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Lower Columbia River juvenile chum salmon monitoring: abundance estimates for chum, Chinook, coho, and steelhead

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Lower Columbia River Juvenile Chum Salmon Monitoring: Abundance Estimates for Chum, Chinook, Coho, and Steelhead

Grays River (2008 – 2016)
Crazy Johnson Creek (2011 – 2016)
Duncan Spawning Channel (2002 – 2016)
Hamilton Creek (2012 – 2016)
Hamilton Springs Spawning Channel (2011 – 2016)

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Executive Summary

Chum salmon (*Oncorhynchus keta*) were historically abundant throughout the lower Columbia River. However, dramatic declines in abundance during the mid-20th century and persistently low returns over several decades led to populations in the Columbia River being listed under the Endangered Species Act (ESA) in 1999. Following ESA listing, state and federal agencies began recovery efforts and the Washington Department of Fish and Wildlife (WDFW) commenced monitoring of juvenile outmigrant abundance to evaluate the effectiveness of recovery projects. Over the years, WDFW has expanded its recovery efforts and subsequently established a robust monitoring program for chum salmon in the Columbia River Evolutionarily Significant Unit focusing on the generation of viable salmon population (VSP) parameter metrics (i.e., abundance, productivity, spatial structure, and diversity). One main component of the WDFW Columbia River chum salmon VSP monitoring program is the collection of juvenile outmigrant data.

For the past 5 to 15 years, WDFW has operated juvenile monitoring traps at five separate locations: Grays River mainstem, Crazy Johnson Creek (Grays River basin), Duncan Creek spawning channel, Hamilton Creek mainstem, and Hamilton Springs spawning channel (Hamilton Creek basin). Juvenile data were collected with either a rotary screw trap (RST) or fence-panel weir. Trap sites were generally operated from late-winter and early-spring (February to March) through late spring to mid-summer (May to August). Although a portion of the collected data have previously been analyzed (i.e., chum salmon fry abundances from Duncan Creek and Hamilton Springs spawning channels), the majority had not. Therefore, the purpose of this report was to summarize the juvenile chum salmon monitoring activities in lower Columbia River since 2002, with specific focus on the generation of annual abundance estimates of juvenile outmigrants. While the emphasis of the juvenile monitoring outlined in this report was to generate unbiased and precise outmigrant estimates for chum salmon, data were collected on all species encountered. Thus, when data were available, outmigrant estimates were generated for other species, including Chinook salmon (*O. tshawytscha*), coho salmon (*O. kisutch*), and steelhead (*O. mykiss*). Abundance estimates were stratified by site, year, species, origin (natural and hatchery), life-stage (fry, parr, and transitional/smolt), and age-class (sub-yearling and yearling). Across all five monitoring sites, we monitored a total of 35 outmigrant years and generated a total of 117 outmigrant abundance estimates and their associated levels of precision.

Introduction

Historically, hundreds of thousands of chum salmon (*Oncorhynchus keta*) adults returned annually to the lower Columbia River and its tributaries (NOAA 2013). Spawning may have occurred as far upriver as the Umatilla and Walla Walla rivers, and as recently as 1942, commercial landings of nearly half a million chum salmon were recorded (Johnson et. al. 1997). However, by the mid-1950s adult returns of chum salmon had dramatically decreased, and from 1960 – 1994 annual adult return estimates in the Columbia River ranged from 1,500 - 6,000 (Johnson et. al. 1997). Much like other salmon populations throughout the Pacific Northwest, this precipitous decline in abundance was a result of anthropogenic impacts (i.e., hydropower, overharvest, and habitat degradation and loss) and climatic changes (National Research Council 1996, Ruckelshaus et al. 2002). Subsequently, Columbia River chum salmon were listed as "Threatened" under the Endangered Species Act (ESA) in 1999. All Columbia River chum salmon are considered to be part of one Evolutionarily Significant Unit (ESU), the Columbia River ESU (CR ESU). The ESU is split into three Major Population Groups (MPGs), which are also referred to as the Coast, Cascade, and Gorge strata, and consists of 17 historical Distinct Independent Populations (DIPs) of which 15 are considered extirpated or nearly so (Figure 1; LCFRB 2010, NOAA 2013).

Following ESA-listing, state and federal agencies began recovery efforts for ESA-listed chum salmon in the Columbia River. These recovery efforts primarily focused on improving freshwater habitat through restoration actions and flow agreements, reducing harvest through regulations, and increasing production through supplementation (NOAA 2013). Specifically, in the early 2000s the Washington Department of Fish and Wildlife (WDFW) and the Pacific States Marine Fisheries Commission (PSMFC) commenced a habitat restoration and supplementation project using funds from the Bonneville Power Administration (BPA) aimed at reestablishing chum salmon in Duncan Creek, a tributary in the Gorge strata. In an effort to evaluate the effectiveness of this recovery project, WDFW and PSMFC began monitoring the abundance of juvenile chum salmon outmigrants from Duncan Creek (Hillson 2002, 2003). In the following decade, WDFW has expanded its recovery efforts and subsequently established a robust monitoring program for chum salmon in the CR ESU. The focus of this monitoring program has been on collecting data that allow for viable salmon population (VSP) parameters (abundance, productivity, spatial structure, and diversity) to be evaluated (McElhany et al. 2000). Therefore, one main component of the CR ESU chum salmon monitoring program is the collection of juvenile outmigrant data.

Over the past 15 years, WDFW has established a network of monitoring locations that are primarily focused on outmigrating juvenile chum salmon in the CR ESU. The goal of these monitoring activities is to collect biological data that can be used for estimating demographic parameters (e.g., survival, abundance), determining the conservation status and trend of populations, as well as continuing to evaluate the effectiveness of ongoing recovery actions. It is recommended that estimates of juvenile outmigrants be obtained from at least one DIP within each MPG of an ESU (McElhany et al. 2003, Crawford and Rumsey 2011). However, given the imperiled status and small number of extant populations of Columbia River chum, WDFW currently monitors juvenile chum salmon outmigrants at five separate locations, within two DIPs, which are located in two of the three CR ESU MPGs (Figure 1). Specifically, juvenile chum salmon are monitored at two locations within the Grays River (Coast MPG), at one location in

Duncan Creek (Gorge MPG), and two locations in Hamilton Creek (Gorge MPG). Currently, estimates of chum salmon juvenile outmigrants are not available for any populations in the Cascade MPG due to low abundance in tributaries of this strata.

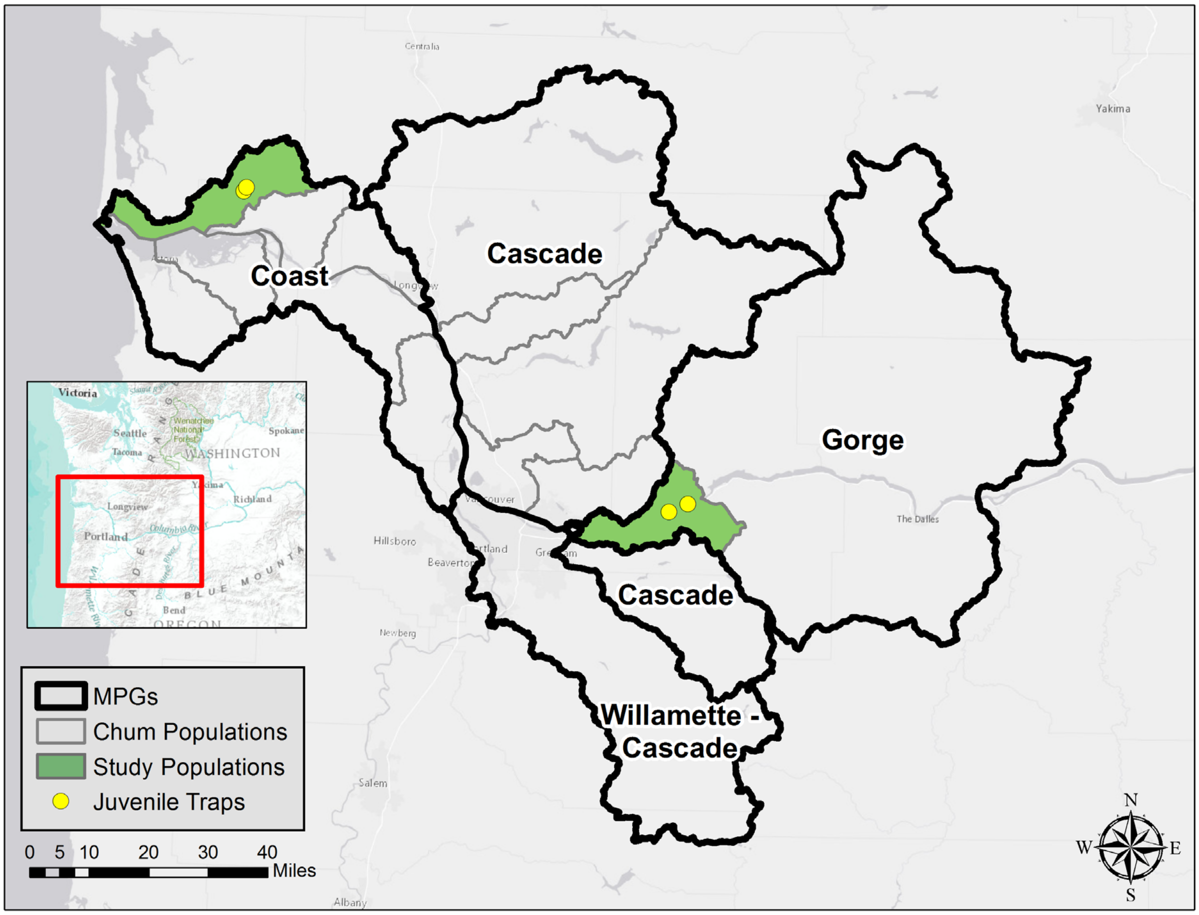

Figure 1. Map of the Columbia River chum salmon ESU. The CR ESU consists of three strata (i.e., MPGs; Major Population Groups) and 17 populations (i.e., DIPs; Distinct Independent Populations). Washington Department of Fish and Wildlife (WDFW) operates five juvenile outmigrant traps (yellow circles) within two DIPs (highlighted in green) focused on chum salmon juveniles. Note: due to the scale of the map, the two monitoring traps in Hamilton Creek are displayed as one site.

The purpose of this report is to summarize the juvenile chum monitoring activities in the CR ESU since 2002, with specific focus on the generation of annual abundance estimates of juvenile outmigrants. While the focus of this work was to generate unbiased and precise outmigrant estimates for chum salmon, data were collected on all species encountered, and funding provided by the Washington State Recreation and Conservation Office (RCO) was used to extend the trapping operations at two of the five monitoring locations to cover the entire outmigration of non-chum salmonids. Therefore, when data were available, outmigrant estimates were generated for other species, including Chinook salmon (*O. tshawytscha*), coho salmon (*O. kisutch*), and steelhead (*O. mykiss*). Juvenile data were collected with either a rotary screw trap (RST) or fence-panel weir. Trap sites were generally operated from late winter and early spring (February to March) through late spring to mid-summer (May to August). Across all five monitoring sites, we monitored a total of 35 outmigrant years (Table 1). Abundance estimates were stratified by site, year, species, origin, life-stage, and age-class. In total, we generated 117 estimates of abundance along with their associated levels of precision.

Table 1. Summary of juvenile abundance estimates generated by site, species, origin (NOR = natural-origin, HOR = hatchery-origin), life-stage (fry, parr, transitional, smolt), and age-class (sub-yearling, yearling).

				Trap Site				
Species	Origin	Life-Stage	Age-class	Grays River	Crazy Johnson Creek	Duncan Spawning Channel	Hamilton Springs Spawning Channel	Hamilton Creek
Chum	NOR	Fry	Sub-Yearling	2008-16	2012-16	2002-16	2011-16	---
Chinook	NOR	Fry	Sub-Yearling	2009-11, 2013-14 & 2016	---	---	---	---
	NOR	Parr/Trans/Smolt	Sub-Yearling	2008-16	---	---	---	---
	HOR	Parr/Trans/Smolt	Sub-Yearling	2008-16	---	---	---	---
Coho	NOR	Trans/Smolt	Sub-Yearling	2008-16	---	---	---	---
	NOR	Trans/Smolt	Yearling	2008-16	---	---	---	2014-16
	HOR	Trans/Smolt	Sub-Yearling	2008-16	---	---	---	---
	HOR	Trans/Smolt	Yearling	2008-16	---	---	---	---
Steelhead	NOR	Trans/Smolt	Yearling	2008-16	---	---	---	2014-16
	HOR	Trans/Smolt	Yearling	2008-16	---	---	---	---

Methods

Study Sites

Grays River Basin – Grays River

The Grays River is a seventh-order stream (Strahler 1952) located in southwest Washington State, draining approximately 321 square kilometers and enters the Columbia River at river kilometer (rkm) 37.4 (Figure 2). The Grays River originates in southeast Pacific County and flows through Wahkiakum County before meeting the Columbia River. The mainstem Grays River is divided into an upper and lower section by a steep canyon, approximately 5 kms long. Prior to being altered in 1951 (WDF 1990), falls within the canyon effectively limited chum, Chinook, and coho salmon spawning to the lower section under all but ideal passage flows. Steelhead are able to traverse the canyon/falls and make extensive use of the upper section. Major tributaries include Hull, Fossil, Mitchell, and Crazy Johnson creeks, and the East, West, North, and South forks of the Grays River (Figure 2). The watershed is rain-dominated and subject to periods of extremely high flows during the fall, winter, and spring periods. The majority of the upper basin is forested and owned by commercial timber companies. The lower basin is a mixture of rural farms and timber land owned by commercial timber companies. A more detailed description of the basin can be found in the watershed assessment report (May and Geist 2007).

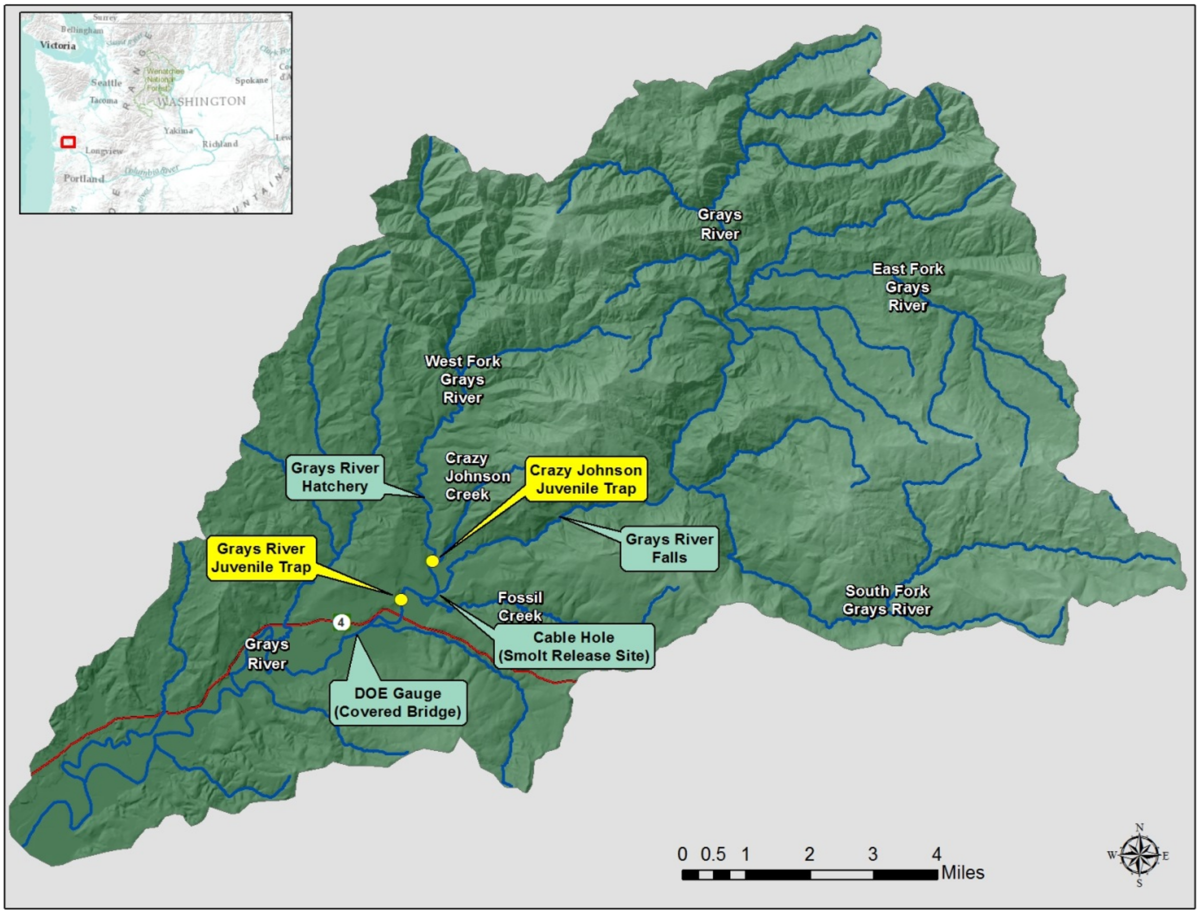

Figure 2. Map of Grays River Basin with locations of the Grays River Hatchery, juvenile monitoring sites, the mainstem Grays trap efficiency trials release site, DOE stream gauge and Grays River Falls.

The Grays River basin supports several naturally-spawning populations of salmon and steelhead, including fall-run chum, tule-stock Chinook, late-stock coho salmon, winter-run steelhead, and coastal cutthroat trout. As a result of various lower Columbia River hatchery programs, there are now naturally-spawning populations of non-native early-stock coho salmon (lower Columbia River origin) and Select Area Bright (SABs) fall-run Chinook salmon (Rogue River origin). The chum, tule-stock Chinook and late-run coho salmon populations are all listed as threatened under the ESA and are part of the Grays/Chinook DIP in the Coastal Strata (MPG). The recovery population viability designation within the Lower Columbia Salmon Recovery Plan is “Primary” for the chum and coho salmon and steelhead populations, and “Contributing” for Chinook salmon (LCFRB 2010).

Juvenile monitoring was initiated in the Grays River watershed in 2008 and has occurred annually since. Juvenile monitoring is accomplished using a platform style 1.5-meter rotary screw trap (Figure 3) located at rkm 19.1. The site was chosen due to its access, suitable channel cross-width configuration, and its location, which is low in the basin and below the majority of primary spawning reaches for salmon and steelhead, but still above tidal influence. The site is also suitable for installing flow defection panels (Figure 3) to maintain favorable trapping conditions during periods of lower flow that may occur during the trapping season. These criteria ensure that the trap can be placed in line with the majority of downstream migrants and that trap avoidance is minimal and not selective based on size or life-stage. As a result of gravel bar movement and formation changing flow patterns, the trap had to be moved upstream ~50 meters in mid-May of the 2012 season. Also, a second platform style 1.5-meter rotary screw trap has been added in early May of each year since the 2012 season and fished in tandem to increase the number of yearling and sub-yearling migrants captured (Figure 3). The second trap is used for outmigrant monitoring in Crazy Johnson (CJ) from February through early May and therefore is not available for use at the Grays mainstem location until that monitoring is completed. Additionally, panels were installed once river flows dropped sufficiently, usually in late-May or early-June, to help direct both flow and outmigrants to the trap(s) (Figure 3).

Figure 3. Grays River mainstem trapping configurations: fishing a single trap (top left), two traps fishing in tandem (top right), single trap with panels installed (lower left) and two traps fishing in tandem with panels installed (bottom right).

The WDFW operates a hatchery facility in the basin, located on the West Fork Grays River (WFG) at rkm 3.2. Currently, the facility rears fall-run chum, early- and late-stock coho, spring Chinook salmon, and winter-run steelhead. The spring Chinook and early-stock coho salmon reared at the Grays River Hatchery are for the Select Area Fisheries Enhancement (SAFE) program and are not for in-basin release; instead they are transported to net pens for final rearing and release. Alternatively, yearling coho salmon and steelhead smolts are released directly from the Grays River Hatchery into the WFG. Prior to 2008, sub-yearling age (fed-fry) chum salmon smolts were also released directly from the Grays River Hatchery into the WFG. However, because hatchery-origin chum salmon fry are internally marked with a thermally-induced otolith mark (Volk et al. 1999), opposed to an external adipose fin clip, they cannot be visually distinguished with 100% certainty from natural-origin fry captured during trapping operations. Therefore, beginning in 2008, hatchery-origin chum salmon fry are trucked to a release location below the juvenile trap to prevent possible bias in the natural-origin chum salmon fry outmigration estimate.

Real-time and historical stream flow data was accessed through a Washington State Department of Ecology (DOE) web site (https://fortress.wa.gov/ecy/wrx/wrx/flows/station.asp?sta=25B060) that reports data from a stream gauge located approximately 1.6 km below the juvenile trapping location.

Grays River Basin – Crazy Johnson Creek

Crazy Johnson Creek (CJ) is a third-order stream located in the Grays River Basin, draining approximately 2.3 square kilometers and currently enters the WFG at rkm 0.8 (Figure 2). Similar to the Grays River, CJ can be divided into lower (rkm 0-0.6) and upper (rkm 0.6-2.9) sections. The lower section includes protected side channels heavily influenced by groundwater and is predominantly used by chum salmon for spawning, frequently at high densities, while the upper section provides spawning and rearing habitat for coho salmon and steelhead. Additionally, the lower section is located in the mainstem Grays reactionary reach and historically has been inundated for periods of time by the mainstem Grays River during high flow events and natural river channel meandering processes. In the early 1960s, a dike (Gorley Dike) was constructed that confined the mainstem Grays to the west side of the valley soon after it exits the canyon reach. This action likely increased the frequency of flooding in the lower section of CJ. In December of 1999, a large flood avulsed the Gorley Dike. Since the avulsion, the mainstem Grays River has occupied the east side of the valley away from CJ under normal- or low-flow conditions and CJ now drains in the WFG instead of directly into the Grays River. A more detailed description can be found in the watershed assessment report (May and Geist 2007).

Juvenile monitoring in CJ was initiated in 2011. A fence-panel weir with live box trap design was used in 2011 and 2012 (Figure 4). However, during high flow events over-land flow from the mainstem Grays into the lower end of CJ would either flood out the trap and/or bring heavy debris loads resulting in missed trapping days. In response, another platform style 1.5-meter rotary screw trap has been used in CJ since the 2013 season (Figure 4). Regardless of the trap design used, trapping has occurred at the same location in all years, approximately 50 meters up from the confluence with the WFG.

Figure 4. Crazy Johnson Creek trapping configurations: fence panel weir with live box used in 2011-12 (left side) and rotary screw trap used in 2013-16 (right side).

Duncan Creek Basin – Duncan Spawning Channel

Duncan Creek is a fifth-order stream located in Skamania County on the west end of the Columbia River Gorge in southwest Washington State, draining approximately 16.1 square kilometers and entering the Columbia River just downstream of Bonneville Dam at rkm 225.8 (Figure 5). The watershed is primarily rain dominated and subject to periods of extremely high flows during the fall, winter, and spring periods. The majority of the basin is forested and ownership is a mixture of private, state and federal agencies. Duncan Creek supports several naturally-spawning populations of salmonids, including fall-run chum salmon, late-stock coho salmon, winter-run steelhead, and coastal cutthroat trout. In 2001, a reintroduction program was initiated in Duncan Creek, the first Columbia River chum salmon reintroduction program post-listing under the ESA. The reintroduction strategy included construction of a spawning channel (Duncan Channel). Since its initial construction in 2001, the spawning channel has been re-worked (in 2008) and expanded (in 2011). In its current configuration, it provides almost 2,000 square meters of available spawning habitat. A detailed description of the Duncan Creek reintroduction program and all associated monitoring activities can be found in BPA annual progress reports (e.g., Hillson 2002, 2006, 2011, 2016).

Juvenile monitoring has occurred in Duncan Creek Spawning Channel since 2002. The Duncan Channel has fixed monitoring weirs that partition the channel into two sections. Juvenile monitoring is conducted at the downstream end of both sections. A fyke net with live box trap design was used in 2002 and at the start of 2003 (Figure 6). That design proved to be problematic to collect unbiased data. The fyke nets were prone to becoming blocked with algae, backing up water in the channels, which under the right conditions, could result in flooding around the monitoring weirs. The trap design was changed to a fence-panel weir with live boxes in 2003, and that design has been used since (Figure 6).

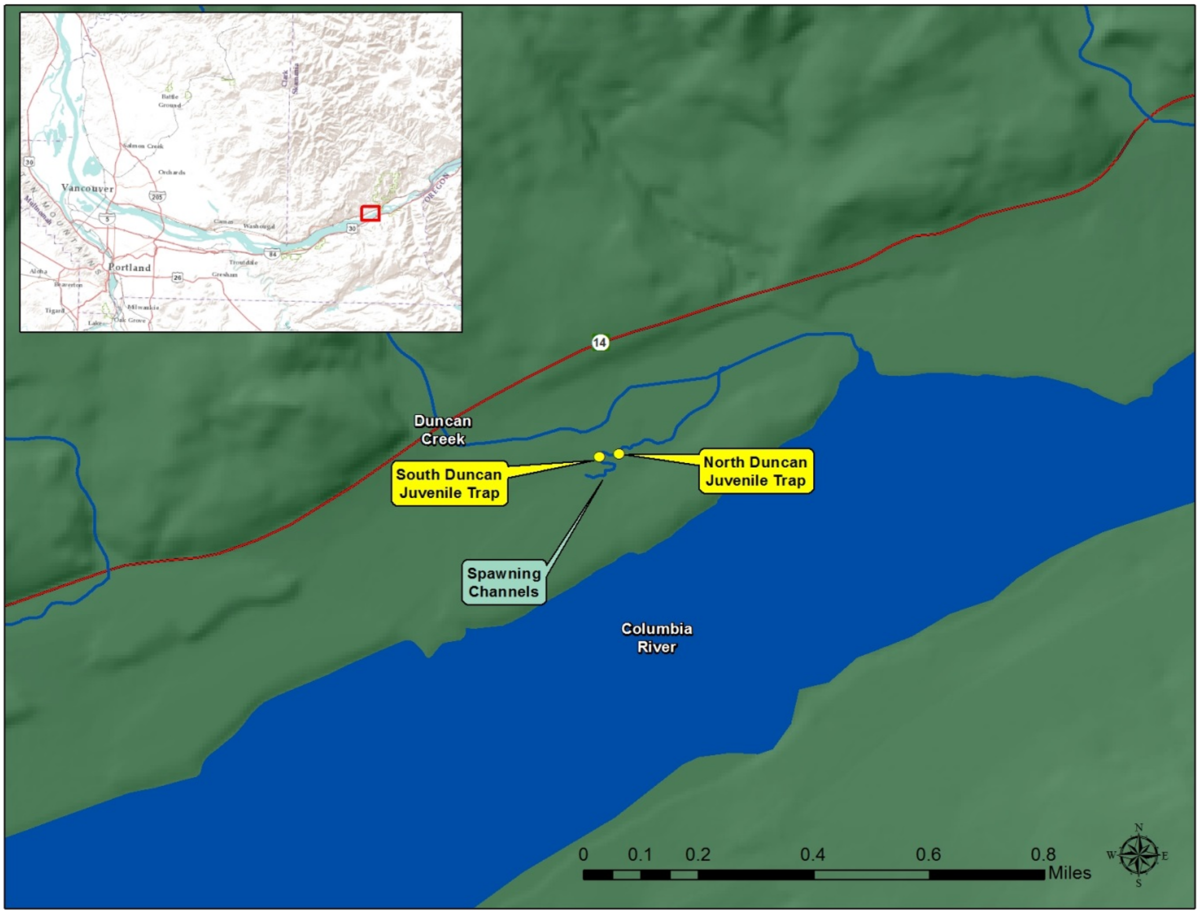

Figure 5. Map of lower Duncan Creek showing the location of the spawning channel and the two juvenile monitoring sites.

Figure 6. Duncan Creek spawning channel trapping configurations: fyke net with live box used in 2002 (left side) and fence panel weir with live box used in 2003-2016 (right side).

Hamilton Creek Basin – Hamilton Creek

Hamilton Creek is a fifth-order stream located in Skamania County on the west end of the Columbia River Gorge in southwest Washington State, draining approximately 58 square kilometers and entering the Columbia River just downstream of Bonneville Dam at rkm 229.6 (Figure 7). The creek has both high and low gradient sections. Major tributaries include Cedar and Greenleaf creeks. In addition, there is an artificial chum salmon spawning channel, Hamilton Springs channel, located in the lower section of the creek. The watershed is primarily rain dominated and subject to periods of extremely high flows during the fall, winter, and spring periods. The majority of the upper basin (rkm 2.3 - 11.0) is forested and ownership is primarily a mixture of state and federal agencies. The lower section (rkm 0 - 2.3) runs through the town of North Bonneville before entering the Columbia River.

Hamilton Creek supports several naturally-spawning populations of fall-run chum, a non-native bright fall-run Chinook and late-stock coho salmon as well as winter-run steelhead and coastal cutthroat trout. Historically, there were releases of hatchery-origin winter-run steelhead within the basin, but none have been made since 1997. The chum salmon, late-run coho salmon and winter-run steelhead spawning populations are listed as threatened under the ESA. Within the Lower Columbia Salmon Recovery Plan they are part of the Lower Gorge DIP in the Gorge Strata (MPG) with population viability objectives of "Primary" (LCFRB 2010).

Juvenile monitoring has occurred annually since 2012 using a standard 1.5-meter rotary screw trap (Figure 8). Two trap sites have been used, an upper and lower site. The upper site, located at rkm 2.1, was fished in 2012 and 2013, but proved to be ineffective at capturing sufficient juveniles to estimate juvenile outmigrant abundance. The trapping site was changed to the lower site, located at rkm 1.9 in 2014, and that site has proven to be an effective trapping location.

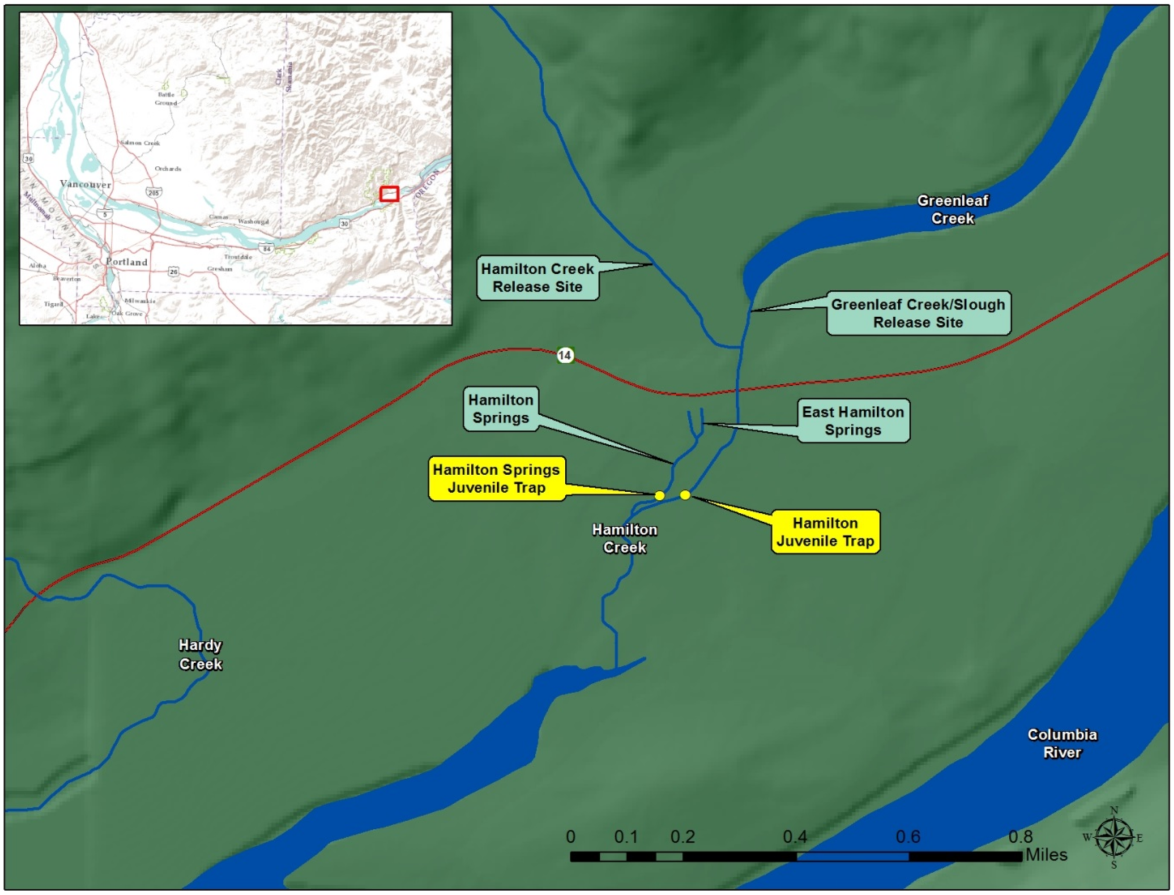

Figure 7. Map of lower Hamilton Creek showing the location of the Hamilton Springs spawning channel, the two juvenile monitoring sites, and the release sites for the Hamilton Creek trap efficiency trials.

Figure 8. Hamilton Creek rotary screw trap trapping sites: the upper site fished in 2012-13 (left side) and the lower site fished in 2014-2016 (right side).

Hamilton Creek Basin – Hamilton Springs Spawning Channel

Hamilton Springs Spawning Channel (Hamilton Springs) is an artificial spawning channel located in Skamania County on the west end of the Columbia River Gorge in southwest Washington State, entering Hamilton Creek at rkm 1.7 (Figure 7). Hamilton Springs was originally built in the early 1960s and has been the subject of several renovation projects since then, the most recent completed in the fall of 2011. In its current configuration, it provides almost 2,100 square meters of available spawning habitat.

Juvenile monitoring by WDFW has occurred annually since 2011, using a fence-panel with live box trap design. Initially only a single fence-panel weir and live box were used (Figure 9). However, this configuration resulted in higher than acceptable mortalities due to impingement on the fence-panel screens when the trap was subject to very high flow conditions. The design was changed to a double v-weir configuration of fence-panel screens and two live boxes for the 2012 season (Figure 9). The double v-weir configuration greatly reduced mortality as a result of impingement and has been used since. Regardless of the trap design used, single or double v-weir, trapping has occurred at the same location in all years, approximately 25 meters up from the confluence with Hamilton Creek.

The juvenile outmigrant monitoring conducted by WDFW and the corresponding estimates presented in this report for the Hamilton Springs spawning channel do not represent the only outmigrant monitoring work at this location. The United States Fish and Wildlife Service (USFWS) conducted outmigrant monitoring at the same location in 2000-2006 under a contract with the Bonneville Power Administration (BPA project 2000-012-00). Their annual reports can be found here: https://www.cbfish.org/PiscesPublication.mvc/SearchByProjectAndContract.

Figure 9. Hamilton Springs spawning channel trapping configurations: single fence panel weir with live box used in 2011 (left side) and double fence panel weir and live boxes used in 2012-16 (right side)

Trap Operations

Traps that focused on the chum fry outmigration were typically installed in early February and operated through early May to encompass the entire juvenile chum salmon outmigration period. When estimates of yearling and sub-yearling aged outmigrants of other species (Chinook, coho, steelhead) were also an objective, traps were fished through June or July if staff was available and river levels remained high enough to continue operating the trap. While the goal was to continuously operate all traps through the seasons, there were instances of unplanned outages due to high flow events, heavy debris load, flooding or backwatering events and inclement weather. Additionally, in some years alternate-day trapping schedules were implemented during peak passage periods to reduce the number of chum salmon fry handled.

In general, the traps were checked, accumulated catch removed and cleaned once per day during the morning hours. During periods of high flow or debris load, additional trap checks and catch processing would be done if necessary. During periods of expected high fish abundance (e.g. a hatchery release passing the Grays mainstem trap), staff would remain at the trap processing catch continuously until abundance decreased and it was safe again to allow catch to accumulate in the live-box. At locations where rotary screw traps were used, panels (sheets of plywood held in place with t-post and rope) would be added as soon as flows allowed during the yearling and sub-yearling juvenile outmigration period to guide juvenile fish into the trap(s) (Figure 3). Panels were also used to change and focus flow direction to increase, or maintain, the speed (revolutions) of the trap to extend the sampling period as flows decrease over the season. Environmental data collection protocols have varied by year, site, and trap design. The only consistent environmental data collected over all seasons are rotations per minute at screw trap sites, water depth (staff gauge readings), and temperature values at spawning channel sites.

Enumeration and Sampling

Accumulated catch would be removed from the live box(es) using a dip net, and salmonids were transferred directly to dark colored 19 L buckets equipped with lids and battery-powered aerators. Non-salmonid fish and other bycatch were enumerated and recorded by species, and released downstream of the trap. Catch was processed on site at all locations except the salmonid catch from the Grays trap which is transported to the Grays River Hatchery for processing. When fish needed to be anesthetized prior to enumeration, sampling or marking, tricaine methanesulfonate (MS-222) was used. All fish exposed to MS-222 were allowed to recover before being released.

Juvenile salmonids were identified and enumerated by status (live or mortality), origin (natural- or hatchery-origin based on presence or absence of an adipose fin), species, life-stage, and mark-status. Steelhead/ rainbow and cutthroat trout fry were grouped together as "trout species fry" because differentiating the two species at this size is extremely difficult. Initially the criterion detailed in Rawding et al. (1999) was used to categorize life-stages into four groups: fry, parr, transitional, and smolt. The criterion for inclusion in the fry life-stage group was a combination of fork length (FL) ≤ 45-50mm and body morphology. In 2013, the life-stage groupings were further divided into two age classes: sub-yearling (<1 year) and yearling (>1 year). Since scales are not taken on each individual fish, an age-class decision criteria was used to assign an individual as either a sub-yearling or yearling. The criteria used to determine age class was combination of size (FL), outmigration life-stage, and date of capture. In 2015, a life-stage by age-class rule set was developed and standardized for each species based on an individual fish's life-stage, fork length, and capture date. These standardized rule-sets were used to assign all life-stage and age-class classifications across all years of data (2002 – 2016). Graphical representations of the rule sets are provided in Appendix A: Figures A1- A3. At locations where releases of marked individuals were used to estimate trap efficiency, all salmonids regardless of live or mortality status were examined for the presence of trap-efficiency release marks to determine if it was a maiden (first capture event) or a recapture (second capture event). At trapping locations where a weir was used, all fish captured are assumed to be maidens.

During the peak chum salmon fry outmigration time period at the CJ and Hamilton Springs sites, the number of chum salmon fry captured can preclude hand counting the fry portion of the daily catch. Therefore, protocols were established for generating daily catch totals of salmonid fry using either volumetric or weight-based expansions for CJ and Hamilton Springs sites, respectively, when daily fry catch was potentially >10,000. To generate a volumetric expansion, a small (~500 ml) cylindrical measuring vessel with a line indicating a "full" volume sample was used. Once the fry were sorted from the rest of the catch, a dip net was used to load them into the measuring vessel to the full line. Water was allowed to drain for 15-20 seconds, and physically wiped from the bottom of the net before the fry were transferred to limit bias. A systematically selected sub-sample of volume samples was hand counted for a juveniles-per-volume value and species composition. Catch by species was estimated by multiplying the number of non-sampled volume samples by the average hand count and combined species composition rate from the sampled volume samples. Hand counts (from the sampled volume samples and fry sampled for FLs or counted prior to starting volumetric sampling) would then be added to the expanded volume sample totals to generate an estimate of the total fry catch by species for that day. Weight-based expansions followed a similar methodology. Dip nets were used to transfer fry into a tared bucket of water. Water was allowed to drain for 15-20 seconds, and physically wiped from the bottom of the net before the fry were poured to limit bias. Individual weight samples were limited to 300-500 grams. Sub-samples of ~100 fry were systematically weighed and species composition recorded to provide expansion values for the bulk weight samples. Catch by species was estimated by multiplying the combined bulk weights by the average fry weight and combined species composition rate from the sub-samples. Hand counts (from the sub-samples and fry sampled for FLs or counted prior to starting bulk weight sampling) were then added to the expanded weight totals to generate an estimate of the total fry catch by species for that day.

With the exception of salmonids classified as fry, the standard protocol for sampling live maiden salmonids at trapping locations other than at a spawning channel (Duncan and Hamilton Springs), was to measure and record FL and document any visible injuries. The standard protocol for live maiden salmonid fry, at trapping locations other than at a spawning channel, was to collect FL data on a subsample of up to 20 fry per species per day. There was no sampling protocol at the two spawning channel locations prior to the 2013 season for any salmonids except chum fry; they were just enumerated by status (live or mortality) and species and then released. This changed in 2013 when the sampling protocols for non-chum salmon fry and all other salmonids were implemented at the spawning channel trap locations. At the two spawning channel trapping sites, chum salmon fry were sampled three times per week, generally on Monday, Wednesday and Friday, and sampling consisted of collecting 30 paired individual FL and weights at each trap.

Marking for Efficiency Trials

Trap efficiency trials were conducted to determine the capture probability for each species and life-stage combinations of interest. Efficiency trials were primarily conducted at screw trap sites where capture efficiency was expected to be less than 100% based on the trap design. During an efficiency trial, fish that were captured for the first time (maidens) were marked and released upstream of a trap. Individuals that were marked and subsequently captured a second time were categorized as “recaptures”. Only juveniles determined to be in the transitional or smolt life-stages were used for trap efficiency trials to prevent bias in the outmigrant estimates resulting from individuals remaining above trap post-release or residing above trap long enough to lose the mark, which can happen with dye and fin clip marks. Since all chum salmon fry outmigrate immediately, or very soon, after emergence, the life-stage of fry equals smolt for this species. Juveniles with injuries or displaying non-standard behavior were excluded from use in efficiency trials.

Three types of batch marks, singularly or in combination, have been used for trap efficiency trials. The first type is a dye mark accomplished using Bismarck brown Y (Bismarck; *Sigma-Aldrich, Product # B2759, St. Louis, MO*). The second type of mark used was fin clips (upper caudal (UC), lower caudal (LC), left ventral (LV) and right ventral (RV) fins). The third type of mark used was colored Visual Implant Elastomer (VIE; *Northwest Marine Technology, Inc., Shaw Island, WA*). Four colors (red, orange, pink and yellow) of VIE, in combination with left and right side, were used to create eight unique marks. Left and right sides of an individual were determined by looking down at the dorsal surface of the fish with its head pointed away. For chum salmon fry, Bismarck was the preferred mark; combinations of Bismarck with UC or LC were used if paired releases were necessary. The preferred mark for Chinook salmon juveniles was dependent on fish size. Bismarck, singularly or in combination with a fin clip, was typically used on individuals with FL ≤ 90mm while VIE was used on individuals >90 mm. The preferred mark for coho and steelhead salmon and cutthroat trout juveniles was VIE. When logistics prevent using VIE mark, fin clips become the preferred mark.

A standardized protocol was used to apply each mark-type to individual fish. To apply a dye mark, juveniles were held in an aerated solution of Bismarck (86 mg per liter) for approximately 60 minutes. Fin clips were accomplished using sharp scissors to remove a section of the target fin. The protocol was to remove just enough fin tissue to make a clear and visible mark by flattening-off a normally curved edge of the fin. VIE marks were applied in the posterior area of the adipose eyelid using NMTs manual elastomer injector. The protocols provided by NMT (2008) were followed for mixing, storing, and injecting the VIE. In addition, protocols developed by Sharpe and Glaser (2007) to ensure high rates of VIE mark retention were followed. These mark-application protocols were universal to all years and trapping sites. All fish marked for efficiency trials were allowed to recover from sampling and tagging prior to release. Additionally, when fry migrant tests were conducted, releases were done at just after dusk whenever logistically feasible.

Species and location-specific mark rotation schedules were developed prior to the start of each season. Trap efficiency trials would begin when sufficient numbers of the transitional and smolt stage juveniles were being captured daily, or would likely be captured over the efficiency trial period, to make recaptures probable based on prior knowledge. At the Grays trap site, to prevent miss-assignment of recaptures when using only Bismarck dye marks for chum salmon fry, efficiency releases were initially spaced four to five days apart. However, in the first month of the 2008 season, the travel time from release site back to the trap was evaluated and the vast majority of the marked chum salmon fry recaptures occurred within 36 hours post-release. Therefore, the schedule for chum fry efficiency trial releases was changed to only two or three days separating releases. The schedule was adjusted again prior to the 2013 season to prevent marked chum salmon fry from efficiency trial releases for the CJ trap being captured at the Grays trap and potentially being miss-assigned to a Grays trap release group. The updated chum salmon fry trap efficiency trial schedule allowed two trap efficiency releases for the Grays trap and one for the CJ trap per week. The marks used for sub-yearling and yearling aged salmonid migrants trap efficiency trials would normally be changed every seven days and not repeated until all other marks in the rotation had been used. However, if trap operations or environmental conditions significantly changed, e.g. moved into, or out of, the thalweg or a high flow event, the efficiency trial mark would be changed to capture the potential change in efficiency.

Efficiency trial release locations were chosen generally based on two factors: access and being located an "adequate" distance above the trap site. Access was driven primarily by landownership, practicality, and safety. Within these accessible sites, the goal was to choose a location that maximized mixing of marked and maiden juveniles but minimized added mortality. Therefore, release sites needed to be far enough up river to have multiple sections of complex stream habitat to achieve equal mixing, but not too far up river that induced added mortality of marked fish post-release. Multiple assumptions of a mark/recapture (M/R) estimator can easily be invalidated if care is not taken when choosing the release site, see "**Assumption Testing"** section below.

The Grays rotary screw trap efficiency trial release site is located on the Grays River, just across from the mouth of the West Fork Grays River, approximately 1.3 km above the trap (Figure 2). This location is locally known as the Cable Hole. The CJ rotary screw trap efficiency trial release site was located ~120 meters above the trap just below a large (30-35 meters in length and 1-1.5 meters in height) stream-spanning beaver dam. Flow between this beaver dam and the juvenile trap is provided through a notch in the beaver dam, which is made and maintained by staff during the trapping season. Between the beaver dam and the juvenile trap, the stream makes several bends as well as passing through other small beaver dams that are also notched by staff to keep juvenile passage open. Hamilton Creek had two release locations due to concerns of potentially violating a mark-recapture estimator assumption (i.e., mixing of marked and unmarked fish) that are rotated on a daily basis (Figure 7). One site is located on Hamilton Creek and the second site is located on Greenleaf Slough/Creek (Greenleaf). These concerns were, 1) the mouth of Greenleaf was located less than 100 meters upstream of the trap site used during the 2012 and 2013 seasons, 2) the absence of any complex stream habitat between Greenleaf's mouth and the trap during those seasons, and 3) the Hamilton Creek efficiency trial release site was on the opposite bank of Greenleaf's mouth. Once the Hamilton Creek screw trap was moved to the lower location in 2014, which resulted in a larger distance between the release location and the trap and several sections of complex habitat, the use of two release sites was likely no longer necessary but nonetheless was maintained.

Assumption Testing

In order to obtain unbiased estimates of abundance using (Petersen) mark-recapture methods, there are five critical assumptions that must be met, or accounted for (Seber 1982). There is an additional assumption when this method is used for juvenile outmigrant estimates (Carlson et al. 1998). These assumptions, and the manner in which they were addressed or evaluated, are detailed below.

Assumption 1 (Closed Population)

The assumption that there is no recruitment or emigration between sample events was addressed by initiating trapping prior to, and fishing continuously through, the expected outmigration time frame.

Assumption 2 (Equal Catchability)

The assumption that all fish have an equal probability of being marked in the first event (2a), or all fish have an equal probability of being inspected for marks in the second event (2b); or marked fish mix completely with unmarked fish between sampling events (2c). This assumption can be satisfied if one of the above three conditions (2a, 2b, 2c) is met. However, this assumption is also considered the "Achilles heel" of the Petersen Estimator (Arnason et al. 1996) because catchability can be influenced by many factors. The assumption that all fish have the same probability of capture in the first or second event (2a, 2b) was addressed by grouping catch by species and life-stage to create homogeneous groups for the analysis. In addition, the mark rotation schedule was created to develop homogeneous temporal strata for trap efficiency (Carlson et al. 1998). Seber (1982) recommended evaluating size selectivity by comparing the size distributions of marked and recovered versus non-recovered individuals. However, this approach is not possible when batch marks are used. When batch marks are used, Thedinga et al. (1994) recommended comparing the size distributions of recaptured against all marked individuals.

The assumption that the second sample is either a simple random sample, or if the second sample is systematic (2b) and marked and unmarked fish mix randomly (2c) was addressed through careful selection and evaluation of the release sites used for trap efficiency trials. Additionally, because of the potential for predation on marked chum salmon fry to bias fry outmigrant estimates at the Grays trap, two trap efficiency trial release sites were evaluated during the 2010 season. The two release sites that were evaluated were referred to as Cable Hole, located ~1.3 km above the trap, and Fossil Creek, located approximately 0.7 km above the trap. Efficiency trial releases for chum salmon fry were alternated between the two sites throughout the season. In total, we conducted 12 paired-release capture efficiency trials from mid-February through mid-April, 2010. Estimates of capture efficiency were generated for each mark release group and paired-releases were compared using Chi-squared tests (Zar 1999).

Assumption 3 (No Mark-Induced Mortality)

The assumption that marking does not affect catchability (i.e. there is no tag-induced mortality), was addressed through quick and efficient processing of the daily catch and sampling protocols. Delayed mortality tests were also conducted in 2008-11 and 2009-11 on chum and Chinook salmon fry respectively captured at the Grays RST to document sampling and marking effects. Specifically, fry of these species were sampled, dye marked (Bismarck brown), and held for 1-28 days at the Grays River Hatchery to document post-sampling and marking mortality rates.

Assumptions 4 and 5 (No Mark loss and Mark Detection/Clarity)

The assumptions that fish do not lose their marks and that recaptured marks are recognized were both addressed through sampling and marking protocols and training. Additionally, the VIE and Bismarck marking protocols were evaluated during the 2008-2011 seasons for effectiveness in placing a mark, mark retention, and duration. Specifically, chum and Chinook salmon fry were sampled and dye marked (Bismarck brown) and held for 1-28 days at the Grays River Hatchery to document mark clarity and retention rates. Additionally, hatchery-origin yearling transitional/smolt coho salmon and steelhead juveniles from the Grays River Hatchery were VIE marked and held for 48hrs to evaluate VIE mark loss.

Assumption 6 (Marked Juveniles are Migrants)

To address this assumption only juveniles determined to be in the transitional or smolt life-stages were used for trap efficiency trials to prevent bias in the outmigrant estimates resulting from individuals remaining above trap post-release or residing above the trap long enough to lose the mark, which can happen with dye and fin clip marks. Since all chum salmon fry outmigrate immediately, or very soon, after emergence, the life-stage of fry equals smolt for this species. Additionally, juveniles with injuries or displaying non-standard behavior were excluded from use in efficiency trials.

Data Analysis

Juvenile abundance estimates were generated for chum, Chinook, coho salmon, and steelhead by year and trap site location for appropriate combinations of fish by origin (NOR = natural-origin, HOR = hatchery-origin), life-stage (fry, parr, transitional, smolt), and age-class (sub-yearling, yearling). Hereafter, the pairwise combinations of origin, age-class, life-stage and species are referred to as abundance groupings. Catch data were entered into an Access database, proofed at a minimum rate of 1:5 for transcription errors, and run through a standardized set of data screening queries to maximize data quality.

Juvenile trapping data were summarized, and abundance estimates were generated, using primarily one of two analytical approaches. First, we used a Bayesian Stratified-Petersen estimator (Bonner 2008, Schwarz et al. 2009, Bonner and Schwarz 2011, Schwarz and Bonner 2012) when data were collected using a mark-recapture design at rotary screw trap sites. Second, at fence panel weirs in some years we obtained a census by summing the daily counts and for years with missing days we developed a Bayesian penalized spline (p-spline) estimator based on Bonner and Schwarz (2011). A third analytical approach (referred to as the "Proportion" estimator) was developed for two abundance groupings (Grays River chum salmon fry - 2012 and 2015) due to poor trapping conditions that resulted in unrepresentative data. A description of the three methods is provided below.

Bayesian Stratified-Petersen estimator for rotary screw trap data

Prior to analysis, screw trap data were summarized based on trapping operations for each abundance grouping. First, fish were classified as either a maiden, mark, or recapture based on its individual capture history. Second, daily catch was summed by period. Here, periods were primarily defined by the implemented marking schedule. However, if the marking schedule results in period groupings of inconsistent lengths, periods were further divided to ensure periods were approximately the same length to improve model fit and improve precision of run-timing estimates. In a temporally stratified study design, a fish that is marked can either be recaptured in the same period (referred to as a “diagonal” movement) or in a later period (referred to as a “non-diagonal” or “delayed” movement or Darroch model (Darroch 1961)). Multiple unique batch marks were used in a set rotation so that when delayed movement occurs, recaptured individuals can be assigned back to their appropriate marking period. Third, the sample proportion was calculated for each period by determining the number of days that were successfully sampled. Here, “trap logs” were constructed for each site and year that described daily trap operations (e.g., time trap was checked, trap status (in or out), comments by crew) and notable events that may have compromised the integrity of the catch data. Individual days with “no issues” were considered successful (i.e., data valid and representative) while days with a “trap outage” (i.e., trap or trap cone set to non-fishing status leading to missed/zero catch) were considered unsuccessful. More specifically, individual days were only assigned as having a trap outage when the trap was non-operational during the night (dusk to dawn). This distinction in trap outage designation is based on known daily migration patterns of juvenile salmonids (Groot and Margolis 1991). There were also days when the trap cone was impeded (i.e., not spinning properly or at all) and were referred to as “cone stopper” days. Based on visual examination of raw catch by date plots (see Appendix B), cone stoppers almost always lead to negatively-biased catch. Therefore, these days were typically classified as unsuccessful and the corresponding catch was adjusted. Specifically, catch data were assigned as zeros for any maiden and recaptures on the cone stopper day and for marks put out the day before the cone stopper. Due to this adjustment in catch data, the actual catch at the trap, which we referred to as “raw catch”, would always have been equal to or larger than the catch data we ultimately used for our analysis, referred to as the “catch for analysis.” Lastly, catch and sample proportion data by period were combined into a final table for analysis (referred to as a “BTSPAS table” – see Appendix C).

Juvenile abundance was estimated using the package BTSPAS (Bayesian Time Stratified Petersen Analysis System) developed by Bonner and Schwarz (2014), which was run in the R statistical programming environment (R Core Team 2016). The main two features of this method are, 1) the use of a spline to model the general shape of the migration (abundance), and 2) a Bayesian hierarchical method that shares information on capture probability (i.e., trap efficiency) and the shape of the spline among trapping periods. The Bayesian Stratified-Petersen estimator is similar to other mark-recapture (M-R) estimators used for juvenile outmigration data (Darroch 1961, Seber 1982, Carlson et al. 1998), but has several advantages over these “standard” methods. First, it accounts for temporal stratification and shares information among neighboring periods, which helps alleviate problems caused by few total recaptures within individual capture efficiency trials. While some Petersen estimators allow for periods to be temporally stratified (e.g., Darroch Analysis with Rank Reduction (DARR); Bjorkstedt 2000), these methods ignore temporal auto-correlation in abundance and trap efficiency. Second, the Bayesian method is self-calibrating and has "automatic model selection" (Schwarz and Bonner 2012). Specifically, if data are sparse, the spline fit is relatively smooth and the trap efficiency is assumed to be roughly the same over the entire trapping period, which is equivalent to a pooled-Petersen estimator. However, if data are rich, more complex models are fit leading to a larger number of effective parameters. Third, the Bayesian Stratified-Petersen estimator allows for abundances to be estimated for missed or "bad" trapping periods. Specifically, when individual days within a period are missed, but catch or capture efficiency data for the entire period were not compromised, maiden catch is simply expanded by the sample proportion. However, if an entire period's catch and/or capture efficiency data were compromised, these data can be flagged prior to analysis. For example, mark and recapture data can be flagged if the Bismarck Brown dye mark group was noted as being faint leading to difficulties in identifying recaptures. In these cases, the period was denoted as "bad" and subsequently these data are omitted and estimates for the identified period are hierarchically estimated. While the Bayesian Stratified-Petersen estimator has many advantages over other M-R analytical methods, the current BTSPAS estimator does have one potential draw-back in how it hierarchically estimates trap efficiency when there are systematic changes in trap efficiency during the middle of a trap season, such as the installation of flow-diverting panels or a second rotary screw trap (see **Lessons Learned** section).

For each abundance grouping, data (i.e., a summarized BTSPAS table) were imported into R and formatted for the BTSPAS model. When applicable, individual maiden, mark, and/or recapture periods were identified as "bad" based on trap log information. Mean stage height data was calculated for each period and used as a potential explanatory covariate in the abundance model. Here, we *a priori* expected flow (measured as stage height) to influence capture efficiency early in the trapping season when flows were highest and most variable, which corresponded primarily to the chum salmon fry outmigration time period. Therefore, stage height was only included in chum salmon fry abundance models. The influence of the flow covariate was evaluated by examining the 95% confidence interval of the coefficient (i.e., did it overlap zero or not?). Across all estimates, stage height was not found to be a significant explanatory variable and thus was not included in the final model estimates. Similar to the DARR estimator, abundance can be calculated in BTSPAS by either accounting for delayed movements (non-diagonal model) or assuming all fish out-migrated in the same period in which they were marked (diagonal model). Although we were able to collect non-diagonal migration data for almost all abundance groupings except for chum salmon fry, we chose to only estimate abundance using the diagonal BTSPAS model for all abundance groupings due to generally low numbers of delayed recaptures across all years and groupings, in addition to generally sparse recapture data for individual periods.

All of the modeling results described in this report have been assessed for chain convergence and the uncertainty in the parameter estimates due to Markov Chain variability (Plummer et al. 2006). Convergence was assessed by visually inspecting the Markov chain Monte Carlo (MCMC) chains and using the Brooks-Gelman-Rubin (BGR) statistic (Lunn et al. 2012). The chain is considered as converged if the BGR values less are than 1.1 (Gelman et al. 2004). In general, each BTSPAS model consisted of two to three MCMC chains and was parameterized to ensure that a minimum number of 4,000 independent samples was reach as measured by effective sample size (ESS). An ESS of 4,000 provides 95% credible interval (CI) that have posterior probabilities between 0.94 and 0.96 (Lunn et al. 2012). Therefore, each MCMC chain was run with 100,000 to 1,000,000 iterations where the first 50,000 to 100,000 iterations were discarded (i.e., burned-in) and a thinning rate of 10 to 200 was used to reduce autocorrelation in in MCMC draws of the posterior distribution of each model parameter and to limit the file size due to computer memory limitations. Posterior predictive checks were used to assess goodness of fit (GOF) through a comparison of the posterior predictive distribution of replicated data from the model with the data analyzed by the model (Gelman et al. 1996). These were measured with a Bayesian *p*-value, which is the proportion of the times the replicated discrepancy measure is more extreme than the observed discrepancy measure. If there is a good fit of the model to the data, we would expect the replicated and observed discrepancy measure to be similar, resulting in a Bayesian p-value of 0.50 while values near 0 or 1 indicate that the model does not fit the data. Across all estimate, the estimated total deviance Bayesian p-values were >0.025 or <0.975 indicating the models provided an adequate fit to the data. Based on these steps, we assume that our reported posterior distributions are accurate and represent the underlying stationary distributions of the estimated parameters.

P-spline estimator for weir trap data

Prior to analysis, weir trap data were organized for each abundance grouping. First, catch was summarized for each trapping day. Here, we either had a total count (census) or an estimate of fry based on the volumetric or bulk weight methods described previously in the data collection section. Second, each trapping day was identified as either having "no issues" or a "trap outage". On days with no issues, it was assumed that catch consisted of 100% of all outmigrants, while catch on days with a trap outage as a result of either 1) broken equipment, 2) flow events that made it impossible or unsafe to operate the trap effectively, or 3) high Bonneville Dam tailwater elevations that result in flooding at a trap site, "backwatering" it, rendering it ineffective as being less than 100%. Additionally, trap outages could have been a result of trapping days being intentionally skipped. During periods of high catch, an alternate-day trapping schedule may have been implemented to reduce catch and ensure that overall catch was less than levels specified by ESA take permits.

In order to account for missed catch on trap outage days, a typical approach is to use linear interpolation or parametric models of arrival timing (Volkhardt et al. 2007, Sethi and Bradley 2016). However, both methods make strong assumptions that the missing data follow assumed distributions, which may not always be justified. Therefore, we adopted the approach of Bonner and Schwarz (2011) to estimate the number of fish on days when the trap was operating at less than 100% capture efficiency. The daily trap count or estimate was modeled as the expected (log) daily run size using the Bayesian penalized spline (p-spline). The shape of a spline is flexible and controlled by the number of knot points and their locations, and the relationship to regression coefficients. We adapted the code and priors from the BTSPAS package (Bonner and Schwarz 2014) with the exception that the daily count was modeled from the Poisson distribution. In addition, we eliminated the code for trap efficiency since we did not have to estimate daily abundances because we had census counts. In the rare case that we had missing data at the end of the season, we supplied zero counts based on the end the outmigration timing from previous years. Graphical analysis of the observed and expected fit of daily counts indicated the model fit the data.

"Proportion" estimator for Grays chum fry – 2012 & 2015

As with all juvenile data collected at a screw trap survey site, estimates of Grays River chum salmon fry abundance in 2012 and 2015 were generated using BTSPAS. However, trapping issues (e.g., missed days during the peak of the outmigration, too few efficiency trials at higher flows to accurately estimate trap efficiency, etc.) that coincided with the peak of the chum salmon fry outmigration (mid-March) resulted in estimates that were judged to be too low based on the number of adult spawners the previous fall. Therefore, we developed an alternative method to estimate Grays River chum fry abundance in 2012 and 2015 and refer to it as the "proportion" estimator. Simply put, the proportion estimator uses Grays River chum salmon fry abundance and run-timing data from the seven years with good estimates (2008-2011, 2013-2014, 2016) to estimate abundance in the two bad years (2012, 2015) based on the proportion of the total run-size that migrated prior March 31. We chose March 31 because in all years we believe we had sufficient data to develop an unbiased estimate of abundance after March 31.

For the first step of the proportion estimator, hierarchical estimates of chum salmon fry abundance were generated for all good years in order to estimate shape parameters of the probability distribution function (PDF). To achieve this, estimates of chum fry abundance were generated by for the entire year and the period after March 31st using BTSPAS for all years. Next, we estimated the shape parameters of a negative binomial distribution that described among-year variation in total total abundance using the seven good years of data (N_i):

$$N_i \sim Negative\ Binomial\ (pi, r)$$

where *pi* and *r* are the two variables (i.e., shape parameters) in the Negative Binomial PDF for each year *i* modeled with a prior *pi* ~ dbeta(1, 1) and *r* ~ dgamma(1,1). The mean *pi* and *r* were then used to estimate the abundance for a year with no data (*Hier_N*):

$$Hier\_N \sim Negative\ Binomial\ (pi, r)$$

This estimate (*Hier_N*) was used as a prior for the abundance for the missing years.

For the second step of the proportion estimator, an abundance estimate was generated for 2012 and 2015 using a hierarchical estimate of the proportion of fish emigrating after March 31:

$$n_i \sim dbin(p_i, N_i])$$

where *n* was the estimated abundance after March 31 and *N* is the estimated total abundance for each year *i*. For the seven good years *N* is the point estimate of abundance from BTSPAS, and for the missing years (2012, 2015) we used our hierarchical estimate of abundance (*Hier_N*). The prior for the proportion (*p*) of the run out-migrating after March 31 for all using years was a beta PDF:

$$p_i \sim dbeta(a, b)$$

where a and b are the estimated shape parameters for year i in the beta PDF modeled with a prior $a \sim$ dgamma(0.001, 0.001) and $b \sim$ dgamma(0.001, 0.001). To ensure convergence the upper limit of a and b were truncated at 100.

Our proportional estimator was conducted using Markov Chain Monte Carlo (MCMC) methods to sample the posterior probability density function using the Just Another Gibbs Sampler (JAGS) software (Gilks et al.1996, Plummer 2003). We called JAGS from the statistical package R using the R2jags package (Su and Yajima 2015). In total, three chains and 10 million iterations of the MCMC sampler were run with the first 10,000 discarded as burn-in. A thinning rate of 1,000 was used to reduce autocorrelation in the estimates. The number of independent samples, as measured by ESS, was monitored to ensure a minimum of 4,000 was reached. This provides a 95% credible interval (CI) that has posterior probabilities between 0.94 and 0.96 (Lunn et al. 2013). Based on these steps, we assume that our reported posterior distributions are accurate and represent the underlying stationary distributions of the estimated parameters.

Results and Discussion

Trap Operation

Outmigrating juvenile salmon and steelhead were monitored at five Columbia River trap site locations beginning in 2002 and continuing through 2016 (Table 2). The mainstem Grays River has been monitored with a rotary screw trap for the past nine years (2008 – 2016) and generally operated for 160 – 180 days each year from early February through early August. Crazy Johnson Creek (CJ) has been monitored for the past six years 2011 – 2016, originally with a fence-panel weir (2011 – 2012) before switching to a rotary screw trap (2013 – 2016). The CJ trap has generally operated for 50 – 65 days each year from early February through early May, after which the rotary screw trap was moved down to the mainstem Grays River to run a tandem set-up. The Duncan Creek spawning channel has been monitored with fence-panel weir traps for the past 15 years (2002 – 2016) and generally operated for 70 – 80 days each year from early February through early May. The Hamilton Springs spawning channel has been monitored with a fence-panel weir trap for the past six years (2011 – 2016) and generally operated for 100 days each year from early February through early June. Hamilton Creek has been monitored with a rotary screw trap for the past five years (2012 – 2016) and generally operated for 60 to 110 days each year from mid-April through mid-June. Specific dates of trap outages and operation changes (e.g., addition of panels) were summarized by year and site in annual trap logs, and graphically represented (along with raw catch) for each reporting group (Appendix B). The proportion of days that were successfully sampled (i.e., "sample proportion"), and thus the dates in which catch data was subsequently used for the estimation of abundance, were summarized by period for each reporting group (Appendix C).

Table 2. Annual dates of trap operation (date installed and removed) and total number of operating days (excluding trap outages) by trap site location.

Year	Grays River	Crazy Johnson Creek	Duncan Creek Spawning Channel	Hamilton Springs Spawning Channel	Hamilton Creek
2002	---	---	3/17 – 5/23 (63)	---	---
2003	---	---	2/10 – 5/21 (99)	---	---
2004	---	---	2/26 – 4/28 (62)	---	---
2005	---	---	2/10 – 5/3 (82)	---	---
2006	---	---	2/21 – 5/4 (64)	---	---
2007	---	---	2/20 – 5/8 (77)	---	---
2008	2/20 – 8/15 (172)	---	2/19 – 5/8 (78)	---	---
2009	2/5 – 7/31 (170)	---	2/17 – 5/12 (84)	---	---
2010	2/2 – 7/30 (175)	---	2/16 – 5/5 (78)	---	---
2011	2/2 – 8/13 (182)	2/8 – 4/27 (52)	2/11 – 5/5 (83)	2/8 – 4/26 (66)	---
2012	2/10 – 8/7 (162)	2/19 – 5/4 (42)	2/13 – 4/27 (60)	2/10 – 6/30 (124)	4/30 – 6/30 (61)
2013	2/7 – 7/31 (172)	2/7 – 5/4 (52)*	2/15 – 5/6 (80)	2/12- 6/26 (134)	4/16 – 6/28 (73)
2014	2/10 – 7/31 (160)	2/5 – 5/14 (66)*	2/12 – 5/9 (77)	2/11 – 6/10 (108)	4/10 – 6/12 (64)
2015	2/2 – 7/31 (171)	2/10 – 4/21 (64)	2/10 – 5/12 (91)	2/11 – 6/8 (117)	2/13 – 6/9 (114)
2016	2/6 – 7/29 (164)	2/1 – 4/25 (80)	2/10 – 5/3 (79)	2/10 – 6/3 (95)**	2/12 – 6/3 (112)

* Trap was operated under an alternate-day fishing schedule from 2/26 to 4/19 in 2013 and from 3/19 to 4/10 in 2014
**Trap was operated under an alternate-day fishing schedule from 3/19 to 4/20

Assumption Testing

Assumption 1 (Closed Population)

Our success at meeting the closed population assumption (i.e. trapping over the entire expected outmigration period of target species) is detailed in Table 2 and can also be seen in the figures of raw catch by date (Appendix B). In general, all traps experienced short periods of zero or near-zero catch at the beginning and end of each season. Short non-fishing periods (trap outages) during the season as a result of high flows, debris, or trap damage did occur at the Grays and CJ traps. However, only in a couple of years was a substantial portion of the catch missed during the peak of the run (Grays 2012 & 2015) and here we developed an alternate analytical approach to estimate abundance.

Assumption 2 (Equal Catchability)

<u>Equal probability over time</u>

Our main focus to meet the equal catchability assumption was to conduct capture efficiency trials over the entire trapping season at rotary screw trap monitoring locations. Prior to the trapping period, a pre-defined marking schedule was developed with the goal of generating an estimate of trap efficiency every 2 – 7 days. This marking schedule was designed to balance the trade-offs between capturing the heterogeneity in trapping conditions among days and weeks while still having a large enough sample size (i.e., marks and recaptures) to detect biological differences in trapping conditions among marking periods. Additionally, we used a Bayesian Stratified-

Petersen abundance estimator that incorporates temporal stratification (i.e., mark groups), but also shares capture efficiency information among neighboring periods, which helps alleviate problems caused by small total recaptures within individual trapping period.

Equal probability by size

In order to evaluate the effect of size (i.e., FL) on capture rates of fish within a single abundance grouping, we compared the size distributions of marked fish relative to recaptured fish using Kolmogorov–Smirnov (KS) tests (Zar 1999). Out of the total 89 comparisons, we detected a statistically significant ($\alpha = 0.05$) effect of size selectivity in 21 tests (Table 3). Put another way, we rejected the null hypothesis that our trap had no size selectivity in 24% of the comparison (versus the expected rate of 5% null rejections if by random chance). However, many of these statistically significant results were a result of large sample sizes that created small effect sizes that may not be biologically significant. For example, the average size of marked and recaptured Grays River chum fry in 2012 was 39 and 40 mm, respectively. The difference in average sizes between the two groups was only 1 mm, but deemed statistically significant. Given that measurement error on juvenile fork lengths is at least ± 2 mm, this "significant" result is misleading for multiple reasons. Therefore, we wanted to evaluate what proportion of our statistically significant test groups was potentially biologically meaningful.

In order to evaluate biologically significant size selectivity, we had to create a threshold difference in sizes between marked and recaptured individuals. Unfortunately, we do not actually know what threshold truly represents biologically significant size selectivity, so we created a somewhat arbitrary threshold that the absolute size difference between marked and recaptured fish had to be greater than 5% of the relative average sizes. For example, the average size of Grays River chum fry in 2012 was 39.5 mm and 5% of that average is approximately 2 mm. Because the absolute size difference between the two groups (1 mm) was less than 5% of the relative size difference (2 mm), we concluded this size difference was not biologically meaningful. Out of the 21 statistically significant tests, only three were deemed to be biologically meaningful based on the criteria outlined above. Of the three biologically meaningful test results, two were for hatchery-origin yearling coho in the Grays River where the trap was potentially biased against the largest individuals. Therefore, overall size selectivity was relatively minimal, but in future years we plan to further investigate the relative impact of size-selectivity on the hatchery-origin yearling estimates.

Equal probability of marked and unmarked fish

The assumption that marked and unmarked fish mix randomly was addressed through careful selection of the trap efficiency trial release sites that had adequate distance, stream sinuosity, and multiple areas of complex stream habitat between release and recapture sites.

During the first two trapping seasons at Hamilton Creek (2012 & 2013), there was initial concern about how to obtain an unbiased estimate of capture efficiency due to the configuration of the trap site location and potential release sites. In the Hamilton Creek basin, fish can migrate out of both Hamilton Creek and the Greenleaf Slough/Creek (Greenleaf). However, the rotary screw trap was located approximately 100 m downstream from the confluence of Greenleaf Slough/ Creek and on river-right (i.e., Hamilton Creek side). Because the 100 m of river between Greenleaf confluence and the trap lacked complex habitat, fish outmigrating from Hamilton

Creek may have had a different capture efficiency relative to fish outmigrating from Greenleaf. To alleviate this potential issue, marks were released from two release sites – one location was in Greenleaf and the other was in Hamilton Creek (termed Hamilton Creek and Greenleaf). The release location was alternated between the two sites on a daily basis. Additionally, during the 2012-2013 monitoring seasons, the Greenleaf release site was located 2.8 km upstream of the trap resulting in marked fish having to navigate ~ 1.6 km through Greenleaf Slough to reach the trap location. The site was dropped in favor of a closer release site due to concerns over possible predation and migration delays that could result in mark loss or miss-assignment to correct release group. In 2014, the Hamilton Creek screw trap was moved to the lower location that resulted in more distance (0.5 – 0.9 km) and good sinuosity and complex stream habitat between both release sites and the juvenile trap.

At first glance, the CJ trap efficiency release site seems extremely close, ~120 meters, above the trap. However, a large (30-35 meters in length and 1-1.5 meters in height) stream-spanning beaver dam exists at this location and all flow in the creek between the beaver dam and the juvenile trap passes through an opening maintained by staff during the trapping season. Because all outmigrants must pass through the narrow notch in the beaver dam and some stream sinuosity is present between the release site and the trap, releasing this close to the recapture site is not likely to invalidate the assumption.

Table 3. Summary of size selectivity results. Average fork lengths (FL; mm) of all marked (M) and recaptured (R) individuals for each correspond abundance grouping (NOR = natural-origin, HOR = hatchery-origin). Bolded cells represent statistically significant size differences (α = 0.05) based on Kolmogorov–Smirnov (KS) tests but deemed to be biologically unimportant (i.e., size difference ≤ 5mm). Bolded and grayed cells represent statistically significant size differences (α = 0.05) based on (KS) tests and potentially biologically significant (i.e., size difference > 5mm).

	2008		2009		2010		2011		2012		2013		2014		2015		2016	
	M	R	M	R	M	R	M	R	M	R	M	R	M	R	M	R	M	R
Grays River																		
NOR Chum Fry	40	40	**40**	**40**	**39**	**39**	40	40	**39**	**40**	**40**	**40**	39	39	**40**	**40**	**40**	**39**
NOR Chinook Sub-Yearling	**73**	**75**	77	73	85	85	**77**	**83**	82	80	82	81	83	84	84	83	**76**	**78**
HOR Chinook Sub-Yearling	89	86	---	---	88	85	77	77	96	93	103	97	85	87	---	---	76	78
NOR Coho Sub-Yearling	99	102	99	102	**100**	**102**	99	102	106	105	106	107	99	98	99	99	100	99
HOR Coho Sub-Yearling	**97**	**99**	104	115	---	---	**100**	**102**	104	99	105	106	93	96	102	93	**93**	**94**
NOR Coho Yearling	121	121	116	121	118	117	124	125	116	118	118	116	116	114	118	118	122	121
HOR Coho Yearling	**154**	**136**	**144**	**137**	150	150	**146**	**137**	138	137	**139**	**134**	131	128	**142**	**138**	140	137
NOR Steelhead Yearling	164	158	160	161	166	160	170	167	164	151	162	160	159	130	159	157	157	159
HOR Steelhead Yearling	**170**	**163**	173	173	192	190	**177**	**171**	173	168	183	180	164	166	184	181	147	159
Crazy Johnson Creek																		
NOR Chum Fry	---	---	---	---	---	---	---	---	---	---	39	40	39	39	40	40	39	39
Hamilton Creek																		
NOR Coho Yearling	---	---	---	---	---	---	---	---	---	---	---	---	**130**	**126**	138	136	131	131
NOR Steelhead Yearling	---	---	---	---	---	---	---	---	---	---	---	---	165	163	170	171	167	167

The reach between the Grays trap and its primary efficiency trial release site (Cable Hole) is ~1.3 km and has good sinuosity and several areas of complex stream habitat. Additionally, the Grays primary release site was evaluated against a closer release site (Fossil Creek) to determine if predation on marked chum salmon fry was resulting in biased recovery rates. Paired releases of marked chum fry were released at the two sites. Of the twelve sets of paired releases, three were determined to have significantly different recovery rates (chi-squared p-values <0.05; Table 4). However, the overall combined recovery rates for the season were 5.16% and 5.17%, Cable Hole and Fossil Creek sites respectively, and were not significantly different (chi-squared p-value = 0.98). Additionally, the 95% confidence intervals of the recovery rate point estimates overlapped for all sets of comparison releases (Figure 10). Based on these results, we assumed that the recapture rates of larger fish (i.e., coho salmon and steelhead) were similar among release locations and thus predation was not an issue from our Cable Hole release location.

Table 4. Summary of Grays River capture efficiency paired-release trials. Date of release (month-day), release site (FC = Fossil Creek – closer to trap, CH = Cable Hole – farther from trap), total number of marks released and recapped, point estimates (± 95% CI), and the resulting chi-squared p-values.

