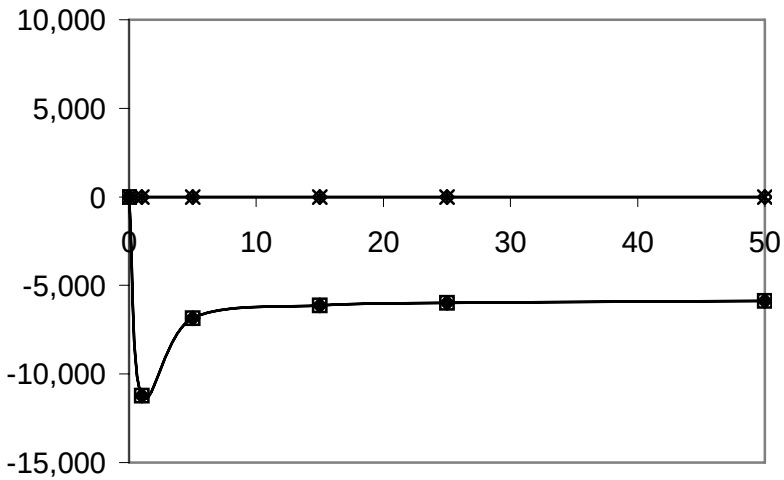
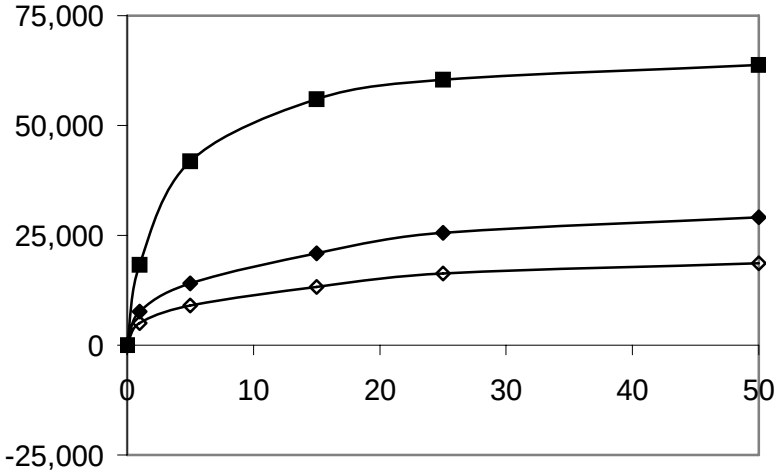
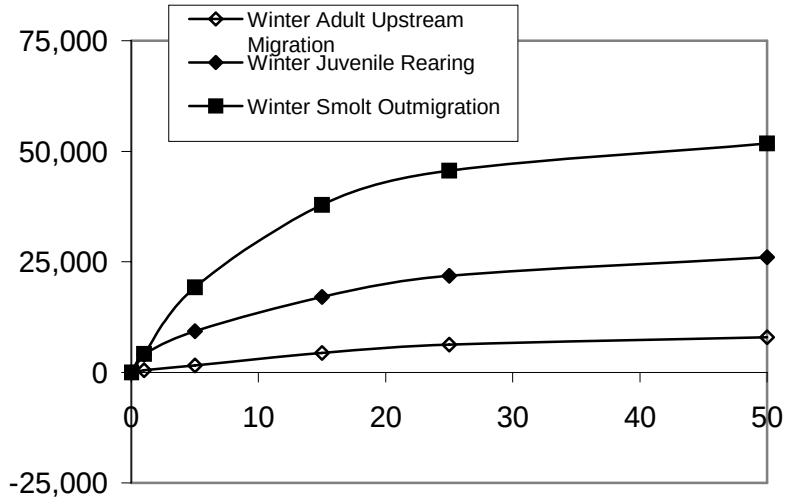


Figure 46. SAM results showing wetted-area weighted relative response (square feet) for delta smelt at Site Sacramento River RM 49.7L.

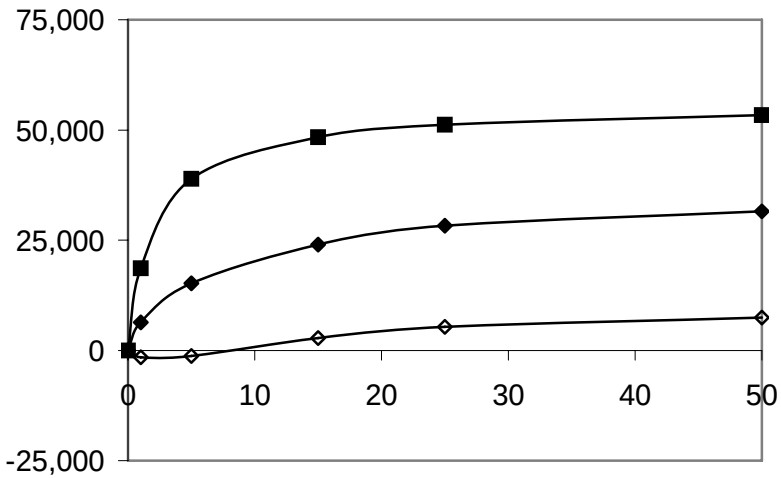
FALL



WINTER



SPRING



SUMMER

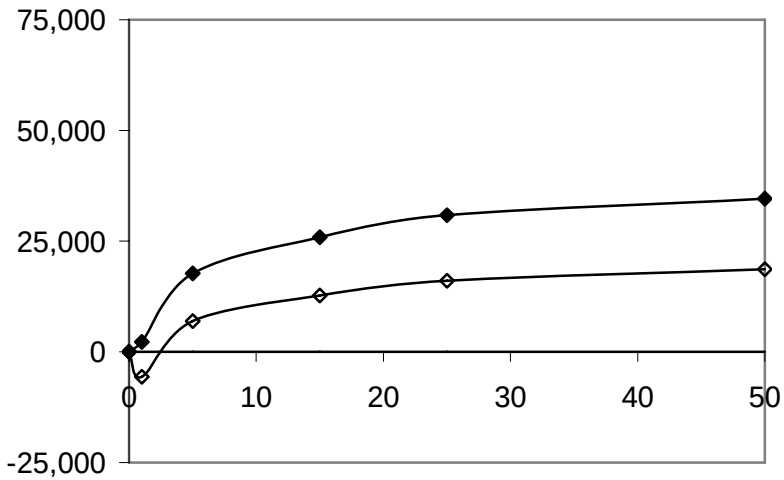
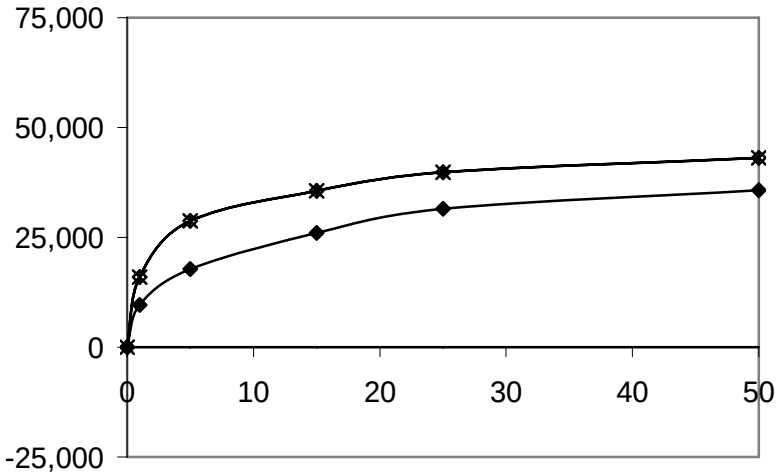
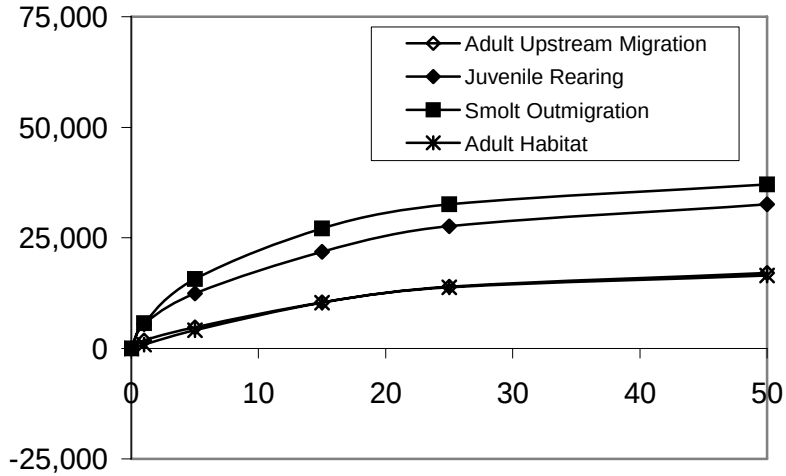


Figure 47. SAM results showing wetted-area weighted relative response (square feet) for Chinook salmon (Winter-run shown) at Site Sacramento River RM 52.3L.

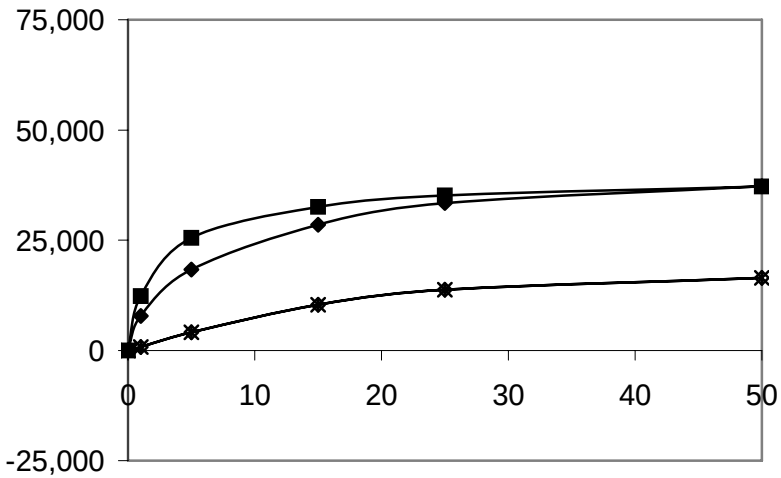
FALL



WINTER



SPRING



SUMMER

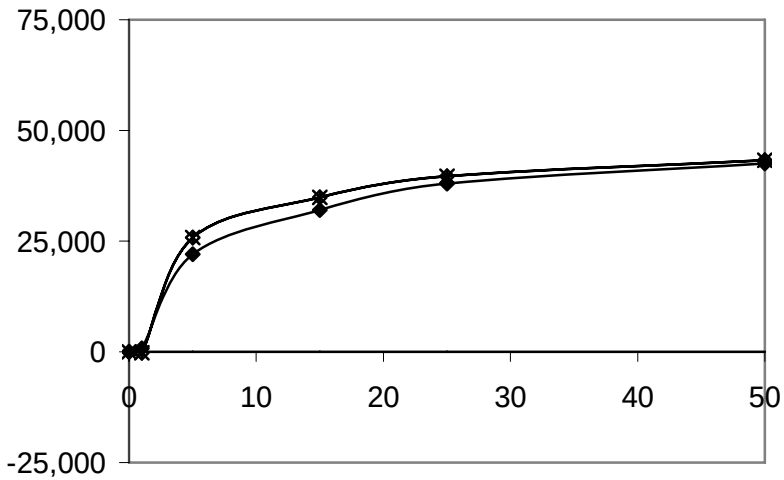
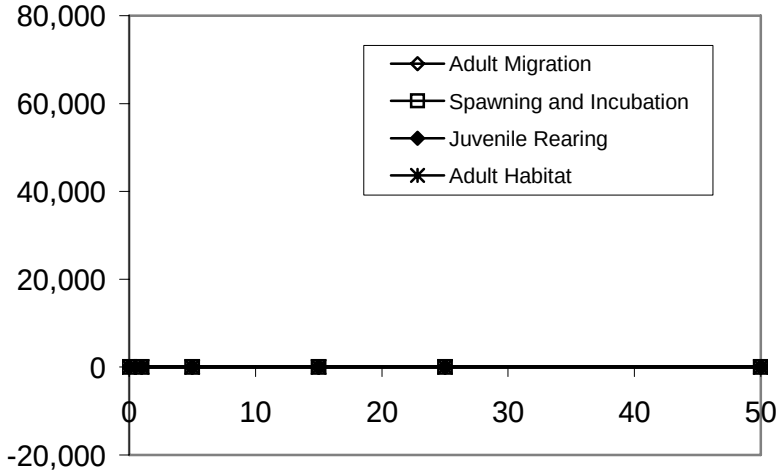
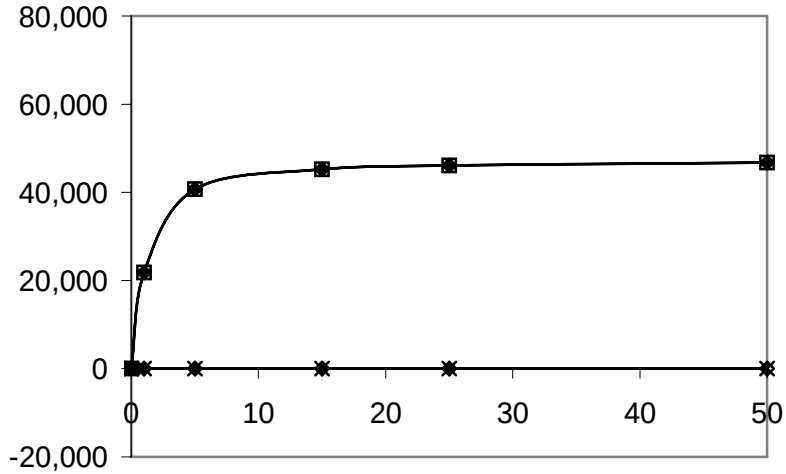


Figure 48. SAM results showing wetted-area weighted relative response (square feet) for Central Valley steelhead at Site Sacramento River RM 52.3L.

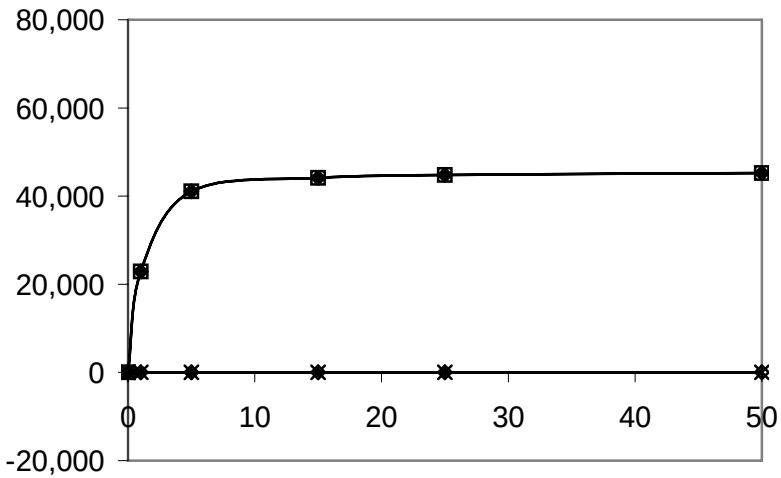
FALL



WINTER



SPRING



SUMMER

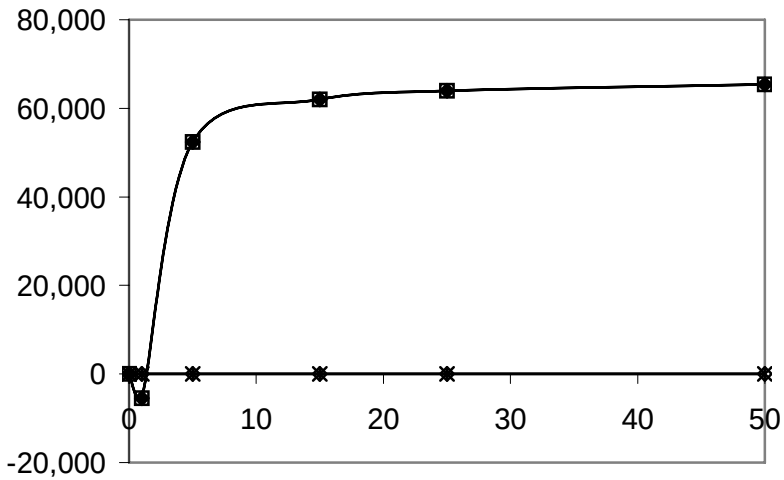
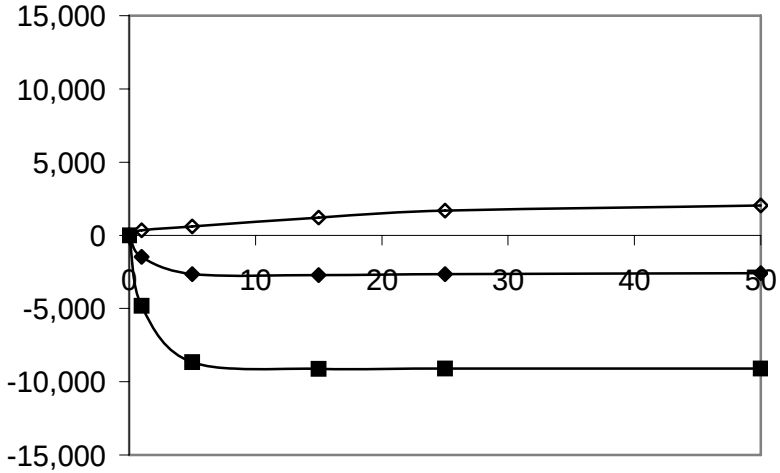
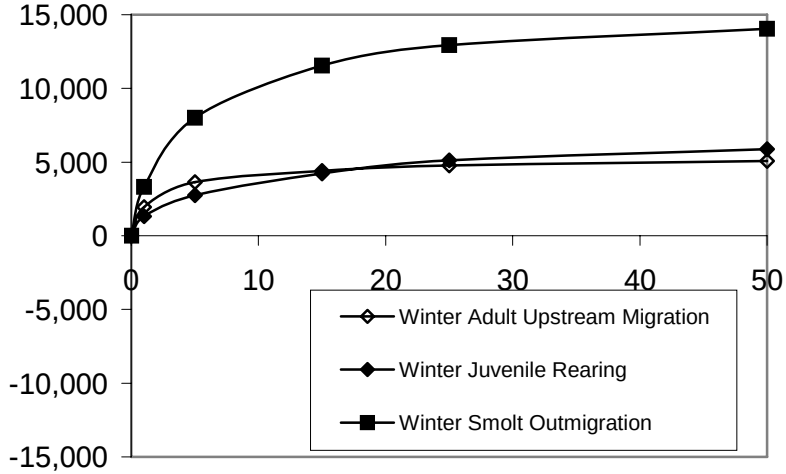


Figure 49. SAM results showing wetted-area weighted relative response (square feet) for delta smelt at Site Sacramento River RM 52.3L.

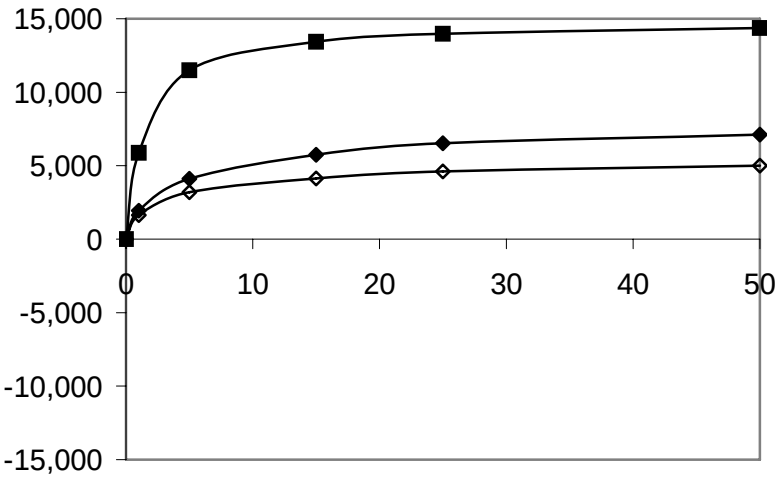
FALL



WINTER



SPRING



SUMMER

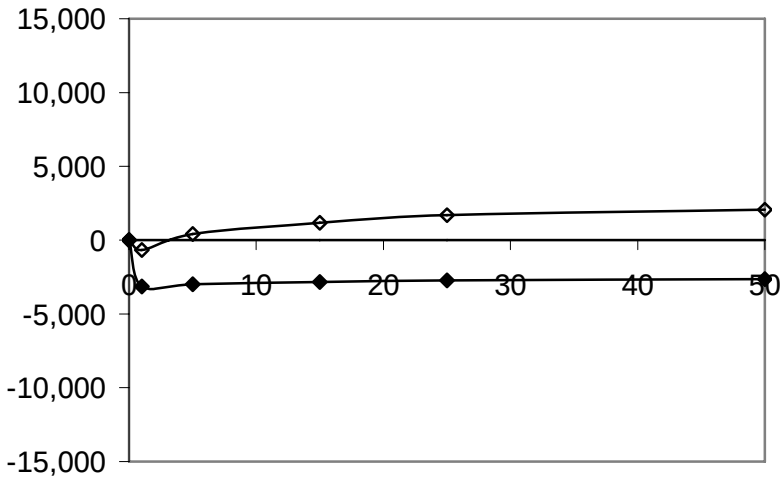
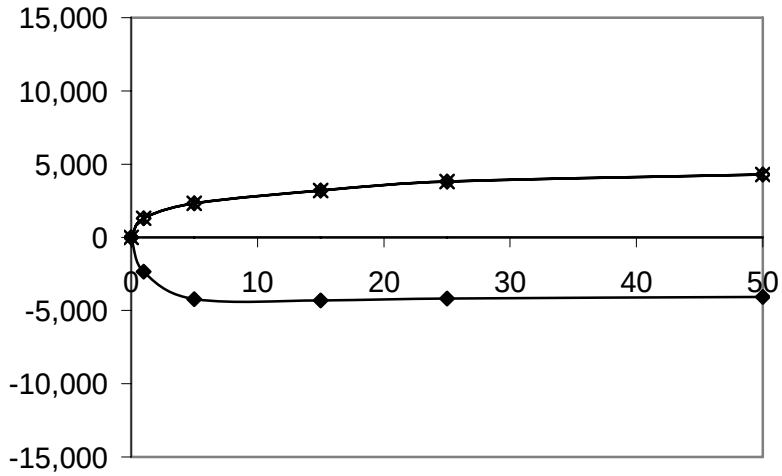
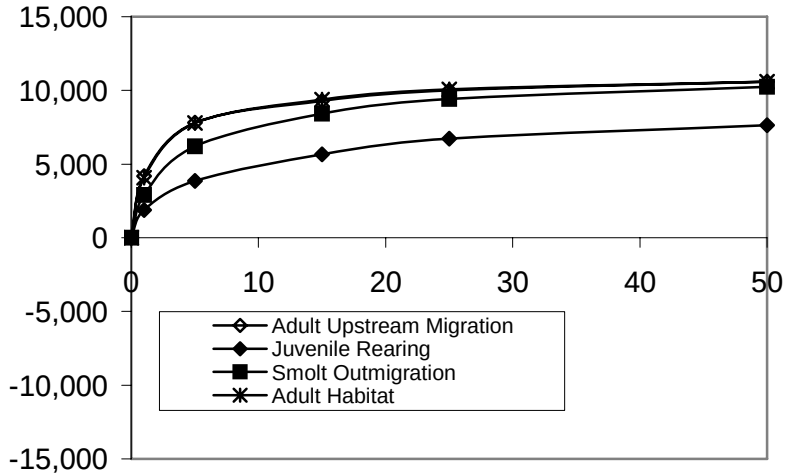


Figure 50. SAM results showing wetted-area weighted relative response (square feet) for Chinook salmon (Winter-run shown) at Site Lower American River RM 0.3L.

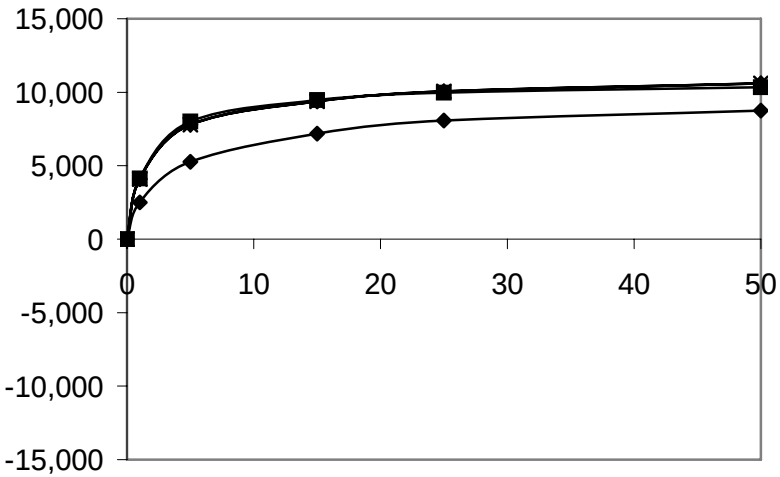
FALL



WINTER



SPRING



SUMMER

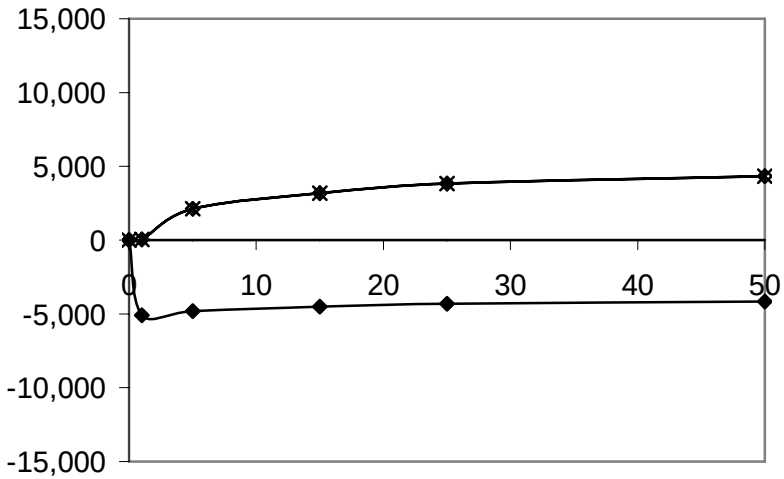


Figure 51. SAM results showing wetted-area weighted relative response (square feet) for Central Valley steelhead at Site Lower American River RM 0.3L.

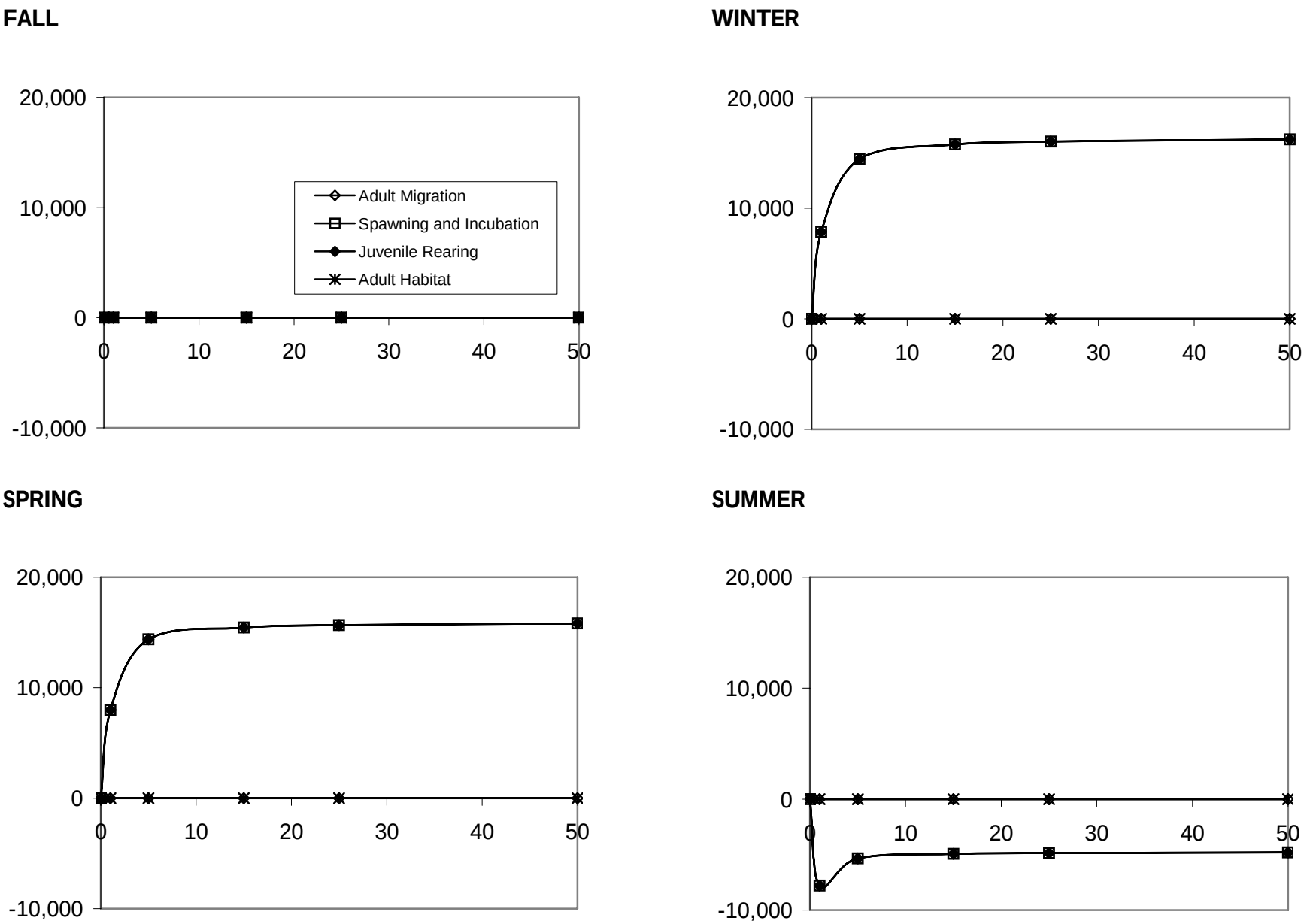
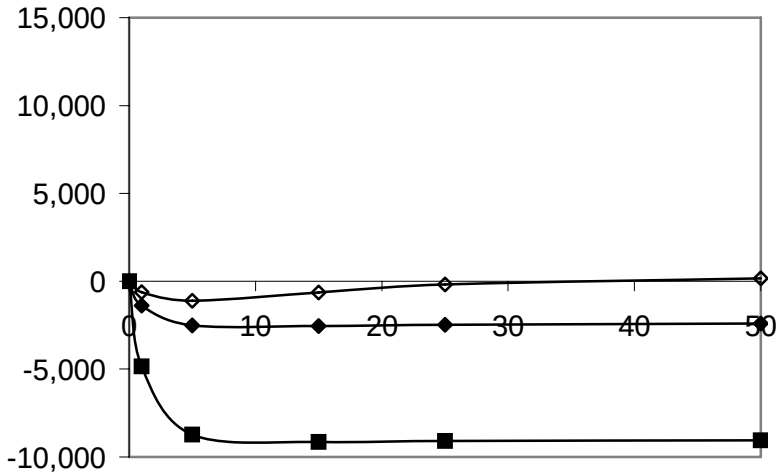
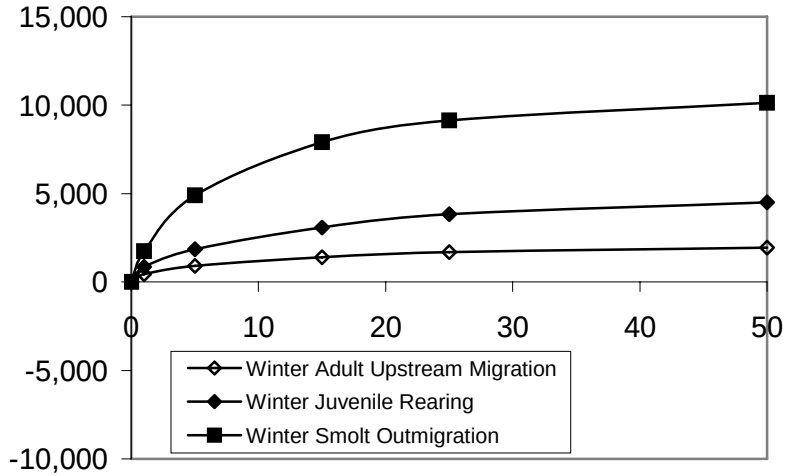


Figure 52. SAM results showing wetted-area weighted relative response (square feet) for delta smelt at Site Lower American River RM 0.3L.