	Release			Efficiency Estimates			Chi-squared
Date	site	# Released	# Recaps	Point	L95%	U95%	test p-values
2/18	FC	100	4	4.00%	0.16%	7.48%	0.798
2/20	CH	183	10	5.46%	2.17%	8.16%	
2/23	CH	522	25	4.79%	2.96%	6.62%	0.319
2/25	FC	479	16	3.34%	1.73%	4.95%	
2/27	CH	434	25	5.76%	3.57%	7.95%	0.067
3/1	FC	695	23	3.31%	1.98%	4.64%	
3/3	CH	1,972	88	4.46%	3.55%	5.37%	*0.040*
3/5	FC	2,802	164	5.85%	4.98%	6.72%	
3/7	CH	4,244	368	8.67%	7.82%	9.52%	0.051
3/9	FC	4,642	349	7.52%	6.76%	8.28%	
3/11	CH	5,698	200	3.51%	3.03%	3.99%	0.802
3/13	FC	1,992	73	3.66%	2.84%	4.49%	
3/15	CH	3,650	154	4.22%	3.57%	4.87%	*0.019*
3/17	FC	4,545	244	5.37%	4.71%	6.02%	
3/19	CH	4,585	234	5.10%	4.47%	5.74%	0.428
3/21	FC	4,381	241	5.50%	4.83%	6.18%	
3/30	FC	1,042	20	1.92%	1.09%	2.75%	0.071
4/1	CH	3,262	99	3.03%	2.45%	3.62%	
4/3	FC	1,150	13	1.13%	0.52%	1.74%	0.382
4/5	CH	627	11	1.75%	0.73%	2.78%	
4/7	FC	544	13	2.39%	1.11%	3.67%	*0.014*
4/9	CH	689	4	0.58%	0.01%	1.15%	
4/11	CH	120	0	0.00%	0.00%	0.00%	0.553
4/14	FC	142	2	1.41%	0.00%	3.35%	
Combined	CH	30,319	1,564	5.16%	4.91%	5.41%	0.983
	FC	22,975	1,187	5.17%	4.88%	5.45%	

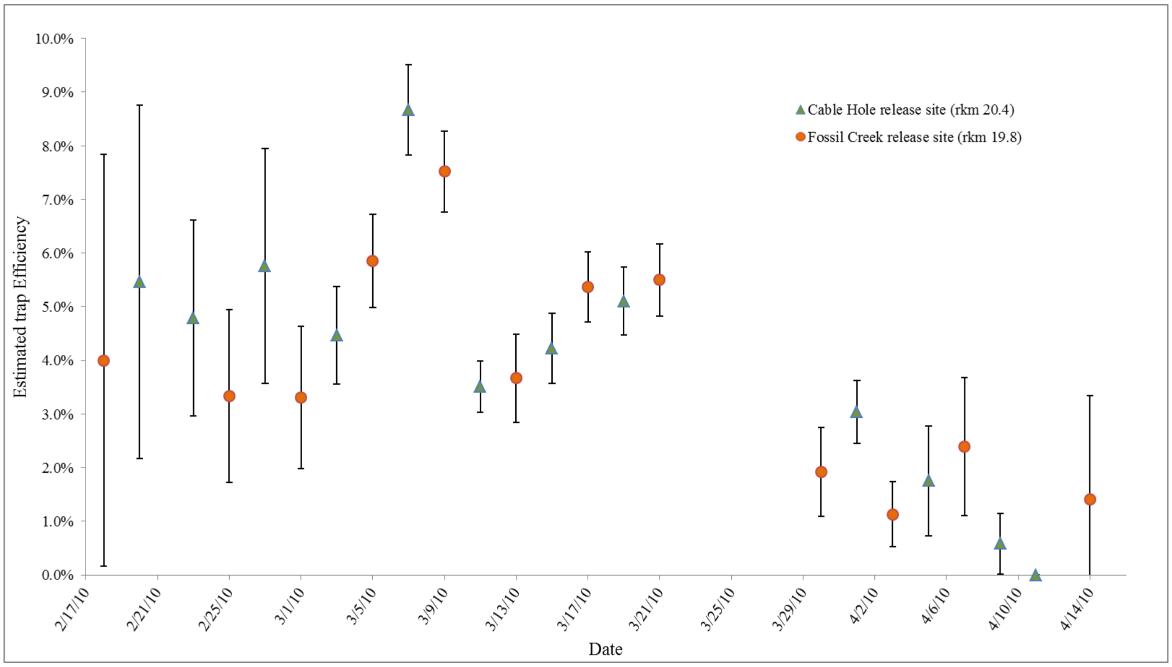

Figure 10. Results of trap efficiency release trials (Mean and ± 95% CI) for chum salmon fry comparing Fossil Creek and Cable Hole release sites, Grays River, 2008.

Assumption 3 (No Mark-Induced Mortality)

To minimize the potentially negative effects of marking on fish, trap staff were properly trained using sampling and marking protocols. Additionally, we only marked individuals that were free from visible injuries or descaling. All marked juveniles were visually evaluated again prior to release to remove any individuals displaying erratic or impaired swimming behaviors. The FL was measured and recorded for any fish marked, but later disqualified from being used in an efficiency trial release so they could be removed from size-selectivity analyses.

Additionally, we conducted numerous delayed-mortality holding tests on chum, Chinook, coho salmon and steelhead juveniles. Holding periods ranged from 24 hours to 28 days and showed the marking protocols in place resulted in very few, if any, mortalities (Table 5). The overall 24-hour delayed-mortality rates for chum and Chinook salmon were estimated to be 0.52% and 1.2% respectively. The overall 2008 delayed-mortality rates for coho salmon and steelhead were slightly higher at 1.7% and 2.8% respectively. However, these results, especially the steelhead rate, should be viewed with caution. There were issues with the screens over the holding tanks used in 2008, and on several occasions marked test fish were found on the ground. If the fish was still alive when found, staff returned them to the holding tank making it impossible to determine if a mortality was the result of being marked or from injuries due to the fish jumping out of the holding tank. The test was repeated in 2009 using steelhead, with the jumping issue resolved, and those tests showed zero 48-hour delayed mortality. Based on these results, we assumed mark-induced mortality was negligible.

Table 5. Summary of delayed mortality test, chum, Chinook and coho salmon and steelhead, 2008-2011.

Species	Year	# Held	Length of Test (days)	Days to First Mortality / Number of Mortalities on that Day
Chum	2008	100	1	No mortalities
Chum	2008	100	1	No mortalities
Chum	2008	100	1	No mortalities
Chum	2008	200	18	No mortalities
Chum	2009	200	28	1 / 1
Chum	2010	242	12	2 / 1
Chum	2010	246	15	1 / 3
Chum	2011	149	14	1 / 3
Chinook	2009	122	10	1 / 2
Chinook	2010	272	12	4 / 4
Chinook	2011	200	14	1 / 5
Coho	2008	1,014	3	1 / 10*
Coho	2008	1,021	3	1 / 4*
Coho	2008	1,012	3	1 / 37*
Steelhead	2008	1,065	3	1 / 49*
Steelhead	2008	1,035	3	1 / 6*
Steelhead	2009	100	2	No mortalities
Steelhead	2009	100	2	No mortalities

* The majority (>95%) of these mortalities were the result of "jumpers" and not due to sampling or marking.

Assumptions 4 and 5 (No Mark loss and Mark Detection/Clarity)

To test the assumptions that fish did not lose their marks and that recaptured marks were recognized, the VIE and Bismarck marking protocols were evaluated during the 2008-2011 seasons for effectiveness in placing a mark, mark retention and duration. Five tests of Bismarck mark retention were conducted using hatchery-origin chum salmon fry. The number of days post marking to mark loss ranged from four to 14 days, averaging 7.4 days overall (Table 6). Three tests of Bismarck mark retention were conducted using hatchery-origin Chinook salmon juveniles (mixture of transitional and smolt stage). The number of days post marking to mark loss ranged from three to 14 days, averaging 6.6 days overall (Table 6).

Two tests of VIE mark retention were conducted using hatchery-origin coho salmon juveniles (mixture of transitional and smolt stage) in 2008. Of the 200 coho salmon juveniles marked and held, two were found to have lost the VIE mark when re-examined 48 hours post marking (Table 7). Four tests, two each in 2008 and 2009, of VIE mark retention were conducted using hatchery-origin steelhead juveniles (mixture of transitional and smolt stage). Of the 400 steelhead juveniles marked and held, three were found to have lost the VIE mark when re-examined 48 hours post marking (Table 7). Given the mark-loss rate, we assumed that mark loss was negligible in our abundance estimates.

Table 6. Summary of Bismarck dye mark retention test, chum and Chinook salmon, 2008-2011.

Species	Year	Mark Type	# Marked	Length of Test (days)	Days to First Mark Loss
Chum	2008	Bismarck	100	1	No loss
Chum	2008	Bismarck	100	1	No loss
Chum	2008	Bismarck	100	1	No loss
Chum	2008	Bismarck	200	18	8
Chum	2009	Bismarck	200	28	6
Chum	2010	Bismarck	191	12	4
Chum	2010	Bismarck	184	12	5
Chum	2011	Bismarck	108	14	14
Chinook	2009	Bismarck	85	10	3
Chinook	2010	Bismarck	200	12	3
Chinook	2011	Bismarck	170	14	14

Table 7. Summary of VIE mark retention test, coho salmon and steelhead, 2008-2011.

Species	Year	Mark Type	# Marked	Length of Test (days)	Results
Coho	2008	VIE	100	2	Two marks lost
Coho	2008	VIE	100	2	Zero marks lost
Steelhead	2008	VIE	100	2	Zero marks lost
Steelhead	2008	VIE	100	2	One mark lost
Steelhead	2009	VIE	100	2	Two marks lost
Steelhead	2009	VIE	100	2	Zero marks lost

Assumption 6 (Marked Juveniles are Migrants)

To avoid invalidating this assumption, protocols on life-stage identification and training were used to ensure that only actively migrating juveniles (i.e. transitional and smolt life-stages) were used for trap efficiency trials. In addition, release sites were chosen that minimized the distance to the trap as much as possible to discourage delay or residualism while still far enough away to provide adequate mixing of marked and unmarked migrants and not violate the equal catchability assumption. Also, juveniles with injuries or displaying non-standard behavior were excluded from use in efficiency trials.

Catch and Capture Efficiency

Grays River

CHUM SALMON

From 2008 – 2016, the average total annual raw maiden catch of natural-origin chum salmon fry was approximately 47,000 and ranged from approximately 15,000 to over 120,000 (Table 8). Although hatchery-origin chum salmon were always scheduled to be released below the mainstem screw trap, a handful of chum were captured that were likely of hatchery-origin based on their size and body morphometrics. Chum fry were captured from as early as February 1st to as late as July 14th, but on average 73% of the catch (range: 38– 89%) among years was caught during the month of March (Appendix C: Tables C1 – C9). In general, catch followed the bell-shaped pattern expected of outmigrating juveniles in all but three years (Appendix B: Figures B1 – B9). Specifically, in two years (2012 and 2015), large flow events during the peak of the run resulted in either inoperable trapping conditions or extremely low catch and thus a large portion of the expected outmigration was missed. Therefore, abundance in 2012 and 2015 had to be estimated using an alternative method (see Methods: "Proportion" estimator for Grays chum fry – 2012 & 2015"). In 2014, daily catch during March was extremely low (<500/day) except in three consecutive days when catch ranged from 4,000 – 7,000, which was higher than any other three day period among all years.

Capture (trap) efficiencies were modeled by period within each year and were typically between 2-5%. However, some years (2014 & 2016) had generally lower overall efficiencies while other years (2009 & 2010) had generally higher efficiencies (Appendix D: Figures D1 –D7). These relatively low capture efficiencies were a direct result of relatively high flows in March and April, and were also periodically exacerbated by rapid and high magnitude changes in flow, which generally decreased catch and trap efficiency. Despite the low overall trap efficiencies, there were still, on average, 829 total recaptures (range: 180 – 2776) within a given year due to the high number of marks released (average: 22,961; range: 7,727 – 53,754). During the month of March, the average number of recaptures for each 2 – 5 day period varied between 10 and 158 in all years but two (2012 & 2016). These large numbers of recaptures led to relatively precise estimates of capture efficiency among periods.

Table 8. Summary of annual raw maiden captures for Grays River natural-origin chum salmon by life-stage and age-class, 2008 – 2016.

		Sub-Yearling			Yearling	
Year	Trap Type	Fry	Parr	Transitional/ Smolt	Parr	Transitional/ Smolt
2008	RST	39,603	---	---	---	---
2009	RST	73,788	---	---	---	---
2010	RST	123,189	---	---	---	---
2011	RST	23,593	---	---	---	---
2012	RST	17,536	---	---	---	---
2013	RST	69,474	---	---	---	---
2014	RST	27,043	---	---	---	---
2015	RST	46,614	---	---	---	---
2016	RST	16,138	---	---	---	---

CHINOOK SALMON

From 2008 – 2016, the average total raw maiden catch of natural-origin Chinook salmon fry was 891 (range: 27 – 2,737) and sub-yearlings (parr, transitional, and smolt) was 1,247 (range: 343 – 4586; Table 9). Although no hatchery-origin Chinook salmon were scheduled to be released in the Grays River, and thus none should have been caught, an average of 389 (range: 5 – 2,656) hatchery-origin (i.e., based solely on adipose clip) sub-yearling Chinook salmon were captured (Table 10). In general, Chinook salmon fry followed a similar outmigration pattern to that of chum fry in the Grays River, with catch occurring from February through July (Appendix B: Figures B10– B18), but on average 60% of the catch (range: 32– 83%) among years was caught during the month of March (Appendix C: Tables C10 – C15). The catch of natural-origin Chinook salmon sub-yearlings was somewhat erratic among years and they were caught throughout the entire trapping season from February through August (Appendix B: Figures B19 – B27). However, the Chinook salmon sub-yearling outmigration generally commenced after the Chinook salmon fry outmigration with an average of 89% of the catch (range: 58– 99%) being caught from May – July (Appendix C: Tables C16 – C24). Similarly, catch of hatchery-origin Chinook salmon sub-yearlings typically occurred from May – July (Appendix B: Figures B28 – B36). ; Appendix C: Tables C25 – C33)

Chinook salmon fry capture (trap) efficiencies were not directly calculated. Therefore, chum salmon fry mark and release group data were used as a surrogate for Chinook salmon fry efficiencies. Overall, capture efficiencies used for Chinook salmon fry were typically between 2-5% (Appendix D: Figures D8 –D13). Unlike Chinook fry, capture efficiencies for Chinook salmon sub-yearling (natural- and hatchery-origin) were directly measured and typically ranged between 10 to 25% (Appendix D: Figures D14 –D31). Efficiencies for sub-yearlings were much higher because these individuals primarily migrated after the installation of flow-diverting panels. Excluding two years (2009 & 2010), there were on average 286 total sub-yearling (range: 80 – 1079) recaptures within a given year, and on average 8 – 90 recaptures for each period from May - June. However, in 2009 and 2010, there were only 25 and 34 total sub-yearling recaptures for the entire trapping season, respectively, leading to highly uncertain estimates of capture efficiency.

One important thing to note is that although Chinook salmon abundance estimates included catch for parr, transitional, and smolt life-stages, only Chinook salmon transitional and smolts were marked for trap efficiency trials. While this trap procedure may have helped meet a mark-recapture assumption by only marking “migrating” fish (i.e., equal capture probabilities), it may have resulted in an underestimation of capture efficiencies for a portion of the total outmigration. Specifically here, Chinook salmon parr generally pass the trapping site earlier in the year relative to Chinook salmon that outmigrate later as transitionals and smolts and thus we would expect the trap efficiency to be lower for parr due to higher flows. However, because parr were not marked, trap efficiencies for the earlier portions of the run were more-or-less equal to the overall hierarchical trap efficiency estimate for all trap efficiency periods. Therefore, trap efficiency for parr may have been overestimated, which would have resulted in an underestimation of total sub-yearling abundance.

The potential impact of this trapping procedure on the abundance estimates depends on two main variables: 1) the proportion of the total outmigrants that were comprised of parr, and 2) the difference in trap efficiencies for earlier (i.e., parr) and later (i.e., transitional and smolt) trapping periods. Among years, parr comprised on average 21% of the total Chinook salmon sub-yearling catch (range: 1 – 81%). Thus, the large majority of the Chinook salmon sub-yearling outmigration estimate consisted of transitionals and smolts. However, because catch and trap efficiency are often correlated, this estimation may also be an underestimate of true catch composition. Therefore, our estimates of Chinook salmon sub-yearling outmigrants should be viewed as a minimum abundance and we should evaluate the pros and cons of collecting capture efficiency data for Chinook parr in future years.

Table 9. Summary of annual raw maiden captures for Grays River natural-origin Chinook by life-stage and age-class, 2008 – 2016.

		Sub-Yearling			Yearling	
Year	Trap Type	Fry	Parr	Transitional/ Smolt	Parr	Transitional/ Smolt
2008	RST	27	16	1,094	0	2
2009	RST	564	64	279	1	1
2010	RST	2,737	44	417	0	0
2011	RST	770	554	4,032	1	2
2012	RST	1,169	151	805	1	3
2013	RST	89	137	445	0	1
2014	RST	1,886	747	917	0	1
2015	RST	721	48	680	0	0
2016	RST	62	46	744	0	6

Table 10. Summary of annual raw maiden captures for Grays River hatchery-origin Chinook by life-stage and age-class, 2008 – 2016.

		Sub-Yearling			Yearling	
Year	Trap Type	Fry	Parr	Transitional/ Smolt	Parr	Transitional/ Smolt
2008	RST	0	0	19	0	0
2009	RST	0	4	4	0	0
2010	RST	20	292	28	1	1
2011	RST	0	502	2,154	0	4
2012	RST	0	6	56	1	6
2013	RST	3	5	46	0	0
2014	RST	0	0	177	0	1
2015	RST	0	1	4	0	2
2016	RST	1	3	197	0	0

COHO SALMON

From 2008 – 2016, the average total raw maiden catch of natural-origin sub-yearling coho salmon fry was 4,096 (range: 371 – 10,632), parr was 90 (range: 2 – 443), and transitional/smolt was 241 (range: 59 – 394) while natural-origin yearling coho salmon parr was 16 (range: 1 – 46) and transitional/smolt was 333 (range: 58 – 581; Table 11). Although no hatchery-origin sub-yearling coho were scheduled to be released in the Grays River, an average of 26 parr (range: 0 – 190) and 131 transitional/smolt (range: 3 – 839) juveniles were captured among years (Table 12). In general, natural-origin yearling transitional/smolt coho salmon were captured from April through June, but on average 70% (range: 43– 90%) were captured during the month of May (Appendix C: Tables C34 – C42). Catch of natural-origin yearling coho matched the expected outmigration timing based on monitoring in other lower Columbia River tributaries, but was also correlated with the installation of flow-diverting panels in May, which dramatically increased catch (Appendix B: Figures B37 – B45). Natural-origin sub-yearlings transitional/smolt coho salmon were captured from May through July, but on average 61% (range: 25– 92%) were captured during the month of July (Appendix C: Tables C43 – C51; Appendix B: Figures B46 – B54). The main release of hatchery-origin yearling transitional/smolt coho salmon occurred from the Grays River Hatchery annually between April 26^{th} - May 1^{st} and on average 88% of the catch (range: 47 – 99%) was captured in three days following the bulk release (Appendix C: Tables C52 – C60; Appendix B: Figures B55 – B63).

In all years, capture (trap) efficiency was modeled for transitional/smolt coho salmon by combining natural- and hatchery-origin mark and recapture data within a given year and age-class (yearling and sub-yearling). Aside from the period that encompassed the hatchery-origin yearling bulk-release, the total number of recaptures within a given period was generally low. Low recapture rates can not only affect the precision of the abundance estimate, they can also lead to potentially inaccurate estimates. Given that trap efficiencies for natural- and hatchery-origin coho salmon were relatively similar for most periods within a given year and each age-class, we combined these data and made the assumption that the capture efficiencies were exchangeable.

In some years, even after combining hatchery- and natural-origin efficiency data, the total number of recaptures was still extremely low. For example, in 2009 and 2010, there were <30 yearlings recaptured through the entire trapping season, of which the majority were recaptured in a single period or two. However, in most other years, by combining hatchery- and natural-origin data, the total number of recaptures for the entire trapping season averaged 125 among years (range: 71 – 199) and within a year most had multiple periods with >10 recaptures per period. Among years and periods, trap efficiency for yearling coho salmon was typically <5% before flow diverting panels were installed, but did increase to 15-20% following installation (Appendix D: Figures D41 – D49, D59 – D67). Trap efficiency for sub-yearling coho salmon was generally more variable relative to yearlings both within and among years with overall efficiencies ranging from <10% to >30% (Appendix D: Figures D32 – D40, D50 – D58).

Table 11. Summary of annual raw maiden captures for Grays River natural-origin coho salmon by life-stage and age-class, 2008 – 2016.

		Sub-Yearling			Yearling	
Year	Trap Type	Fry	Parr	Transitional/ Smolt	Parr	Transitional/ Smolt
2008	RST	1,544	20	76	9	471
2009	RST	3,595	2	59	11	58
2010	RST	5,923	14	216	7	222
2011	RST	10,390	167	339	46	519
2012	RST	10,632	443	187	14	175
2013	RST	1,348	83	323	30	581
2014	RST	1,705	18	394	11	289
2015	RST	1,355	26	349	1	331
2016	RST	371	34	229	3	350

Table 12. Summary of annual raw maiden captures for Grays River hatchery-origin coho salmon by life-stage and age-class, 2008 – 2016.

		Sub-Yearling			Yearling	
Year	Trap Type	Fry	Parr	Transitional/ Smolt	Parr	Transitional/ Smolt
2008	RST	0	0	33	3	2,552
2009	RST	0	0	3	31	3,773
2010	RST	0	190	8	58	3,303
2011	RST	0	11	25	0	1,498
2012	RST	0	6	44	179	9,379
2013	RST	0	1	59	0	4,837
2014	RST	0	0	159	0	7,537
2015	RST	0	0	6	4	7,220
2016	RST	0	23	839	3	6,174

STEELHEAD

From 2008 – 2016, the average total raw maiden catch of natural-origin yearling steelhead parr was 469 (range: 293 – 715) and transitional/smolt was 322 (range: 112 – 568; Table 13), while hatchery-origin transitional/smolt was 632 (range: 13 – 1,172; Table 14). Unlike coho salmon, there was no detected catch of hatchery-origin sub-yearling steelhead. In general, natural-origin yearling transitional/smolt steelhead were captured from April through June, but on average 74% (range: 45– 96%) were captured during the month of May (Appendix C: Tables C70 – C78). Similar to yearling coho salmon, catch followed a bell-shaped pattern, but in some years did not pick up until flow diverting panels were installed (Appendix B: Figures B64 – B72). Therefore, in years where the panels were not installed until mid- to late-May, catch was extremely low, and in some years (2008, 2010) much lower than expected. The main release of hatchery-origin yearling transitional/smolt steelhead typically occurred from the Grays River Hatchery between April 26th - May 1st and on average 89% of the catch (range: 59 – 98%) was captured in three days following the bulk release (Appendix B: Tables B73 – B80; Appendix C: Tables C79 – C87).

In all years, capture (trap) efficiency was modeled for transitional/smolt steelhead by combining natural- and hatchery-origin mark and recapture data within a given year and age-class (yearling and sub-yearling). Similar to coho salmon, trap efficiencies for natural- and hatchery-origin steelhead were relatively similar for most periods within a given year and each age-class. Therefore, we chose to combine these data and made the assumption that the capture efficiencies were exchangeable. However, even after combining hatchery- and natural-origin efficiency data, the total number of recaptures was still extremely low in most years. Among years, the total number of yearling recaptures throughout the entire trapping season averaged just 34 (range: 13 – 78) and in only two years were there multiple periods during the peak of the migration (mid-May) with more than 10 recaptures. Nonetheless, trap efficiency for yearling steelhead was typically <5% among years and periods before flow-diverting panels were installed, but increased to 5-15% following installation (Appendix D: Figures D68 – D84).

Table 13. Summary of annual raw maiden captures for Grays River natural-origin steelhead by life-stage and age-class, 2008 – 2016.

		Sub-Yearling			Yearling	
Year	Trap Type	Fry*	Parr	Transitional/ Smolt	Parr	Transitional/ Smolt
2008	RST	---	119	---	479	280
2009	RST	---	20	---	645	112
2010	RST	---	19	---	293	184
2011	RST	---	118	---	715	531
2012	RST	---	23	---	583	121
2013	RST	---	75	---	367	487
2014	RST	---	95	---	429	262
2015	RST	---	54	---	362	352
2016	RST	---	189	---	351	568

* Steelhead and cutthroat are very difficult to ID at the fry stage. Fry of both species were recorded as “trout and steelhead fry”.

Table 14. Summary of annual raw maiden captures for Grays River hatchery-origin steelhead by life-stage and age-class, 2008 – 2016.

		Sub-Yearling			Yearling	
Year	Trap Type	Fry	Parr	Transitional/ Smolt	Parr	Transitional/ Smolt
2008	RST	NA	0	0	0	741
2009	RST	NA	0	0	0	1,172
2010	RST	NA	0	0	0	740
2011	RST	NA	0	0	0	370
2012	RST	NA	0	0	0	654
2013	RST	NA	0	0	0	1,078
2014	RST	NA	0	0	0	767
2015	RST	NA	0	0	0	149
2016	RST	NA	0	0	0	13

OTHER SPECIES

In addition to chum, Chinook and coho salmon, and steelhead for which abundance estimates were generated, cutthroat trout (Table 15), trout and steelhead fry (Table 16), and at least 11 other non-target species (Table 17) were captured at the Grays trap from 2008 – 2016. Given that the screw trap was not operated to maximize the catch of these non-target species, the numbers reported in the tables below should be viewed as a minimum total estimate.

Table 15. Summary of annual raw maiden captures for Grays River natural-origin cutthroat trout by life-stage and age-class, 2008 – 2016.

		Sub-Yearling			Yearling	
Year	Trap Type	Fry*	Parr	Transitional/ Smolt	Parr	Transitional/ Smolt
2008	RST	---	0	0	4	15
2009	RST	---	0	0	1	15
2010	RST	---	0	0	7	21
2011	RST	---	0	0	4	30
2012	RST	---	0	0	10	4
2013	RST	---	0	0	9	48
2014	RST	---	0	0	6	18
2015	RST	---	0	0	6	33
2016	RST	---	0	0	12	76

* Steelhead and cutthroat are very difficult to ID at the fry stage. Fry of both species were recorded as "trout and steelhead fry".

Table 16. Summary of annual raw maiden captures for Grays River natural-origin "trout and steelhead fry" by life-stage and age-class, 2008 – 2016.

		Sub-Yearling			Yearling	
Year	Trap Type	Fry	Parr	Transitional/ Smolt	Parr	Transitional/ Smolt
2008	RST	3,818	---	---	---	---
2009	RST	273	---	---	---	---
2010	RST	445	---	---	---	---
2011	RST	1,924	---	---	---	---
2012	RST	1,319	---	---	---	---
2013	RST	1.067	---	---	---	---
2014	RST	1,734	---	---	---	---
2015	RST	1,873	---	---	---	---
2016	RST	490	---	---	---	---

Table 17. Non-target salmonid and non-salmonid catch Summary for Grays River, 2008 - 2016.

	Year								
Species	2008	2009	2010	2011	2012	2013	2014	2015	2016
3-Spine Stickleback	1,106	82	445	275	212	424	970	718	316
Brook Lamprey	0	0	0	0	50	0	0	0	0
Bullhead: General	110	53	214	0	0	0	0	0	0
Dace: General	0	0	0	0	0	0	18	14	7
Eulachon	1	0	0	0	0	0	0	148	68
Golden Shiner	0	0	0	0	0	0	0	0	2
Lamprey: General	147	83	41	20	12	122	100	43	141
Longnose Dace	0	0	0	0	4	16	0	0	0
Northern Pikeminnow	2	0	69	17	0	7	1	2	4
Pacific Lamprey	0	0	0	0	4	0	0	0	0
Peamouth Chub	169	17	404	1,083	150	289	230	1,200	986
Sculpin: General	388	262	10	264	371	704	753	666	728
Sucker: General	12	1	3	26	2	3	6	1	4
Trout-General	26	0	0	0	3	28	28	12	12

Crazy Johnson Creek

CHUM SALMON

From 2011 – 2016, the average total raw maiden catch of natural-origin chum salmon fry at the Crazy Johnson Creek (CJ) trap site was approximately 253,000 and ranged from approximately 95,000 to over 447,000 (Table 18). Among years, chum fry were generally captured once the trap was installed in early February until the trap was pulled in early May, but on average 65% of the catch (range: 37– 79%) was caught during the month of March (Appendix C: Tables C88 – C92). In 2011, the majority of the trapping season was missed due to two high-flow events in March that compromised trap operation. In three years (2012, 2013, 2014), alternate-day trapping was implemented to decrease overall catch and stay under ESA take permit levels. In 2015, abnormally low flows in early March resulted in relatively lower catch due to issues with getting the screw trap to operate (rotate) correctly (Appendix B: Figures B81 – B86) . Regardless of some trapping issues, catch was still overall relatively high and estimates of abundance could be generated in all years but one (2011).

Capture (trap) efficiencies at CJ varied by trap type. In 2011 and 2012, a fence-panel weir was operated and capture efficiency was assumed to be 100% unless the trap was compromised, in which case catch was interpolated (p-spline method) for the missing days. In 2013 – 2016 a rotary screw trap was used and trap efficiency was modeled by period within each year, and was typically between 25 – 50% (Appendix D: Figures D85 – D88). Because trap efficiencies were relatively high, only 100 marks were typically released every 4 – 6 days for an average total of ~1,100 marks (range: 900 – 1,520) each year. Among the four years of screw trap data, on average a total of 521 marked chum fry (range: 296 – 1,034) were recaptured within a given year and on average 23 – 69 fish were recaptured in each period.

Table 18. Summary of annual raw maiden captures for Crazy Johnson Creek natural-origin chum salmon by life-stage and age-class, 2011 – 2016.

		Sub-Yearling			Yearling	
Year	Trap Type	Fry	Parr	Transitional/ Smolt	Parr	Transitional/ Smolt
2011	Weir	95,152	---	---	---	---
2012	Weir	204,612	---	---	---	---
2013	RST	447,672	---	---	---	---
2014	RST	334,877	---	---	---	---
2015	RST	128,030	---	---	---	---
2016	RST	311,421	---	---	---	---

OTHER SPECIES

In addition to chum salmon fry, for which abundance estimates were generated, several other species were captured at the CJ trap, including: natural-origin Chinook (Table 19), hatchery-origin Chinook (Table 20), natural-origin coho (Table 21), hatchery-origin coho salmon (Table 22), natural-origin steelhead (Table 23), hatchery-origin steelhead (Table 24), cutthroat trout (Table 25), trout and steelhead fry (Table 26), and at least nine non-target fish species (Table 27). Given that the screw trap was not operated to maximize the catch of these non-target species, the numbers reported in the tables below should be viewed as a minimum total estimate.

Table 19. Summary of annual raw maiden captures for Crazy Johnson Creek natural-origin Chinook salmon by life-stage and age-class, 2011 – 2016.

		Sub-Yearling			Yearling	
Year	Trap Type	Fry	Parr	Transitional/ Smolt	Parr	Transitional/ Smolt
2011	Weir	16	12	---	---	---
2012	Weir	35	113	---	---	---
2013	RST	2	0	---	---	---
2014	RST	897	107	---	---	---
2015	RST	7	5	---	---	---
2016	RST	1	2	---	---	---

Table 20. Summary of annual raw maiden captures for Crazy Johnson Creek hatchery-origin Chinook salmon by life-stage and age-class, 2011 – 2016.

		Sub-Yearling			Yearling	
Year	Trap Type	Fry	Parr	Transitional/ Smolt	Parr	Transitional/ Smolt
2011	Weir	---	0	---	---	---
2012	Weir	---	0	---	---	---
2013	RST	---	1	---	---	---
2014	RST	---	0	---	---	---
2015	RST	---	0	---	---	---
2016	RST	---	0	---	---	---

Table 21. Summary of annual raw maiden captures for Crazy Johnson Creek natural-origin coho salmon by life-stage and age-class, 2011 – 2016.

		Sub-Yearling			Yearling	
Year	Trap Type	Fry	Parr	Transitional/ Smolt	Parr	Transitional/ Smolt
2011	Weir	6,123	4	0	3	229
2012	Weir	2,373	159	0	36	339
2013	RST	826	4	0	398	167
2014	RST	1,905	19	0	2	110
2015	RST	5,381	99	0	12	121
2016	RST	1,568	58	0	34	106

Table 22. Summary of annual raw maiden captures for Crazy Johnson Creek hatchery-origin coho salmon by life-stage and age-class, 2011 – 2016.

		Sub-Yearling			Yearling	
Year	Trap Type	Fry	Parr	Transitional/ Smolt	Parr	Transitional/ Smolt
2011	Weir	0	0	0	0	6
2012	Weir	0	0	0	0	8
2013	RST	0	0	0	0	25
2014	RST	0	0	0	0	1
2015	RST	0	0	0	3	52
2016	RST	0	1	0	1	5

Table 23. Summary of annual raw maiden captures for Crazy Johnson Creek natural-origin steelhead by life-stage and age-class, 2011 – 2016.

		Sub-Yearling			Yearling	
Year	Trap Type	Fry*	Parr	Transitional/ Smolt	Parr	Transitional/ Smolt
2011	Weir	---	10	NA	115	2
2012	Weir	---	4	NA	57	2
2013	RST	---	3	NA	318	50
2014	RST	---	7	NA	205	24
2015	RST	---	0	NA	78	20
2016	RST	---	0	NA	192	41

* Steelhead and cutthroat are very difficult to ID at the fry stage. Fry of both species were recorded as "trout and steelhead fry".

Table 24. Summary of annual raw maiden captures for Crazy Johnson Creek hatchery-origin steelhead by life-stage and age-class, 2011 – 2016.

		Sub-Yearling			Yearling	
Year	Trap Type	Fry	Parr	Transitional/ Smolt	Parr	Transitional/ Smolt
2011	Weir	NA	0	NA	0	0
2012	Weir	NA	0	NA	0	0
2013	RST	NA	0	NA	0	0
2014	RST	NA	0	NA	0	1
2015	RST	NA	0	NA	0	2
2016	RST	NA	0	NA	0	1

Table 25. Summary of annual raw maiden captures for Crazy Johnson Creek natural-origin cutthroat trout by life-stage and age-class, 2011 – 2016.

		Sub-Yearling			Yearling	
Year	Trap Type	Fry*	Parr	Transitional/ Smolt	Parr	Transitional/ Smolt
2011	Weir	---	0	0	0	2
2012	Weir	---	0	0	5	2
2013	RST	---	0	0	12	8
2014	RST	---	0	0	19	11
2015	RST	---	0	0	5	8
2016	RST	---	0	0	8	5

* Steelhead and cutthroat are very difficult to ID at the fry stage. Fry of both species were recorded as "trout and steelhead fry".

Table 26. Summary of annual raw maiden captures for Crazy Johnson Creek natural-origin "trout and steelhead fry" by life-stage and age-class, 2008 – 2016.

		Sub-Yearling			Yearling	
Year	Trap Type	Fry	Parr	Transitional/ Smolt	Parr	Transitional/ Smolt
2011	Weir	19	---	---	---	---
2012	Weir	0	---	---	---	---
2013	RST	0	---	---	---	---
2014	RST	0	---	---	---	---
2015	RST	0	---	---	---	---
2016	RST	0	---	---	---	---

Table 27. Non-target salmonid and non-salmonid catch Summary for Crazy Johnson Creek, 2011 - 2016.

	Year					
Species	2011	2012	2013	2014	2015	2016
3-Spine Stickleback	24	2,952	640	2,958	499	365
Brook Lamprey	NA	132	NA	NA	NA	NA
Dace: General	0	NA	0	NA	0	145
Lamprey: General	16	1	84	142	105	0
Longnose Dace	0	2	0	24	0	0
Pacific Lamprey	NA	NA	NA	NA	NA	1
River Lamprey	NA	NA	NA	NA	NA	675
Sculpin: General	81	166	689	1,008	239	0
Sucker: General	0	0	0	1	0	339
Trout-General	0	1002	5	0	42	0

Duncan Creek spawning channel

CHUM SALMON

From 2002 – 2016, the average total raw maiden catch of natural-origin chum salmon fry at the Duncan Creek spawning channel trap sites was approximately 34,000 and ranged from approximately 8,000 to over 65,000 (Table 28). Chum salmon fry were generally captured from early February until the traps were pulled in late April and May, but on average 62% of the catch (range: 21– 86%) was caught during the month of March, and 37% (range: 9 – 74%) in April among all years excluding 2002 (Appendix C: Tables C93 – C107). As mentioned previously, in 2002, fine mesh fyke nets and live boxes were used, which proved to be problematic to fish effectively and thus an unbiased abundance estimate was not possible. In all other years, catch generally followed a bell-shaped pattern that is expected of outmigrating juveniles. However, in some years daily catch was somewhat erratic (e.g., 2003, 2005) and sometimes bi-modal (2008, 2014; Appendix B: Figures B87 – B101), which may be a direct artifact of manual adult planting into the spawning channels and the resulting spawn timing. In all years, capture efficiency was assumed to be 100% unless the trap was compromised, in which case catch was interpolated (p-spline method) for the missing days.

Table 28. Summary of annual raw maiden captures for Duncan Creek spawning channel natural-origin chum salmon by life-stage and age-class, 2002 – 2016.

		Sub-Yearling			Yearling	
Year	Trap Type	Fry	Parr	Transitional/ Smolt	Parr	Transitional/ Smolt
2002	Fyke net	8,483	---	---	---	---
2003	Weir	25,478	---	---	---	---
2004	Weir	45,450	---	---	---	---
2005	Weir	27,814	---	---	---	---
2006	Weir	30,978	---	---	---	---
2007	Weir	29,707	---	---	---	---
2008	Weir	25,659	---	---	---	---
2009	Weir	27,569	---	---	---	---
2010	Weir	32,161	---	---	---	---
2011	Weir	25,571	---	---	---	---
2012	Weir	49,830	---	---	---	---
2013	Weir	36,160	---	---	---	---
2014	Weir	31,099	---	---	---	---
2015	Weir	48,213	---	---	---	---
2016	Weir	65,543	---	---	---	---

OTHER SPECIES

In addition to chum salmon fry, small numbers of non-targeted salmonid juveniles (primarily coho salmon fry and parr, yearling steelhead and yearling cutthroat trout) and non-salmonids are also captured at this location. Annual catch summaries of non-target fish have been previously detailed in progress reports (Hillson 2002, 2003, 2004, 2006a, 2006b, 2009, 2011, 2016).

Hamilton Creek

CHUM SALMON

From 2012 – 2016, the average total raw maiden catch of chum salmon fry at the Hamilton Creek rotary screw trap was 62 (range: 0 – 195; Table 29). These low catch numbers are a result of limited spawning habitat above the survey site and was not unexpected. The trap is located near what we believe is the upper boundary of the chum salmon spawning distribution in the creek. Catch of chum salmon fry at this trap is used primarily to confirm the spawning distribution and indicate changes that may require adjustments to adult monitoring.

Table 29. Summary of annual raw maiden captures for Hamilton Creek natural-origin chum salmon by life-stage and age-class, 2012 – 2016.

		Sub-Yearling			Yearling	
Year	Trap Type	Fry	Parr	Transitional/ Smolt	Parr	Transitional/ Smolt
2012	RST	195	---	---	---	---
2013	RST	7	---	---	---	---
2014	RST	56	---	---	---	---
2015	RST	0	---	---	---	---
2016	RST	53	---	---	---	---

CHINOOK SALMON

From 2012 – 2016, the average total raw maiden catch of natural-origin Chinook salmon fry was 2,793 (range: 496 – 6,004) and sub-yearlings (parr, transitional, and smolt) was 1,412 (range: 396 – 2,207; Table 30). It should be noted that the majority of lower Columbia River sub-yearling Chinook salmon typically out-migrate from May – July, but the Hamilton Creek trap site was typically pulled in early June, when flows decrease to the point that the rotary screw trap ceases to function despite the use of flow diverting panels.

Table 30. Summary of annual raw maiden captures for Hamilton Creek natural-origin Chinook salmon by life-stage and age-class, 2012 – 2016.

		Sub-Yearling		Yearling	
Year	Trap Type	Fry	Parr/Transitional/Smolt	Parr	Transitional/ Smolt
2012	RST	3,208	396	---	---
2013	RST	6,004	1,469	---	---
2014	RST	1,186	1,129	---	---
2015	RST	3,072	1,859	---	---
2016	RST	496	2,207	---	---

COHO SALMON

From 2012 – 2016, the average total raw maiden catch of natural-origin sub-yearling coho salmon fry was 223 (range: 6 – 849), parr was 101 (range: 12 – 203), and transitional/smolt was 12 (range: 11 – 15), while natural-origin yearling coho salmon parr was 20 (range: 0 – 75) and transitional/smolt was 913 (range: 109 – 1427; Table 31). Among years (excluding 2012) natural-origin yearling transitional/smolt coho were captured from as early as late-February until early June when the trap was pulled, but on average 34% of the total catch (range: 21– 44%) was captured during the month of April and 57% (range: 46– 75%) during the month of May (Appendix B: Tables B102 – B104; Appendix C: Tables C108 – C110). In 2012, the screw trap was not installed until April 30th. One important thing to note is that catch of yearling transitional/smolt was much higher in 2014 – 2016 due to the relocation of the trap site 0.2 km downstream.

Capture (trap) efficiencies were modeled by period within each year (2014, 2015, and 2016) and were typically estimated to be 15 – 25% (Appendix D: Figures D89 – D91). Among the three years, there were on average 315 total recaptures (range: 258 – 424) within a given year and an average of 22 – 42 recaptures per 6 - 7 day trapping period during April and May (Appendix C: Tables C108 – C110).

Table 31. Summary of annual raw maiden captures for Hamilton Creek natural-origin coho salmon by life-stage and age-class, 2012 – 2016.

		Sub-Yearling			Yearling	
Year	Trap Type	Fry	Parr	Transitional/ Smolt	Parr	Transitional/ Smolt
2012	RST	118	133	15	0	109
2013	RST	112	109	12	2	221
2014	RST	30	49	11	13	1,406
2015	RST	849	203	11	75	1,427
2016	RST	6	12	0	12	1,404

STEELHEAD

From 2012 – 2016, the average total raw maiden catch of natural-origin sub-yearling parr steelhead was 13 (range: 0 – 45), and transitional/smolt was 0, while natural-origin yearling parr steelhead was 233 (range: 30 – 389) and transitional/smolt was 479 (range: 49 – 1084; Table 32). Among years, excluding 2012, natural-origin steelhead transitional/smolt yearlings were captured from early March until early June when the trap was pulled, but on average 47% of the total catch (range: 43– 51%) was captured during the month of April and 47% (range: 40– 54%) during the month of May (Appendix B: Tables B105 – B107; Appendix C: Tables C111 – C113). In 2012, the screw trap was not installed until April 30th. Similar to coho salmon, the catch of yearling transitional/smolts was much higher in 2014 – 2016 due to the relocation of the trap site 0.2 km downstream.

Capture (trap) efficiencies were modeled by period within each year (2014, 2015, 2016) and were typically estimated to be 15 – 20% (Appendix D: Figures D92 – D94). Among the three years, there were on average 131 (range: 84 – 211) total recaptures within a given year and an average of 10 – 20 recaptures per 4 - 8 day trapping period among years during April and May (Appendix C: Tables C111 – C113).

Table 32. Summary of annual raw maiden captures for Hamilton Creek natural-origin steelhead by life-stage and age-class, 2012 – 2016.

		Sub-Yearling			Yearling	
Year	Trap Type	Fry*	Parr	Transitional/ Smolt	Parr	Transitional/ Smolt
2012	RST	---	1	0	113	75
2013	RST	---	2	0	30	49
2014	RST	---	0	0	261	583
2015	RST	---	15	0	389	604
2016	RST	---	45	0	374	1,084

* Steelhead and cutthroat are very difficult to ID at the fry stage. Fry of both species were recorded as "trout and steelhead fry".

OTHER SPECIES

In addition to chum, Chinook and coho salmon and steelhead, the Hamilton Creek screw trap captured cutthroat trout (Table 33), trout and steelhead fry (Table 34), and at least 15 other non-target species from 2012 – 2016 (Table 35). Given that the screw trap was not operated to maximize the catch of these non-target species, the numbers reported in the tables below should be viewed as a minimum total estimate.

Table 33. Summary of annual raw maiden captures for Hamilton Creek natural-origin cutthroat trout by life-stage and age-class, 2012 – 2016.

		Sub-Yearling			Yearling	
Year	Trap Type	Fry*	Parr	Transitional/ Smolt	Parr	Transitional/ Smolt
2012	RST	---	0	0	2	3
2013	RST	---	0	0	3	4
2014	RST	---	0	0	7	22
2015	RST	---	0	0	22	34
2016	RST	---	0	0	5	30

* Steelhead and cutthroat are very difficult to ID at the fry stage. Fry of both species were recorded as "trout and steelhead fry".

Table 34. Summary of annual raw maiden captures for Hamilton Creek natural-origin "trout and steelhead fry" by life-stage and age-class, 20012 – 2016.

		Sub-Yearling			Yearling	
Year	Trap Type	Fry	Parr	Transitional/ Smolt	Parr	Transitional/ Smolt
2012	RST	0	---	---	---	---
2013	RST	0	---	---	---	---
2014	RST	0	---	---	---	---
2015	RST	15	---	---	---	---
2016	RST	0	---	---	---	---

Table 35. Non-target salmonid and non-salmonid catch Summary for Hamilton Creek, 2012 - 2016.

	Year				
Species	2012	2013	2014	2015	2016
3-Spine Stickleback	6	11	436	193	36
Bluegill	1	1	13	30	50
Brook Lamprey	NA	NA	1	NA	NA
Dace: General	0	0	0	81	80
Lamprey: General	3	16	NA	89	98
Largemouth Bass	0	2,653	0	0	6
Longnose Dace	0	119	74	0	0
Northern Pikeminnow	1	3	30	68	215
Pacific Lamprey	NA	NA	23	NA	NA
Peamouth Chub	22	70	832	144	1,494
Pumpkinseed	0	0	0	6	22
Redside Shiner	0	5	39	11	11
River Lamprey	NA	NA	2	NA	NA
Sculpin: General	467	568	795	1,139	567
Smallmouth Bass	5	313	9	0	9
Sucker: General	29	4	27	38	207
Whitefish	0	1	0	0	0
Yellow Bullhead	0	3	16	3	14

Hamilton Springs

CHUM SALMON

From 2011 – 2016, the average total raw maiden catch of natural-origin chum salmon fry at the Hamilton Springs spawning channel trap site was approximately 406,000 and ranged from approximately 198,000 to over 493,000 (Table 36). In general, chum salmon fry were captured from late February through early May, but on average 59% of the catch (range: 30– 86%) was caught during the month of March and 37% (range: 12 – 61%) in April among all years (Appendix C: C114 – C119). Overall, catch followed a bell-shaped shape pattern that is expected of outmigrating juveniles (Appendix B: B108 – B113). In 2016, alternate-day trapping was implemented to decrease overall catch and stay under ESA take permit levels. In all years, a fence-panel weir was operated and thus capture efficiency was assumed to be 100% unless the trap was compromised in which case catch was interpolated for the missing days (p-spline method).

Table 36. Summary of annual raw maiden captures for Hamilton Springs spawning channel natural-origin chum salmon by life-stage and age-class, 2011 – 2016.

		Sub-Yearling			Yearling	
Year	Trap Type	Fry	Parr	Transitional/ Smolt	Parr	Transitional/ Smolt
2011	Weir	153,022	---	---	---	---
2012	Weir	386,058	---	---	---	---
2013	Weir	459,369	---	---	---	---
2014	Weir	198,302	---	---	---	---
2015	Weir	493,329	---	---	---	---
2016	Weir	493,390	---	---	---	---

CHINOOK SALMON

From 2011 – 2016, there were less than 25 individual Chinook salmon juveniles captured at the Hamilton Springs trap regardless of life-stage or age-class for a given year (Table 37). These low catch totals are not unexpected. In most years there is no use of the channel for spawning by adult Chinook

Table 37. Summary of annual raw maiden captures for Hamilton Springs spawning channel natural-origin Chinook salmon by life-stage and age-class, 2011 – 2016.

<table>
<tr><th></th><th></th><th colspan="3">Sub-Yearling</th><th colspan="2">Yearling</th></tr>
<tr><th>Year</th><th>Trap Type</th><th>Fry</th><th>Parr</th><th>Transitional/ Smolt</th><th>Parr</th><th>Transitional/ Smolt</th></tr>
<tr><td>2011</td><td>Weir</td><td>0</td><td colspan="4">0</td></tr>
<tr><td>2012</td><td>Weir</td><td>2</td><td colspan="4">2*</td></tr>
<tr><td>2013</td><td>Weir</td><td>3</td><td colspan="2">0</td><td colspan="2">0</td></tr>
<tr><td>2014</td><td>Weir</td><td>7</td><td colspan="2">11**</td><td colspan="2">4**</td></tr>
<tr><td>2015</td><td>Weir</td><td>19</td><td colspan="2">4**</td><td colspan="2">0</td></tr>
<tr><td>2016</td><td>Weir</td><td>0</td><td colspan="2">0</td><td colspan="2">0</td></tr>
</table>

* life- and age-class data unavailable, ** life-stage data unavailable

COHO SALMON

From 2011 – 2016, the average total raw maiden catch of natural-origin sub-yearling coho salmon fry was 4,278 (range: 685 – 7,861) and parr was 174 (range: 1 – 425) while natural-origin yearling coho salmon parr was 3 (range: 0 – 7) and transitional/smolt was 41 (range: 13 – 88; Table 38). The apparent contradiction presented here of why are there so few sub-yearling and yearling coho salmon captured but several thousand coho fry are captured, indicating at least a few adult coho do spawn in the channel annually, is due to the fact that the channel completely dewaters every summer for an extended period of time (3-5 months). In 2013, there were also 14 hatchery-origin yearlings captured.

Table 38. Summary of annual raw maiden captures for Hamilton Springs spawning channel natural-origin coho salmon by life-stage and age-class, 2011 – 2016.

		Sub-Yearling			Yearling	
Year	Trap Type	Fry	Parr	Transitional/ Smolt	Parr	Transitional/ Smolt
2011	Weir	2,359		641*		
2012	Weir	7,861		550*		
2013	Weir	834	125	6	5	124
2014	Weir	6,086	425	7	1	88
2015	Weir	7,841	143	3	7	21
2016	Weir	685	1	5	0	13

* life- and age-class data unavailable

STEELHEAD

From 2011 – 2016, there were less than 35 individual steelhead juveniles captured at the Hamilton Springs trap regardless of life-stage or age-class for a given year (Table 39). What was mentioned above concerning coho juvenile catch, the channel is completely dry for several months each year, also explains the very low catch of sub-yearling and yearling steelhead juveniles.

Table 39. Summary of annual raw maiden captures for Hamilton Springs spawning channel natural-origin steelhead by life-stage and age-class, 2011 – 2016.

		Sub-Yearling			Yearling	
Year	Trap Type	Fry*	Parr	Transitional/ Smolt	Parr	Transitional/ Smolt
2011	Weir	---		4**		
2012	Weir	---		52**		
2013	Weir	---	2	0	3	15
2014	Weir	---	25	0	4	3
2015	Weir	---	0	0	4	2
2016	Weir	---	1	0	26	1

* Steelhead and cutthroat are very difficult to ID at the fry stage. Fry of both species were recorded as "trout and steelhead fry", **life- and age-class data unavailable

OTHER SPECIES

In addition to chum, Chinook and coho salmon and steelhead, the Hamilton Creek screw trap captured cutthroat trout (Table 40), trout and steelhead fry (Table 41), and at least 15 other non-target species from 2012 – 2016 (Table 42).

Table 40. Summary of annual raw maiden captures for Hamilton Springs spawning channel natural-origin cutthroat trout by life-stage and age-class, 2011 – 2016.

		Sub-Yearling			Yearling	
Year	Trap Type	Fry*	Parr	Transitional/ Smolt	Parr	Transitional/ Smolt
2011	Weir	---	0**			
2012	Weir	---	0**			
2013	Weir	---	0	0	0	0
2014	Weir	---	0	0	1	0
2015	Weir	---	0	0	0	2
2016	Weir	---	0	0	2	0

* Steelhead and cutthroat are very difficult to ID at the fry stage. Fry of both species were recorded as "trout and steelhead fry", **life- and age-class data unavailable

Table 41. Summary of annual raw maiden captures for Hamilton Springs spawning channel natural-origin "trout and steelhead fry" by life-stage and age-class, 2011 – 2016.

		Sub-Yearling			Yearling	
Year	Trap Type	Fry	Parr	Transitional/ Smolt	Parr	Transitional/ Smolt
2011	Weir	36	---	---	---	---
2012	Weir	0	---	---	---	---
2013	Weir	0	---	---	---	---
2014	Weir	0	---	---	---	---
2015	Weir	2	---	---	---	---
2016	Weir	0	---	---	---	---

Table 42. Non-target salmonid and non-salmonid catch Summary for Hamilton Springs, 2011 – 2016.

	Year					
Species	2011	2012	2013	2014	2015	2016
3-Spine Stickleback	19	112	6	0	17	1
Bluegill	0	0	0	0	0	0
Brook Lamprey	0	0	0	0	0	0
Dace: General	0	0	0	0	0	0
Lamprey: General	0	0	1	0	0	0
Largemouth Bass	0	0	0	0	0	0
Longnose Dace	0	0	0	0	0	0
Northern Pikeminnow	7	264	28	14	43	101
Pacific Lamprey	0	0	0	0	0	0
Peamouth Chub	13	78	25	20	19	0
Pumpkinseed	0	0	0	0	0	0
Redside Shiner	0	0	0	0	0	0
River Lamprey	0	0	0	0	0	0
Sculpin: General	79	5548	189	189	291	253
Smallmouth Bass	0	0	0	1	0	0
Sucker: General	1	40	0	1	0	0
Trout-General	7	0	0	0	0	0
Whitefish	0	0	0	0	0	0
Yellow Bullhead	0	0	0	0	0	0

Abundance estimates

Grays River

CHUM SALMON

Natural-Origin, Sub-Yearlings (Fry)

Outmigration estimates were generated for Grays River natural-origin chum salmon fry for 2008 – 2016. Across the nine years, the total median chum salmon fry abundance estimates ranged from 1.11 – 2.88 million (Table 43, Figure 11). Within a given year, abundance was also estimated for each individual trapping period, except for the two years (2012, 2015) when the "Proportion" method was used (Appendix E – Figures E1 – E7). On average, 75% (range: 69 – 84%) of the outmigrants passed the Grays River screw trap during the month of March, and among years the 50% passage date ranged from approximately March 8th to March 26th (Figure 12). In general, abundance followed the expected outmigration bell-shaped pattern in all years except 2014. Here, the abnormal pattern in catch lead to an estimate that had 38% of the total abundance being captured in a single three-day period. Therefore, this estimate should be taken with caution. However, the same out-migration pattern was seen for Chinook salmon fry at the Grays trap, so it is possible that the chum outmigration was highly condensed in 2014.

Among years, the precision of the abundance estimates, measured as the coefficient of variation (CV), averaged 0.21 (range: 0.05 – 0.65). In four out of the nine years, the estimated CV ranged from 0.05 – 0.10 and thus the abundance estimates were relatively precise. These years were characterized by good trapping conditions (i.e., lower flows leading to higher absolute recaptures and fewer trap outages). In three of the nine years, the CV ranged from 0.16 – 0.23 and, in general, these three years had lower absolute recaptures rates, especially during peak migration and more variable daily catch. In the remaining two years (2012, 2015), the CVs were 0.34 and 0.65 and these years correspond to the two years in which abundance was estimated using the "Proportion" method as opposed to the Bayesian Time-Stratified (i.e., BTSPAS) method. Although the estimates of abundance using the "Proportion" method resulted in estimates that were relatively imprecise, the abundance estimates were much more reasonable (see "**Analytical Methods**").

Table 43. Summary of annual maiden catch used for analysis and outmigration estimates for Grays River natural-origin chum (life-stage = fry; age-class = sub-yearling), 2008 – 2016.

Year	Trap Type	Analysis	Maiden Catch for Analysis	Median Outmigration Estimate	SE	L95%	U95%	CV
2008	RST	BTSPAS	36,700	1,866,292	441,146	1,564,363	2,594,287	0.230
2009	RST	BTSPAS	72,448	1,288,377	60,136	1,181,625	1,413,802	0.050
2010	RST	BTSPAS	121,192	2,882,565	14,048	2,660,209	3,213,390	0.050
2011	RST	BTSPAS	23,113	2,203,544	230,130	1,832,165	2,736,686	0.100
2012	RST	Proportion	15,008	2,451,852	837,826	1,201,332	4,498,815	0.342
2013	RST	BTSPAS	69,175	2,664,990	207,120	2,310,939	3,131,029	0.077
2014	RST	BTSPAS	27,043	2,711,159	452,346	2,082,920	3,822,653	0.163
2015	RST	Proportion	44,114	1,106,601	835,828	186,485	3,339,932	0.652
2016	RST	BTSPAS	16,061	1,306,160	253,960	986,431	1,950,566	0.189

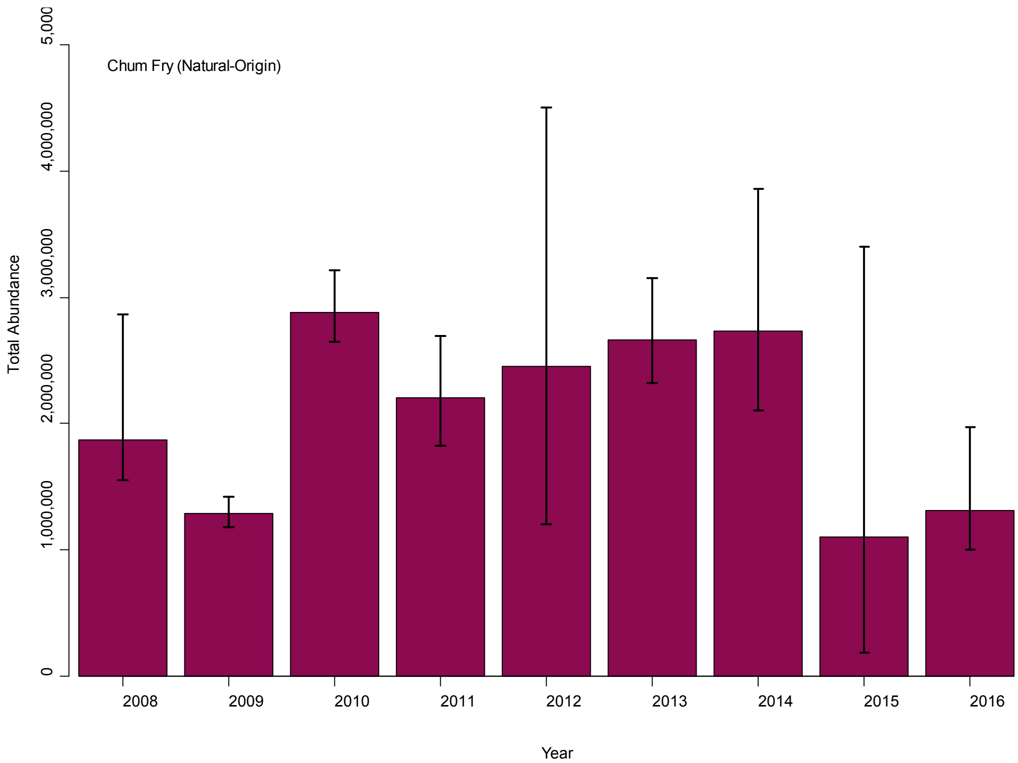

Figure 11. Estimated total abundance (± 95% CI) by year for natural-origin chum salmon (life-stage =fry; age-class = sub-yearling) produced above the mainstem Grays River screw trap from 2008-2016.

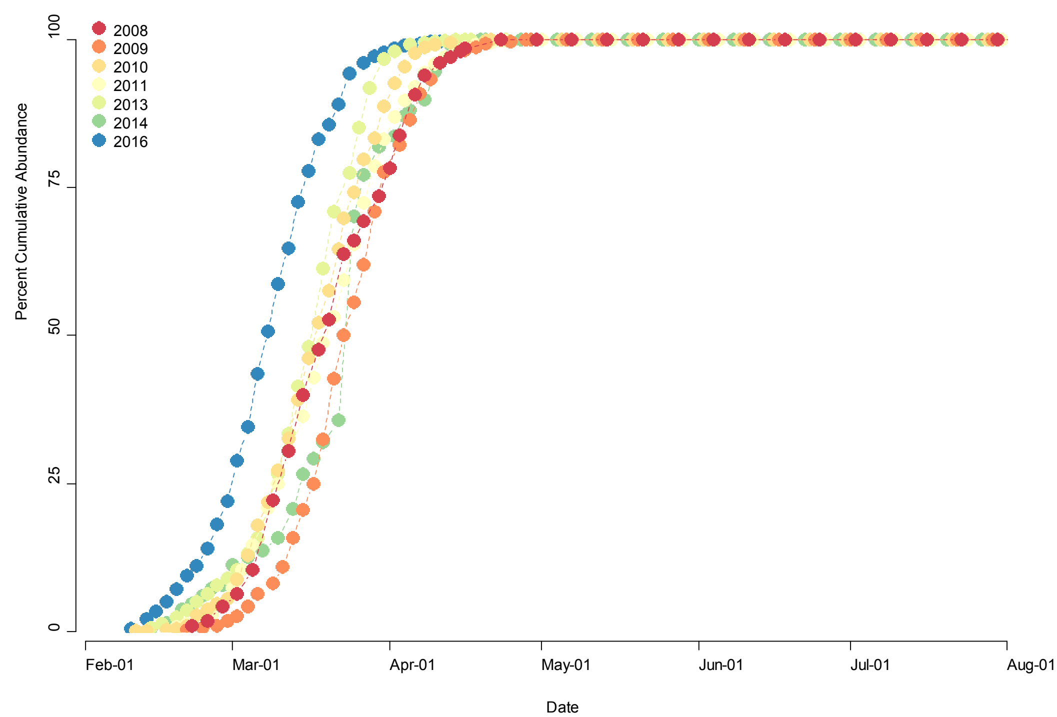

Figure 12. Percent cumulative abundance by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) produced above the mainstem Grays River screw trap from 2008-2011, 2013-14, and 2016.

CHINOOK SALMON

Natural-Origin, Sub-Yearling (Fry)

Outmigration estimates were generated for Grays River natural-origin Chinook salmon fry for 2009 – 2011, 2013 – 2014, and 2016. Across these six years, the total median Chinook salmon fry abundance estimates ranged from 3,834 to 194,377 (Figure 13) and the precision of the abundance estimates, measured as the coefficient of variation (CV), averaged 0.13 excluding 2016 (range: 0.07 – 9.8; Table 44). In 2016, there were only a total of 63 total recaptures throughout the entire trapping season, leading to highly imprecise estimates of abundance (CV = 9.8). Abundance estimates were not generated for the 2008 outmigration year as there was only a total of 26 maiden Chinook salmon fry captured. Abundance estimates were not generated in 2012 and 2015, as we lacked reliable surrogate capture efficiency data (i.e. sufficient chum captured and marked during the Chinook migration period, since trap efficiency trials were not conducted on Chinook).

Unlike chum salmon fry, which generally followed the expected bell-shaped outmigration pattern, Chinook salmon fry abundance by individual trapping period was much more erratic, (Appendix E – Figures E8 – E13) leading to estimated run-timing curves that were relatively more variable (Figure 14). These patterns could partly be due to the low number of maiden captures within most periods among years. It's also possible that Chinook fry are not "outmigrating" around a central timing but are essentially rearing unless triggered to move by freshets. Alternatively, chum salmon fry capture efficiency may not be totally representative of Chinook salmon fry capture efficiencies, leading to inaccurate estimates of abundance. Although in some years (2010, 2014), catch of Chinook and chum salmon fry followed similar patterns, in other years (2012, 2013), they did not. Specifically, in 2012, chum salmon fry catch was highly affected by two large storms that occurred mid-March and early April (Appendix B: Figure B5) but Chinook salmon fry catch was not, (Appendix B: Figure B14) while in 2013 the opposite was true (Appendix B: Figure B6, Appendix B: Figure B15). Therefore, the Grays River natural-origin Chinook salmon fry estimates should be viewed with caution until an evaluation of capture efficiencies is conducted for Chinook salmon fry relative to chum salmon fry. Moving forward, we will evaluate the feasibility of obtaining direct estimates of capture efficiency for Chinook salmon fry.

Table 44. Summary of annual maiden catch used for analysis and outmigration estimates for Grays River natural-origin Chinook salmon (life-stage = fry; age-class = sub-yearling), 2008 – 2016.

Year	Trap Type	Analysis	Maiden Catch for Analysis	Median Outmigration Estimate	SE	L95%	U95%	CV
2008	RST	---	26	---	---	---	---	---
2009	RST	BTSPAS	564	8,743	977	7,601	10,770	0.110
2010	RST	BTSPAS	2,735	65,922	4,362	59,106	76,231	0.066
2011	RST	BTSPAS	791	69,071	10,819	54,842	95,265	0.153
2012	RST	---	1,005	---	---	---	---	---
2013	RST	BTSPAS	88	3,873	604	2,950	5,298	0.154
2014	RST	BTSPAS	1,886	195,190	32,724	150,109	277,490	0.164
2015	RST	---	683	---	---	---	---	---
2016	RST	BTSPAS	63	8,336	107,504	4,023	23,342	9.826

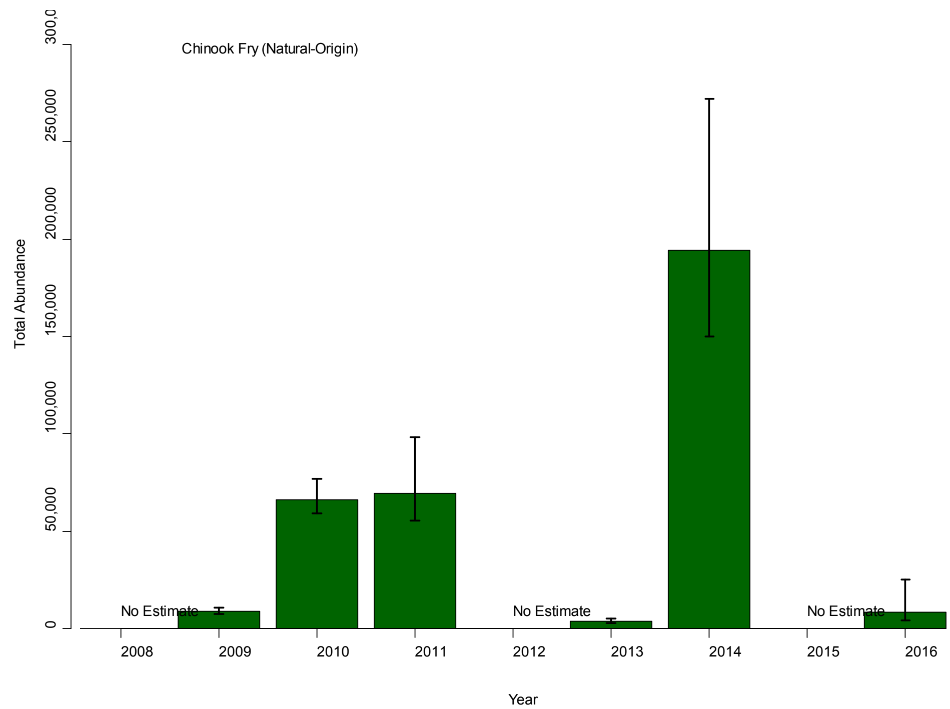

Figure 13. Estimated total abundance (± 95% CI) by year for natural-origin Chinook salmon (life-stage fry; age-class = sub-yearling) produced above the mainstem Grays River screw trap from 2008-2016

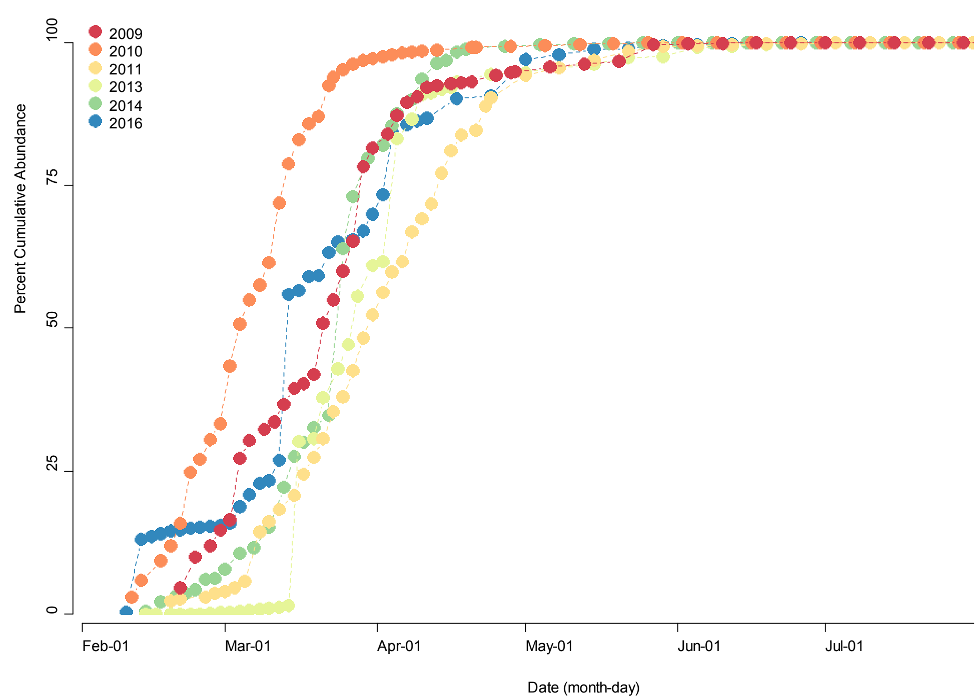

Figure 14. Percent cumulative abundance by date for natural-origin Chinook salmon (life-stage =fry; age-class = sub-yearling) produced above the mainstem Grays River screw trap from 2008-2016.

Natural-origin, Sub-yearling (Parr/Transitional/Smolt)

Outmigration estimates were generated for Grays River natural-origin Chinook salmon sub-yearlings (parr, transitional, and smolt) for 2008 – 2016 (Table 45). In eight of the nine years, the total median Chinook salmon parr/ transitional/smolt abundance estimates ranged from a little over 2,400 to slightly less than 10,000, while in one year (2011) the outmigration was estimated to be approximately 25,000 (Figure 15). The precision of the abundance estimates, measured as the coefficient of variation (CV), ranged from 0.06 – 0.38, but averaged 0.14 among all nine years. Within each year, abundance was estimated for each individual trapping period, which were typically 6 – 8 days in length. Interestingly, in almost every single year, the outmigration appeared to be bi-modal with peaks in abundance typically occurring in mid-May to late May and again in mid-June to late June (Appendix E: Figures E14 – E22). In general, the first peak corresponded to the outmigration of parr while the second peak corresponded to the transitionals and smolts. The 50% of the total outmigration occurred approximately from May 28th to July 4th among years (Figure 16). The one major exception to the outmigration patterns was in 2014, when the first peak occurred in early April while the second still occurred in late June (Appendix E: Figure E20).

Although the outmigrant estimates for Grays River sub-yearling Chinook salmon do not seem unreasonable based on data from other lower Columbia River tributaries (Kinsel et al. 2009, Lamperth et al. 2014), there are several caveats that should be highlighted. First, as previously mentioned, only Chinook salmon transitional and smolt juveniles were marked for trap efficiency trials. Due to the run-timing difference in parr and transitional/smolt juveniles, capture efficiencies may have been underestimated for the earlier-migrating parr, and thus ultimately leading to an underestimation of total sub-yearling Chinook salmon abundance. Second, an unknown portion of the natural-origin catch may have consisted of unmarked hatchery-origin fish (i.e., adipose intact "leakers"). This potential issue is highlighted when evaluating the number and size distribution of fish throughout the migration season. Specifically, in at least three years (2011, 2013, 2014), there were portions of fish that were substantially larger than all others for a given time period and they often were captured in pulses. For example, in 2014, approximately 80% of the Chinook salmon classified as natural-origin parr were captured before May 1st and ranged in size from 45 – 70 mm, but sub-yearling Chinook salmon this time of year should mostly still be fry sized (<45 mm). While we know that there are certainly hatchery-origin sub-yearling Chinook salmon escaping from the hatchery (see following section), it appears as though a portion may be unclipped, which jeopardizes the integrity of the natural-origin estimate. Lastly, the natural-origin sub-yearling Chinook salmon may be the progeny of several different "stocks". Historically, the Grays River basin would have only had lower Columbia River tule Chinook. Currently, there is a remnant population of natural-origin tules in addition to several different "stocks" of hatchery-origin Chinook salmon that spawn in Grays River, including spring Chinook (strays from the Deep River net-pen program), tules (strays from Oregon and Washington hatchery programs), non-native Rogue River origin "Select-Area-Bright" (SABs) strays, and potentially natural-origin SABs (Roegner et al. 2010).

Table 45. Summary of annual maiden catch used for analysis and outmigration estimates for Grays River natural-origin Chinook salmon (life-stage =Parr/Transitional/Smolt; age-class = sub-yearling), 2008 – 2016.

Year	Trap Type	Analysis	Maiden Catch for Analysis	Median Outmigration Estimate	SE	L95%	U95%	CV
2008	RST	BTSPAS	1,109	3,957	312	3,431	4,641	0.078
2009	RST	BTSPAS	343	4,319	1,808	2,853	9,096	0.384
2010	RST	BTSPAS	461	5,161	1,324	3,561	8,593	0.245
2011	RST	BTSPAS	4,586	24,923	1,542	22,966	28,479	0.061
2012	RST	BTSPAS	954	8,923	1,173	7,131	11,697	0.130
2013	RST	BTSPAS	583	2,400	210	2,032	2,860	0.087
2014	RST	BTSPAS	1,674	9,636	907	8,105	11,665	0.094
2015	RST	BTSPAS	728	6,420	828	5,080	8,355	0.128
2016	RST	BTSPAS	775	3,539	278	3,078	4,160	0.078

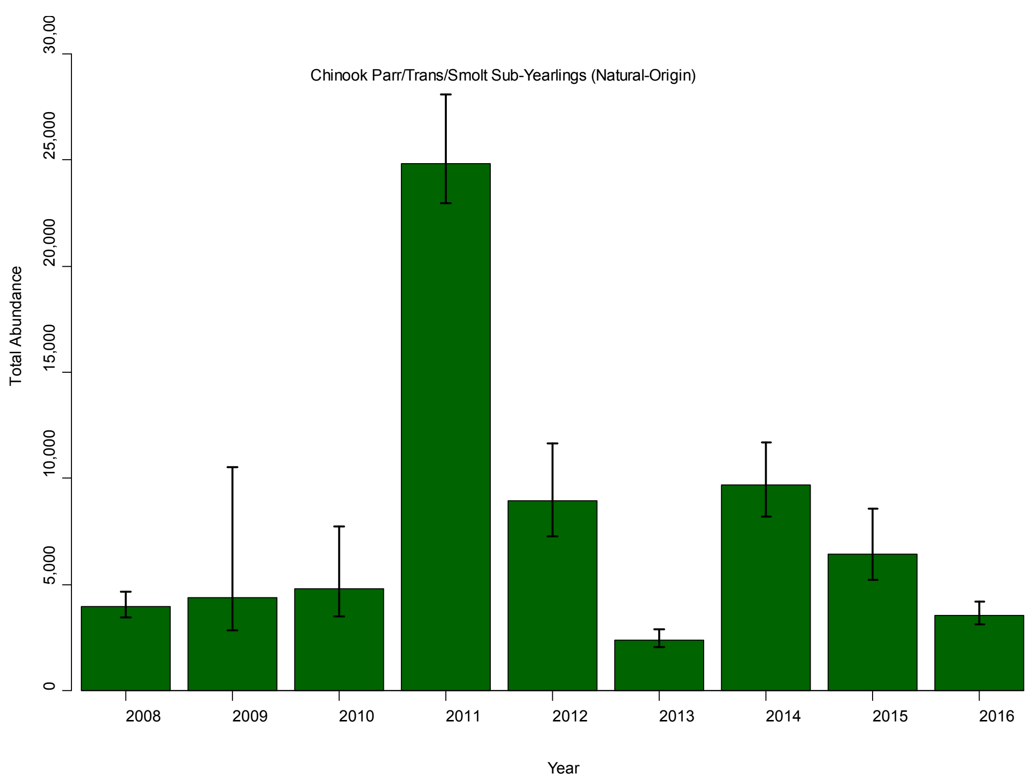

Figure 15. Estimated total abundance (± 95% CI) by year for natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap from 2008-2016.

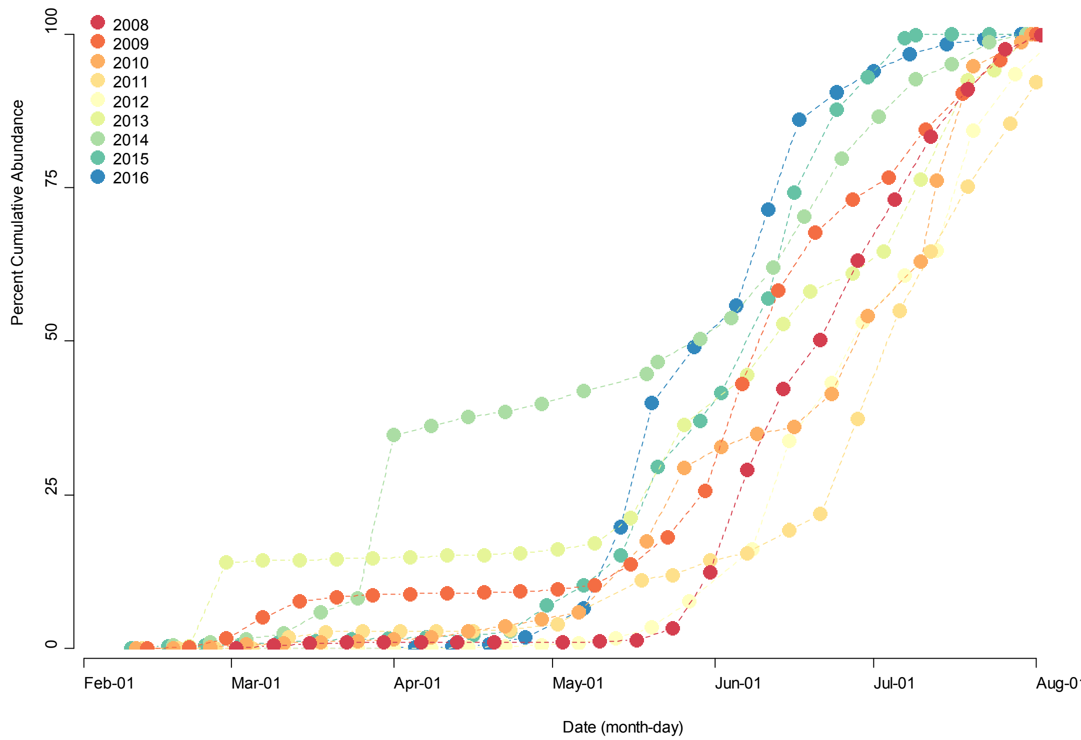

Figure 16. Percent cumulative abundance by date for natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap from 2008-2016.

Hatchery-Origin, Sub-Yearling (Parr/Transitional/Smolt)

As previously mentioned, hatchery-origin sub-yearling Chinook salmon were not scheduled to be released in the Grays River. However, in each year the Grays River screw trap was operated, there were some hatchery-origin sub-yearling Chinook salmon captured. Across the nine years, outmigration estimates for known hatchery-origin fish ranged from 44 to 18,401 (Table 46, Figure 17). However, as previously mentioned, these abundance estimates may only represent a portion of all hatchery-origin sub-yearling Chinook salmon outmigrants if juveniles escape from the hatchery prior to being mass-marked (adipose fin removed) for identification. Within and among years, the timing of the catch was quite variable and episodic, (Figure 18, Appendix E: Figures E23 – E31) likely due to low overall abundances and sporadic events that led to fish escaping the hatchery. These hatchery-origin escapees would be spring Chinook destined for terminal fishery net-pens located in the Columbia River.

Table 46. Summary of annual maiden catch used for analysis and outmigration estimates for Grays River hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling), 2008 – 2016.

Year	Trap Type	Analysis	Maiden Catch for Analysis	Median Outmigration Estimate	SE	L95%	U95%	CV
2008	RST	BTSPAS	19	73	22	45	130	0.293
2009	RST	BTSPAS	8	108	419	48	357	3.011
2010	RST	BTSPAS	213	5,132	1,333	3,569	8,570	0.248
2011	RST	BTSPAS	2,659	18,377	1,669	15,887	22,355	0.090
2012	RST	BTSPAS	62	564	116	396	846	0.200
2013	RST	BTSPAS	51	211	32	159	285	0.151
2014	RST	BTSPAS	177	1,019	105	838	1,250	0.102
2015	RST	BTSPAS	5	40	19	16	88	0.441
2016	RST	BTSPAS	199	849	84	706	1,035	0.099

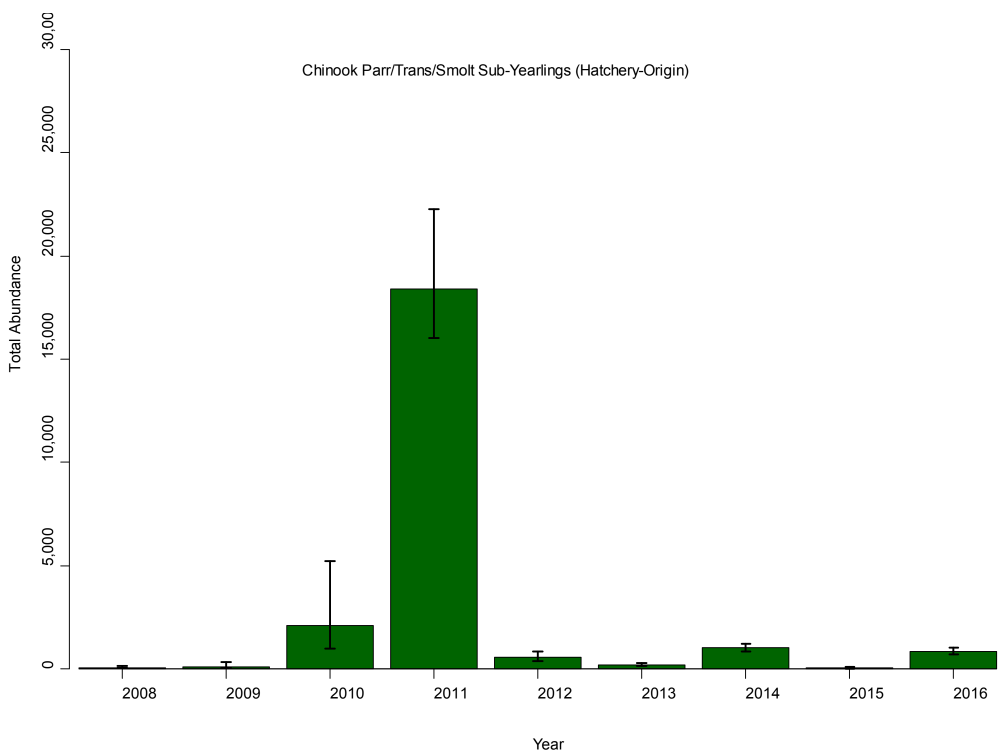

Figure 17. Estimated total abundance (± 95% CI) by year for hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap from 2008-2016.

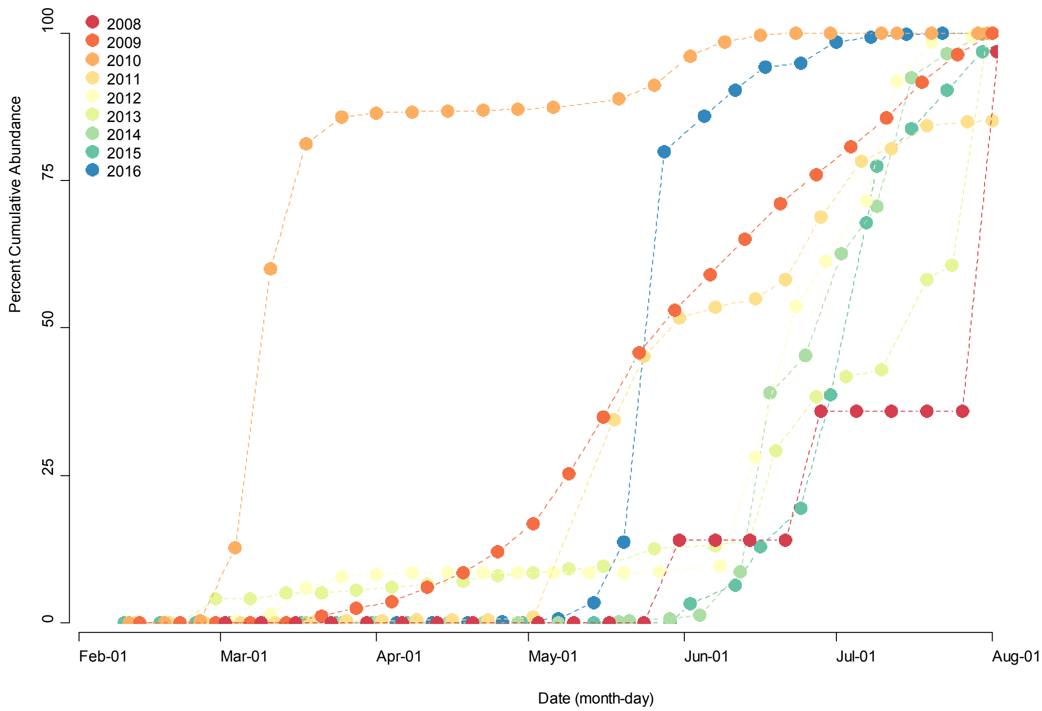

Figure 18. Percent cumulative abundance by date for hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap from 2008-2016.

COHO SALMON

Natural-Origin, Sub-yearling (Transitional, Smolt)

Outmigration estimates were generated for Grays River natural-origin sub-yearling coho salmon for 2008 – 2016. Across the nine years, the total median abundance estimates ranged from 244 – 3,702 (Table 47, Figure 19). Within each year, abundance was estimated for individual trapping periods and overall the outmigration followed the expected bell-shaped pattern (Appendix E: Figures E32 – E40). The 50% passage date ranged from approximately June 18th to July 15th (Figure 20). However, in at least two years (2010, 2012), it appears as though the outmigration period extended past the normal trapping time frame based on the abundance by period plots (see Appendix E: Figures E34 and E36). Among years, the precision of the abundance estimates, measured as the coefficient of variation (CV), averaged 0.46 (range: 0.13 – 2.151). However, excluding two years (2009, 2010), the CV averaged 0.18 (range: 0.13– 0.29). In 2009 and 2010, there were only a total of 3 and 23 recaptures throughout the entire trapping season, respectively, leading to highly imprecise (CVs of 0.70 and 2.15) estimates of abundance.

Because age data (scale samples) were not collected from individual coho salmon juveniles, age-class was classified based on a “life-stage and age-class” rule set (Appendix A: Figure A2). While yearling coho salmon generally outmigrate a month or two earlier than sub-yearlings, and are larger for a given time period, there is overlap both in timing and size (primarily in late May and early June) that caused uncertainly in age-class assignment. This overlap, and thus uncertainty, was more pronounced in some years (2011 and 2012) relative to others (2008, 2010). Interestingly, in most years the portion of the sub-yearling transitional/smolt juveniles caught in June and July were as large, or larger, than the yearling parr caught in February and March. Additionally, over the past several years the trapping crew have noted coho salmon juveniles that were unclipped but appeared to be hatchery escapees based on the fish's body morphometrics and the timing of when hatchery fish were clipped. Therefore, as with Chinook salmon, a portion of the natural-origin sub-yearling coho salmon outmigration may be unclipped hatchery-origin fish that have leaked from the hatchery. Moving forward, scales were collected in 2016 and should help elucidate age-class assignment for previous and future years. Although the uncertainty in age-class assignment likely had a small effect on the abundance estimate, the reported estimates should be viewed as preliminary until further analysis. However, because scales pattern analysis of juveniles is not a reliable method to assign origin (*Andrew Claiborne, WDFW, personal communication)* another method would have to be used.

Table 47. Summary of annual maiden catch used for analysis and outmigration estimates for Grays River natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling), 2008 – 2016.

Year	Trap Type	Analysis	Maiden Catch for Analysis	Median Outmigration Estimate	SE	L95%	U95%	CV
2008	RST	BTSPAS	76	228	38	171	318	0.162
2009	RST	BTSPAS	59	1,359	1,178	543	4,719	0.703
2010	RST	BTSPAS	216	2,947	9,801	1,640	16,733	2.151
2011	RST	BTSPAS	339	3,773	1,135	2,524	6,615	0.285
2012	RST	BTSPAS	187	1,170	211	850	1,672	0.177
2013	RST	BTSPAS	323	1,463	195	1,168	1,924	0.131
2014	RST	BTSPAS	362	3,491	499	2,706	4,652	0.141
2015	RST	BTSPAS	338	3,263	712	2,368	5,112	0.211
2016	RST	BTSPAS	228	1,182	172	927	1,599	0.143

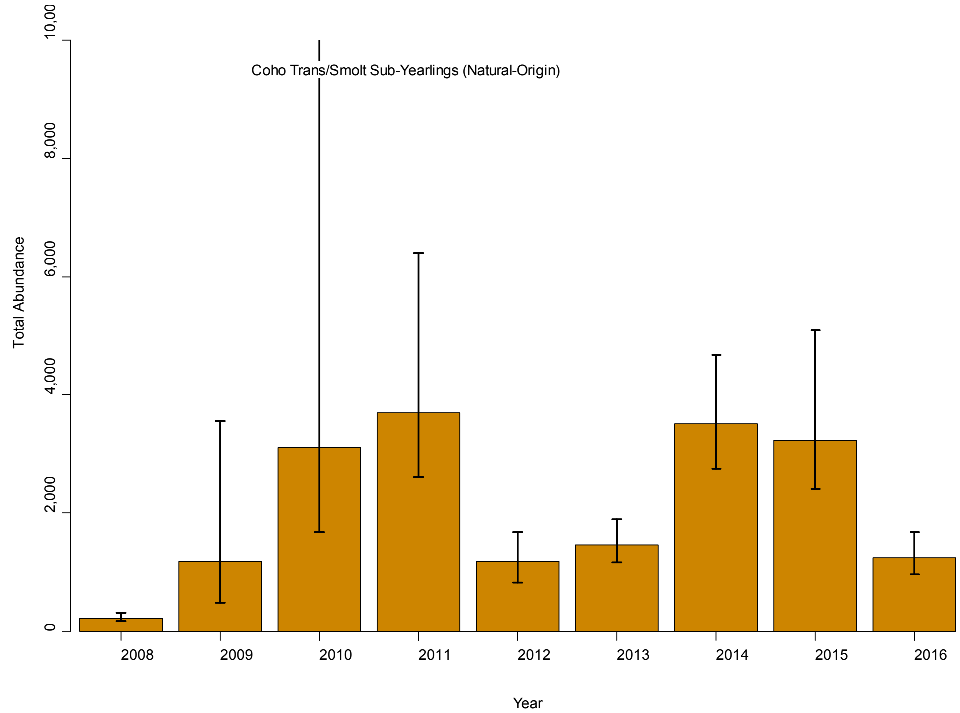

Figure 19. Estimated total abundance (± 95% CI) by year for natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap from 2008-2016.

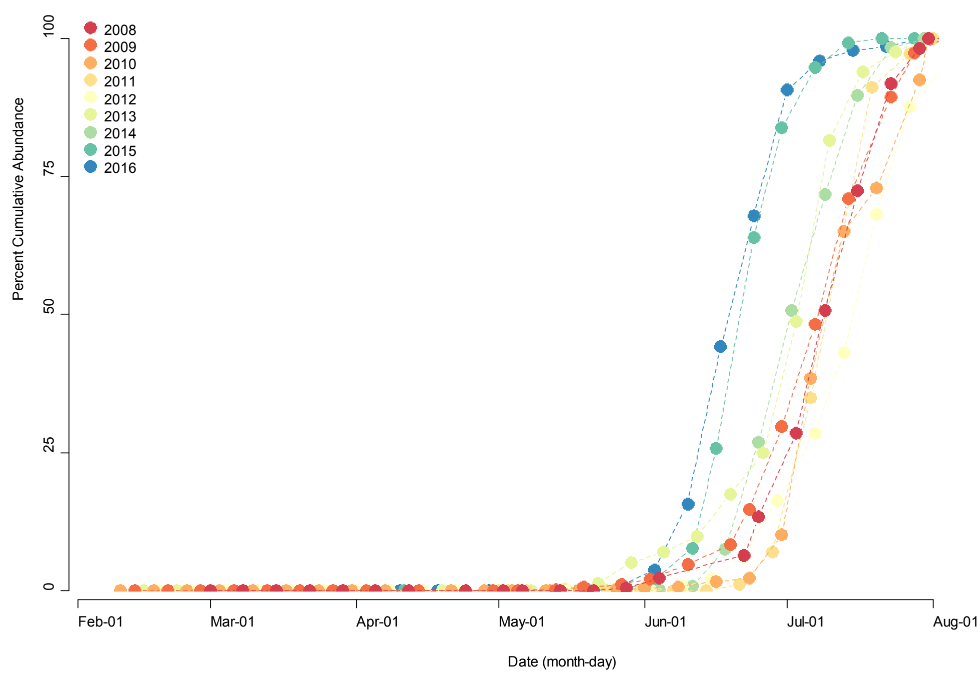

Figure 20. Percent cumulative abundance by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap from 2008-2016.

Natural-Origin, Yearlings (Transitional, Smolt)

Outmigration estimates were generated for Grays River natural-origin coho salmon yearlings for 2008 – 2016. Across the nine years, the total median abundance estimates ranged from 4,474 – 13,142 (Table 48, Figure 21). Within each year, abundance was estimated for individual trapping periods and, overall, the outmigration followed the expected bell-shaped pattern (Appendix E: Figures E41 – E49) and the 50% passage date ranged from approximately May 1st to May 28th (Figure 22). Among years, the precision of the abundance estimates, measured as the coefficient of variation (CV), averaged 0.38 (range: 0.13 – 1.52). However, excluding two years (2009, 2010), the CV averaged 0.19 (range: 0.13– 029). In 2009 and 2010, there were only a total of 28 and 29 total recaptures throughout the entire trapping season, respectively, leading to highly imprecise (CVs of 0.60 and 1.52) estimates of abundance.

Similar to the natural-origin sub-yearling coho salmon estimates, individual age-classes were assigned with a "life-stage and age-class" rule-set (Appendix A: Figure A2). Due to some uncertainly in age-class assignment, (primarily in late May and early June), a portion of the individuals assigned as yearlings may have been relatively large sub-yearlings or, rather, a portion of individuals assigned as sub-yearlings may have been relatively small yearlings. Scales were collected in 2016 and should help elucidate age-class assignment for previous and future years. Although the uncertainly in age-class assignment likely had a small effect on the abundance estimate, the reported estimates should be viewed as preliminary until further analysis.

Table 48. Summary of annual maiden catch used for analysis and outmigration estimates for Grays River natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling), 2008 – 2016.

Year	Trap Type	Analysis	Maiden Catch for Analysis	Median Outmigration Estimate	SE	L95%	U95%	CV
2008	RST	BTSPAS	471	7,228	2,067	5,086	11,829	0.274
2009	RST	BTSPAS	58	11,821	29,608	5,058	89,878	1.524
2010	RST	BTSPAS	222	13,552	9,052	6,934	31,271	0.597
2011	RST	BTSPAS	519	4,687	653	3,727	6,275	0.137
2012	RST	BTSPAS	170	9,508	2,884	5,817	16,761	0.290
2013	RST	BTSPAS	581	7,363	1,198	5,838	10,122	0.159
2014	RST	BTSPAS	284	4,510	809	3,293	6,447	0.176
2015	RST	BTSPAS	319	4,511	644	3,497	6,026	0.141
2016	RST	BTSPAS	335	4,385	588	3,452	5,737	0.132

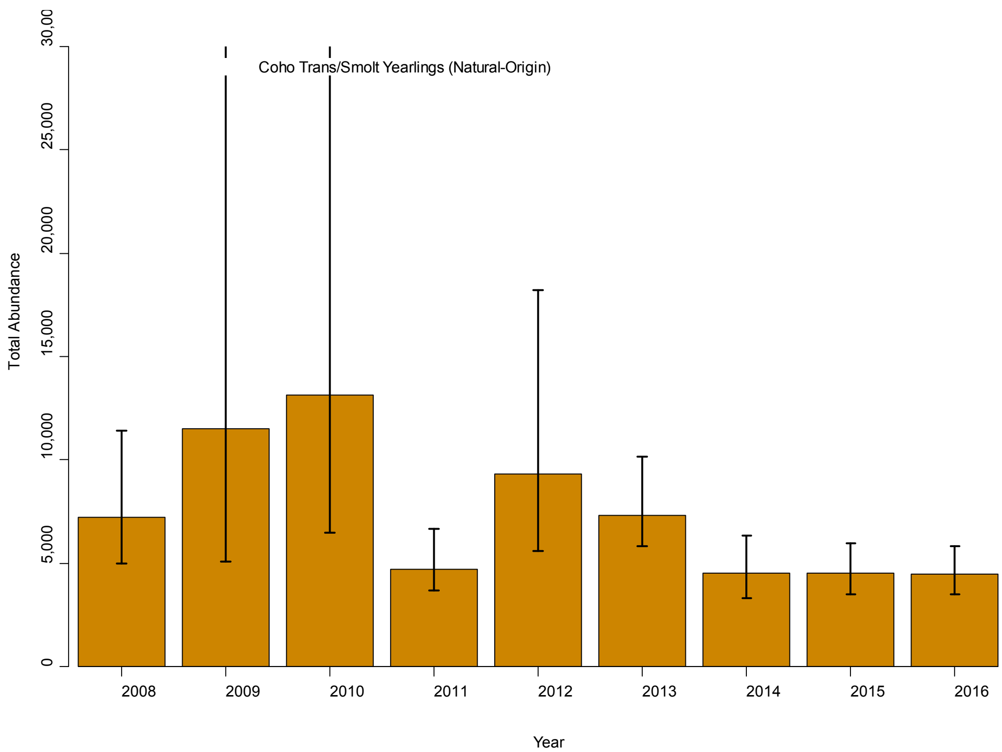

Figure 21. Estimated total abundance (± 95% CI) by year for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap from 2008-2016.

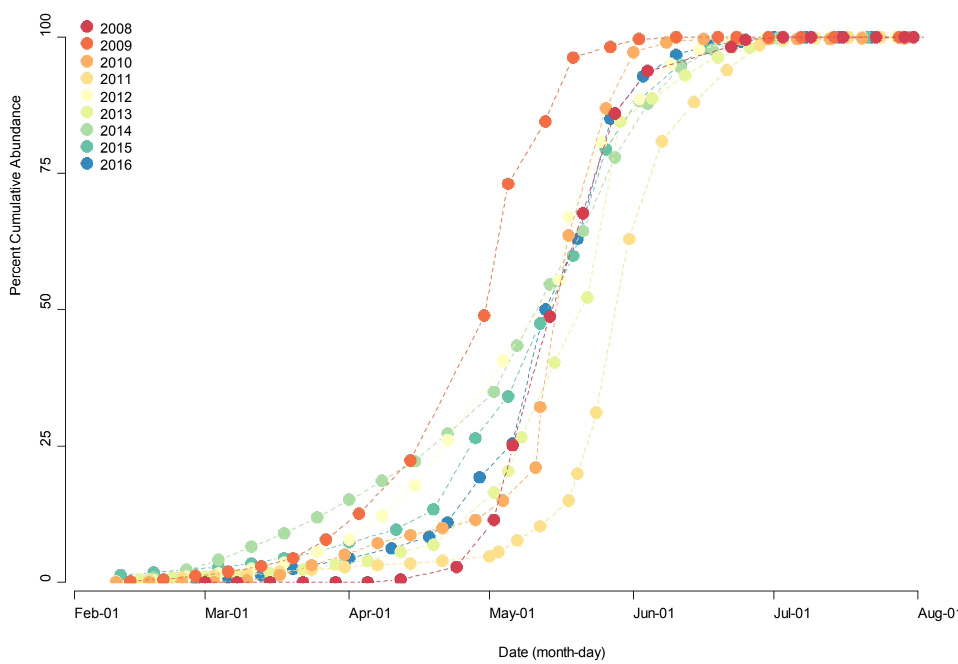

Figure 22. Percent cumulative abundance by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap from 2008-2016.

Hatchery-Origin, Sub-Yearlings (Transitional/Smolt)

As previously mentioned, hatchery-origin sub-yearling coho salmon were not scheduled to be released in the Grays River. However, in each year the Grays River screw trap was operated, there were some hatchery-origin sub-yearling coho salmon captured. Across the nine years, outmigration estimates for known hatchery-origin fish ranged from 24 to 4,595 (Table 49, Figure 23), but may only represent a portion of all hatchery-origin sub-yearling coho salmon outmigrants due to possible unclipped hatchery escapees. Within and among years, the timing of the catch was quite variable and episodic (Figure 24, Appendix E: Figures E50 – E58) likely due to low overall abundances and sporadic events that led to fish escaping the hatchery

Table 49. Summary of annual maiden catch used for analysis and outmigration estimates for Grays River hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling), 2008 – 2016.

Year	Trap Type	Analysis	Maiden Catch for Analysis	Median Outmigration Estimate	SE	L95%	U95%	CV
2008	RST	BTSPAS	33	99	20	69	146	0.195
2009	RST	BTSPAS	3	41	99	10	240	1.551
2010	RST	BTSPAS	8	93	265	37	384	2.109
2011	RST	BTSPAS	25	310	269	173	686	0.780
2012	RST	BTSPAS	44	288	68	192	457	0.229
2013	RST	BTSPAS	59	257	46	186	363	0.174
2014	RST	BTSPAS	157	1,356	204	1,019	1,819	0.149
2015	RST	BTSPAS	5	58	44	24	149	0.672
2016	RST	BTSPAS	830	4,214	371	3,979	5,038	0.087

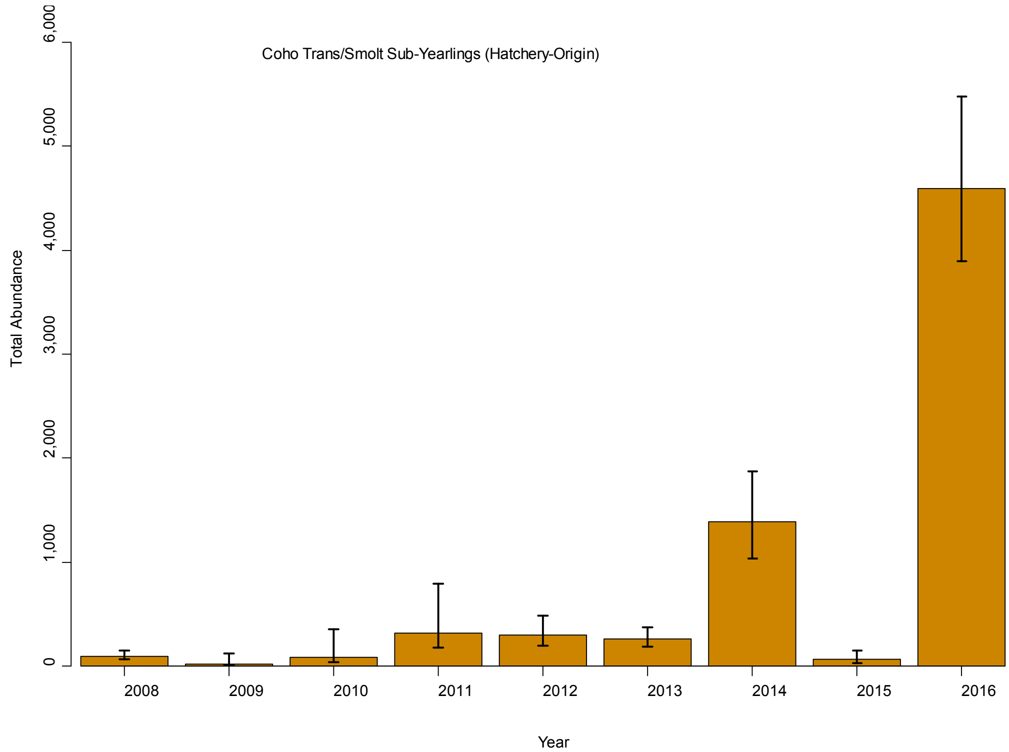

Figure 23. Estimated total abundance (± 95% CI) by year for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap from 2008-2016.

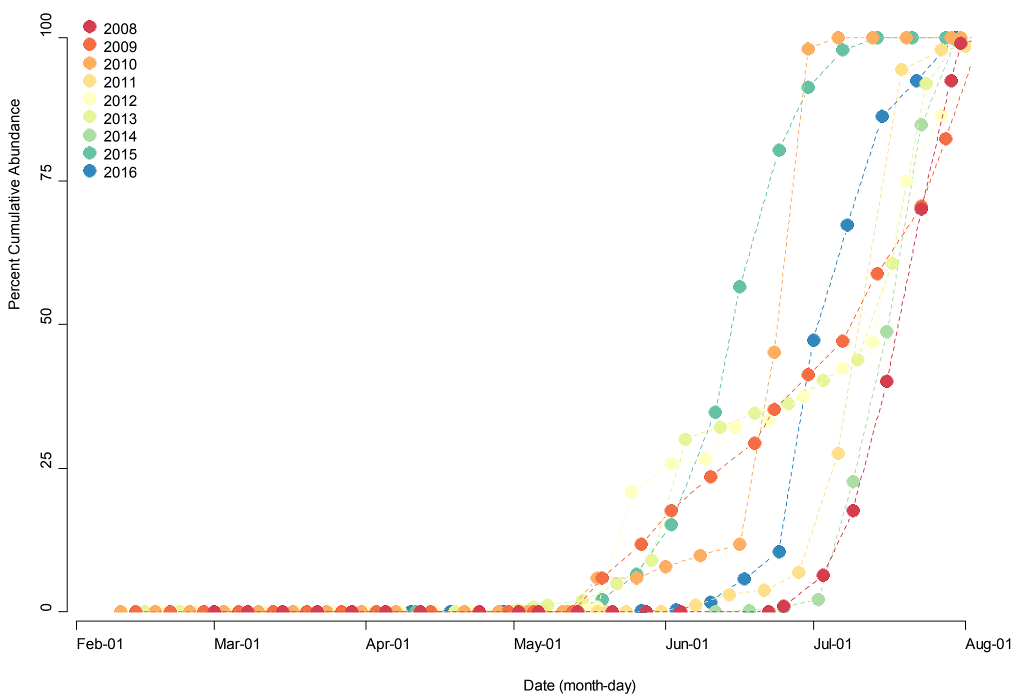

Figure 24. Percent cumulative abundance by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap from 2008-2016.

Hatchery-Origin, Yearling (Transitional/Smolt)

Outmigration estimates were generated for Grays River hatchery-origin yearling coho salmon for 2008 – 2016. Across the nine years, we estimated that the Grays River Hatchery released on average approximately 335,000 yearling coho smolts annually, with releases ranging from 72,000 to 981,000 (Table 50, Figure 25); however, see caveats below regarding the estimates from 2009 and 2011. Within each year, abundance was estimated by trapping period, and on average 88% of the hatchery outmigrants (range: 75 – 96%) passed the trap in a single trap period that occurred in the last week of April or first week of May (Figure 26; Appendix E: Figures E59 – E67). Among years, the precision of the abundance estimates, measured as the coefficient of variation (CV), averaged 0.21 (range: 0.12 – 0.42). As with natural-origin yearling coho, there was an extremely low number of recaptures (<30) in 2009 and 2010, due to poor trapping conditions, leading to relatively imprecise estimates.

Based on data from the Regional Mark Information System (RMIS; Pacific States Marine Fisheries Commission), Grays River Hatchery reportedly released 132 - 165K yearling coho salmon from 2008 – 2015. However, in all years but one, our estimates of hatchery release were greater than the reported numbers, and in only three of the nine years did the 95% CIs of our estimates encompass the reported release numbers. As mentioned previously, two of our abundance estimates (2009, 2011) should be caveated. In 2009, the estimated outmigrant abundance was 981,595, but is almost certainly biased high. Here, poor trapping conditions led to an extremely low number of recaptured fish (N = 6) from the main hatchery bulk release, despite a decent number of hatchery-origin captures. In 2011, the estimated outmigrant abundance was 62,781 and could possibly be biased low. Here, the total number of raw maiden captures at the mainstem Grays trap was substantially lower (1,576) than all other years (2,500 – 9,300), despite relatively normal trap efficiencies. Upon further investigation, there were some unresolved data recording issues around the time when the hatchery bulk group were released (i.e., it appears as though there may have been additional hatchery fish captured at the screw trap that were not recorded). Regardless, the reported release numbers of coho smolts from the Grays River Hatchery may have been an underestimate of true abundance.

Table 50. Summary of annual maiden catch used for analysis and outmigration estimates for Grays River hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling), 2008 – 2016. Note: estimates in light gray italicized text should be viewed with some caution (see text).

Year	Trap Type	Analysis	Maiden Catch for Analysis	Median Outmigration Estimate	SE	L95%	U95%	CV
2008	RST	BTSPAS	2,548	176,742	47,029	113,183	298,087	0.256
2009	RST	BTSPAS	3,773	*981,898*	*459,491*	*535,872*	*2,238,637*	*0.424*
2010	RST	BTSPAS	3,303	460,135	122,762	301,419	779,590	0.256
2011	RST	BTSPAS	1,576	*61,939*	*10,346*	*46,594*	*86,770*	*0.164*
2012	RST	BTSPAS	9,378	389,561	71,619	276,127	556,183	0.181
2013	RST	BTSPAS	4,837	185,320	31,735	137,587	262,033	0.168
2014	RST	BTSPAS	7,534	339,468	60,011	251,214	481,655	0.173
2015	RST	BTSPAS	7,152	187,801	23,627	149,230	241,589	0.125
2016	RST	BTSPAS	6,156	211,275	25,169	169,488	267,397	0.118

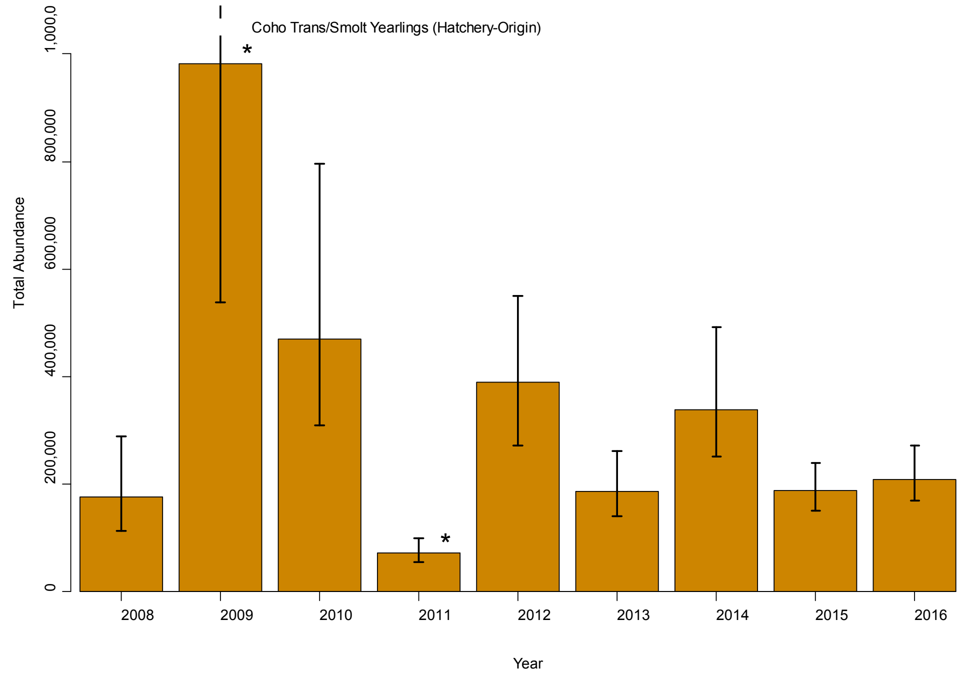

Figure 25. Estimated total abundance (± 95% CI) by year for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap from 2008-2016. Note: estimates with an asterisk should be viewed with caution (see text).

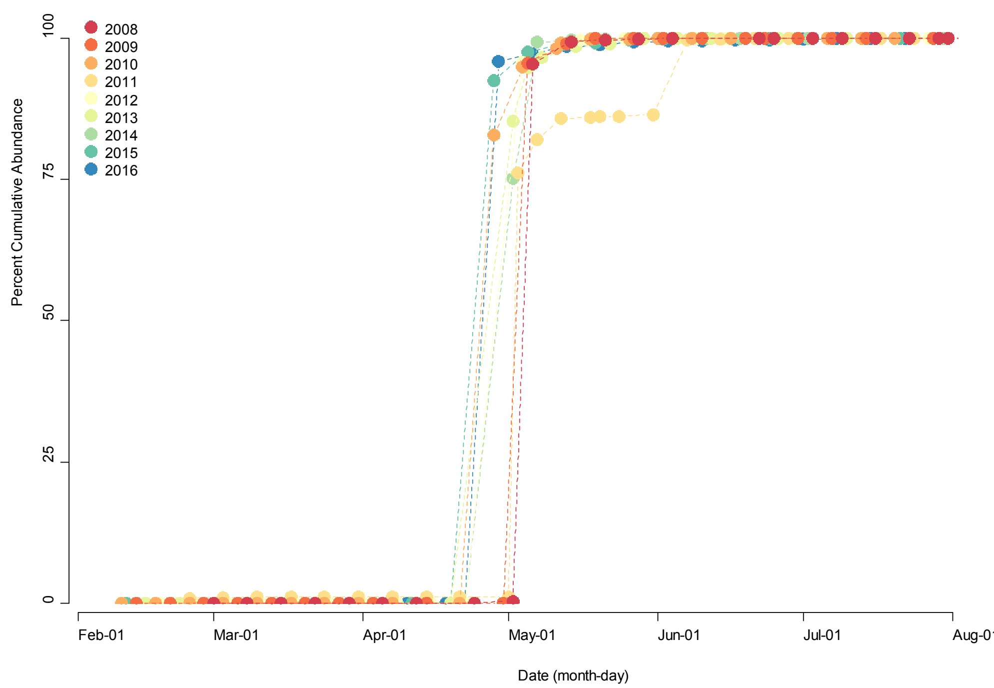

Figure 26. Percent cumulative abundance by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap from 2008-2016.

STEELHEAD

Natural-Origin, Yearling (Transitional/Smolt)

Outmigration estimates were generated for Grays River natural-origin steelhead yearlings for 2008 – 2016. Across the nine years, the total median abundance estimates ranged from 3,873 – 19,023 (Table 51, Figure 27), however, see caveat below regarding two estimates (2008 and 2010). Within each year, abundance was estimated for individual trapping periods and, overall, the outmigration followed the expected bell-shaped pattern (Appendix E: Figures E68 – E76) and the 50% passage date ranged from approximately May 3rd to May 26th (Figure 28). Among years, the precision of the abundance estimates, measured as the coefficient of variation (CV), averaged 0.27 (range: 0.18 – 0.37). As previously mentioned, the total number of yearling recaptures throughout the entire trapping season within a year averaged just 34 individuals (range: 13 – 78) among years, which ultimately led to the relatively imprecise estimates of abundance.

Similar to natural-origin coho salmon, scale data have been collected from outmigrating steelhead to directly estimate age (i.e., sub-yearlings vs. yearlings), but have not yet been analyzed. So instead, individual age-classes were assigned with a "life-stage and age-class" rule set (Appendix A: Figure A3). Briefly, the rule-set assigned age classes for each individual based on their corresponding size (FL) and capture date. Life stages were assigned based on field calls except that we applied a hard cut-off for individual yearling fish to be classified as a transitional or smolt, whereby all fish caught after June 15th could only be parr despite some individuals being classified differently in the field (see Appendix A: Figure A3). Photos of juveniles at different life stages and capture dates were collected in 2016 to verify life-stage assignments for future analyses and field-collection protocols. Overall, although there was some uncertainly in both the life-stage and age-class assignment, they likely had a small effect on the abundance estimate based on when the questionable assignments may have occurred. Regardless, the reported estimates should be viewed as preliminary until further analysis.

Lastly, although we felt comfortable producing estimates of abundance for each of the past nine years, the estimates for 2008 and 2010 should currently be viewed with some caution. Specifically, based on the size of the Grays River watershed and the number of adult spawners, the estimates in 2008 and 2010 seem lower than expected. Upon evaluating the raw maiden catch in these two years (Appendix B: Figures B64 and B66), there were practically no fish caught prior to the installation of the flow-diverting panels in early to mid-May. Despite the fact that capture efficiencies were estimate to be low (Appendix D: Figures D68 and D70), there were almost no maiden captures to expand and thus overall estimates were low. Interestingly, the pattern with catch and flow-diverting panels was seen in other years (2011 and 2016), but outmigrant abundances appeared to be more reasonable. One explanation could be the effect of run timing where it is possible that a larger portion of run in 2008 and 2010 were missed prior to panel installation relative to 2011 and 2016. Currently, we do not have an alternative method to estimate abundance in 2008 and 2010, but regardless, these estimates should be viewed as preliminary.

Table 51. Summary of annual maiden catch used for analysis and outmigration estimates for Grays River natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling), 2008 – 2016. Note: estimates in light gray italicized text should be viewed with some caution (see text).

Year	Trap Type	Analysis	Maiden Catch for Analysis	Median Outmigration Estimate	SE	L95%	U95%	CV
2008	RST	BTSPAS	279	*4,975*	*900*	*3,603*	*7,099*	*0.177*
2009	RST	BTSPAS	112	12,816	5,153	6,956	26,415	0.373
2010	RST	BTSPAS	184	*3,825*	*1,061*	*2,412*	*6,432*	*0.266*
2011	RST	BTSPAS	498	12,389	3,071	8,884	20,829	0.236
2012	RST	BTSPAS	121	14,113	4,584	8,382	25,908	0.308
2013	RST	BTSPAS	487	16,119	4,185	10,820	26,776	0.249
2014	RST	BTSPAS	259	19,017	6,812	10,625	36,736	0.337
2015	RST	BTSPAS	340	12,878	3,417	8,211	21,477	0.255
2016	RST	BTSPAS	547	14,751	3,494	9,591	23,192	0.230

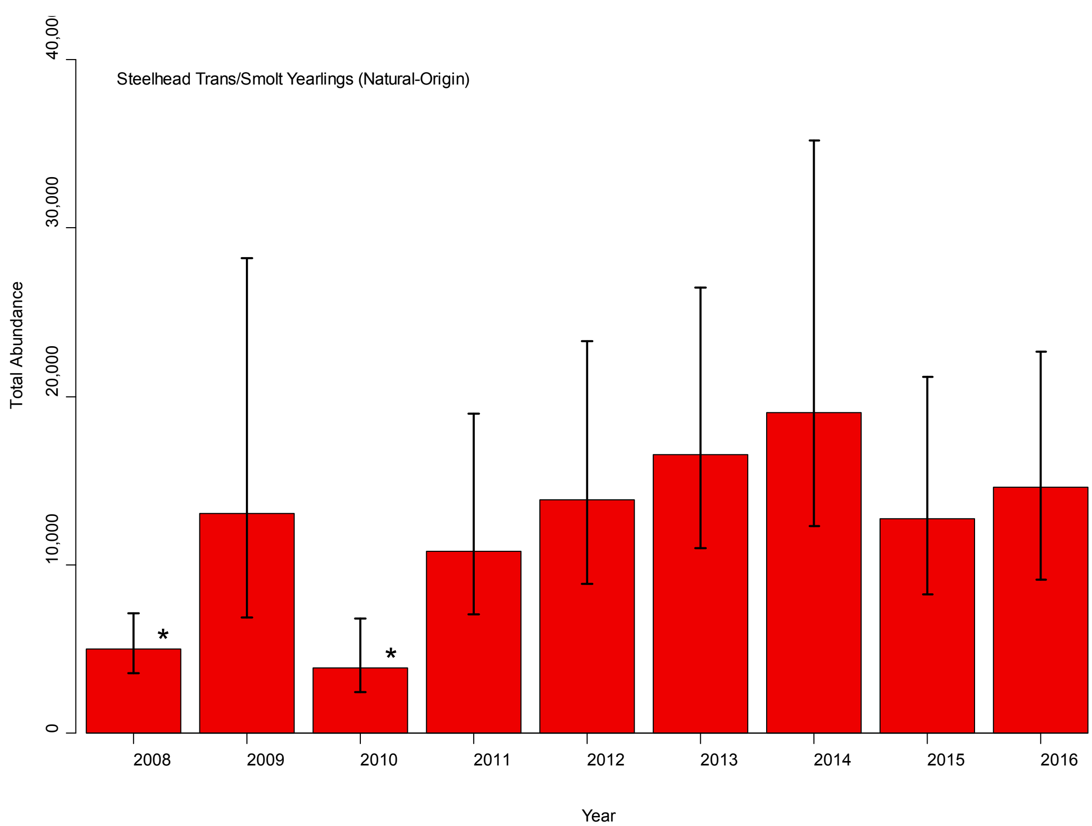

Figure 27. Estimated total abundance (± 95% CI) by year for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap from 2008-2016. Note: estimates with an asterisk should be viewed with caution (see text).

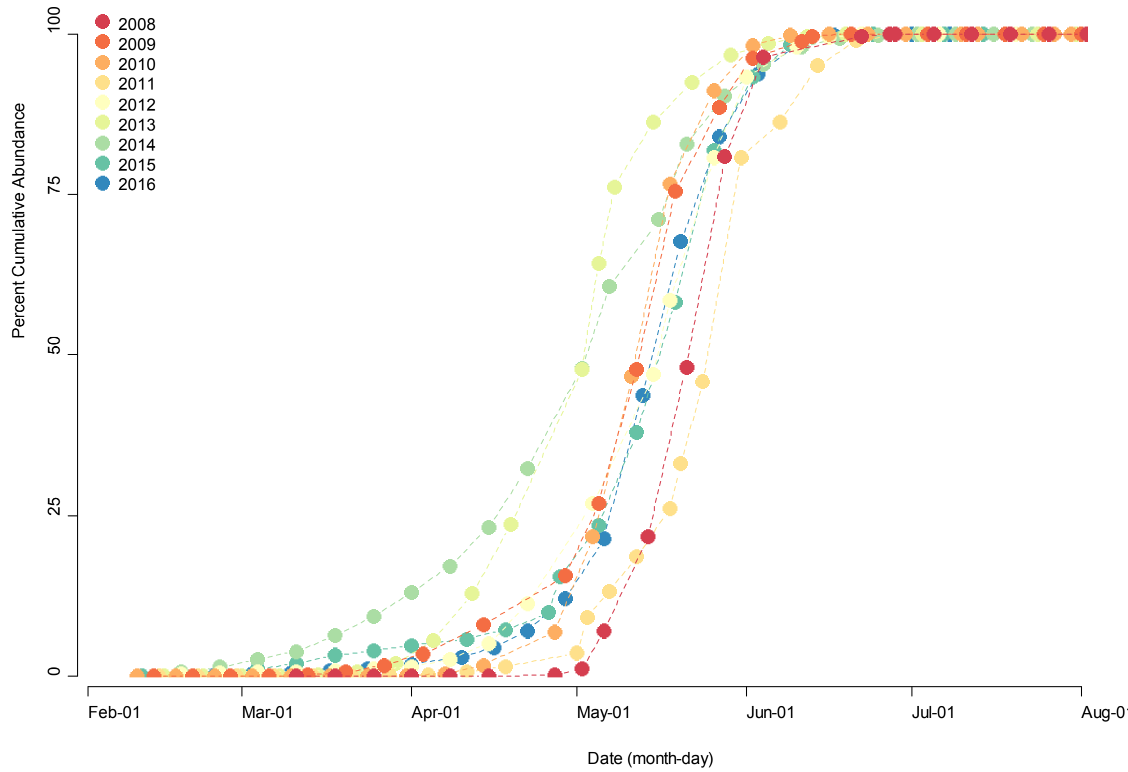

Figure 28. Percent cumulative abundance by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap from 2008-2016.

Hatchery-Origin, Yearling (Transitional/Smolt)

Outmigration estimates were generated for Grays River Hatchery-origin yearling steelhead for 2008 – 2015. Beginning in 2016, hatchery-origin steelhead would no longer be released into the Grays River watershed as the Grays River was designated a "Wild Steelhead Gene Bank" (WDFW 2008). Despite there being no hatchery release in 2016, a small number (N = 13) of hatchery steelhead were captured. Regardless, we did not generate a 2016 estimate. Therefore, among the eight years with hatchery releases, we estimated that the Grays River Hatchery released, on average, approximately 50,000 steelhead smolts but that the annual release ranged from 6,000 to 97,000 (Table 52, Figure 29). Within each year, abundance was estimated by trapping period and, on average, 82% of the hatchery outmigrants (range: 67 – 98%) passed the trap in a single trap period that occurred in the last week of April or first week of May (Figure 30; Appendix E: Figures E77 – E84). Among years, the precision of the abundance estimates, measured as the coefficient of variation (CV), averaged 0.31 (range: 0.19 – 0.55). As was the case with natural-origin steelhead estimates, the overall low number of recaptures among years led to the relatively low levels of precision and thus large 95% CI.

Based on data from the Regional Mark Information System (RMIS; Pacific States Marine Fisheries Commission), Grays River Hatchery reportedly released an average of approximately 35,000 (range: 8,000 – 46,000) steelhead yearling smolts per year. In six of the eight years, the 95% CIs of our estimates encompassed the reported release numbers. However, in two years (2010 and 2015) our estimates differed. In 2010, as with other years, our estimates were relatively imprecise and the lower 95% CI was just slightly higher (45,162) than the reported release (44,000). In 2015, field staff noted that the hatchery steelhead were in relatively poor condition when the bulk release group were being tagged prior to release. Therefore, one of the two low estimates (relative to reported release numbers) may be an artifact of imprecise estimates and/or reporting while the other may be due to a disease issue. Overall, the abundance estimates were relatively imprecise due to low recapture numbers. Moving forward, since the hatchery-origin steelhead release group has been discontinued, there will be even fewer recaptures available for natural-origin abundance estimates unless mark releases or recapture efficiencies can be increased.

Table 52. Summary of annual maiden catch used for analysis and outmigration estimates for Grays River hatchery-origin steelhead (life-stage = transitional/smolt; age-class = yearling), 2008 – 2016. Note: estimates in light gray italicized text should be viewed with some caution (see text).

Year	Trap Type	Analysis	Maiden Catch for Analysis	Median Outmigration Estimate	SE	L95%	U95%	CV
2008	RST	BTSPAS	740	37,427	7,292	26,700	55,100	0.190
2009	RST	BTSPAS	1,172	61,202	38,599	29,423	167,306	0.546
2010	RST	BTSPAS	739	77,064	26,641	45,704	148,596	0.325
2011	RST	BTSPAS	381	8,968	2,516	6,177	15,682	0.265
2012	RST	BTSPAS	654	67,637	22,480	43,121	128,055	0.312
2013	RST	BTSPAS	1,078	98,301	29,336	61,561	173,934	0.284
2014	RST	BTSPAS	767	45,804	12,119	30,280	75,808	0.254
2015	RST	BTSPAS	147	*6,451*	*2,112*	*3,671*	*11,805*	*0.327*
2016	RST	---	13	---	---	---	---	---

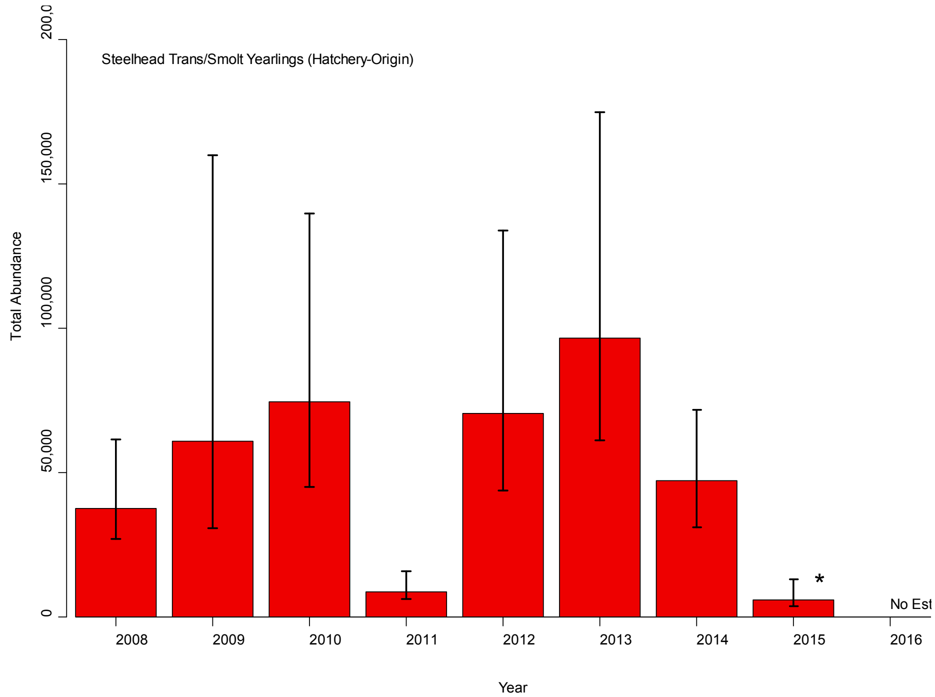

Figure 29. Estimated total abundance (± 95% CI) by year for hatchery-origin steelhead (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap from 2008-2016. Note: in 2016 there was no hatchery release and therefore we did not generate an estimate. Additionally, the estimate with an asterisk should be viewed with caution (see text).

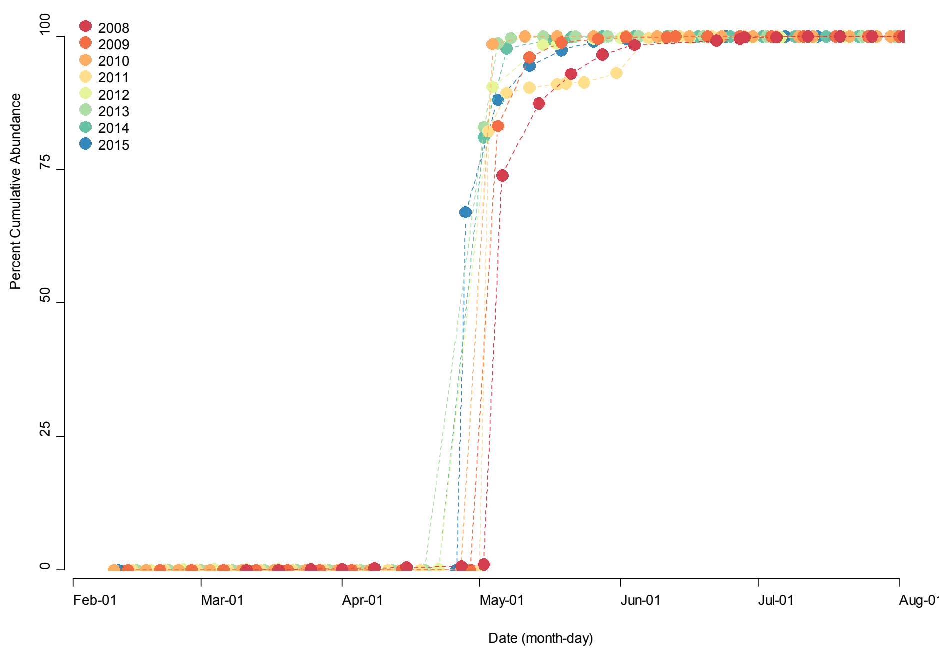

Figure 30. Percent cumulative abundance by date for hatchery-origin steelhead (life-stage = transitional/ smolt; age-class = yearling) produced above the mainstem Grays River screw trap from 2008-2016.

Crazy Johnson

CHUM SALMON

Natural-Origin, Sub-Yearlings (Fry)

Outmigration estimates were generated for Crazy Johnson Creek (CJ) natural-origin chum salmon fry for 2012 – 2016. Across the five years, the total median chum salmon fry abundance estimates ranged from 0.45 – 1.45 million (Table 53, Figure 31). Within a given year, abundance was also estimated for each individual trapping period and, in four of the five years, followed the expected bell-shaped pattern (Appendix E – Figures E85 – E89; see caveat in following paragraph). On average, 59% (range: 32 – 75%) of the outmigrants passed the CJ screw trap during the month of March, and among years the 50% passage date ranged from approximately March 5th to April 4th (Figure 32). Among years, the precision of the abundance estimates, measured as the coefficient of variation (CV), averaged 0.12 (range: 0.04 – 0.26).

Although we felt comfortable producing estimates of abundance for chum salmon fry for each of the past five years, the estimates for 2012 and 2015 should currently be viewed with some caution. Specifically, in 2012, a fence-panel weir was operated and the analysis used assumed daily captures consisted of 100% of all outmigrants unless the trap was inoperable, in which case catch was estimated via interpolation (i.e., Bayesian p-spline). However, two large flow events during mid- and late March, resulted in extended periods of missed trapping days during the hypothetical peak of the run (Appendix B: Figure B82). Therefore, even though catch was interpolated for the missing days, the interpolation may not have made up for the fact that the peaks in daily catch may have been missed resulting in an underestimation of catch. In 2015, low flow condition resulted in poor trapping conditions during March. During these low flows, catch was negatively affected (Appendix B: Figure B85), but, oddly, capture efficiencies were not consistently lower throughout the entire low-flow period. As a result, the outmigration abundance during early to mid-March, which is typically near the peak of the run, was lower than late February and late March. This bi-modal outmigration pattern seen in 2015 was not observed in any other year for either Grays or CJ chum salmon fry. Therefore, catch during the peak of the run may have been missed, resulting in an underestimation of abundance. While we were able to employ an alternative abundance estimator for Grays River chum in years with suspicious estimates (i.e., "Proportion" method), we currently do not have enough years of data to use for CJ.

Table 53. Summary of annual maiden catch used for analysis and outmigration estimates for Crazy Johnson Creek natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2011 – 2016. Note: estimates in light gray italicized text should be viewed with some caution (see text).

Year	Trap Type	Analysis	Maiden Catch for Analysis	Median Outmigration Estimate	SE	L95%	U95%	CV
2011	Weir	---	95,152	---	---	---	---	---
2012	Weir	P-Spline	204,612	*608,834*	*158,743*	*407,389*	*994,207*	*0.261*
2013	RST	BTSPAS	443,424	1,466,141	57,180	1,383,049	1,603,192	0.039
2014	RST	BTSPAS	334,887	1,101,635	115,684	950,172	1,388,438	0.103
2015	RST	BTSPAS	116,207	*419,369*	*59,523*	*314,031*	*568,966*	*0.139*
2016	RST	BTSPAS	299,824	1,155,179	68,964	1,031,159	1,304,596	0.059

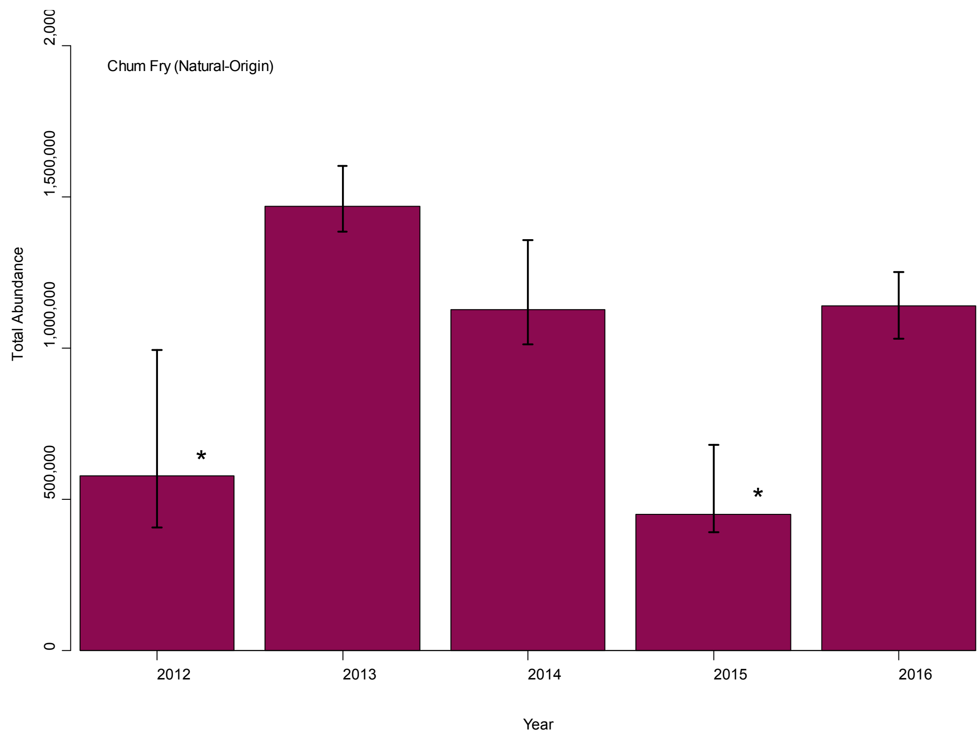

Figure 31. Estimated total abundance (± 95% CI) by year for natural-origin chum salmon (life-stage =fry; age-class = sub-yearling) produced above the Crazy Johnson Creek screw trap from 2012-2016. Note: estimates with an asterisk should be viewed with caution (see text).

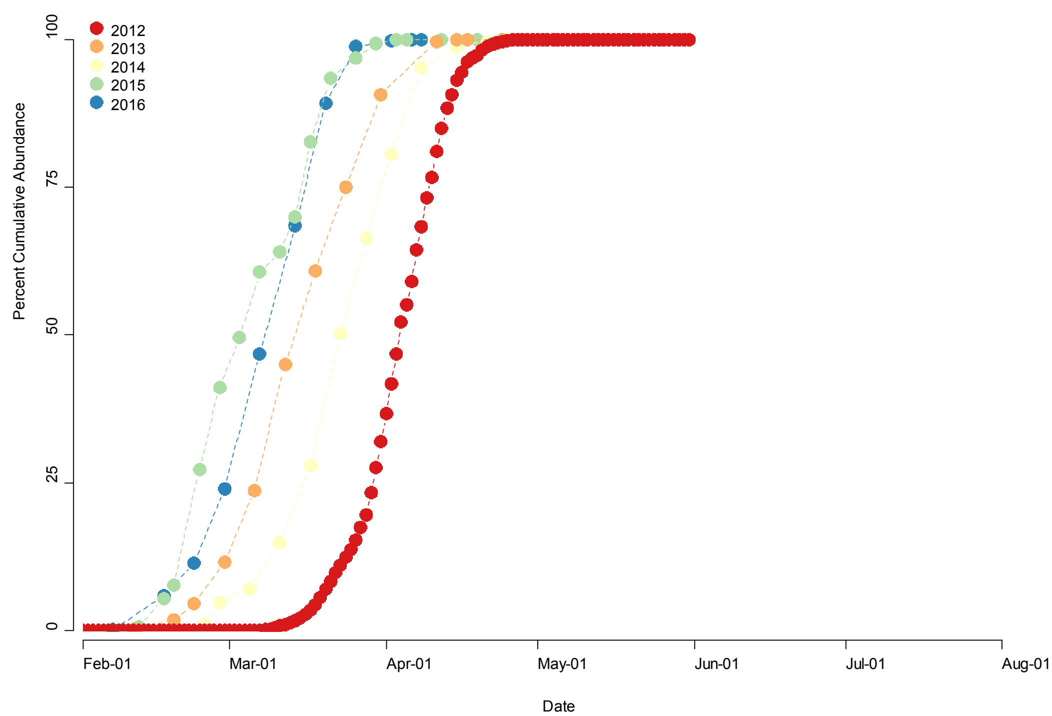

Figure 32. Percent cumulative abundance by date for natural-origin chum salmon (life-stage = fry; age-class = NA) produced above the Crazy Johnson Creek screw trap from 2012- 2016.

Duncan Channel

CHUM SALMON

Natural-Origin, Sub-Yearlings (Fry)

Outmigration estimates were generated for Duncan Creek spawning channel natural-origin chum salmon fry for 2003 – 2016. These estimates were previously published in program annual reports, but are re-reported here to provide context, and include all juvenile monitoring conducted under the larger lower Columbia River Chum BiOp Project. Briefly, across the fourteen years the total chum salmon fry abundance estimates (posterior median) ranged from approximately 25,000 to 66,000 (Table 54, Figure 33). In 9 of the 14 years, catch was assumed to be a census count that resulted in no error associated with the estimate. In the five other years, trap outages required the "p-spline" method to be used to estimate abundance and the associated error during missed periods. Among these five years, the estimated precision of the abundance estimates, measured as the coefficient of variation (CV), averaged 0.04 (range: 0.01 – 0.08). Within a given year, abundance was also estimated for each individual trapping period and in general followed the expected bell-shaped pattern (Appendix E – Figures E90 – E103; but see figures for 2003, 2005, 2008, 2014). Among years, the 50% passage date ranged from approximately March 15th to April 15th (Figure 34).

Table 54. Summary of annual maiden catch used for analysis and outmigration estimates for Duncan Creek spawning channels natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2002 – 2016.

Year	Trap Type	Analysis Type	Maiden Catch for Analysis	Outmigration Estimate	SE	L95%	U95%	CV
2002	Fyke net	---	8,483	---	---	---	---	---
2003	Weir	Census	25,478	25,478	---	---	---	---
2004	Weir	Census	45,450	45,450	---	---	---	---
2005	Weir	Census	27,814	27,814	---	---	---	---
2006	Weir	P-Spline	30,978	31,229	195	30,847	31,612	0.006
2007	Weir	Census	29,707	29,707	---	---	---	---
2008	Weir	Census	25,659	25,659	---	---	---	---
2009	Weir	Census	27,569	27,569	---	---	---	---
2010	Weir	Census	32,161	32,161	---	---	---	---
2011	Weir	P-Spline	25,544	29,657	2,071	25,581	33,698	0.071
2012	Weir	P-Spline	47,482	61,519	2,168	57,270	68,768	0.035
2013	Weir	Census	36,160	36,160	---	---	---	---
2014	Weir	P-Spline	26,478	34,514	2,870	28,887	40,140	0.083
2015	Weir	Census	48,213	48,213	---	---	---	---
2016	Weir	P-Spline	65,530	65,558	256	64,850	66,260	0.004

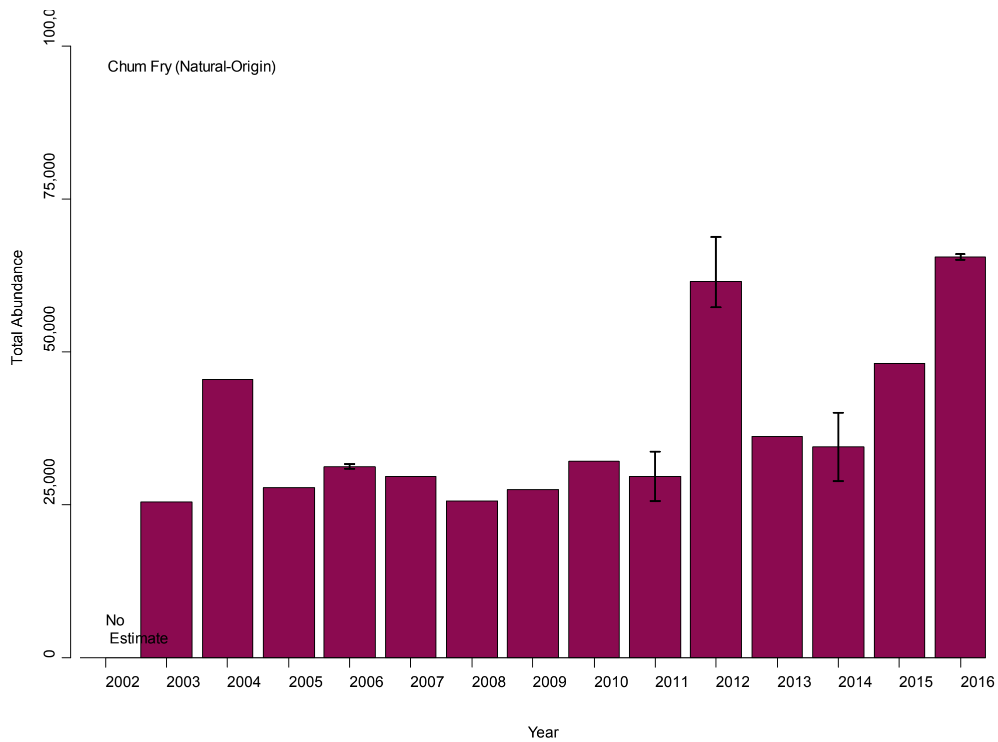

Figure 33. Estimated total abundance (± 95% CI) by year for natural-origin chum salmon (life-stage =fry; age-class = sub-yearling) produced above the Duncan Creek spawning channel weirs from 2002-2016.

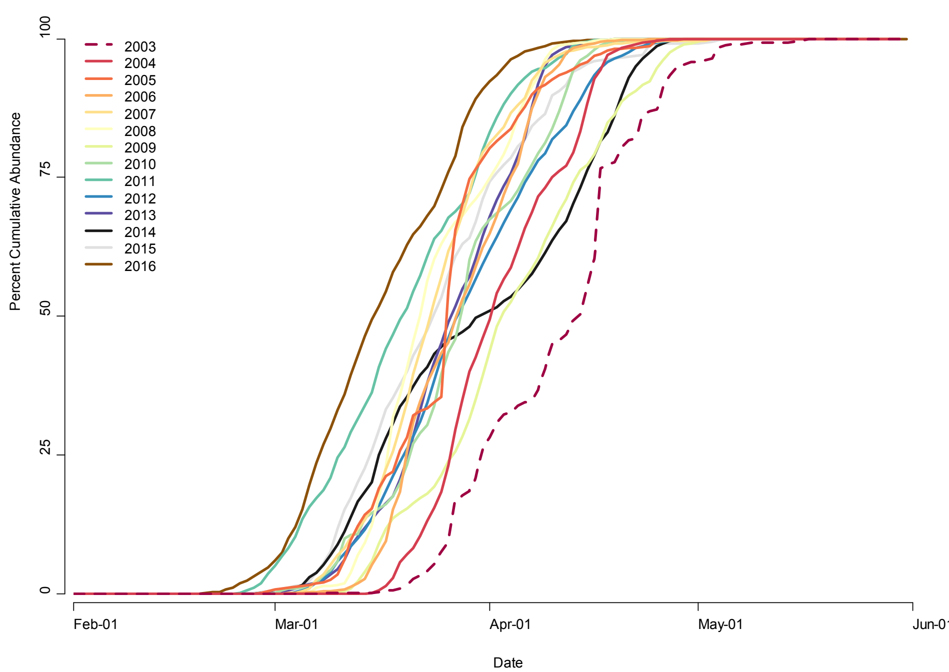

Figure 34. Percent cumulative abundance by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) produced above the Duncan Creek spawning channel weirs, 2003 - 2016.

Hamilton Creek

COHO SALMON

Natural-Origin, Yearlings (Transitional/Smolt)

Outmigration estimates were generated for Hamilton Creek natural-origin yearling coho salmon for 2014 – 2016. Across the three years, the total median abundance estimates ranged from 5,098 – 8,229 (Table 55, Figure 35). Among years, the precision of the abundance estimates, measured as the coefficient of variation (CV), averaged 0.06 (range: 0.06 – 0.07). Within each year, abundance was estimated for individual trapping periods and overall the outmigration followed the expected bell-shaped pattern (Appendix E: Figures E104 – E106) and the 50% passage date ranged from approximately April 20th to May 10th (Figure 36). In 2014, the screw trap was not installed until April 10th, approximately two months later than the trap was installed in 2015 and 2016 (Table 2). In 2015 and 2016, approximately 20 – 30% of the run was captured before April 10th. Therefore, the late starting date to the trapping season in 2014 may not only have biased the 50% passage date, but, more importantly, the abundance estimate. However, evaluating the 2014 abundance by period (Appendix E: Figures E104), the run appears to have been slightly later than 2015 and 2016 and, thus, the estimate may not be underestimated by 20 – 30%.

As with coho salmon in the Grays River system, coho salmon age data were not collected and therefore age-class was classified based a "life-stage and age-class" rule set (Appendix A: Figure A2). However, unlike Grays River coho salmon, there appeared to be limited potential overlap in the migration timing of similar sized yearling and sub-yearling migrants based on FL by date plots. Therefore, the yearling coho salmon abundance estimates should be robust despite no direct estimates of age.

Table 55. Summary of annual maiden catch used for analysis and outmigration estimates for Hamilton Creek natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling), 2012 – 2016.

Year	Trap Type	Analysis Type	Maiden Catch for Analysis	Median Outmigration Estimate	SE	L95%	U95%	CV
2012	RST	---	109	---	---	---	---	---
2013	RST	---	221	---	---	---	---	---
2014	RST	BTSPAS	1,401	8,247	559	7,266	9,462	0.068
2015	RST	BTSPAS	1,343	7,487	470	6,649	8,494	0.063
2016	RST	BTSPAS	1,398	5,098	323	4,553	5,804	0.063

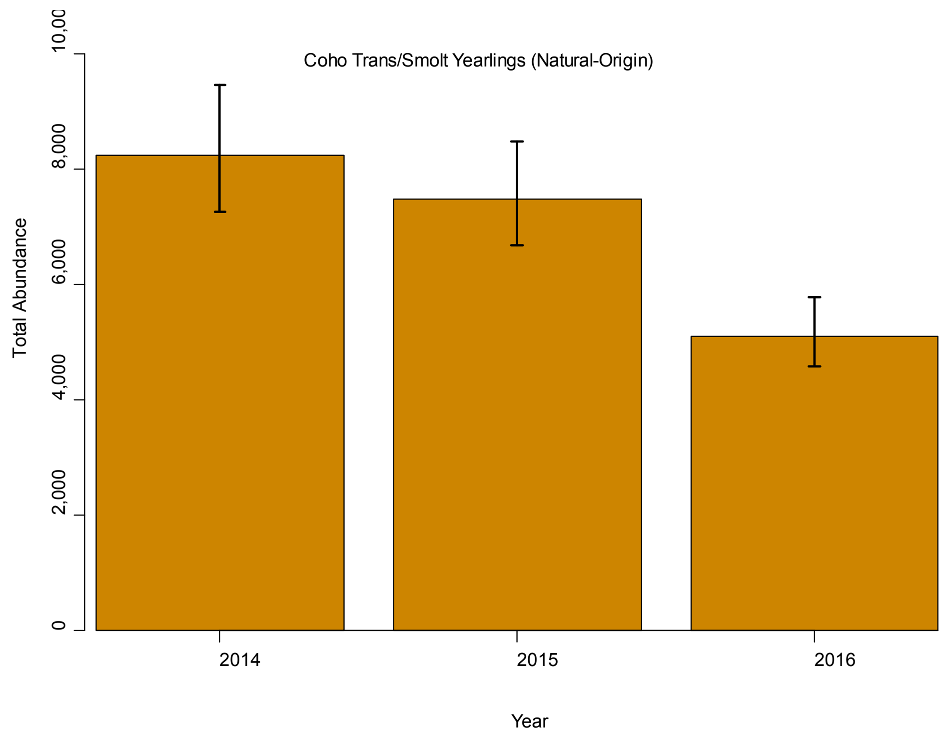

Figure 35. Estimated total abundance (± 95% CI) by year for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) produced above the Hamilton Creek screw trap from 2014-2016.

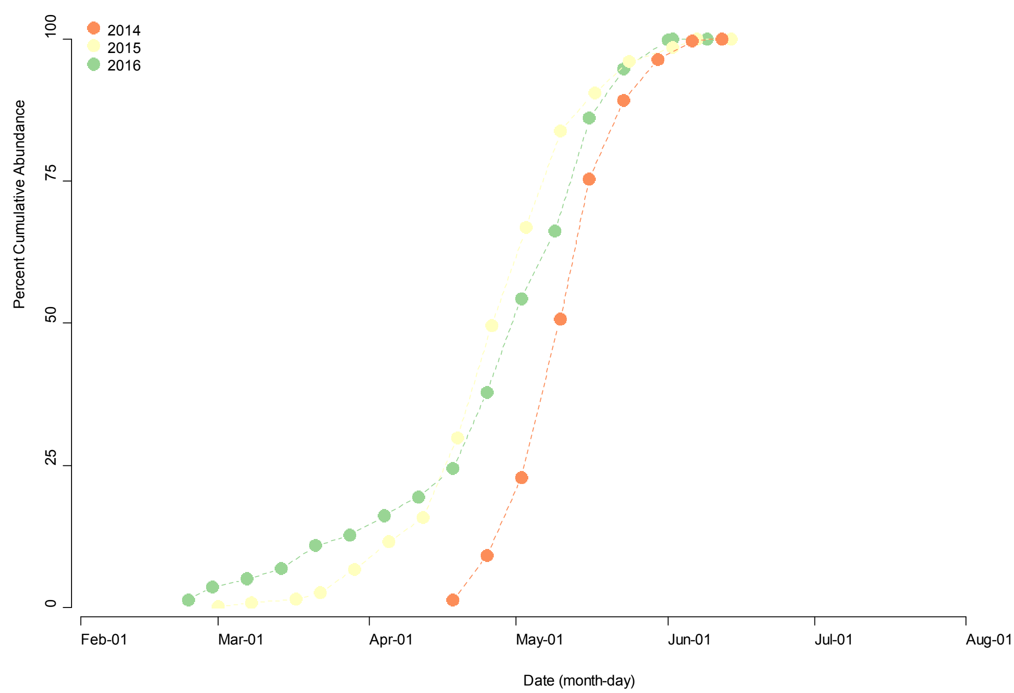

Figure 36. Percent cumulative abundance by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) produced above the Hamilton Creek screw trap from 2014-2016.

STEELHEAD

Natural-Origin, Yearlings (Transitional/Smolt)

Outmigration estimates were generated for Hamilton Creek natural-origin yearling steelhead for 2014 – 2016. Across the three years, the total median abundance estimates ranged from 3,538 – 5,632 (Table 56, Figure 37). Among years, the precision of the abundance estimates, measured as the coefficient of variation (CV), averaged 0.09 (range: 0.08 – 0.11). Within each year, abundance was estimated for individual trapping periods and overall the outmigration followed the expected bell-shaped pattern (Appendix E: Figures E107 – E109) and the 50% passage date ranged from approximately April 25th to May 2nd (Figure 38). In 2014, the screw trap was not installed until April 10th, approximately two months after the trap was installed in 2015 and 2016 (Table 2). In 2015 and 2016, approximately 15% of the run was captured before April 10th. Unlike the among years patterns in yearling coho salmon outmigration, the 2014 yearling steelhead run does not appear to be later than 2015- and 2016-based abundance by period plots. Therefore, the condensed trapping season in 2014 may not only have biased the 50% passage date, but, more importantly, led to an underestimate of abundance.

Table 56. Summary of annual maiden catch used for analysis and outmigration estimates for Hamilton Creek natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling), 2012 – 2016.

Year	Trap Type	Analysis Type	Maiden Catch for Analysis	Median Outmigration Estimate	SE	L95%	U95%	CV
2012	RST	---	75	---	---	---	---	---
2013	RST	---	49	---	---	---	---	---
2014	RST	BTSPAS	577	3,483	357	2,891	4,287	0.102
2015	RST	BTSPAS	595	3,717	392	3,058	4,595	0.105
2016	RST	BTSPAS	1,084	5,650	418	4,951	6,590	0.074

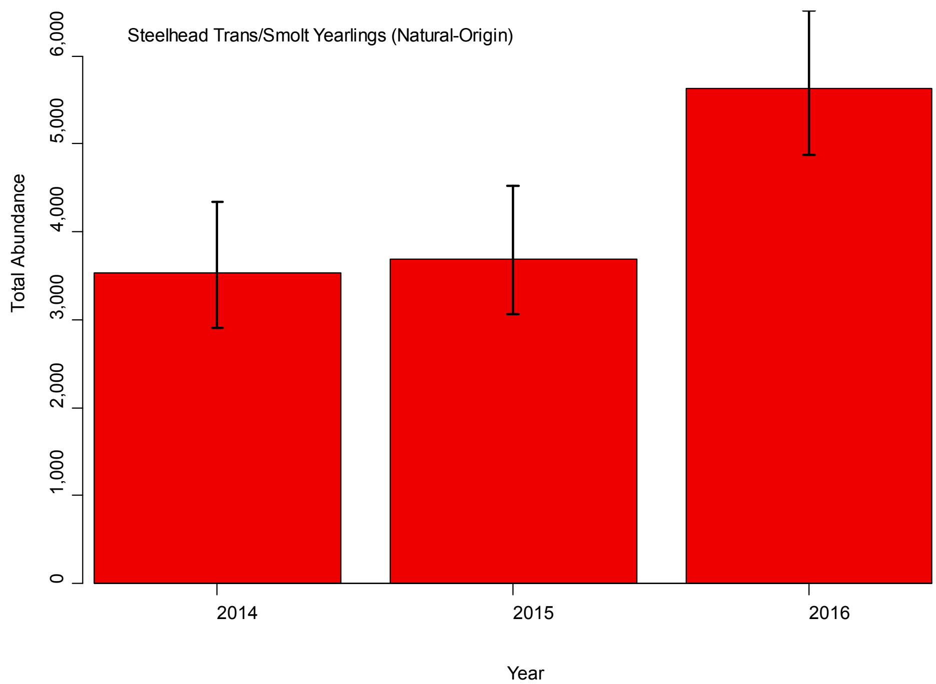

Figure 37. Estimated total abundance (± 95% CI) by year for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) produced above the Hamilton Creek screw trap from 2014-2016.

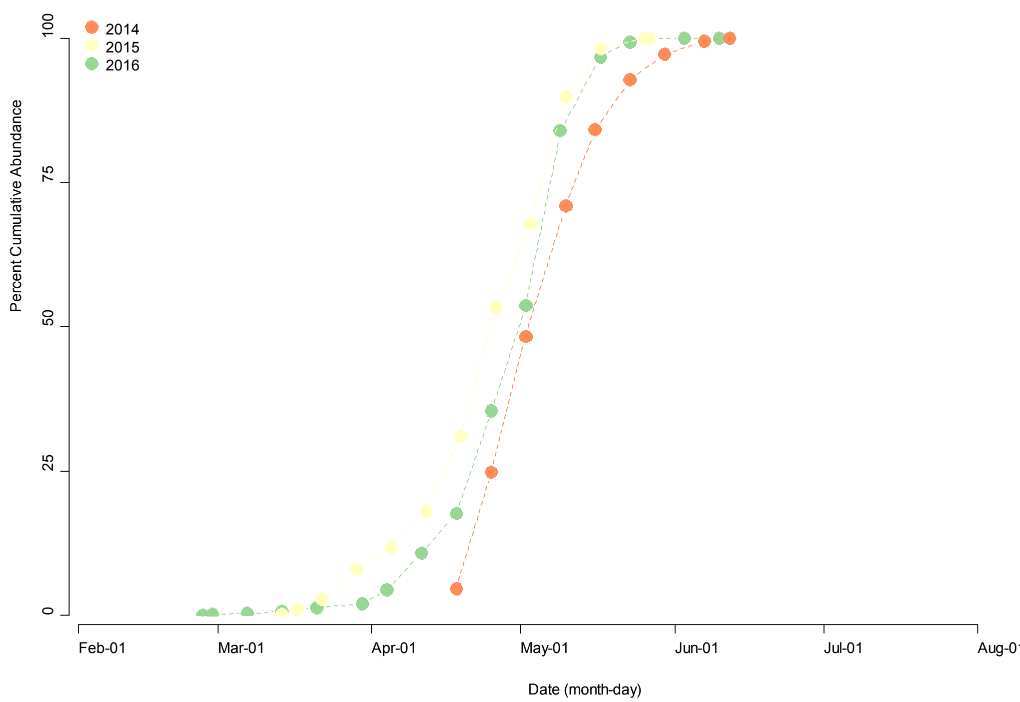

Figure 38. Percent cumulative abundance by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) produced above the Hamilton Creek screw trap from 2014-2016.