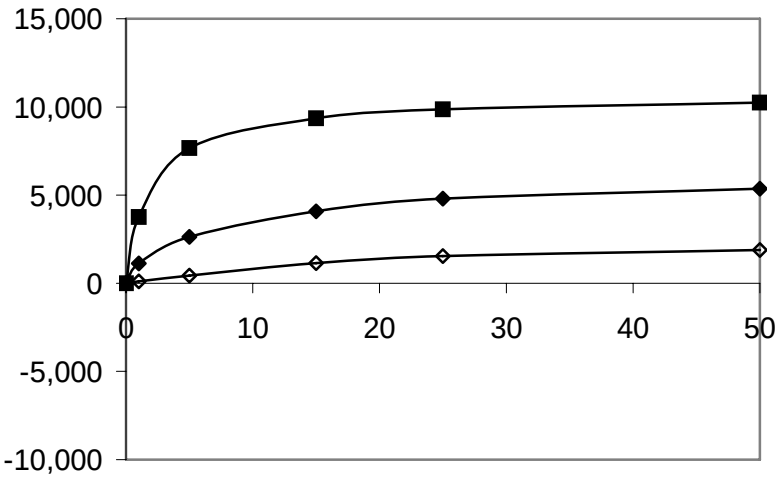
FALL



WINTER



SPRING



SUMMER

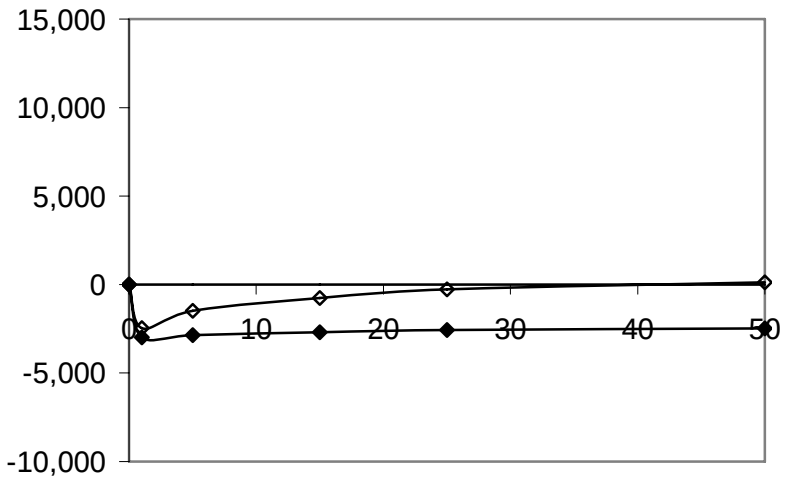
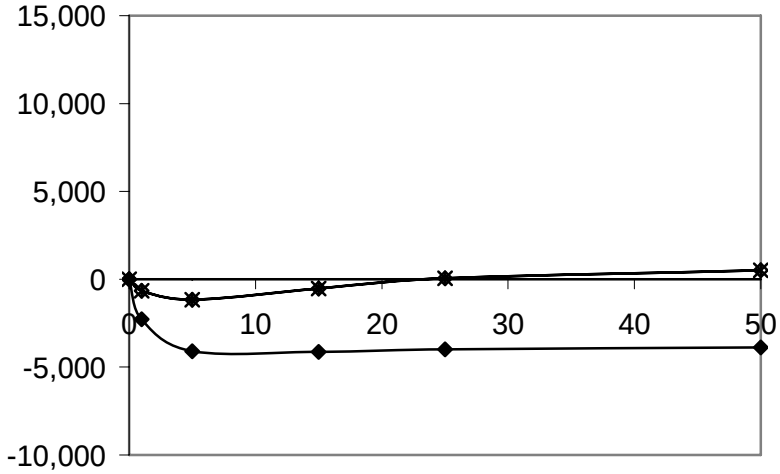
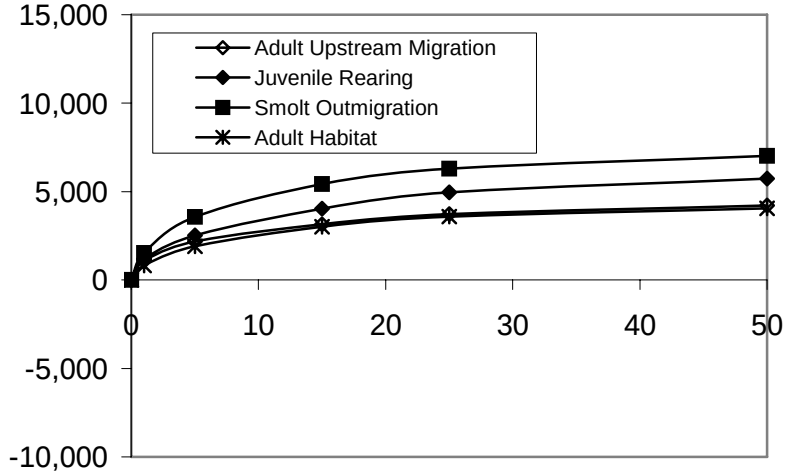


Figure 53. SAM results showing wetted-area weighted relative response (square feet) for Chinook salmon (Winter-run shown) at Site Lower American River RM 2.8L.

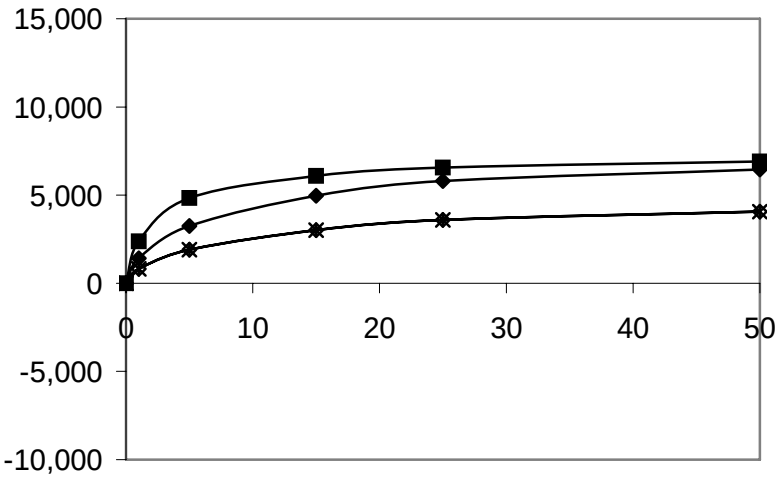
FALL



WINTER



SPRING



SUMMER

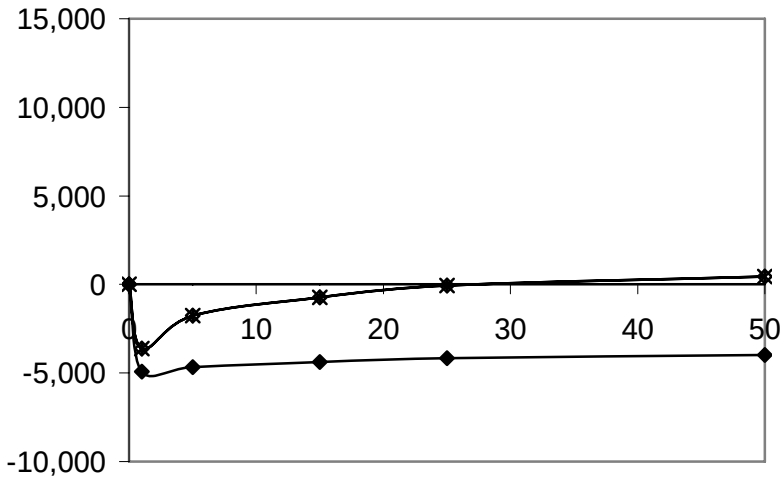
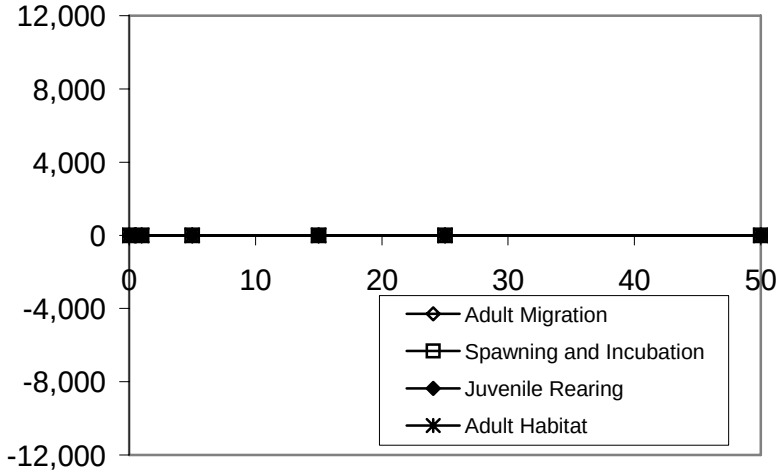
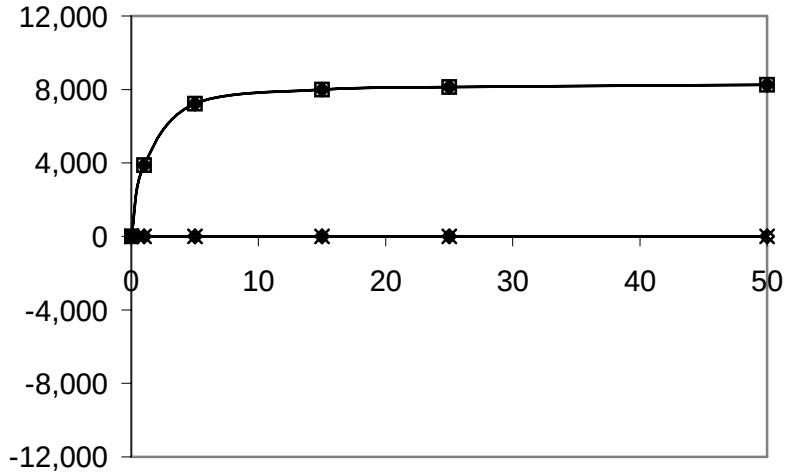


Figure 54. SAM results showing wetted-area weighted relative response (square feet) for Central Valley steelhead at Site Lower American River RM 2.8L.

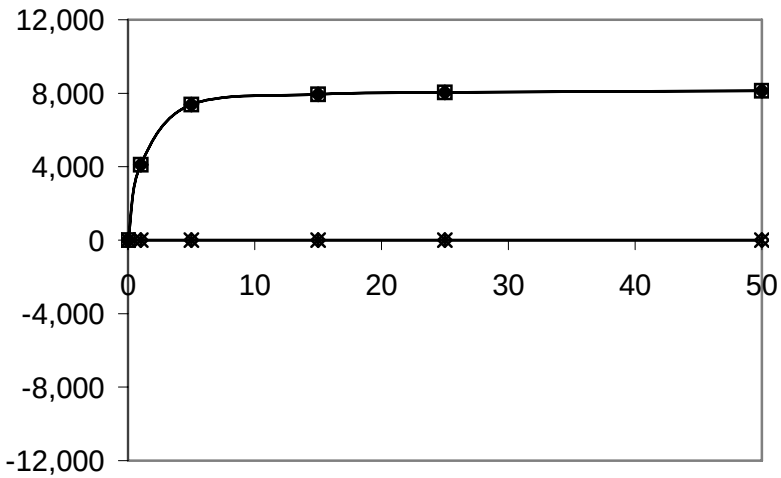
FALL



WINTER



SPRING



SUMMER

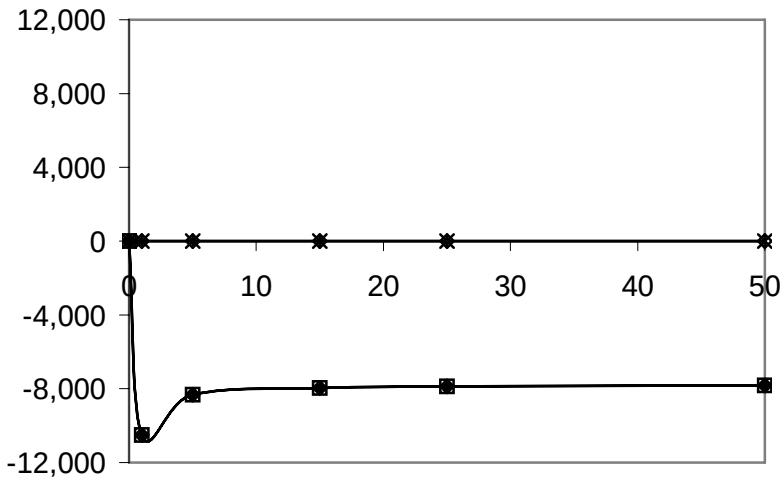
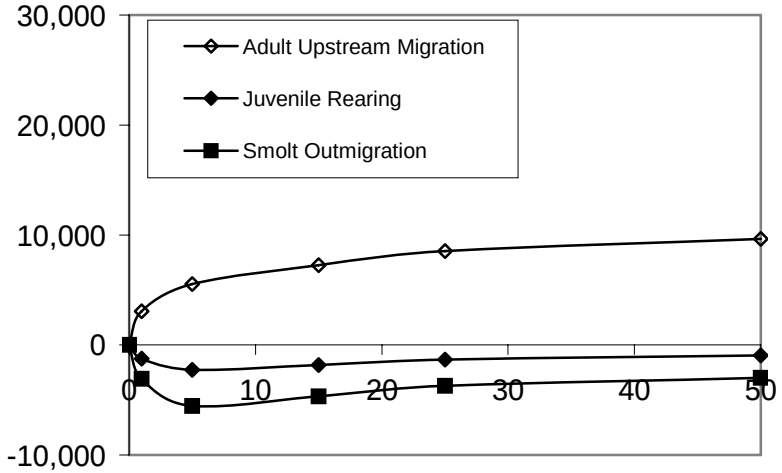
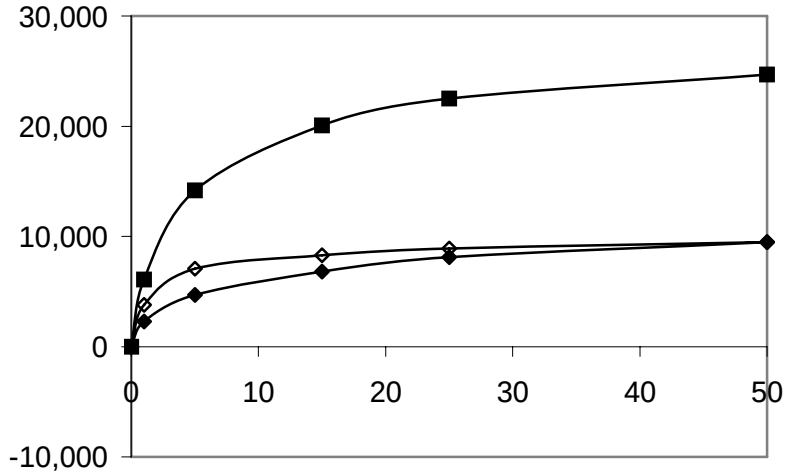


Figure 55. SAM results showing wetted-area weighted relative response (square feet) for delta smelt at Site Lower American River RM 2.8L.

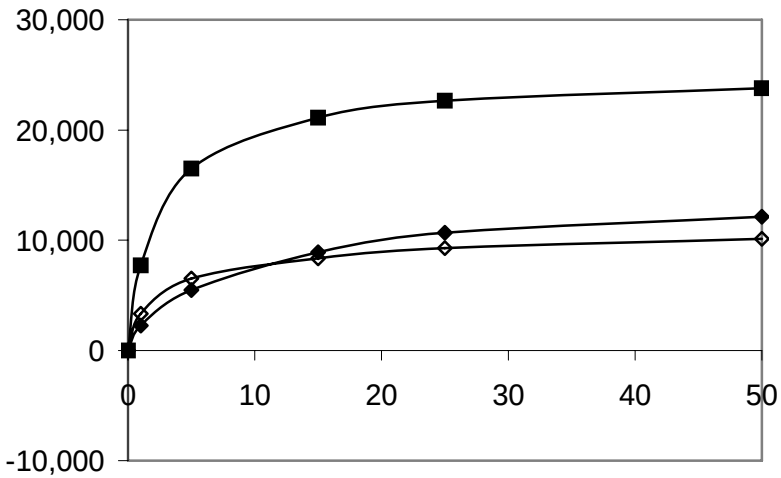
FALL



WINTER



SPRING



SUMMER

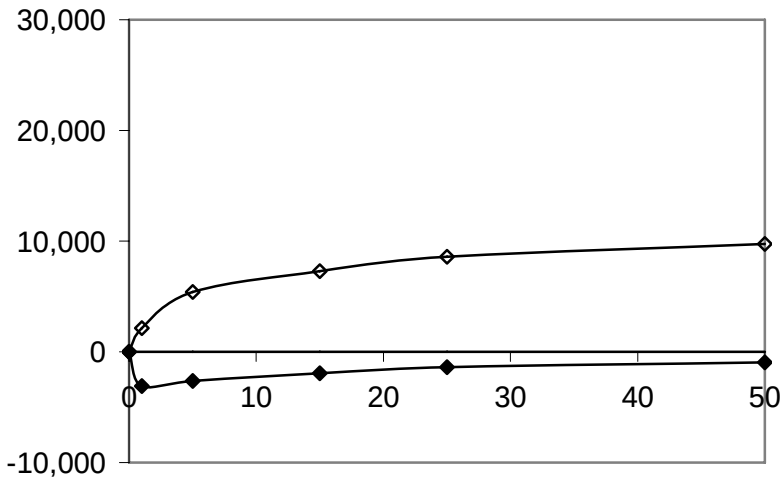


Figure 56. SAM results showing wetted-area weighted relative response (square feet) for Chinook salmon (Winter-run shown) at Site Sacramento River RM 53.5R.

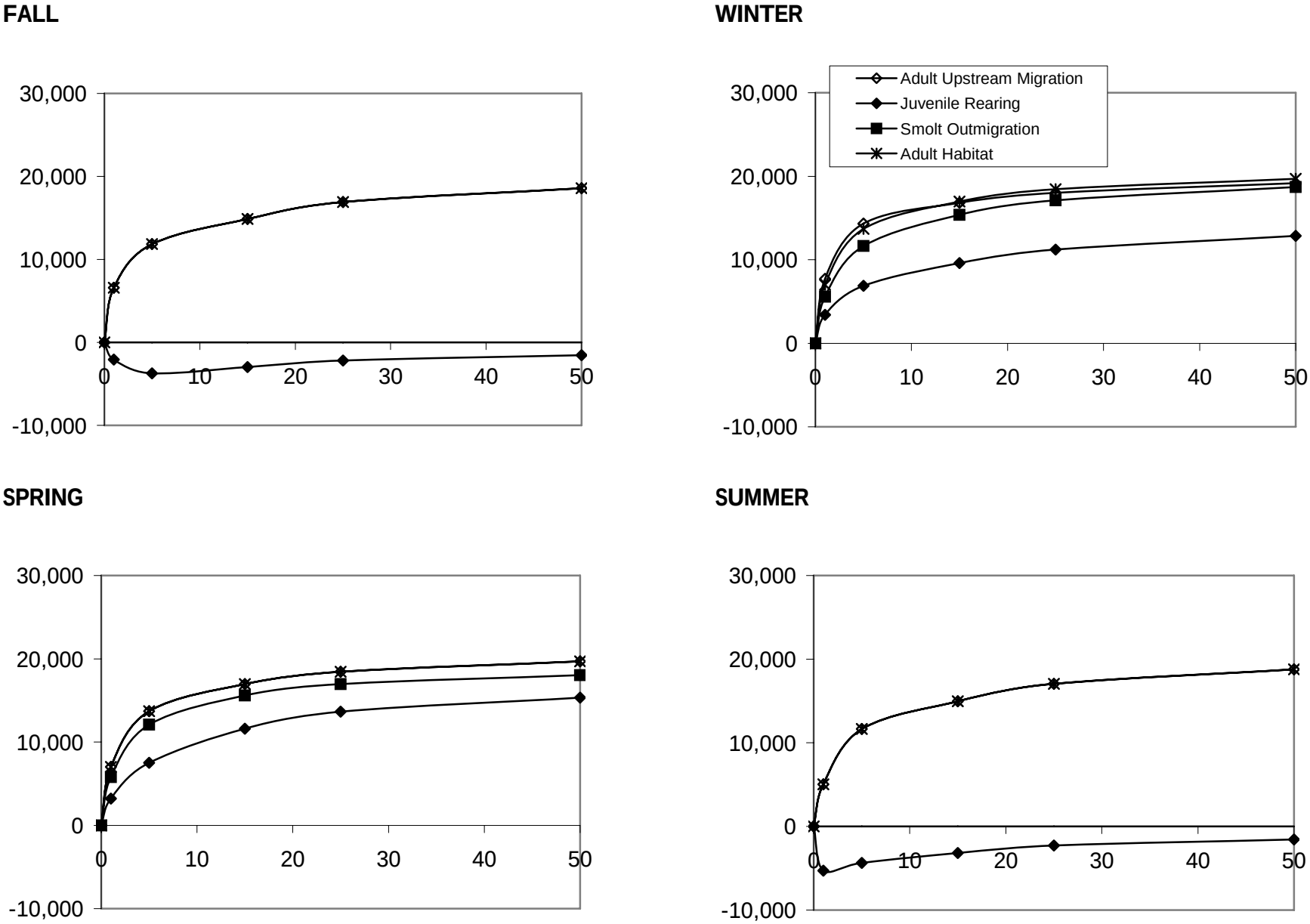
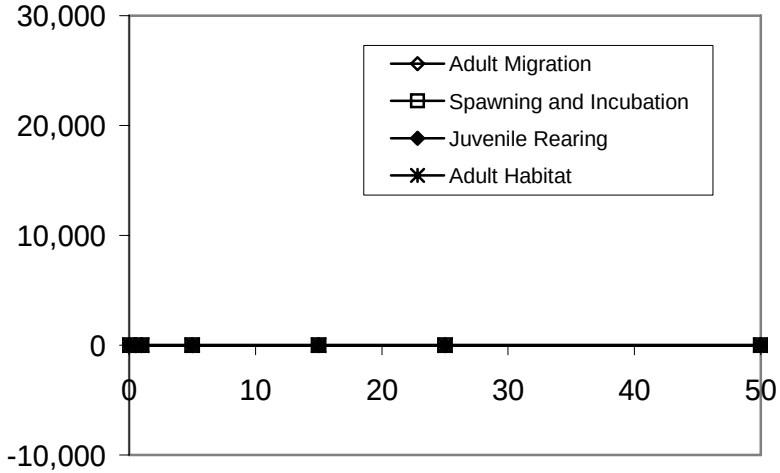
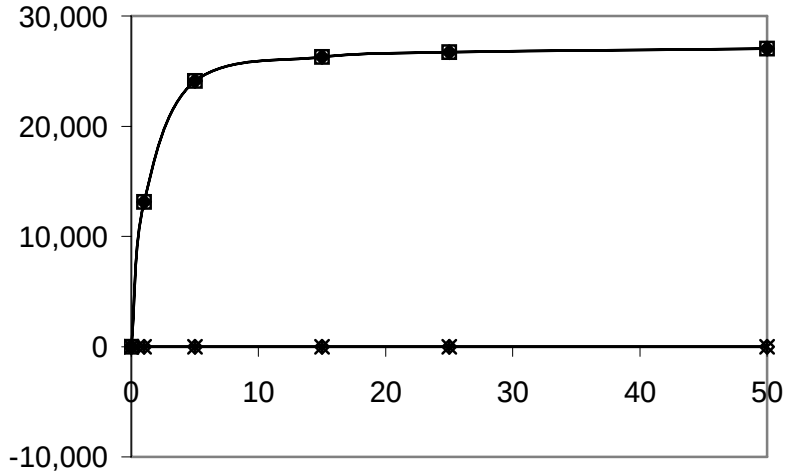


Figure 57. SAM results showing wetted-area weighted relative response (square feet) for Central Valley steelhead at Site Sacramento River RM 53.5R.

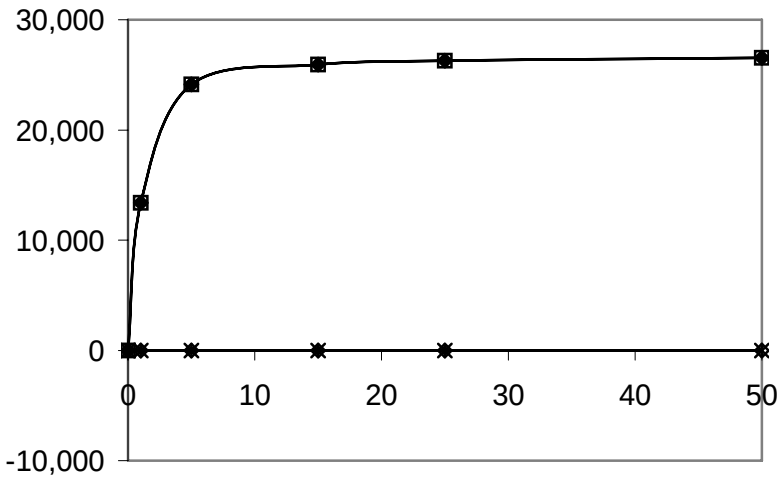
FALL



WINTER



SPRING



SUMMER

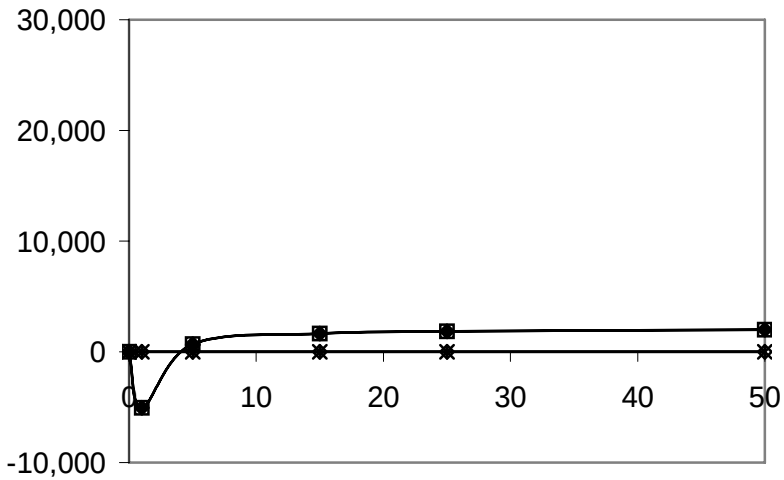


Figure 58. SAM results showing wetted-area weighted relative response (square feet) for delta smelt at Site Sacramento River RM 53.5R.

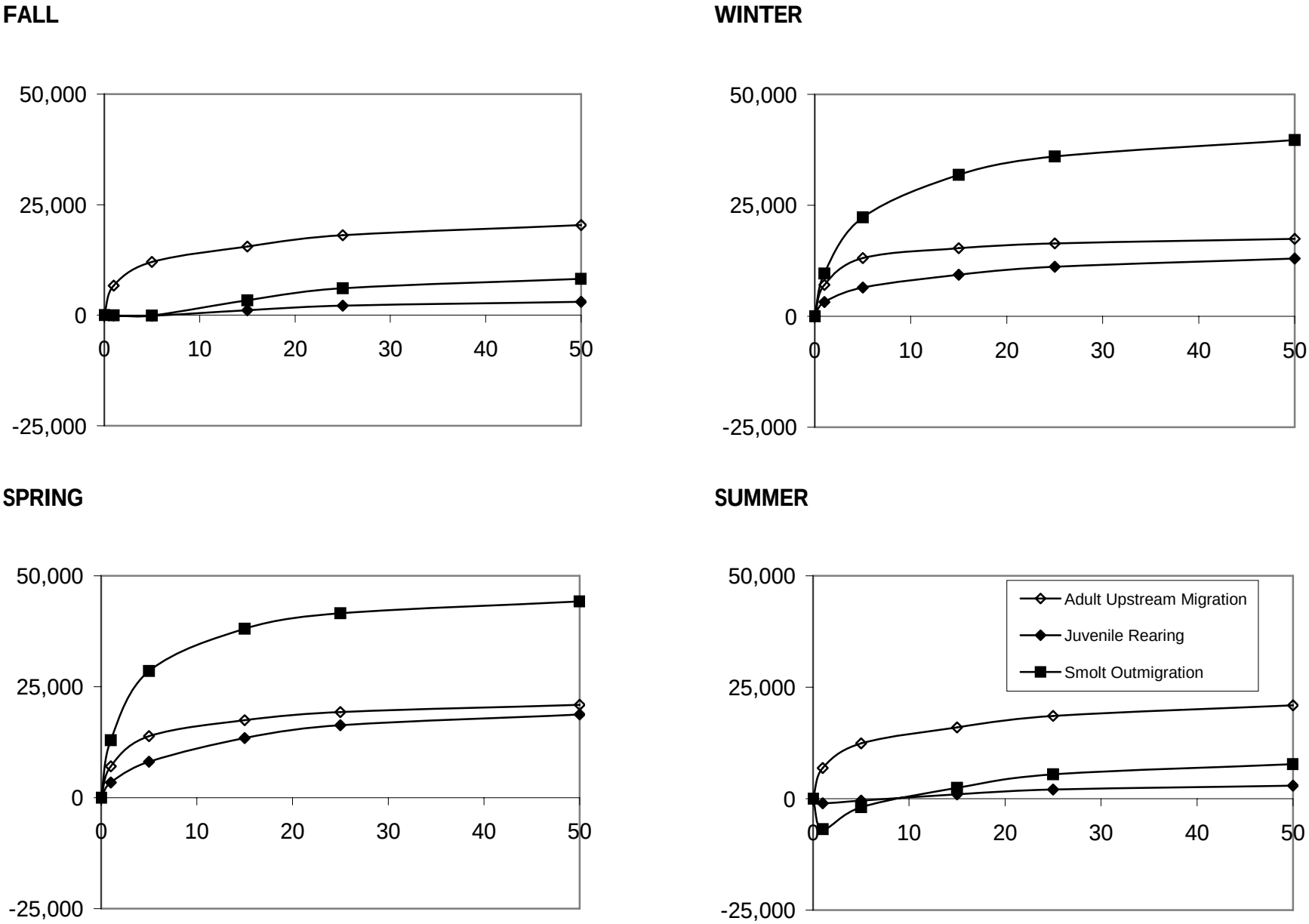
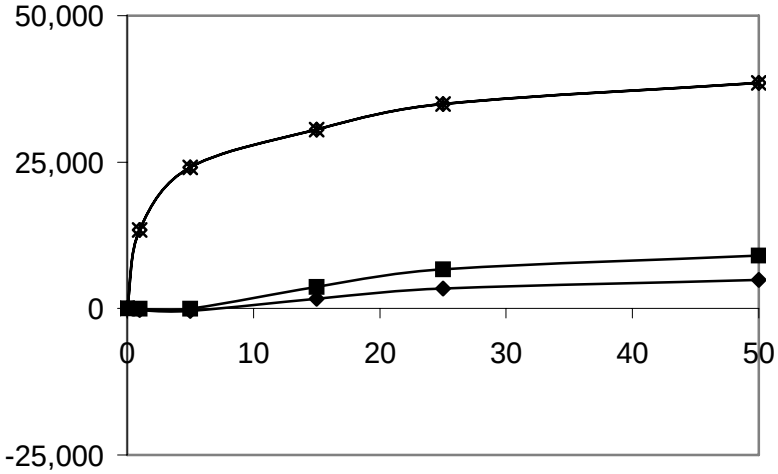
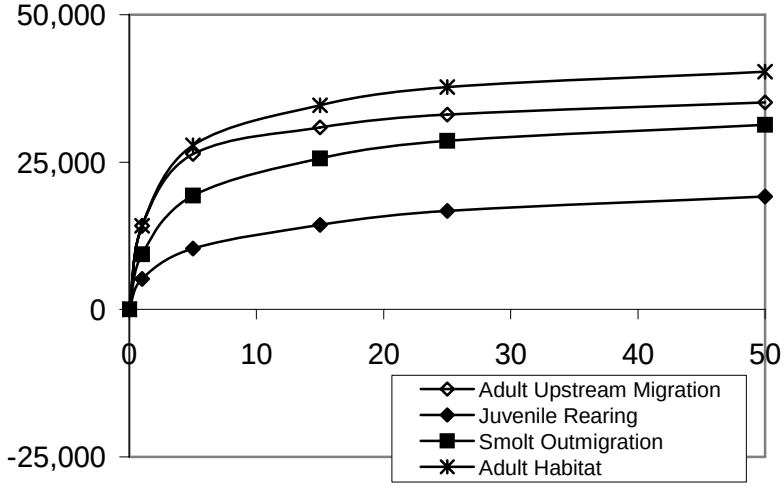


Figure 59. SAM results showing wetted-area weighted relative response (square feet) for Chinook salmon (Winter-run shown) at Site Sacramento River RM 177.8R.