Hamilton Springs Channel

CHUM SALMON

Natural-Origin, Sub-Yearlings (Fry)

Outmigration estimates were generated for Hamilton Springs Channel natural-origin chum salmon fry for 2011 – 2016. Across the six years, the total median chum salmon fry abundance estimates ranged from approximately 164,000 to 780,000 (Table 57, Figure 39). In two of the six years, catch was assumed to be a census count that resulted in no error associated with the estimate. In the four other years, trap outages, both unintentional and intentional, required the "p-spline" method to be used to estimate abundance and the associated error during missed periods. Among those four years, the estimated precision of the abundance estimates, measured as the coefficient of variation (CV), averaged 0.03 (range: 0.02 – 0.04). Within a given year, abundance was also estimated for each individual trapping period and in general followed the expected bell-shaped pattern (Appendix E – Figures E110 – E115). Among years, the 50% passage date ranged from approximately March 24^{th} to April 18^{th} (Figure 40).

Table 57. Summary of annual maiden catch used for analysis and outmigration estimates for Hamilton Springs spawning channel natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2011 – 2016.

Year	Trap Type	Analysis Type	Maiden Catch for Analysis	Median Outmigration Estimate	SE	L95%	U95%	CV
2011	Weir	P-Spline	142,070	163,531	3,980	155,729	171,332	0.024
2012	Weir	P-Spline	345,016	439,971	15,246	410,089	469,853	0.034
2013	Weir	Census	459,369	459,369	---	---	---	---
2014	Weir	P-Spline	194,633	206,080	3,352	199,510	212,649	0.016
2015	Weir	Census	493,329	493,329	---	---	---	---
2016	Weir	P-Spline	493,379	779,993	27,550	725,996	833,990	0.035

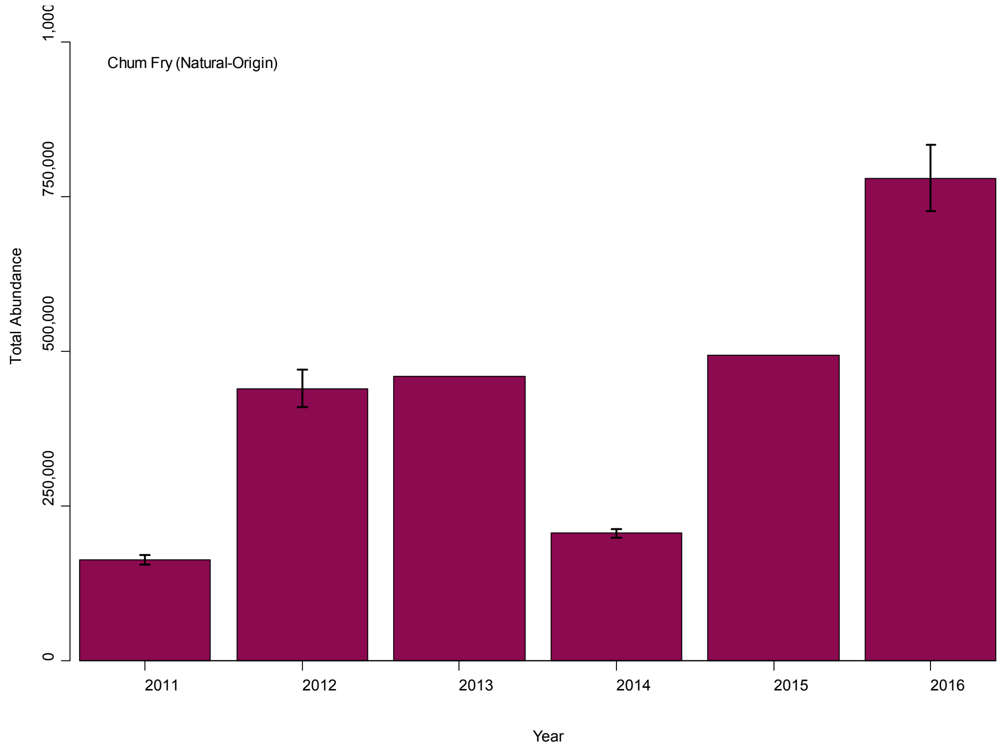

Figure 39. Estimated total abundance (± 95% CI) by year for natural-origin chum salmon (life-stage =fry; age-class = sub-yearling) produced above the Hamilton Springs spawning channel weir from 2011-2016.

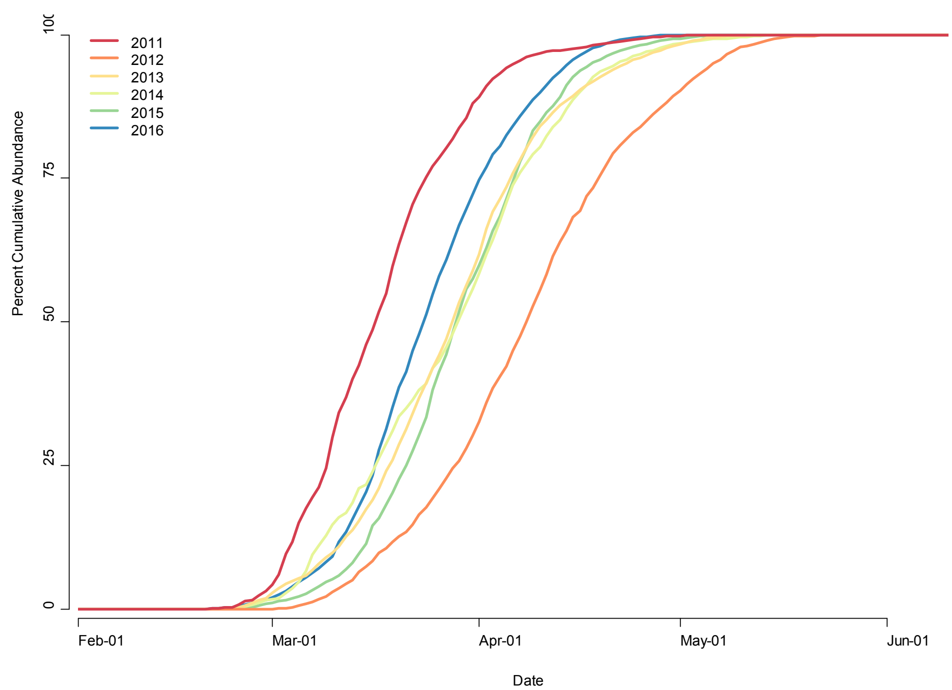

Figure 40. Percent cumulative abundance by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) produced above Hamilton Springs spawning channel weir from 2011- 2016.

Summary

This is the first comprehensive summary of WDFWs juvenile monitoring activities focused on chum salmon in Washington's portion of the Columbia River ESU since their listing under the ESA. Across all five monitoring sites, we monitored a total of 35 chum salmon outmigrant years and generated a total of 34 chum salmon outmigrant abundance estimates and their associated level of precision (measured by the estimates CV). Overall, the CV values for chum salmon juvenile estimates ranged from a low of 0.000 (census counts at weirs) to a high of 0.755 (proportional analysis method), averaging 0.084 for the 34 estimates generated. The CVs for approximately 80% of the estimates fell below the monitoring programs precision goal (CV ≤ 0.15). While the emphasis of the juvenile monitoring outlined in this report was to generate unbiased and precise juvenile abundance estimates for chum salmon, data were collected on all species encountered. Thus, when data were available, outmigrant estimates were generated for other species, including Chinook and coho salmon, and steelhead. Across all five monitoring sites, we monitored a total of 35 outmigrant years and generated a total of 83 non-chum salmonid outmigrant abundance estimates and their associated level of precision. With the exception of Hamilton Creek NOR coho and steelhead and Grays River NOR sub-yearling Chinook, which had average CVs of 0.063, 0.094 and 0.154, respectively, calculated CVs for non-chum estimates were typically larger and more variable than CVs for chum in the same locations and years. Larger CVs (i.e., higher uncertainty in the estimate) were generally a result of lower absolute (maiden) catch, which resulted in relatively low numbers of marks for trap efficiency releases.

This report is the first to document multiple years of juvenile chum salmon abundance estimates from multiple populations within two of the three Columbia River chum salmon ESUs strata (Coastal and Gorge). Additionally, we report a time series of abundance estimates for NOR juvenile chum salmon across a wide range of available spawning habitats within the Columbia River ESU (i.e. mainstem tributary alluvial channels, protected natural off-main channel areas, and spawning channels). These abundance estimates provide missing VSP values needed to evaluate the status of Columbia River chum salmon and data needed to evaluate current, and guide future, chum salmon reintroduction and hatchery enhancement programs. When combined with spawner estimates above trapping sites, estimates of juvenile chum salmon outmigrant abundance will provide critical pieces of information needed to develop a life-cycle model for Columbia River chum salmon; an effort that is scheduled to begin in 2017. The estimates of Chinook, coho and steelhead juvenile abundance generated not only contribute to the long-term status and trend monitoring of those species, but are also directly used in the wild coho forecast for the lower Columba River (e.g., Zimmerman 2016) and the assessment of biological reference points for steelhead throughout Washington State (Buehrens 2016).

Lessons Learned

At first glance, monitoring juvenile outmigrants and generating an abundance estimate appears to be relatively straightforward. The primary steps are: 1) choose an appropriate site and install a juvenile trap, 2) operate the trap during the outmigration timeframe and capture all, or a representative sample, of the outmigrating juveniles, 3) identify and enumerate the catch by desired analysis/results groupings, 4) mark some, or all, of the captured juveniles and release the individuals upstream of the trap to generate estimates of trap efficiency, and 5) use an appropriate analytical method (e.g., mark-recapture model) to generate estimates of abundance. However, as detailed in the sections above, each of these five steps requires multiple sub-steps. The manner in which these sub-steps are performed will affect the success of the monitoring program and ultimately determine whether or not an unbiased and precise abundance estimate can be generated. Drawing on almost a decade and a half of juvenile monitoring experience, notable "lessons learned" for each of these steps are detailed below.

Choose an appropriate site and install a juvenile trap

Over the nine years of juvenile trapping at the Grays River mainstem site, there has been substantial gravel bar formation and movement along with changes to the shoreline and alignment of the thalweg. These changes forced a slight relocation of the trap site in 2012. While the new site is still adequate for trapping juvenile chum and Chinook salmon, it generally performs poorly for yearling-age salmonid outmigrants until flow-diverting panels and/or a second rotary screw trap are installed. Unfortunately, the installation of flow-diverting panels is dictated by river flow and they typically cannot be installed until early-May. However, in some years, persistently high flows prevent panel installation until late-May to early-June at which point the majority of the yearling outmigration has occurred. Installation of the second rotary screw trap has been dictated by its use in Crazy Johnson Creek and cannot be installed until late-April or early-May. Therefore, it is critical to choose a trapping location and operate sampling gear that can capture a sufficient number of juvenile outmigrants for all species, life-stages, and age-classes of interest across the entire outmigration period.

The first two years of trapping at the Duncan spawning channels proved that fyke nets combined with live boxes are not a viable method when debris and algae are likely to be present (Figure 6; Hillson 2002). Fence panel weirs combined with live boxes are an effective method to use for achieving census counts. However, the first year of trapping at the Hamilton Springs spawning channel proved that the weir panels need to be at steep angles in relation to the flow direction to avoid impingement problems with fry migrants (Figure 9). When trapping wide locations, likely anything >8', fence-panel weirs will need to consist of multiple "V"s to avoid impingement issues with fry migrants.

Operate the trap throughout the entire outmigration period and capture all, or a representative sample of, the outmigrating juvenile salmonids

Sampling the entire outmigration period requires that the trap be installed before emigration begins and operated until the last outmigrant leaves. To ensure this occurs, the trap should be installed, operating, and catching zero fish for 5 – 7 days at the beginning and end of the season for each abundance grouping of interest. Accomplishing this feat is a balancing act between staff priorities, funding resources, and the anticipated impact and potential bias in the estimates resulting from missing an unknown portion of the outmigration. Because our work was focused on monitoring juvenile chum salmon, most of which begin outmigrating immediately after emergence, it required that traps be installed in early February. Even with trap installations occurring in the first week of February, a small number of chum fry were often captured on the first day of trapping at the Grays and CJ traps. However, this had an insignificant impact on the final total estimates due to the small number of fish captured early relative to the number caught throughout the remainder of the season.

Flow conditions can lead to periods of time when the trap is inoperable. These periods are referred to as "trap outages" and can be brief (minutes to hours) or last several days. The most common trap outage is caused by extraordinarily high flows. During these high flows the trap is moved from the thalweg to the bank and the cone is lifted. Once flows attenuate, the first priority is to get the trap operating as soon as possible, and in years past the trap has slowly been moved back into the thalweg over several days to a week. However, we have recognized that incremental trap position adjustments in this manner following an outage may violate the "exchangeability" assumption implicit in the estimation of trap efficiency across temporal strata using the BTSPAS analysis method. Therefore, in future years, we plan on delaying trap redeployment following an outage until flows have subsided enough that the trap can be fished in its normal/standard location. At the other extreme, when fishing RSTs in both Hamilton and Crazy Johnson creeks, low flow conditions during and near the end of the season can result in periods of non-fishing when the cone stops rotating. Installation of flow-diverting panels, disconnecting the debris wheel drive system, and installing a battery drive system to power the debris wheel were all techniques used to successfully extend seasons, see **Methods** section for details.

Operating the trap every other day can be an effective way to manage staff workload, impacts to monitored species, and avoid exceeding ESA take permit levels while still achieving the goal of precise and unbiased estimates, if catch and efficiency mark sample sizes are sufficient. Implementing alternate-day trapping when fishing a RST requires no trap modifications and can be as simple as lifting the cone. However, fishing a fence-panel weir and live box traps requires the addition of "dump" ports (6" bulkheads with threaded plugs) to the live boxes. Regardless of the trap type, being consistent with start- and stop-fishing times, choosing even blocks of time when making trap status changes (e.g., alternating between fishing or not fishing for 24, 48 or 72 hr. blocks), and fishing a sufficient number of days during the expected peak outmigration timeframe to capture the shape of the outmigration curve are critical to prevent bias in the estimate.

Identify and enumerate catch by desired analysis/results groupings

As mentioned previously in the **Enumeration and Sampling** section, while the criteria for being classified into the parr, transitional or smolt life-stages has not changed since 2008, there have been multiple changes to the sub-groups (bins) of these life-stages. Some of these changes were driven by ESA permit reporting requirements (e.g. splitting steelhead parr into sub-yearling and yearling groups), the desire to use this data in other analysis (e.g. splitting coho salmon smolts into sub-yearling and yearling groups), and efforts to standardize juvenile outmigrant reporting groups within the region and state (e.g. including sub-yearling Chinook salmon parr in the sub-yearling Chinook salmon juvenile estimate). Generation of the life-stage by age-class rule sets in 2015 not only standardized grouping criteria across species at all five monitoring sites, it provided a means to standardize historical monitoring data sets from the sites and generate outmigrant estimates by abundance groupings that were comparable over time.

At two of the monitoring sites (Crazy Johnson Creek and Hamilton Springs spawning channel) it was not uncommon to have daily catches of salmon fry (a mix of chum, Chinook, and coho salmon) that exceeded 10,000. When this occurs, daily workload often prevents hand counting. Two methods, volumetric and bulk weight sampling, combined with sub-sampling for counts and species composition, were used to efficiently and accurately estimate the daily catch. Sampling and analysis protocols were developed that not only generated catch estimates but also the variance on the daily catch estimates. While these daily catch estimate variances are not reported in this document, they were evaluated during the first seasons these methods were used and found to be very small (CVs of daily catch estimates <0.05) and likely introduced an insignificant amount of unreported additional uncertainty in the total outmigration estimates.

Hatchery operations within the Grays River basin may be contributing to biased estimates of natural-origin (NOR) and hatchery-origin (HOR) yearlings and sub-yearlings for coho salmon. Specifically, there is strong evidence that sub-yearling coho salmon are escaping from the hatchery prior to being adipose-clipped. Therefore, when these unclipped HOR fish are captured at the rotary screw trap, they cannot be externally distinguished from NOR fish. This not only leads to a potential bias in the outmigration estimate of HORs and NORs, it may also lead to a bias in the proportion of HOR spawners (pHOS) estimates, as unclipped HOR adults would be incorrectly enumerated as NOR. Additionally, ad-clipped sub-yearling and/or yearling Chinook salmon juveniles have been captured at the Grays rotary screw trap annually. These HOR Chinook salmon juveniles are a non-native spring-run stock reared at the Grays Hatchery and scheduled for release into net-pens for final rearing and acclimation on the mainstem Columbia River as part of the Select Area Fisheries Enhancement (SAFE) program. The extent of these two problems appears to vary among years, but are difficult to assess with existing data.

Mark some, or all, of the juvenile salmonids captured and release them above the trap to generate estimates of trap efficiency

Many of the lessons learned related to this step were about balancing priorities and meeting analysis assumptions. Because only a single batch mark (i.e., Bismarck brown) was available for marking chum salmon fry (as opposed to other species for which multiple mark types were available), and their travel time from the release site to the trap was unknown, the initial mark release schedule at the Grays RST was two consecutive days of releasing marks followed by four days of no mark releases. It quickly became evident that the majority of the marked fry were passing through the trap site within 24 hours and > 99.9% had passed within 48 hours. With this knowledge, the mark release schedule was adjusted to allow for three release groups per week, which resulted in more marks being released, more overall recaptures, and more releases to capture changes in trap efficiency as flows changed. This in turn resulted in relatively precise estimates despite low capture efficiency for chum salmon fry.

Use an appropriate analytical method (e.g., mark-recapture model) to generate estimates of abundance

While the Bayesian Stratified-Petersen estimator has many advantages over other M-R analytical methods, the current BTSPAS estimator does have one potential drawback in how it hierarchically estimates trap efficiency. Specifically, the BTSPAS estimator assumes that any individual observed trap efficiencies come from a common "hierarchical" distribution of trap efficiencies. However, this assumption may be violated when there are strategic shifts in trapping operations and/or drastic changes in environmental conditions. For example, when flow-diverting panels or a second screw-trap are installed, the trap efficiencies pre- and post-changes may differ systematically, rather than arising from a common distribution. Because maiden catch, trap efficiency, and recaptures are all positively related, if maiden catch and recapture numbers are low before trap changes, the resulting abundance estimates for these trapping periods may also be biased low. Although we have identified this potential issue and highlighted estimates that may be affected, we have not formally evaluated the effects of this potential issue.

The use of a Bayesian penalized spline to account for missed catch on trap outage days and during alternate-day trapping at weir sites proved to be a very effective and robust outmigrant estimator tool. Prior to the 2016 juvenile monitoring season at the Hamilton Springs spawning channel, we anticipated that if we operated our trap every day we would end up handling more fish than our ESA permit allowed based on the high chum salmon spawner abundance (the adult estimate just over 1,400) in the channel the previous fall. To avoid exceeding our annual permitted handling limit, or being forced to stop trapping before the season was over, we employed an alternate-day trapping schedule once the peak of the outmigration had been accounted for. This strategy of trapping through the peak before initiating the alternate-day schedule combined with running in-season p-spline estimates (using daily catch totals to date and providing an expected end date to the outmigration) to know when it was likely safe to resume daily trapping resulted in an outmigration estimate with a CV of just 0.035 despite having no daily catch data for 18 days in late-March and early-April.

Future Recommendations

In an effort to improve abundance estimates generated for juvenile salmonids in the Grays River, Crazy Johnson, Duncan and Hamilton creek basins, we have provided the following list of recommendations regarding field data collection and analytical methods.

1) **Work with WDFW hatchery staff to ensure the number of hatchery "leakers" is minimized and ultimately reduced to zero.** This begins with direct communication with hatchery personal as well as the WDFW Region 5 Management Team. Moving forward, we will continue to collect hatchery "leaker" information and explore available options to more definitively assess the extent of this issue.

2) **Operate two rotary-screw traps at the mainstem Grays River site over the entire outmigration season.** While adding a second rotary screw trap (RST) will likely increase the precision of the abundance estimates made for all species, the biggest gains would be seen in yearling (coho and steelhead) outmigrant estimates. Currently, a single, 1.5 meter RST set up is used from February through mid-May. During this time period, capture efficiencies for coho and steelhead yearlings are relatively low (<5%) resulting in low numbers (<10) of recaptures per weekly trap efficiency stratum. When the second 1.5 meter RST is installed, which is available once monitoring in Crazy Johnson Creek has ended in early May, capture efficiencies for all species dramatically increase. Unfortunately, a substantial portion of the coho salmon and steelhead outmigration, and sometimes the peak of the run, can occur before the installation of the second trap leading to imprecise estimates that are also likely biased low in some years (e.g., steelhead yearlings in 2008 and 2010).

3) **Explore options for powering the rotary screw trap debris drum and cone.** Toward the tail end of the monitoring season it is not uncommon for the rotary screw traps (RSTs) installed in Crazy Johnson and Hamilton creeks to "run out of water". Disconnecting the debris drum drive system on the RST can result in "gaining back" 1-2 cone revolutions per minute. However, debris loads can still be high even in low-flow situations. A battery-powered drive system to turn the debris drum on a RST was designed, installed, and proved effective on the RST used in Crazy Johnson Creek in 2015. A similar system should be built and installed on the RST used in Hamilton Creek. Using battery power to rotate the cone of a

RST in the absence of sufficient water flow for any meaningful duration would be a much more complex system, likely requiring the assistance of mechanical and electrical engineers, but would be worth pursuing.

4) **Explore options for marking Chinook salmon fry and parr.** In previous years, Chinook salmon fry and parr have not been marked and, therefore, direct estimates of capture efficiency could not be calculated. In an effort to generate estimates for these two groupings, capture efficiencies were calculated using "surrogate" groupings. Specifically, chum salmon fry capture efficiencies were used for Chinook salmon fry and Chinook salmon transitional/smolts capture efficiencies were used for Chinook salmon parr. However, using these surrogate groups requires us to assume that trap efficiencies between these groupings are exchangeable. Therefore, we should explore options to get direct estimates of trap efficiency for Chinook salmon fry and parr.

5) **Evaluate the retention, detection, and catchability of fin clip marks.** Three of the six assumptions that must be met to generate unbiased mark-recapture estimates for juvenile outmigrants pertain to the retention, detection, and catchability when using external marks. Over the years, these assumptions have been tested for multiple tags, species, and age-classes of fish. However, these assumptions have not been tested for fin clip marks used on coho salmon and steelhead for trap efficiency trials at the Hamilton Creek rotary-screw trap. Conducting these evaluations would be logistically challenging to do on-site, and there would only be ESA-listed natural-origin juveniles available. Therefore, these tests should be done at a local hatchery facility using hatchery-origin coho and steelhead juveniles as surrogates for trap-caught juveniles. This would require the additional assumption that fin regeneration rates between hatchery- and natural-origin juveniles are the same.

6) **Evaluate the sensitivity of the BTSPAS generated estimates to the "exchangeability" assumption.** As mentioned in the "Lessons Learned" section, the BTSPAS estimator assumes that any individual observed trap efficiencies come from a shared "hierarchical" distribution of trap efficiencies. However, this assumption may be violated when there are strategic shifts in trapping operations and/or drastic changes in environmental conditions. Therefore, we need to assess the sensitivity of estimates to this assumption and, if necessary, update the analytical approach. One possible solution that will be explored is using covariates to account for systematic changes in trapping efficiency.

7) **Update how variance is estimated for abundance.** The Bayesian penalized spline abundance model generates an estimate and variance value for every period, even when census count data is available for that period. Even though the amount of added uncertainty is essentially inconsequential (changes to estimate CVs in the tenths of a percent), there technically is no associated variance with a census count. Additionally, neither the BTSPAS nor penalized spline analysis models incorporate the uncertainty in daily catch estimates when volumetric or weight expansion methods are used to generate daily catch totals. While modifying the variance estimators to include this uncertainty would result in no change to the point estimate, it would provide a more accurate estimate of its uncertainty.

8) **Explore the sensitivity of abundance estimates using a "diagonal" vs. "non-diagonal" estimator.** Two general approaches can be used to analyze mark-recapture (M-R) data when multiple batch mark groups or individual tags are used. The first method is referred to as a diagonal M-R estimator, and it assumes that all marked fish used for capture efficiency trials migrate back past the trap in the same period as they were released. The diagonal estimates should be used when releases are close to the trap (approximately <3 kilometers) and most marked fish pass the trap within a few days of being released. The second method is referred to as a non-diagonal M-R estimator, and it accounts for fish that do not migrate past the trap in the same period they were released (i.e., delayed migration). Although we were able to collect non-diagonal migration data for almost all abundance groupings except chum salmon fry, we chose to use a diagonal M-R estimator for all abundance groupings due to generally low numbers of delayed recaptures across all years and groupings, in addition to generally sparse recapture data for individual periods.

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Appendices: Lower Columbia River juvenile chum salmon monitoring: abundance estimates for chum, Chinook, coho, and steelhead

by Todd Hillson, Kale Bentley, Dan Rawding, and Julie Grobelny

Washington Department of FISH and WILDLIFE

APPENDICES

Lower Columbia River Juvenile Chum Salmon Monitoring: Abundance Estimates for Chum, Chinook, Coho, and Steelhead

Grays River (2008 – 2016)
Crazy Johnson Creek (2011 – 2016)
Duncan Spawning Channel (2002 – 2016)
Hamilton Creek (2012 – 2016)
Hamilton Springs Spawning Channel (2011 – 2016)

Todd Hillson
Kale Bentley
Dan Rawding
Julie Grobelny

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Appendix A – Life-Stage and Age-Class by date Rule Sets

In 2015, a rule-set was developed to standardize the life-stage and age-class classifications for individual fish. Specifically, this rule set uses the measured fork length (FL) and capture date to classify the life-stage and age-class each individual fish. These generalized rule-sets were developed using scatterplots of FL and life-stage among all years. Within a year, these generalized rule-sets were adjusted based on visual patterns from the specific year's scatterplot. Below are the standardized life-stage and age-class classifications for Chinook salmon (Figure A1), coho salmon (Figure A2) and steelhead (Figure A3).

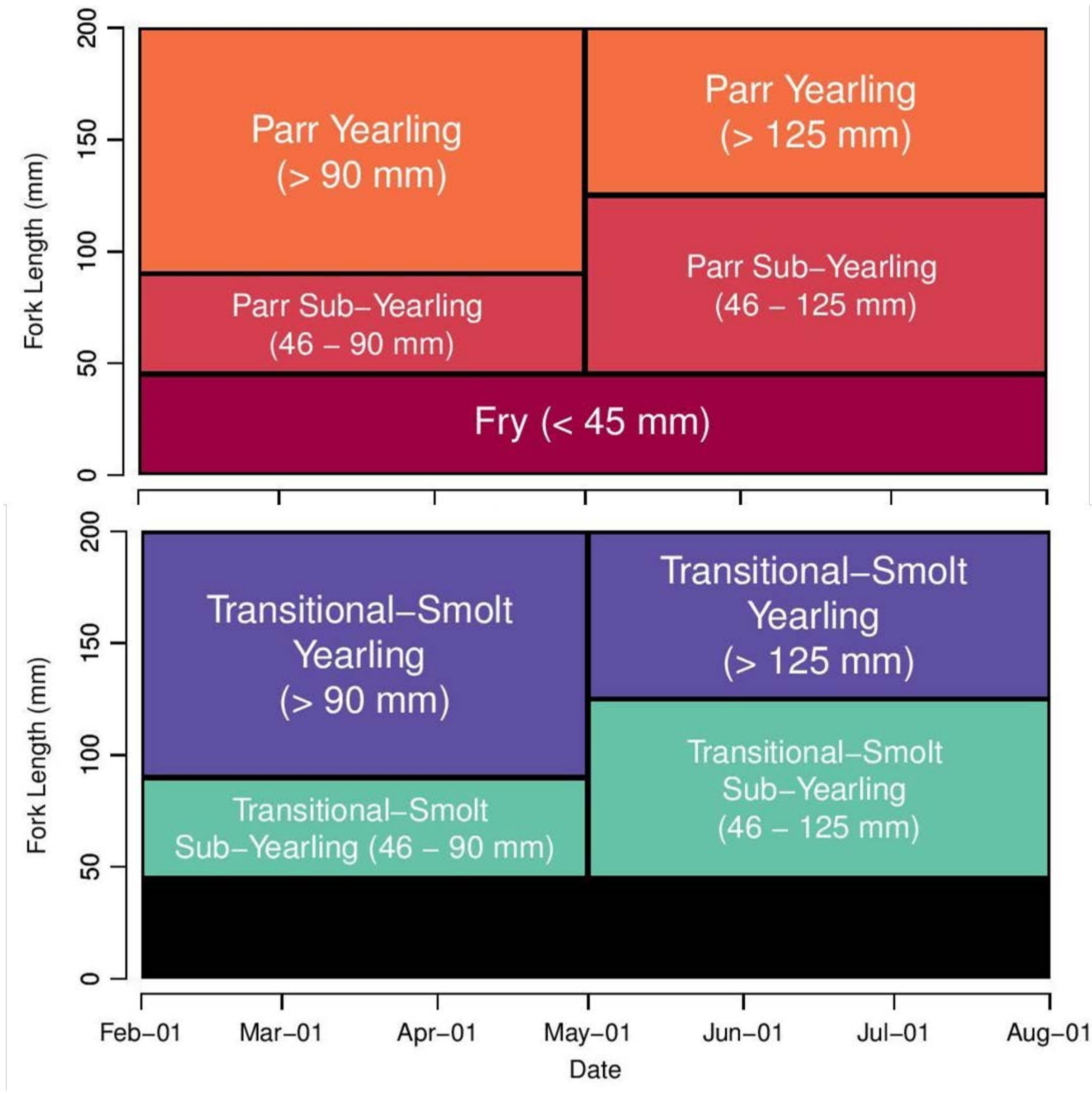

Figure A1. Ruleset for defining Chinook salmon life stage and age class by date and fork length.

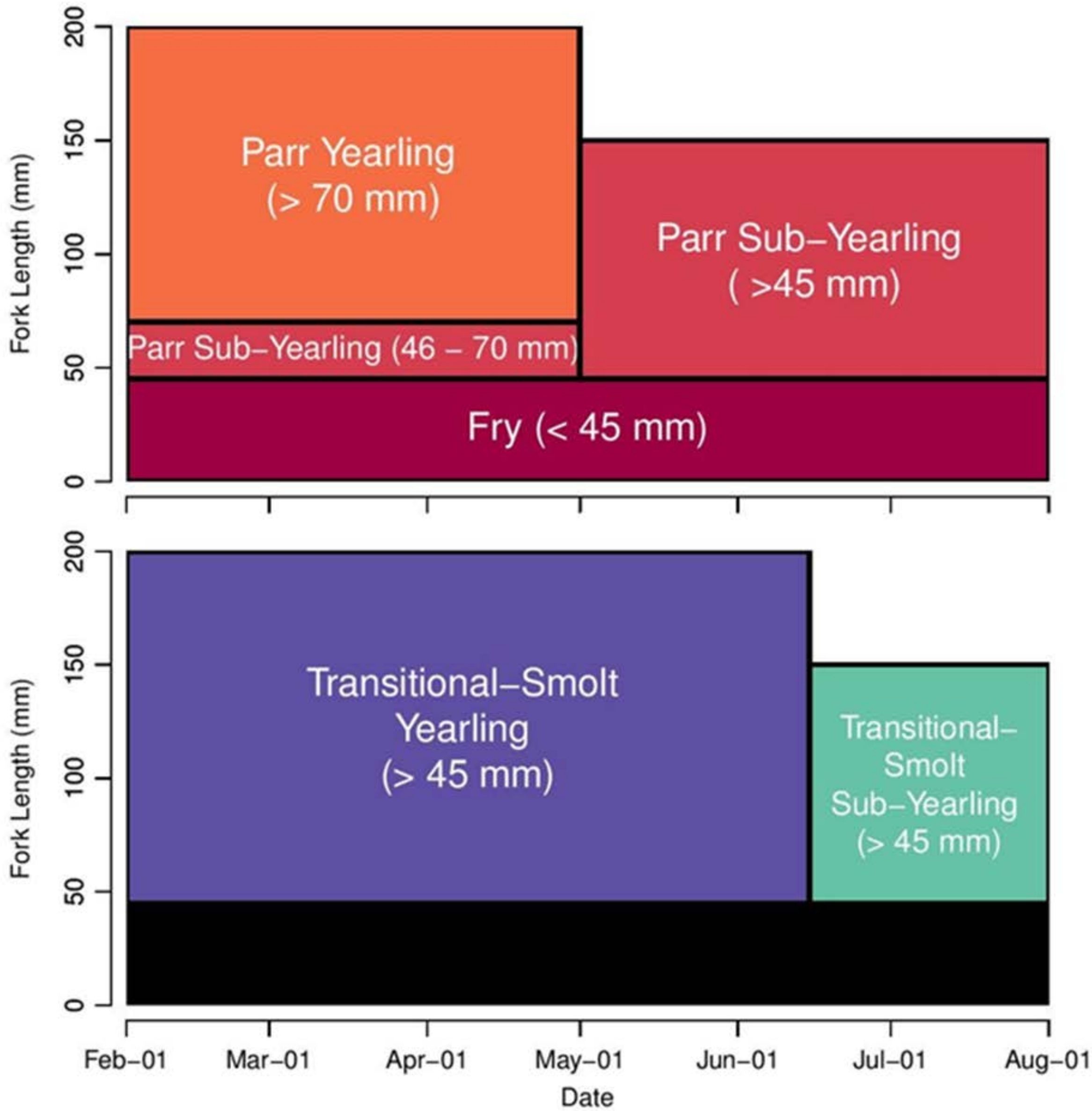

Figure A2. Ruleset for defining coho salmon life stage and age class by date and fork length.

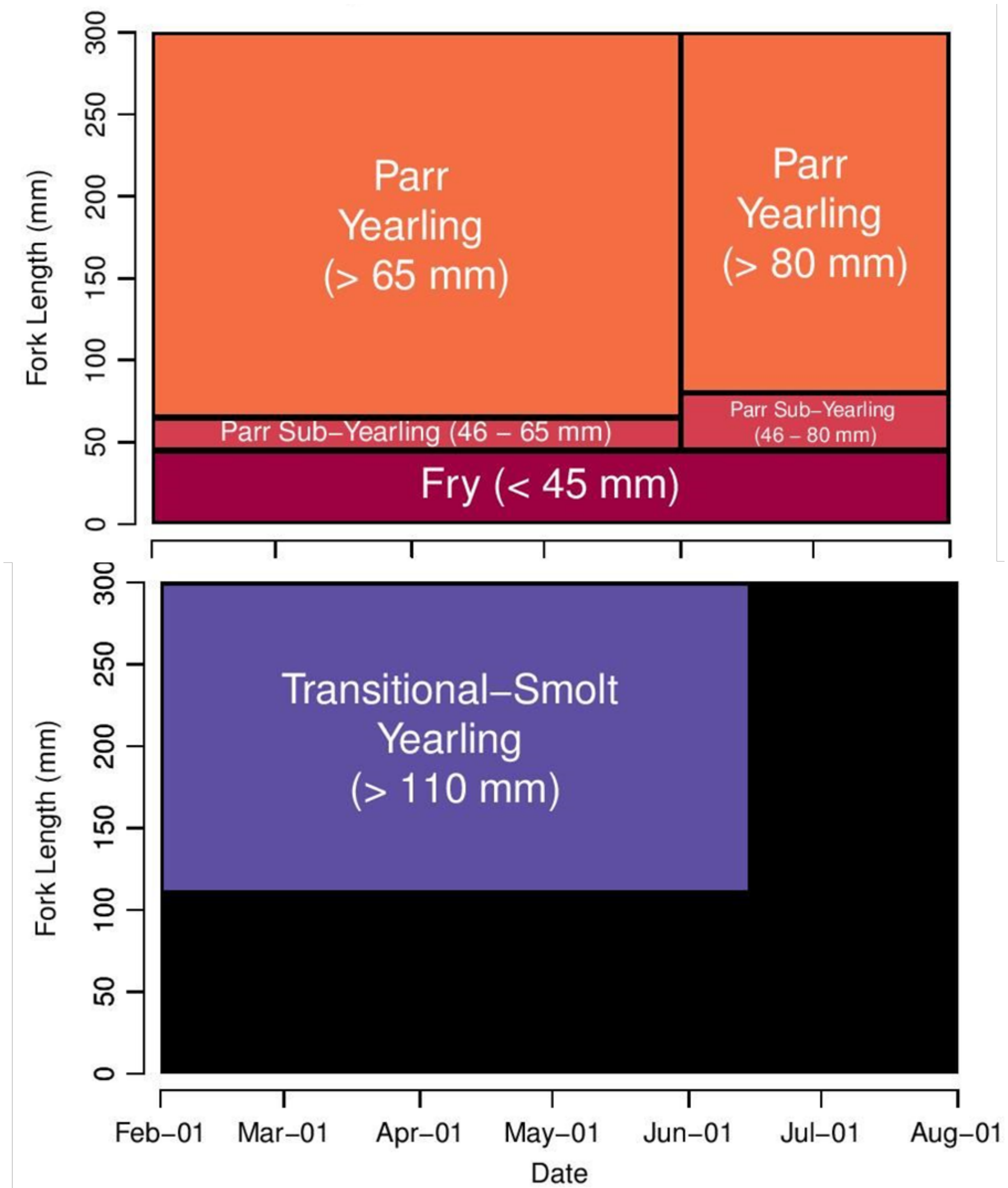

Figure A3. Ruleset for defining steelhead life stage and age class by date and fork length.

Appendix B - Raw catch, stage height, and trap events by date plots

Plots of raw maiden catch and mean daily stage height by date are included below for each group of fish in which an abundance estimate was generated. Groups of fish were broken up by (1) Trap Site, (2) Species, (3) Origin, (4) Life-stage/Age-class, (5) Year. Stage height data used for Grays River and Crazy Johnson Creek plots were collected near the mouth of Grays River by the Washington Department of Ecology (Station ID: 25B060). Ducan Spring, Hamilton Creek, and Hamilton Springs do not have a flow monitoring station. Therefore, stage height data collected from 2007 – 2016 in the East Fork Lewis River by the USGS (Station ID: 14222500) was used for reference. Notable trap operation events are represented on the plots as follows: no trapping issues (black circle), trap outages/pulled (red circle), and cone stoppers (blue circles). The date(s) flow diverting panels and a second rotary screw were installed (when applicable) are denoted with arrows and a brown "P" or gray "T", respectively.

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Grays River

Chum salmon (Natural-Origin, Fry)

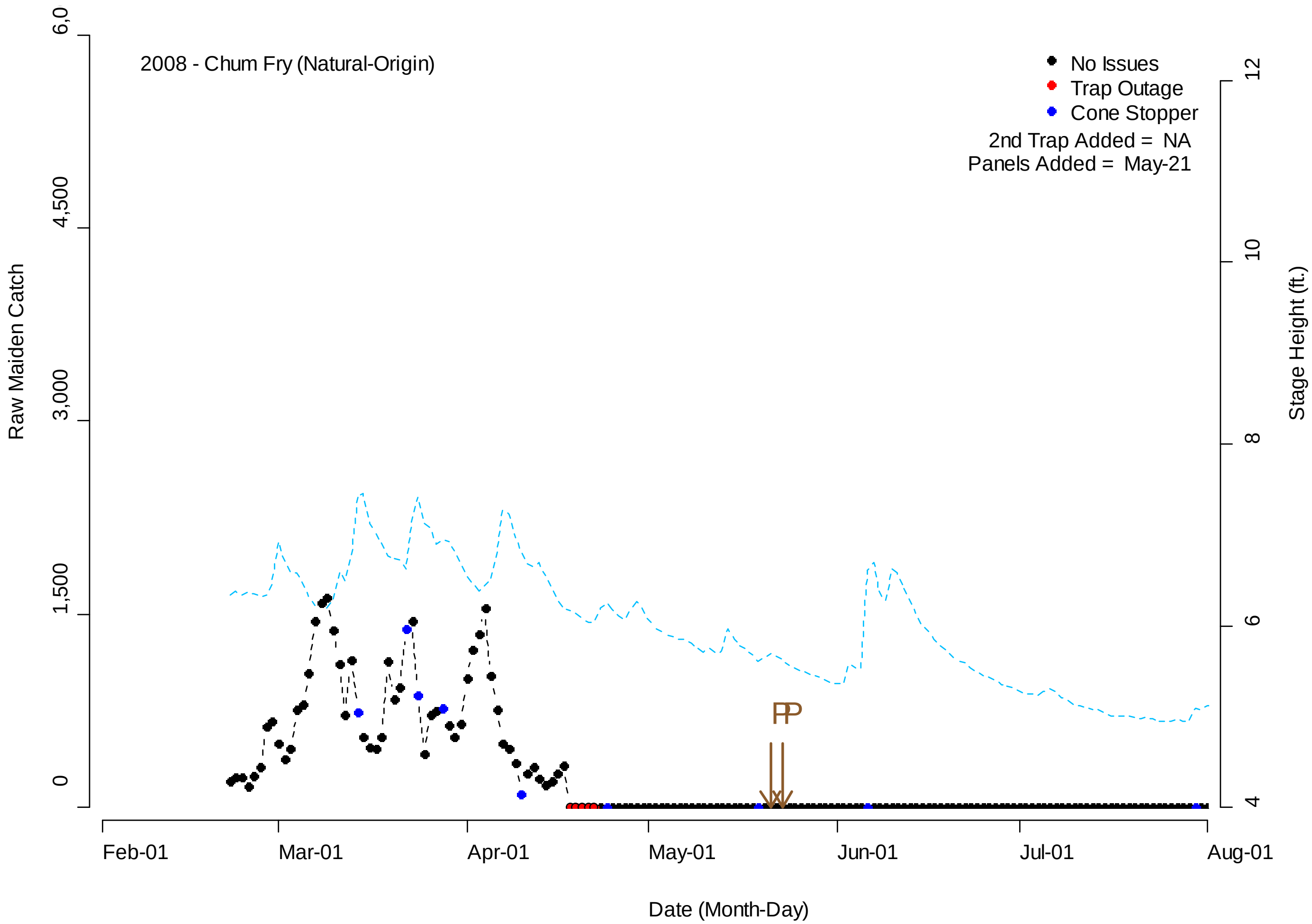

Figure B1. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2008.

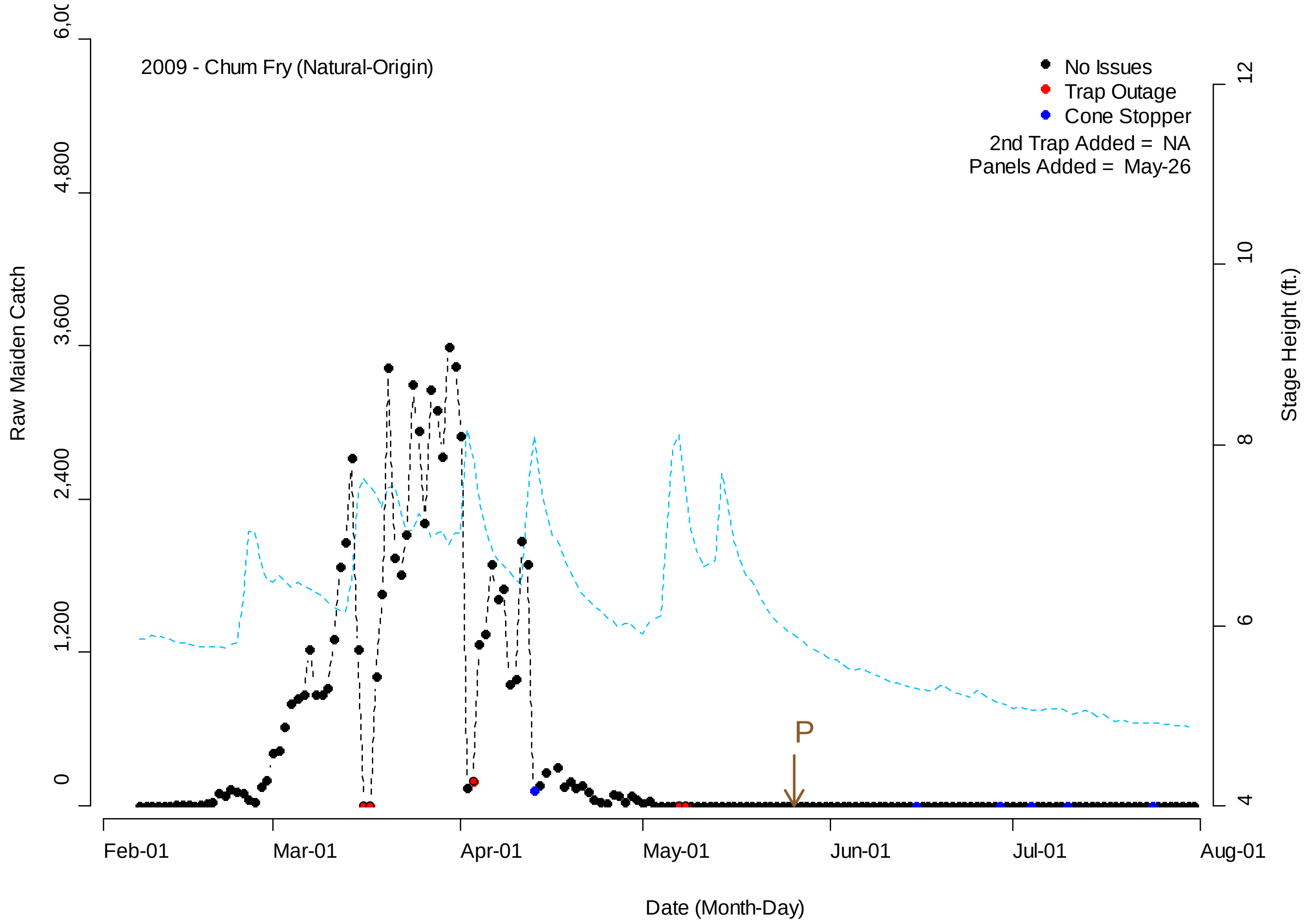

Figure B2. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2009.

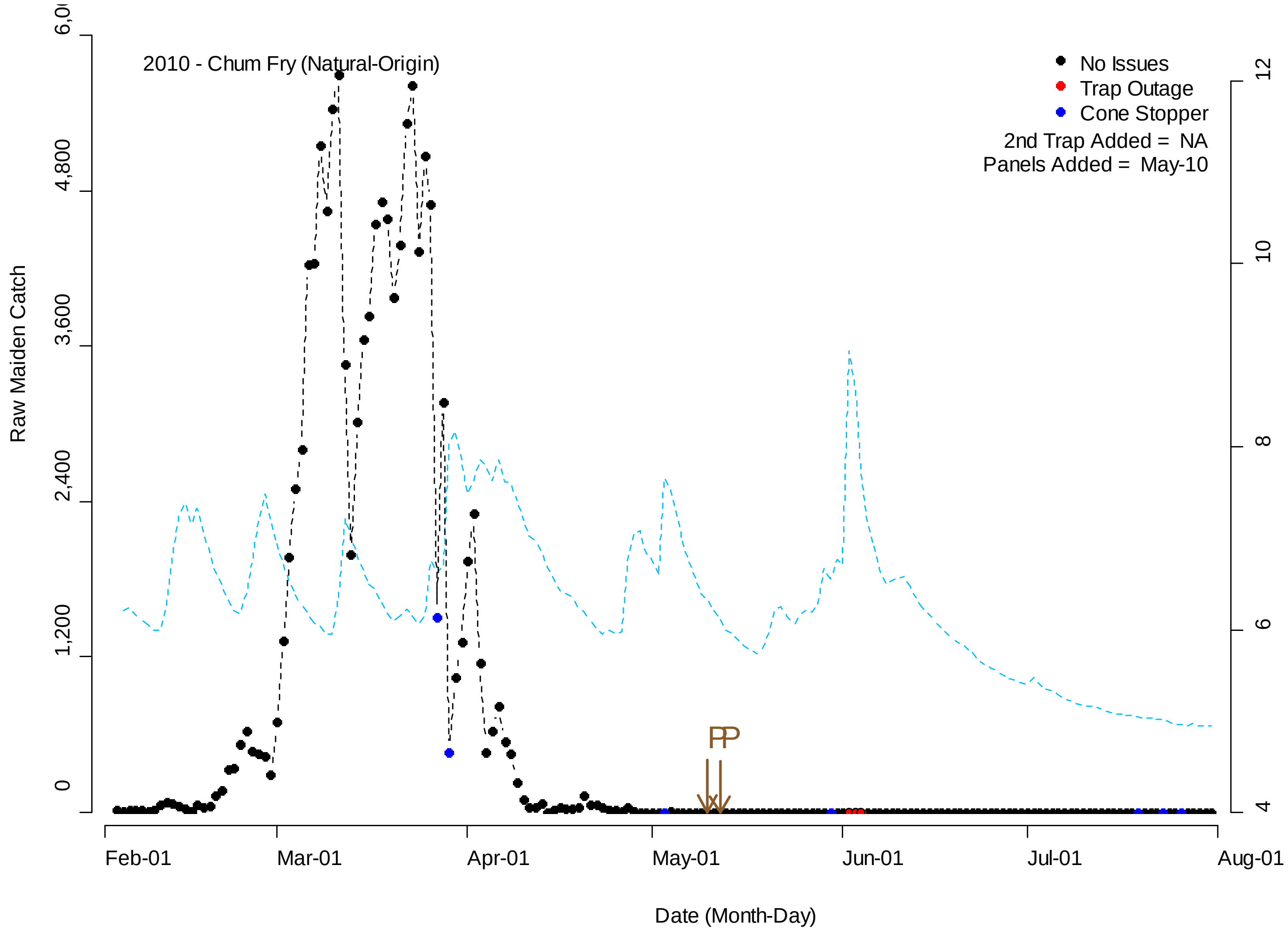

Figure B3. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2010.

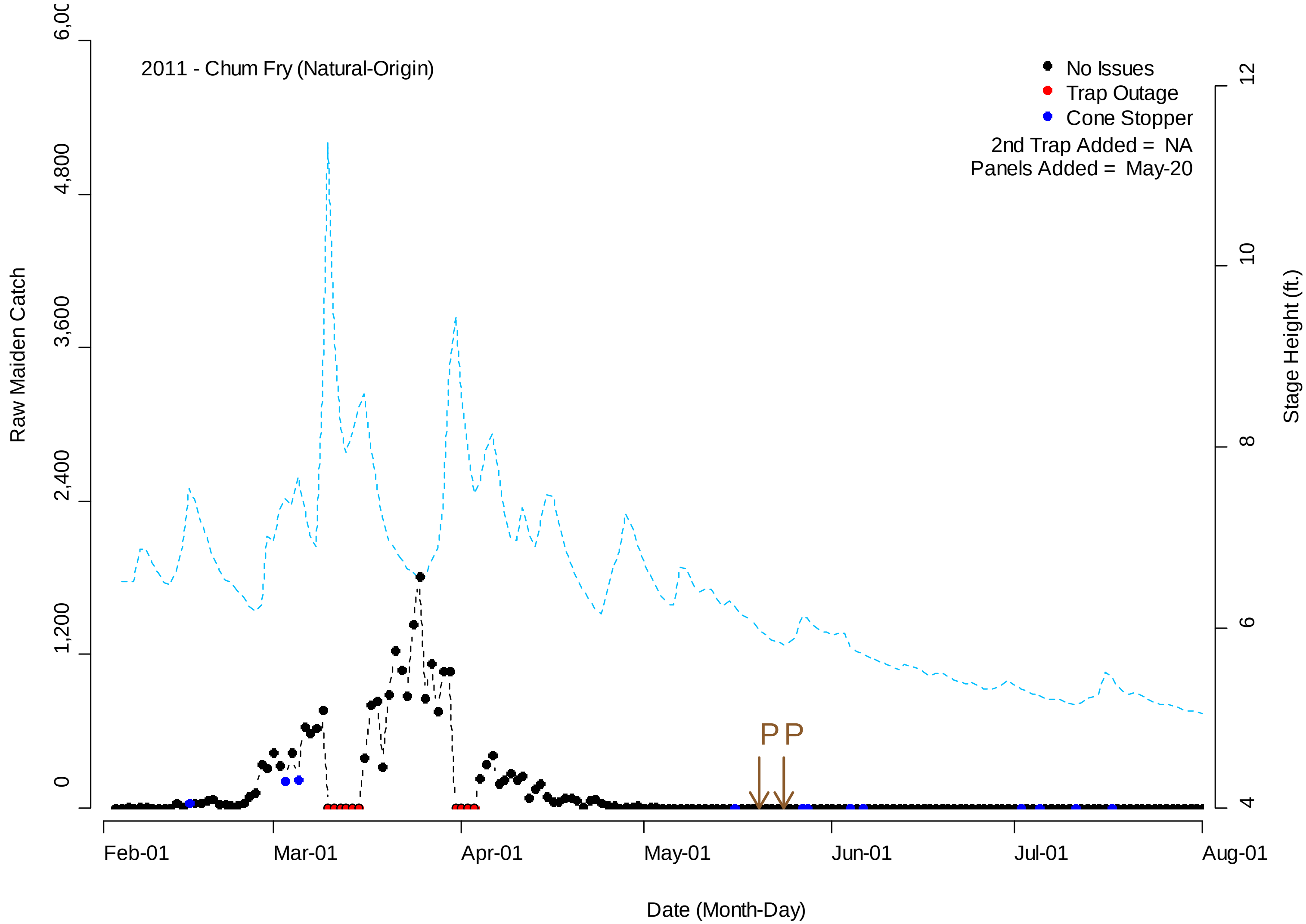

Figure B4. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2011.

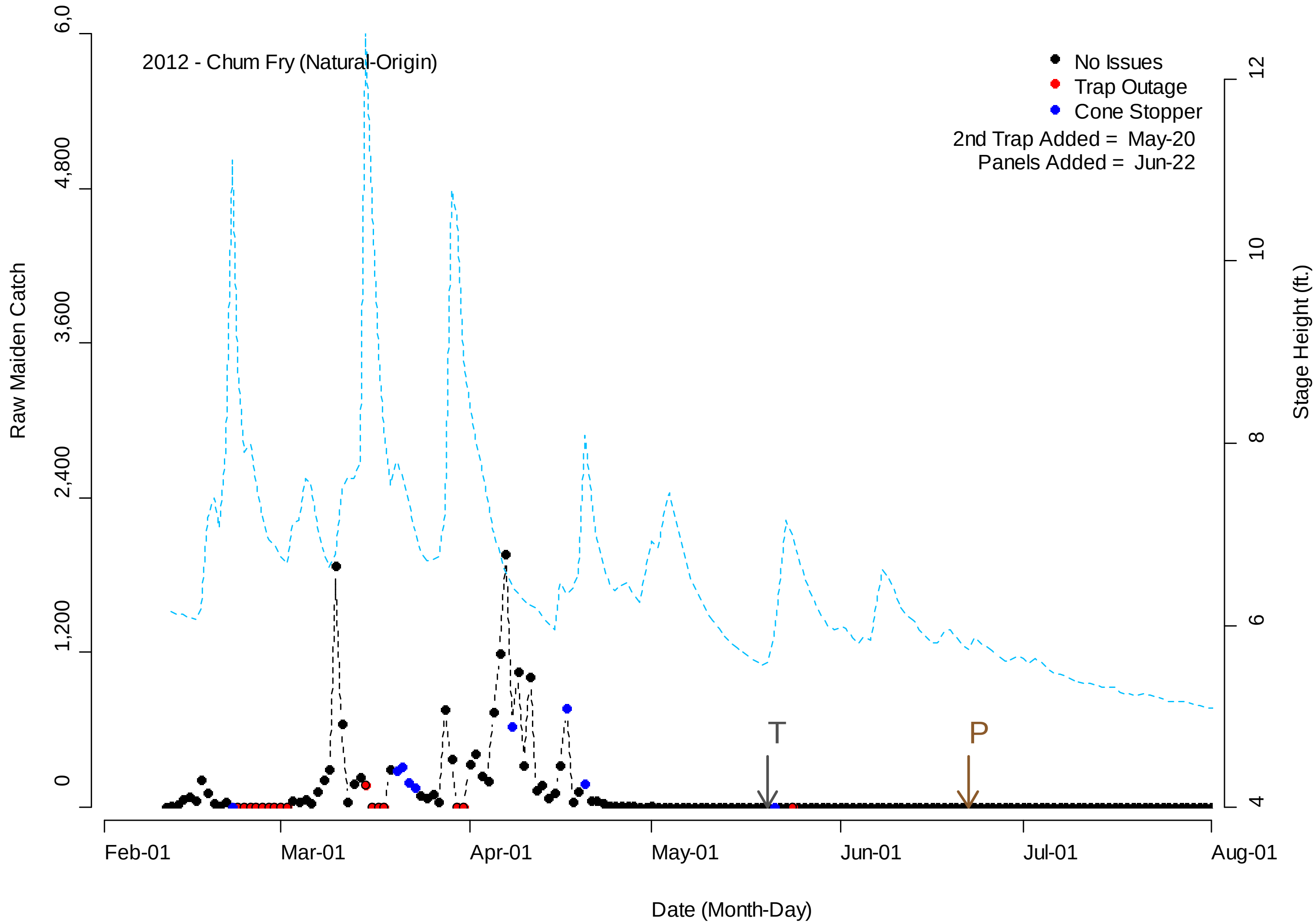

Figure B5. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2012.

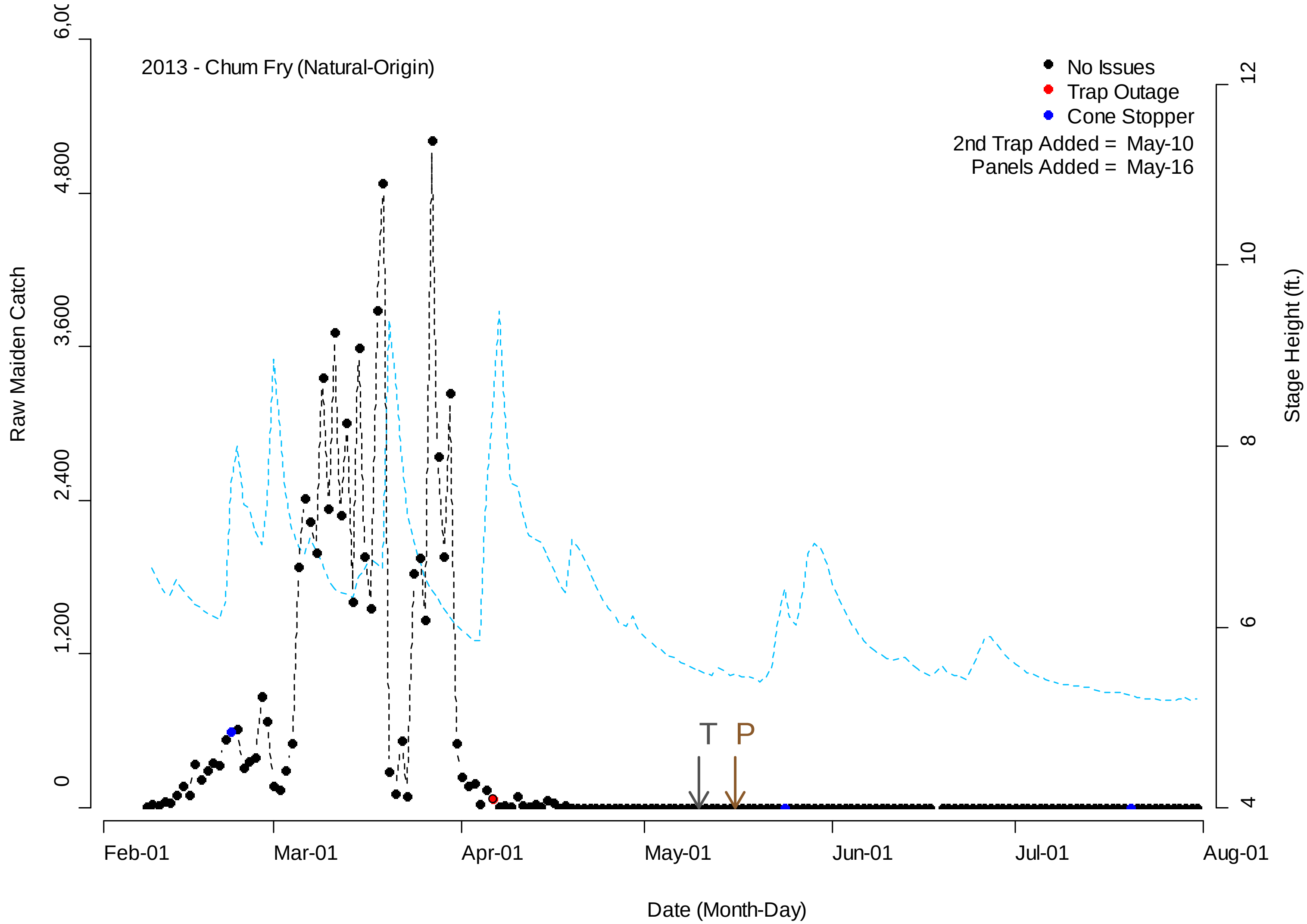

Figure B6. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2013.

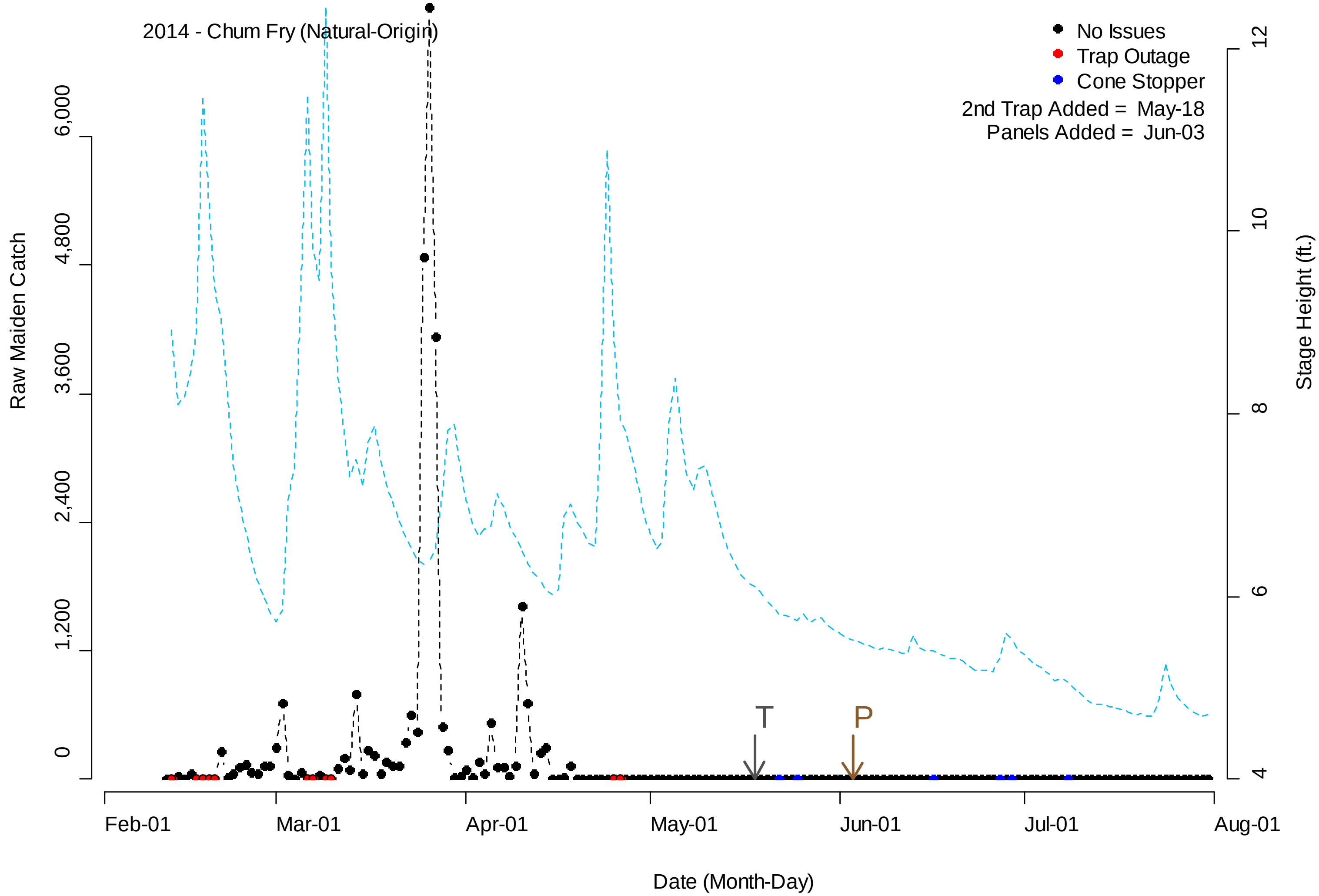

Figure B7. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2014.

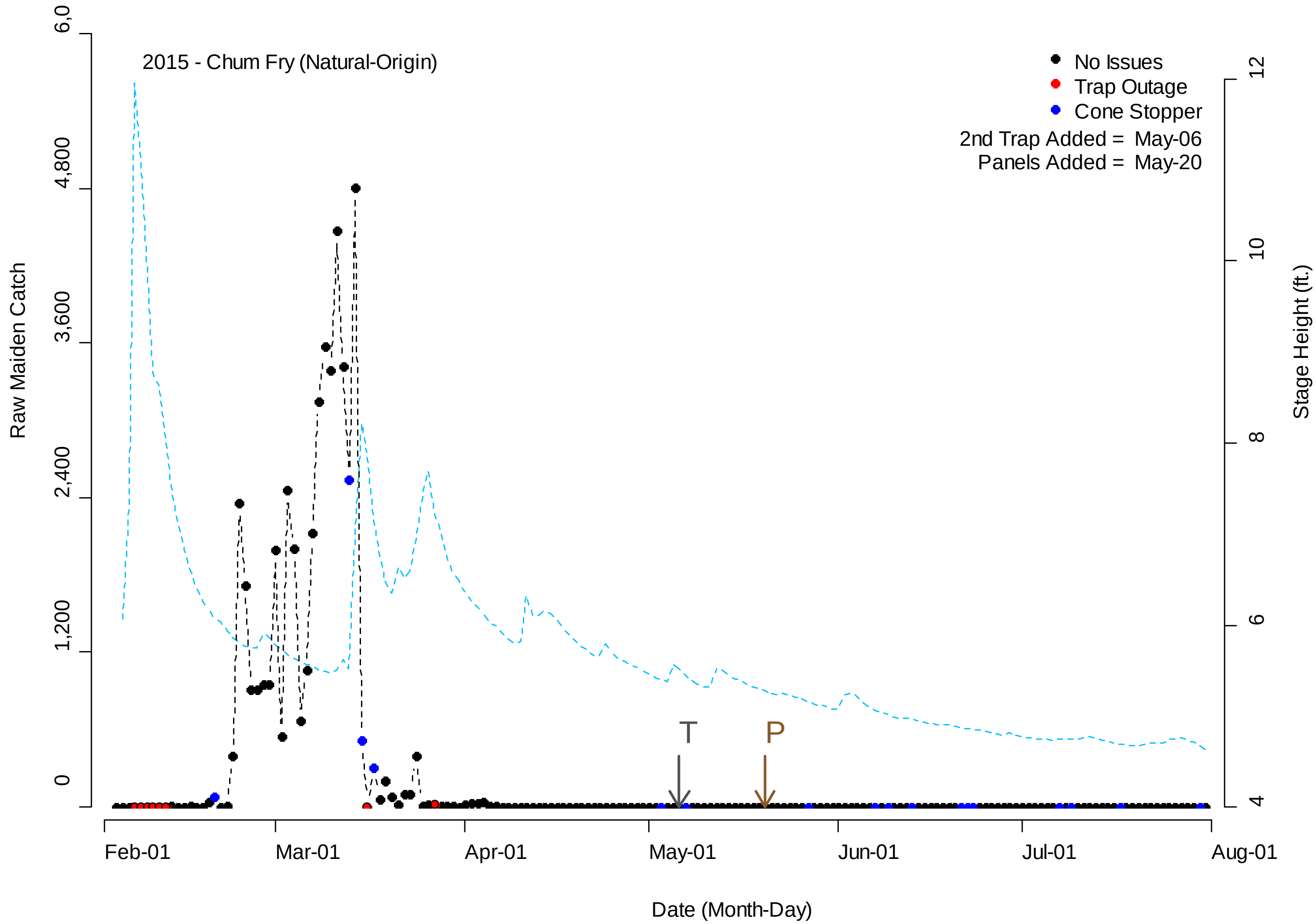

Figure B8. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2015.

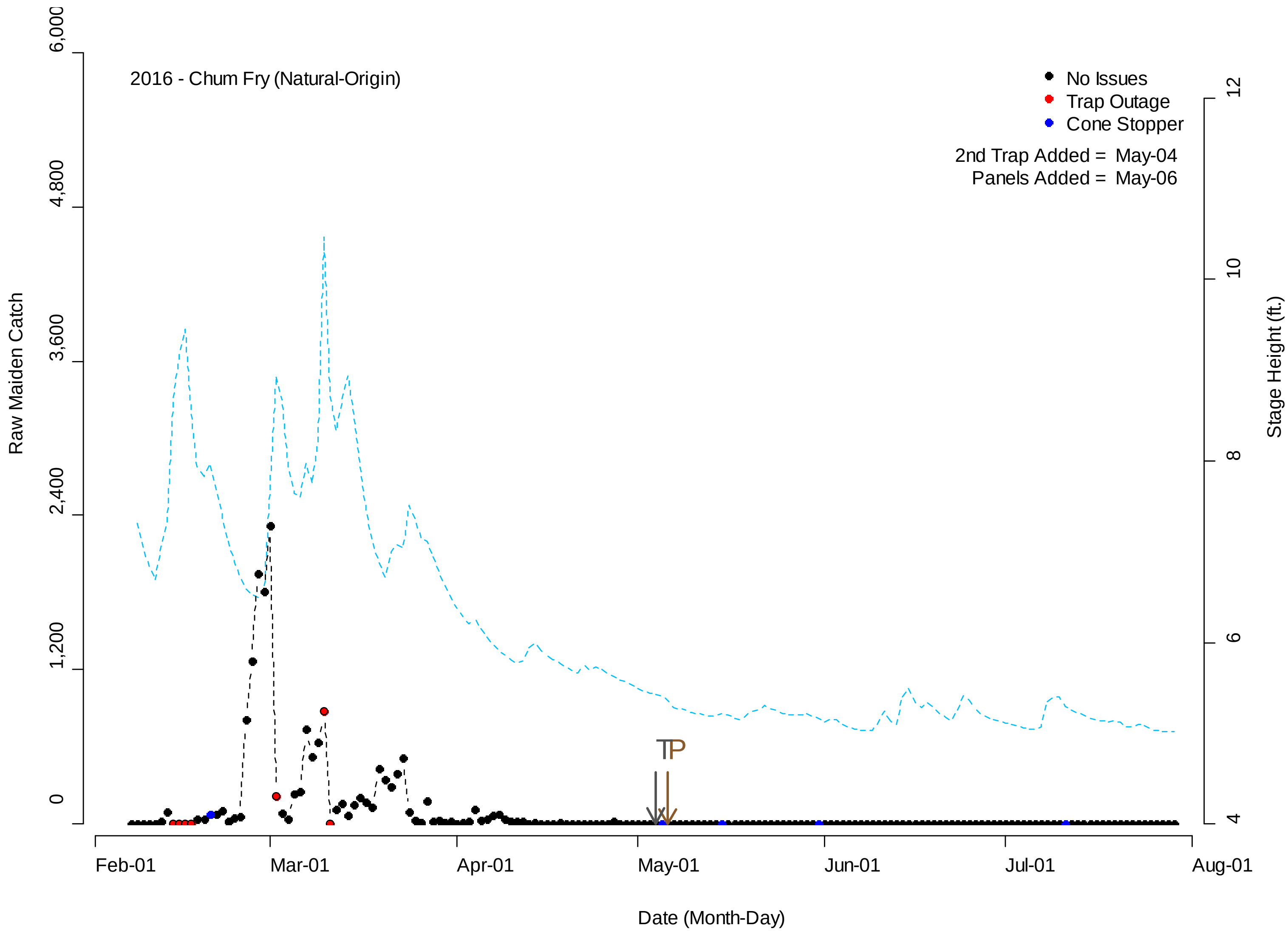

Figure B9. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2016.

Chinook salmon (Natural-Origin, Fry)

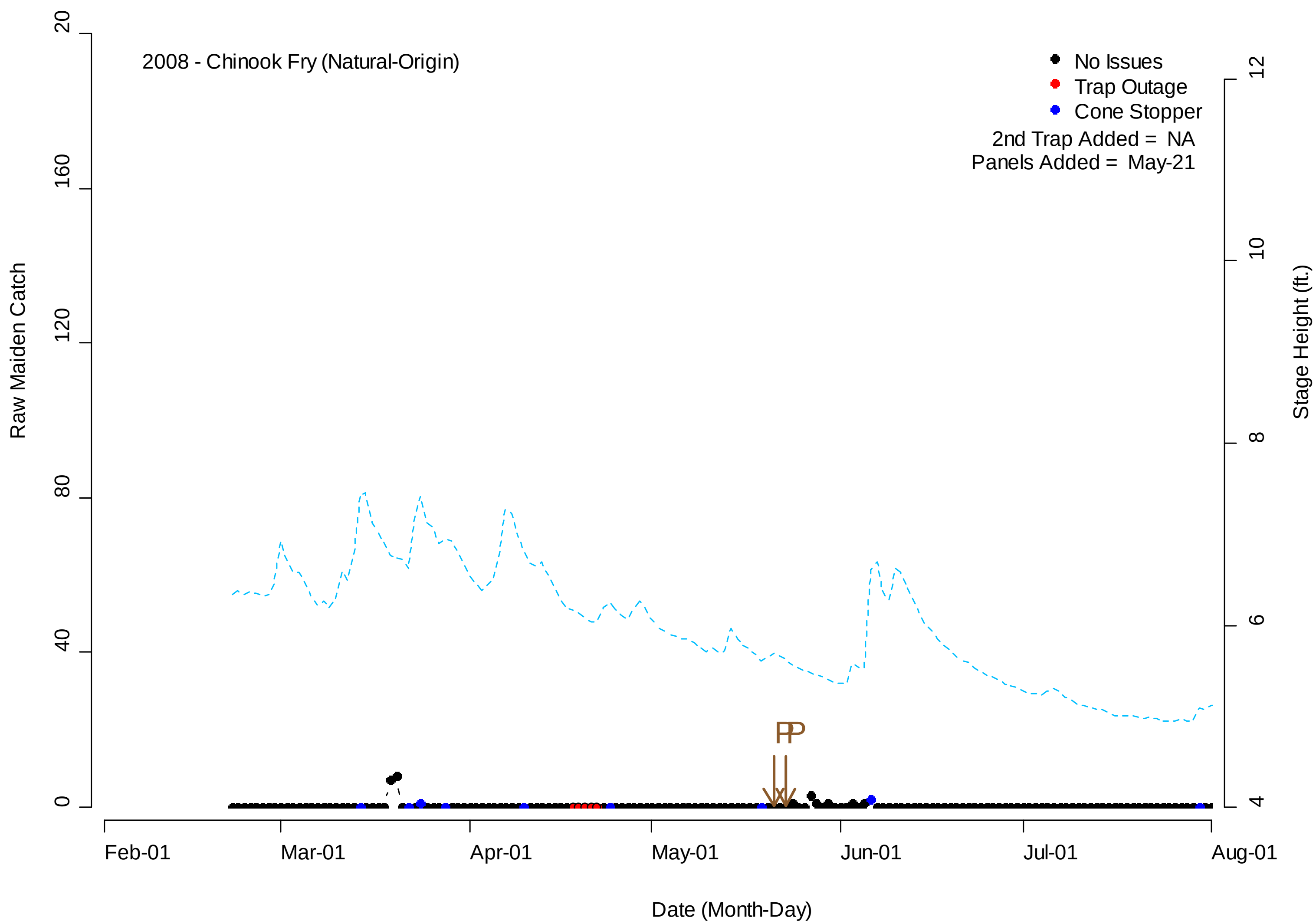

Figure B10. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin Chinook salmon (life-stage = fry; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2008.

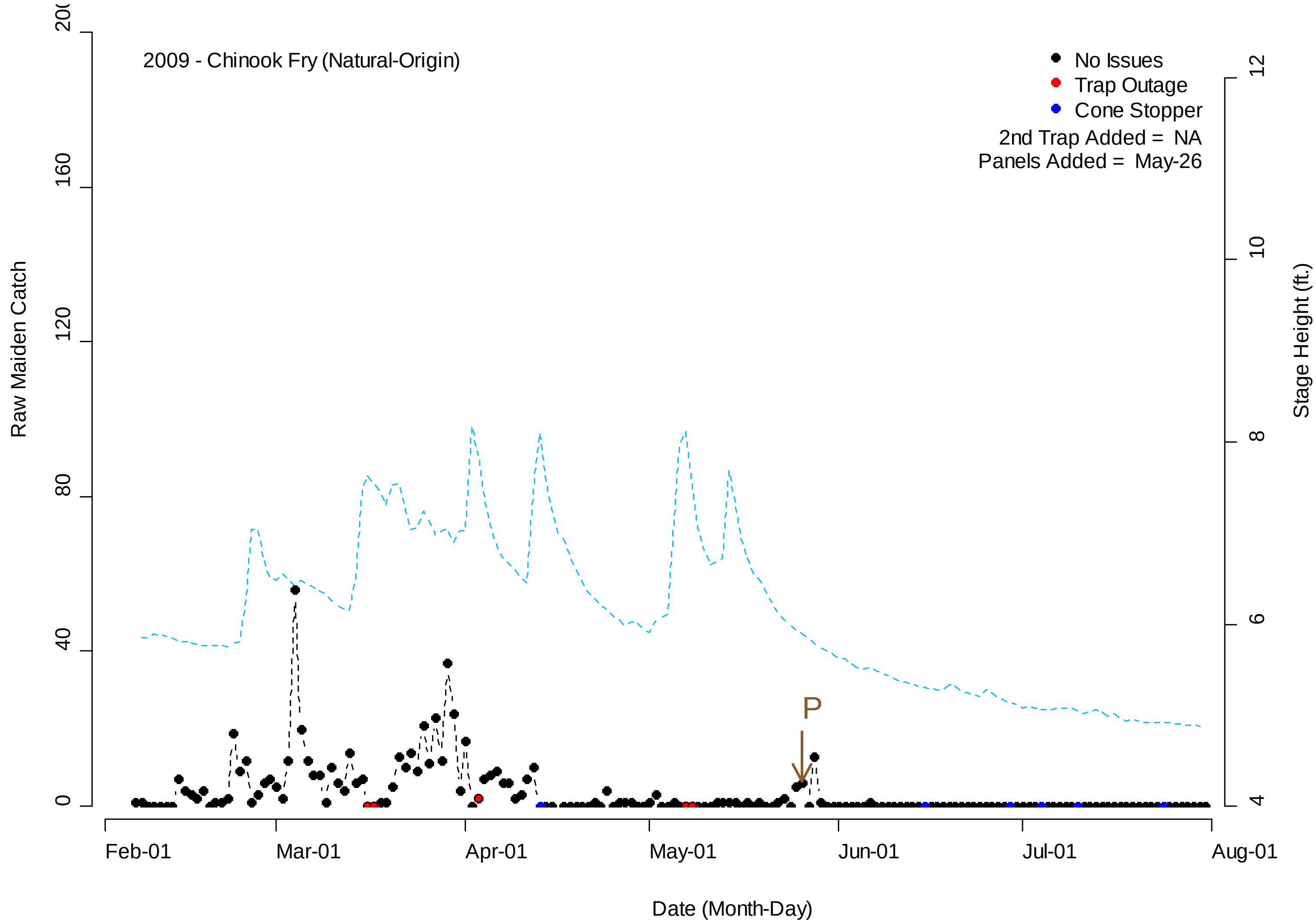

Figure B11. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin Chinook salmon (life-stage = fry; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2009.