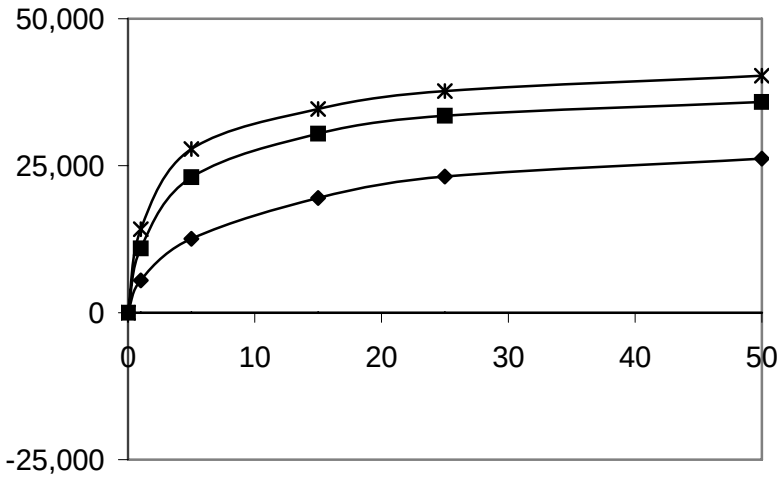
FALL



WINTER



SPRING



SUMMER

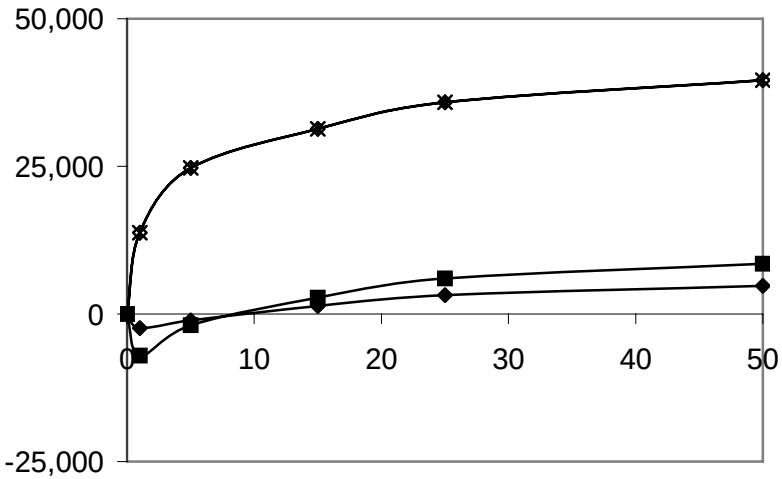
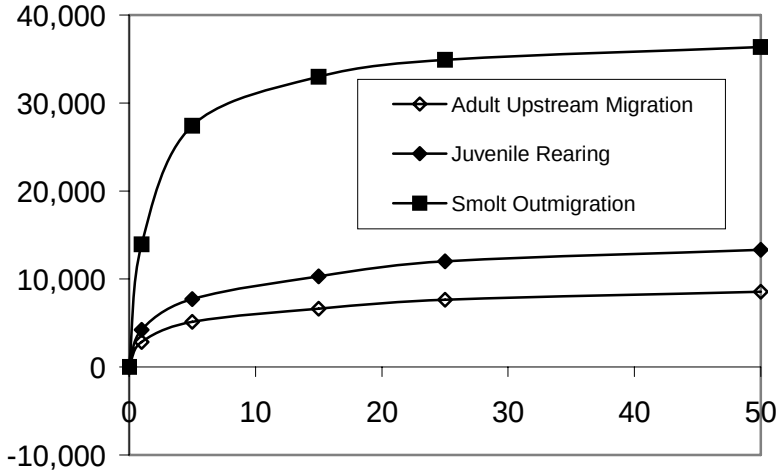
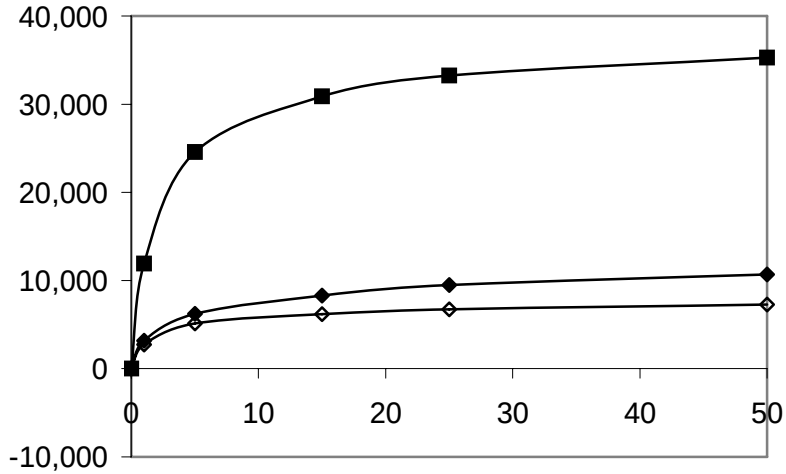


Figure 60. SAM results showing wetted-area weighted relative response (square feet) for Central Valley steelhead at Site Sacramento River RM 177.8R.

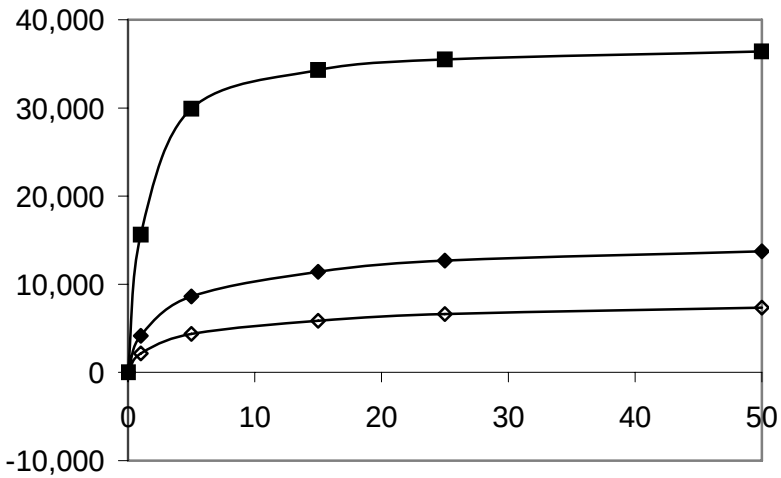
FALL



WINTER



SPRING



SUMMER

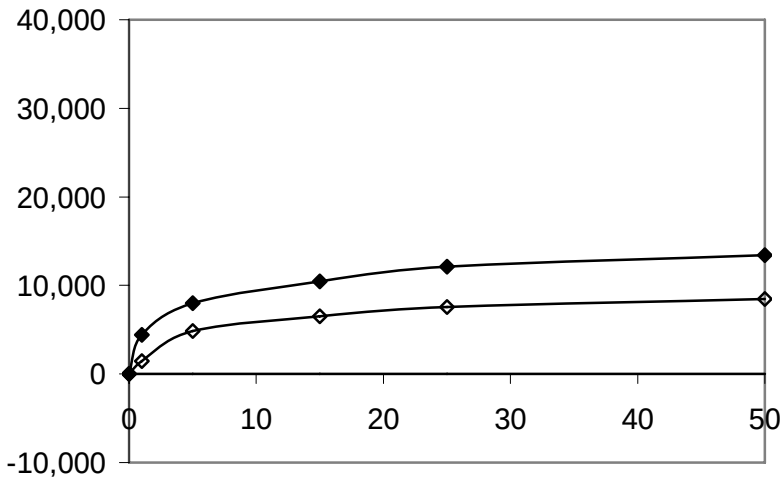


Figure 61. SAM results showing wetted-area weighted relative response (square feet) for Chinook salmon (Winter-run shown) at Site Sacramento River RM 16.8L.

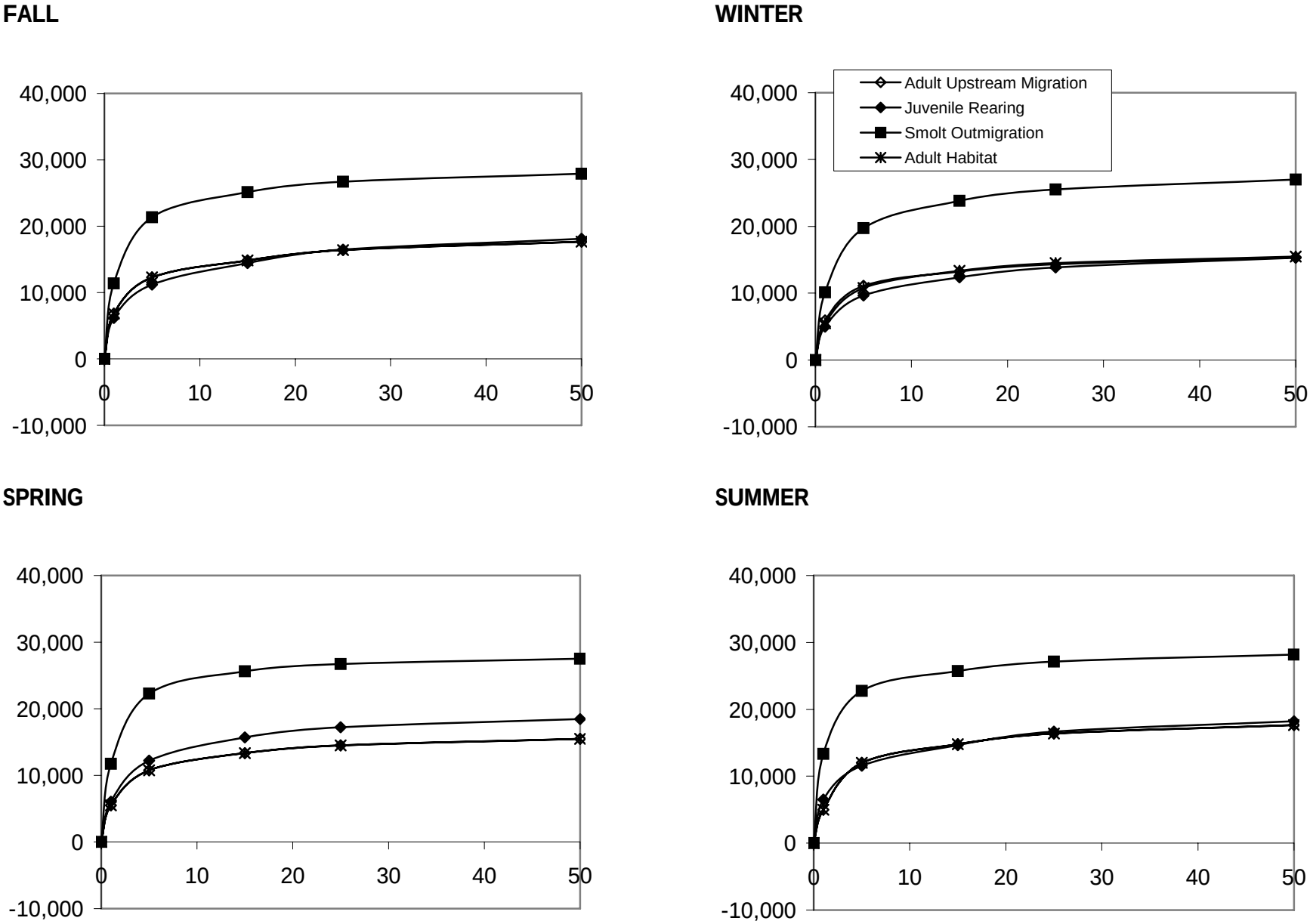
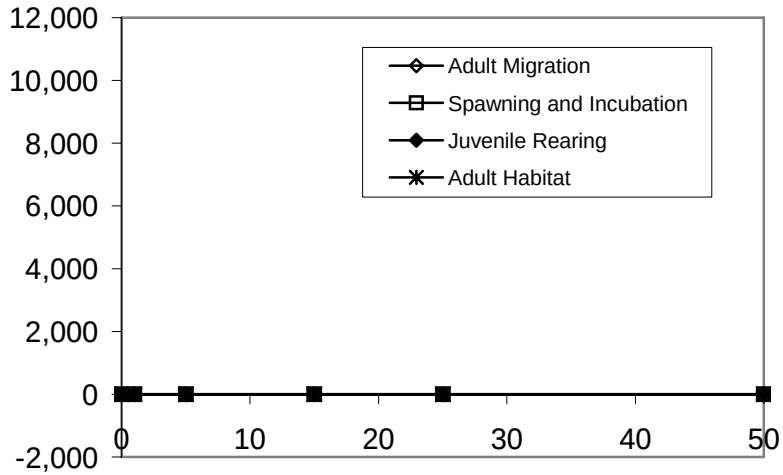
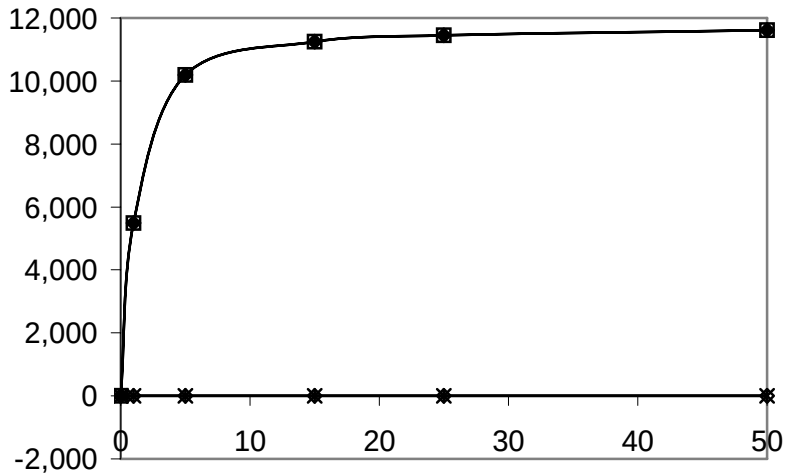


Figure 62. SAM results showing wetted-area weighted relative response (square feet) for Central Valley steelhead at Site Sacramento River RM 16.8L.

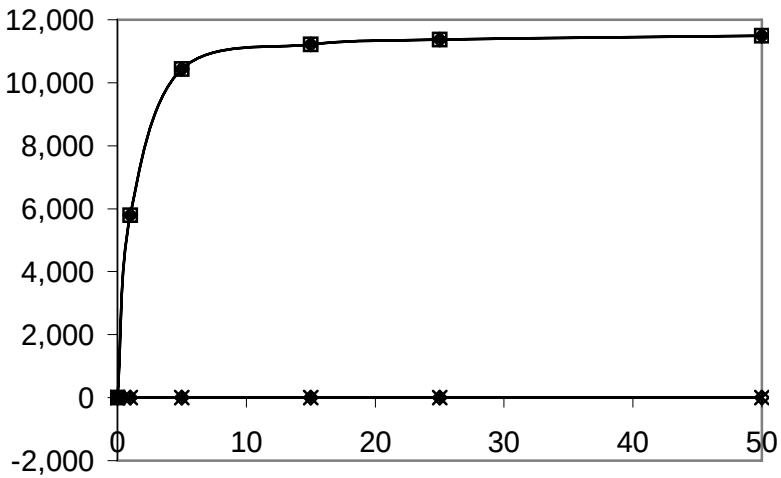
FALL



WINTER



SPRING



SUMMER

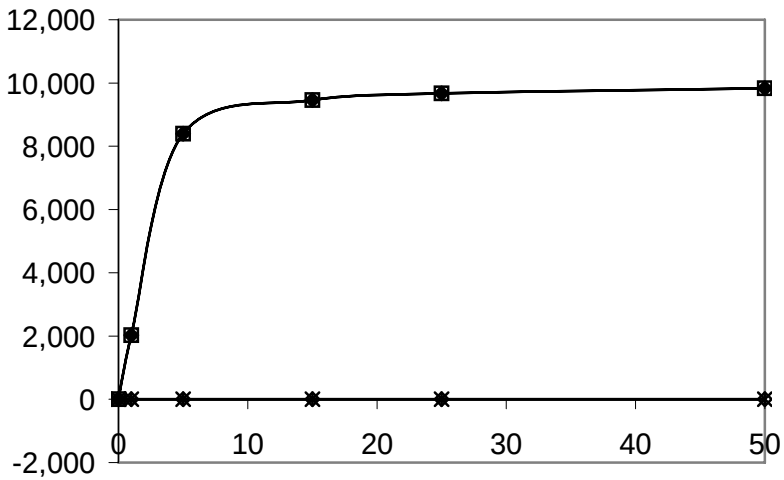
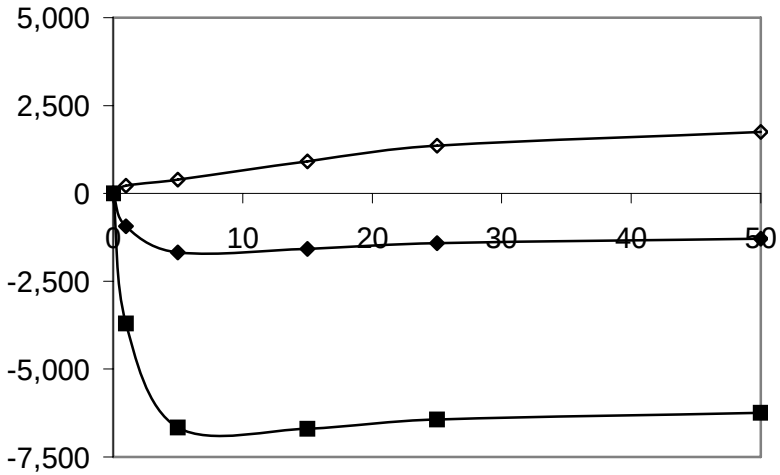
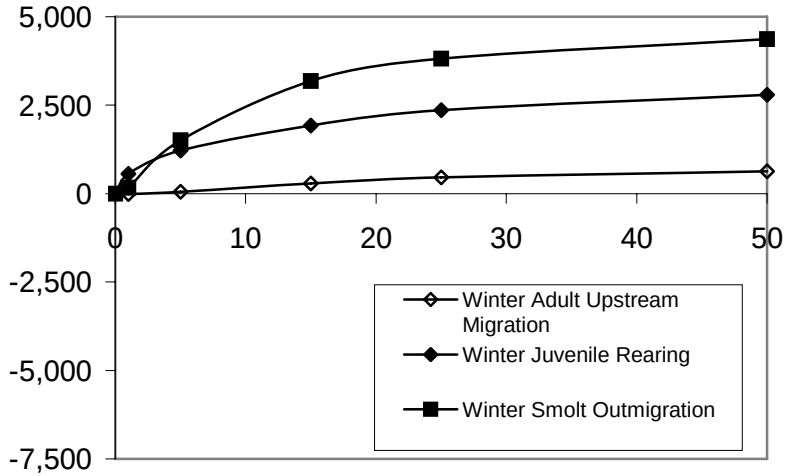


Figure 63. SAM results showing wetted-area weighted relative response (square feet) for delta smelt at Site Sacramento River RM 16.8L.

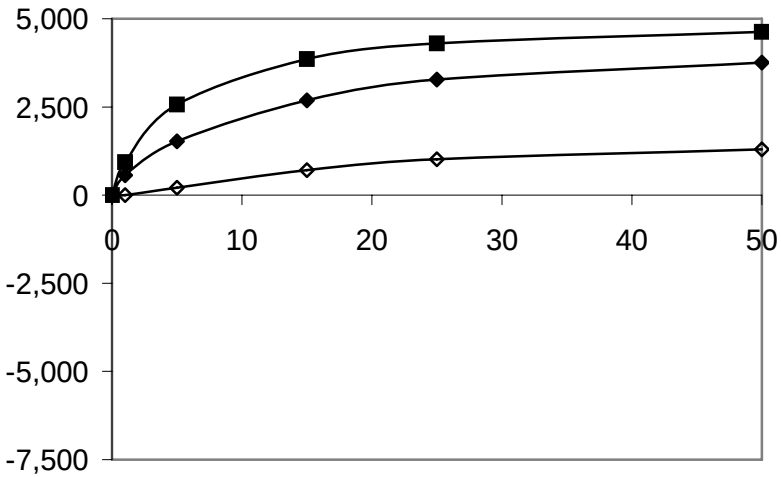
FALL



WINTER



SPRING



SUMMER

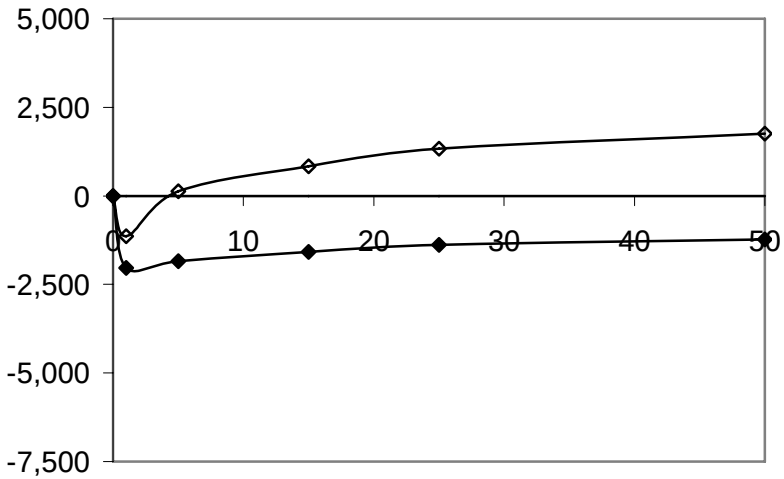
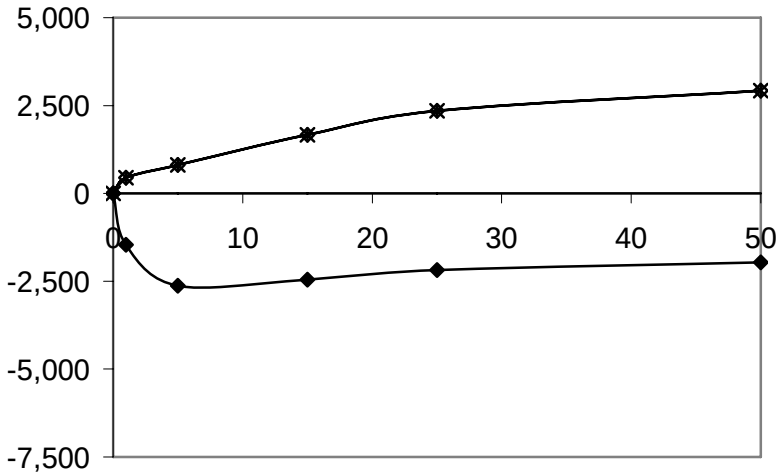
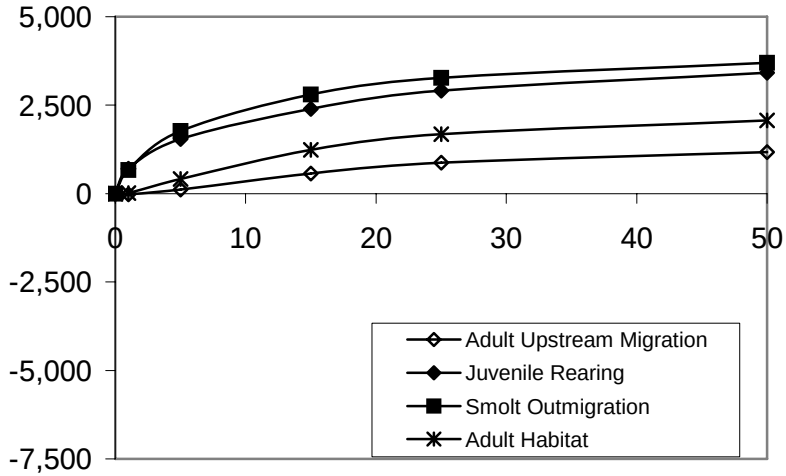


Figure 64. SAM results showing wetted-area weighted relative response (square feet) for Chinook salmon (Winter-run shown) at Site Sacramento River RM 42.7R.

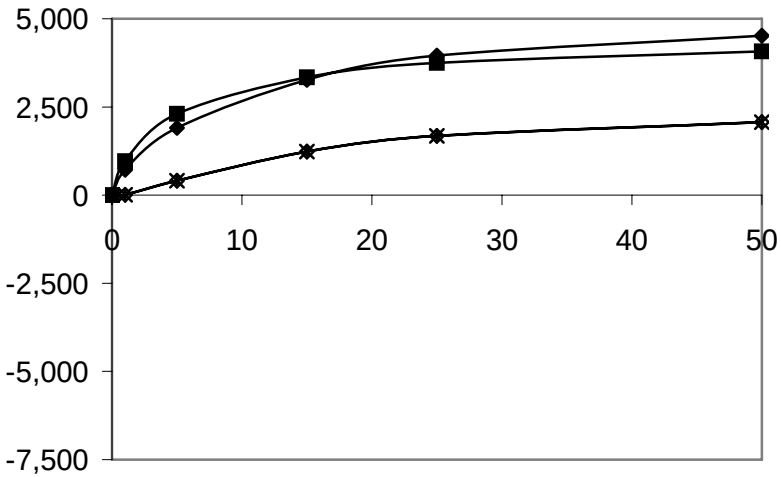
FALL



WINTER



SPRING



SUMMER

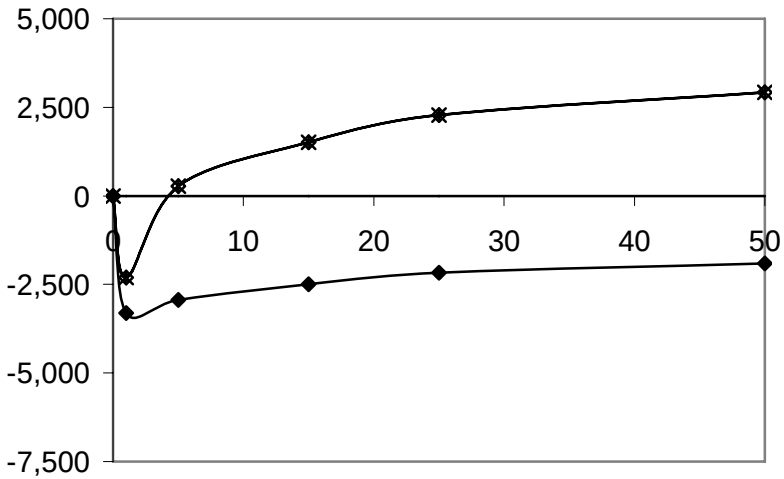


Figure 65. SAM results showing wetted-area weighted relative response (square feet) for Central Valley steelhead at Site Sacramento River RM 42.7R.

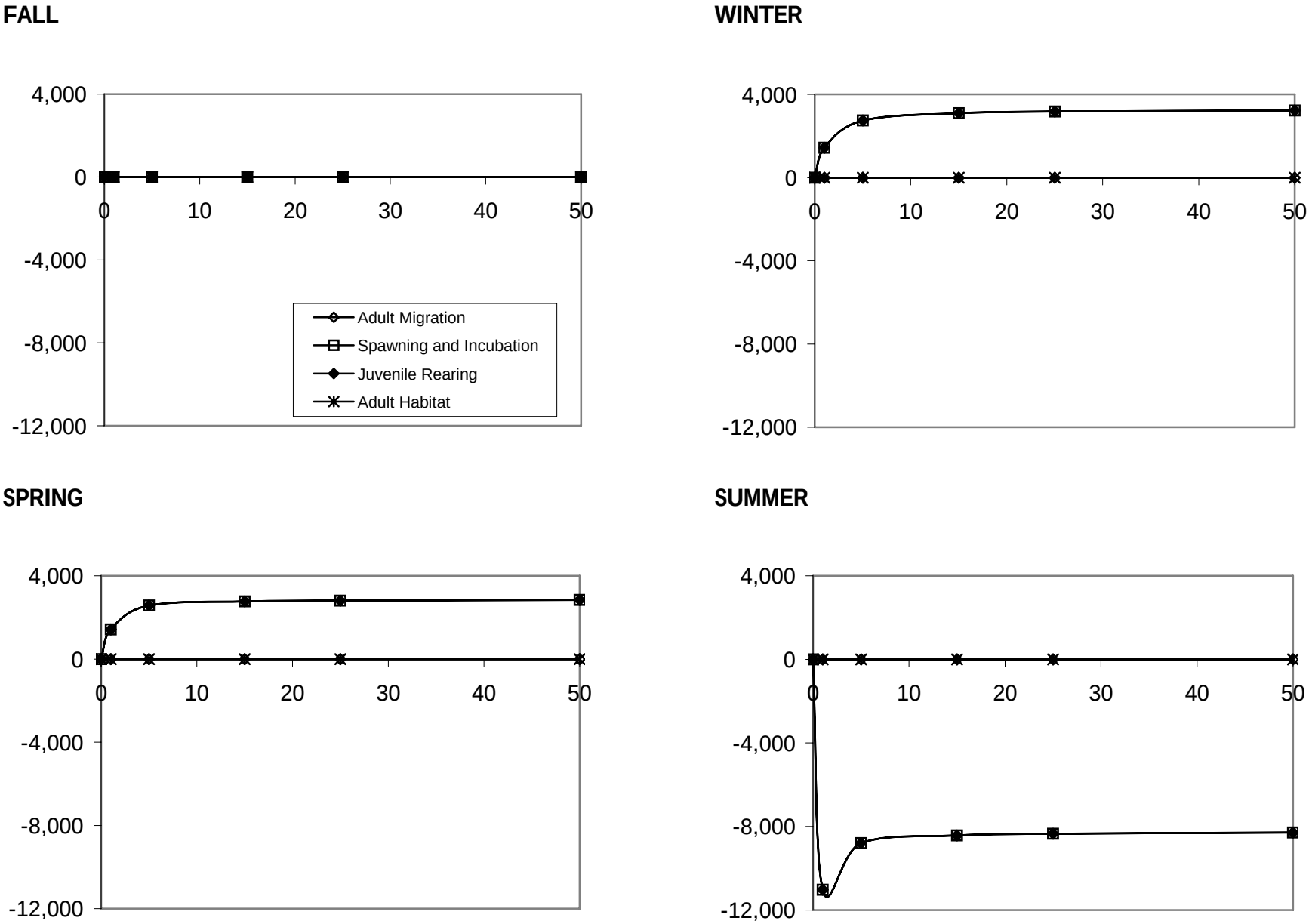
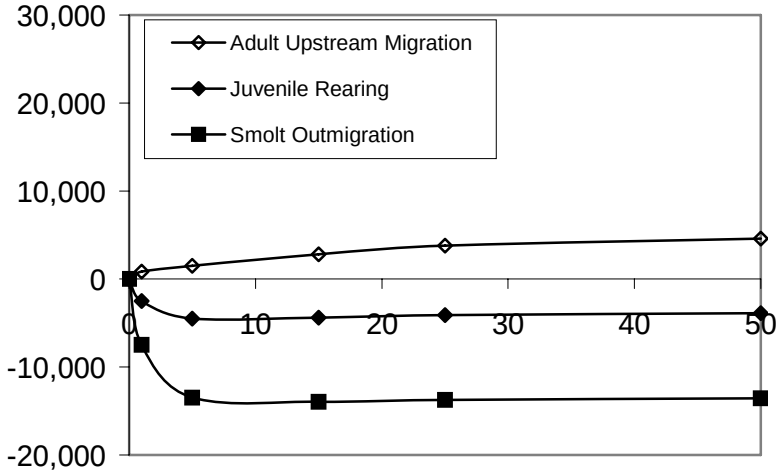
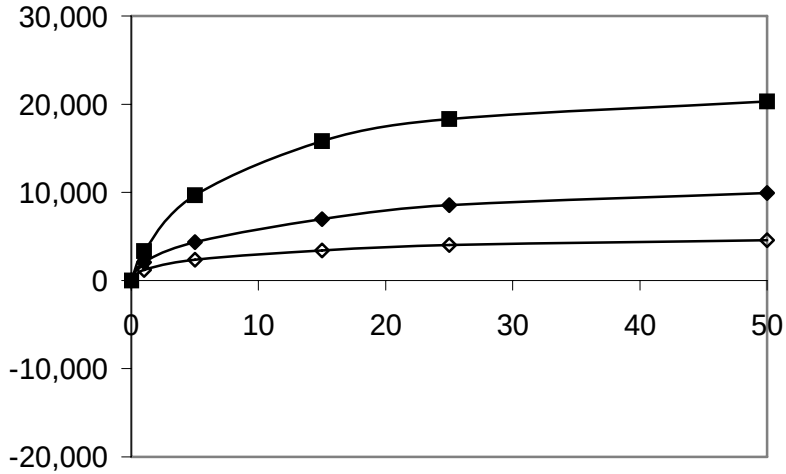


Figure 66. SAM results showing wetted-area weighted relative response (square feet) for delta smelt at Site Sacramento River RM 42.7R.

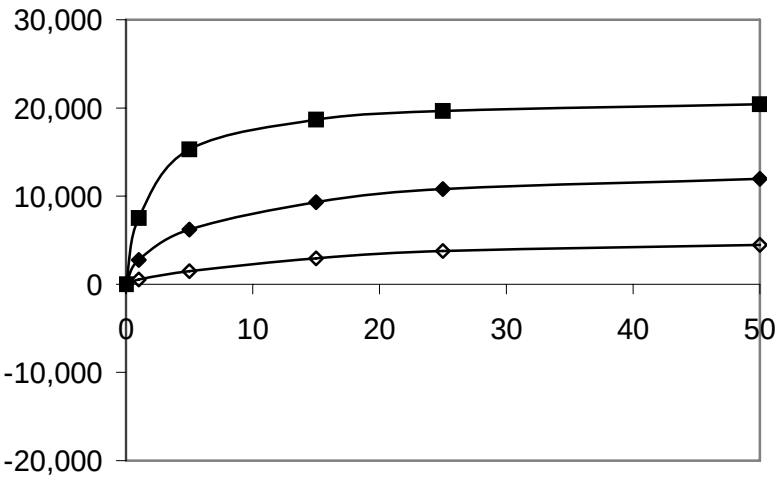
FALL



WINTER



SPRING



SUMMER

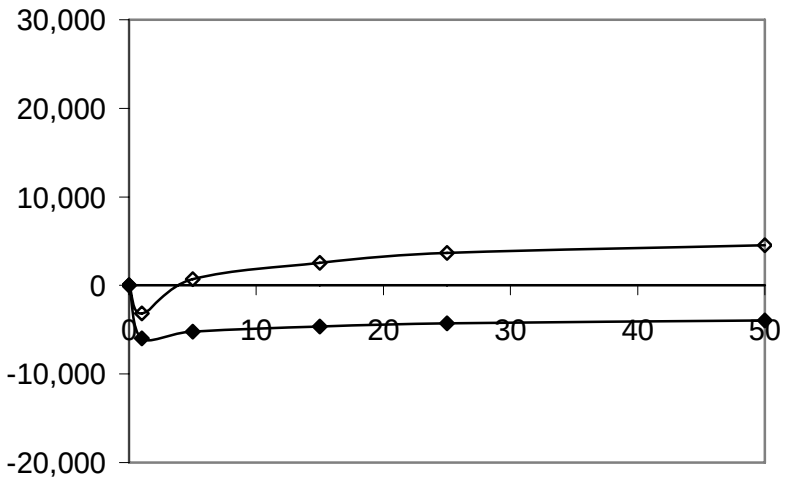
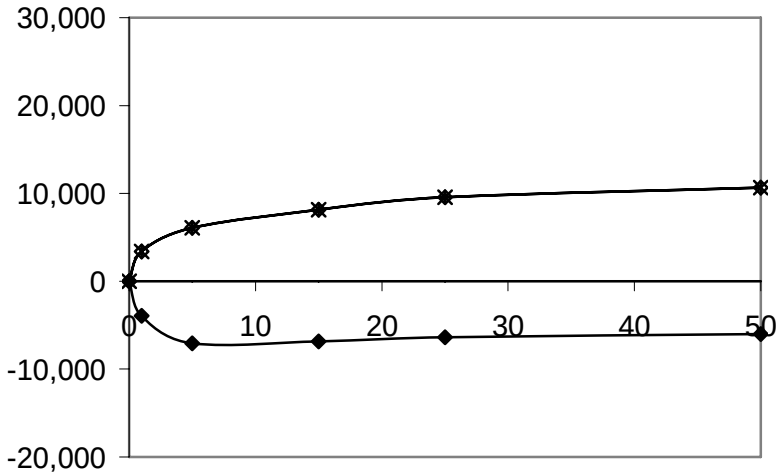
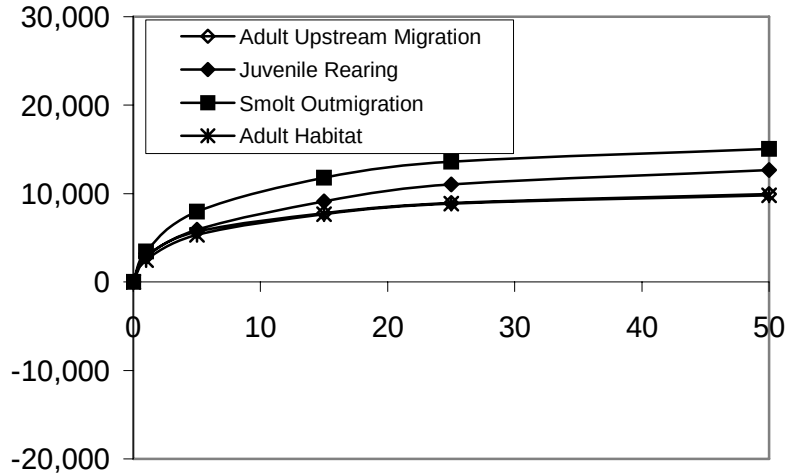


Figure 67. SAM results showing wetted-area weighted relative response (square feet) for Chinook salmon (Winter-run shown) at Site Sacramento River RM 55.2L.

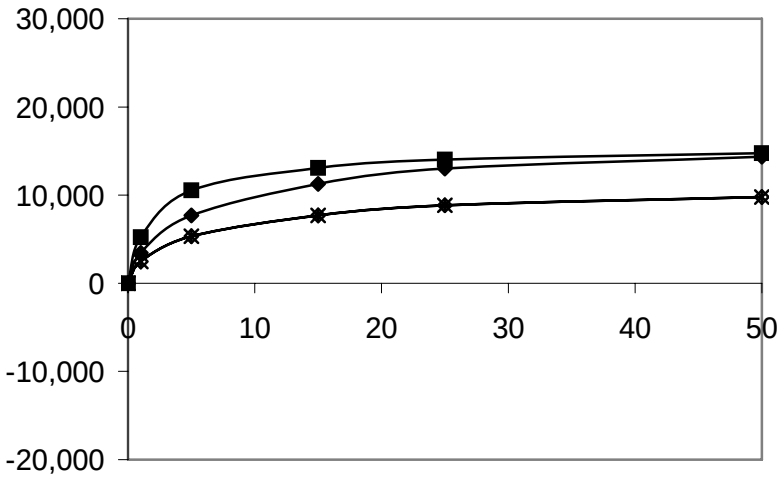
FALL



WINTER



SPRING



SUMMER

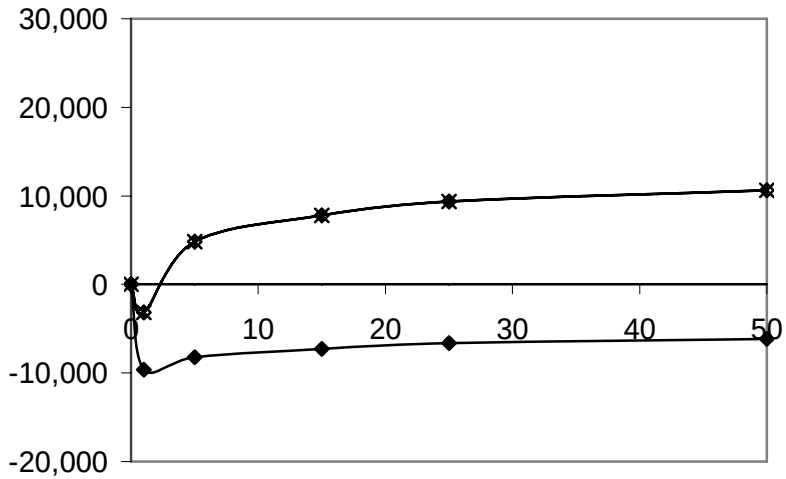
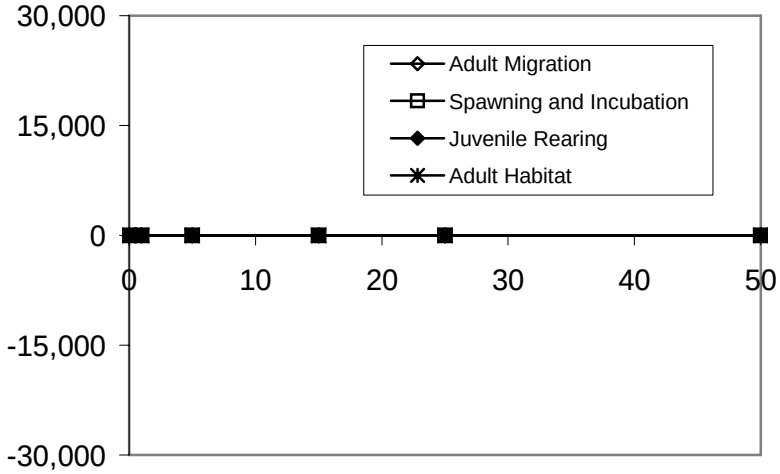
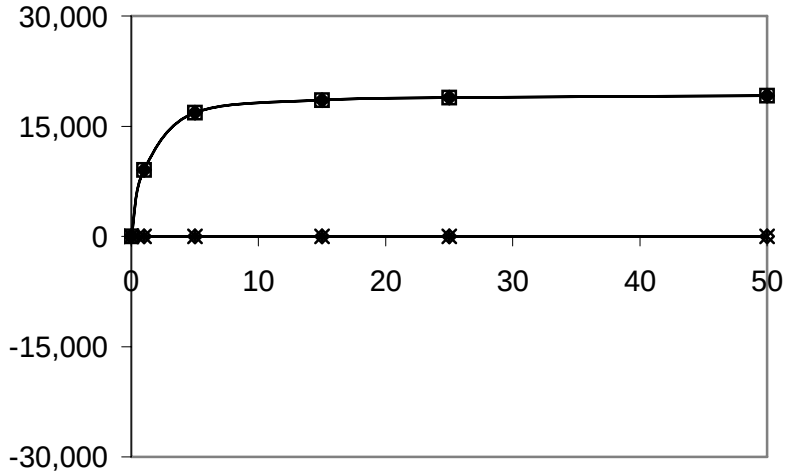


Figure 68. SAM results showing wetted-area weighted relative response (square feet) for Central Valley steelhead at Site Sacramento River RM 55.2L.

FALL



WINTER



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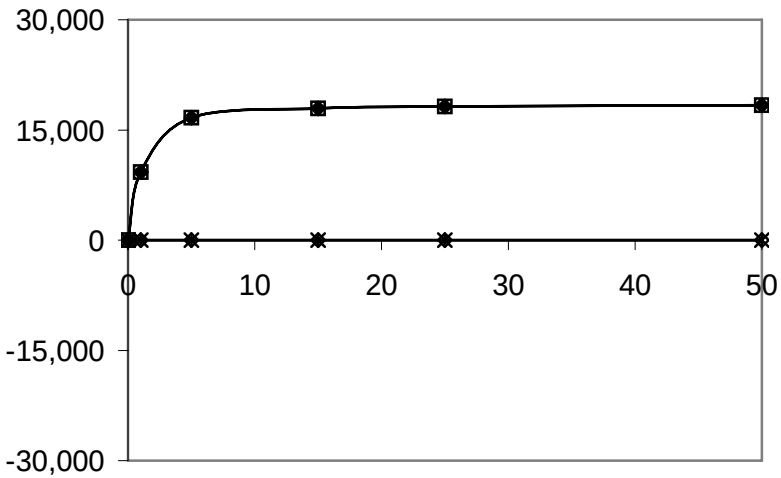


SUMMER

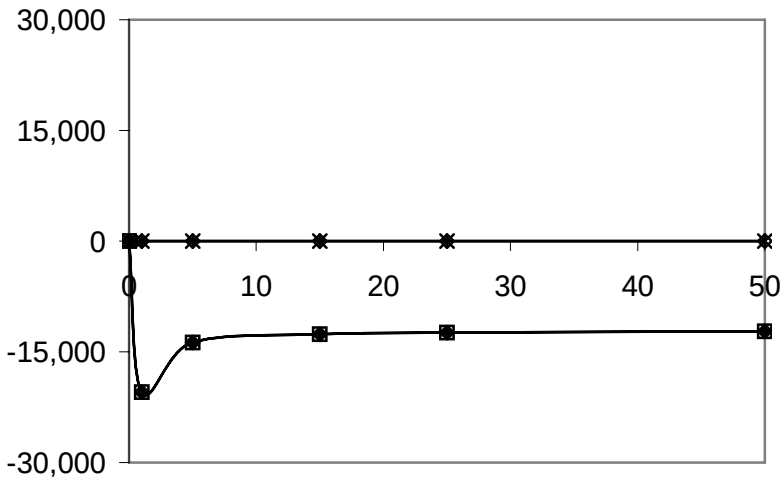
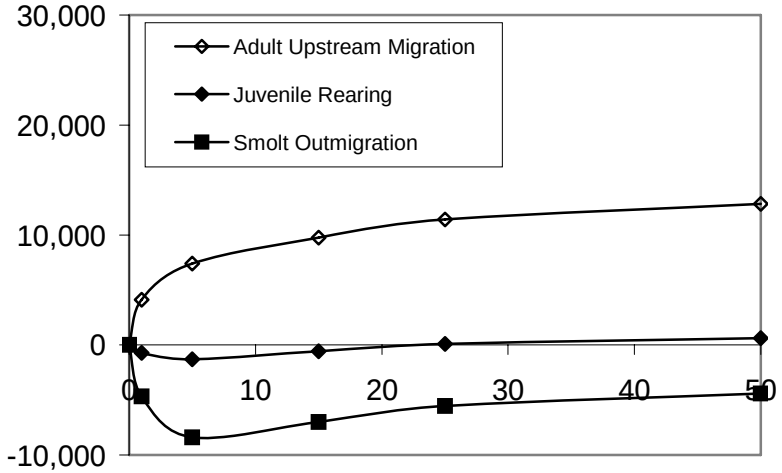
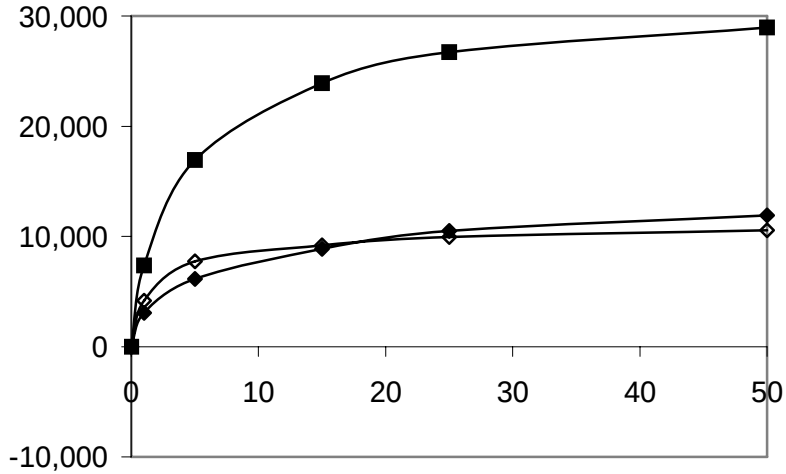


Figure 69. SAM results showing wetted-area weighted relative response (square feet) for delta smelt at Site Sacramento River RM 55.2L.

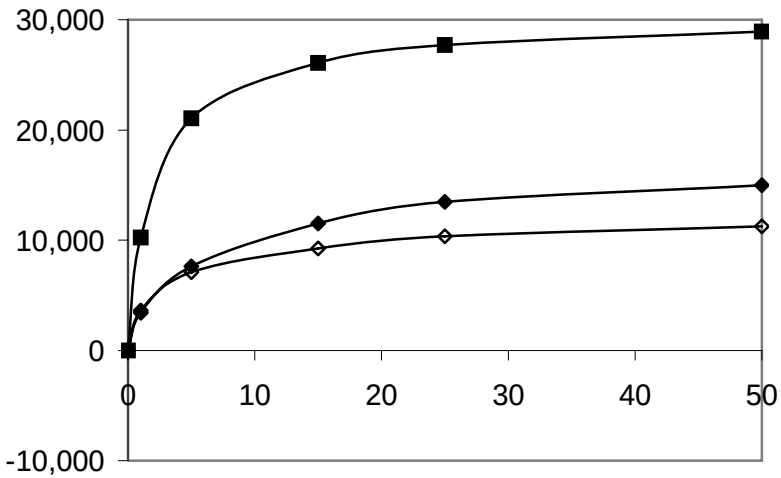
FALL



WINTER



SPRING



SUMMER

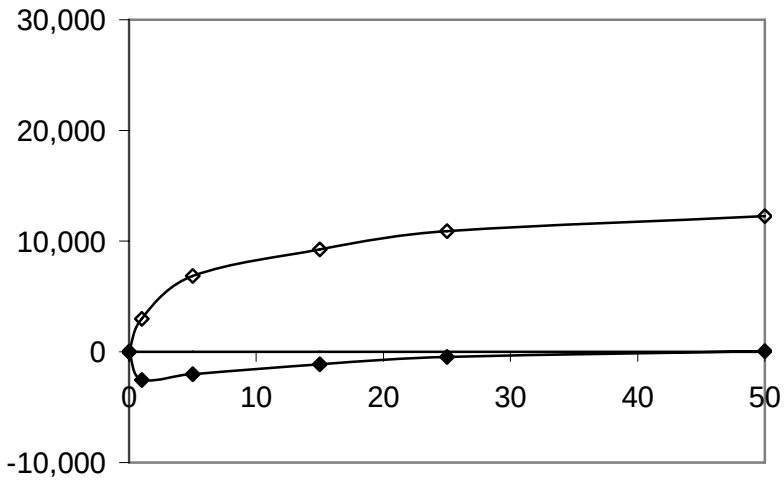
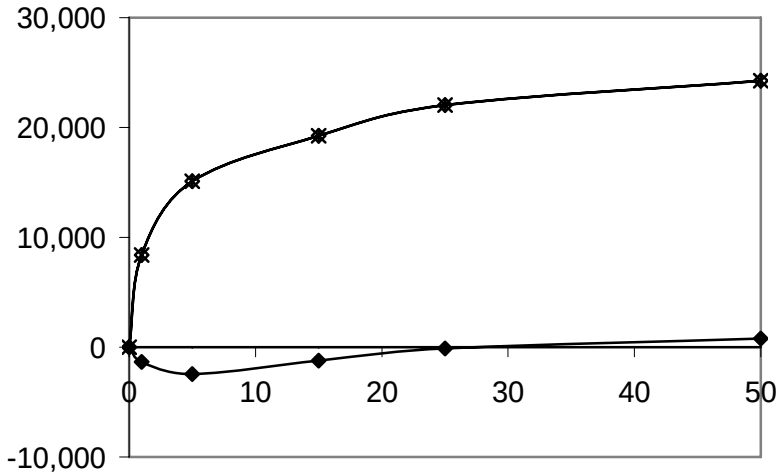
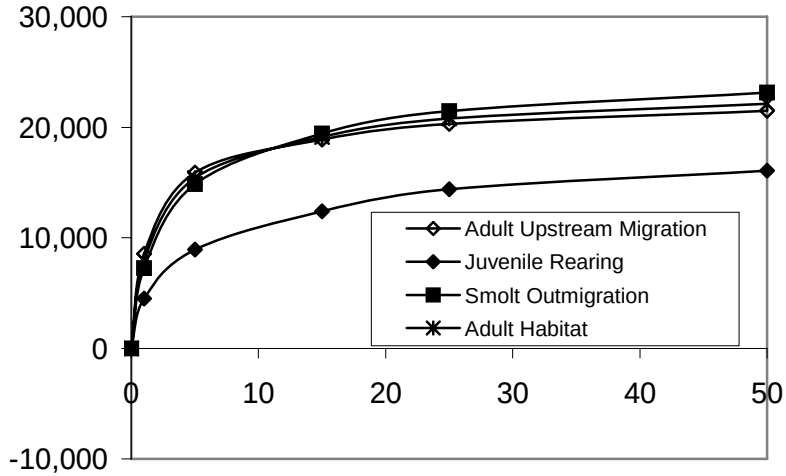


Figure 70. SAM results showing wetted-area weighted relative response (square feet) for Chinook salmon (Winter-run shown) at Site Sacramento River RM 77.2L.

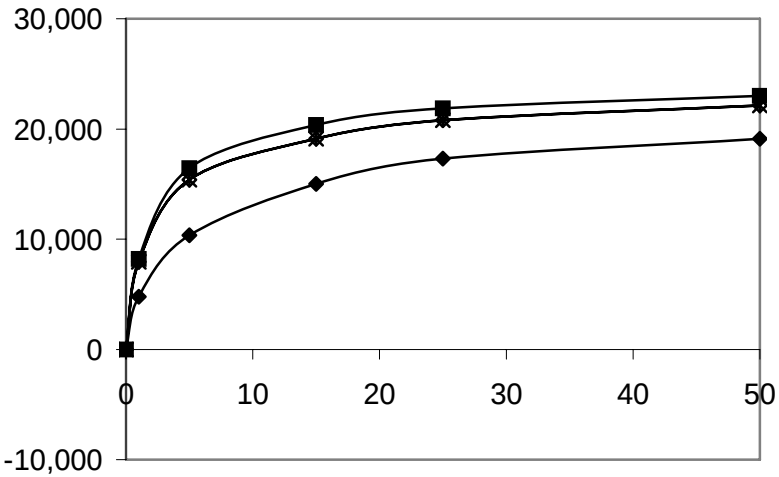
FALL



WINTER



SPRING



SUMMER

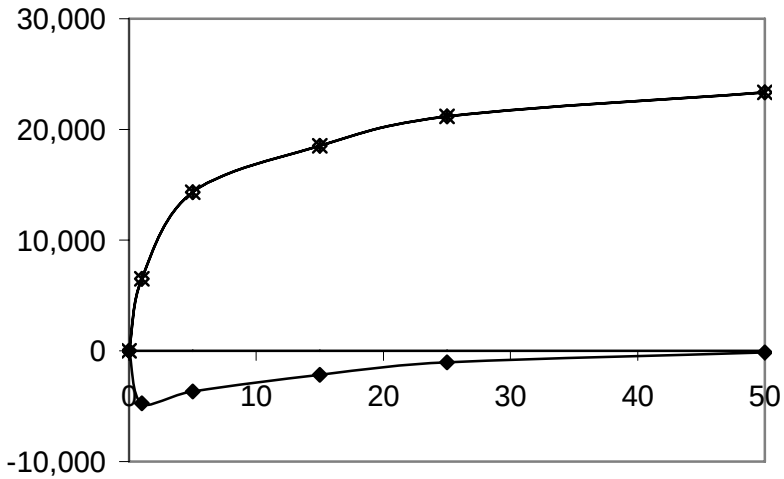
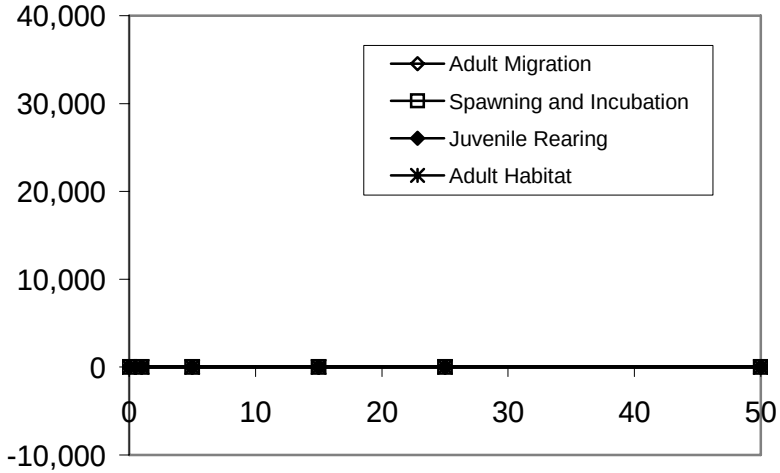
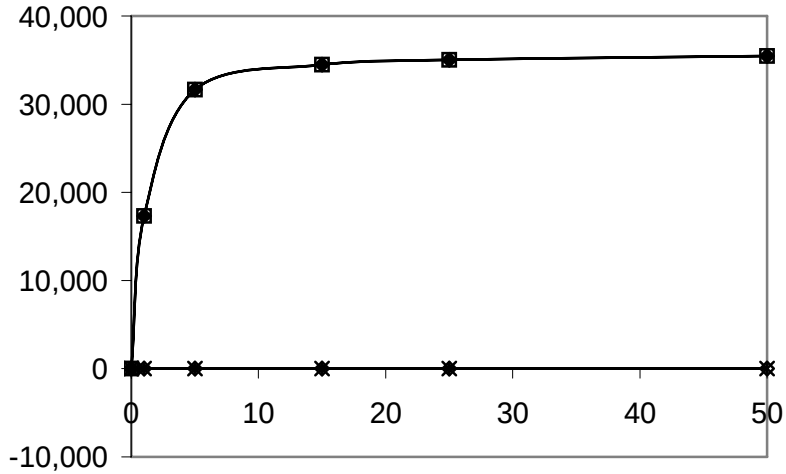


Figure 71. SAM results showing wetted-area weighted relative response (square feet) for Central Valley steelhead at Site Sacramento River RM 77.2L.

FALL



WINTER



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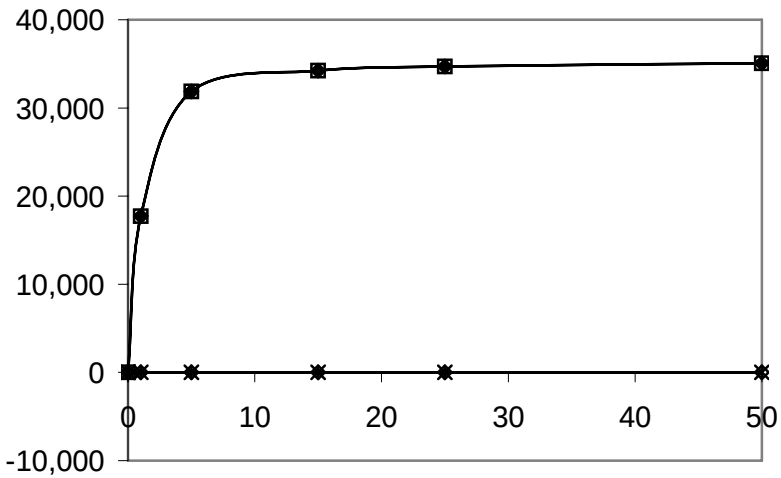

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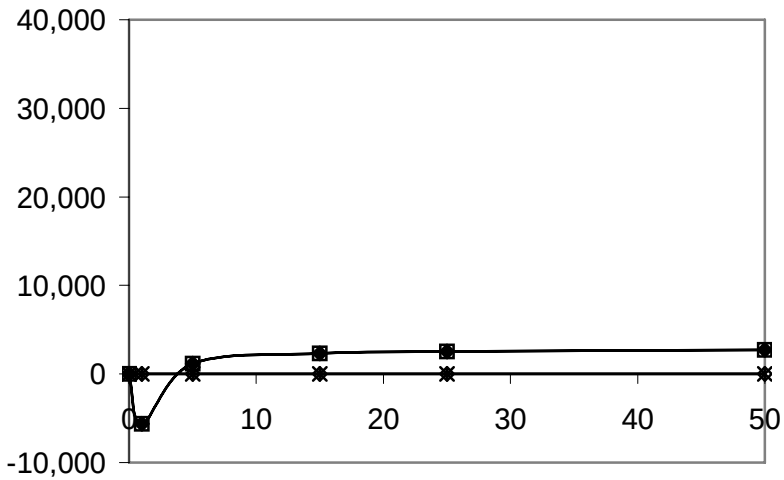
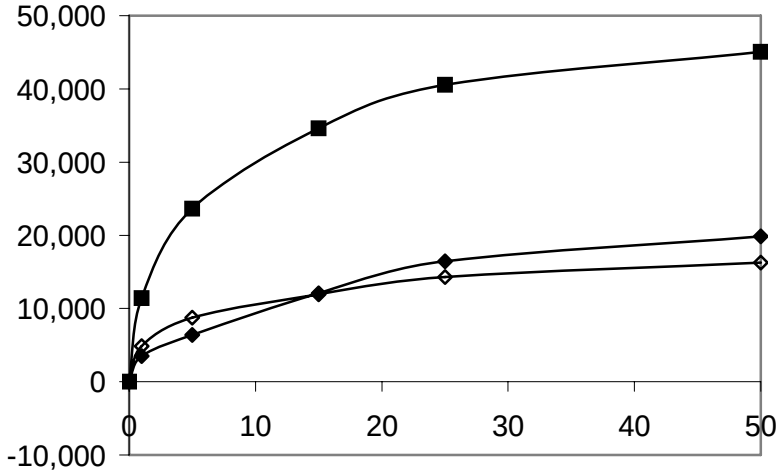
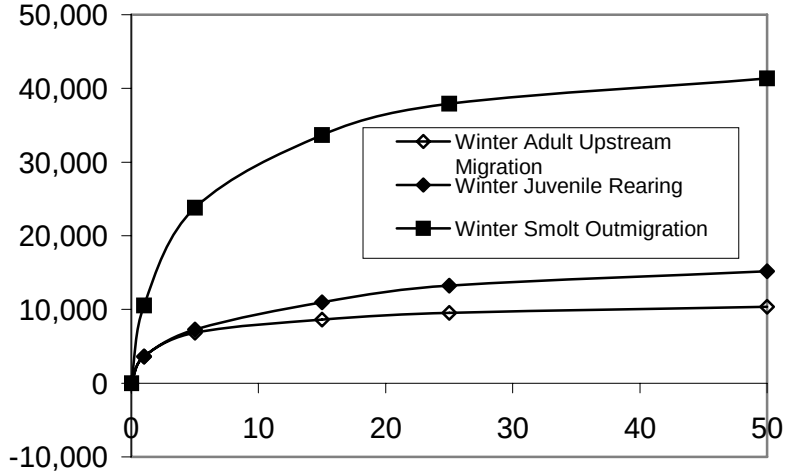


Figure 72. SAM results showing wetted-area weighted relative response (square feet) for delta smelt at Site Sacramento River RM 77.2L.

FALL



WINTER



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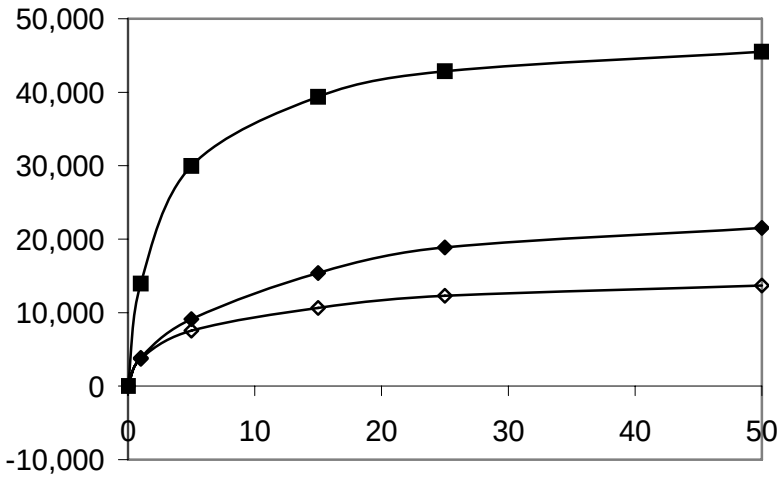

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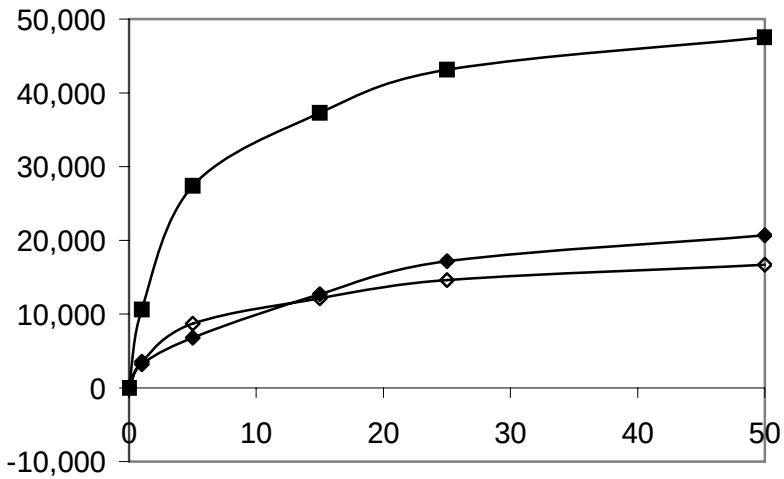
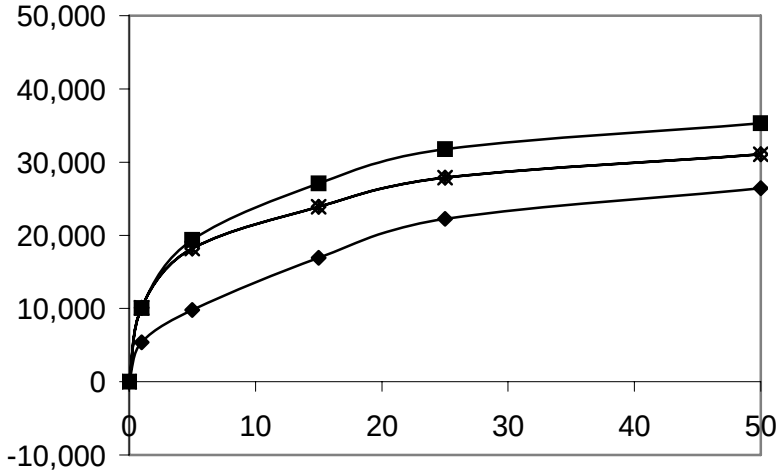
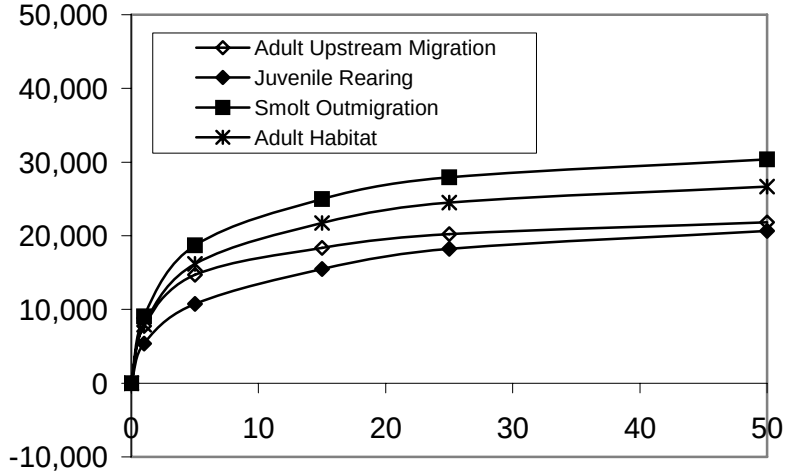


Figure 73. SAM results showing wetted-area weighted relative response (square feet) for Chinook salmon (Winter-run shown) at Site Feather River RM 28.5R.