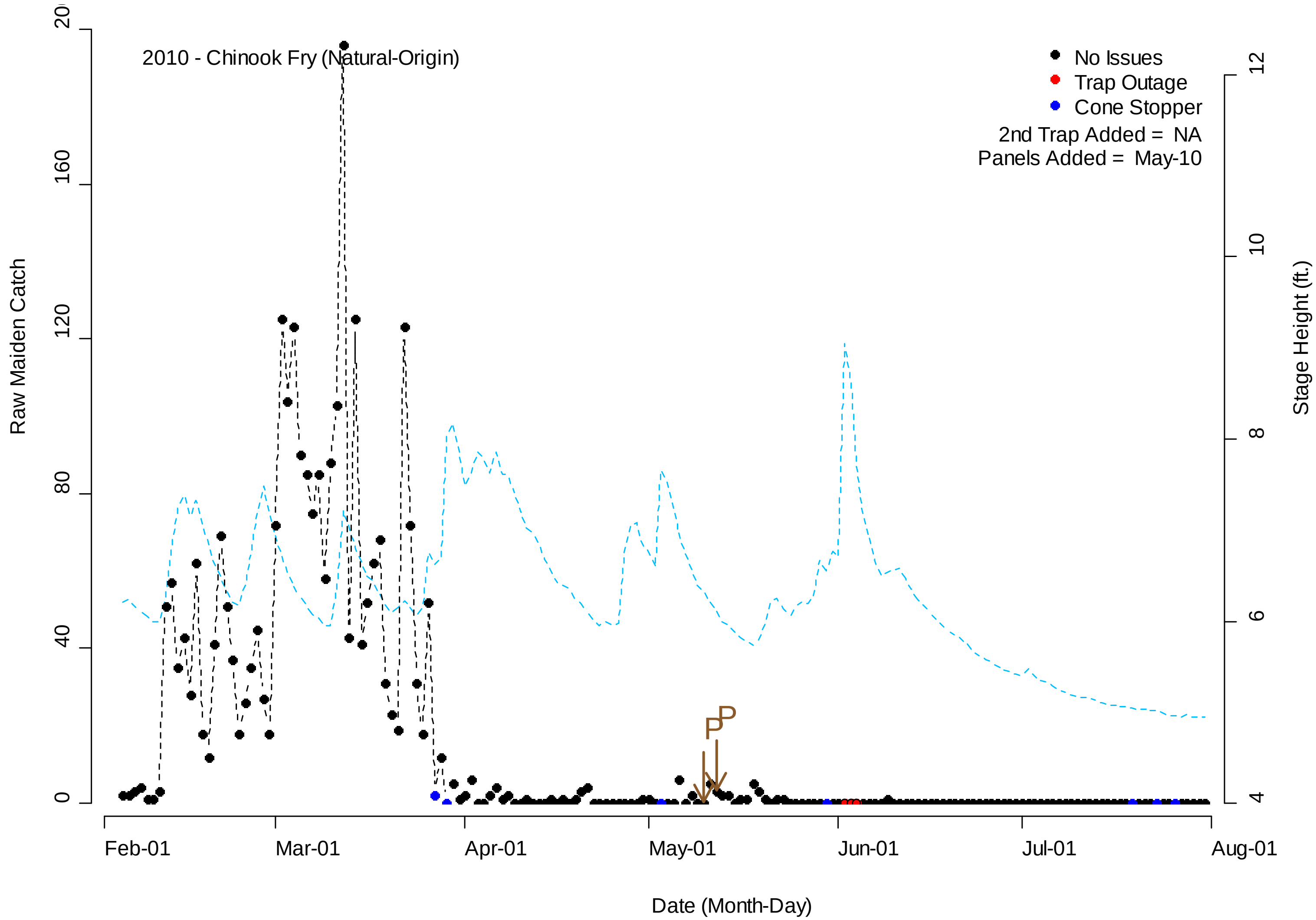

Figure B12. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin Chinook salmon (life-stage = fry; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2010.

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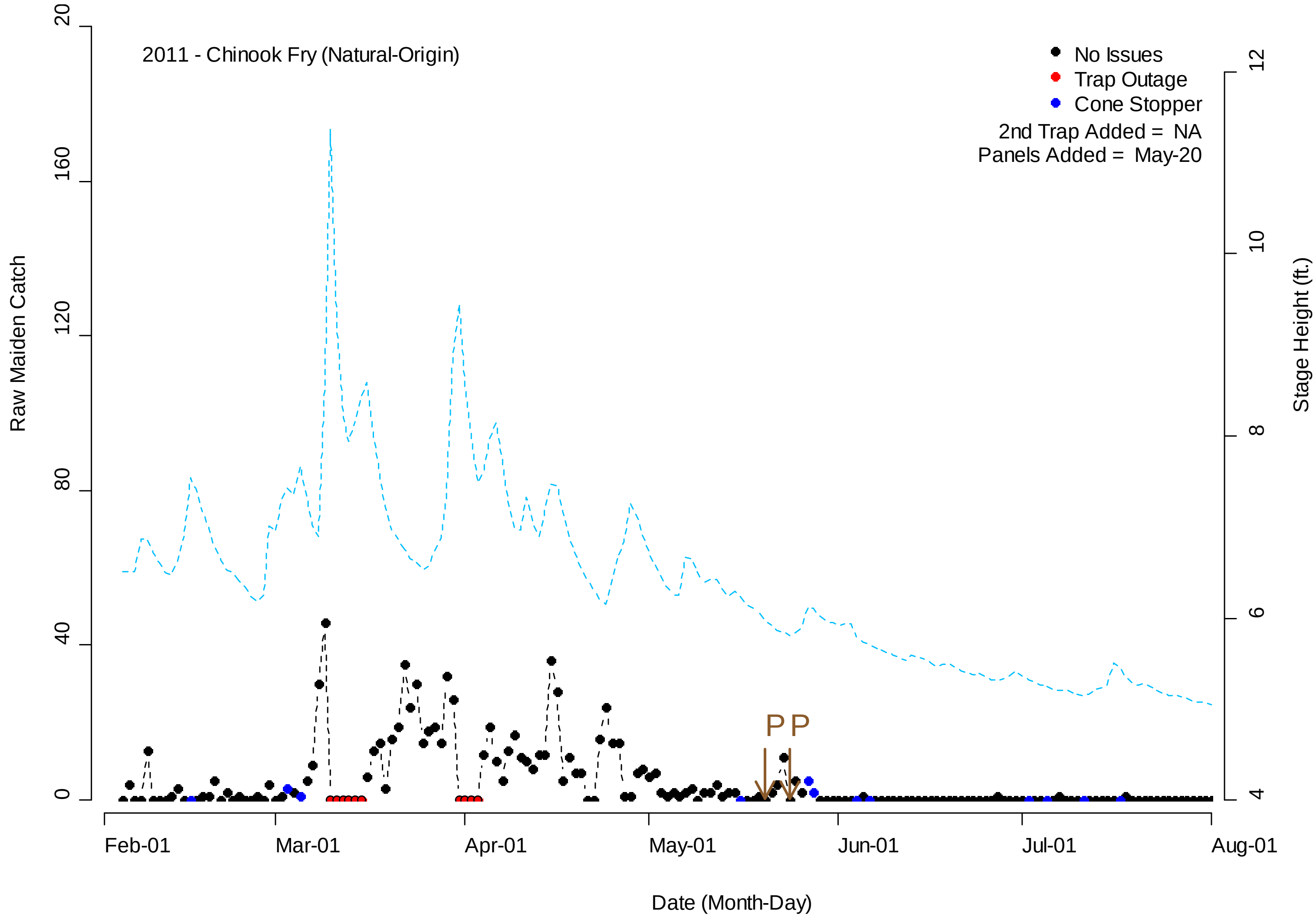

Figure B13. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin Chinook salmon (life-stage = fry; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2011.

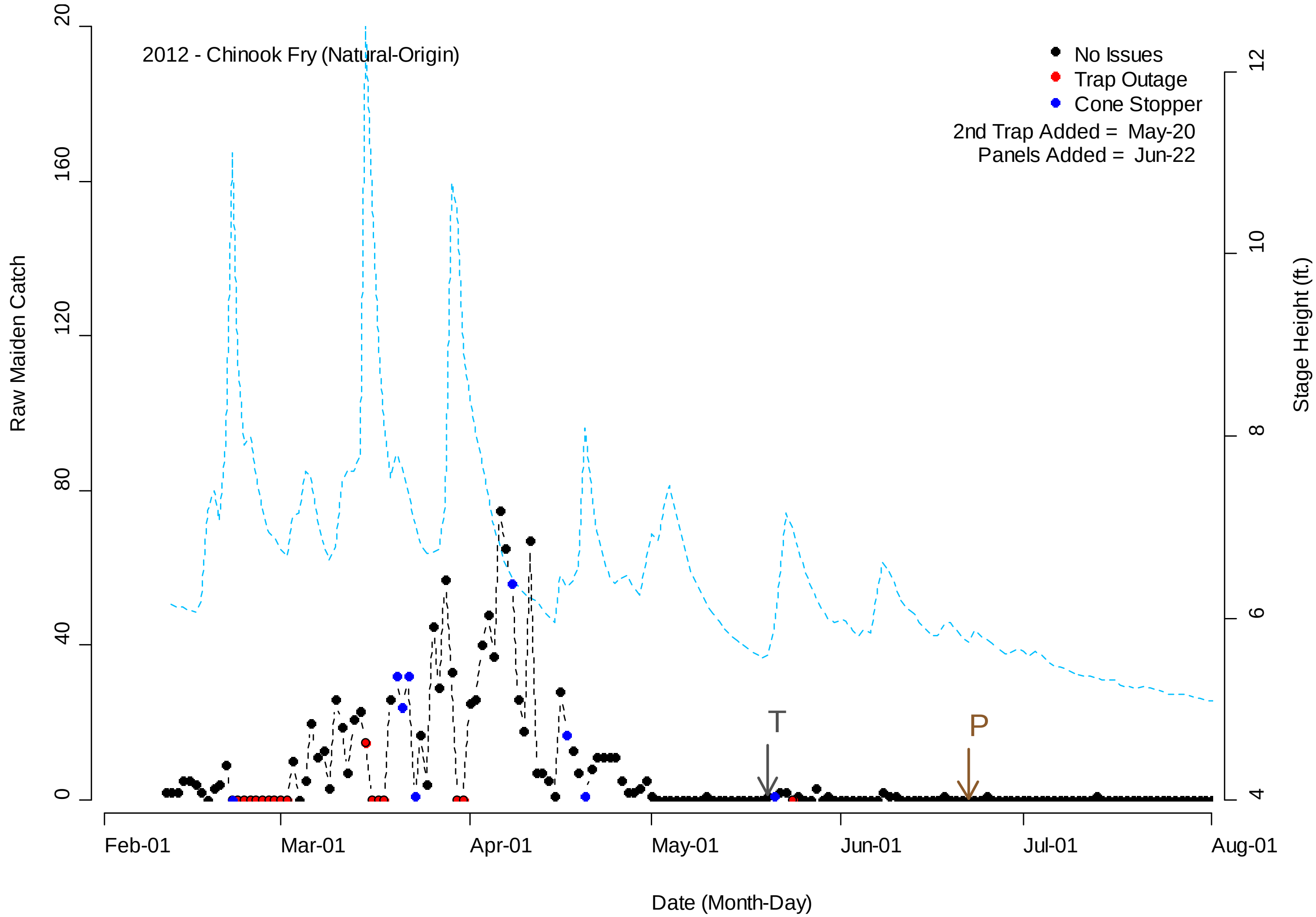

Figure B14. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin Chinook salmon (life-stage = fry; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2012.

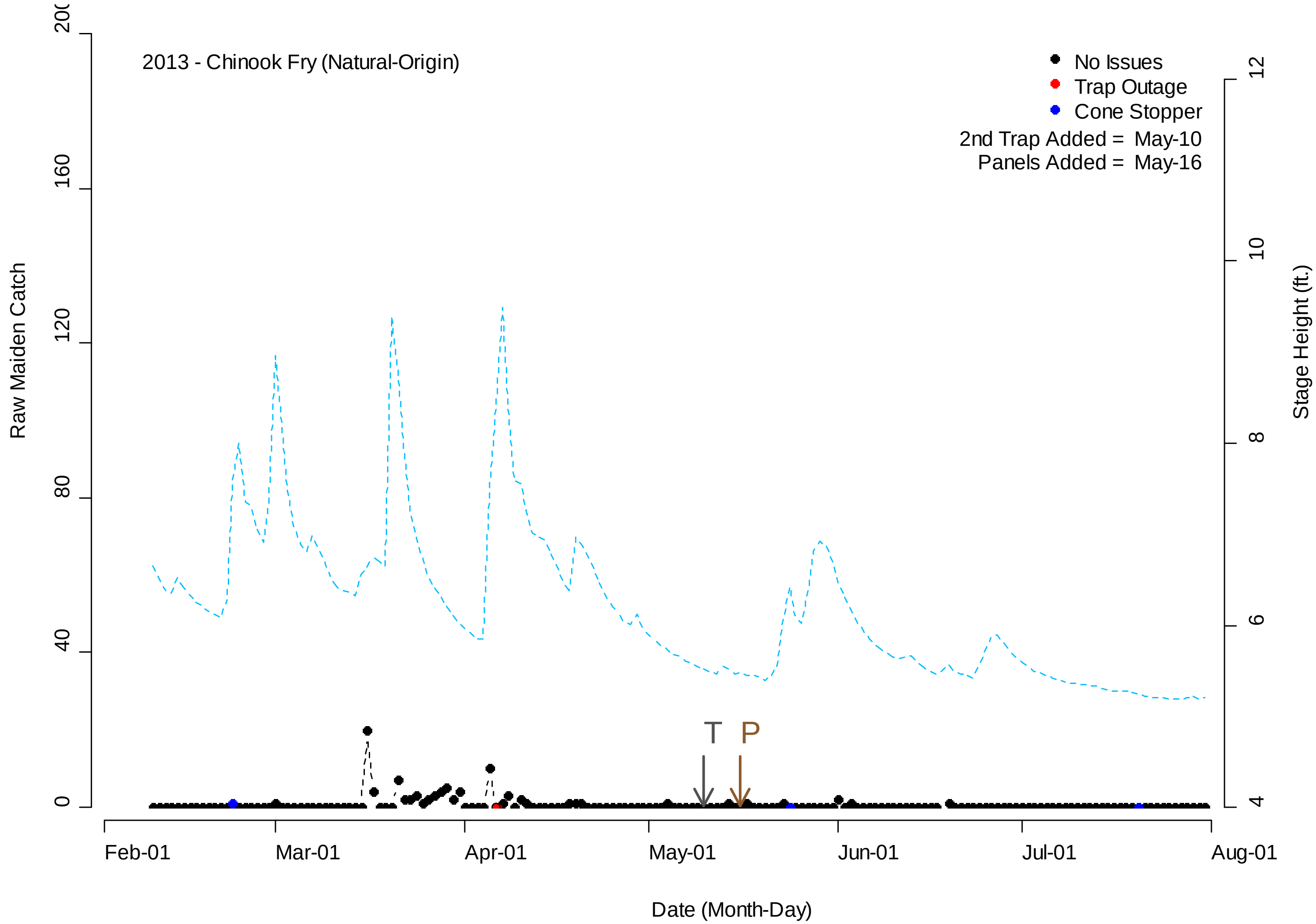

Figure B15. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin Chinook salmon (life-stage = fry; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2013.

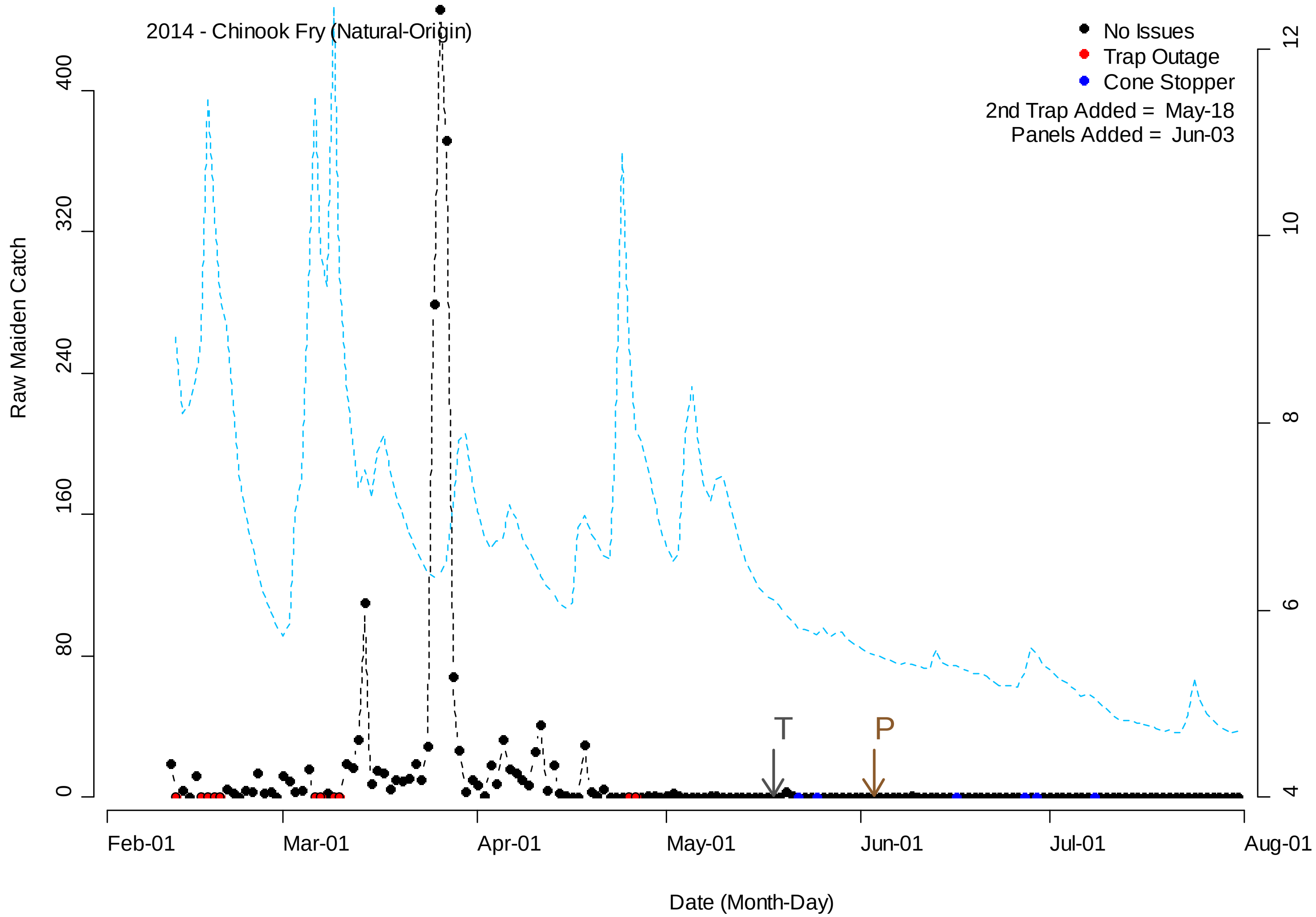

Figure B16. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin Chinook salmon (life-stage = fry; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2014. NOTE: change in y-axis scale relative to other Chinook fry catch plots.

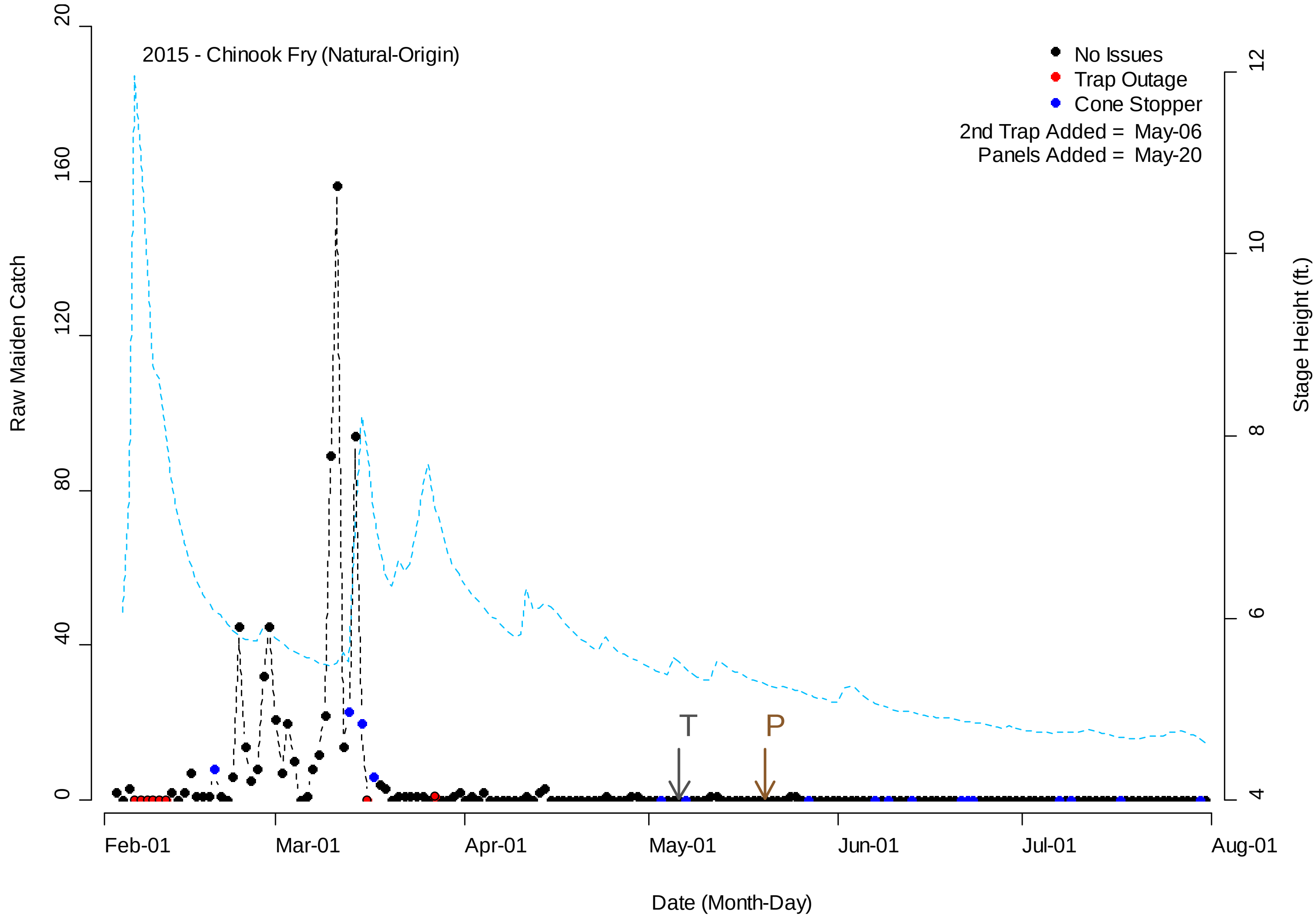

Figure B17. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin salmon Chinook (life-stage = fry; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2015.

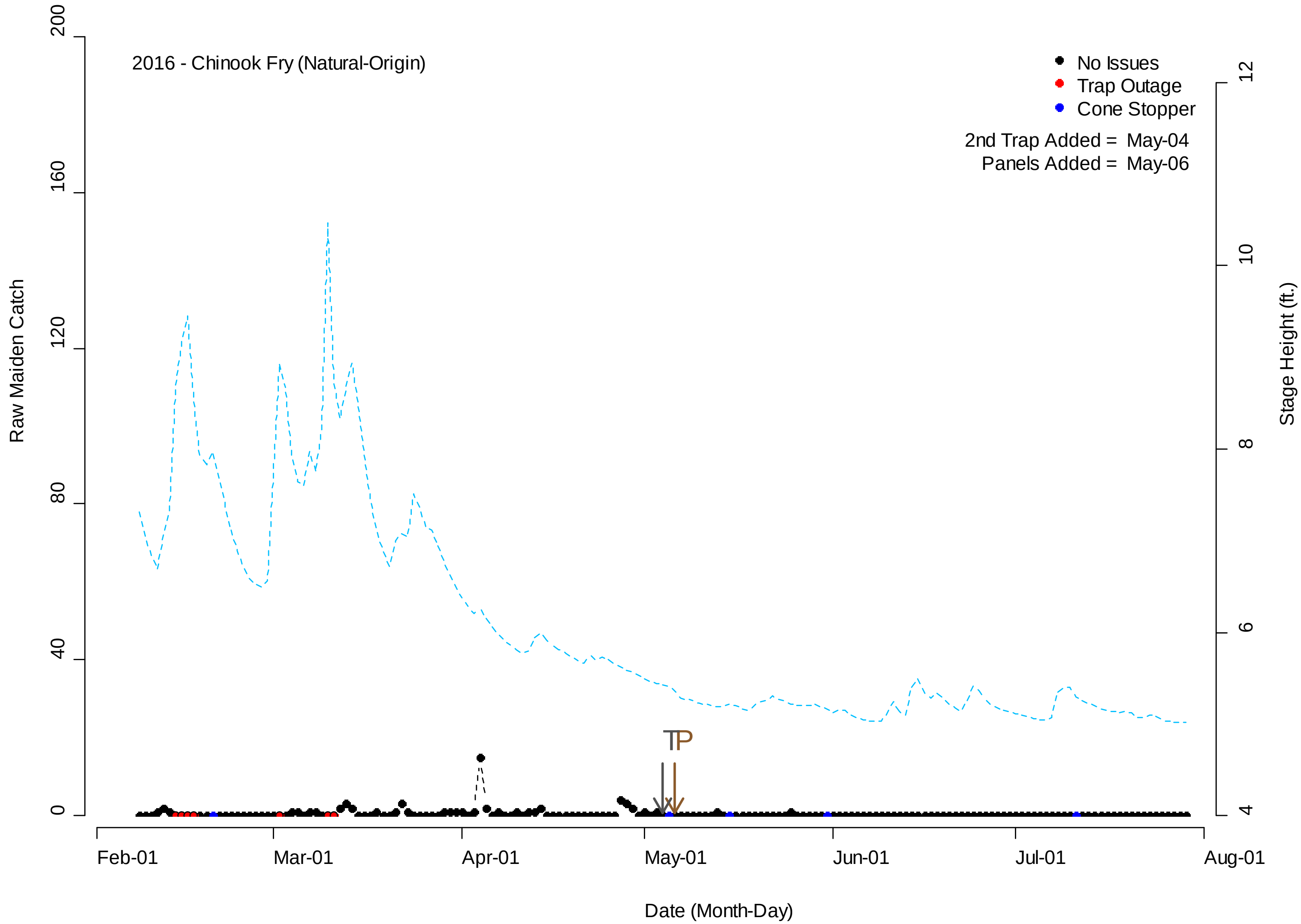

Figure B18. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin salmon Chinook (life-stage = fry; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2016.

Chinook salmon (Natural-Origin, Parr/Transitional/Smolt, Sub-Yearling)

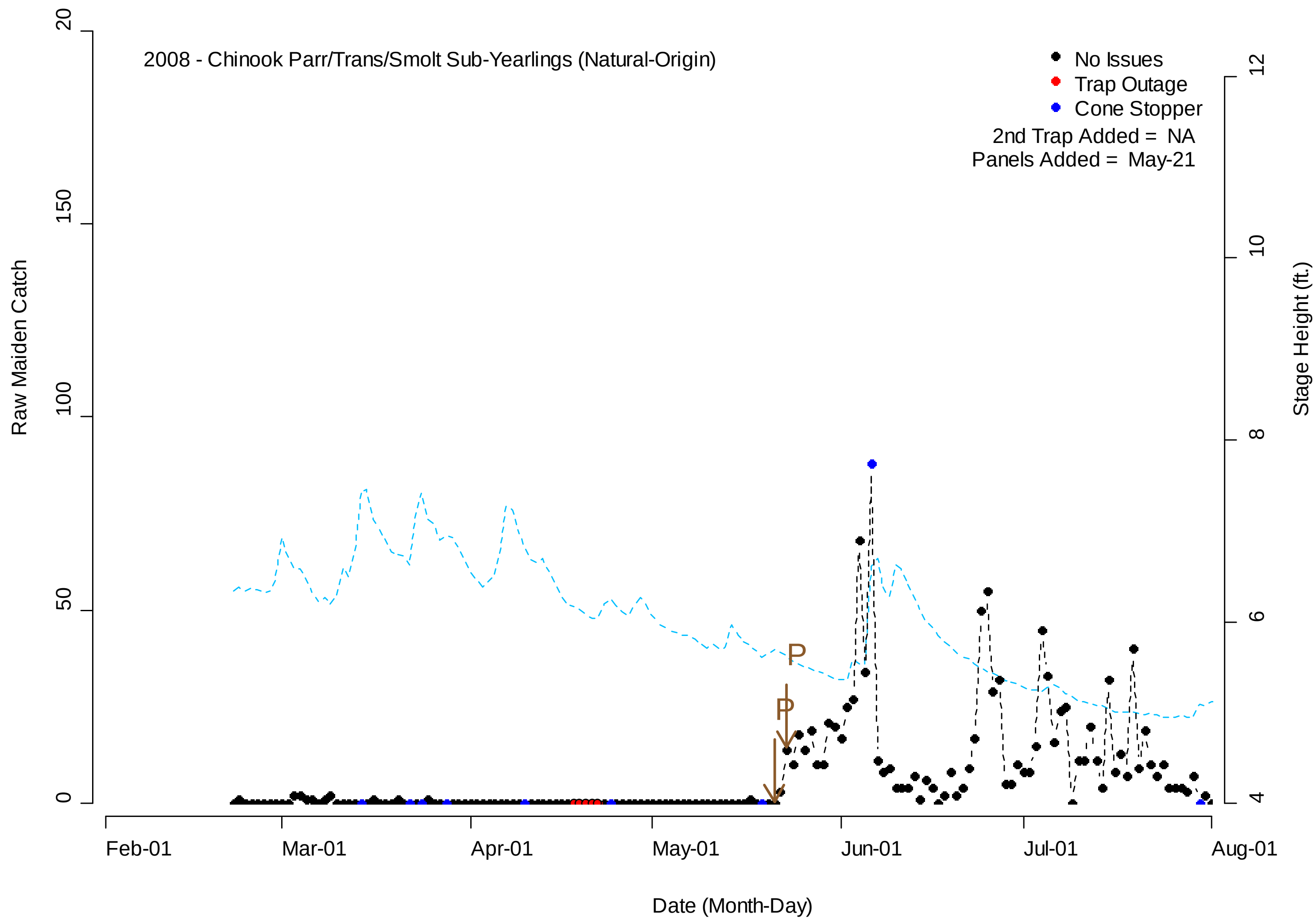

Figure B19. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2008.

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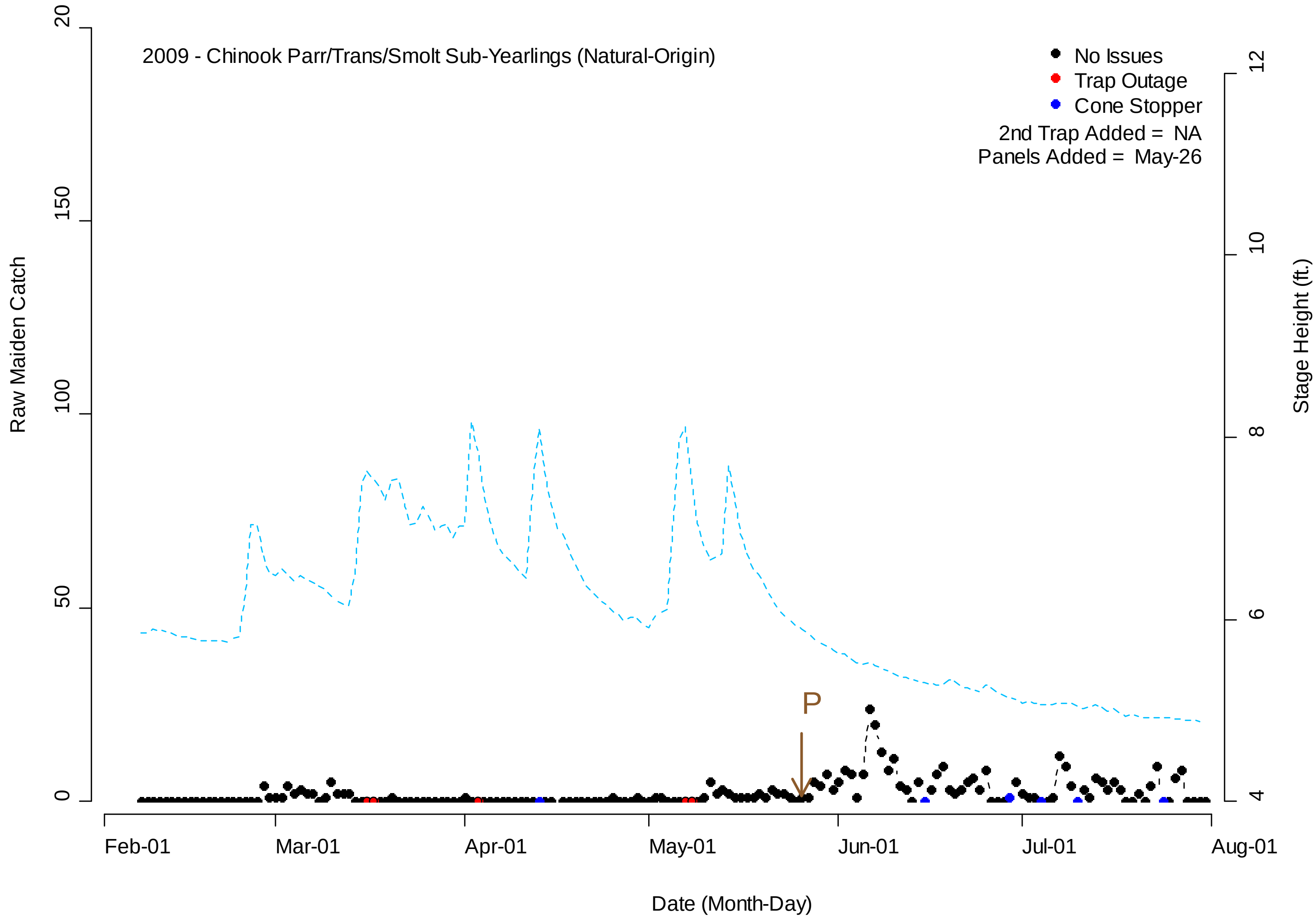

Figure B20. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2009.

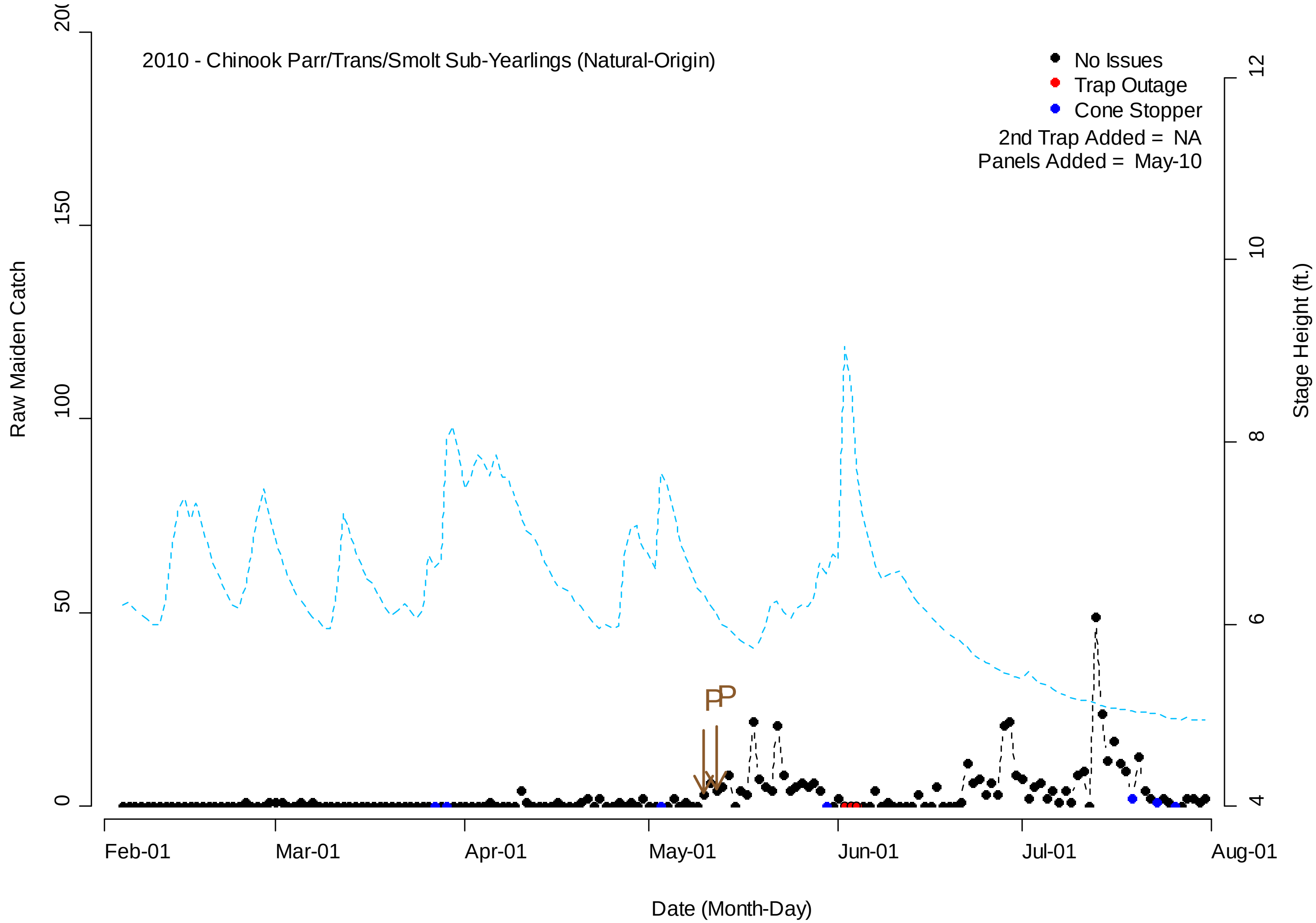

Figure B21. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2010.

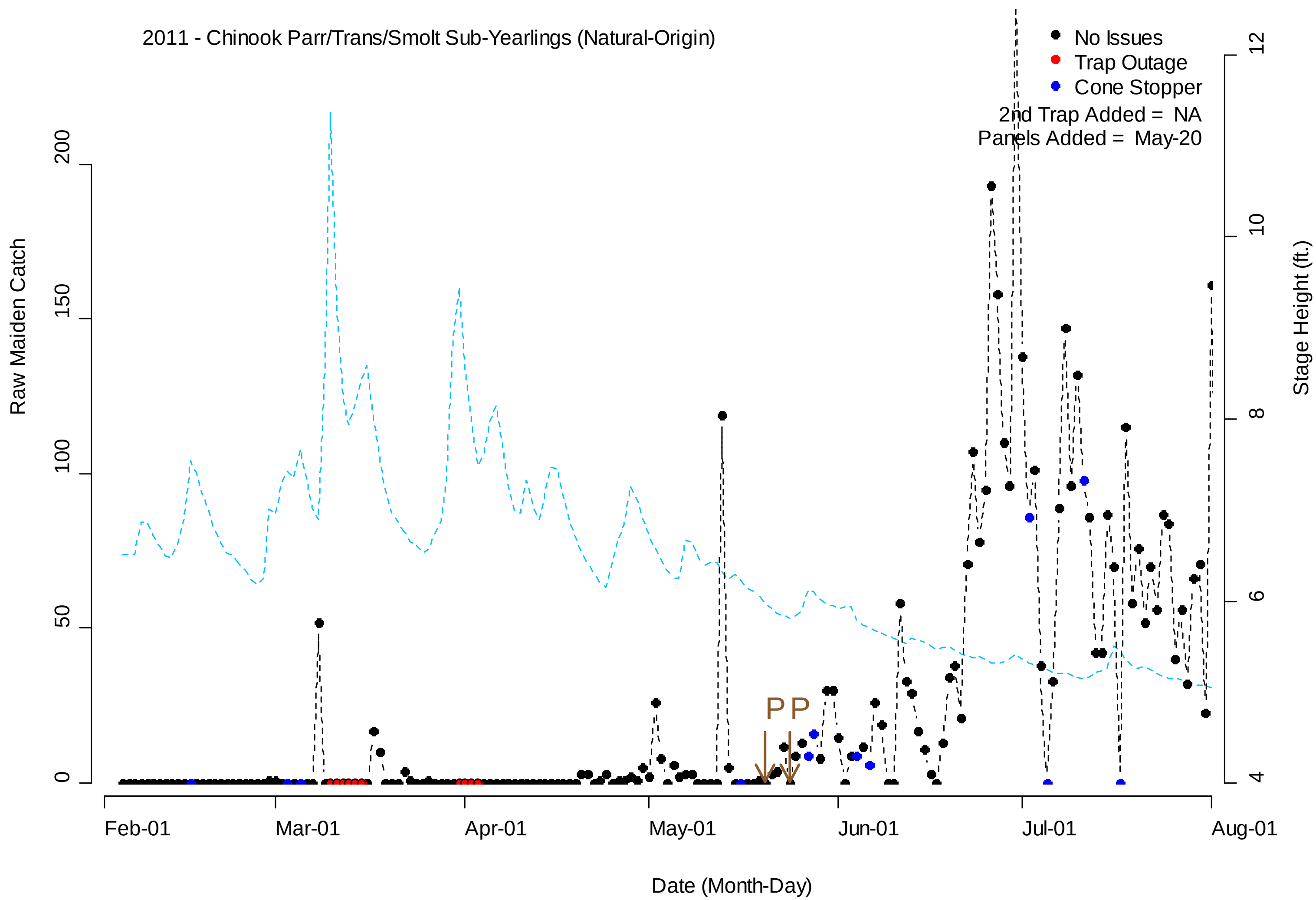

Figure B22. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2011.

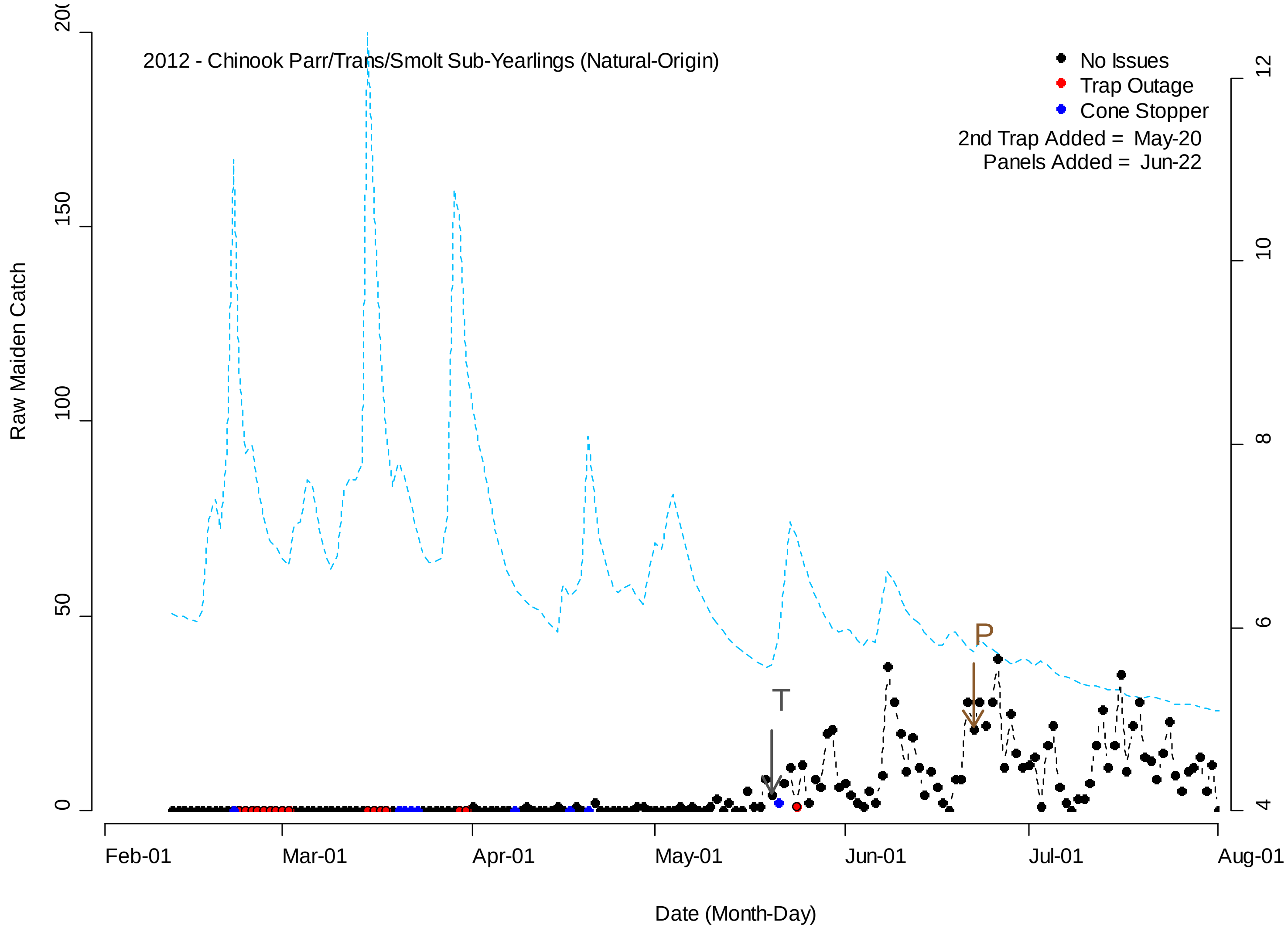

Figure B23. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2012.

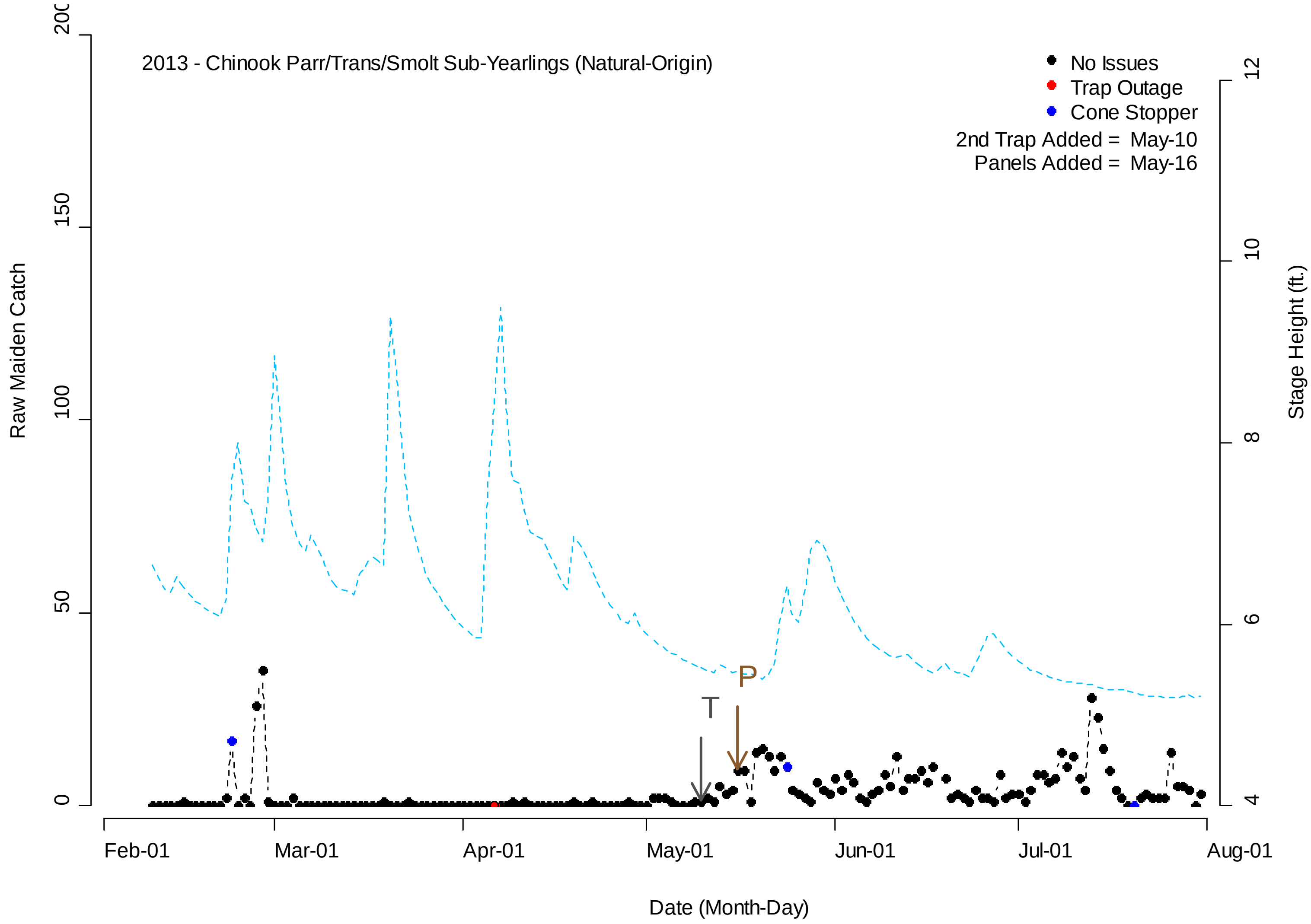

Figure B24. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2013.

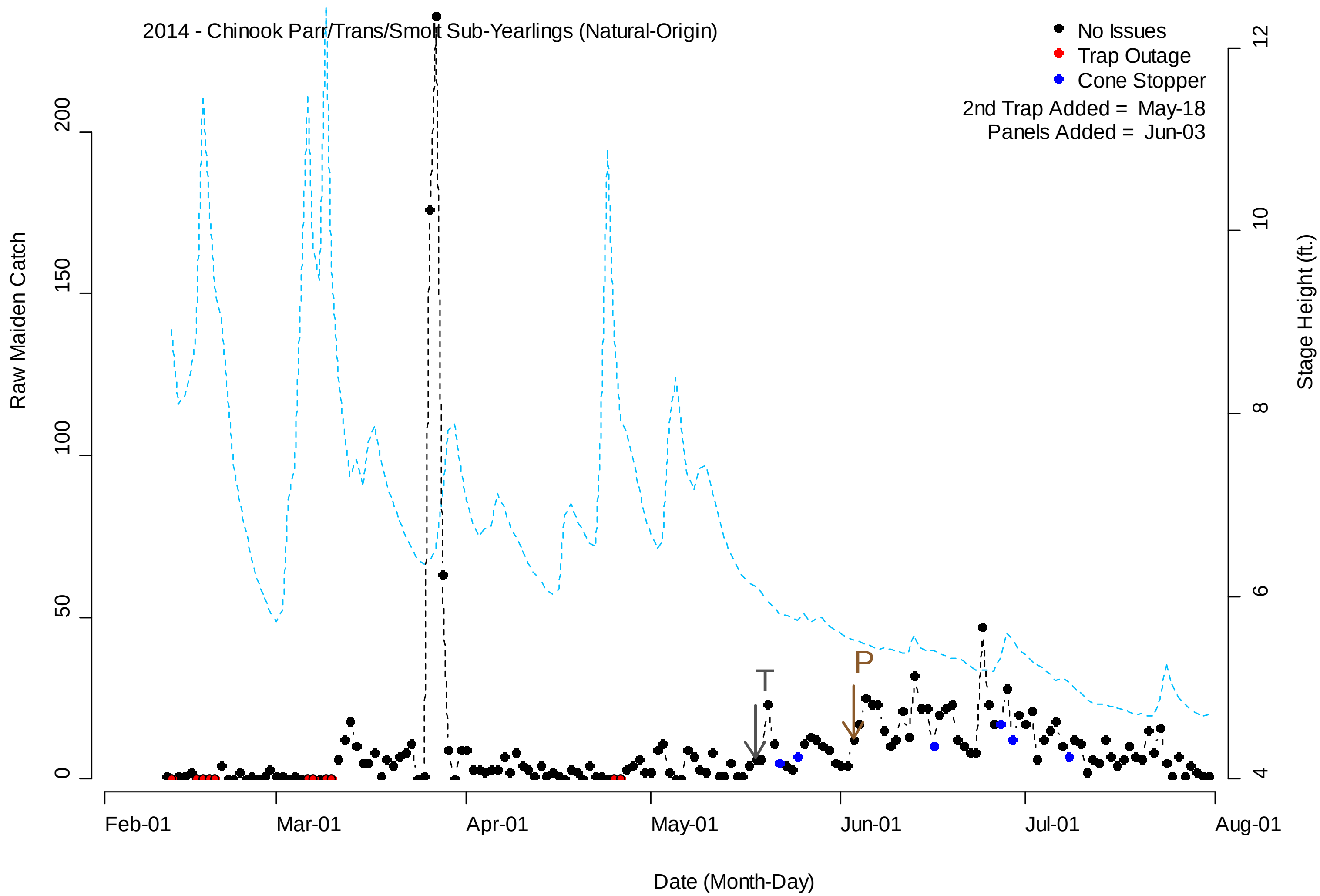

Figure B25. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2014.

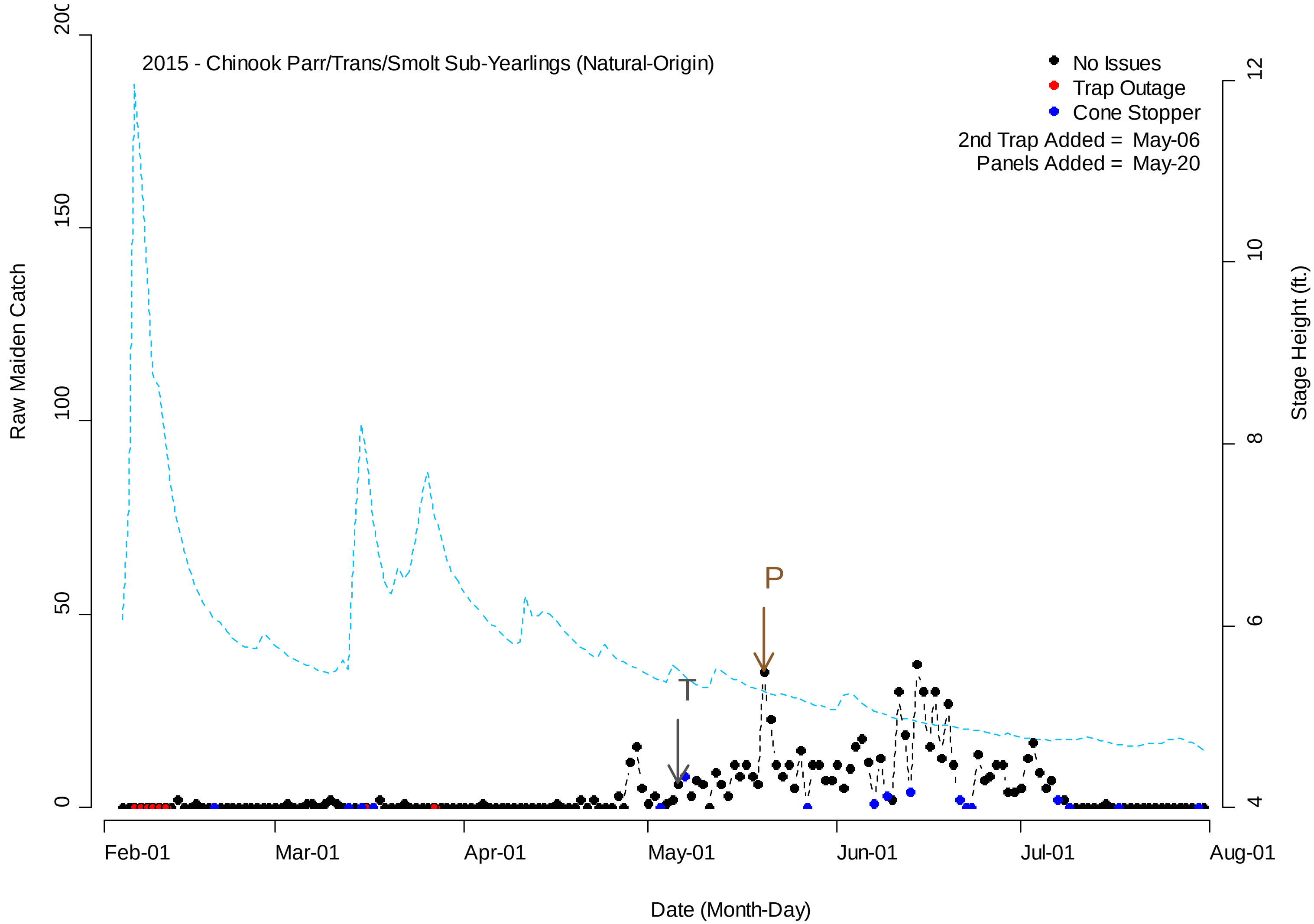

Figure B26. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2015.

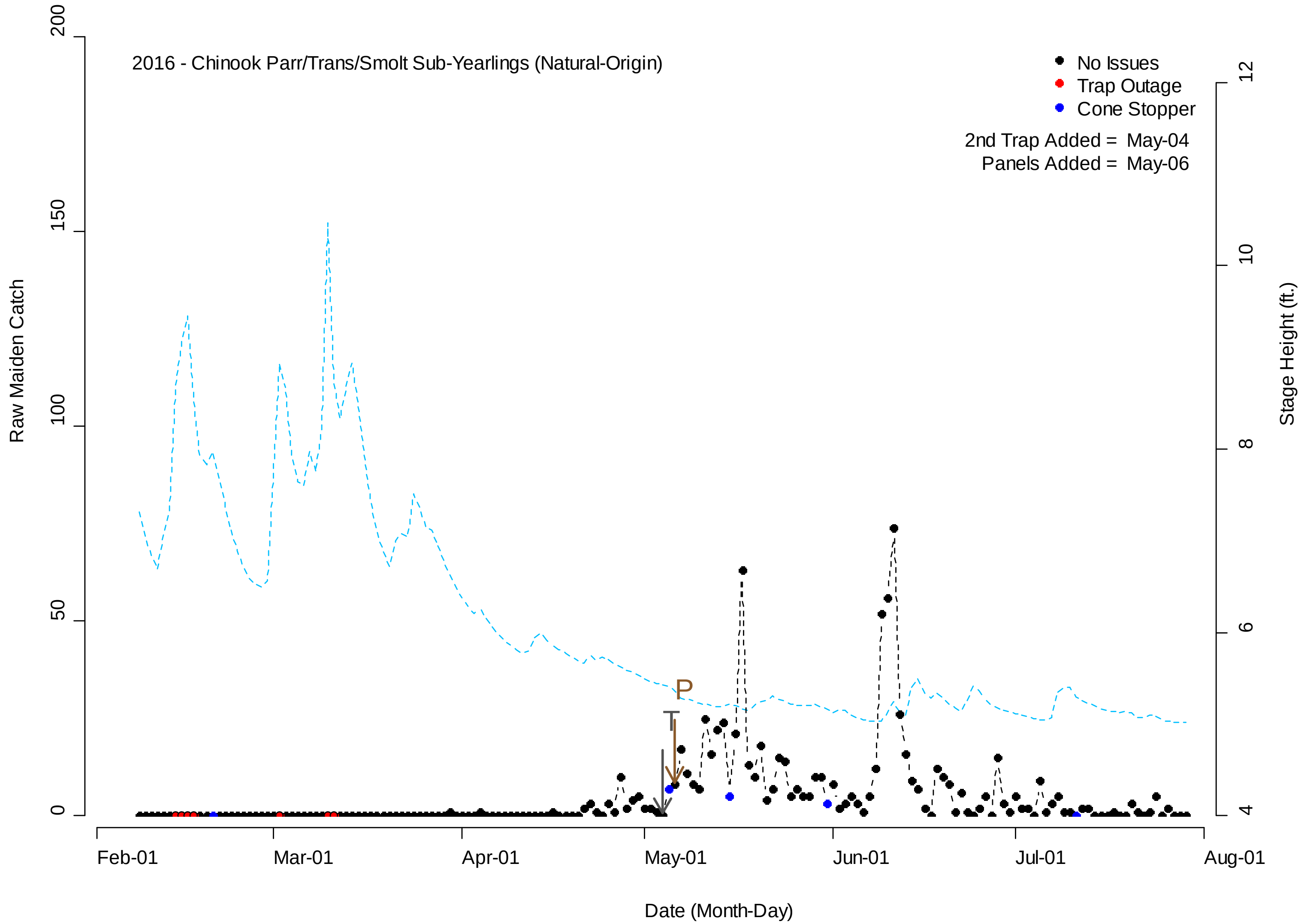

Figure B27. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2016.

Chinook salmon (Hatchery-Origin, Parr/Transitional/Smolt, Sub-Yearling)

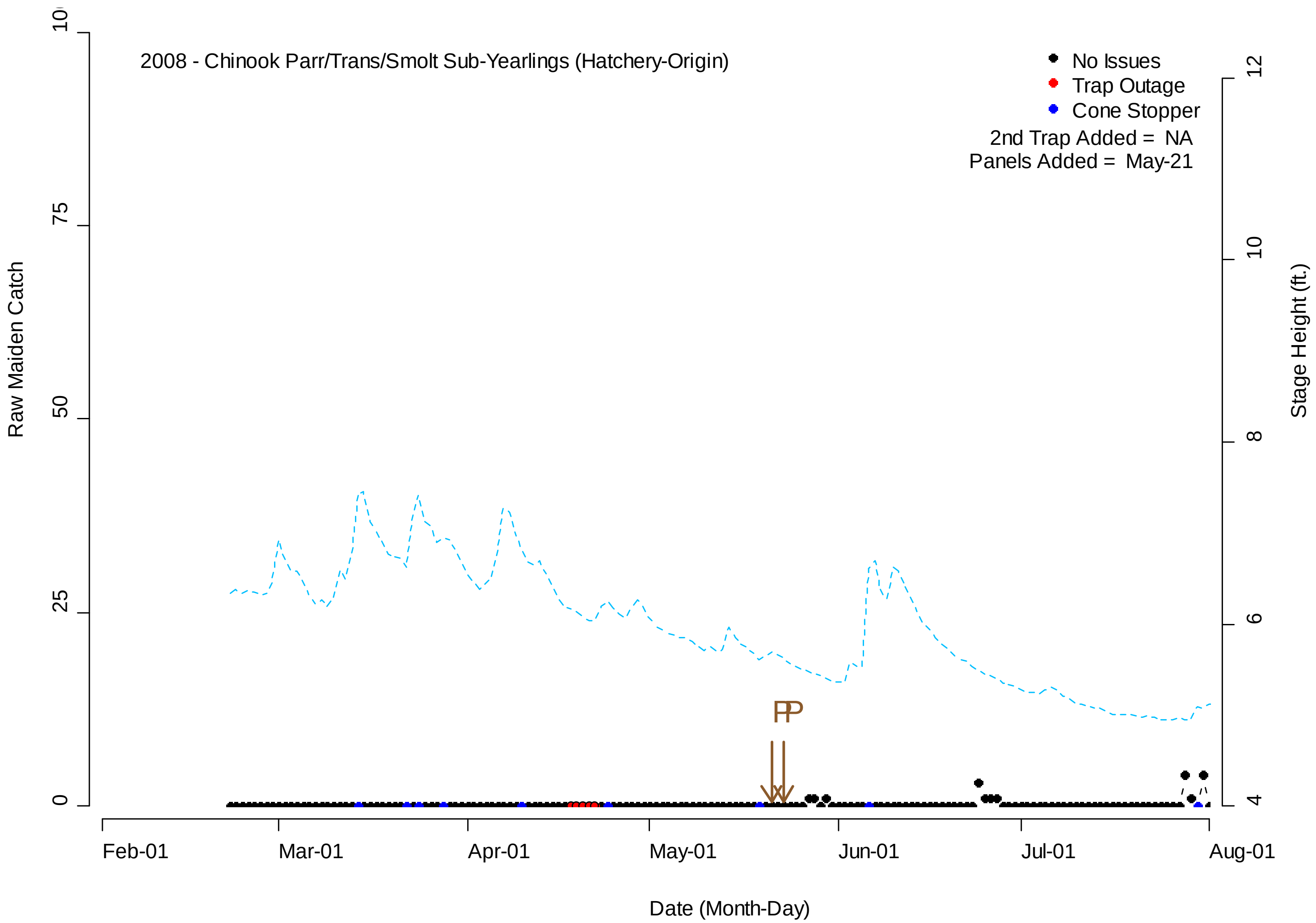

Figure B28. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2008.

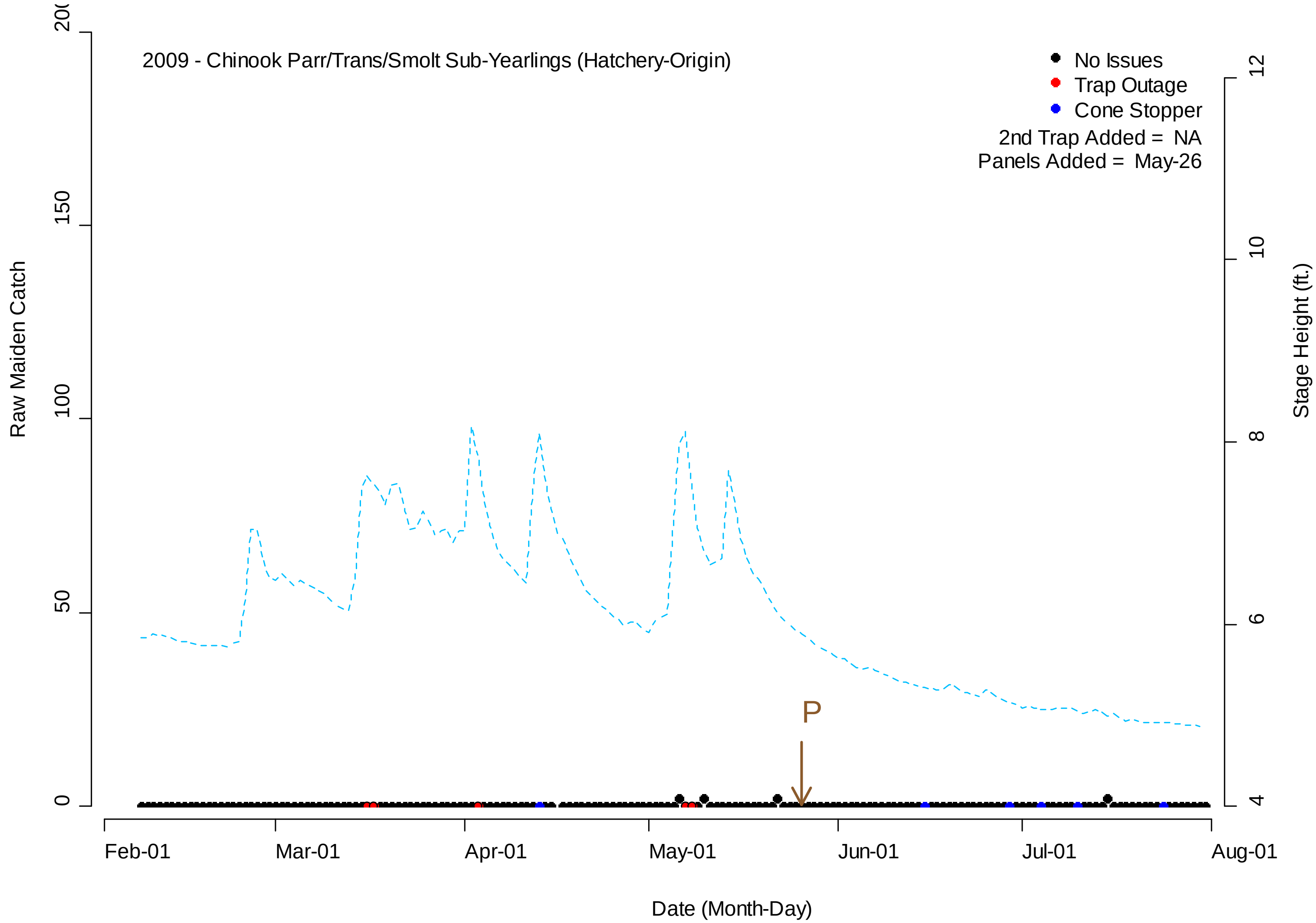

Figure B29. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2009.

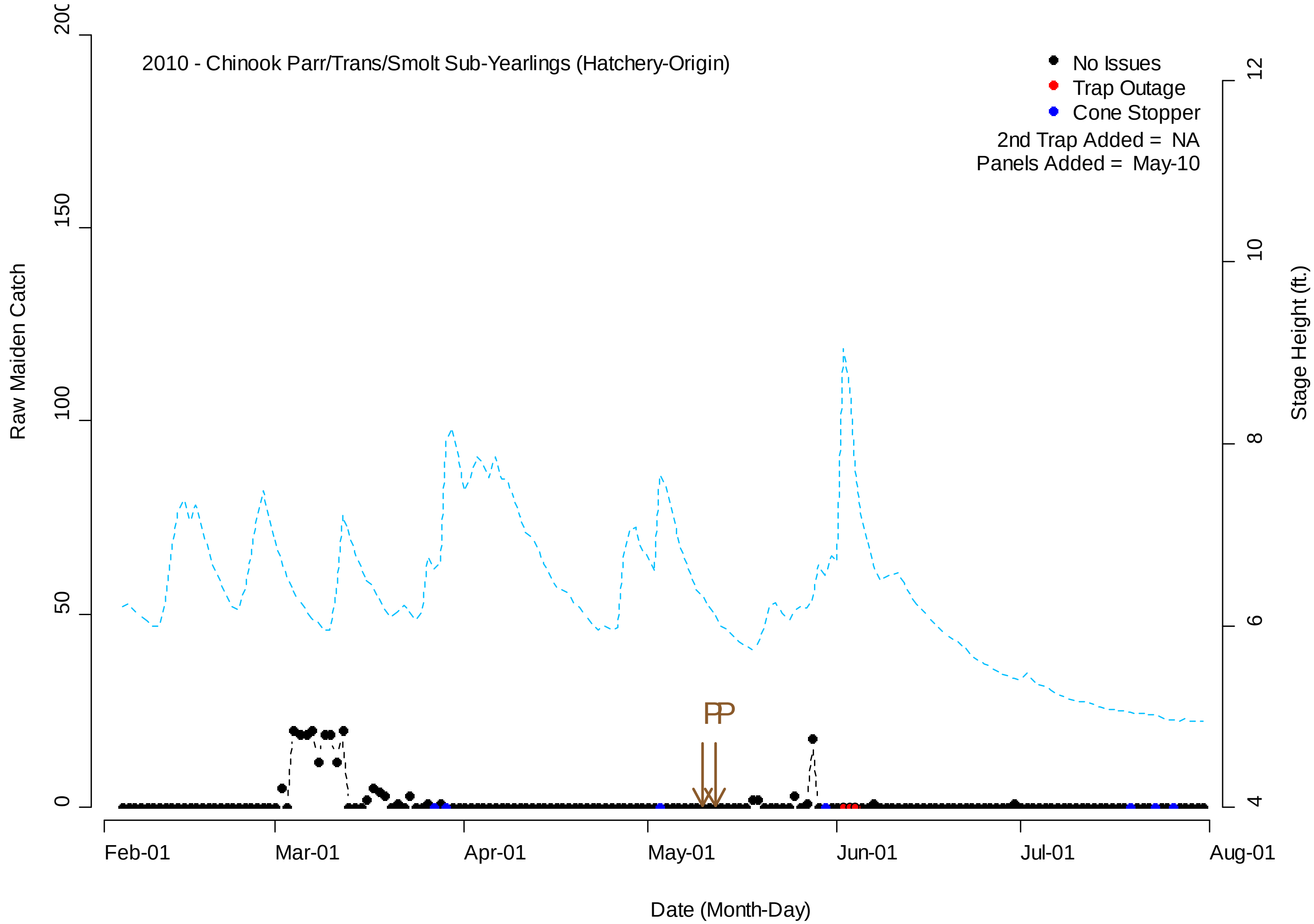

Figure B30. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2010.

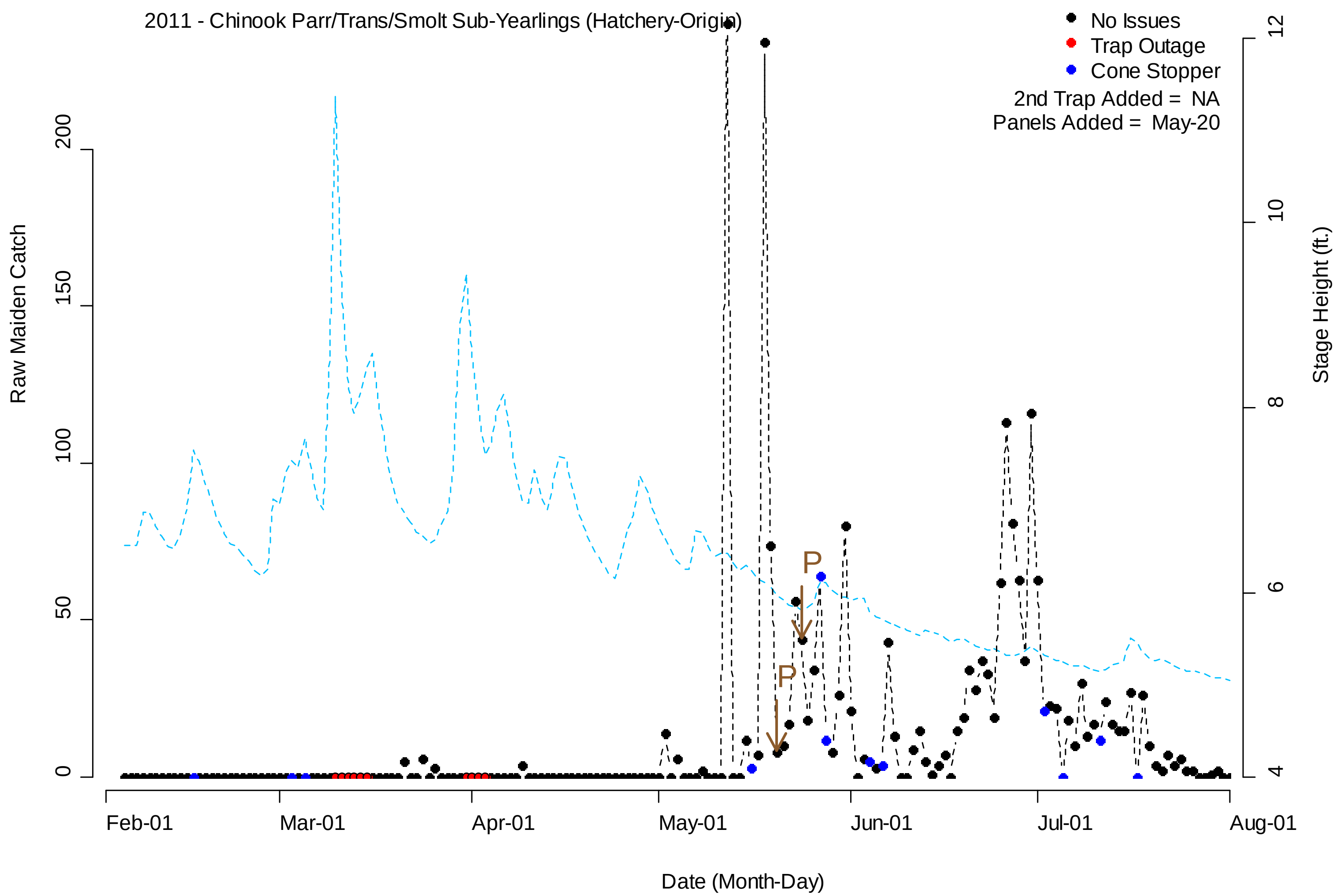

Figure B31. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2011.

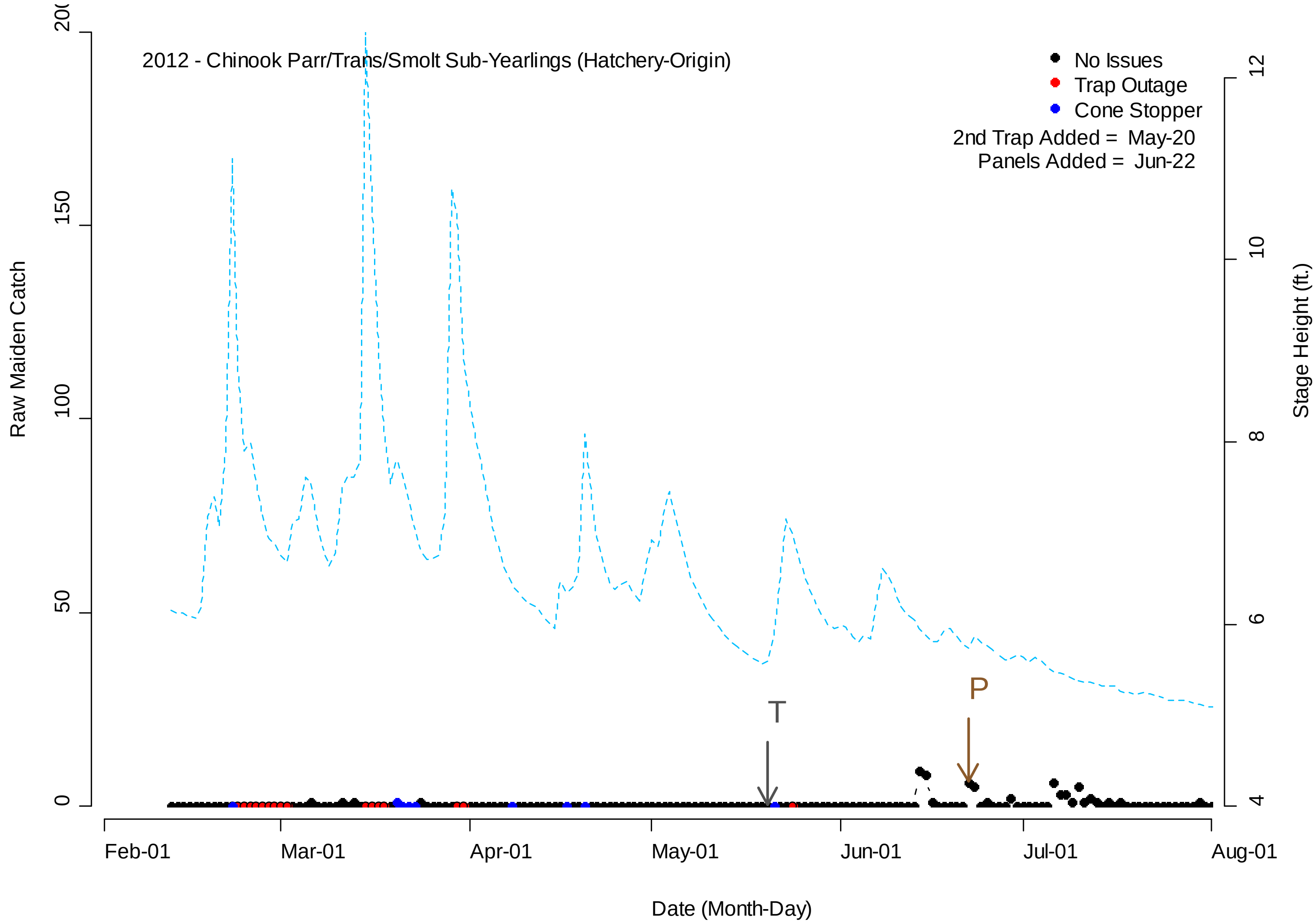

Figure B32. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2012.