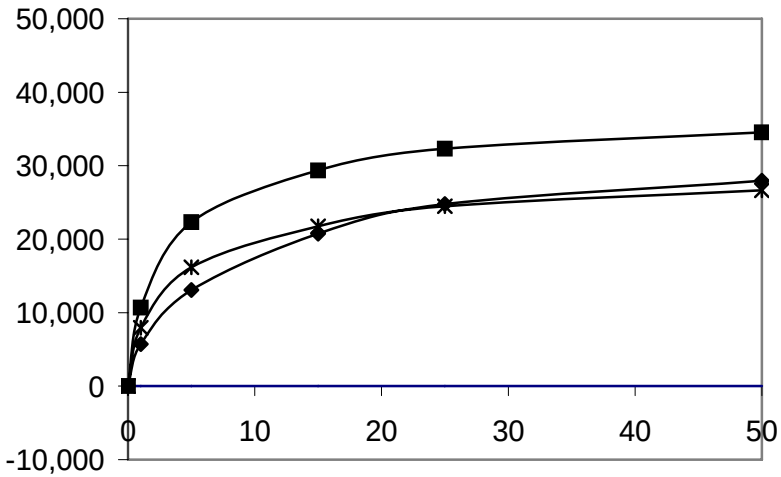
FALL



WINTER



SPRING



SUMMER

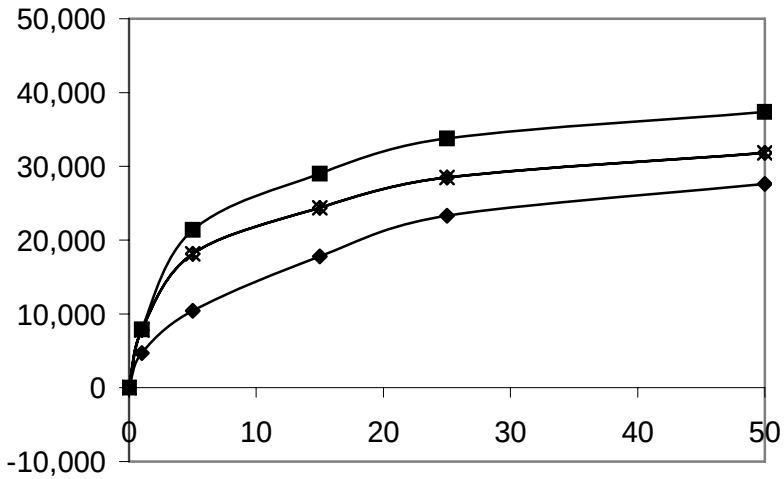
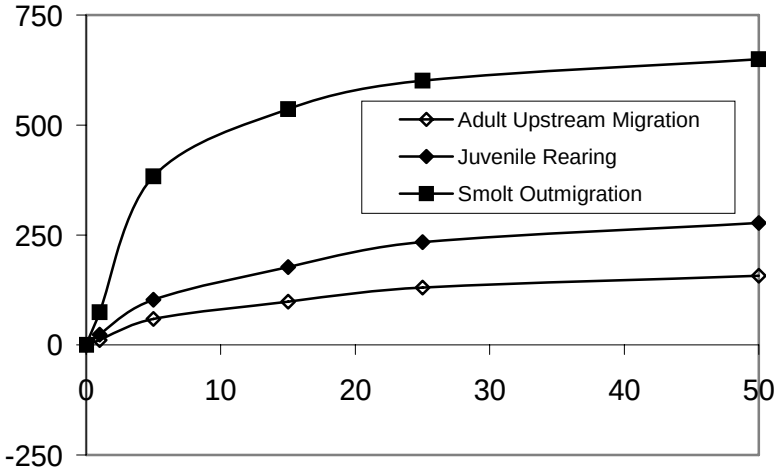
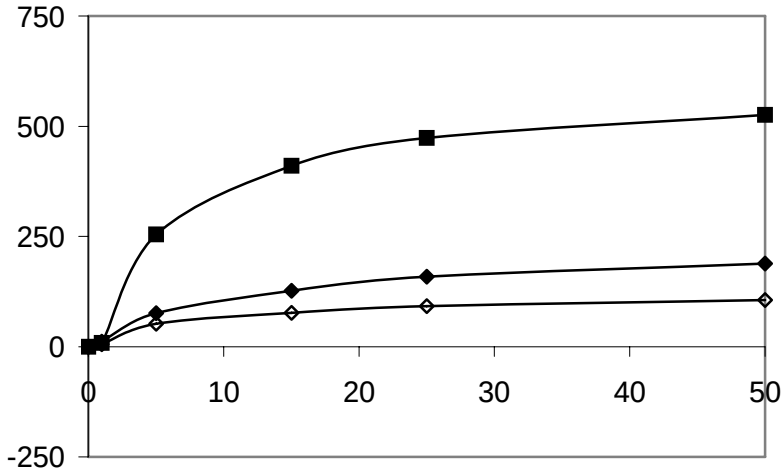


Figure 74. SAM results showing wetted-area weighted relative response (square feet) for Central Valley steelhead at Site Feather River RM 28.5R.

FALL



WINTER



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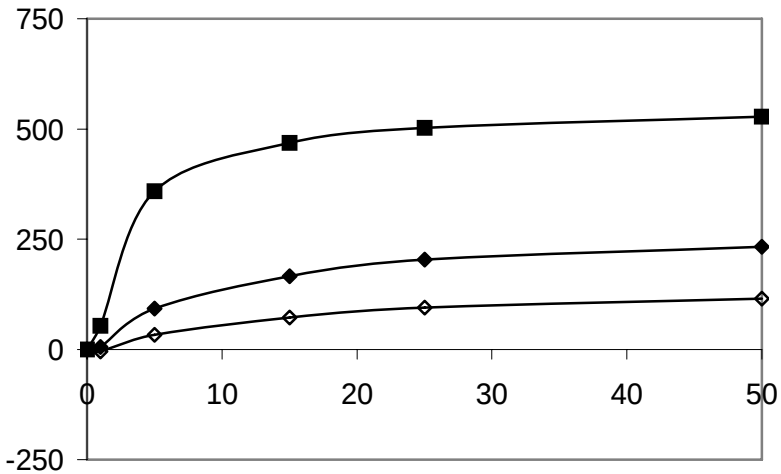


SUMMER

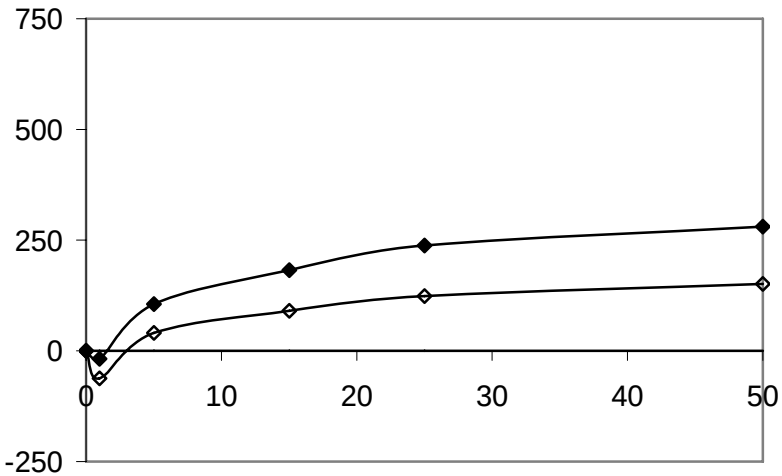
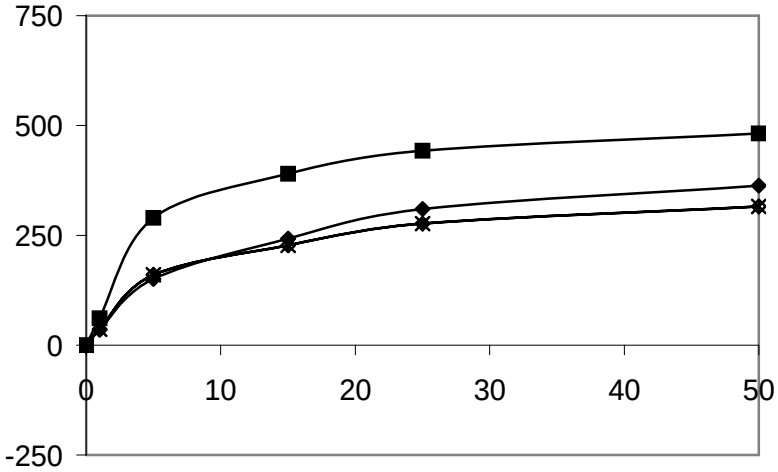
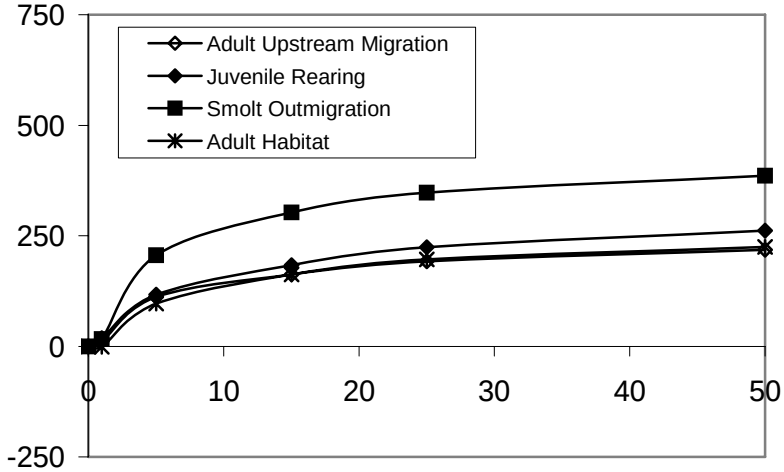


Figure 75. SAM results showing cumulative bank-line weighted relative responses (feet) for Chinook salmon (Winter-run shown) for bank repair sites within Region 1a (3 sites).

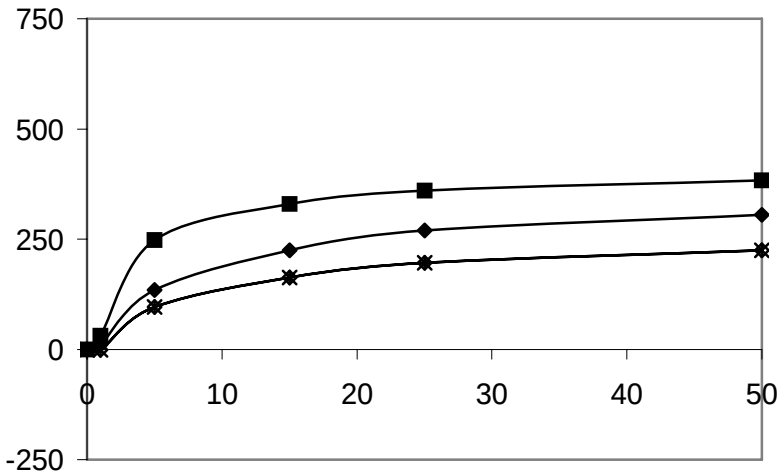
FALL



WINTER



SPRING



SUMMER

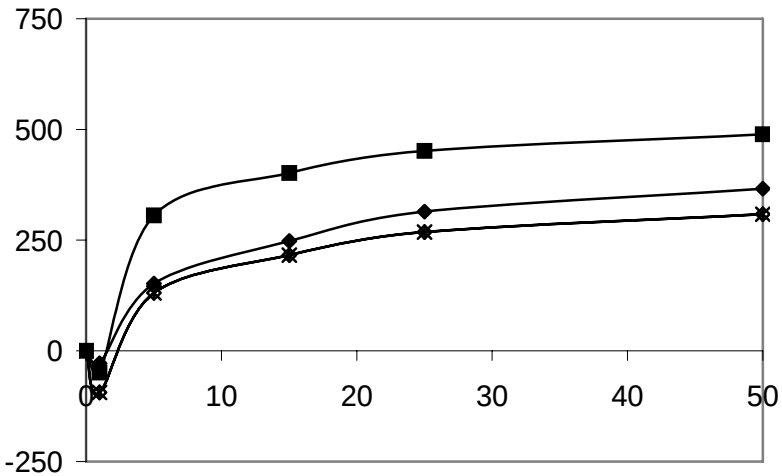
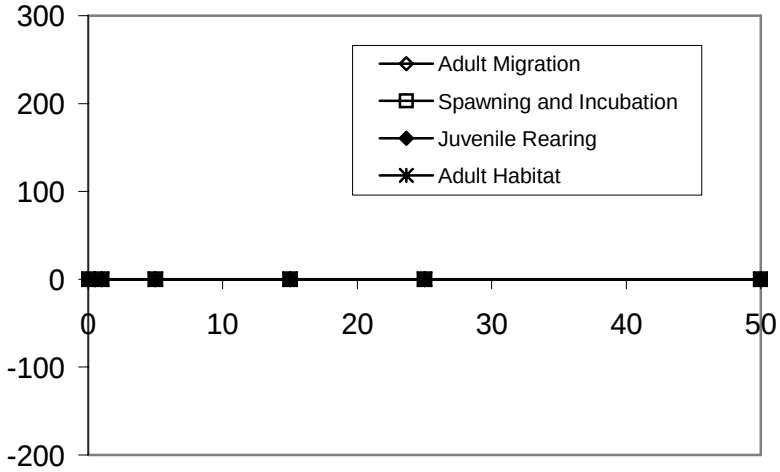
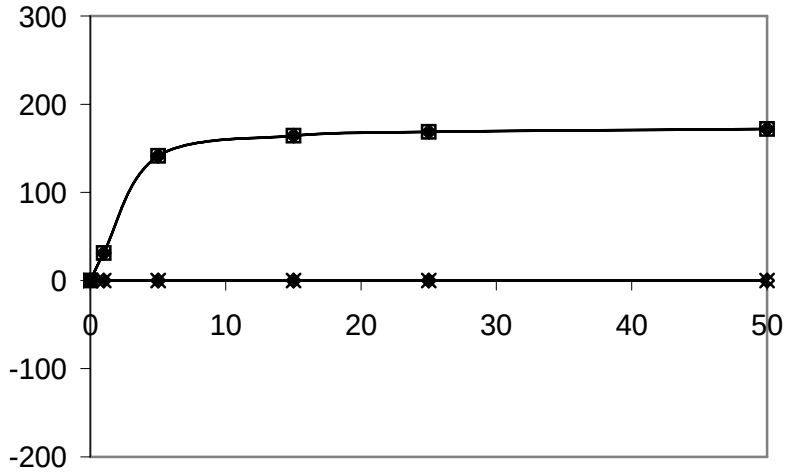


Figure 76. SAM results showing cumulative bank-line weighted relative responses (feet) for Central Valley steelhead for bank repair sites within Region 1a (3 sites).

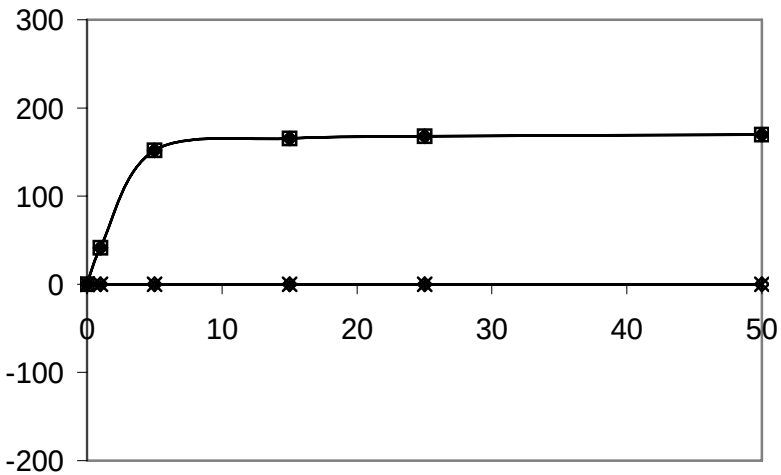
FALL



WINTER



SPRING



SUMMER

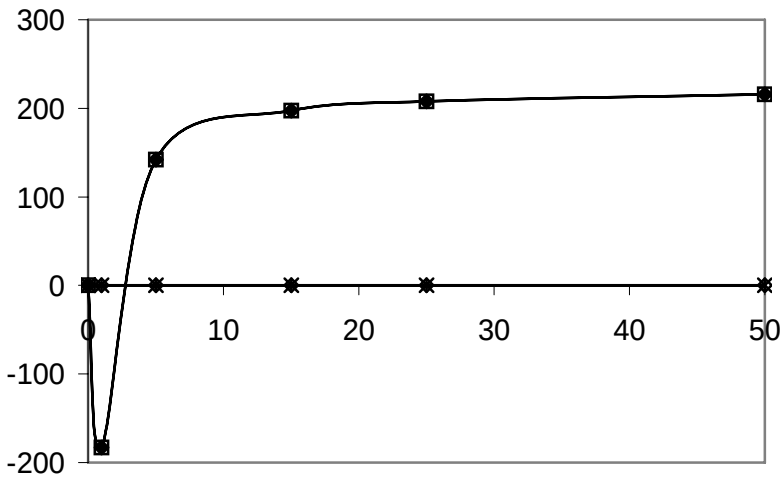
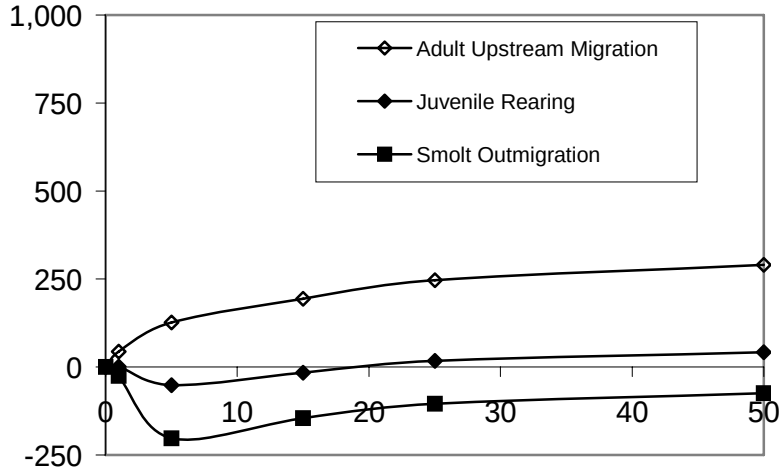
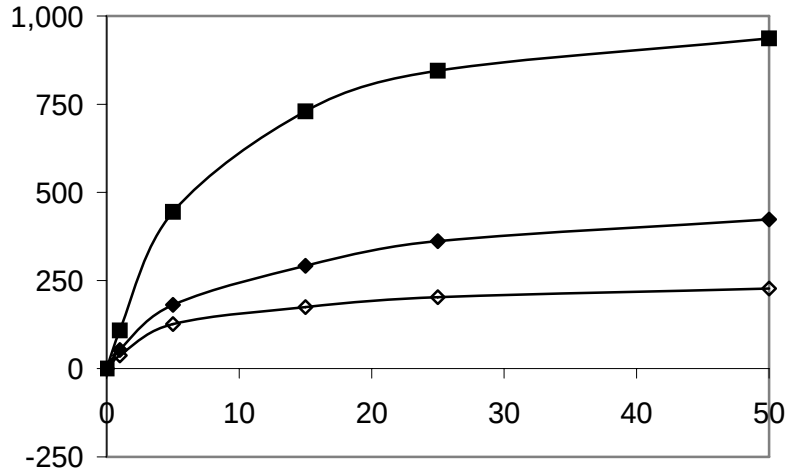


Figure 77. SAM results showing cumulative bank-line weighted relative responses (feet) for delta smelt for bank repair sites within Region 1a (3 sites).

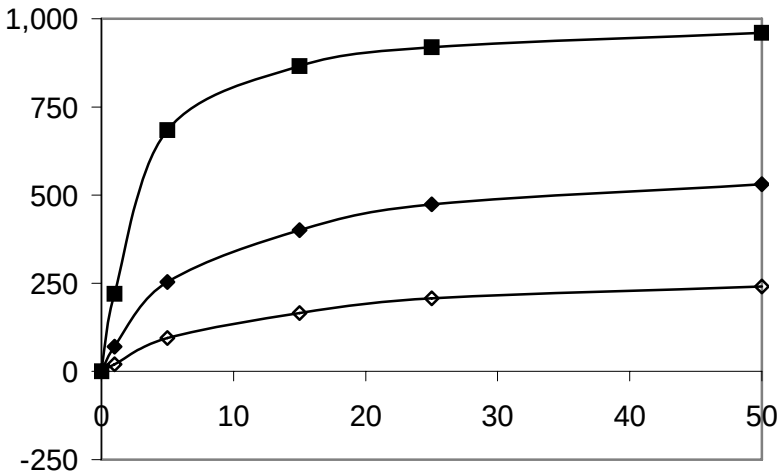
FALL



WINTER



SPRING



SUMMER

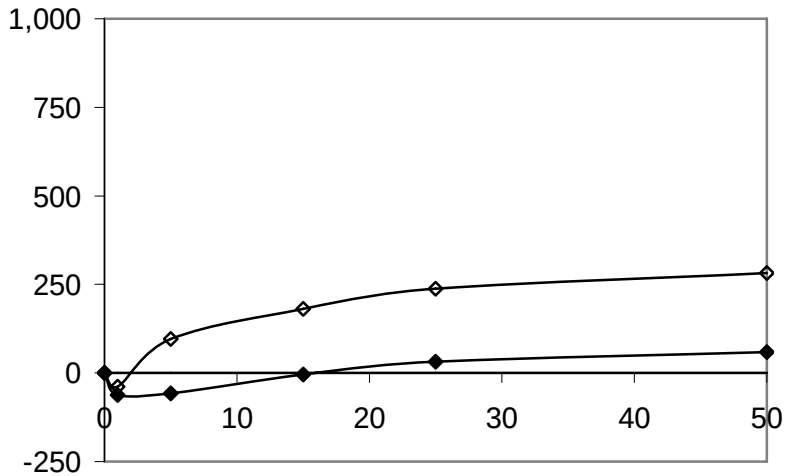
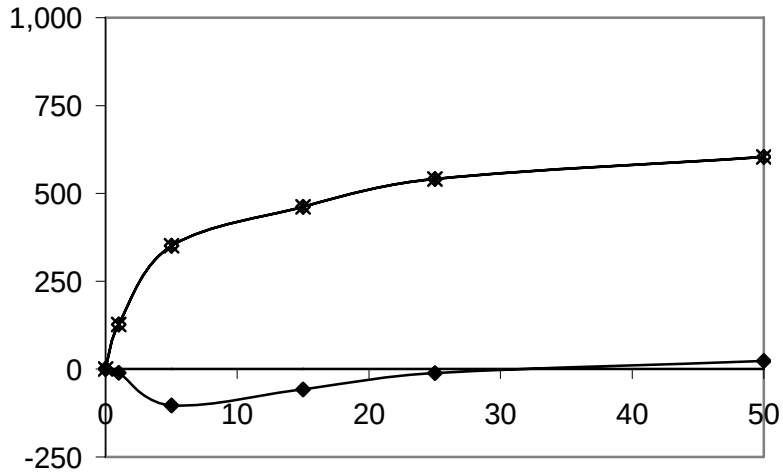
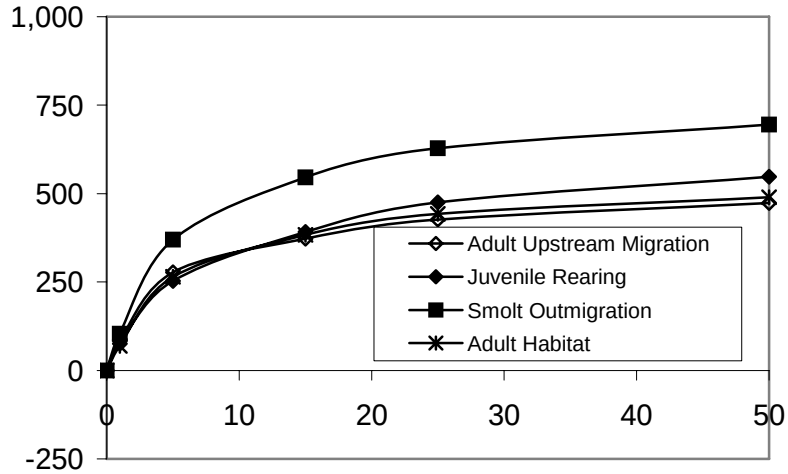


Figure 78. SAM results showing cumulative bank-line weighted relative responses (feet) for Chinook salmon (Winter-run shown) for bank repair sites within Region 1b (8 sites).

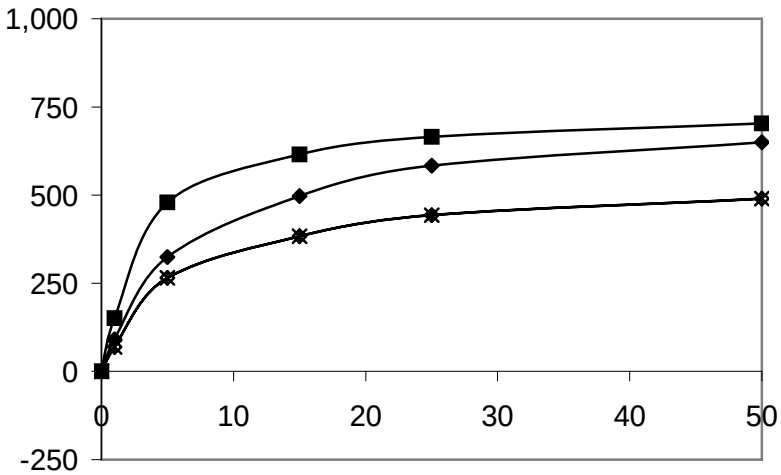
FALL



WINTER



SPRING



SUMMER

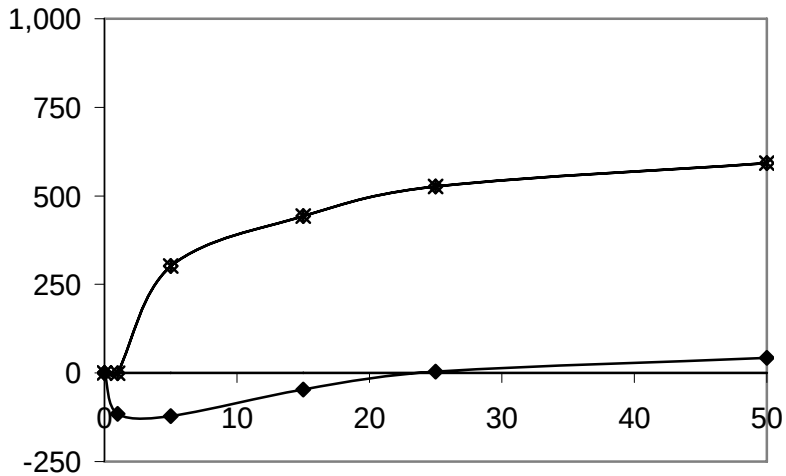
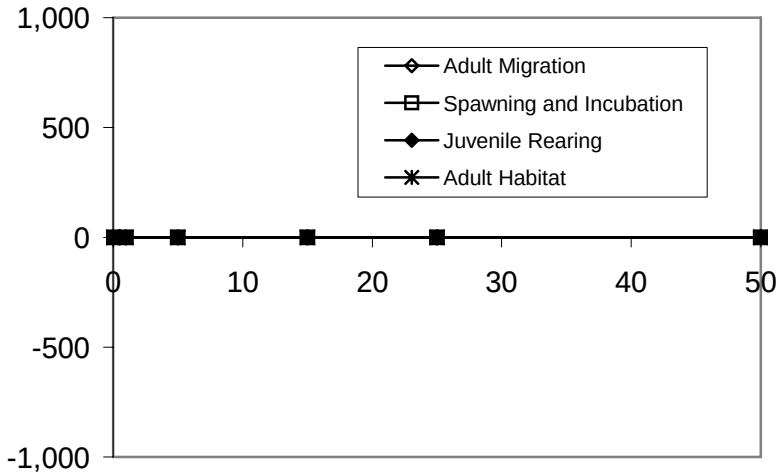
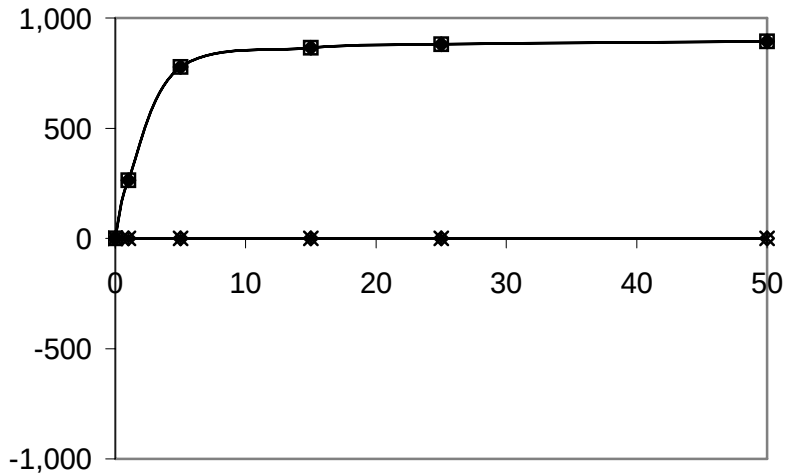


Figure 79. SAM results showing cumulative bank-line weighted relative responses (feet) for Central Valley steelhead for bank repair sites within Region 1b (8 sites).

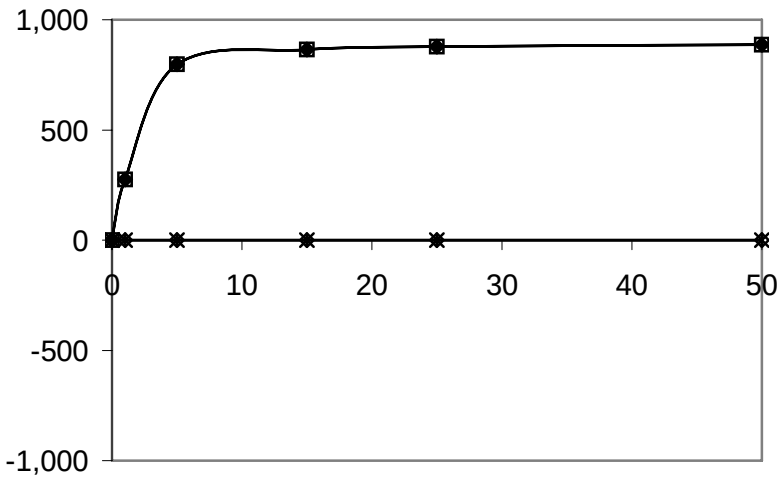
FALL



WINTER



SPRING



SUMMER

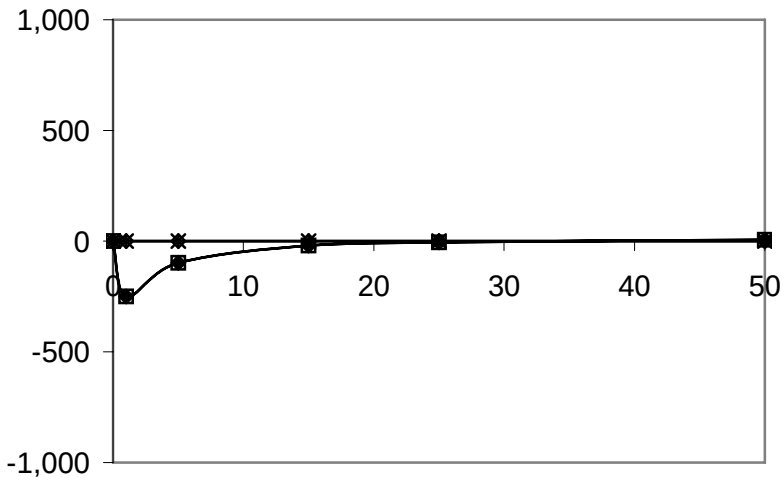
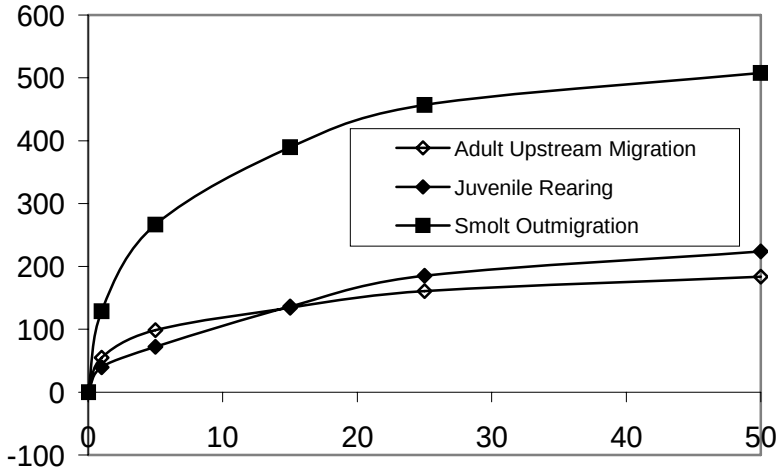
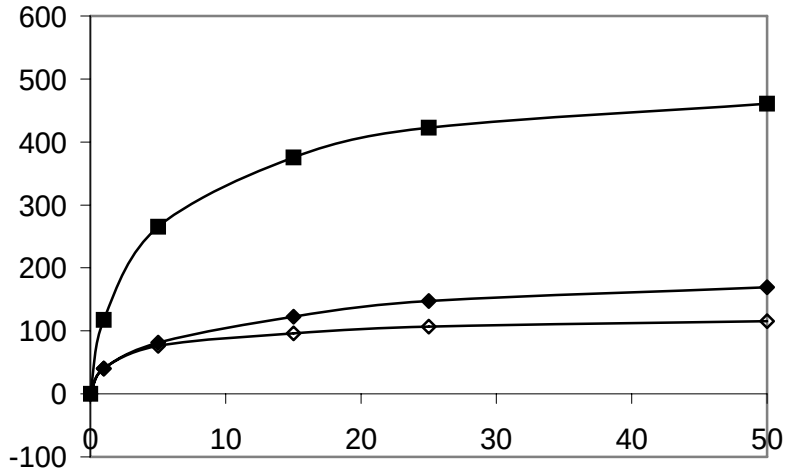


Figure 80. SAM results showing cumulative bank-line weighted relative responses (feet) for delta smelt for bank repair sites within Region 1b (8 sites).

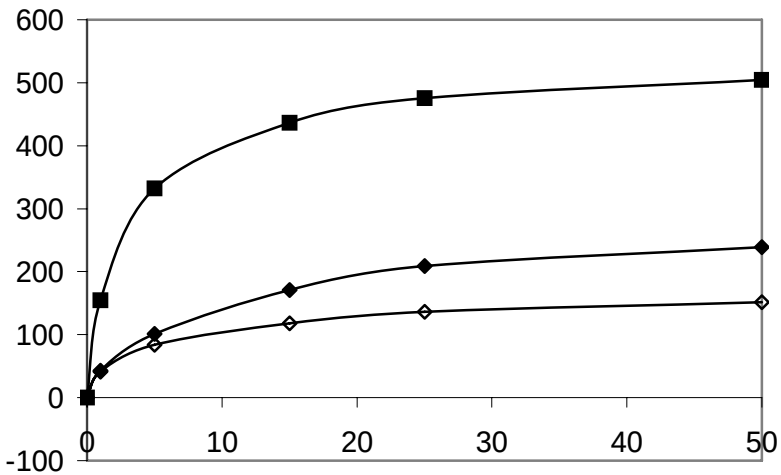
FALL



WINTER



SPRING



SUMMER

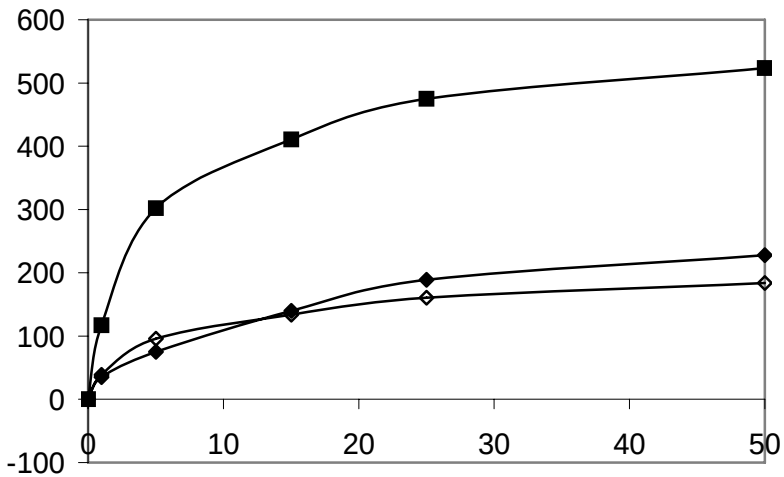
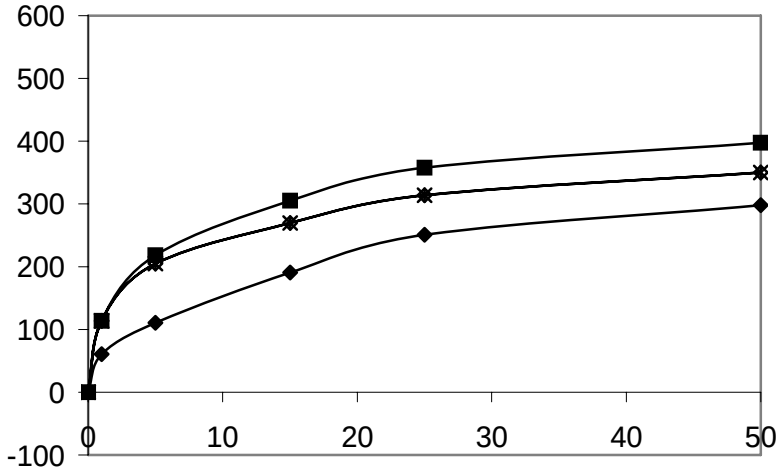
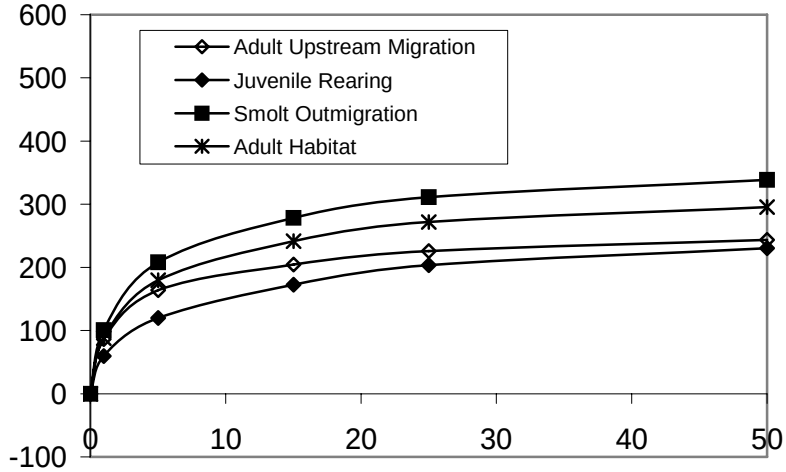


Figure 81. SAM results showing cumulative bank-line weighted relative responses (feet) for Chinook salmon (Winter-run shown) for bank repair sites within Region 2 (Feather River RM 28.5R).

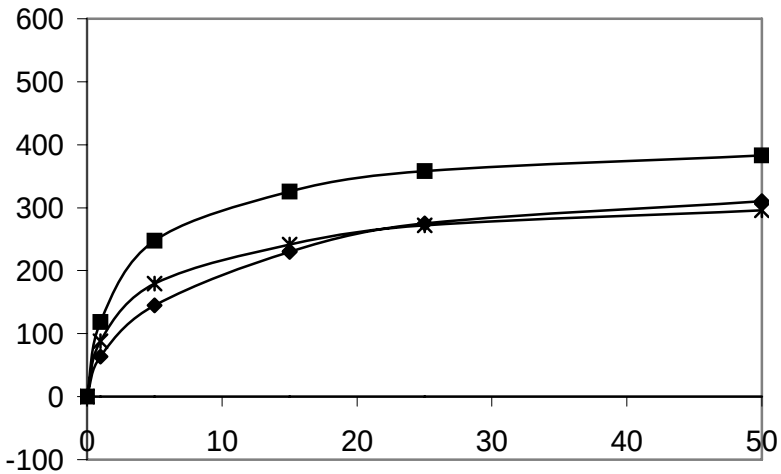
FALL



WINTER



SPRING



SUMMER

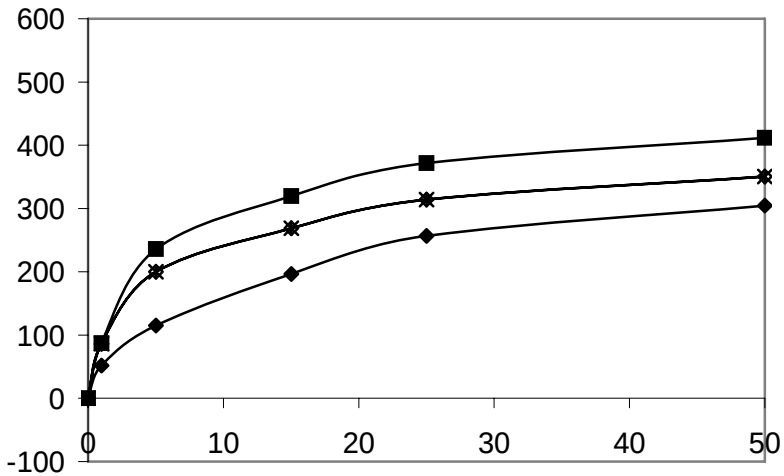
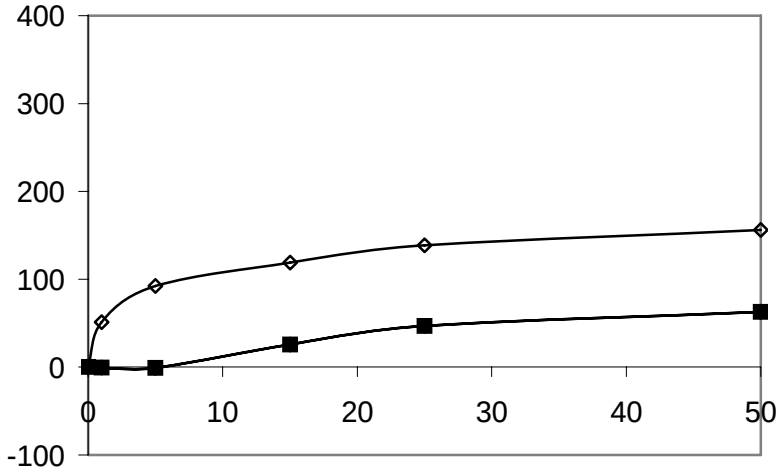
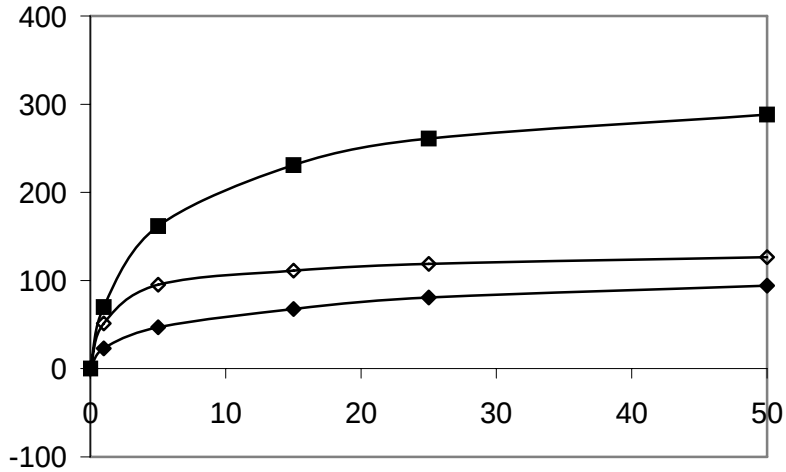


Figure 82. SAM results showing cumulative bank-line weighted relative responses (feet) for Central Valley steelhead for bank repair sites within Region 2 (Feather River RM 28.5R).

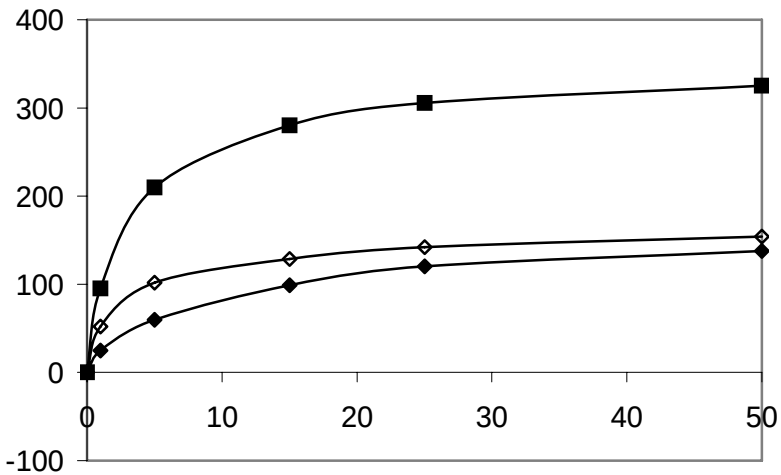
FALL



WINTER



SPRING



SUMMER

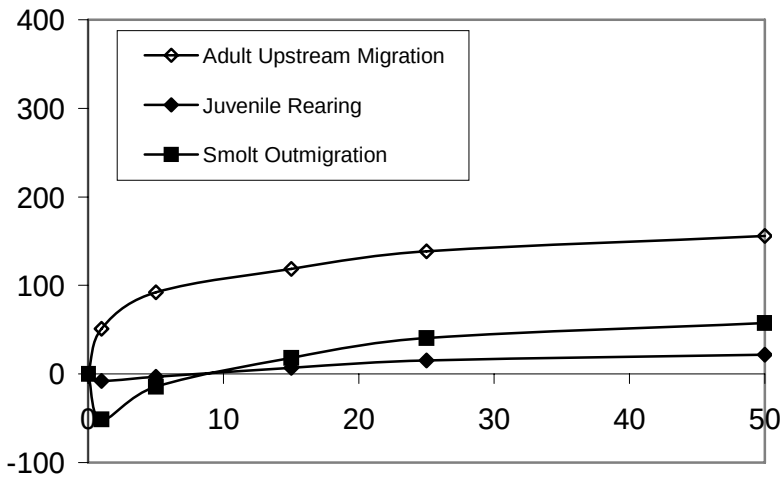
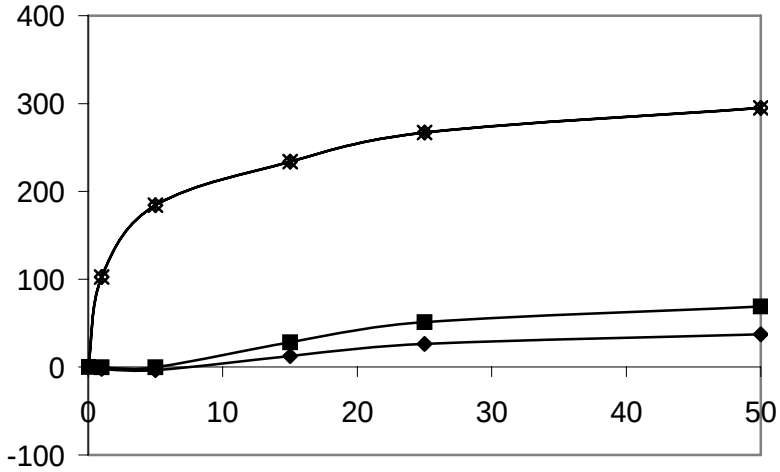
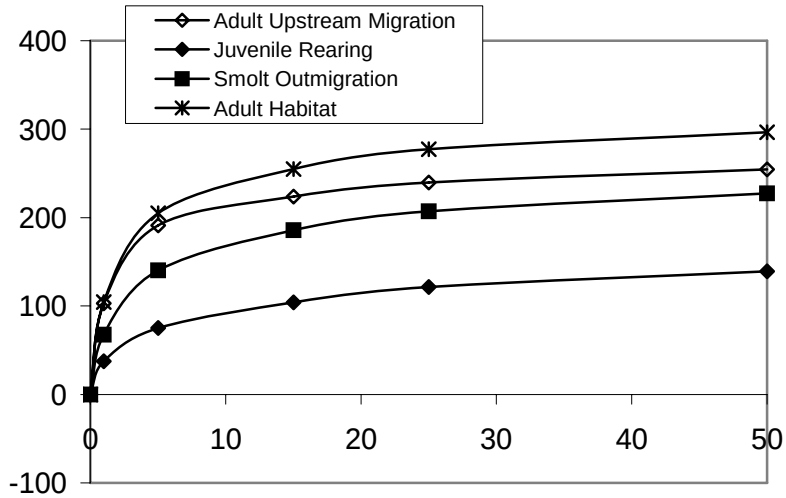


Figure 83. SAM results showing cumulative bank-line weighted relative responses (feet) for Chinook salmon (Winter-run shown) for bank repair sites within Region 3 (Sacramento River RM 177.8R).

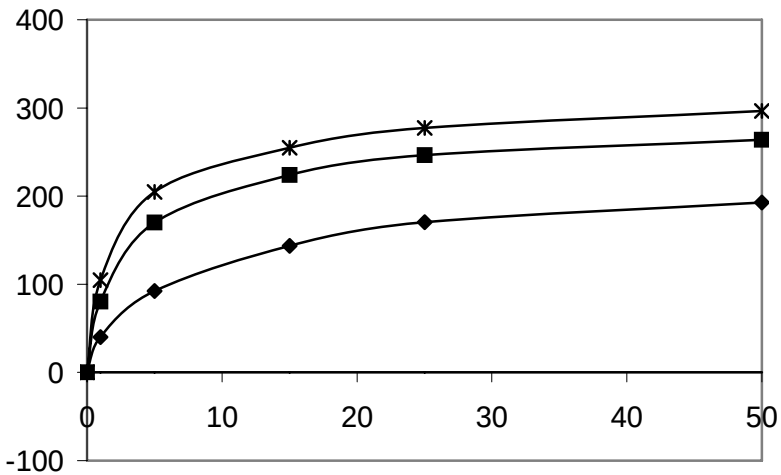
FALL



WINTER



SPRING



SUMMER

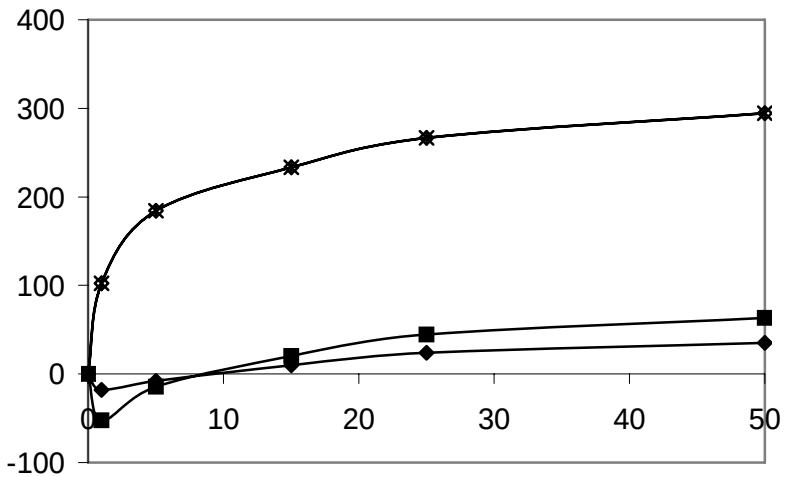
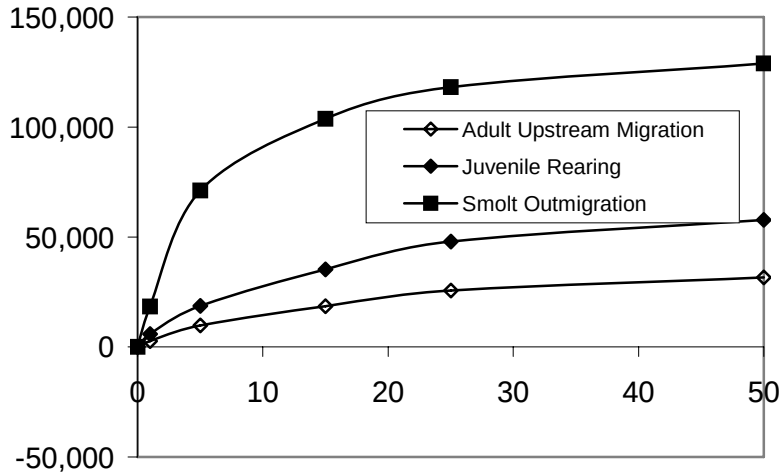
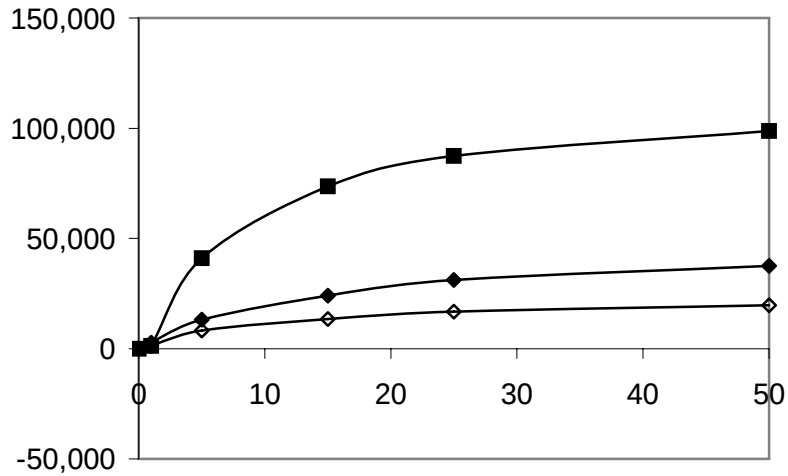


Figure 84. SAM results showing cumulative bank-line weighted relative responses (feet) for Central Valley steelhead for bank repair sites within Region 3 (Sacramento River RM 177.8R).

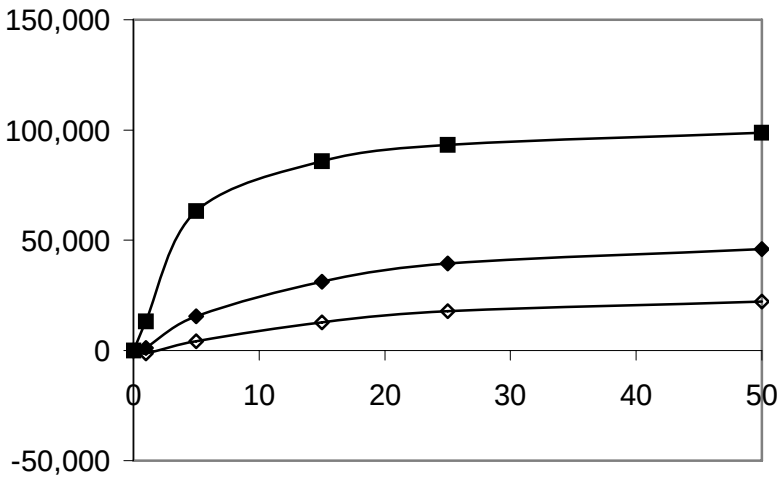
FALL



WINTER



SPRING



SUMMER

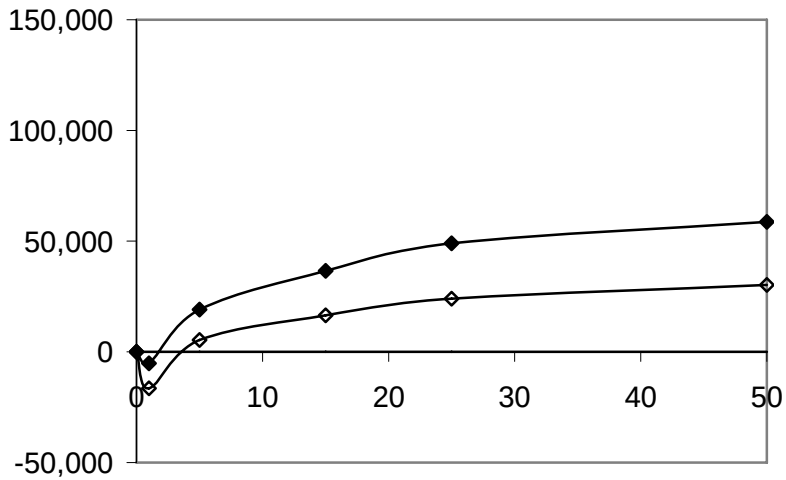
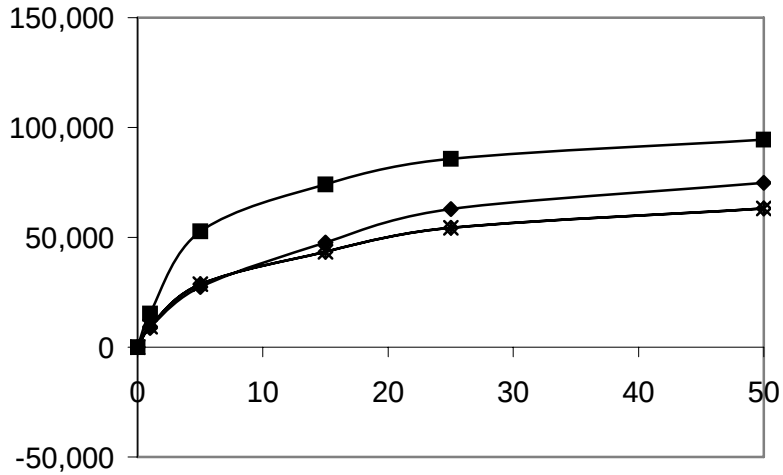
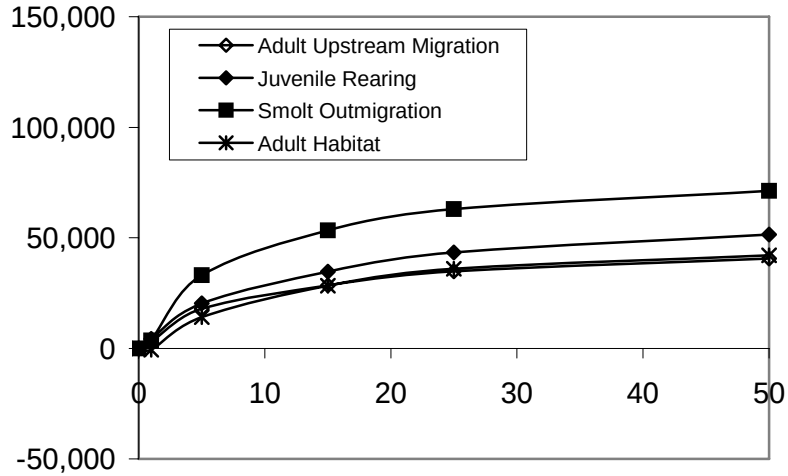


Figure 85. SAM results showing cumulative wetted-area weighted relative responses (square feet) for Chinook salmon (Winter-run shown) for bank repair sites within Region 1a (3 sites).

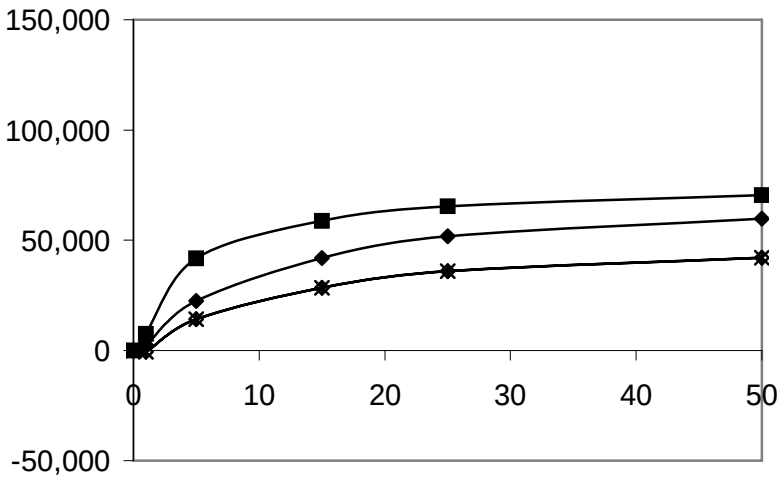
FALL



WINTER



SPRING



SUMMER

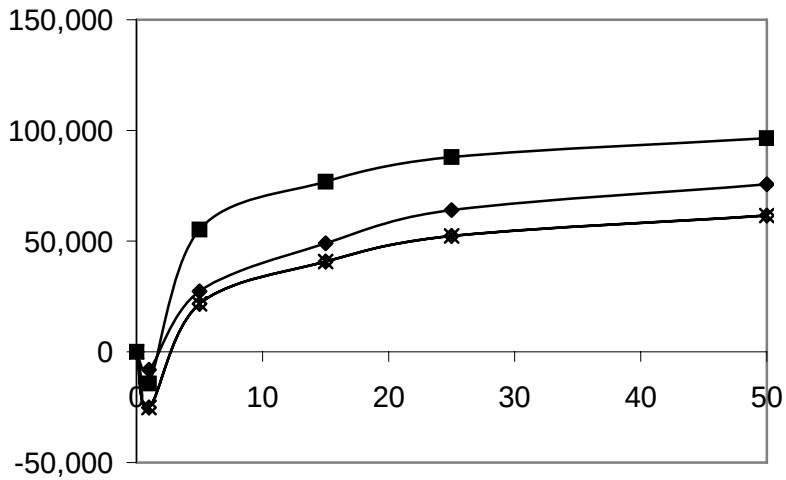
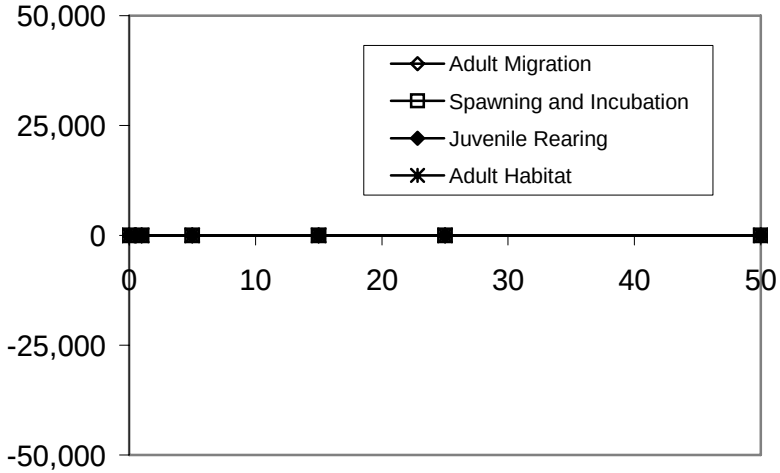
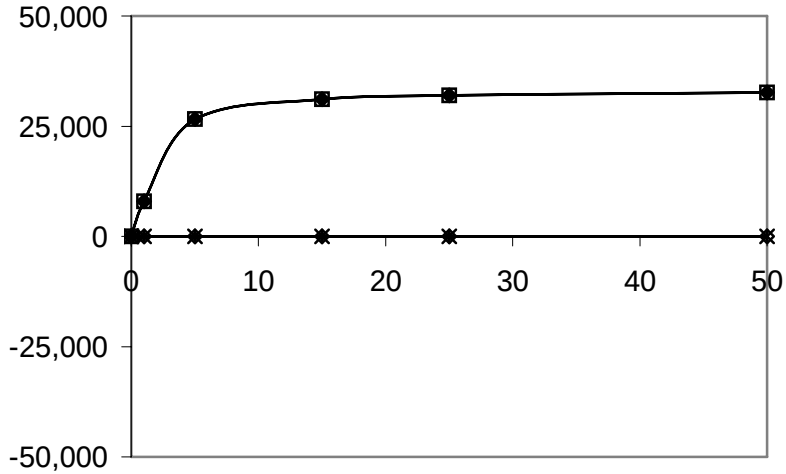


Figure 86. SAM results showing cumulative wetted-area weighted relative responses (square feet) for Central Valley steelhead for bank repair sites within Region 1a (3 sites).