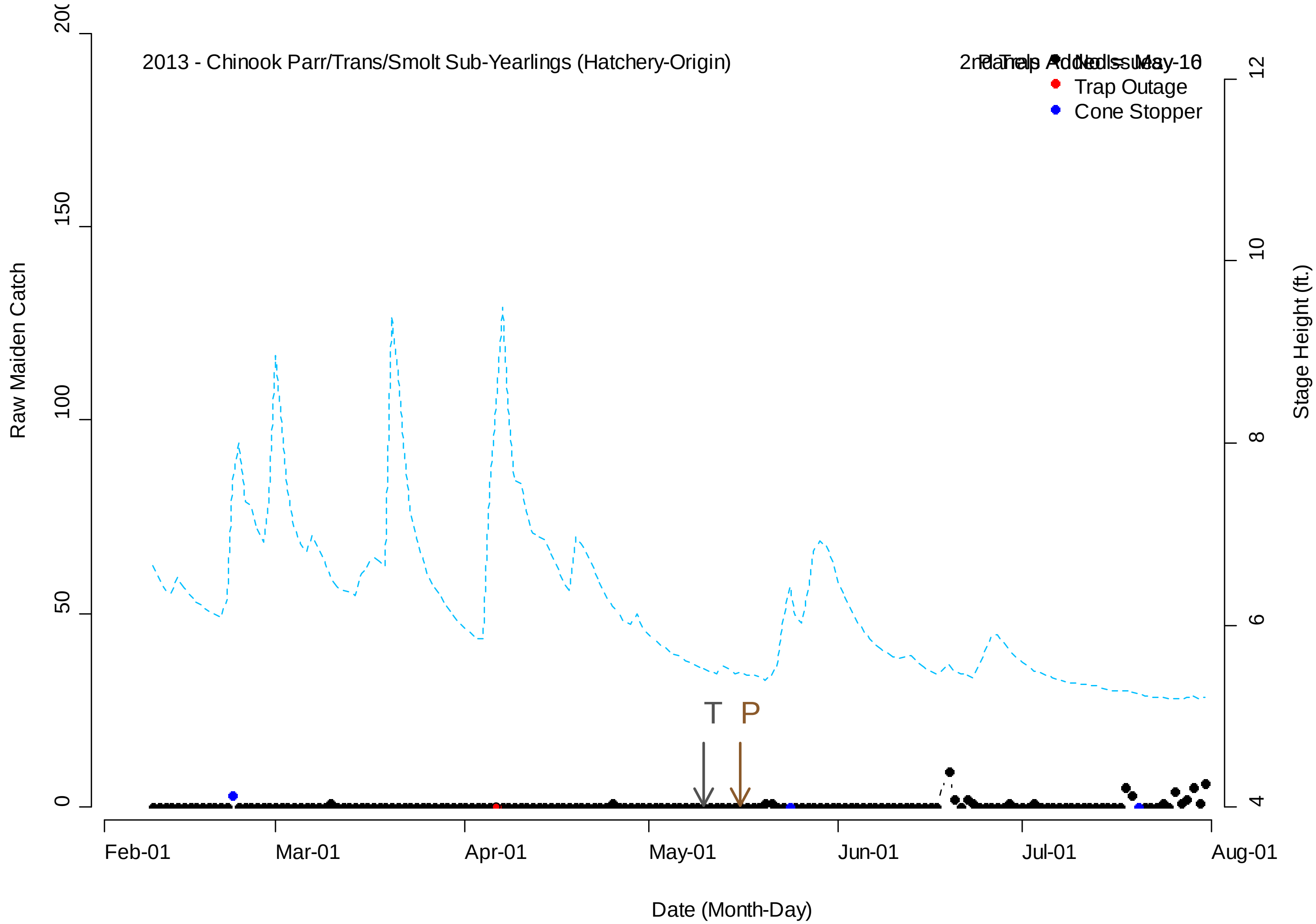

Figure B33. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2013.

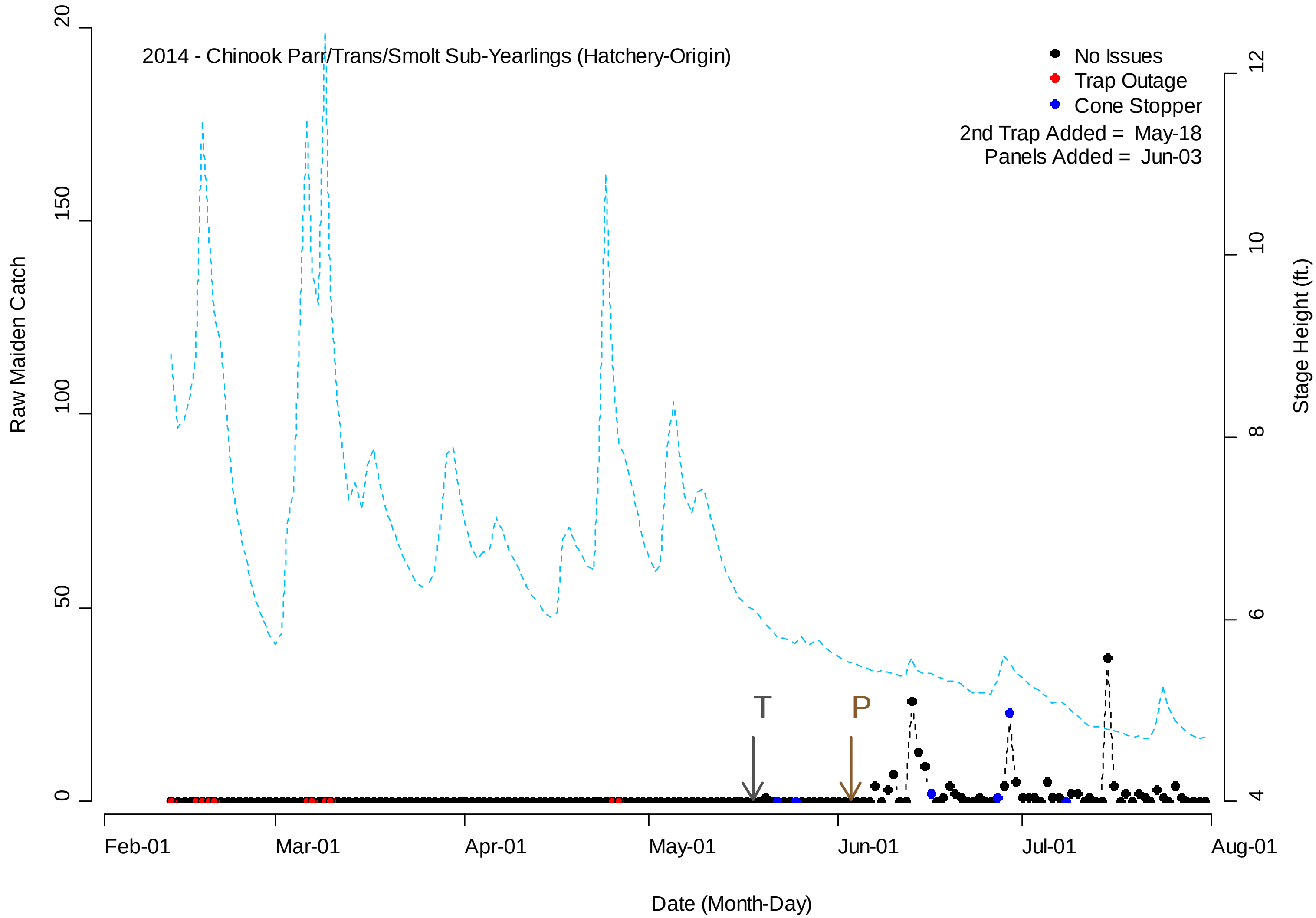

Figure B34. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2014.

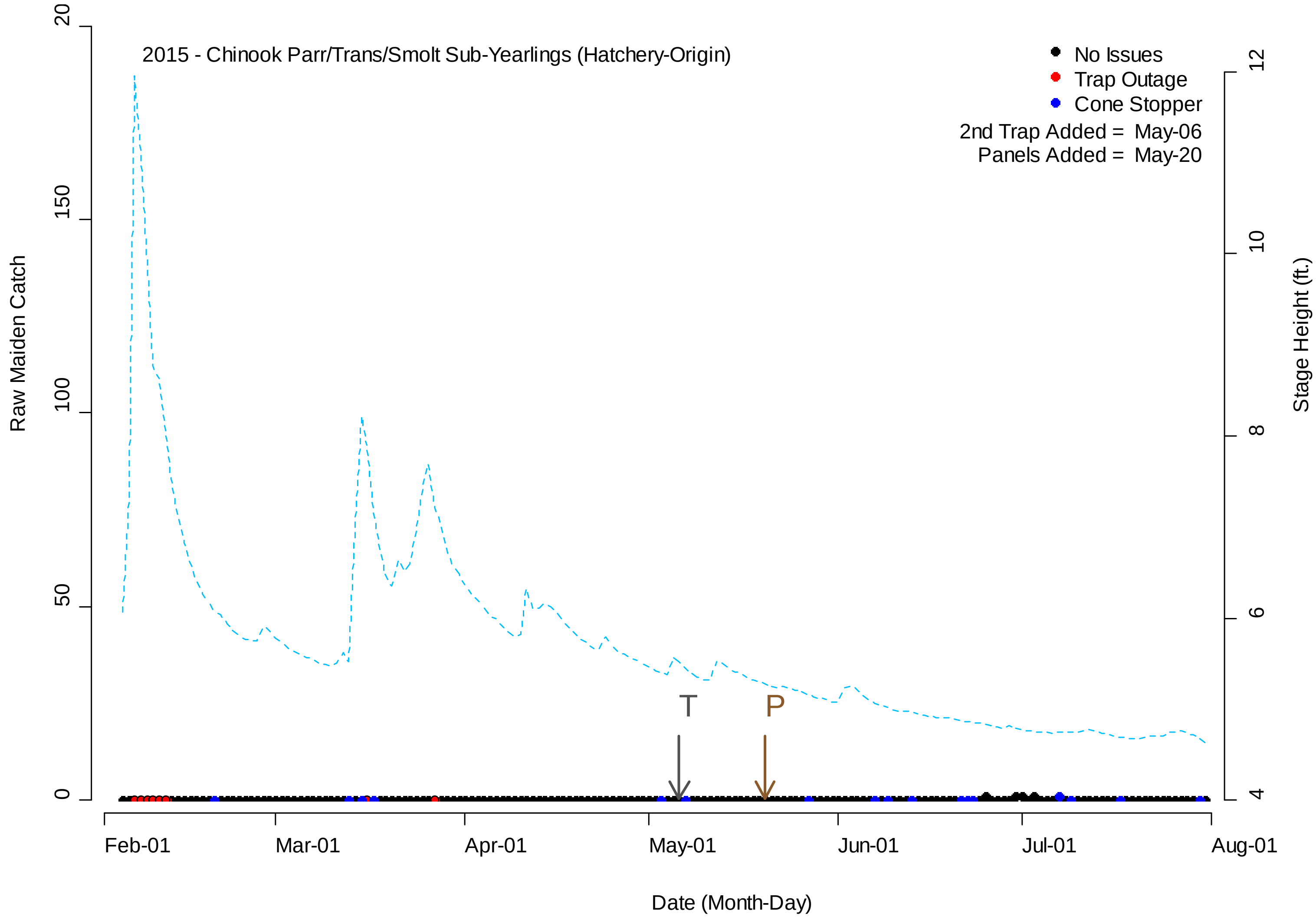

Figure B35. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2015.

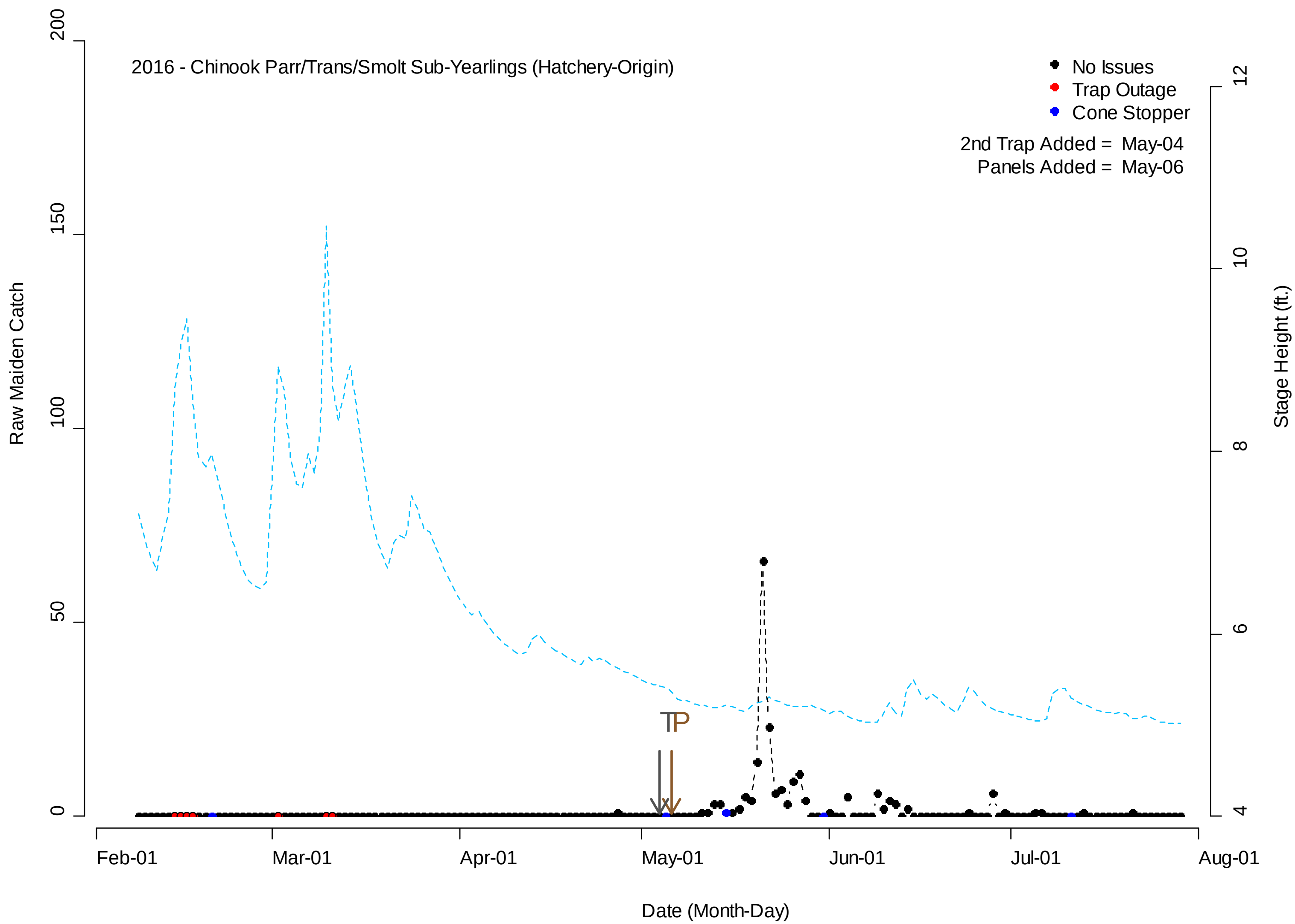

Figure B36. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2016.

Coho salmon (Natural-Origin, Transitional/Smolt, Yearling)

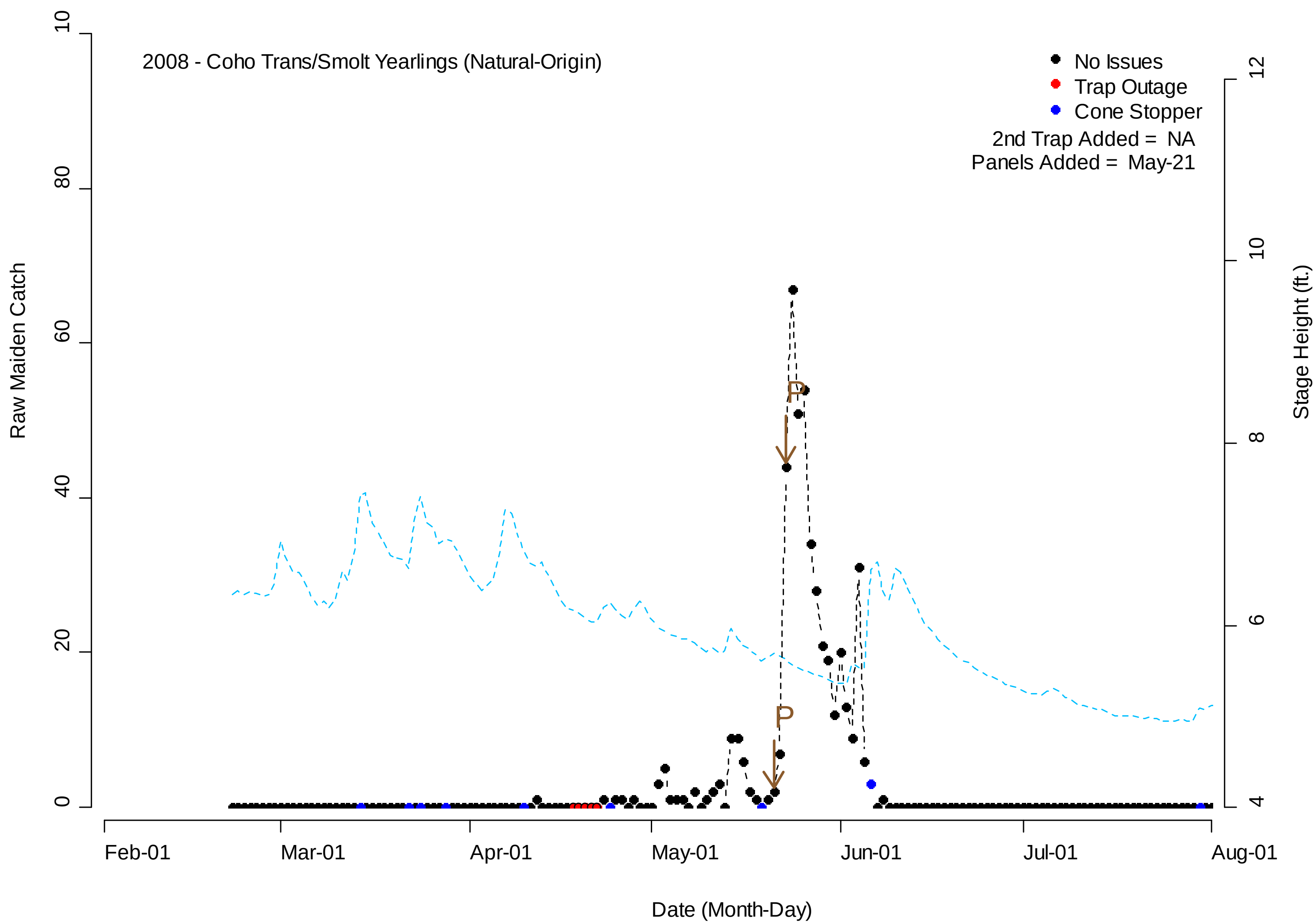

Figure B37. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2008.

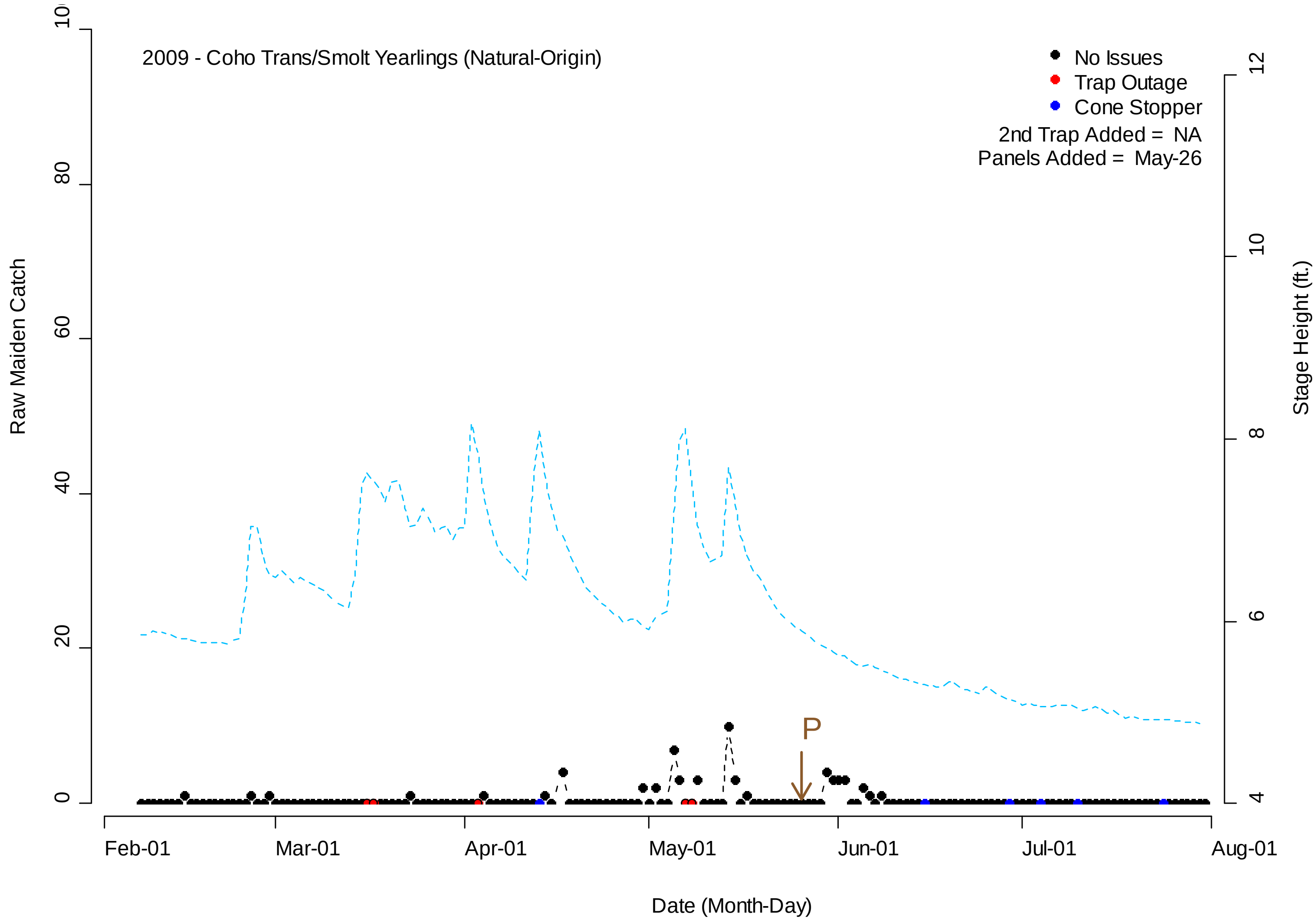

Figure B38. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2009.

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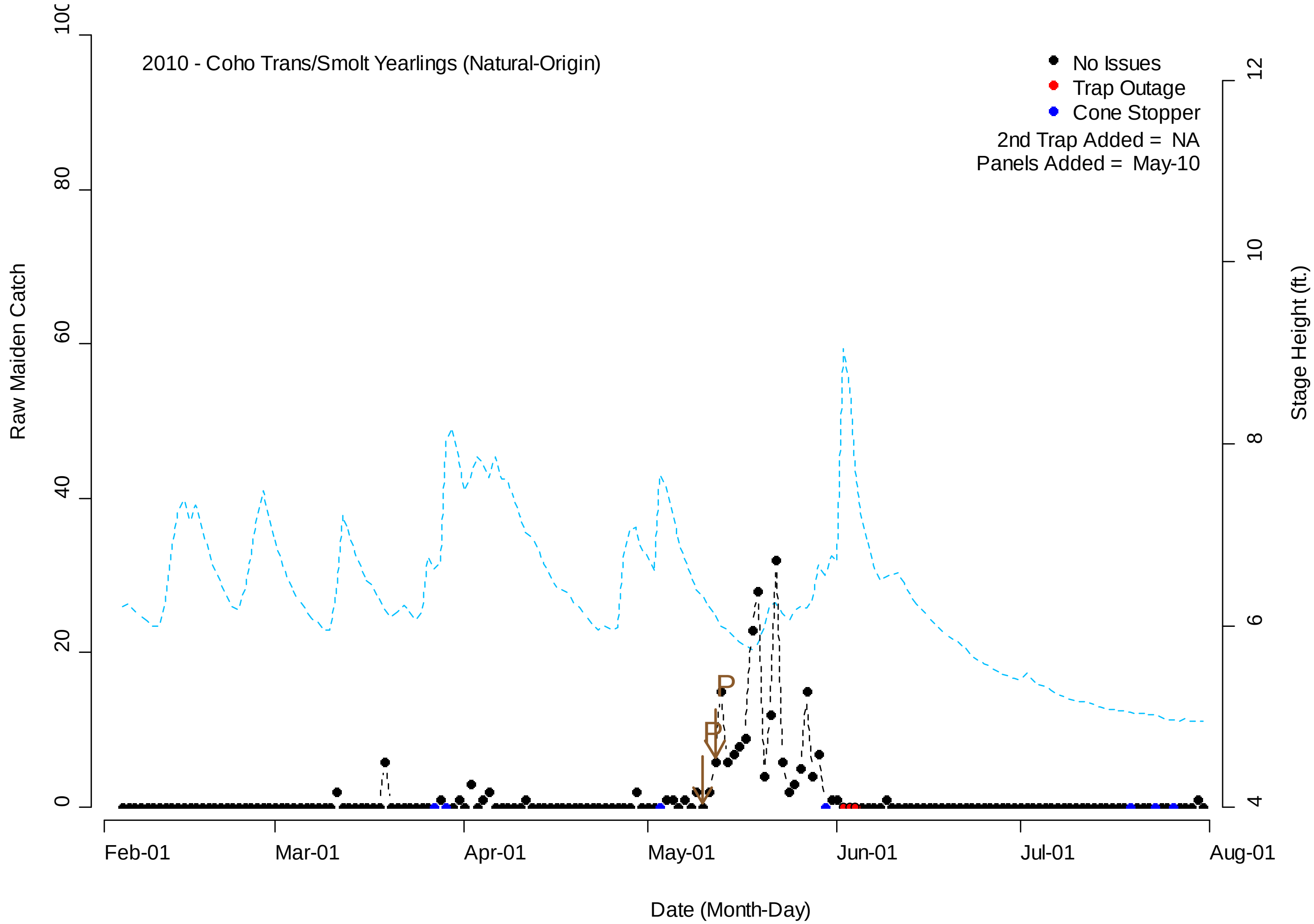

Figure B39. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2010.

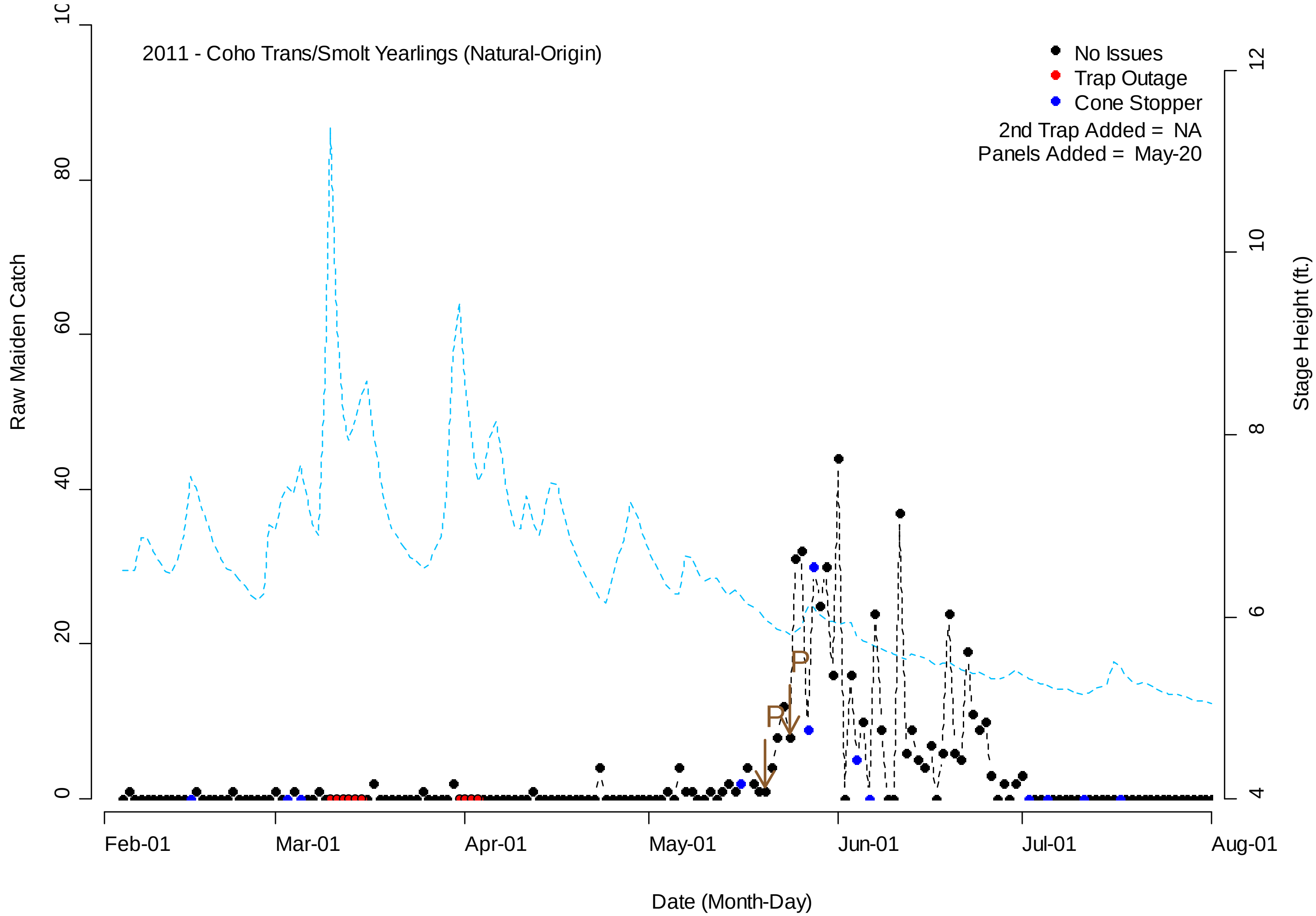

Figure B40. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2011.

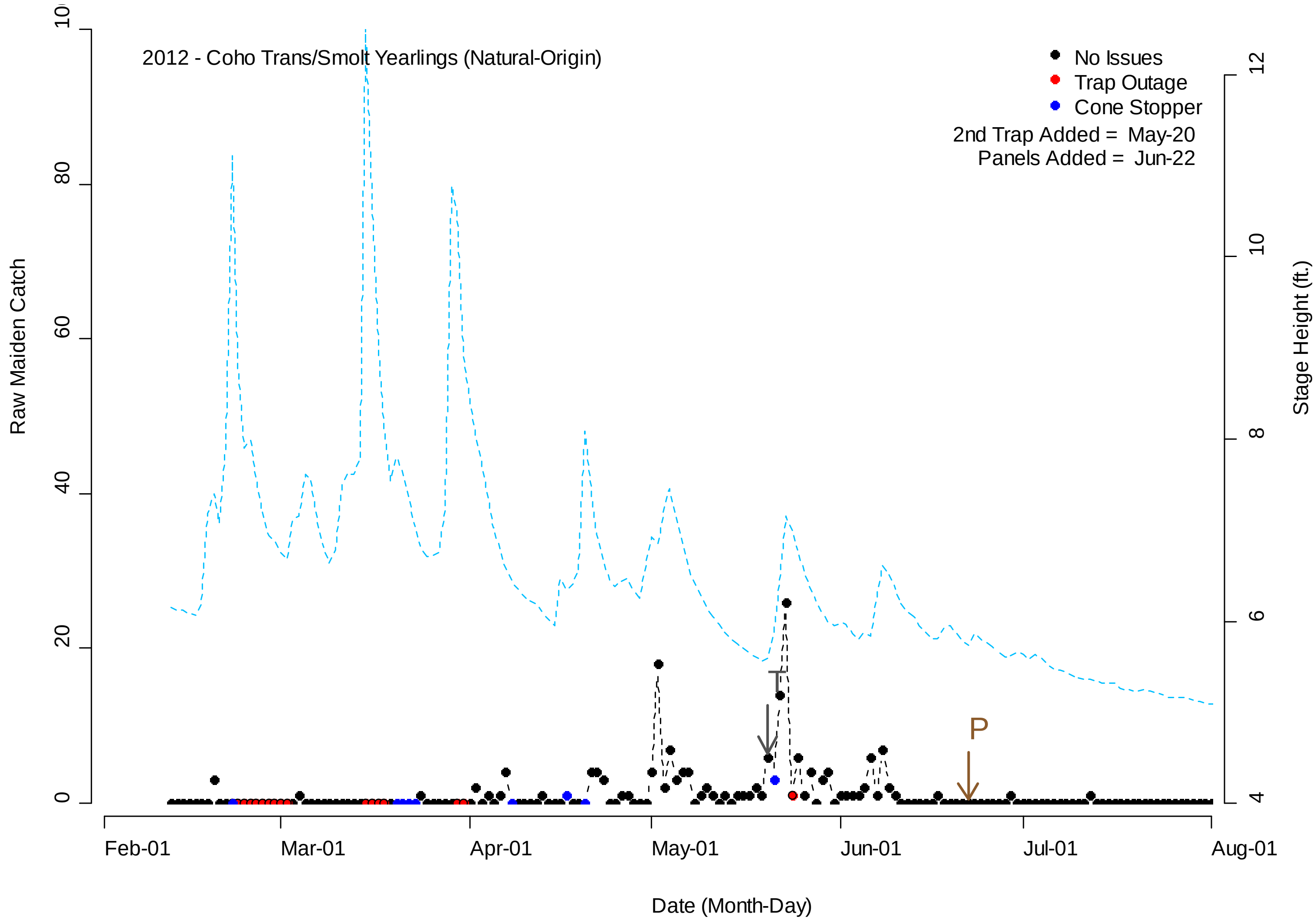

Figure B41. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2012.

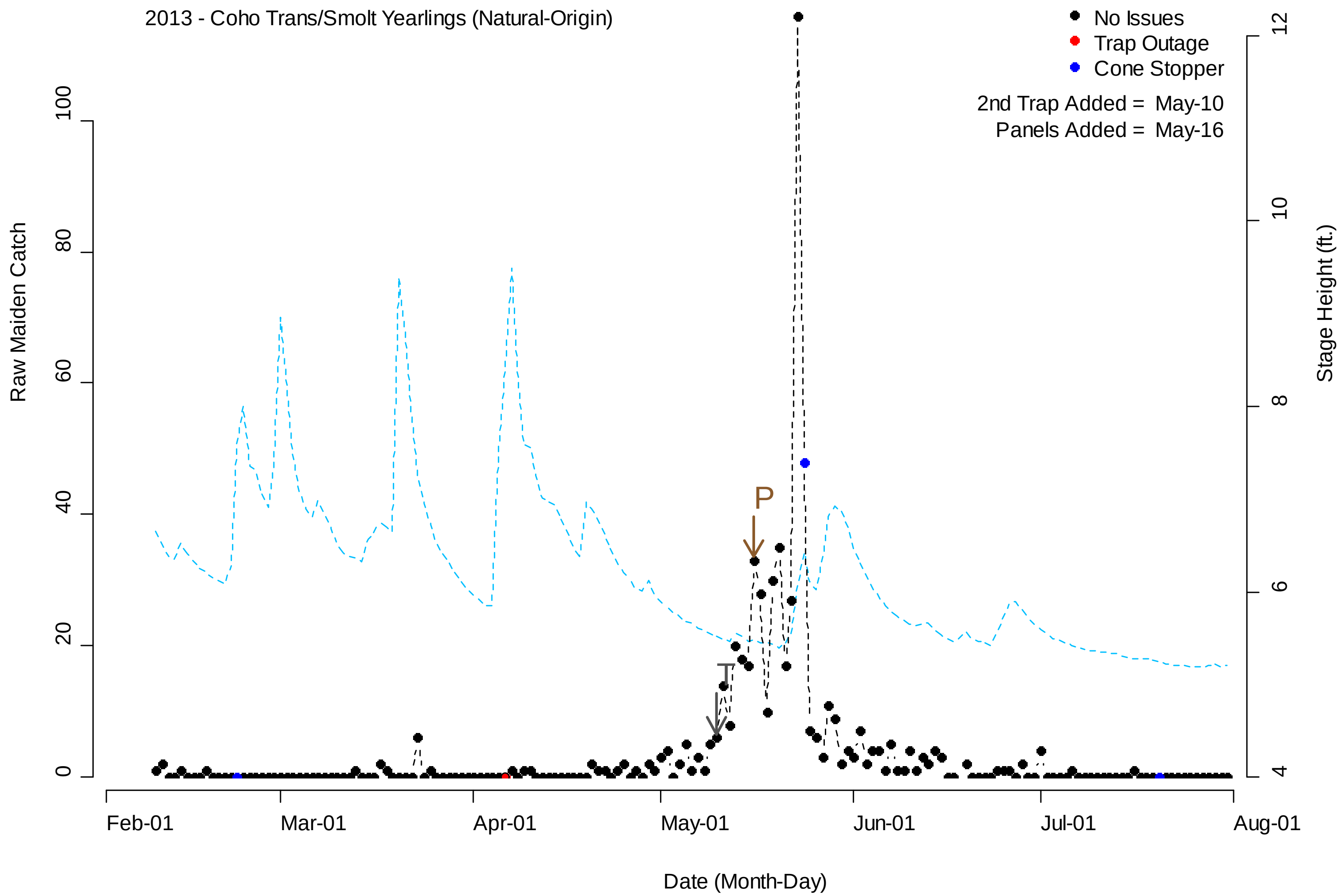

Figure B42. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2013.

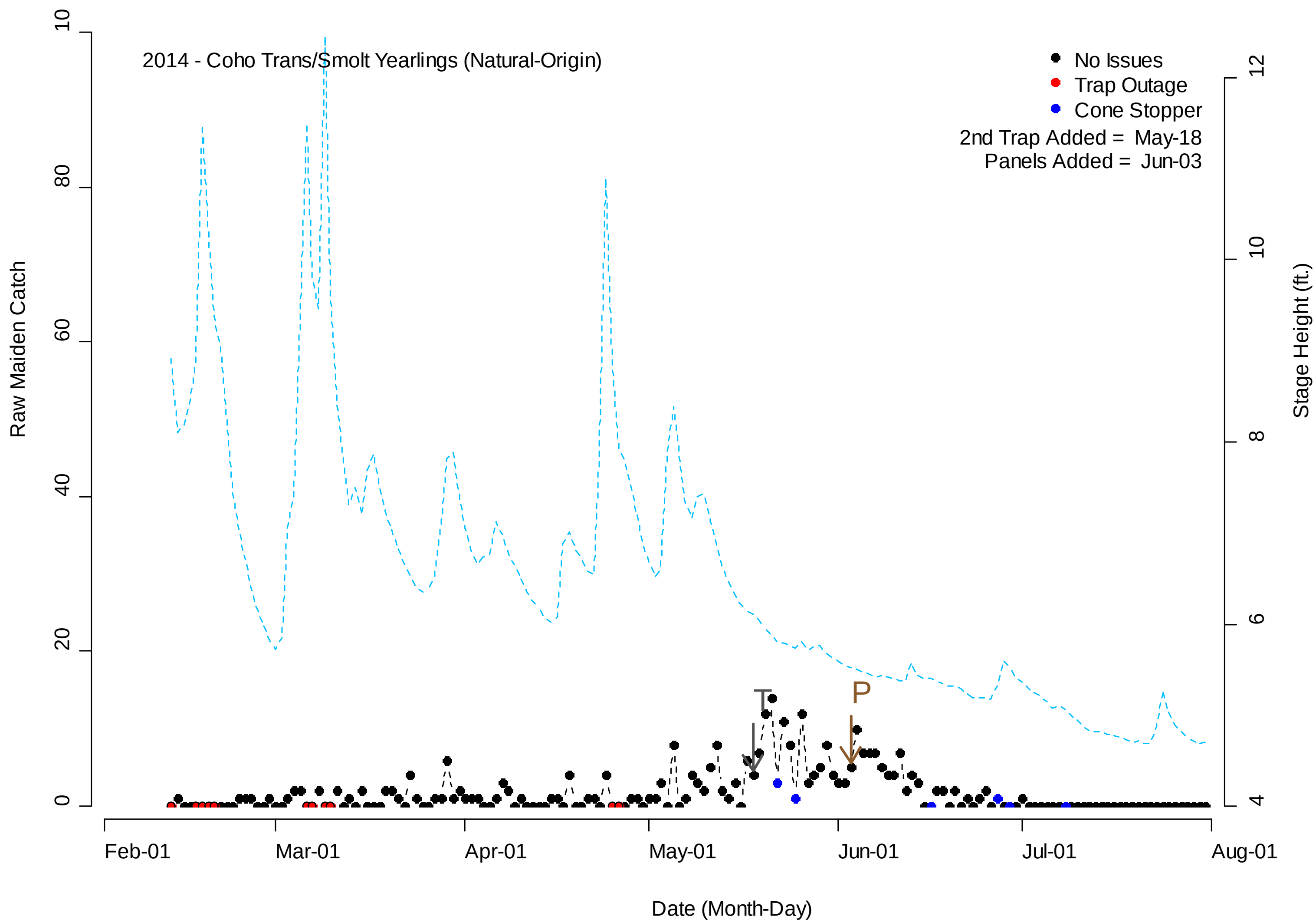

Figure B43. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2014.

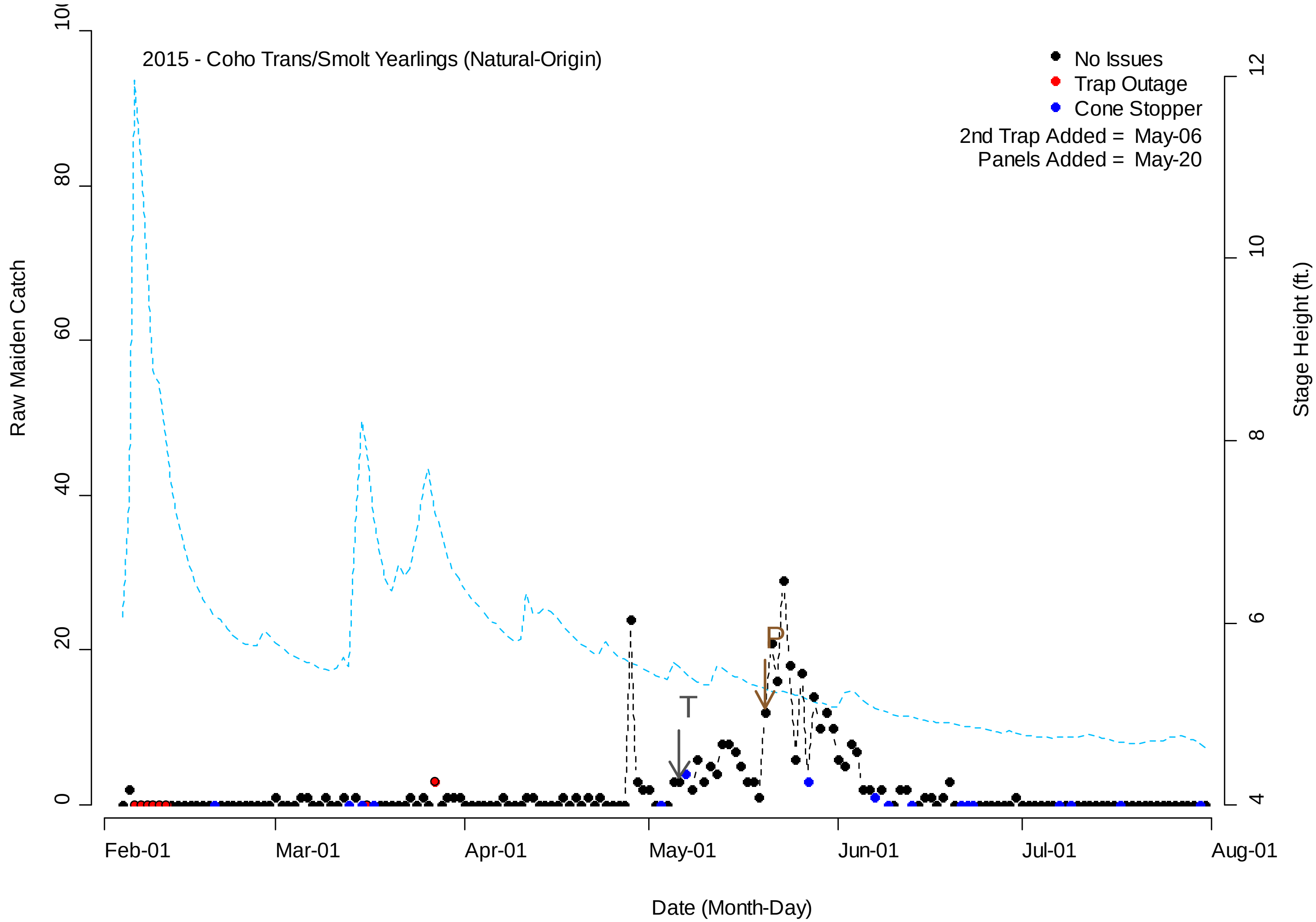

Figure B44. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2015.

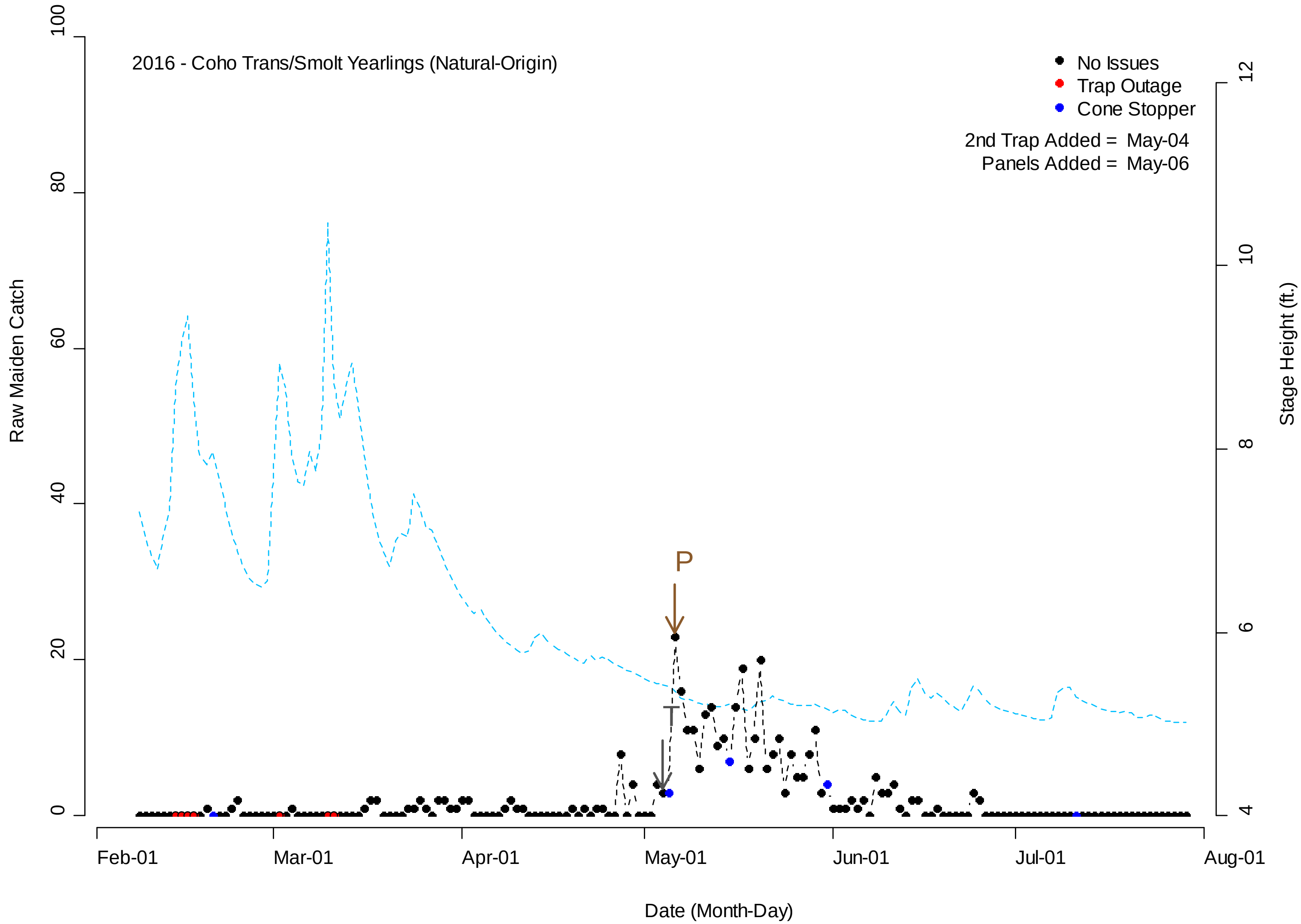

Figure B45. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2016.

Coho salmon (Natural-Origin, Transitional/Smolt, Sub-Yearling)

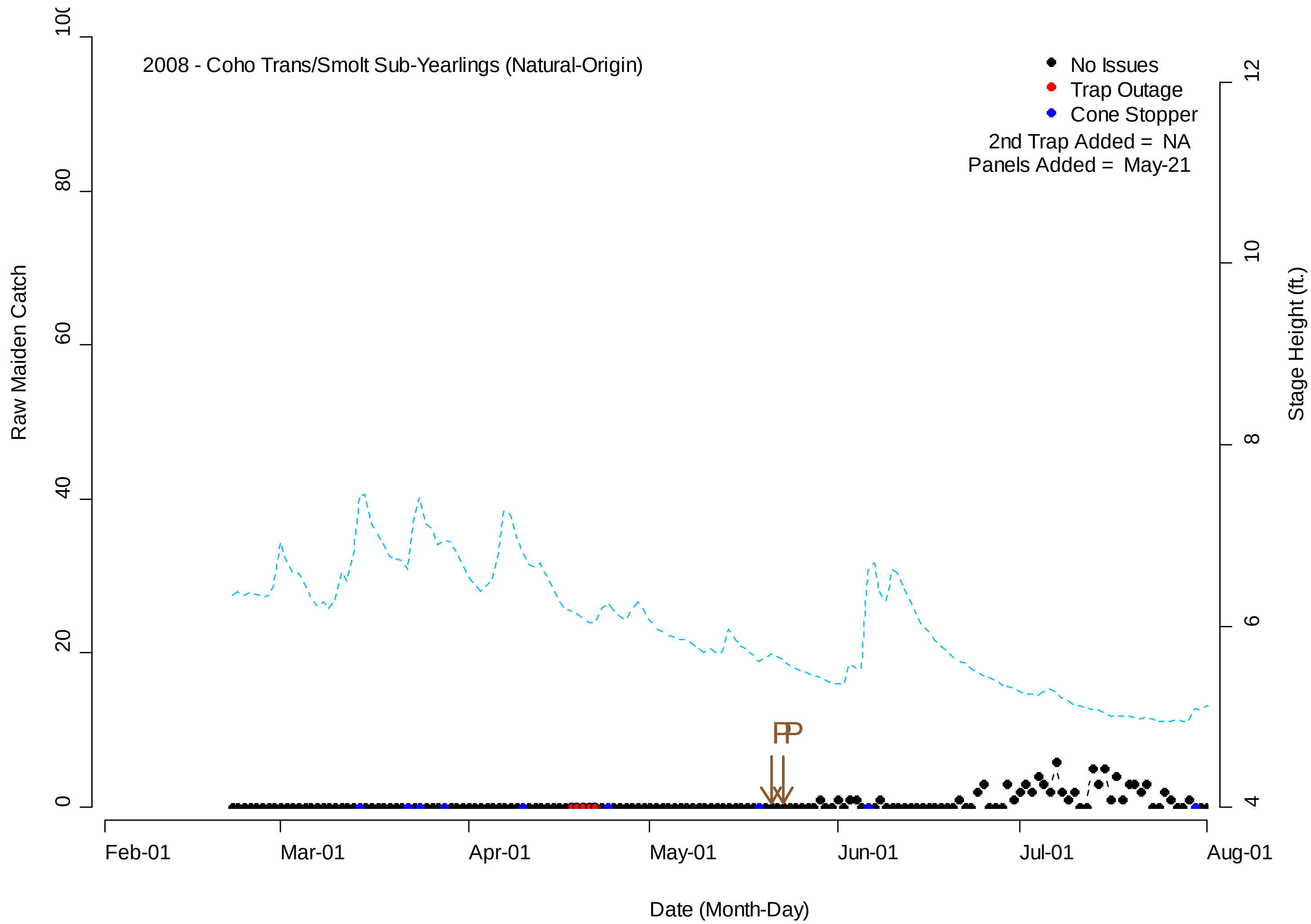

Figure B46. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2008.

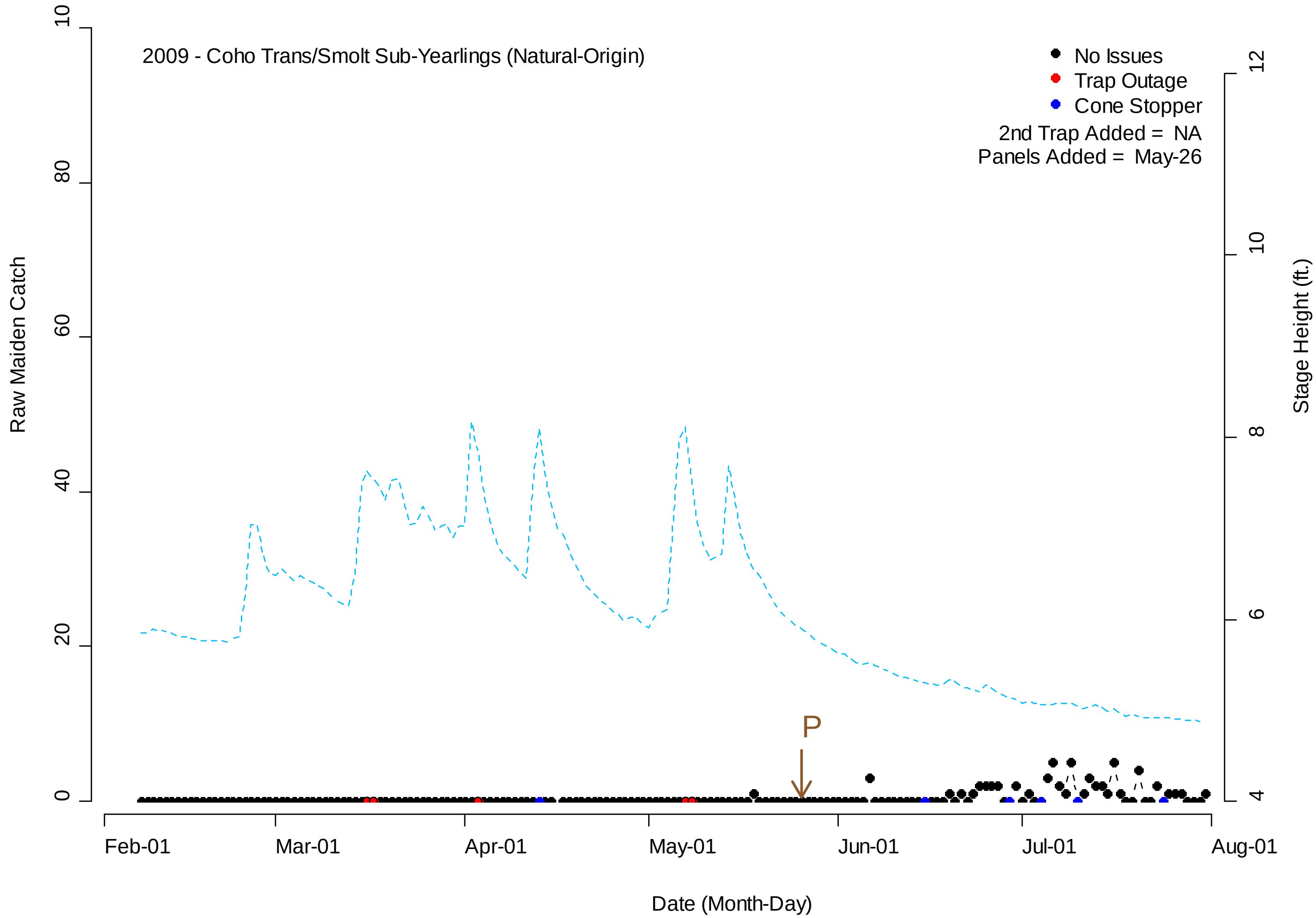

Figure B47. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2009.

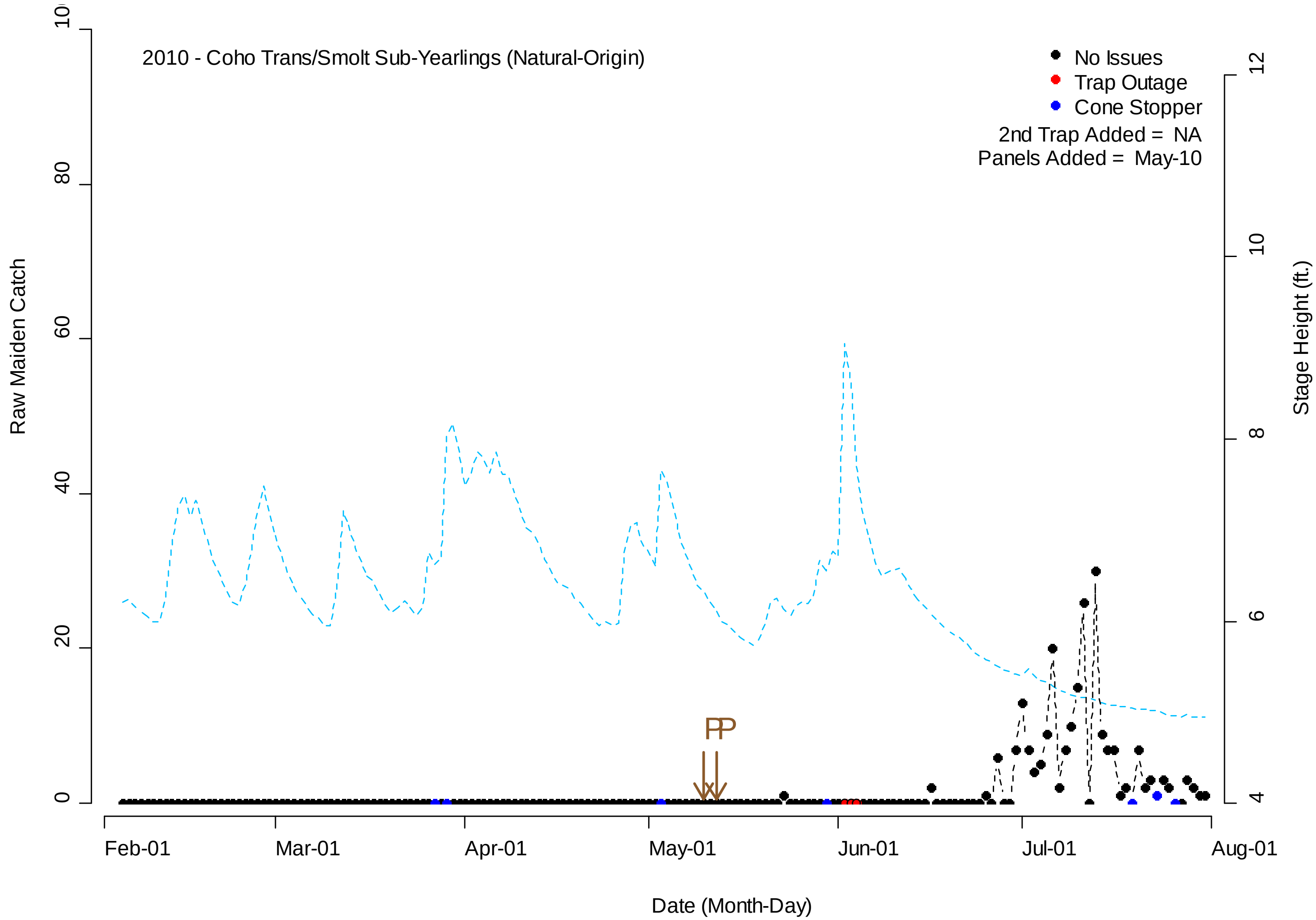

Figure B48. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2010.

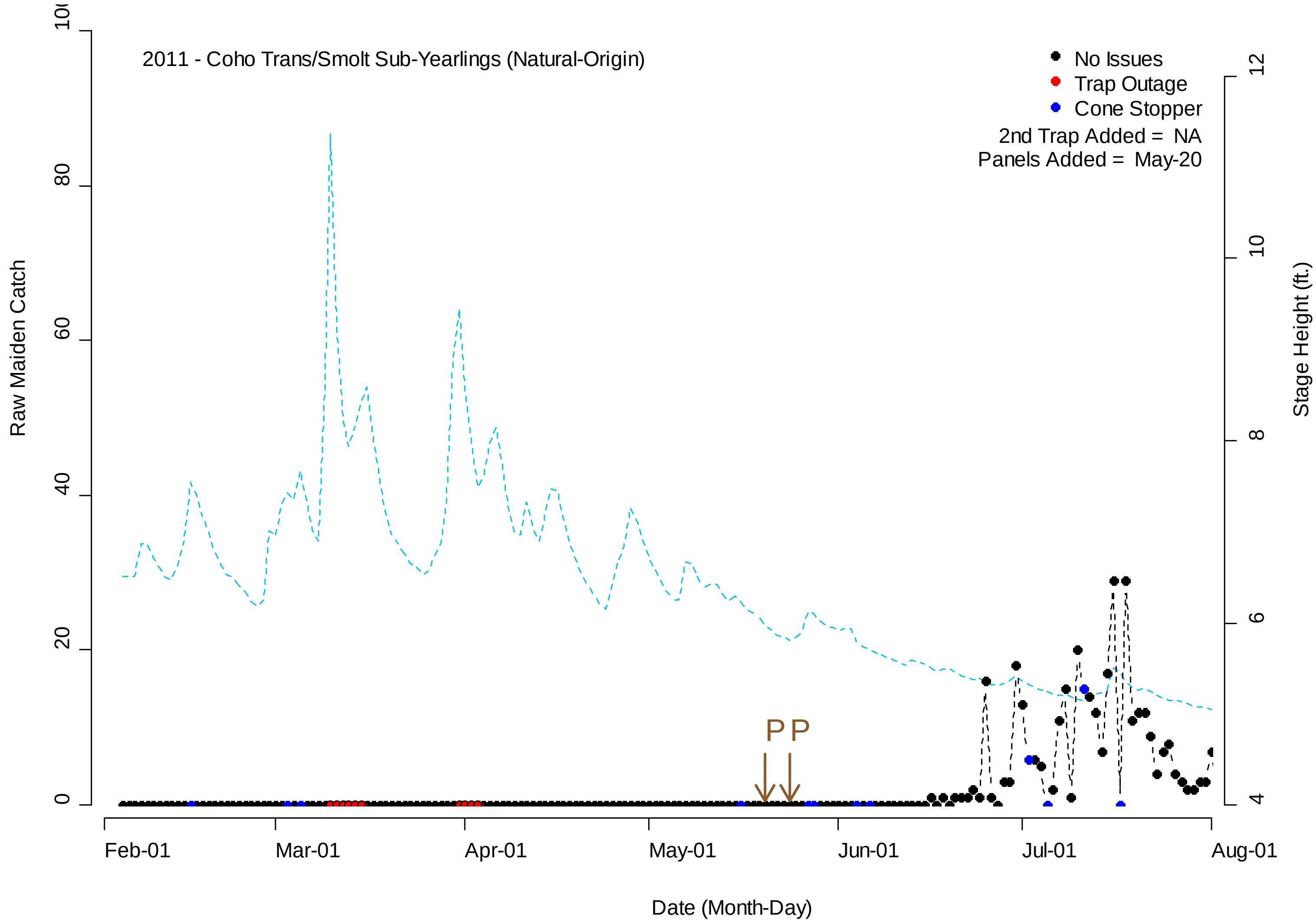

Figure B49. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2011.

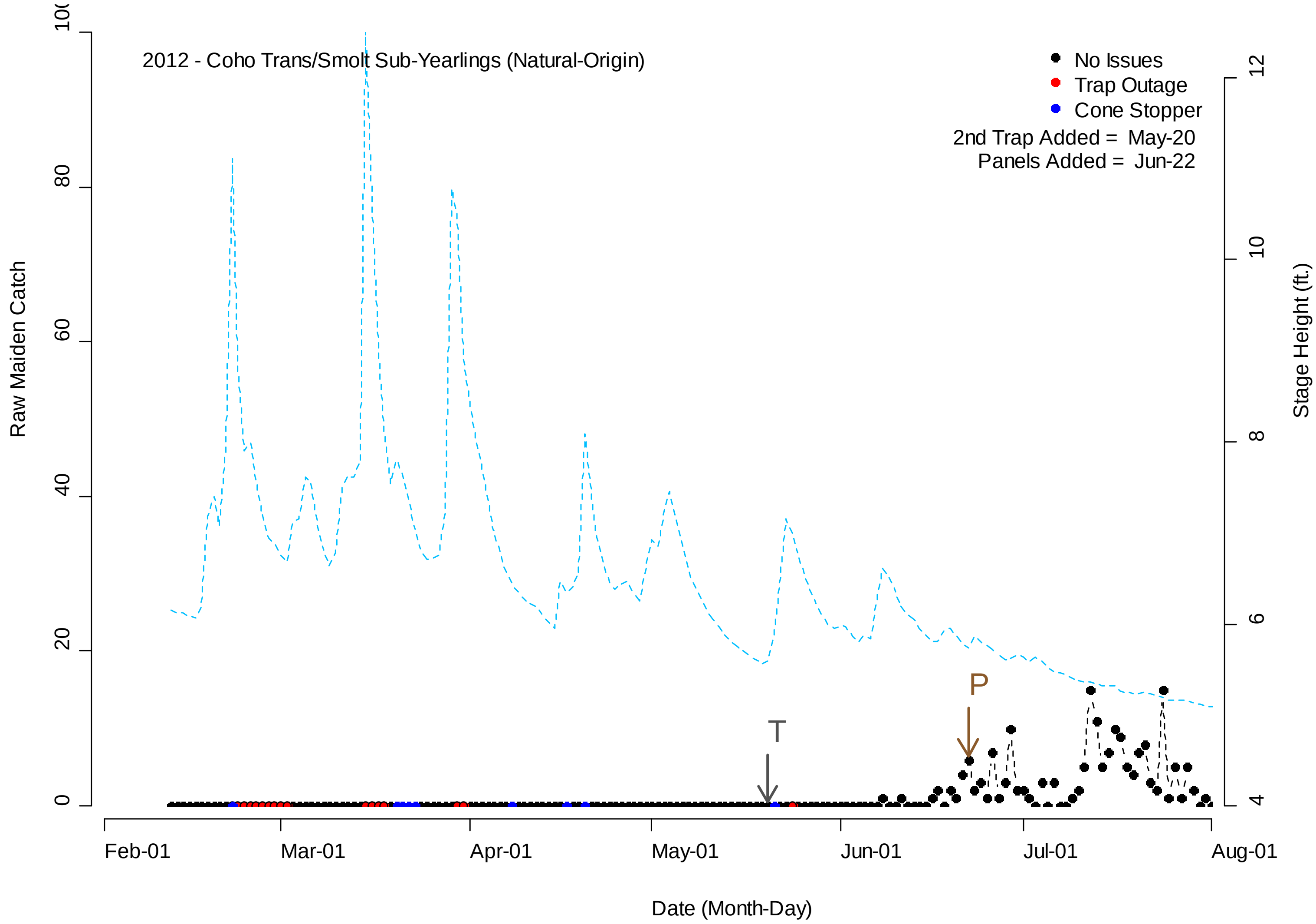

Figure B50. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2012.

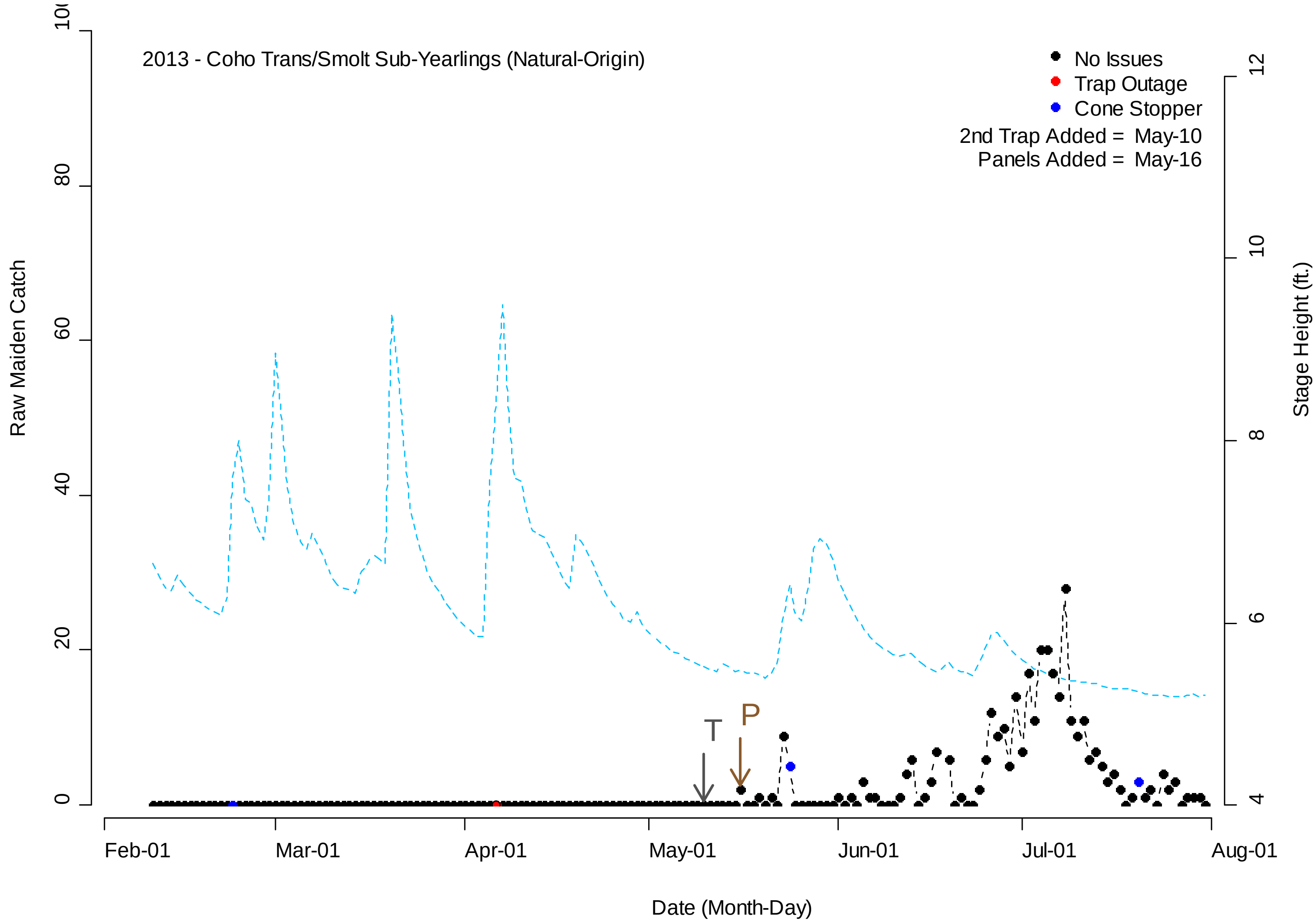

Figure B51. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2013.

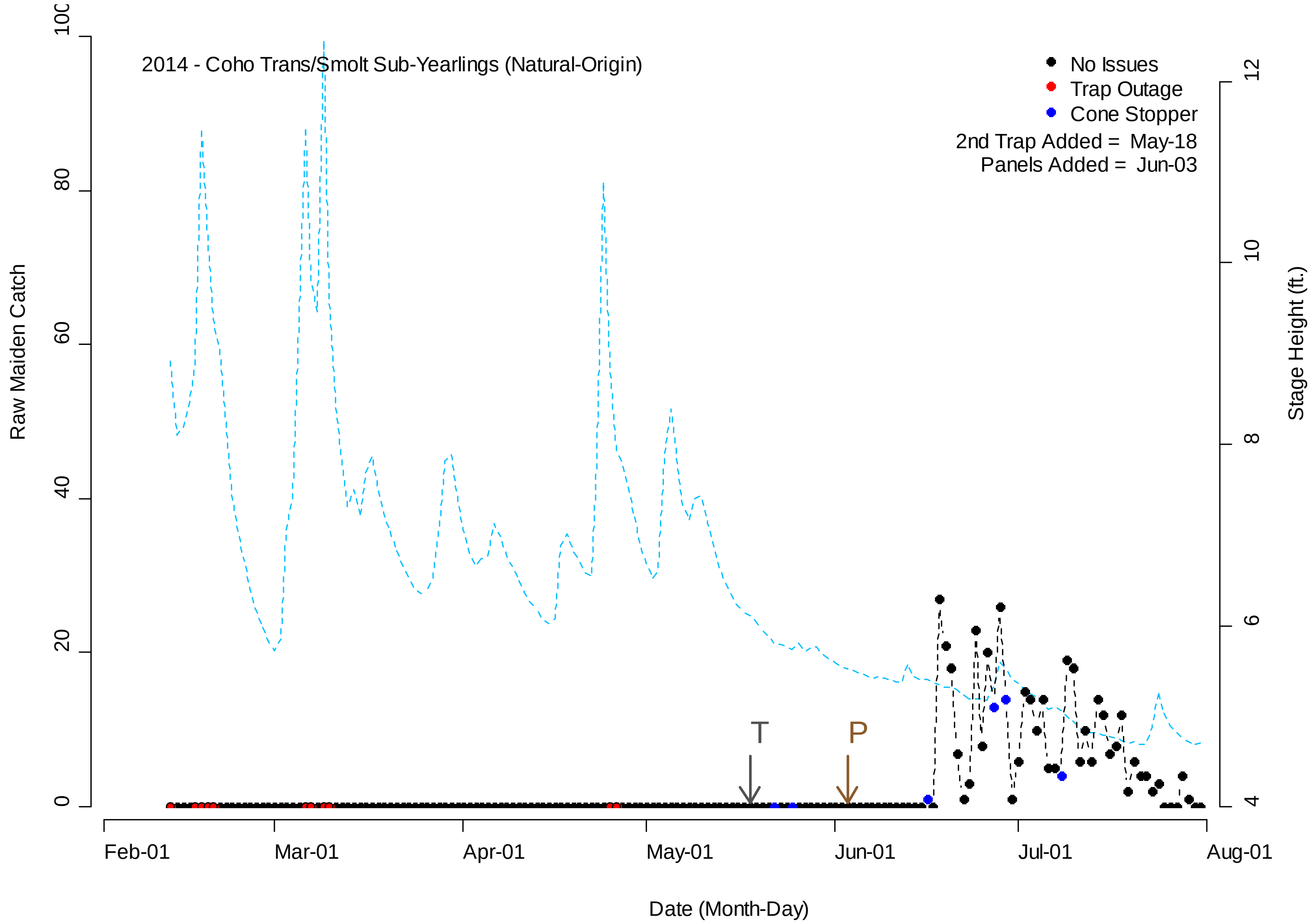

Figure B52. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2014.

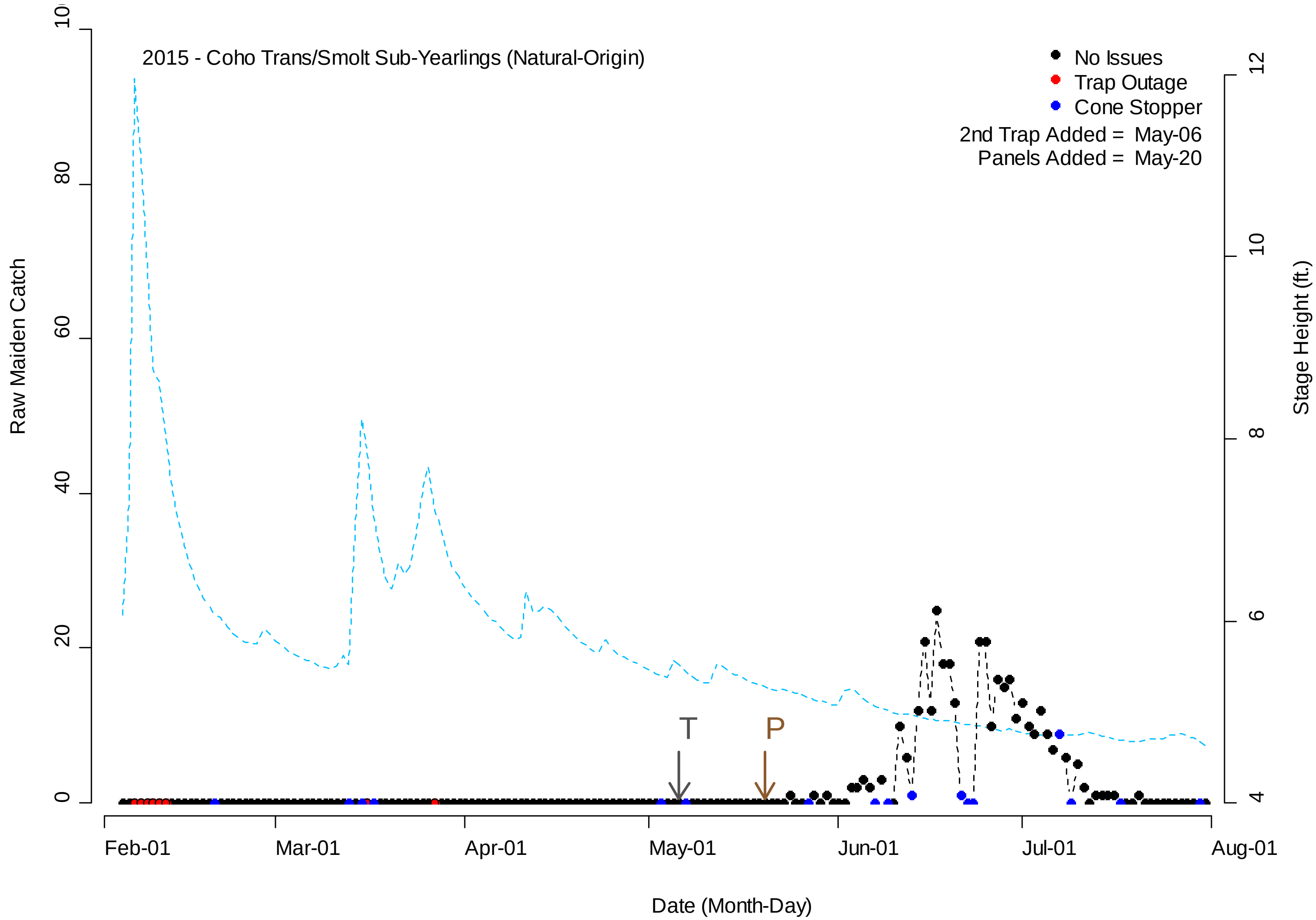

Figure B53. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2015.