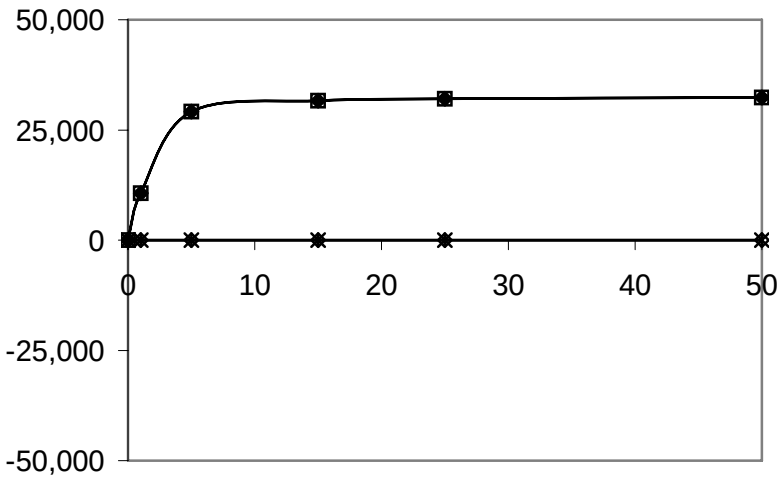
FALL



WINTER



SPRING



SUMMER

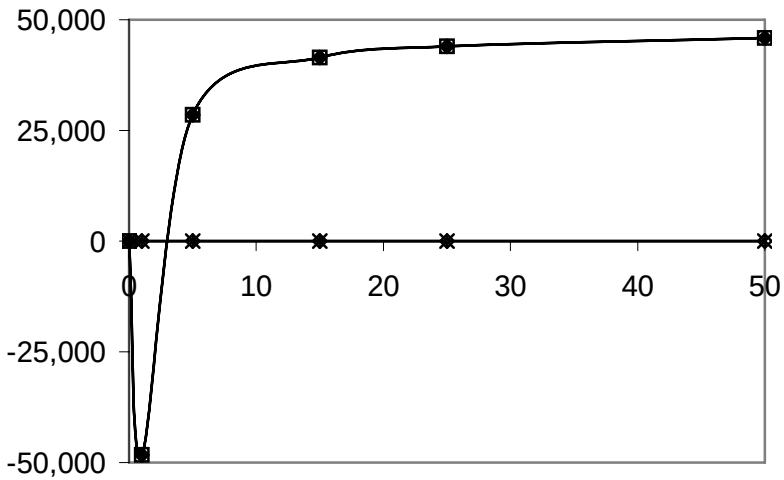
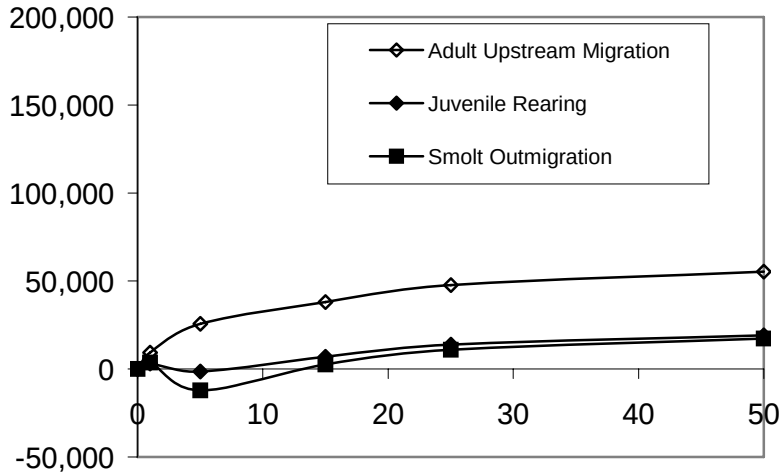
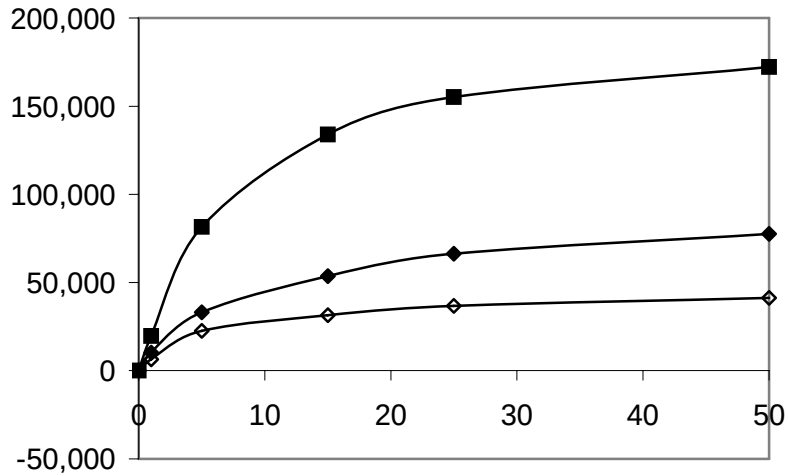


Figure 87. SAM results showing cumulative wetted-area weighted relative responses (square feet) for delta smelt for bank repair sites within Region 1a (3 sites).

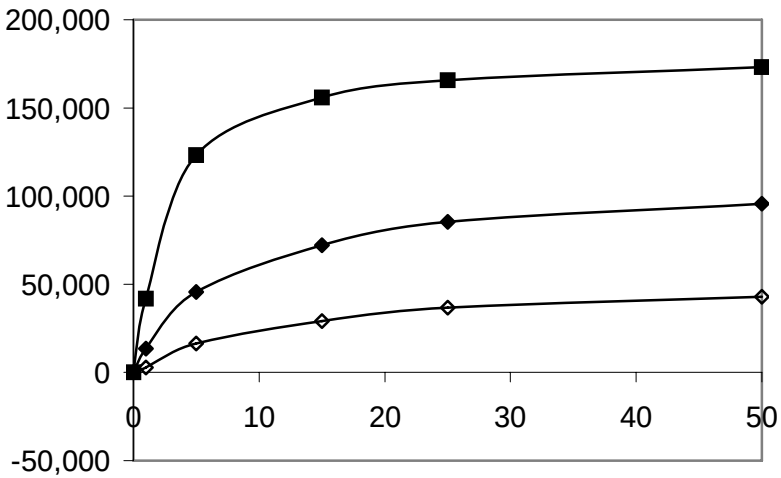
FALL



WINTER



SPRING



SUMMER

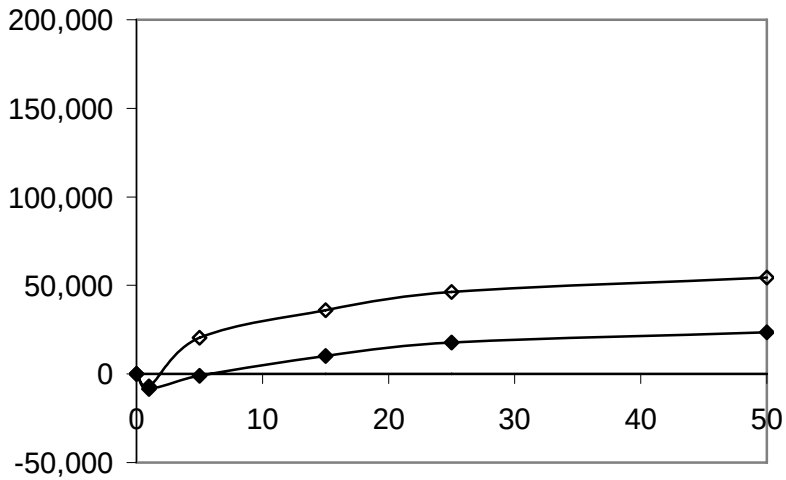
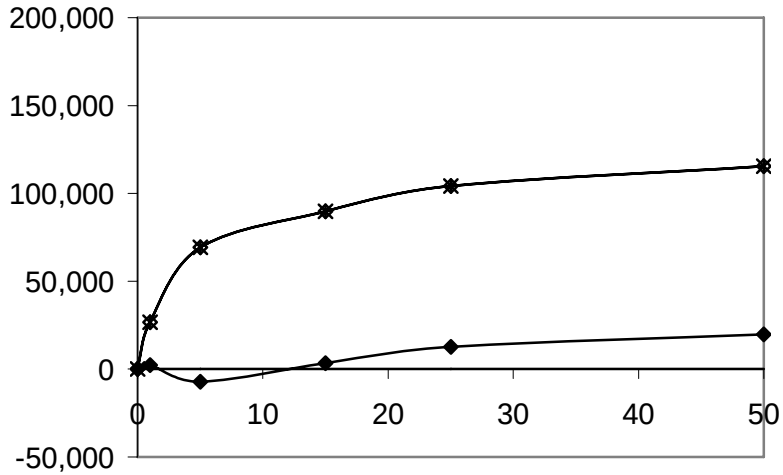
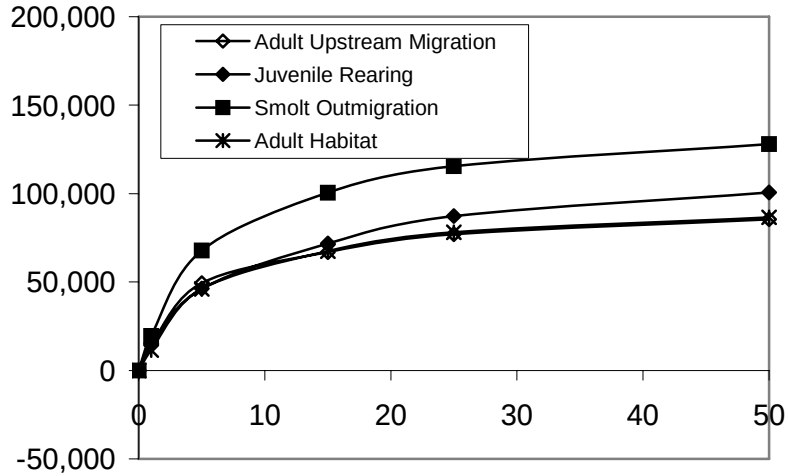


Figure 88. SAM results showing cumulative wetted-area weighted relative responses (square feet) for Chinook salmon (Winter-run shown) for bank repair sites within Region 1b (8 sites).

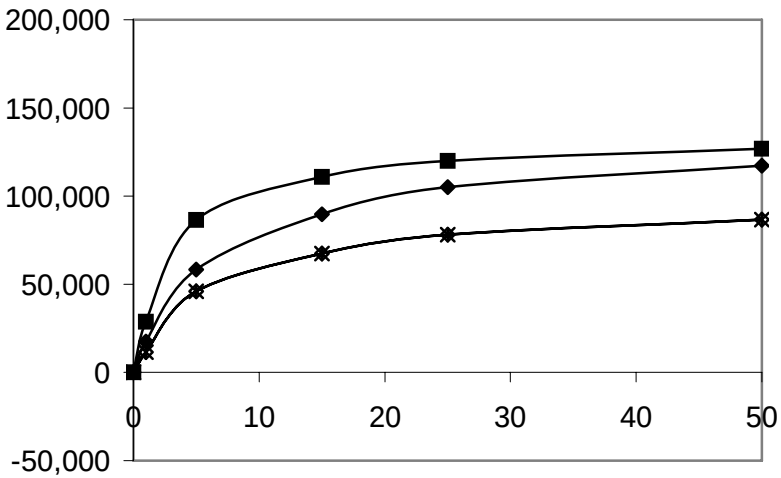
FALL



WINTER



SPRING



SUMMER

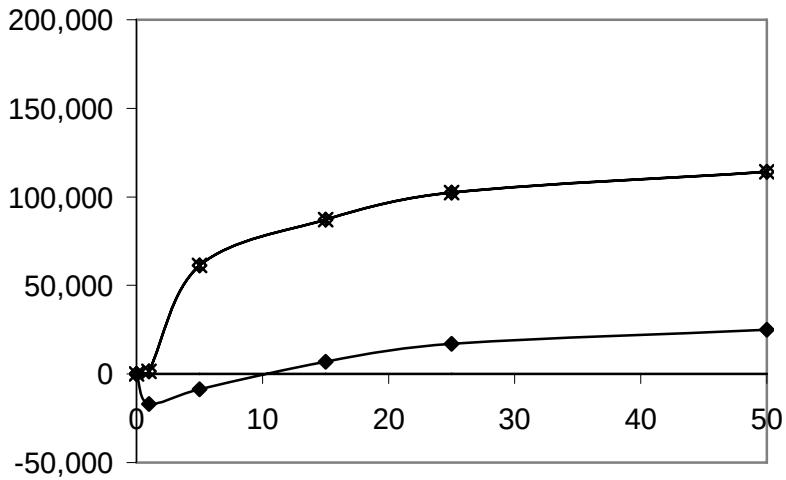
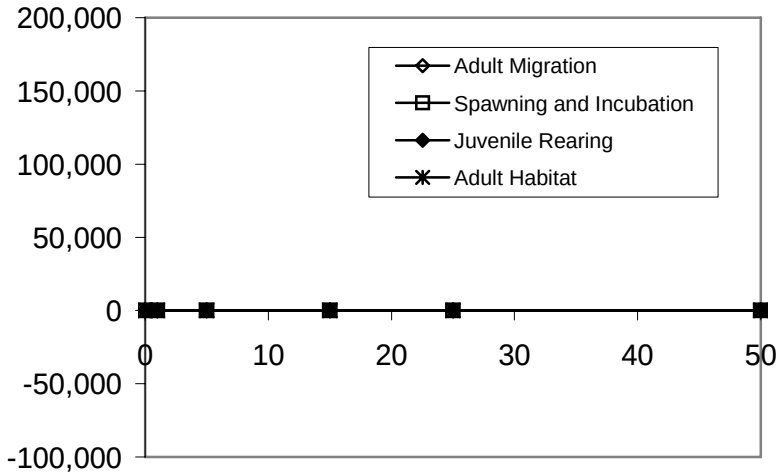
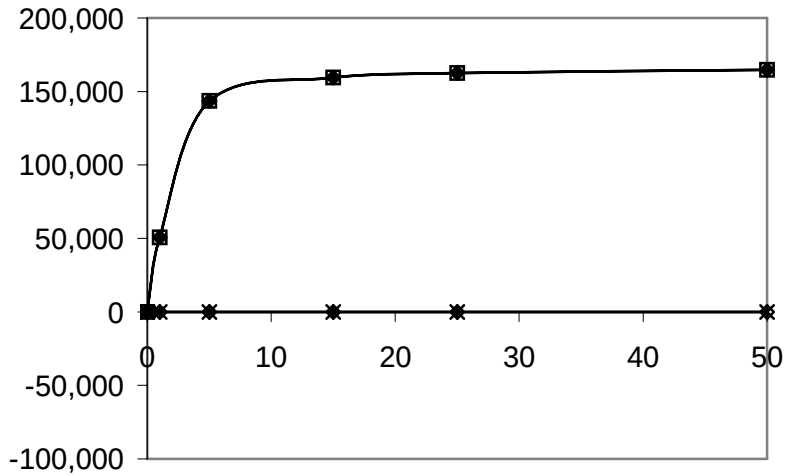


Figure 89. SAM results showing cumulative wetted-area weighted relative responses (square feet) for Central Valley steelhead for bank repair sites within Region 1b (8 sites).

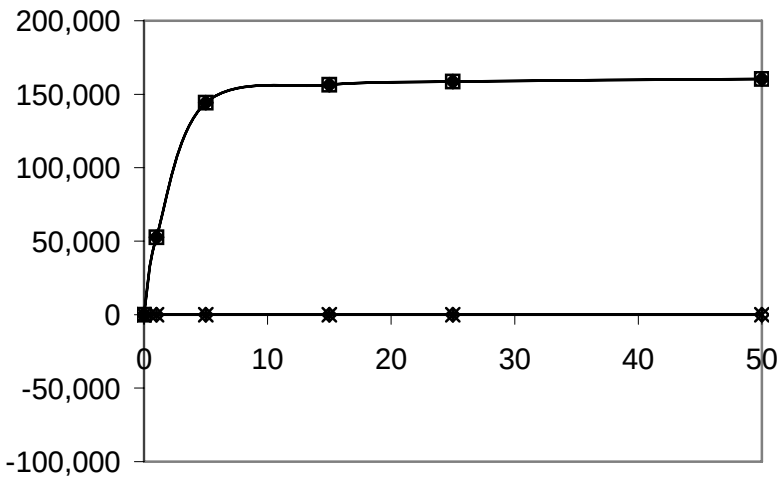
FALL



WINTER



SPRING



SUMMER

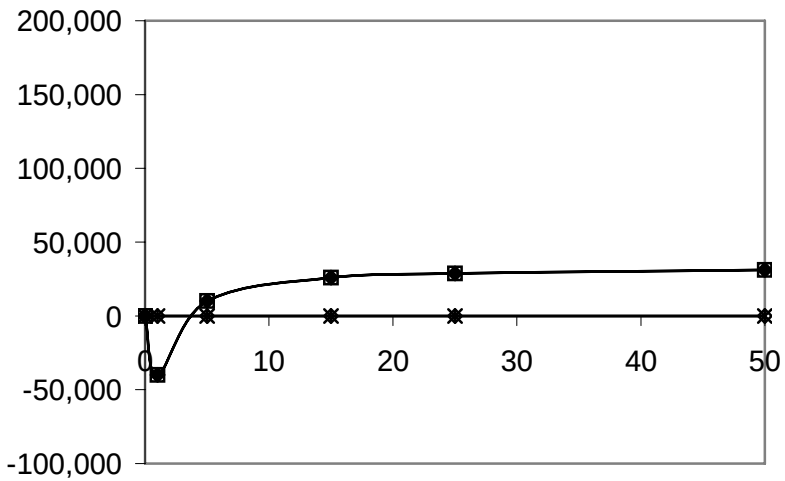
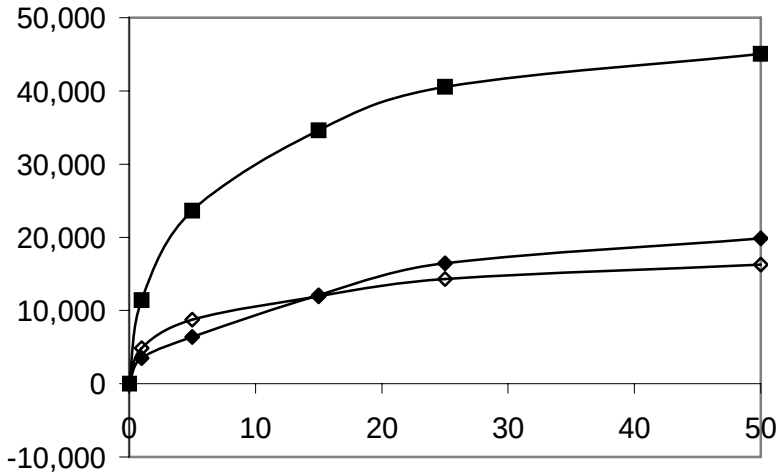
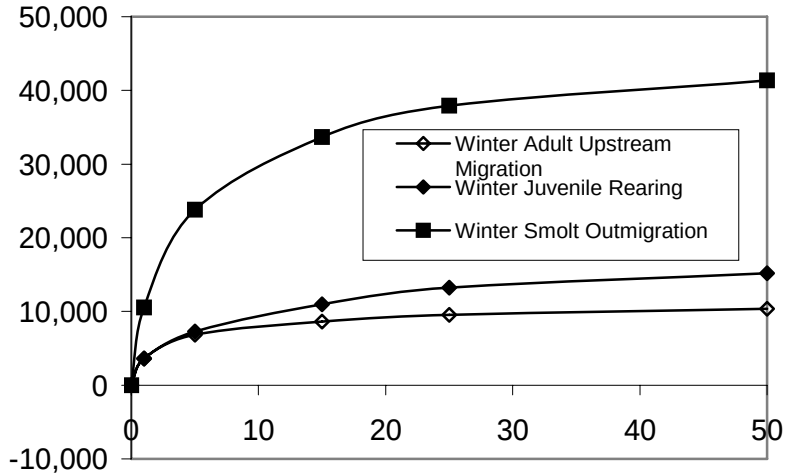


Figure 90. SAM results showing cumulative wetted-area weighted relative responses (square feet) for delta smelt for bank repair sites within Region 1b (8 sites).

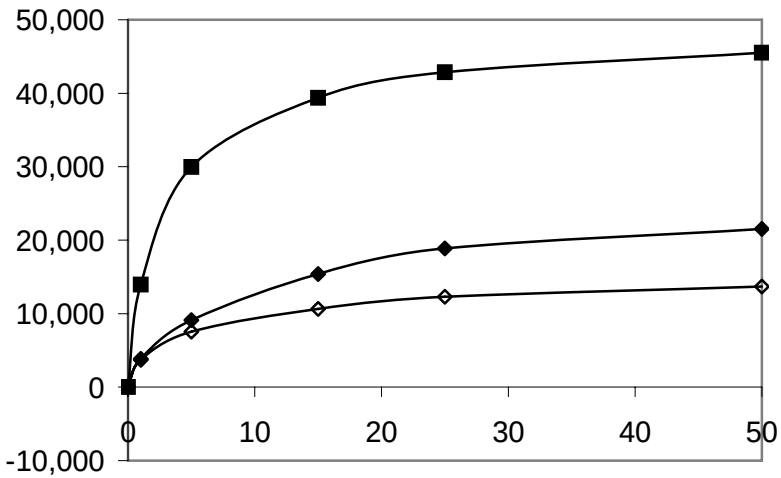
FALL



WINTER



SPRING



SUMMER

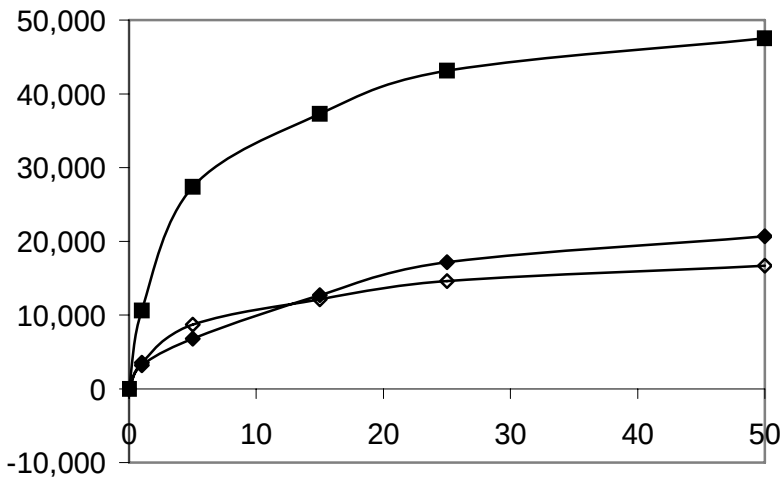
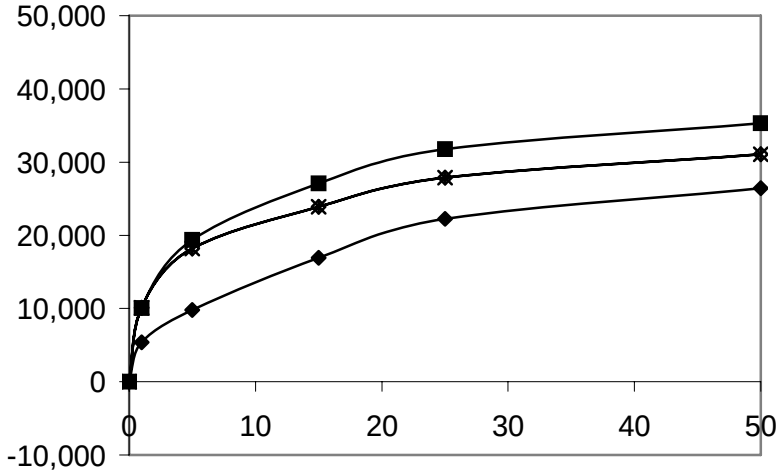
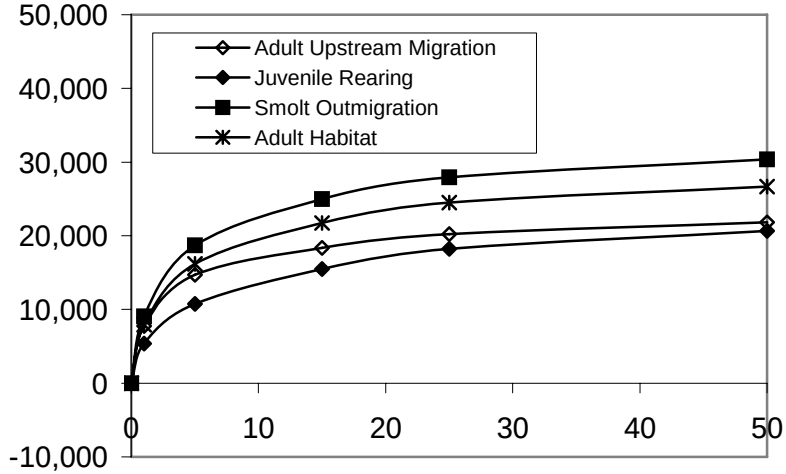


Figure 91. SAM results showing cumulative wetted-area weighted relative responses (square feet) for Chinook salmon (Winter-run shown) for bank repair sites within Region 2 (Feather River RM 28.5R).

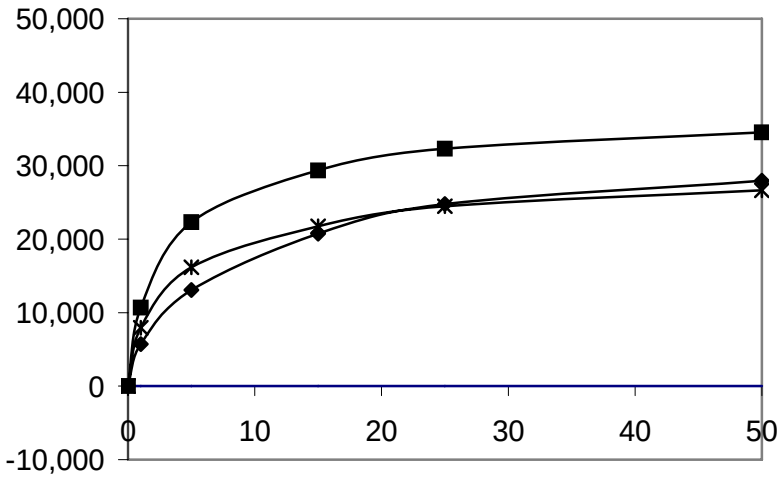
FALL



WINTER



SPRING



SUMMER

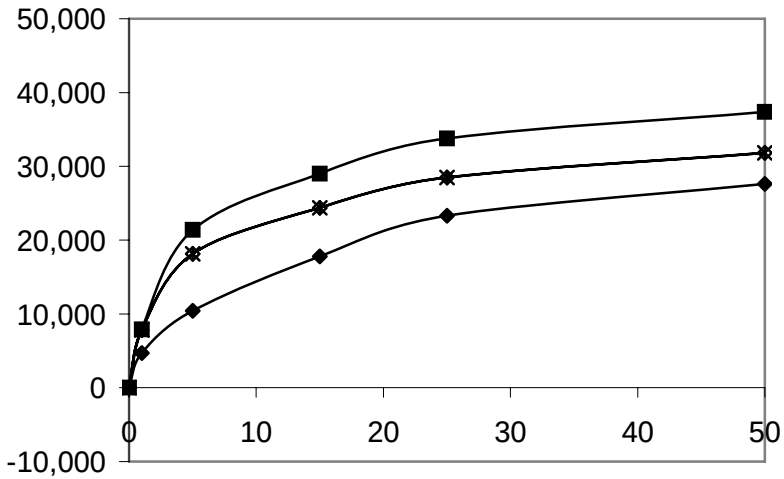


Figure 92. SAM results showing cumulative wetted-area weighted relative responses (square feet) for Central Valley steelhead for bank repair sites within Region 2 (Feather River RM 28.5R).

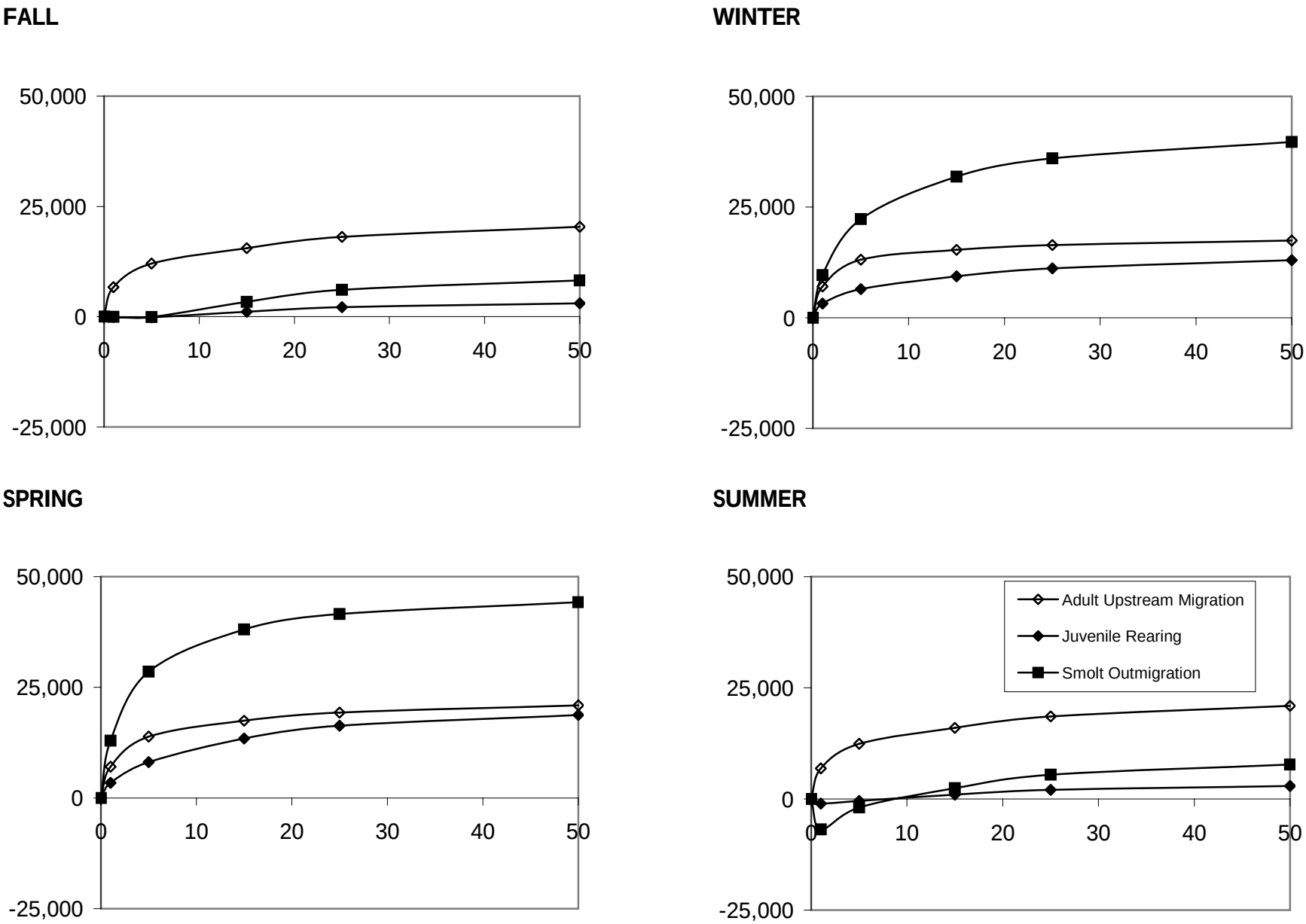
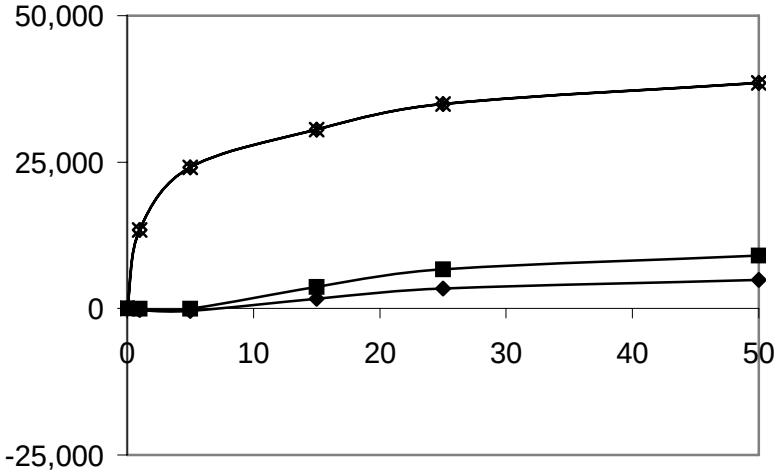
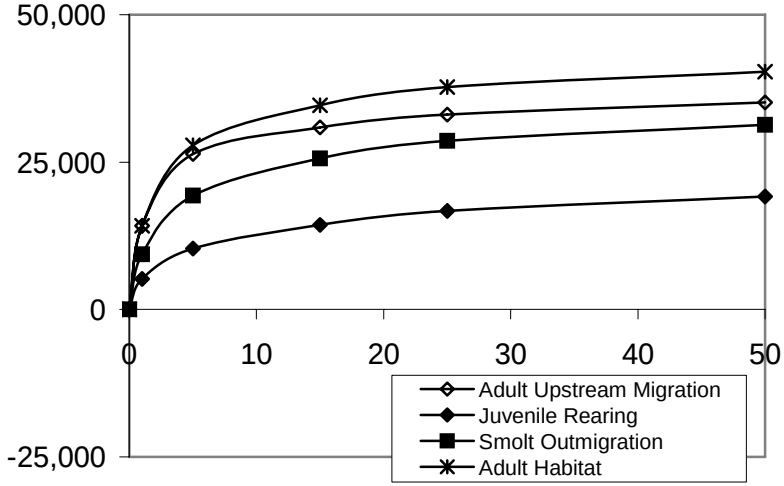


Figure 93. SAM results showing cumulative wetted-area weighted relative responses (square feet) for Chinook salmon (Winter-run shown) for bank repair sites within Region 3 (Sacramento River RM 177.8R).