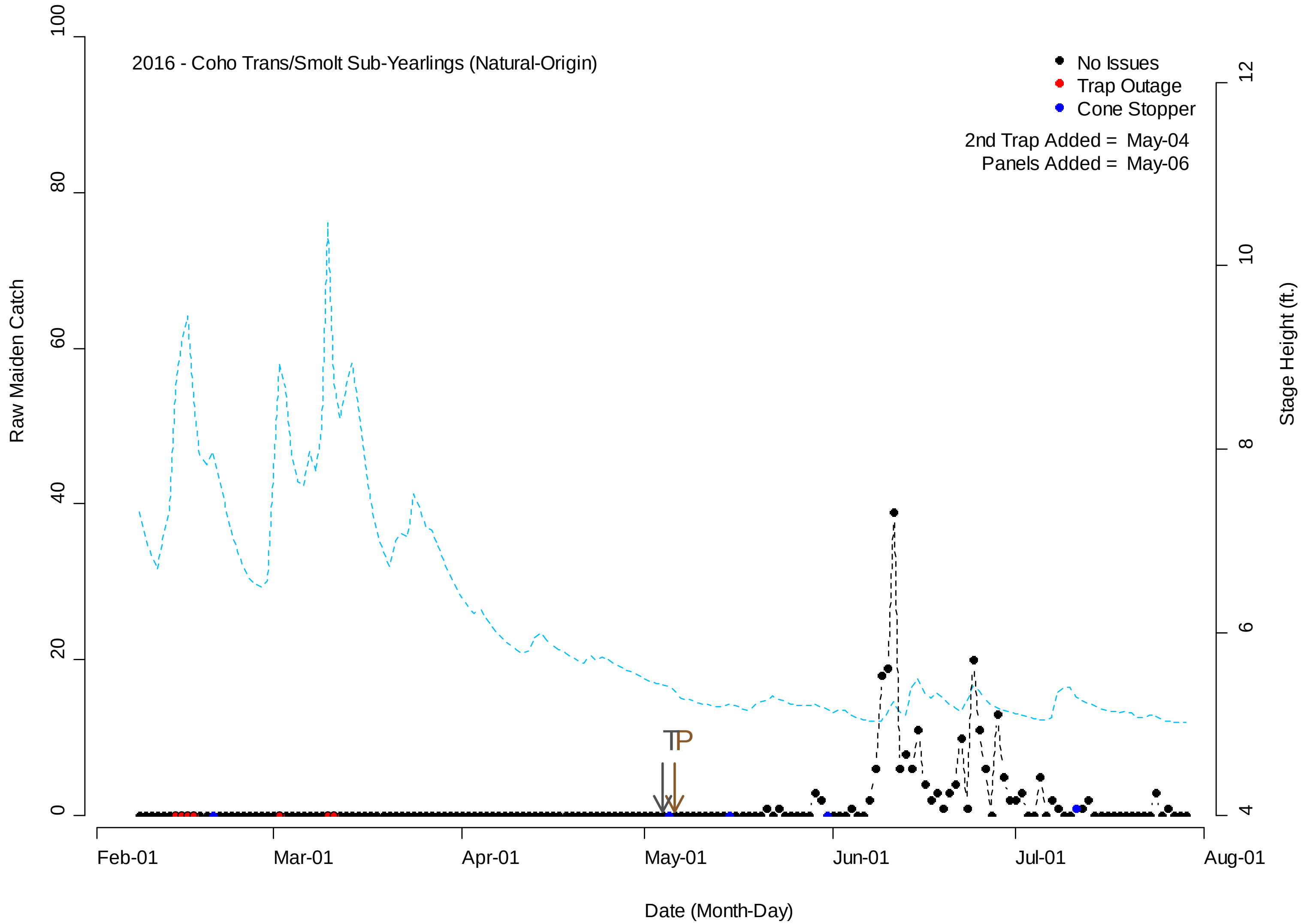

Figure B54. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2016.

Coho salmon (Hatchery-Origin, Transitional/Smolt, Yearling)

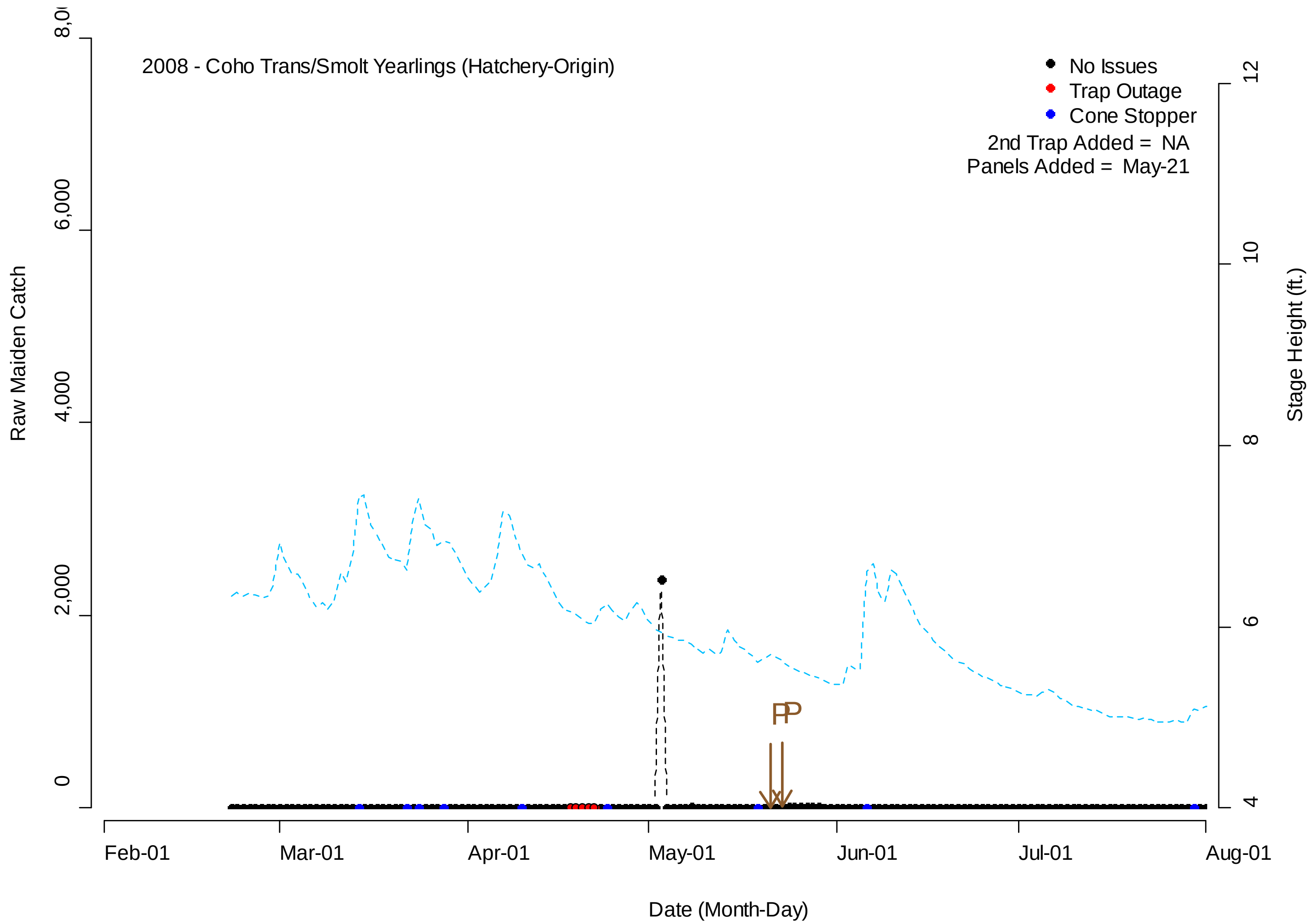

Figure B55. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2008.

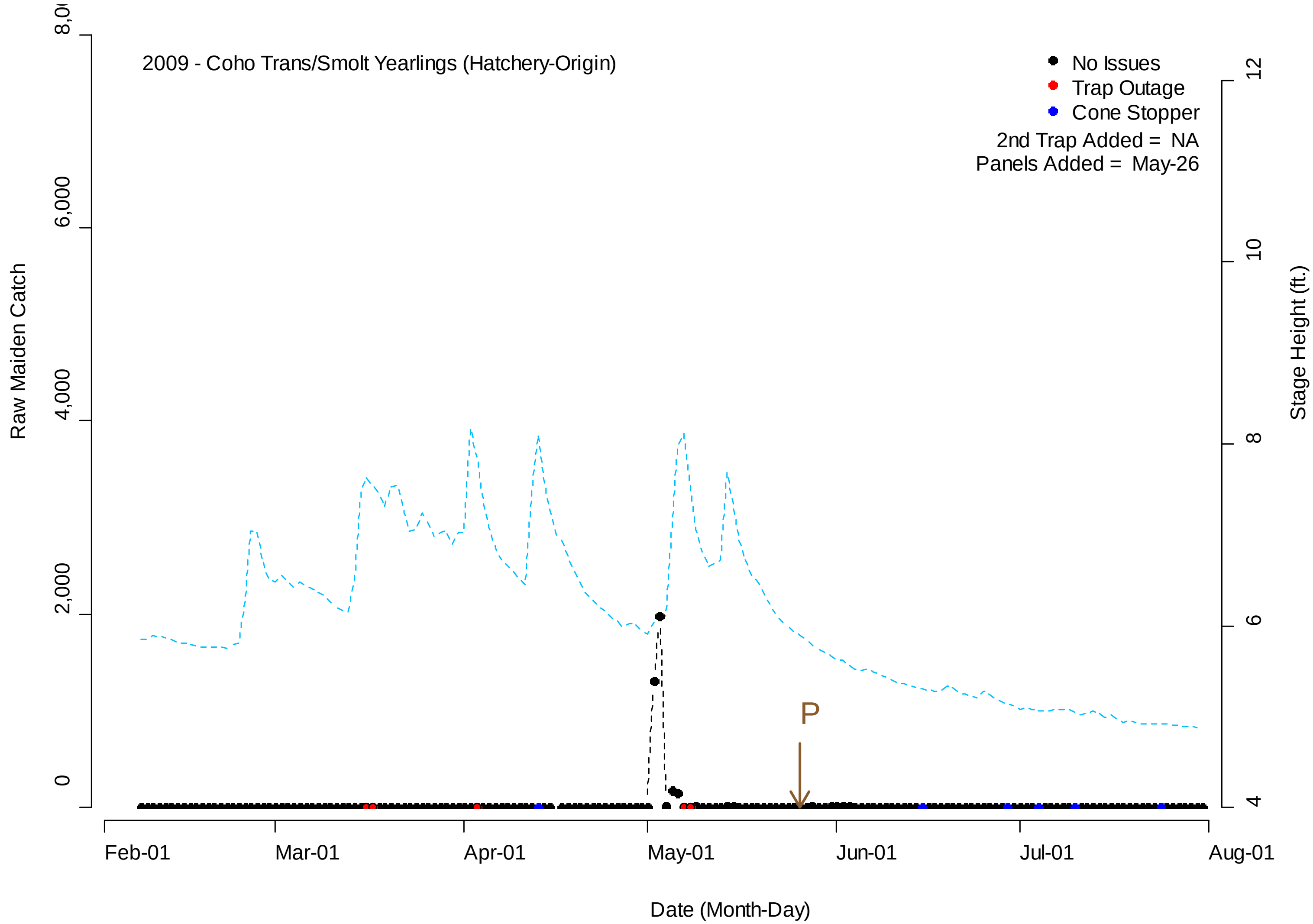

Figure B56. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2009.

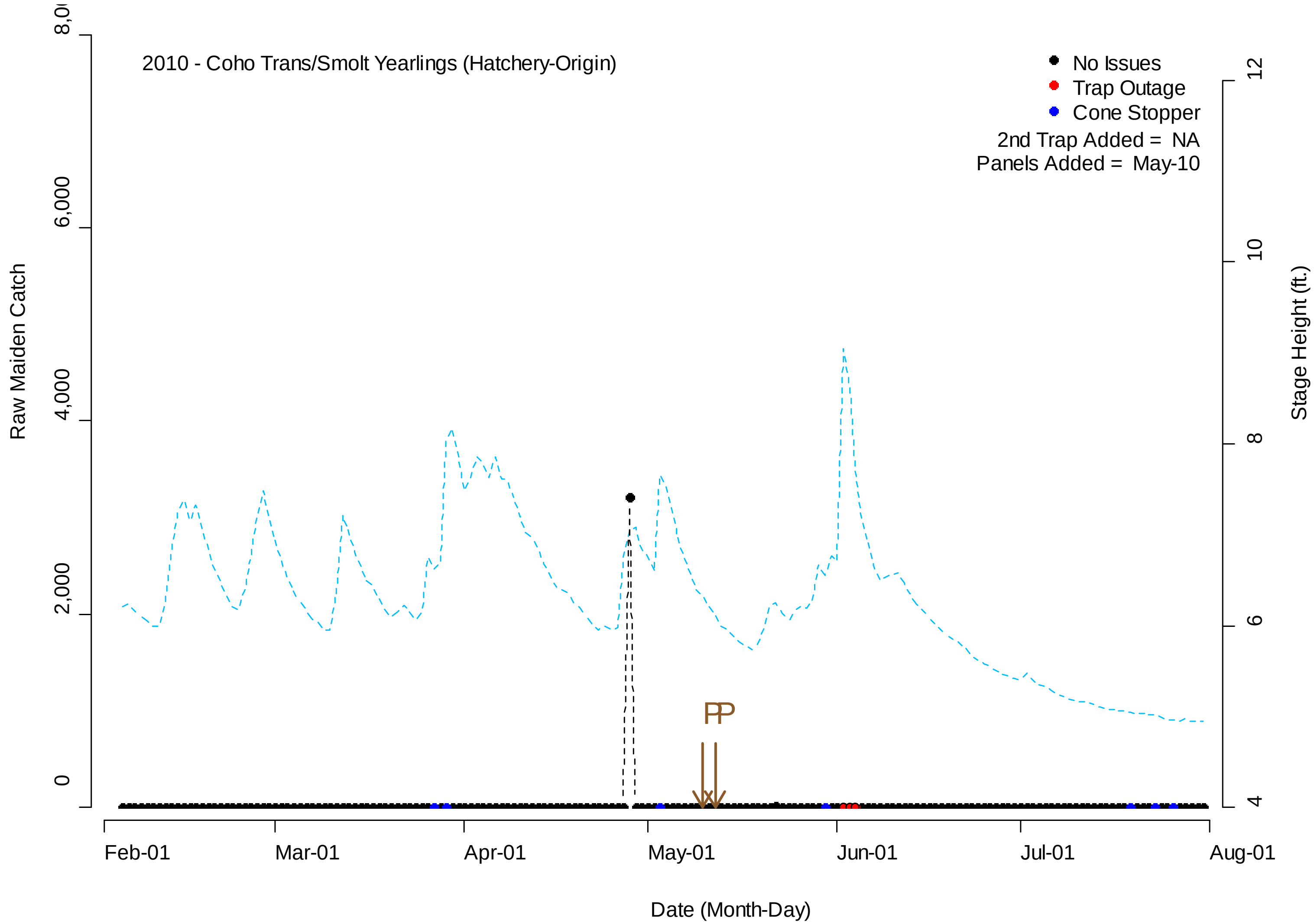

Figure B57. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2010.

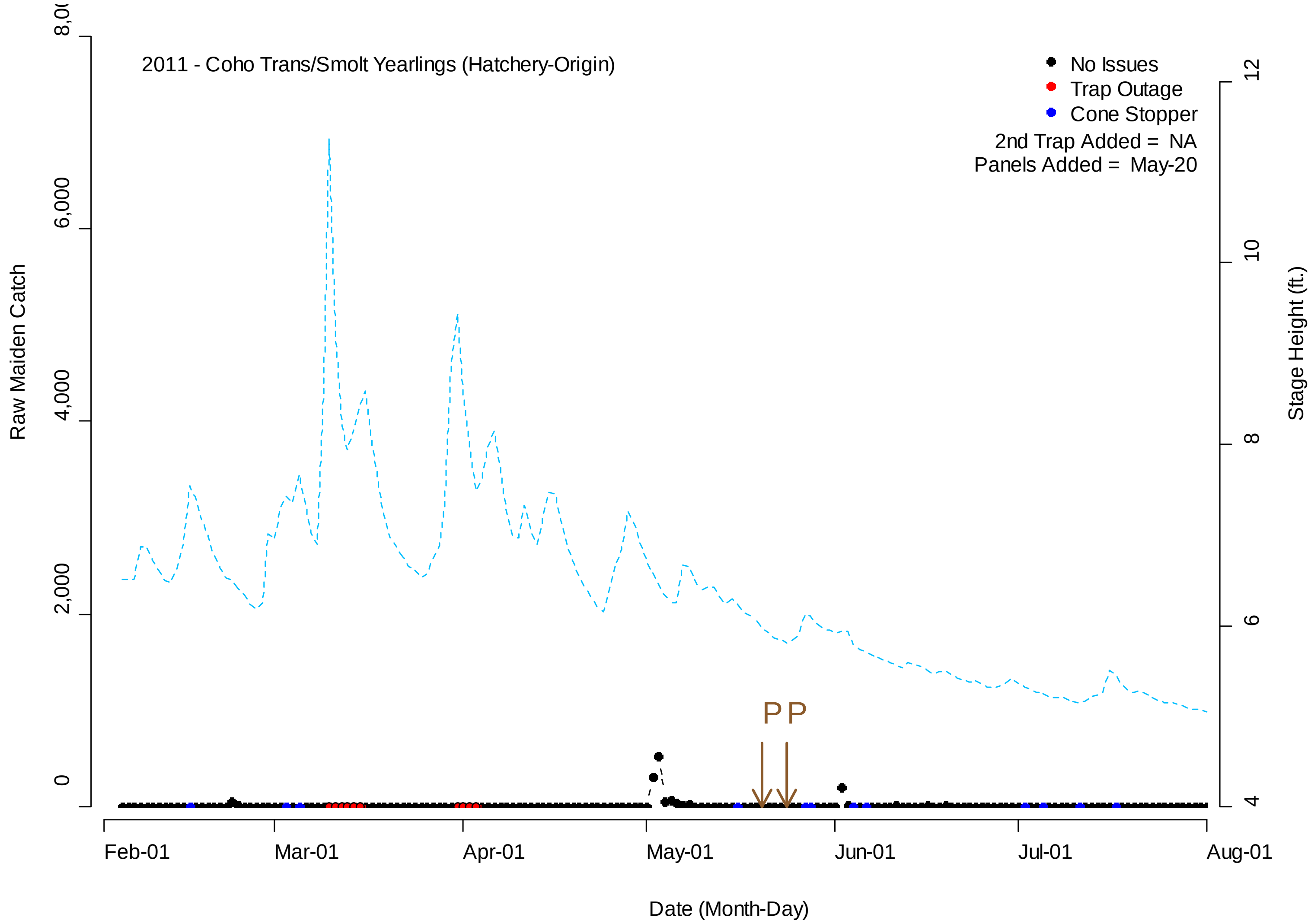

Figure B58. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2011.

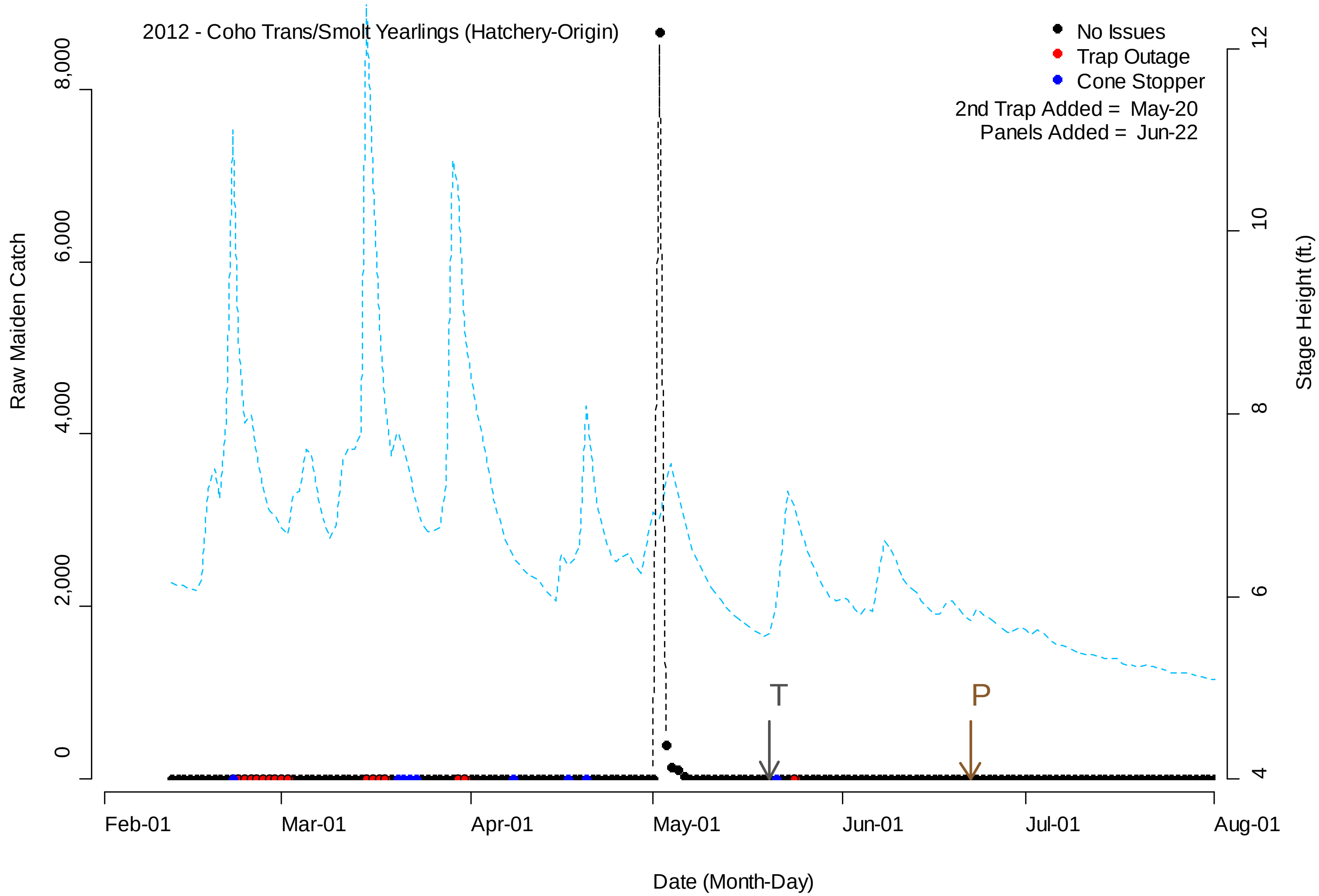

Figure B59. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2012.

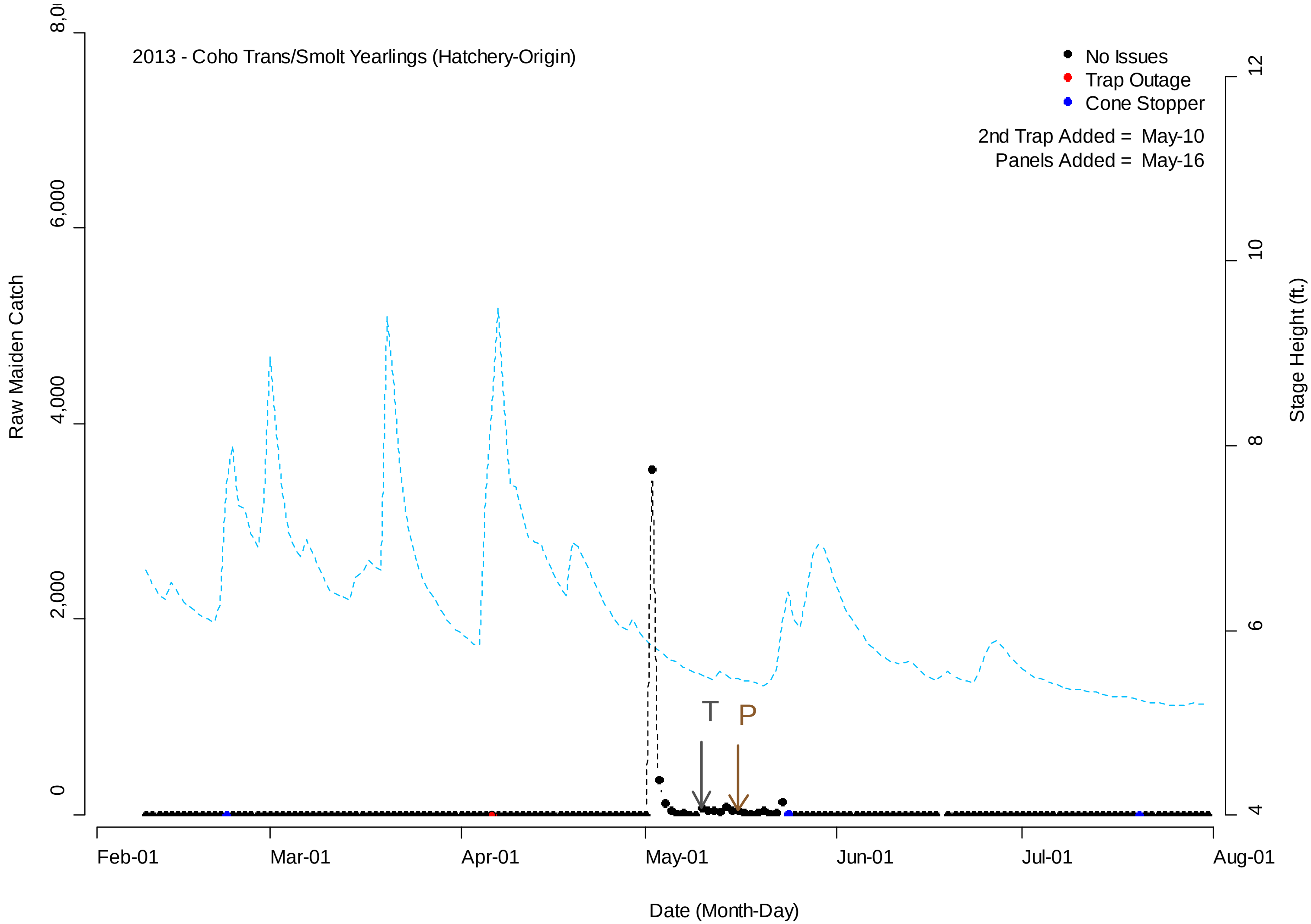

Figure B60. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2013.

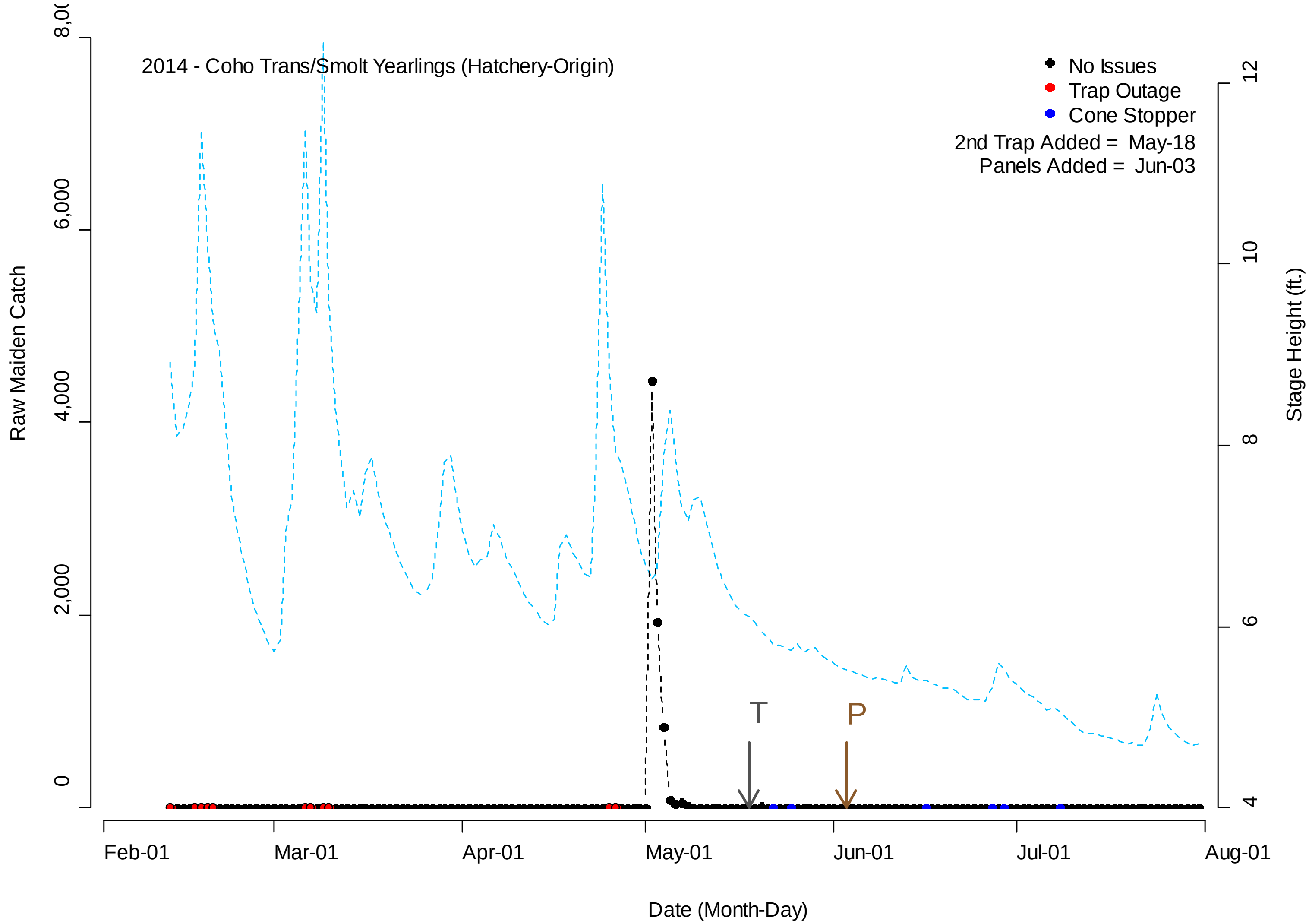

Figure B61. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2014.

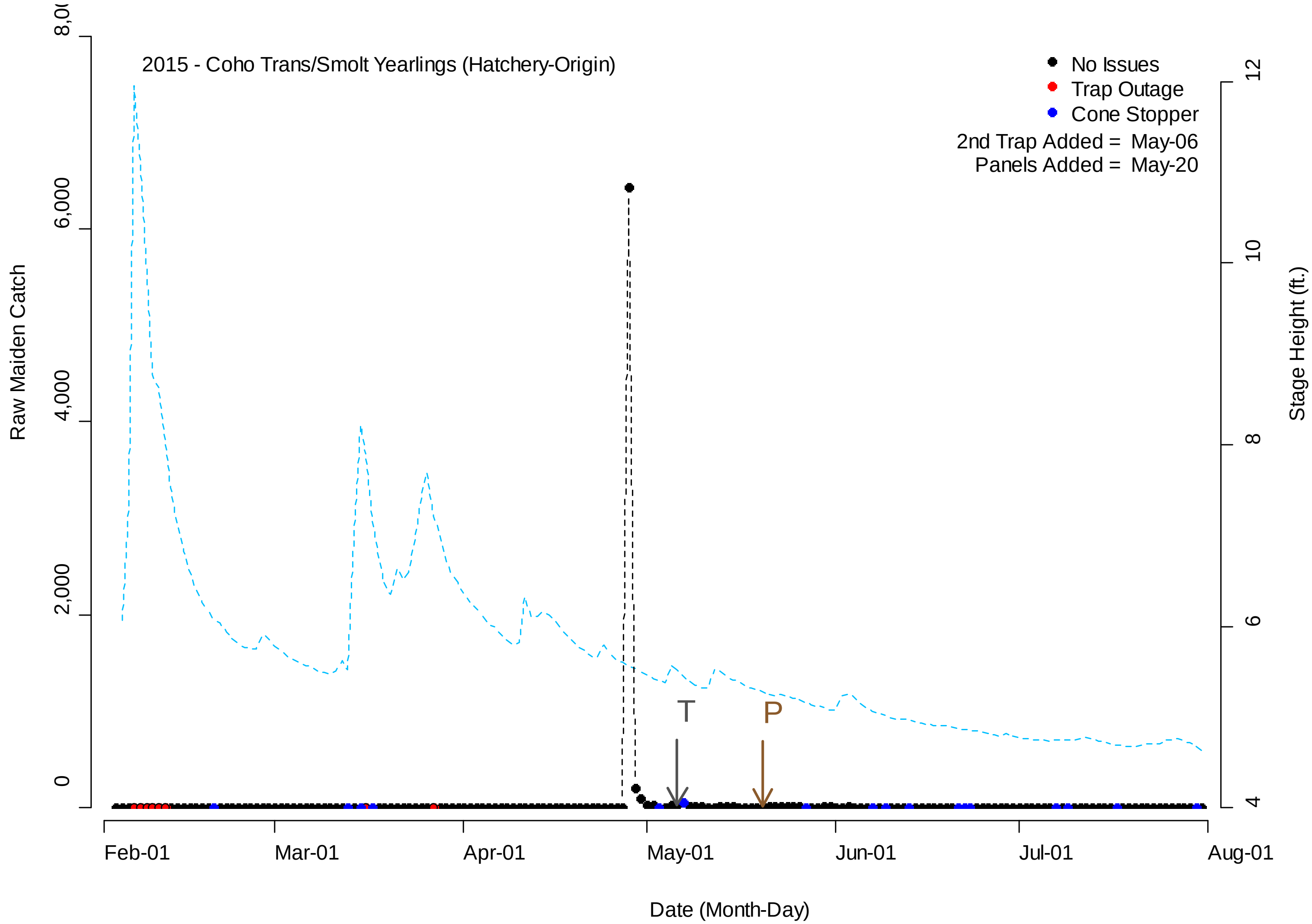

Figure B62. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2015.

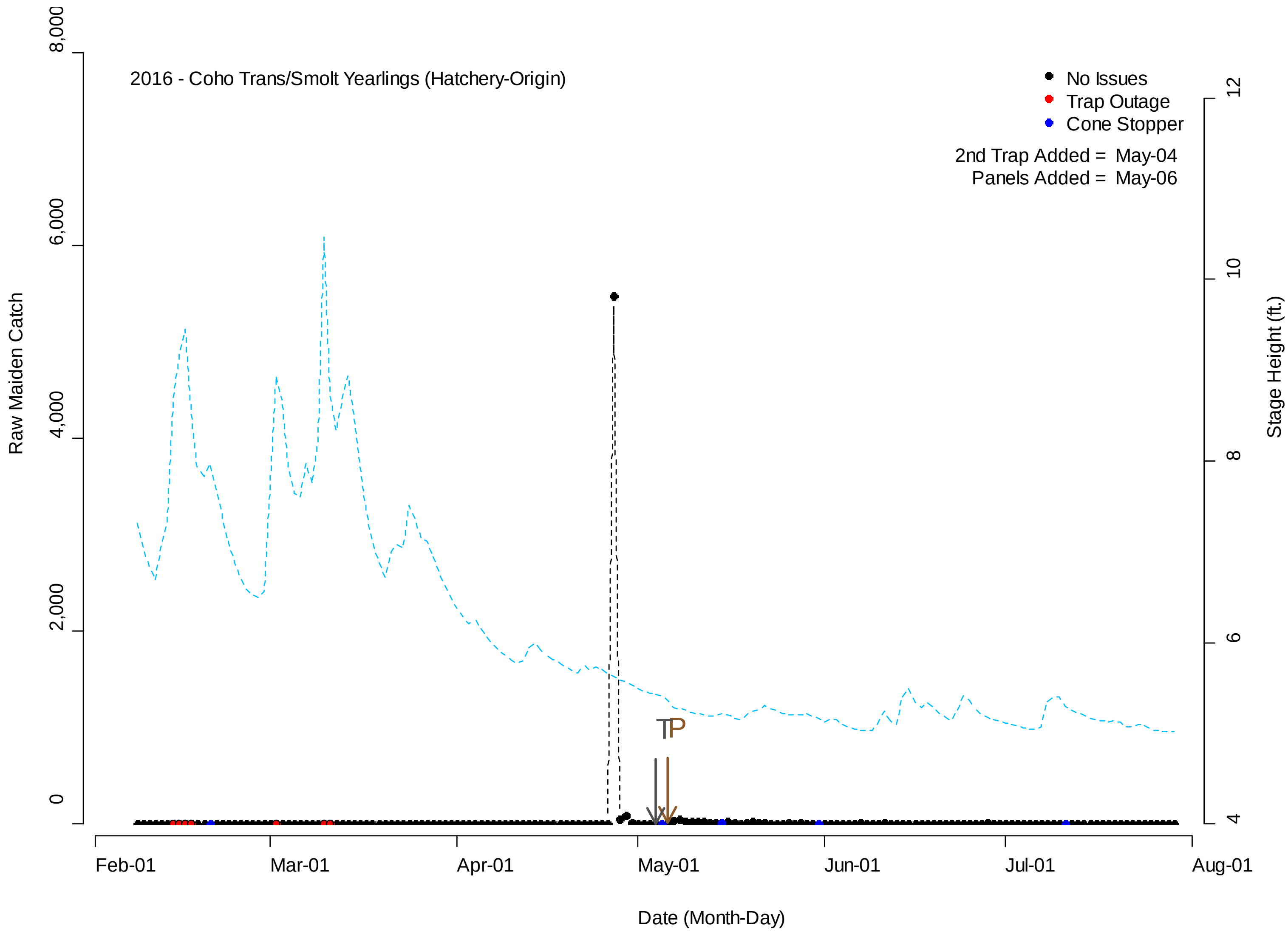

Figure B63. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2016.

Steelhead (Natural-Origin, Transitional/Smolt, Yearling)

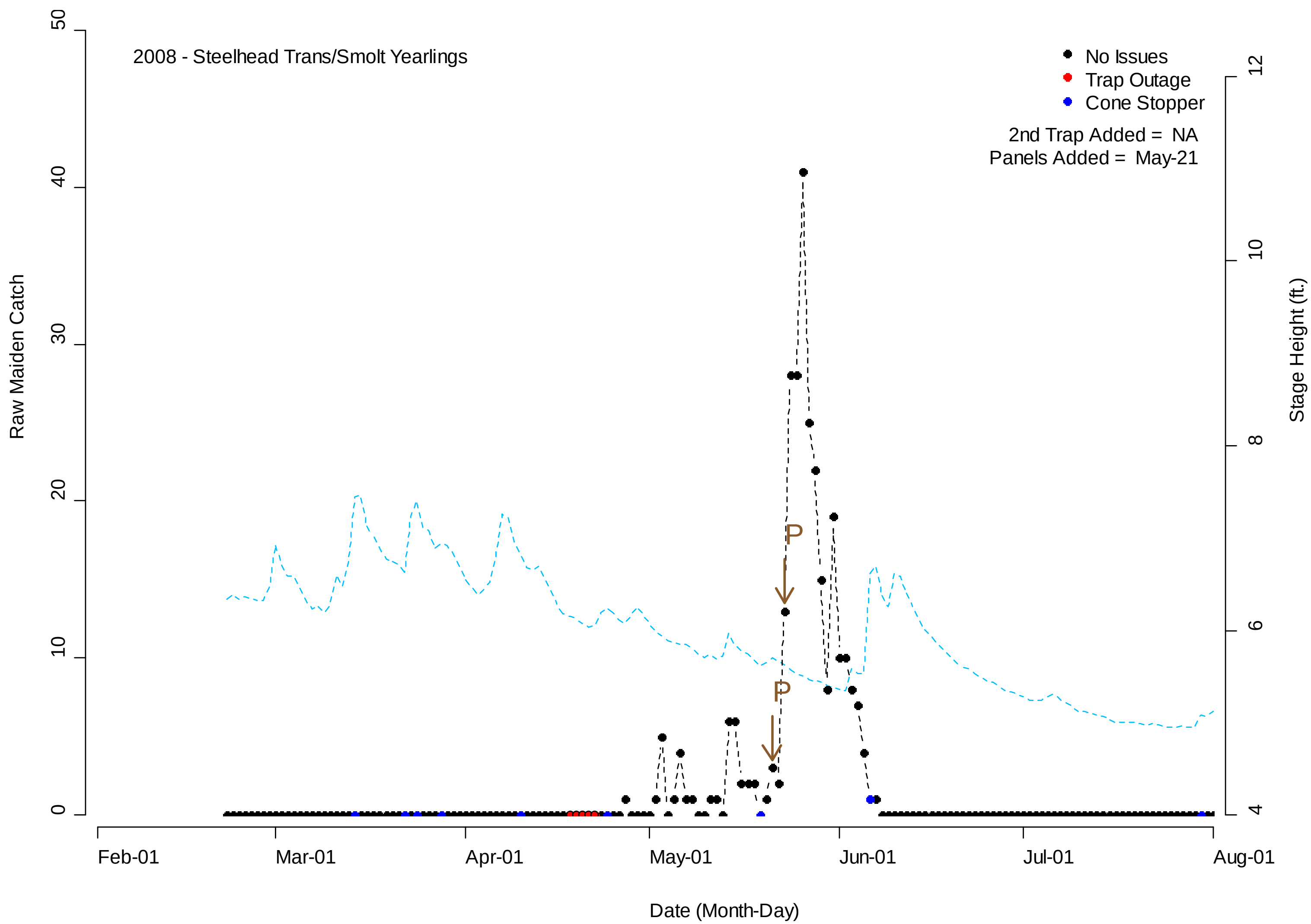

Figure B64. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2008.

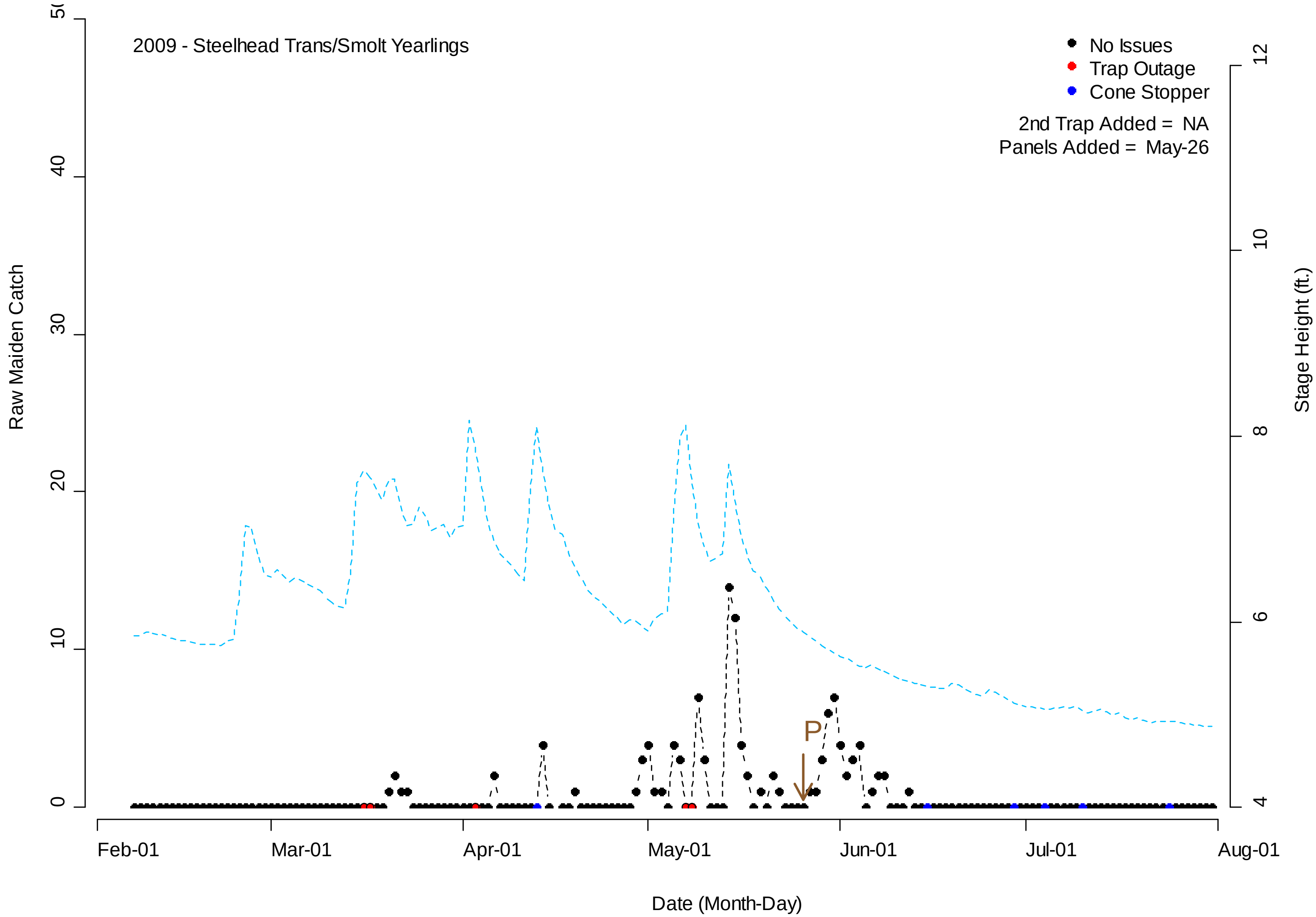

Figure B65. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2009.

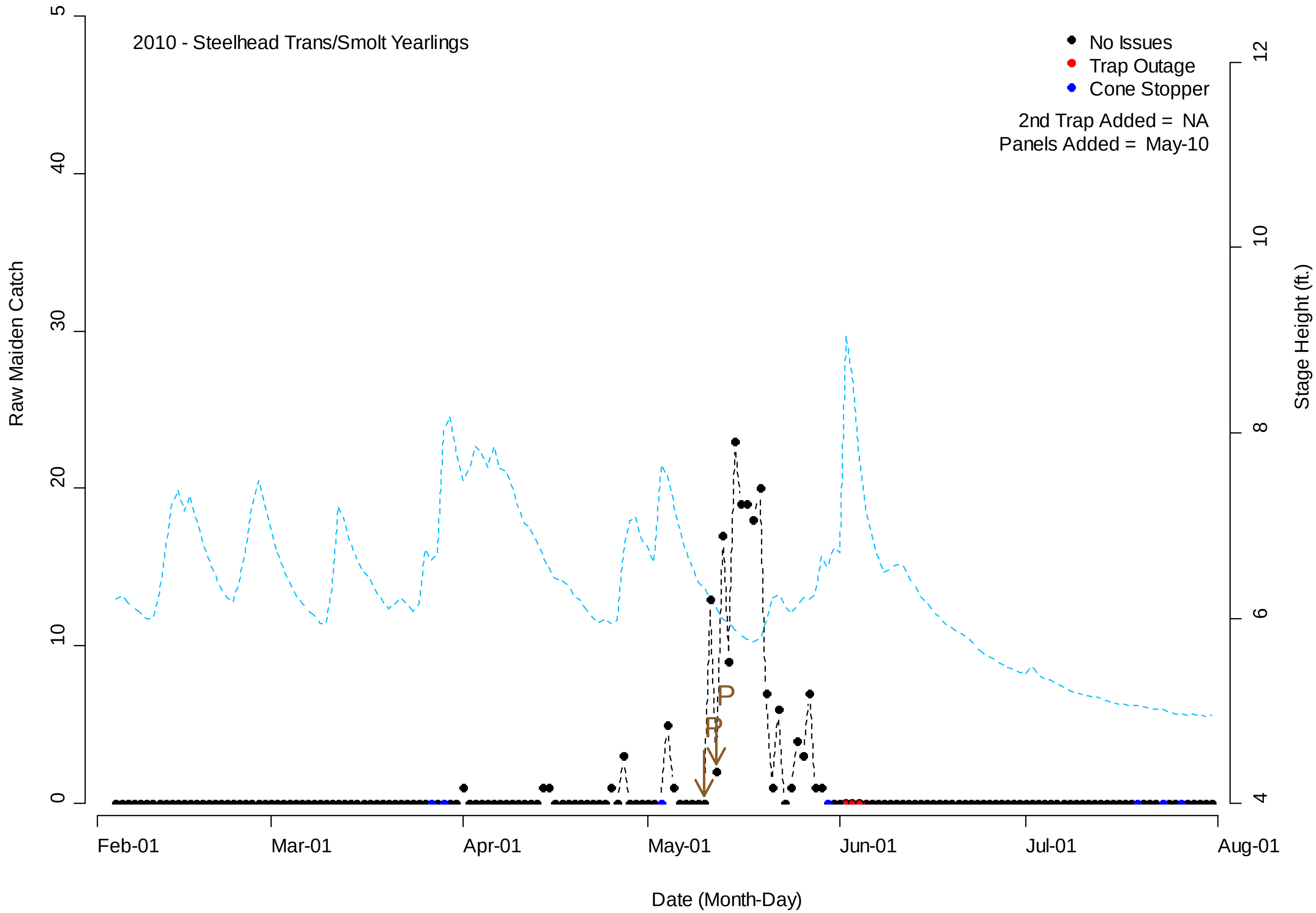

Figure B66. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2010.

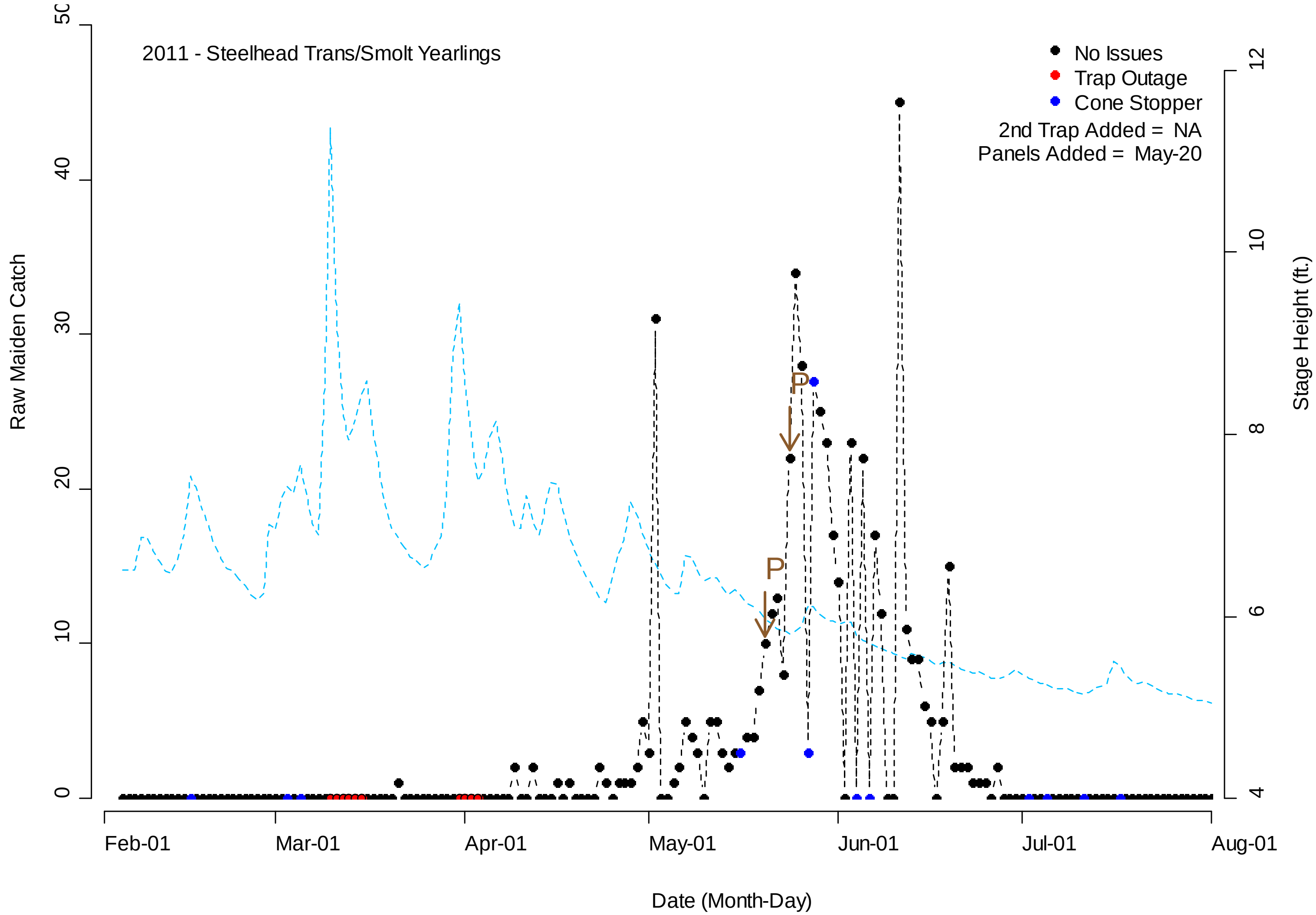

Figure B67. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2011.

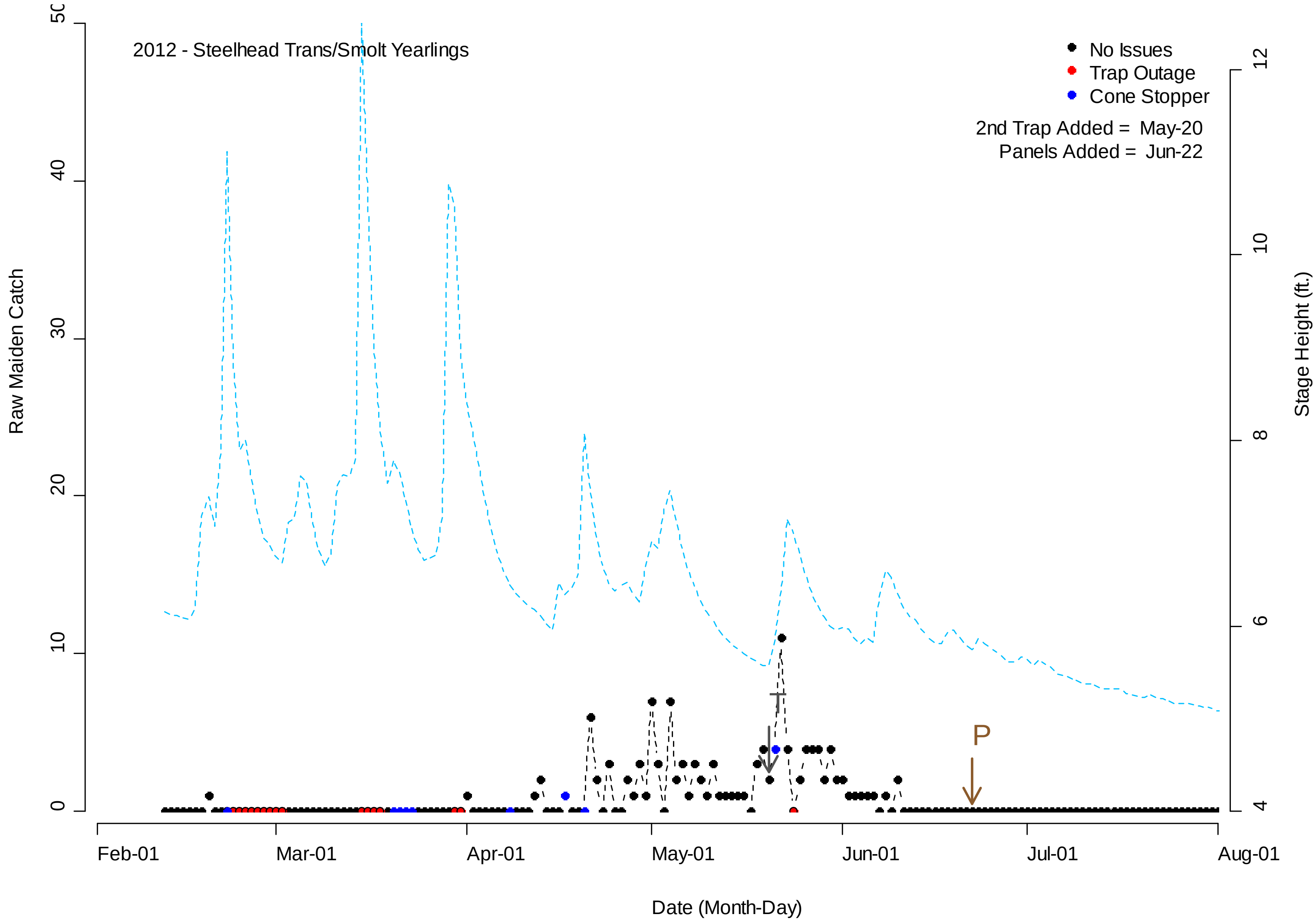

Figure B68. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2012.

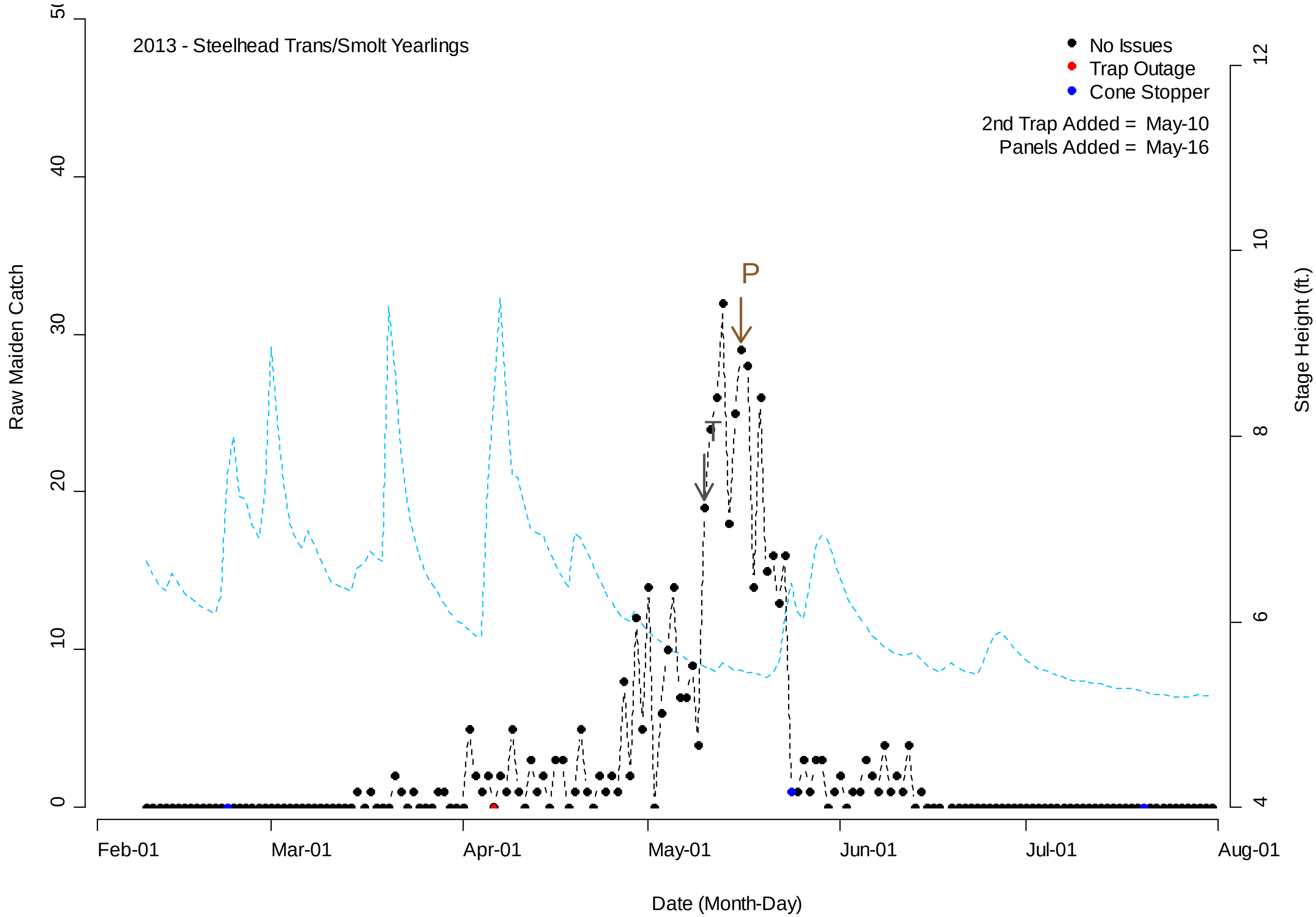

Figure B69. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2013.

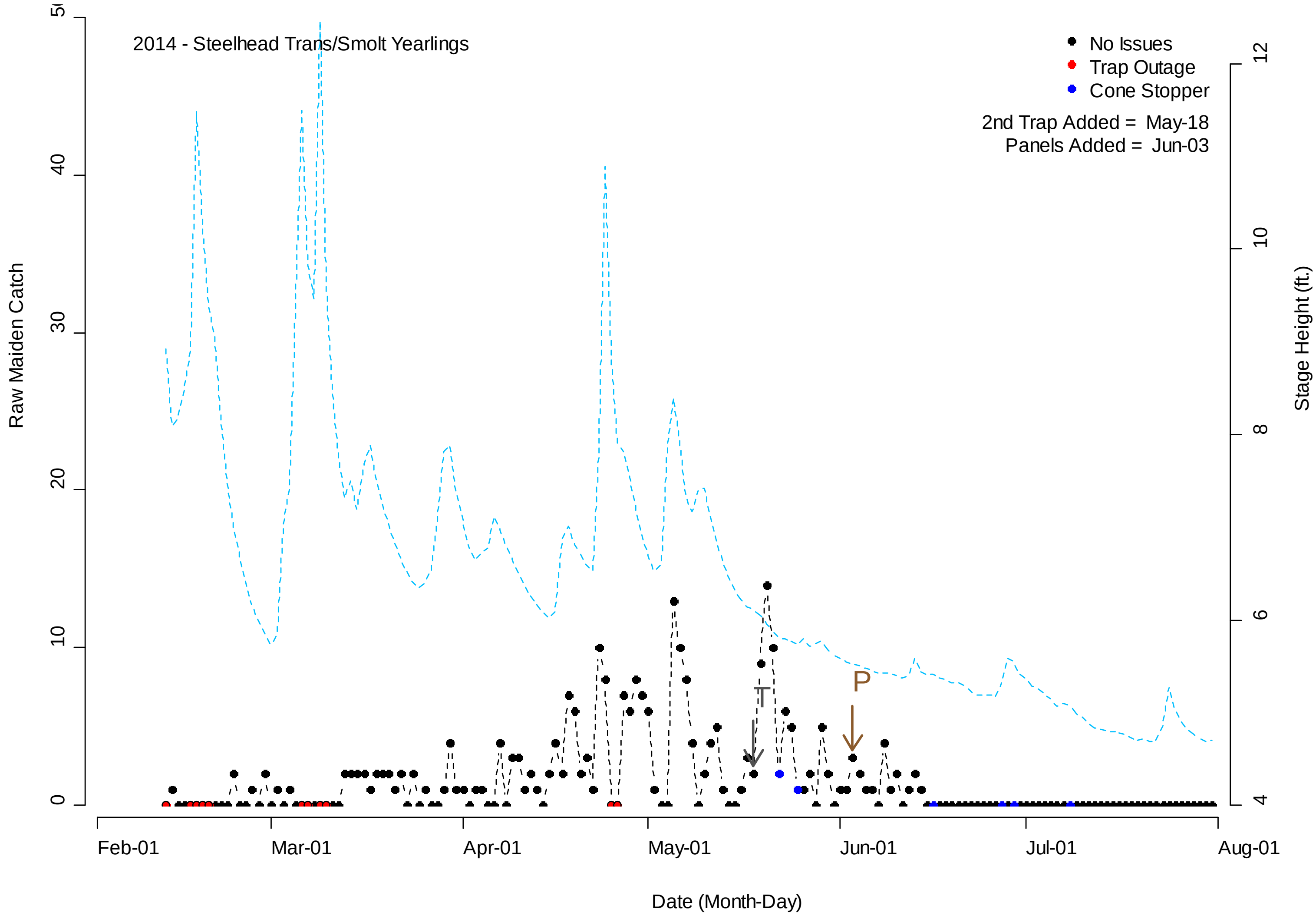

Figure B70. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2014.

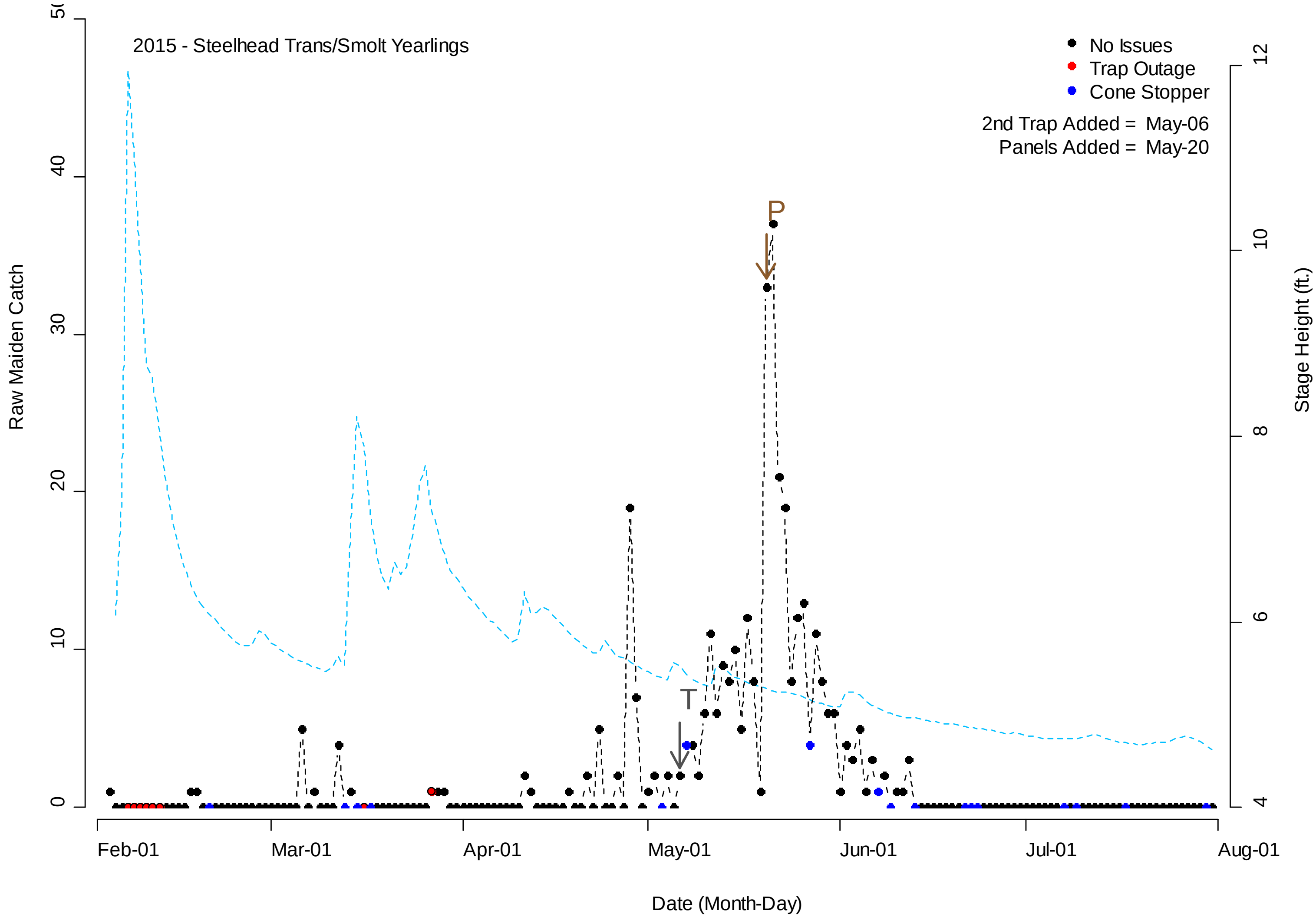

Figure B71. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2015.

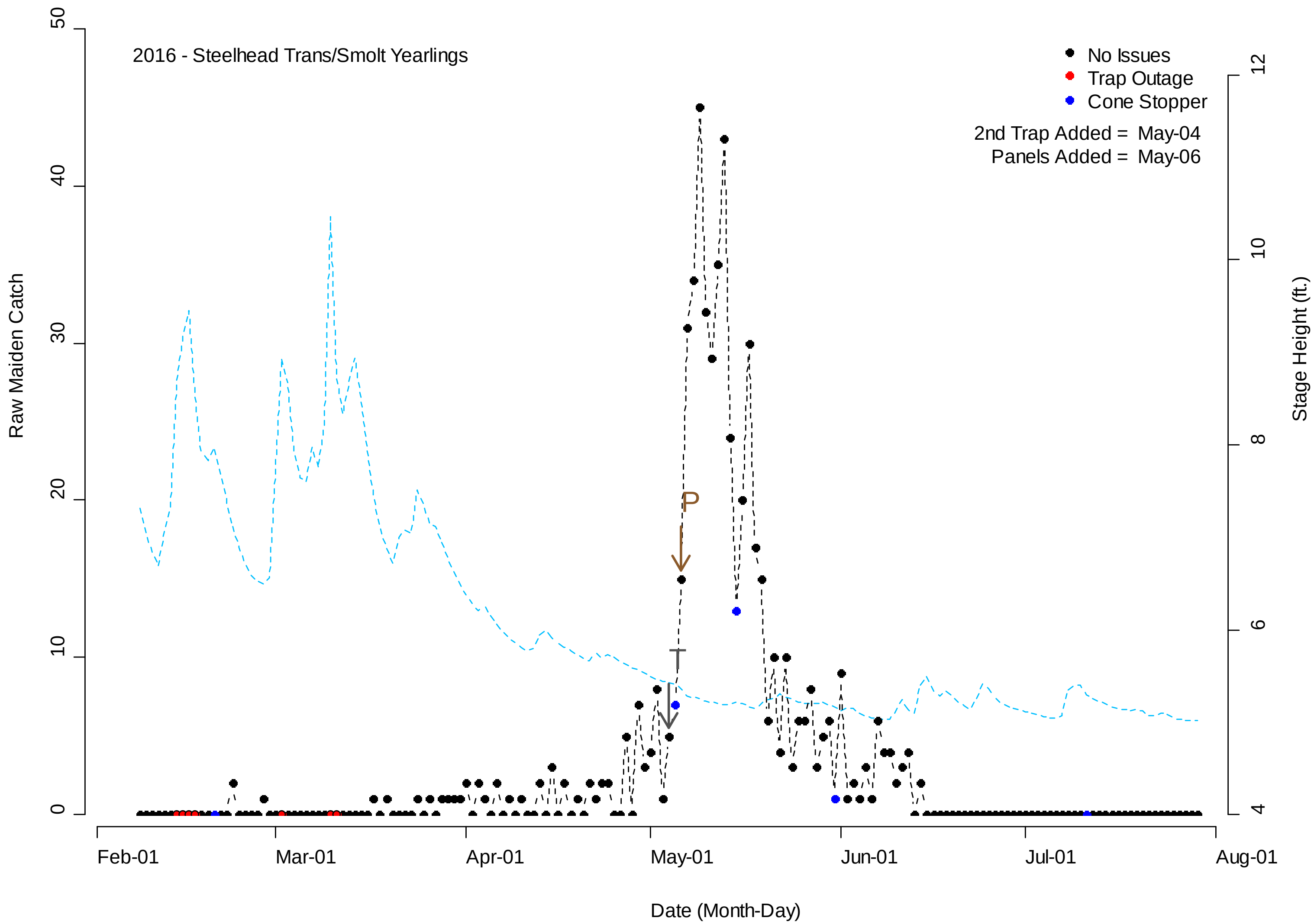

Figure B72. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2016.

Steelhead (Hatchery-Origin, Transitional/Smolt, Yearling)

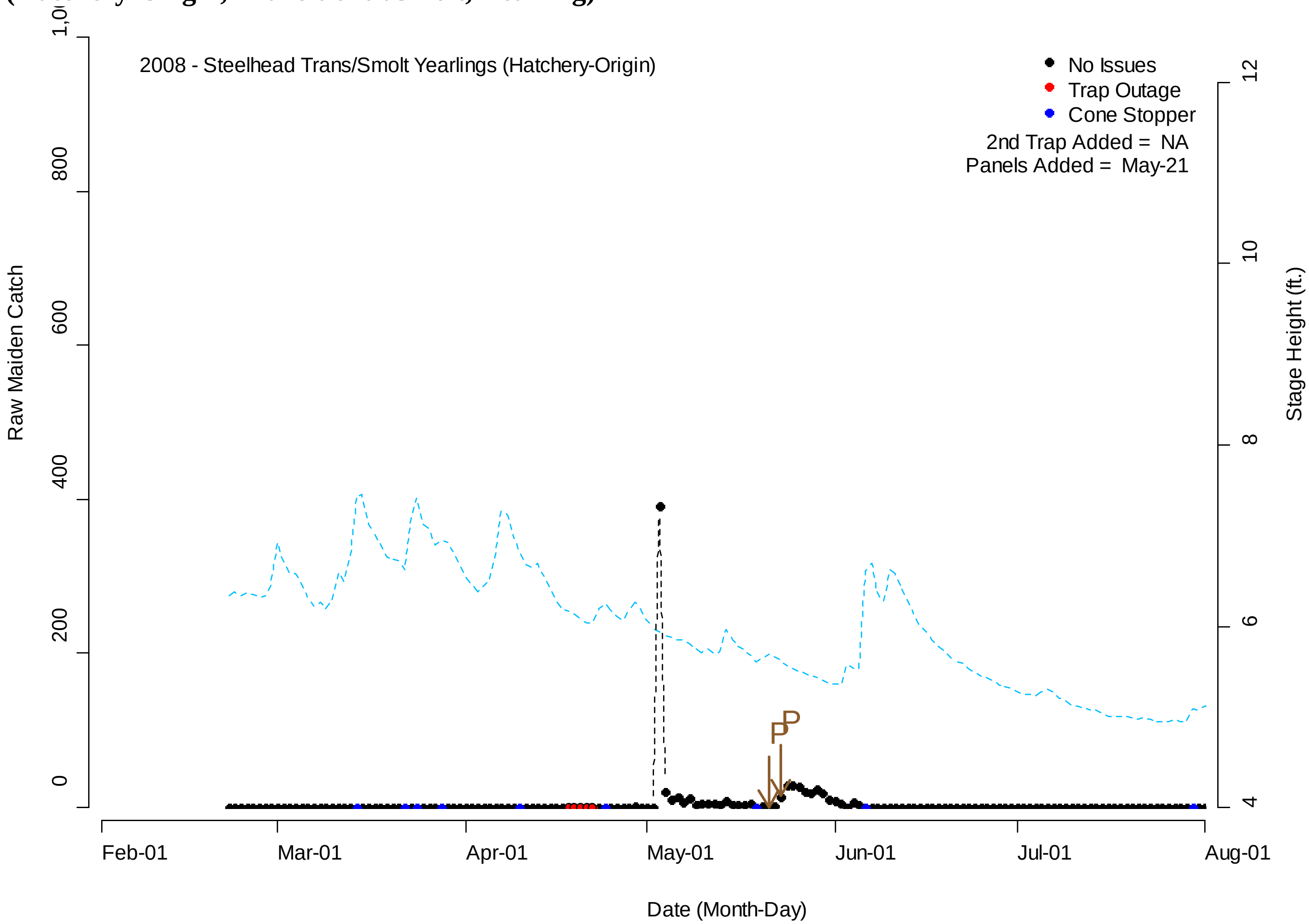

Figure B73. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for hatchery-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2008.

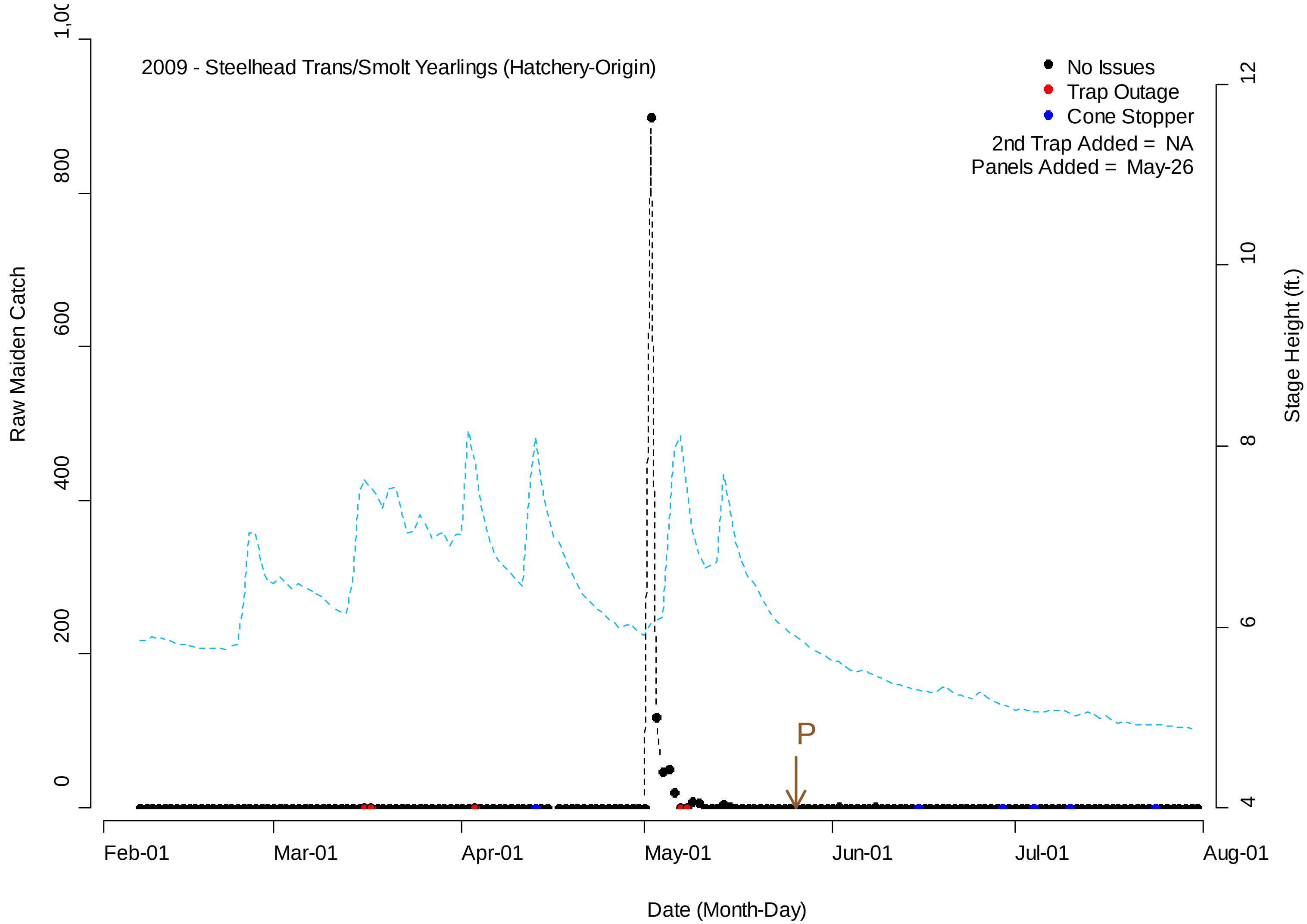

Figure B74. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for hatchery-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2009.