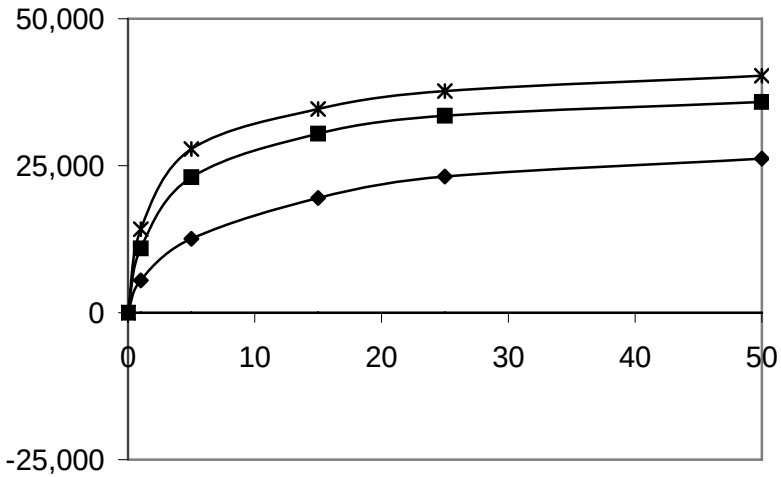
FALL



WINTER



SPRING



SUMMER

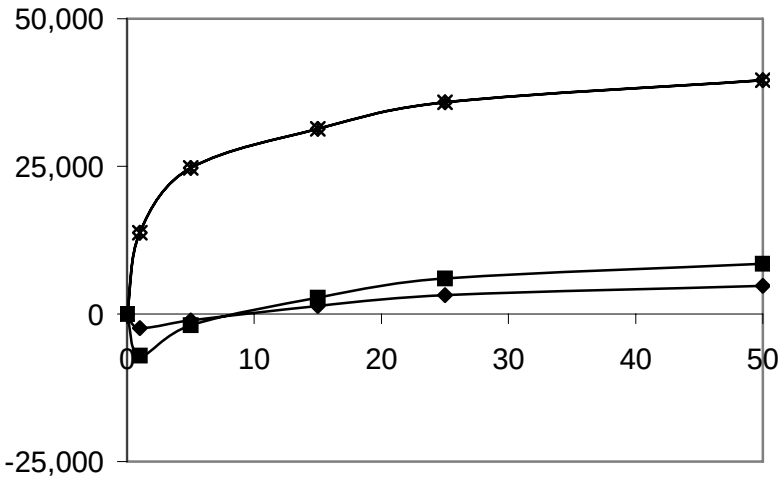
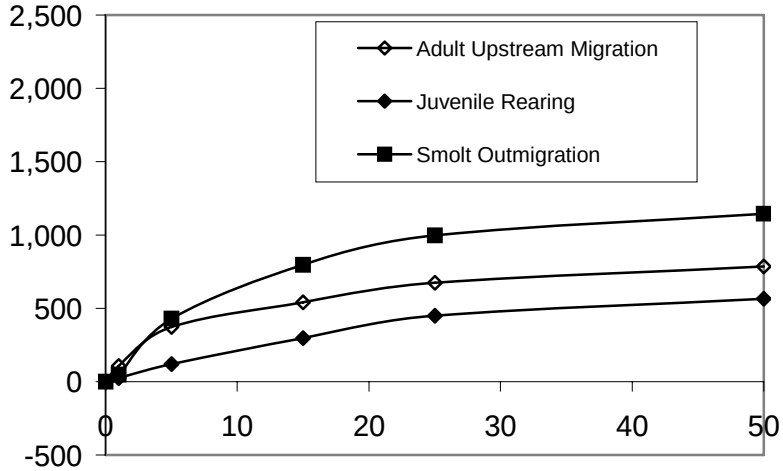
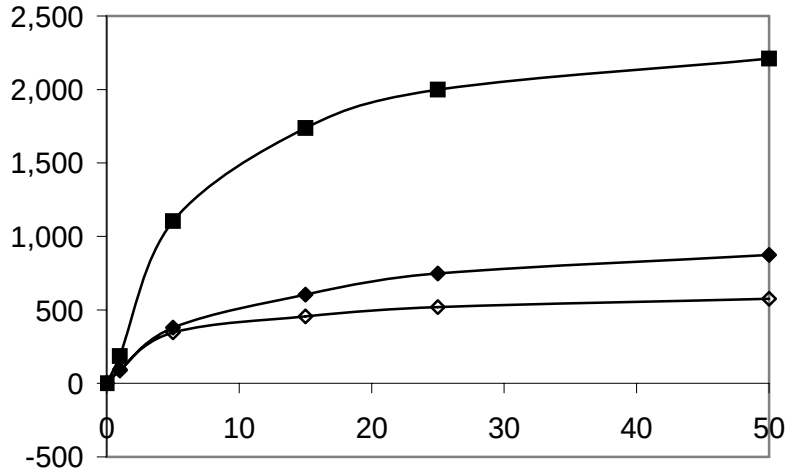


Figure 94. SAM results showing cumulative wetted-area weighted relative responses (square feet) for Central Valley steelhead for bank repair sites within Region 3 (Sacramento River RM 177.8R).

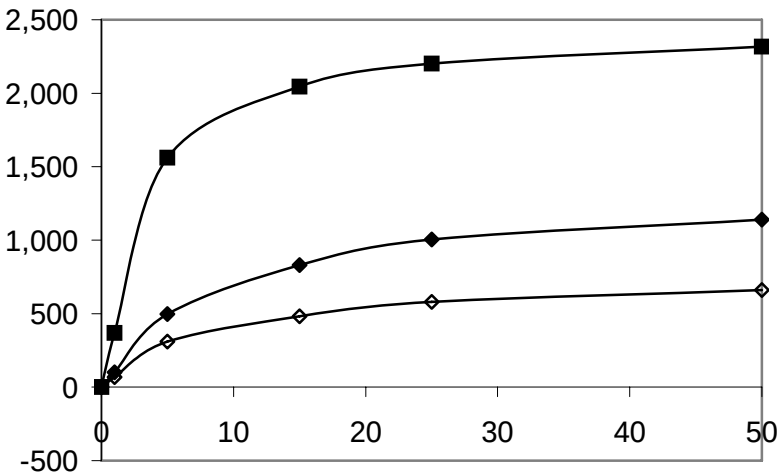
FALL



WINTER



SPRING



SUMMER

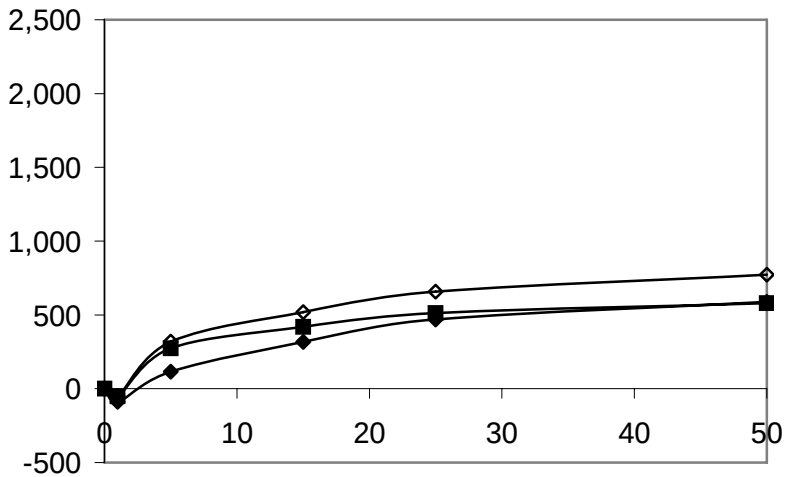
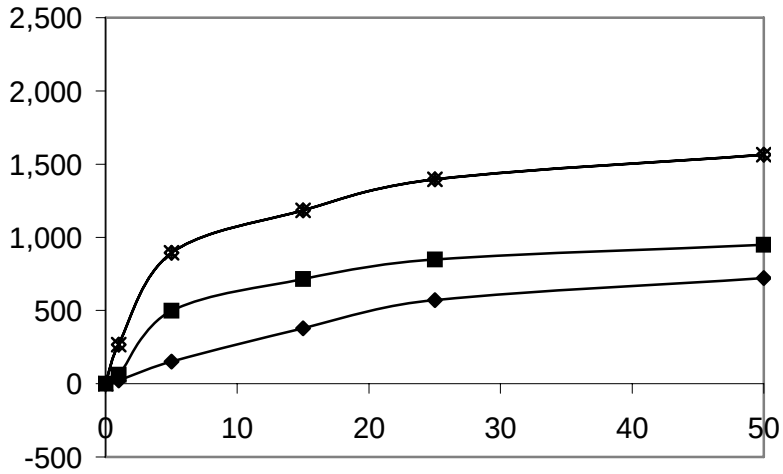
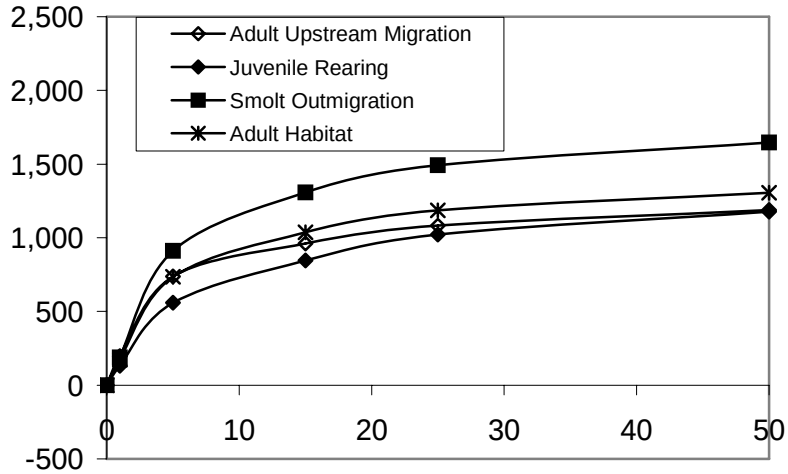


Figure 95. SAM results showing cumulative bank-line weighted relative responses (feet) for Chinook salmon (Winter-run shown) for all 13 bank repair sites

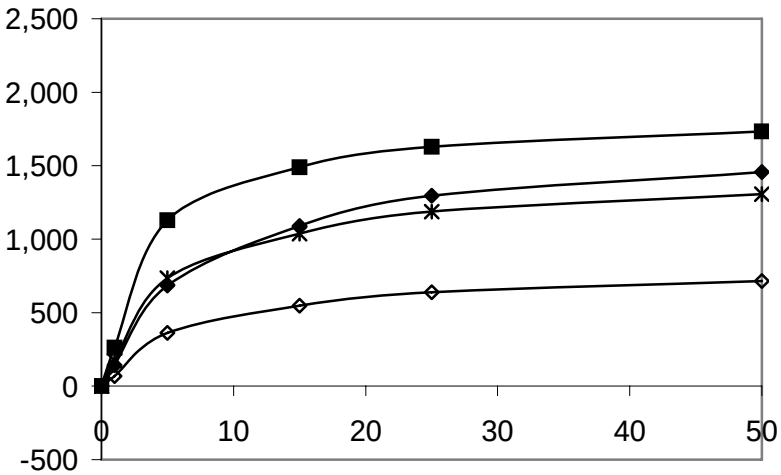
FALL



WINTER



SPRING



SUMMER

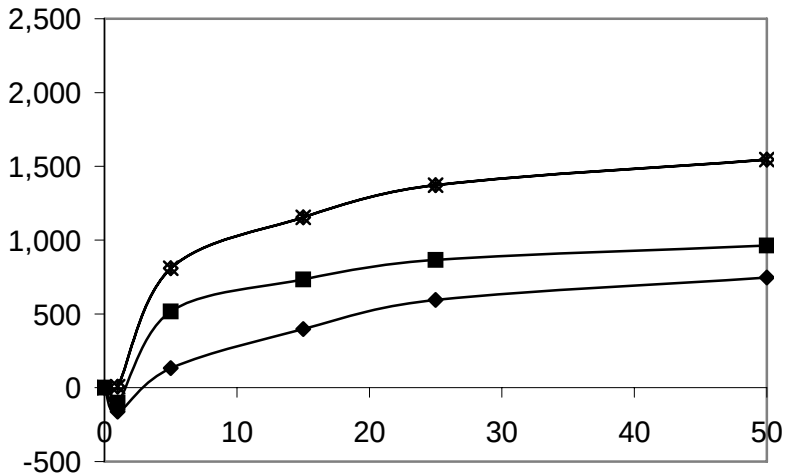
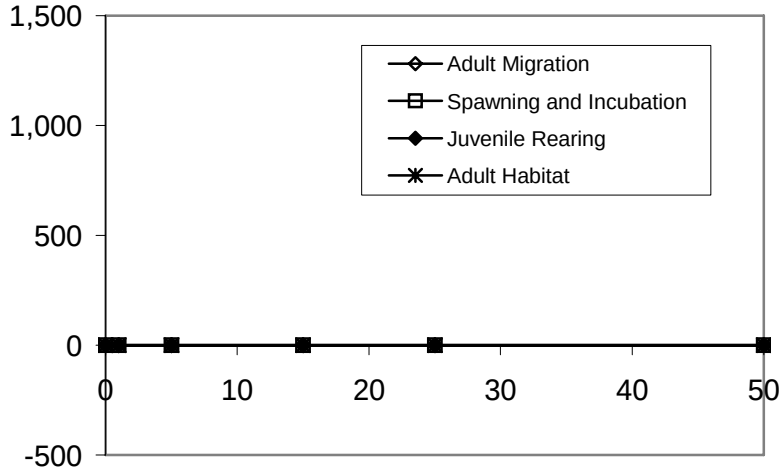
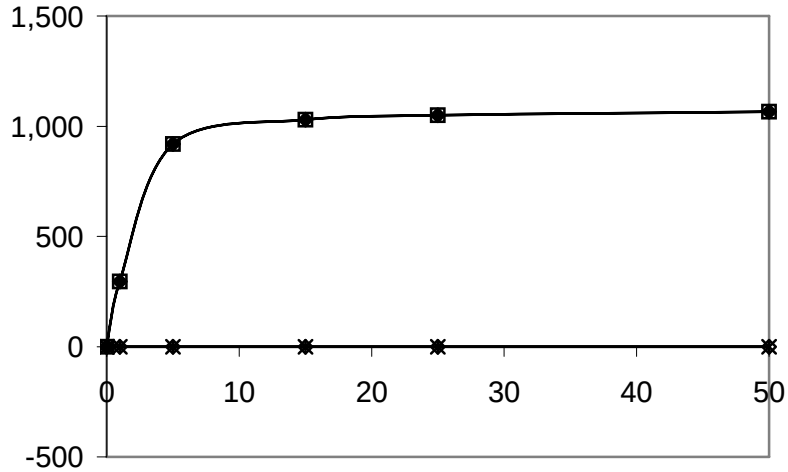


Figure 96. SAM results showing cumulative bank-line weighted relative responses (feet) for Central Valley steelhead for all 13 bank repair sites

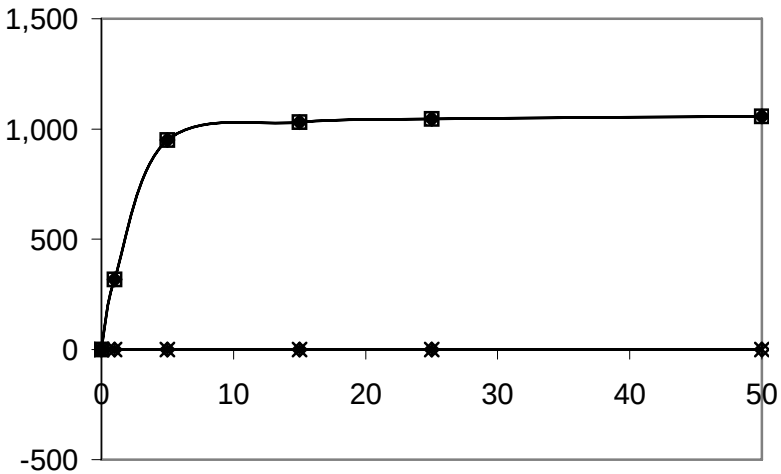
FALL



WINTER



SPRING



SUMMER

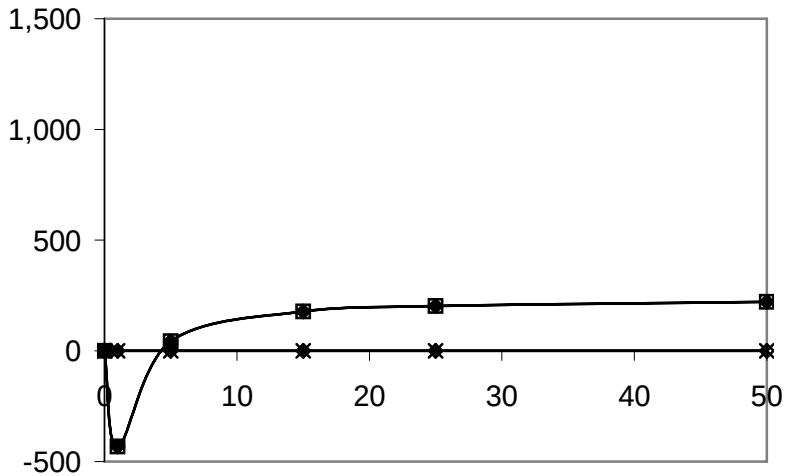
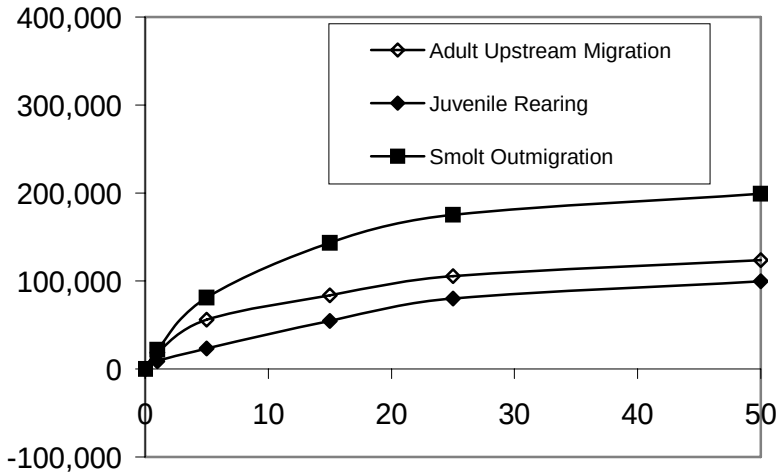
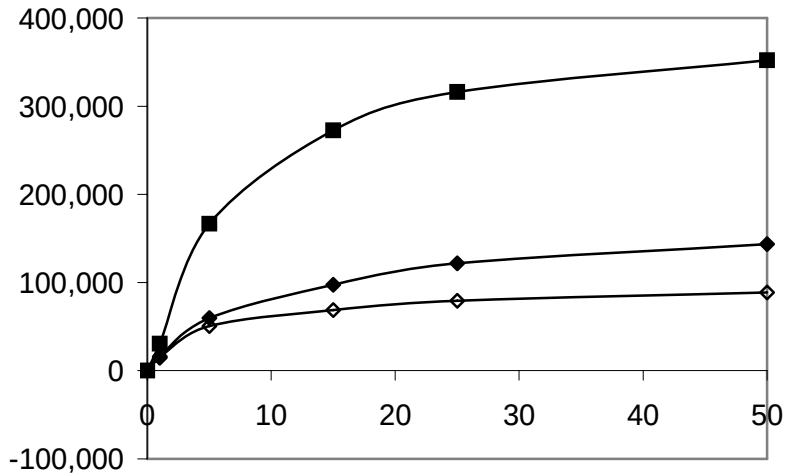


Figure 97. SAM results showing cumulative bank-line weighted relative responses (feet) for delta smelt for 11 bank repair sites

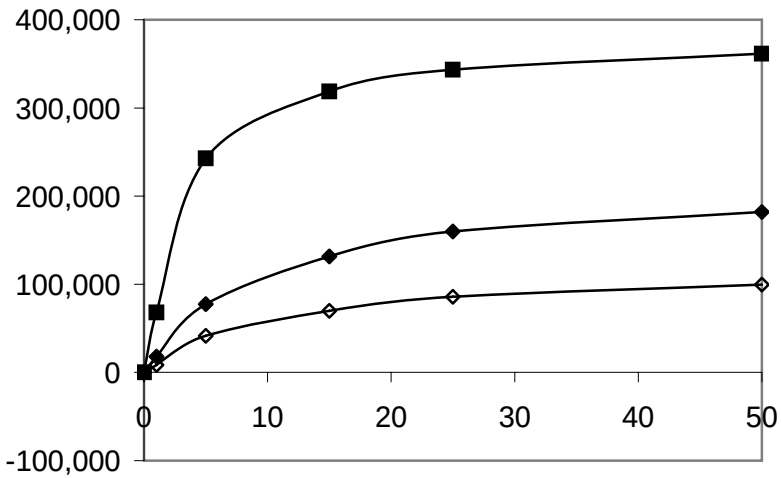
FALL



WINTER



SPRING



SUMMER

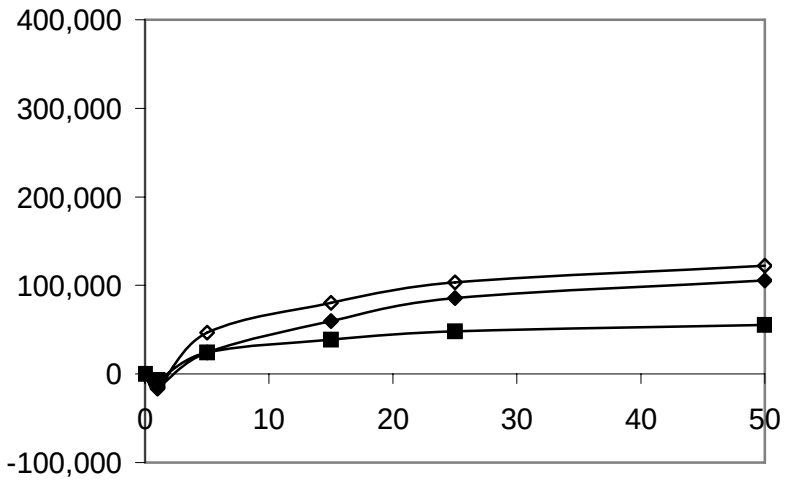
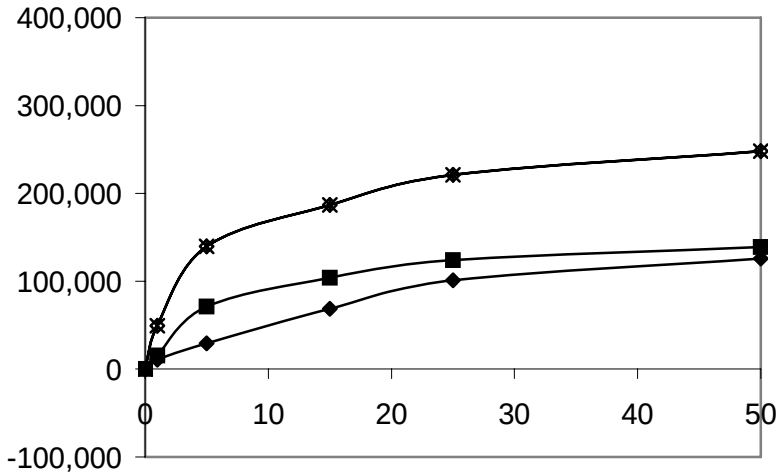
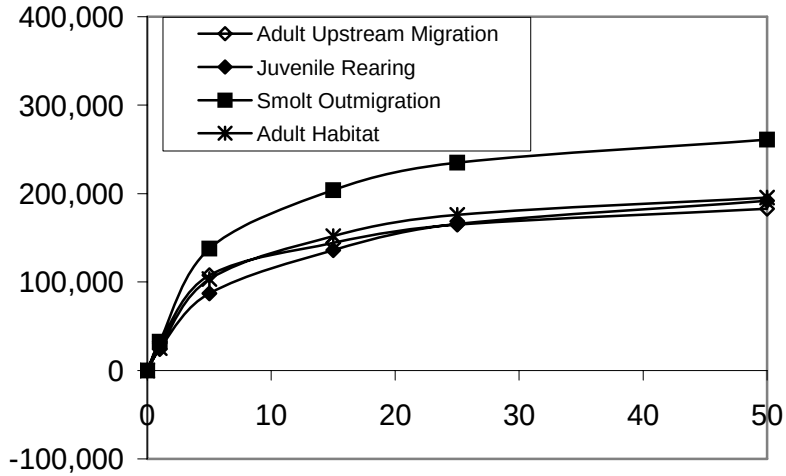


Figure 98. SAM results showing cumulative wetted-area weighted relative responses (square feet) for Chinook salmon (Winter-run shown) for all 13 bank repair sites.

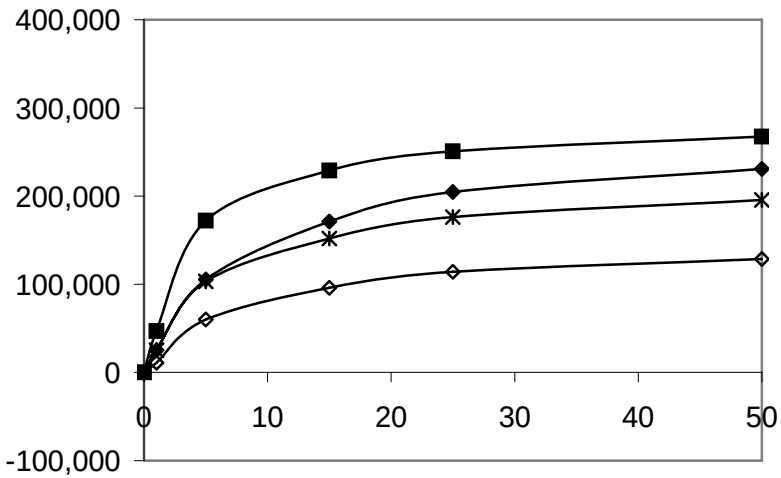
FALL



WINTER



SPRING



SUMMER

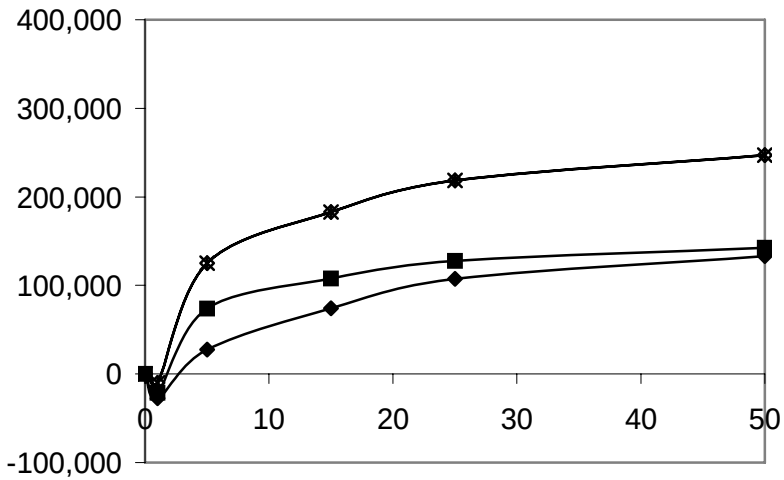
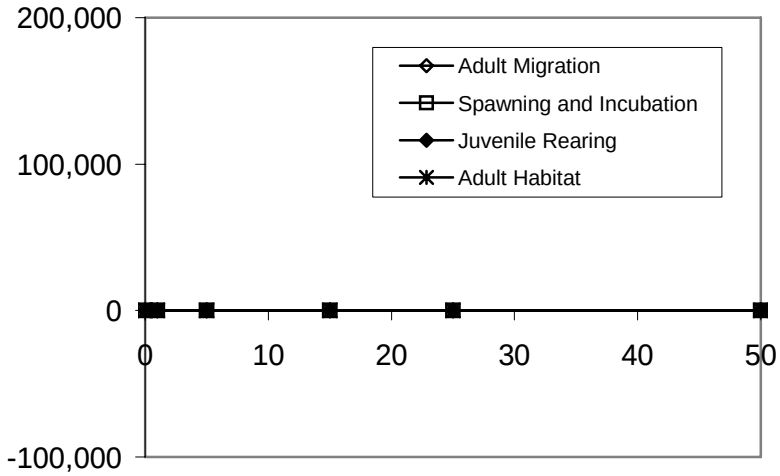
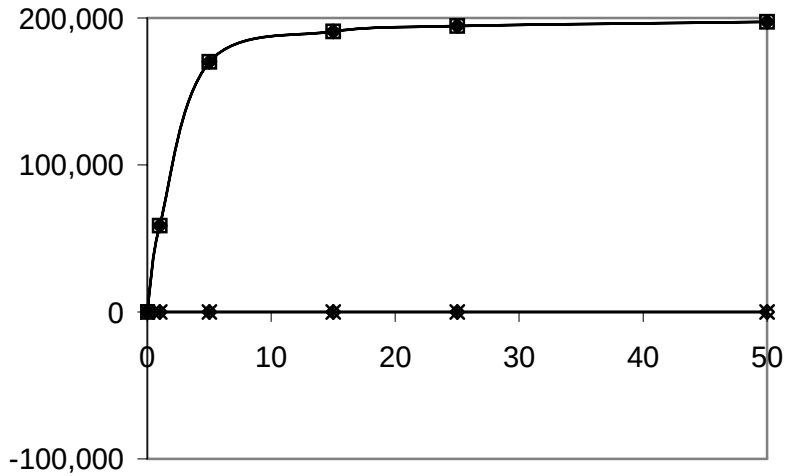


Figure 99. SAM results showing cumulative wetted-area weighted relative responses (square feet) for Central Valley steelhead for all 13 bank repair sites.

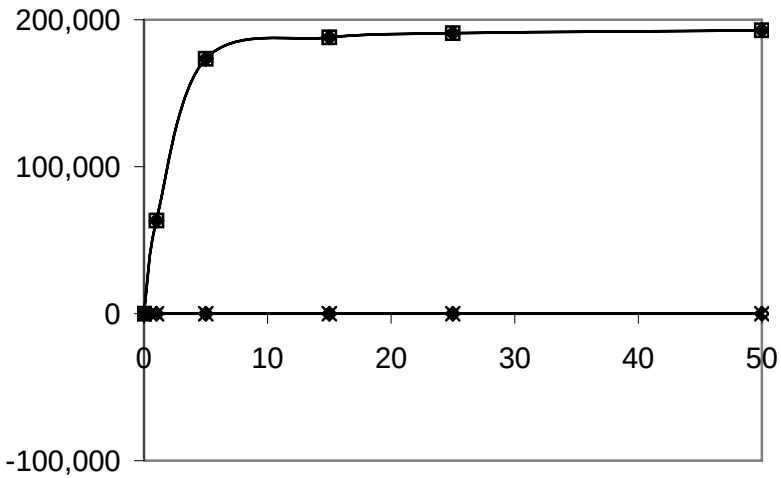
FALL



WINTER



SPRING



SUMMER

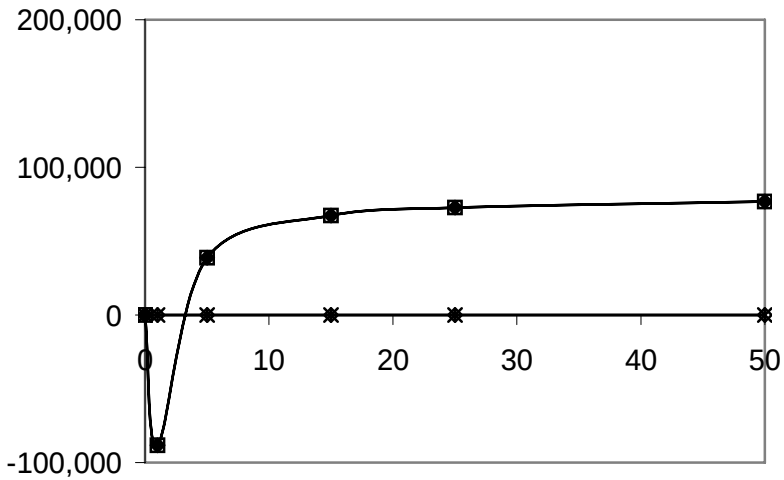


Figure 100. SAM results showing cumulative wetted-area weighted relative responses (square feet) for delta smelt for 11 bank repair sites.