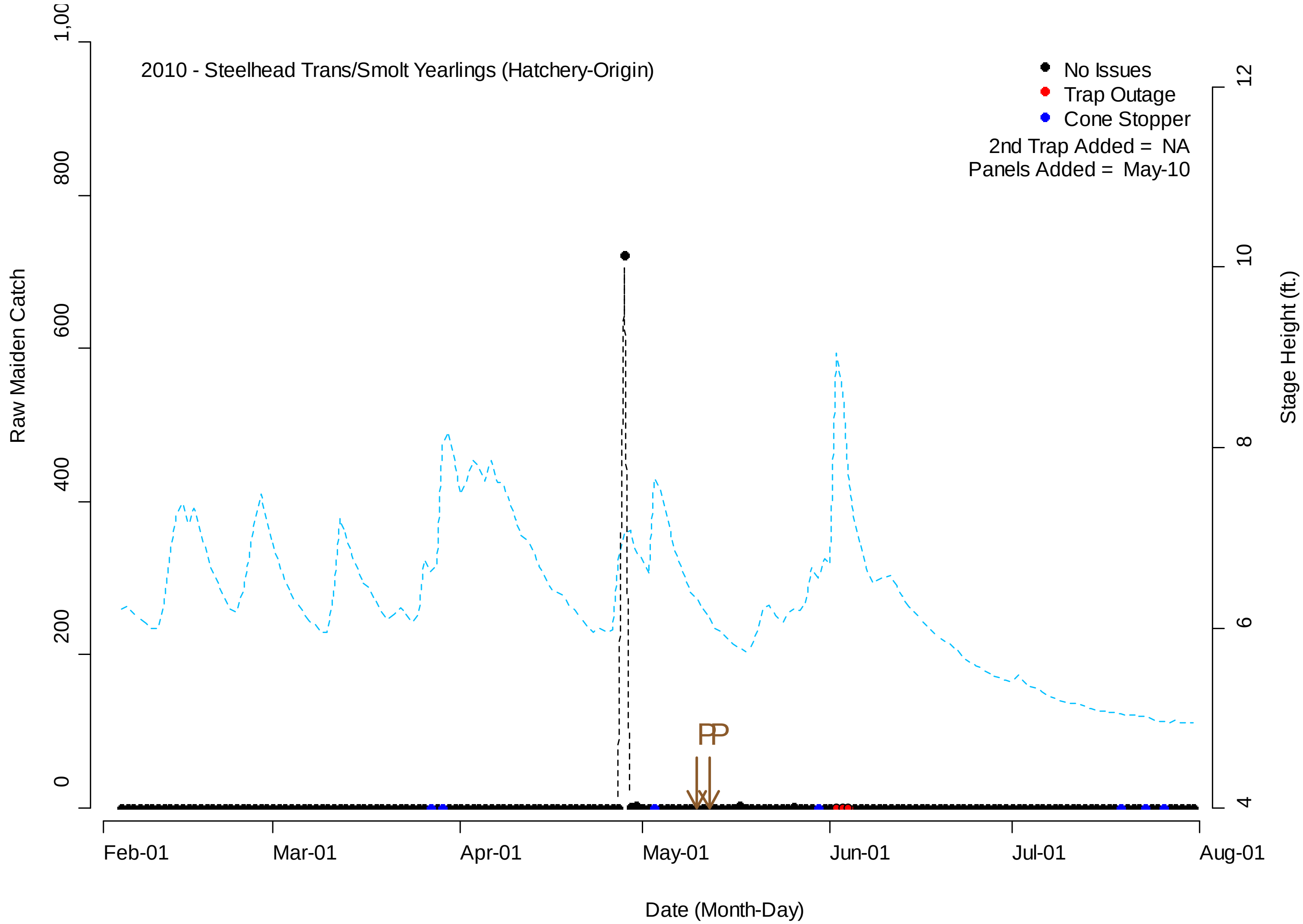

Figure B75. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for hatchery-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2010.

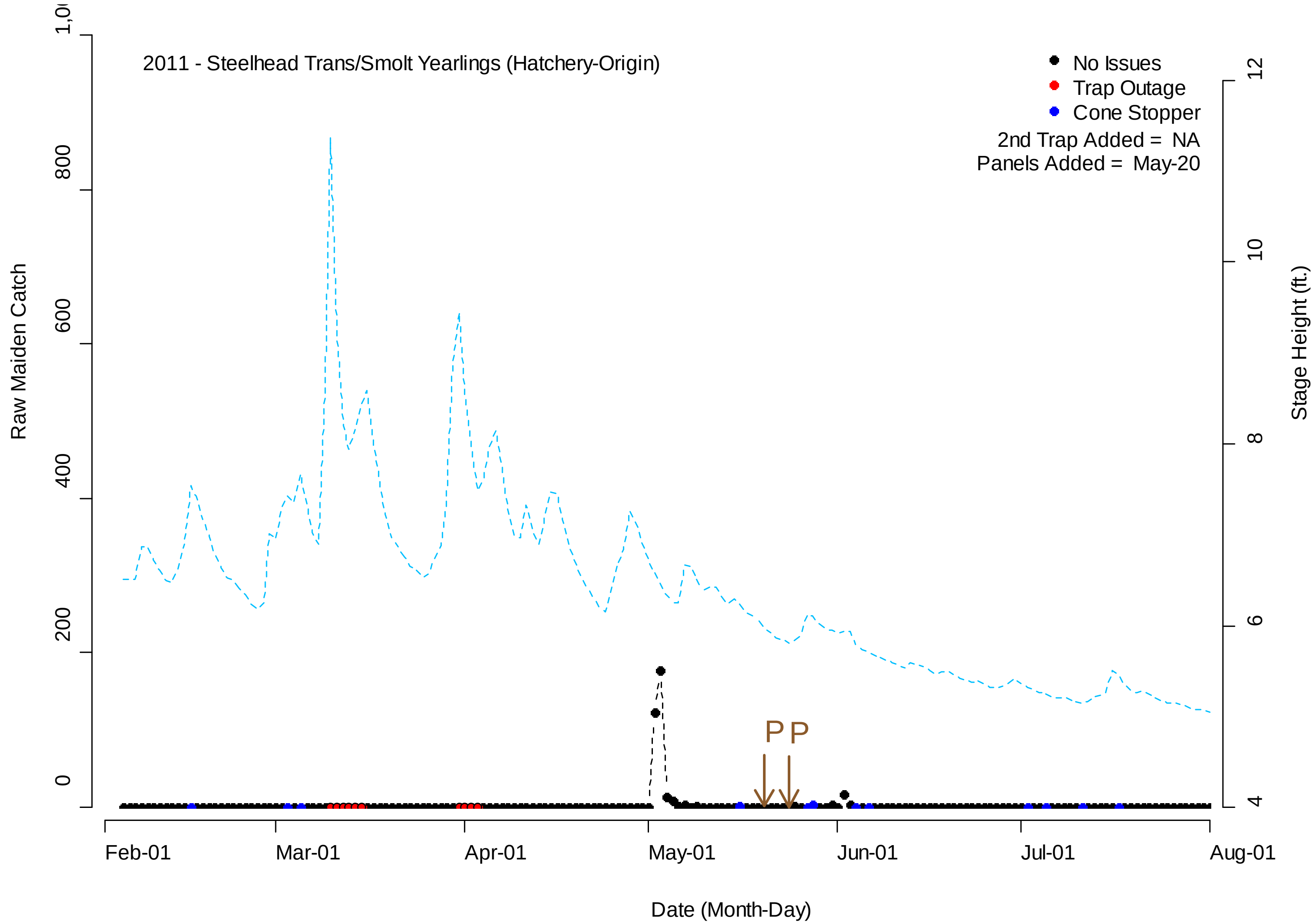

Figure B76. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for hatchery-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2011.

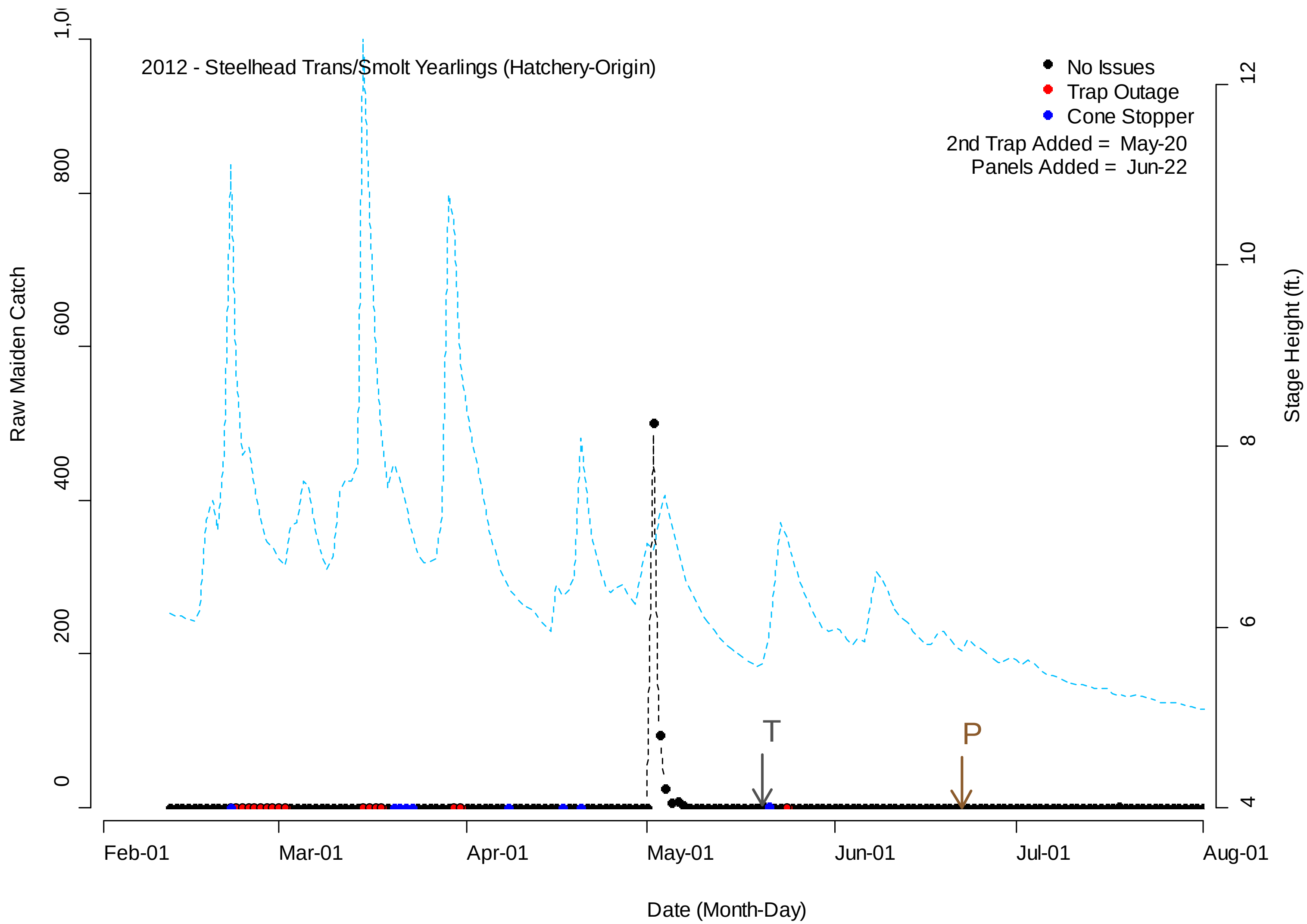

Figure B77. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for hatchery-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2012.

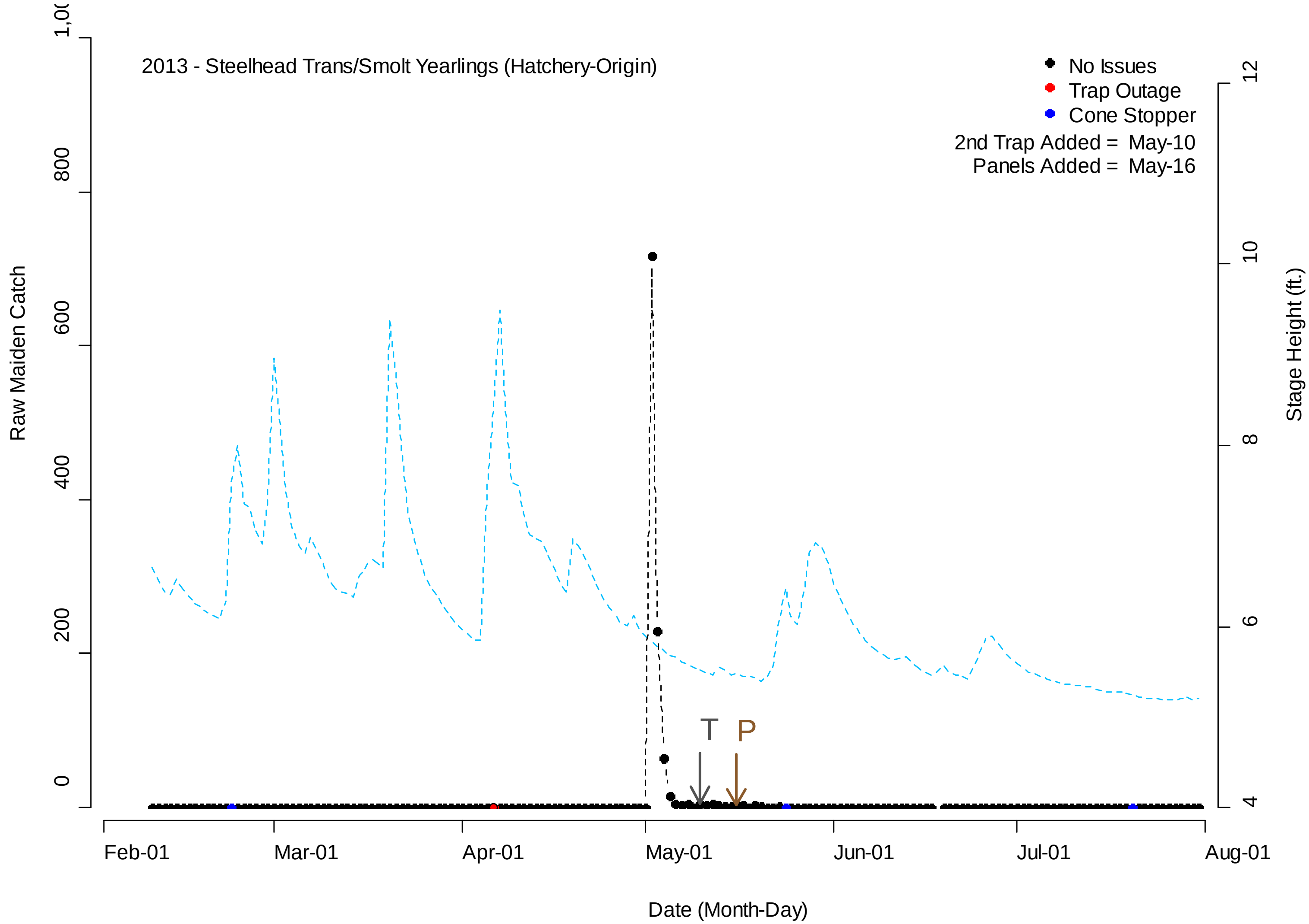

Figure B78. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for hatchery-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2013.

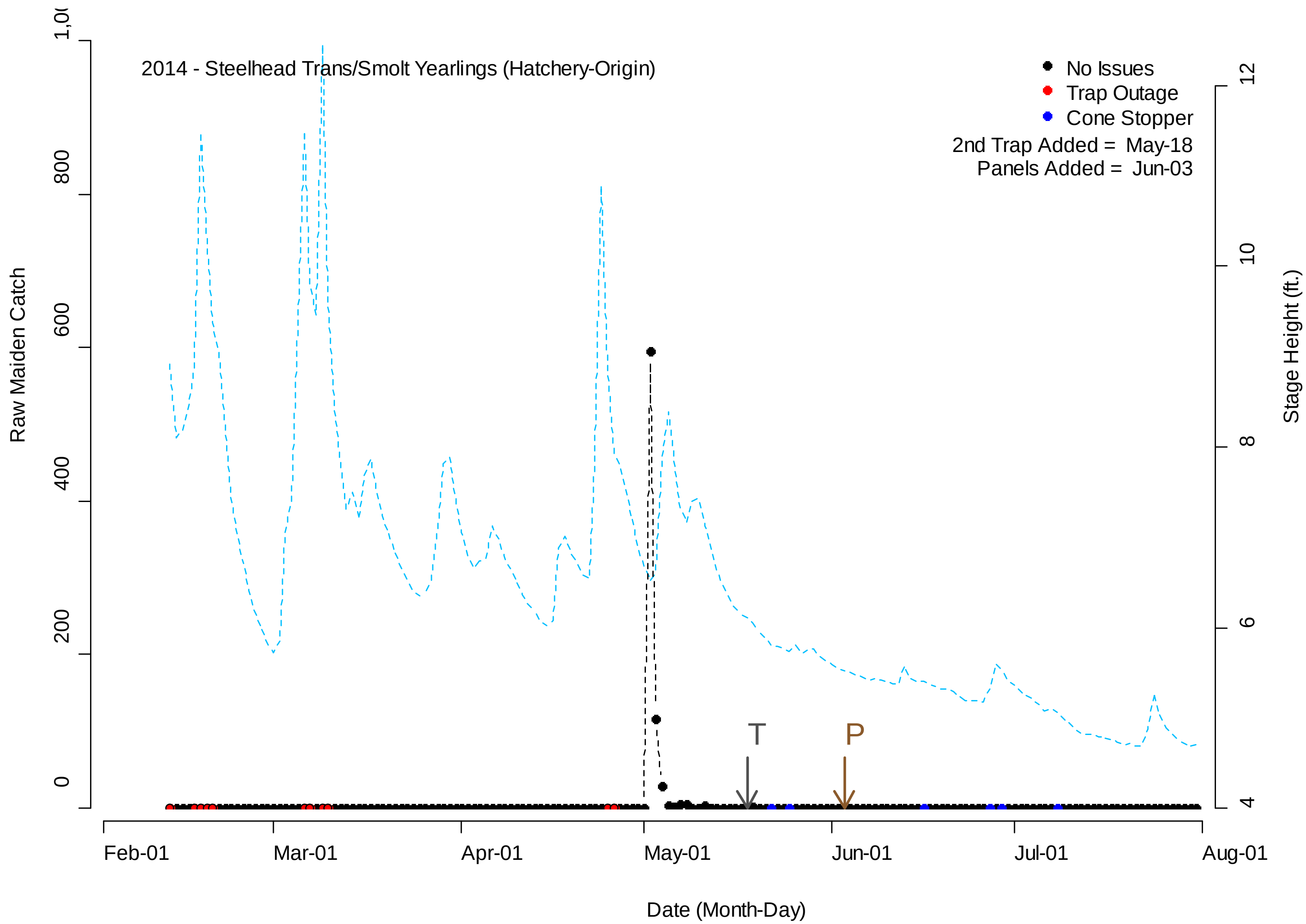

Figure B79. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for hatchery-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2014.

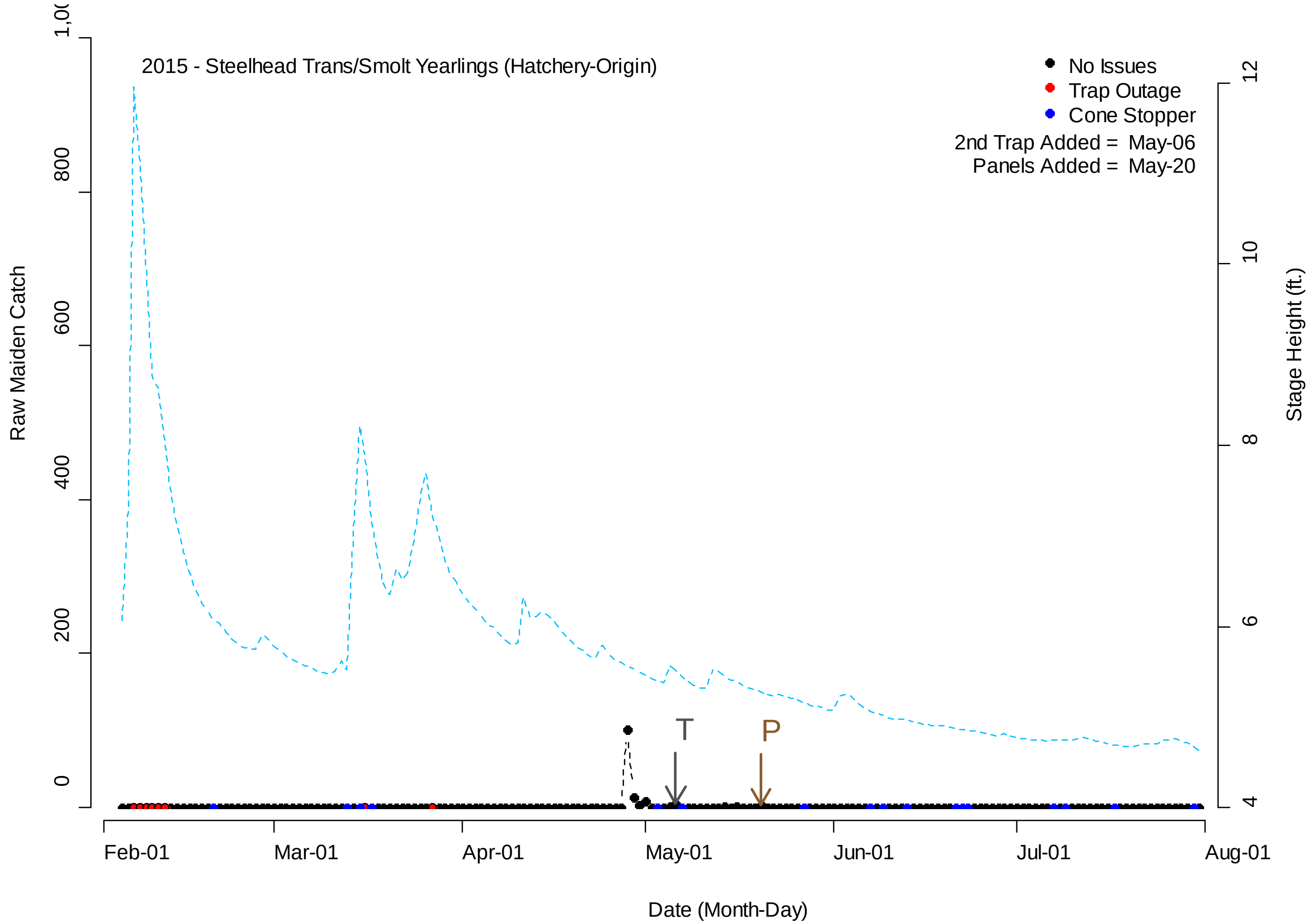

Figure B80. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for hatchery-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2015.

Crazy Johnson

Chum salmon (Natural-Origin, Fry)

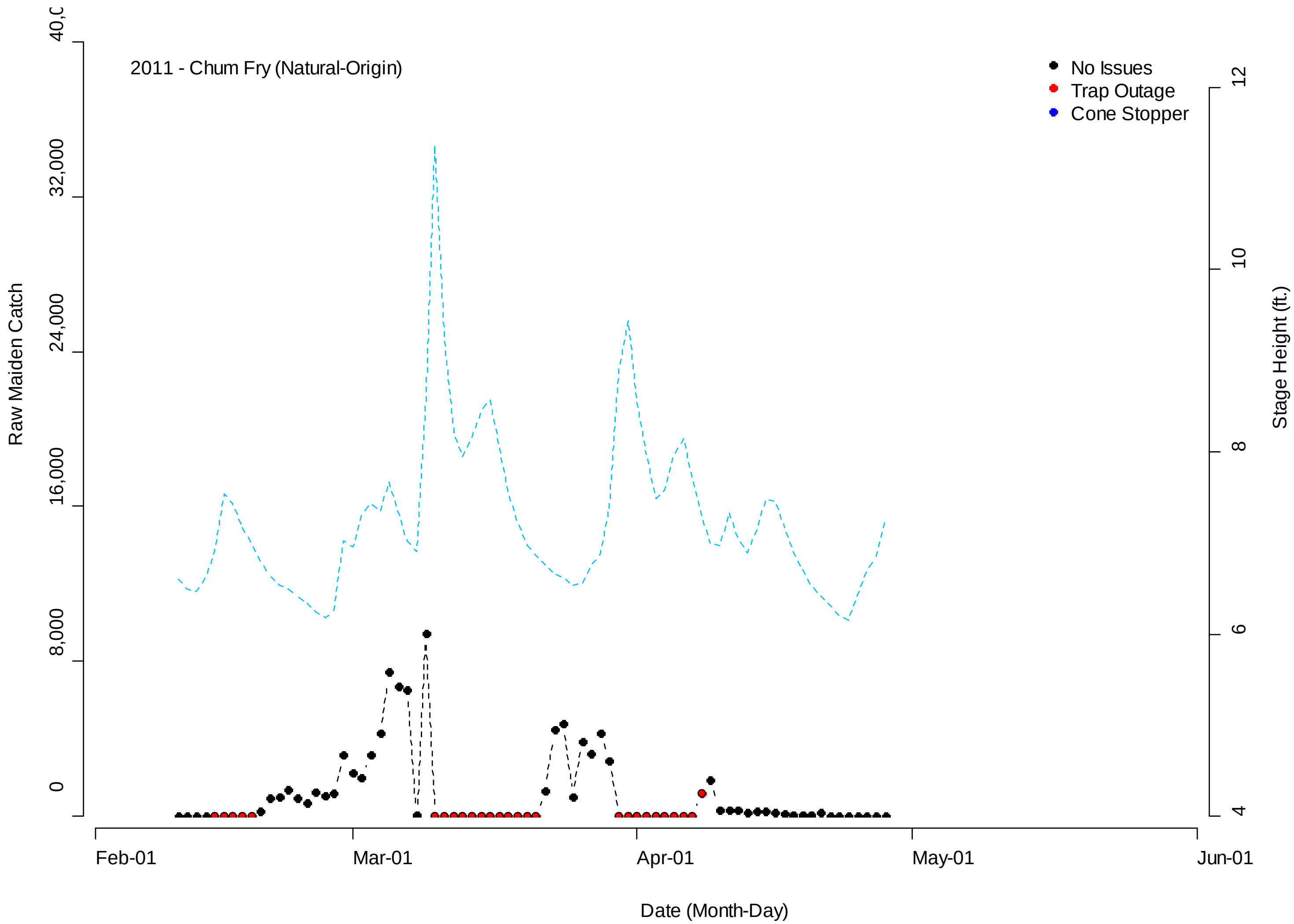

Figure B81. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin chum salmon (life-stage = fry; age-class = Sub-yearling) captured at the Crazy Johnson Creek fence-panel weir trap in 2011.

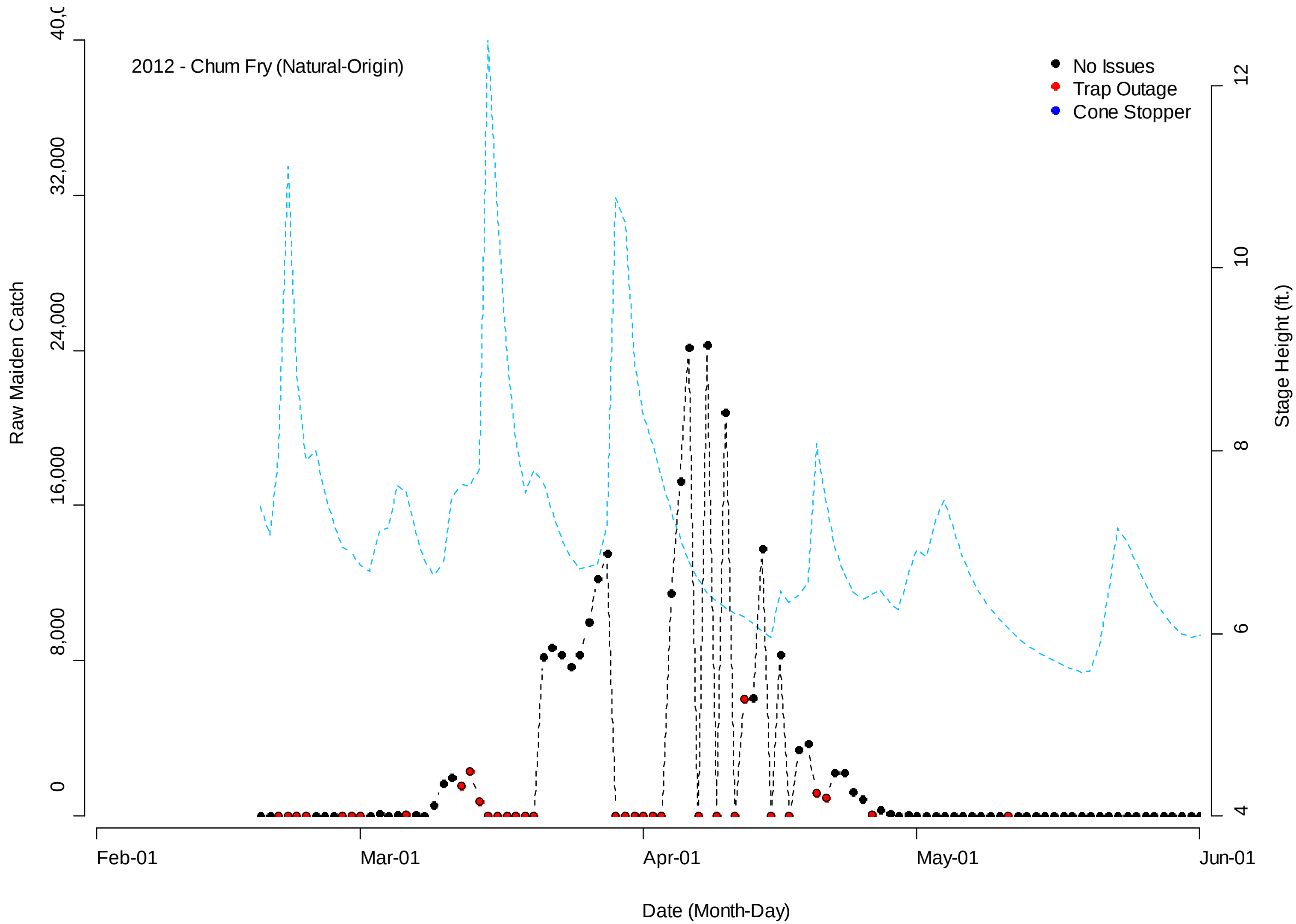

Figure B82. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin chum salmon (life-stage = fry; age-class = Sub-yearling) captured at the Crazy Johnson Creek fence-panel weir trap in 2012.

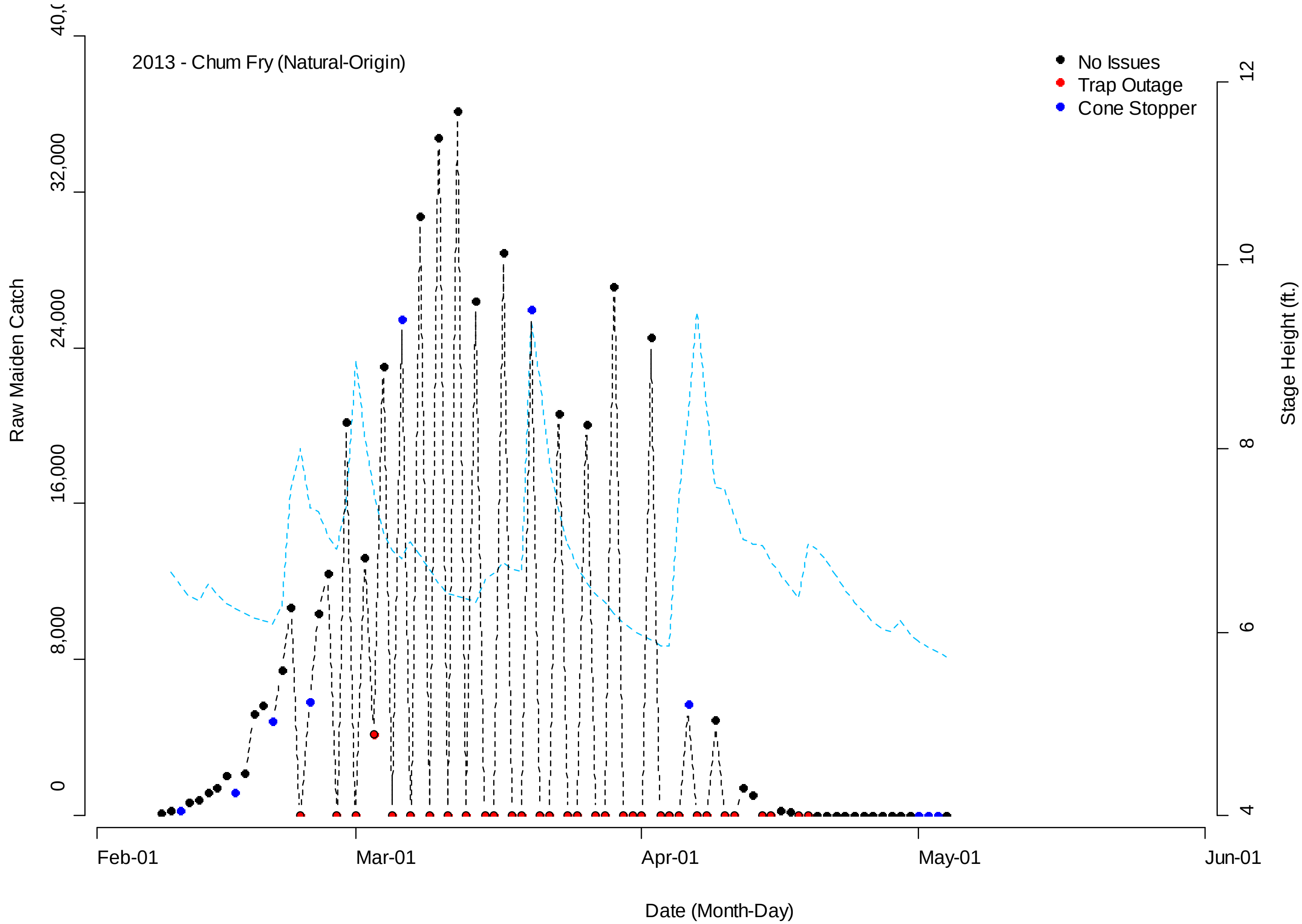

Figure B83. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin chum salmon (life-stage = fry; age-class = Sub-yearling) captured at the Crazy Johnson Creek screw trap in 2013. Note: all Trap Compromised days in March and April were intentional under an alternate-day trapping schedule.

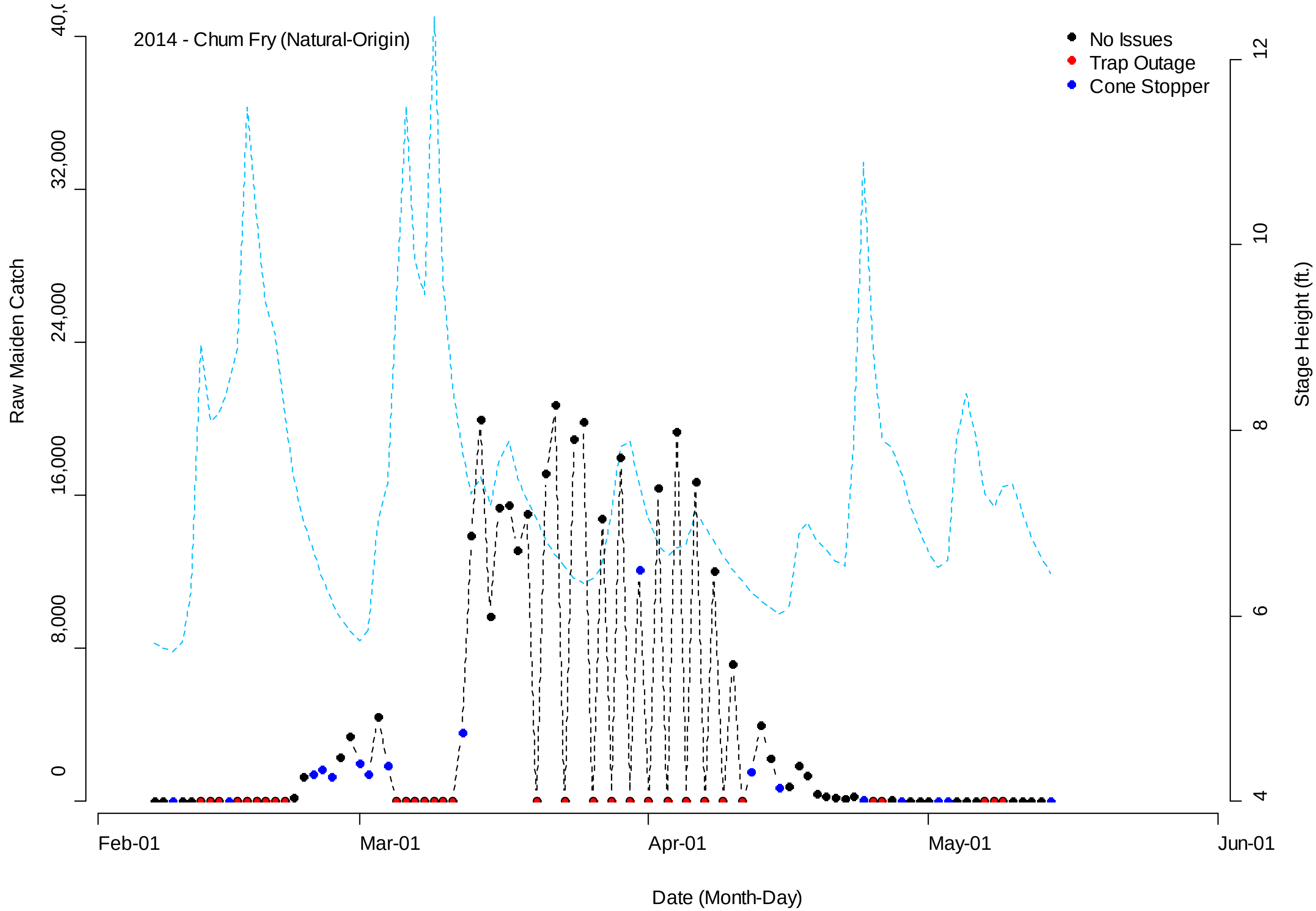

Figure B84. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin chum salmon (life-stage = fry; age-class = Sub-yearling) captured at the Crazy Johnson Creek screw trap in 2014. Note: all Trap Compromised days in late March and early April were intentional under an alternate day trapping schedule.

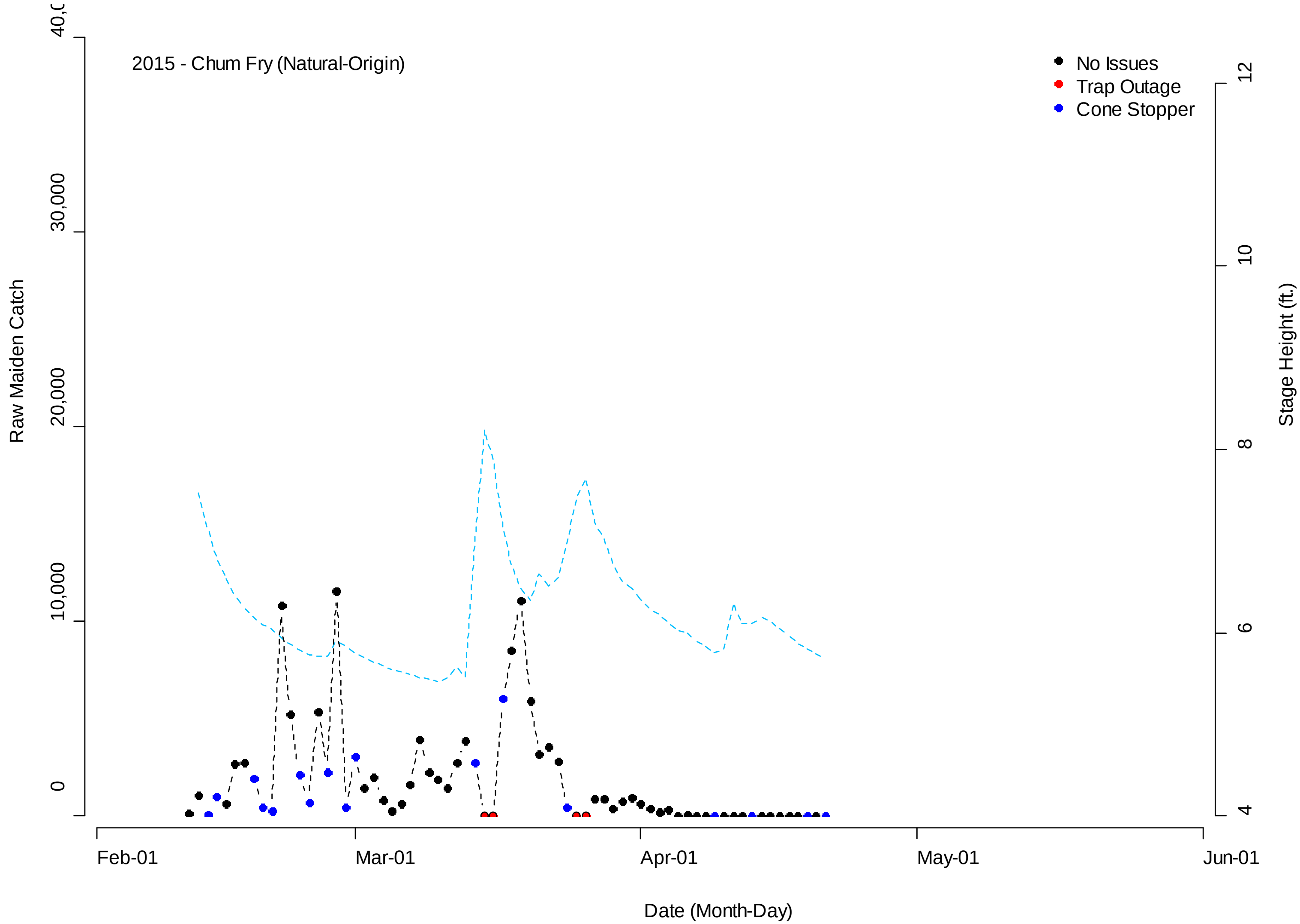

Figure B85. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin chum salmon (life-stage = fry; age-class = Sub-yearling) captured at the Crazy Johnson Creek screw trap in 2015.

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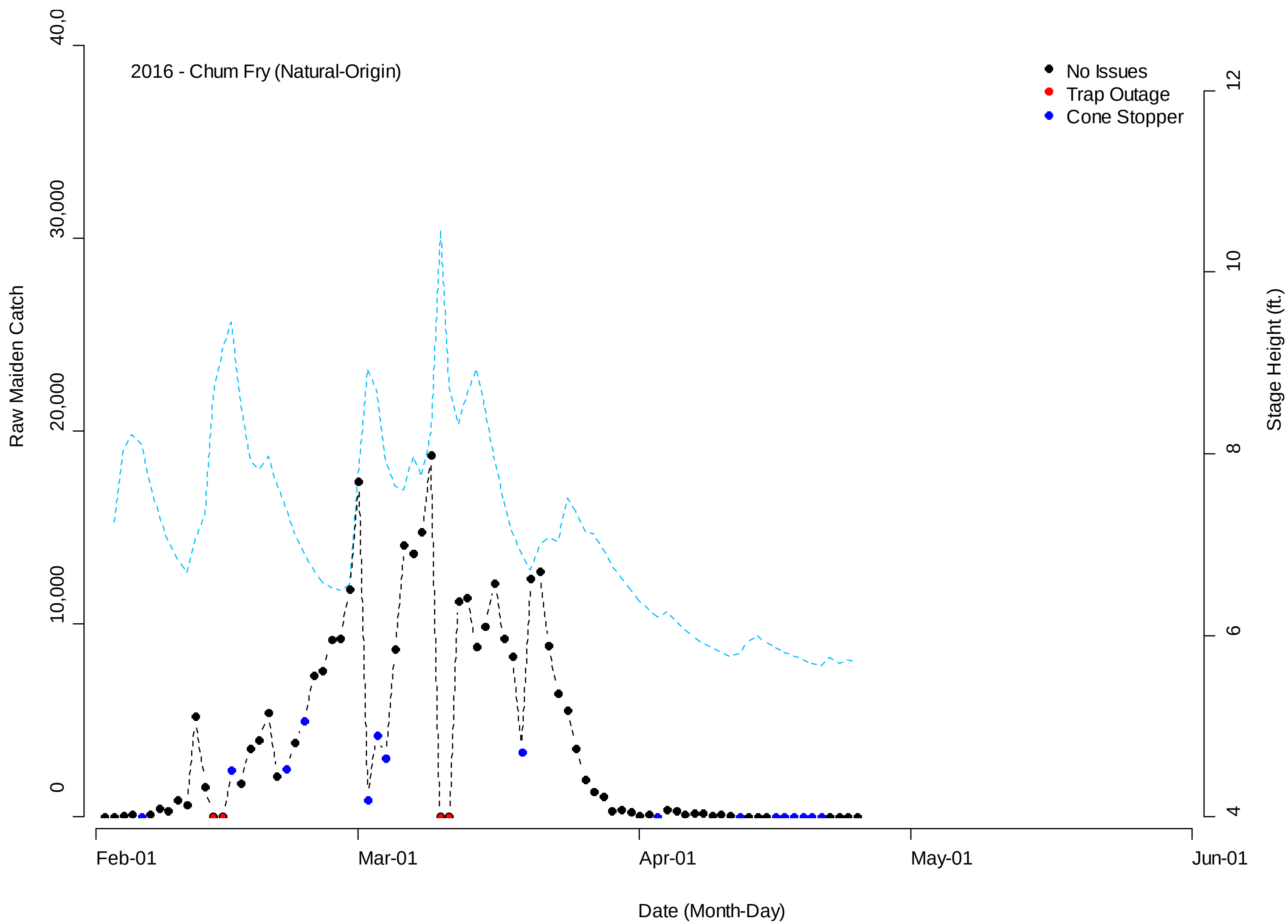

Figure B86. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin chum salmon (life-stage = fry; age-class = Sub-yearling) captured at the Crazy Johnson Creek screw trap in 2016.

Duncan Channels

Chum salmon (Natural-Origin, Fry)

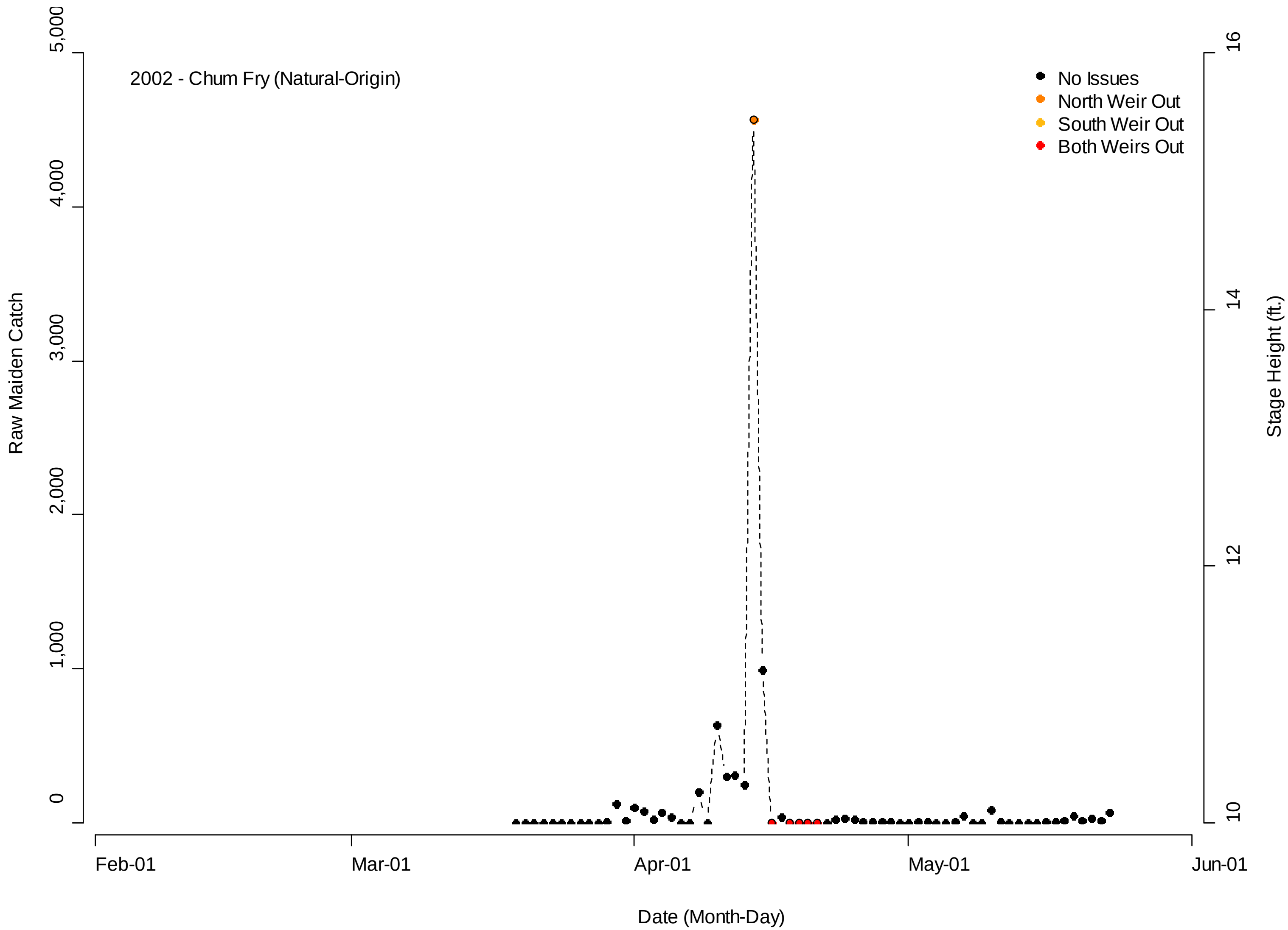

Figure B87. Combined raw maiden catch (black dashed) by date for natural-origin chum salmon (life-stage = fry; age-class = Sub-yearling) captured at the Duncan Creek spawning channel traps in 2002.

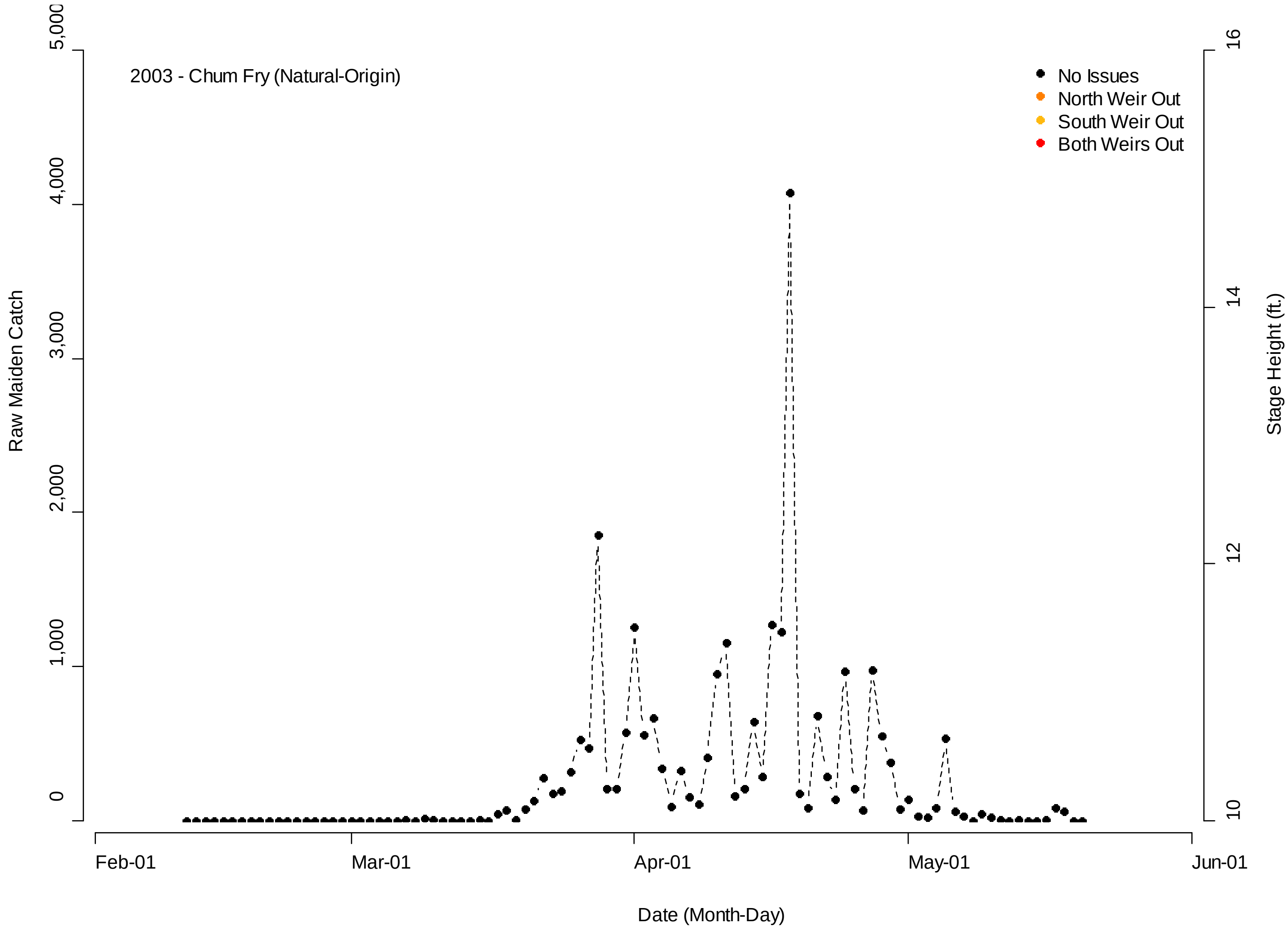

Figure B88. Combined raw maiden catch (black dashed) by date for natural-origin chum salmon (life-stage = fry; age-class = Sub-yearling) captured at the Duncan Creek spawning channel traps in 2003.

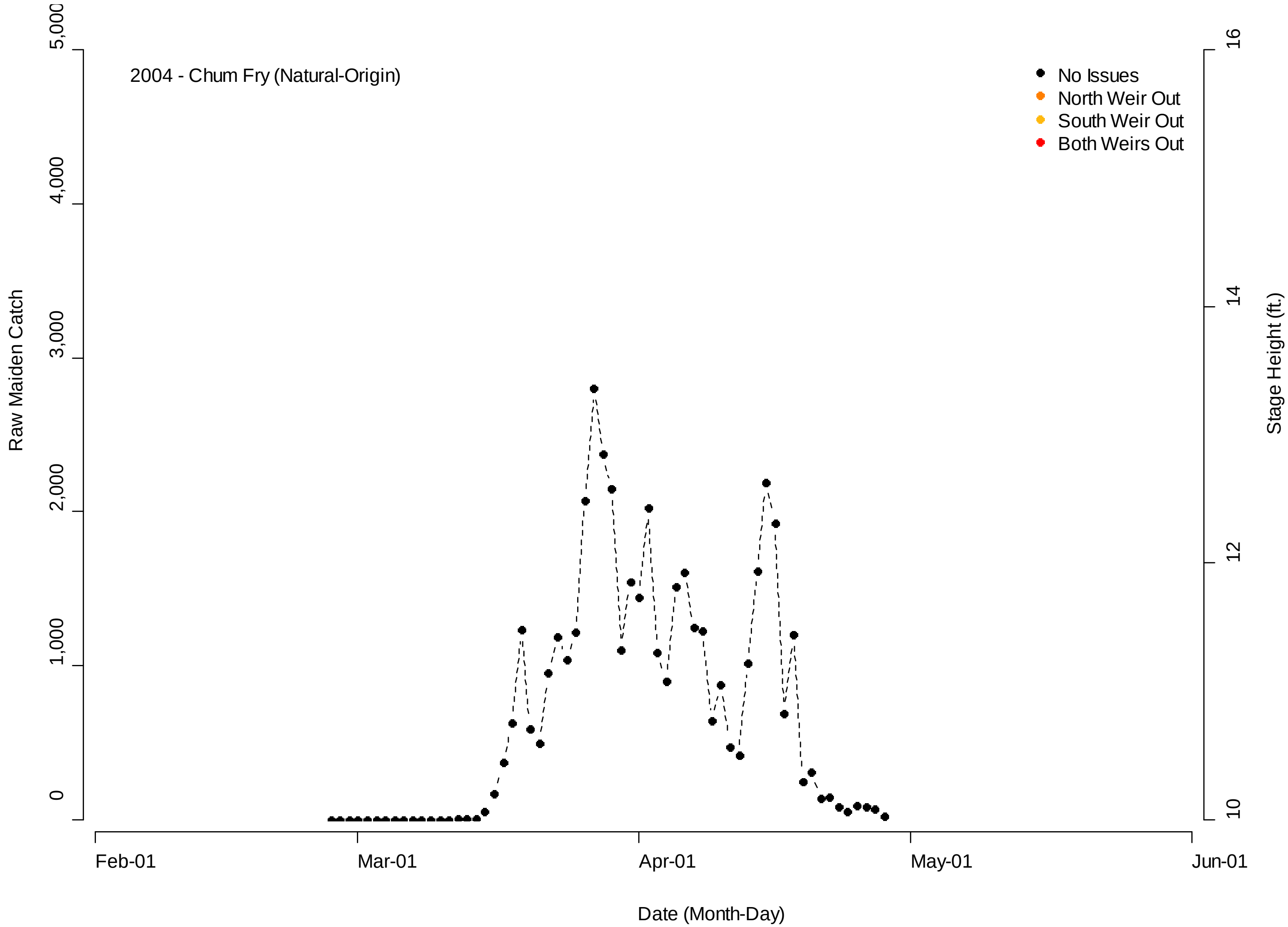

Figure B89. Combined raw maiden catch (black dashed) by date for natural-origin chum salmon (life-stage = fry; age-class = Sub-yearling) captured at the Duncan Creek spawning channel traps in 2004.

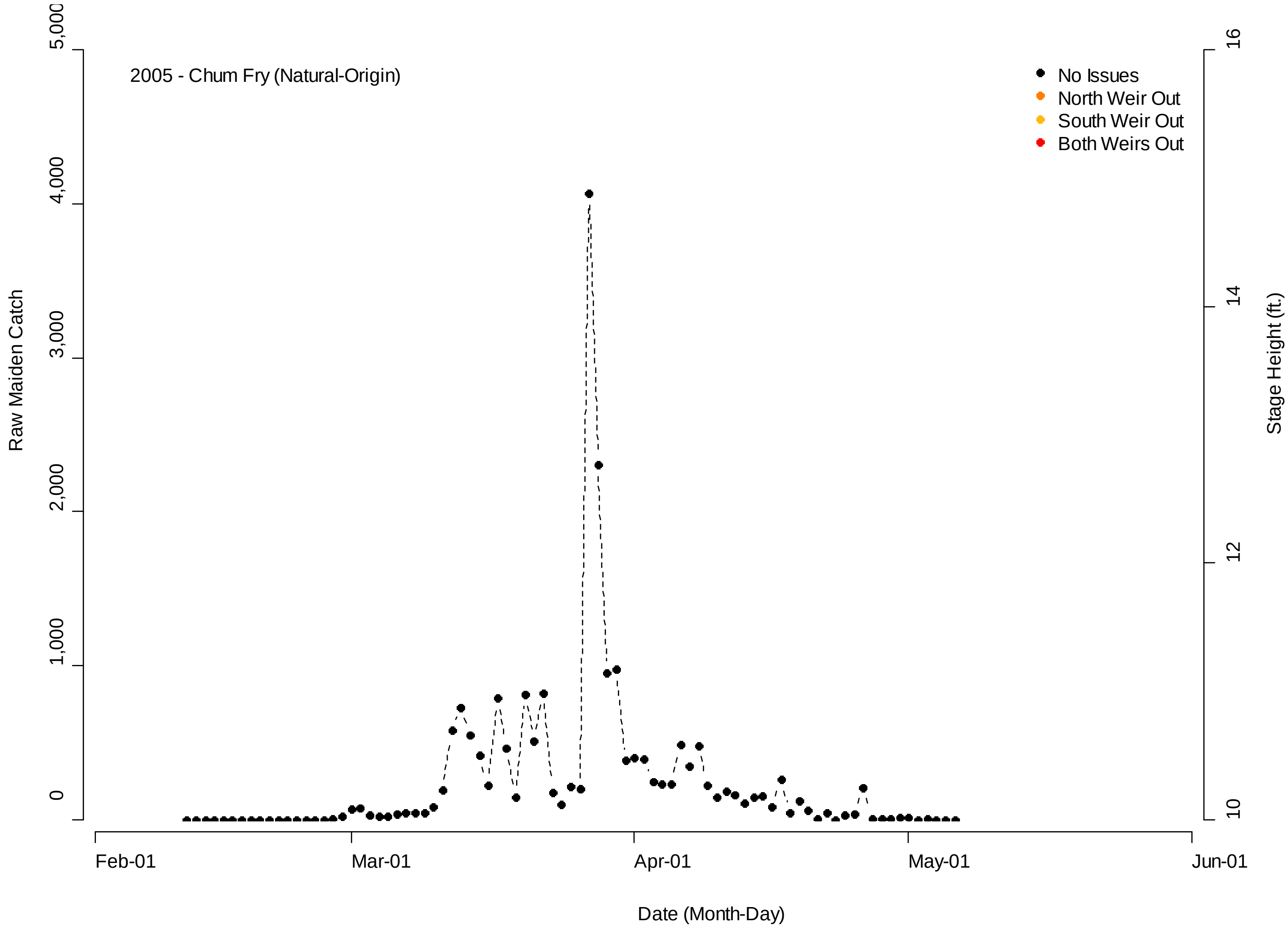

Figure B90. Combined raw maiden catch (black dashed) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) captured at the Duncan Creek spawning channel traps in 2005.

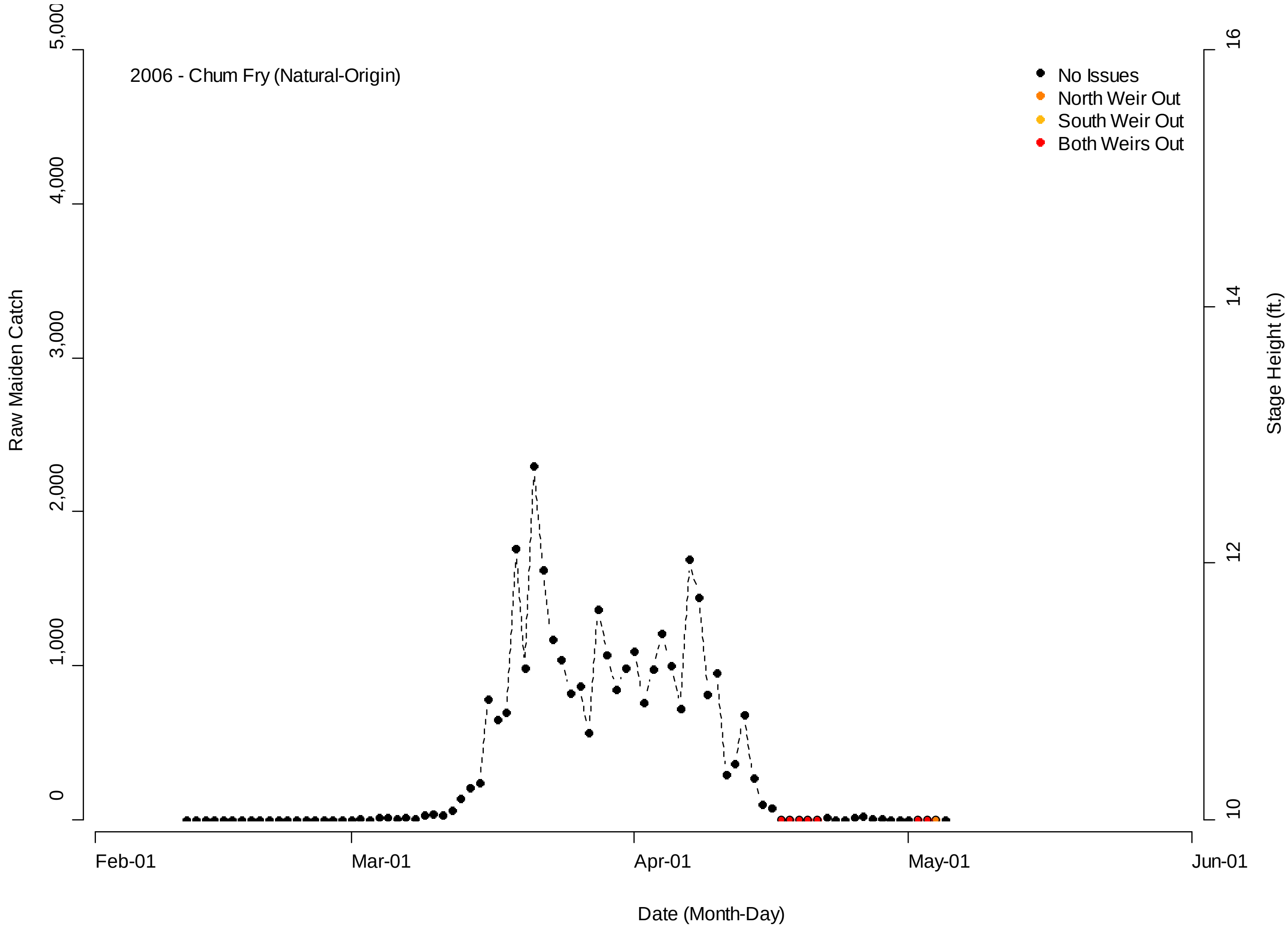

Figure B91. Combined raw maiden catch (black dashed) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) captured at the Duncan Creek spawning channel traps in 2006.

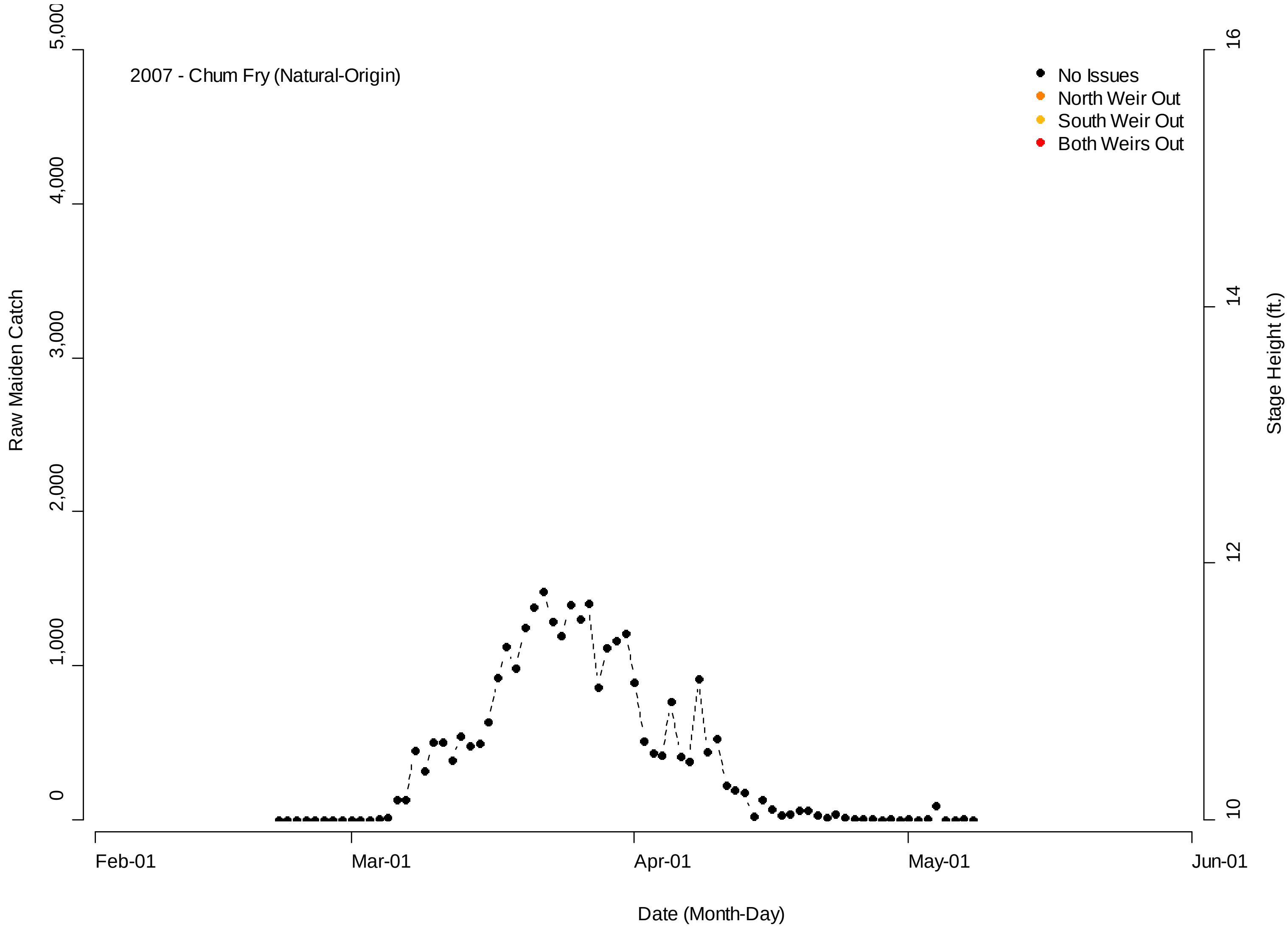

Figure B92. Combined raw maiden catch (black dashed) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) captured at the Duncan Creek spawning channel traps in 2007.

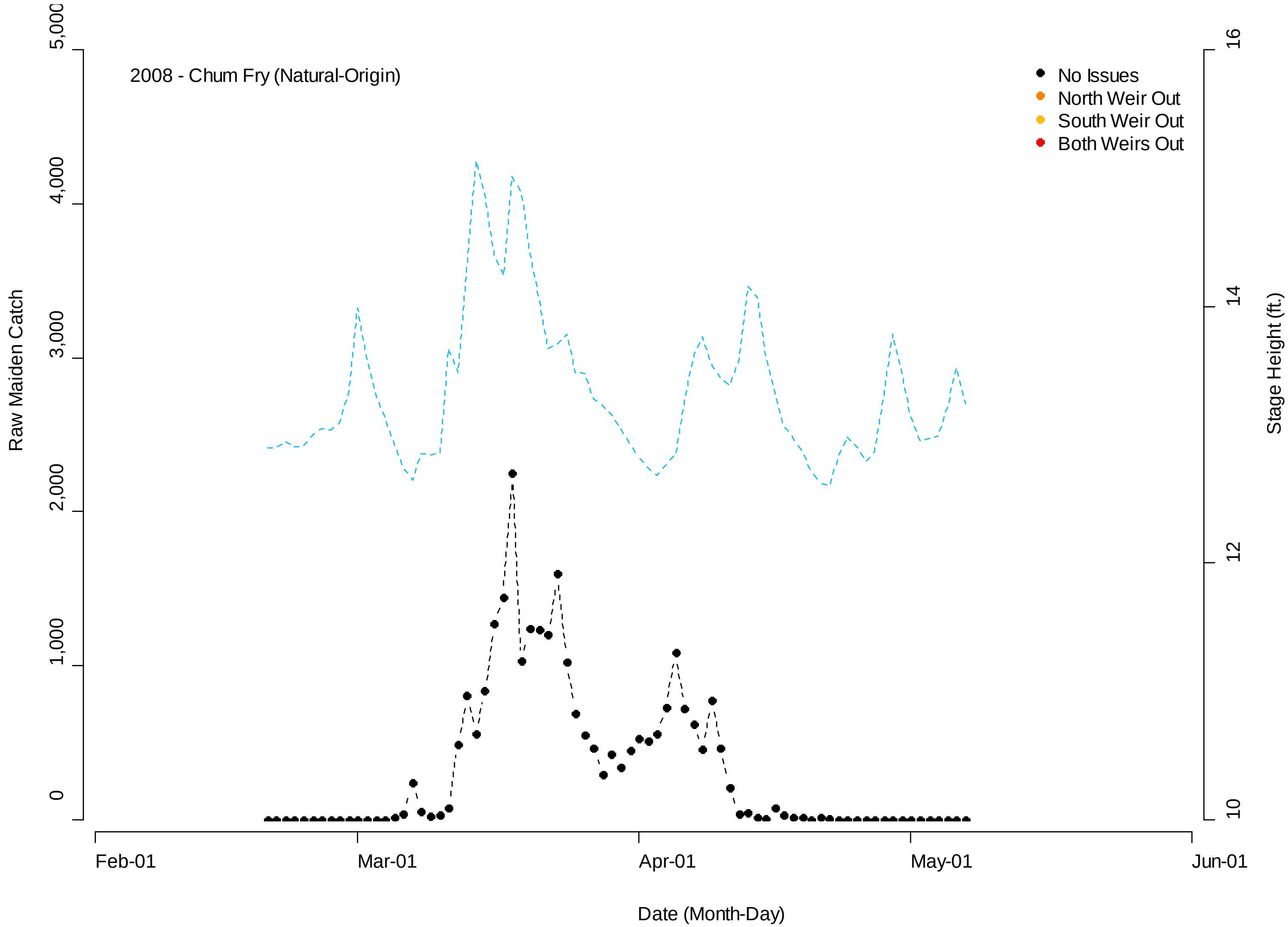

Figure B93. Combined raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) captured at the Duncan Creek spawning channel traps in 2008.

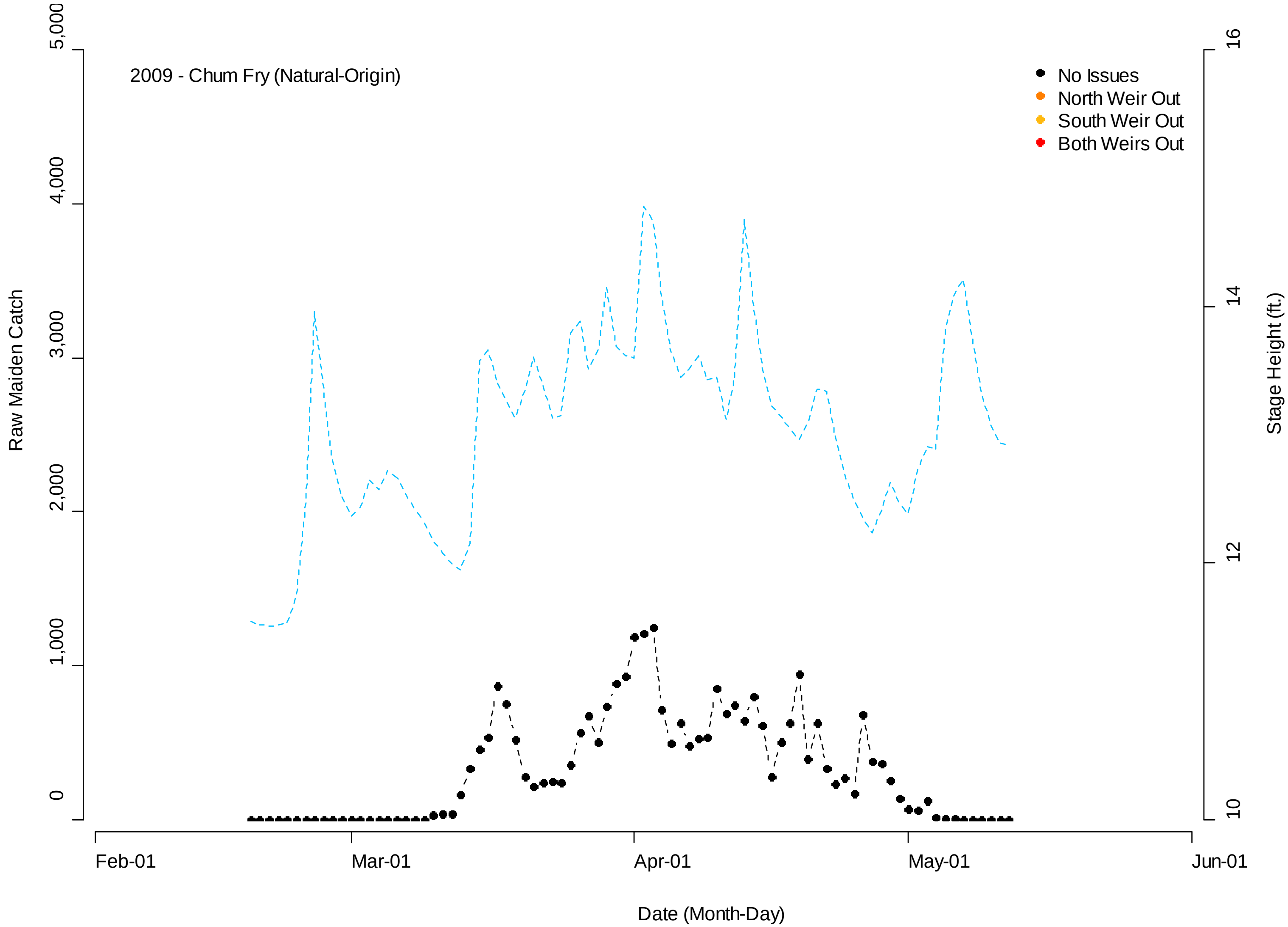

Figure B94. Combined raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) captured at the Duncan Creek spawning channel traps in 2009.

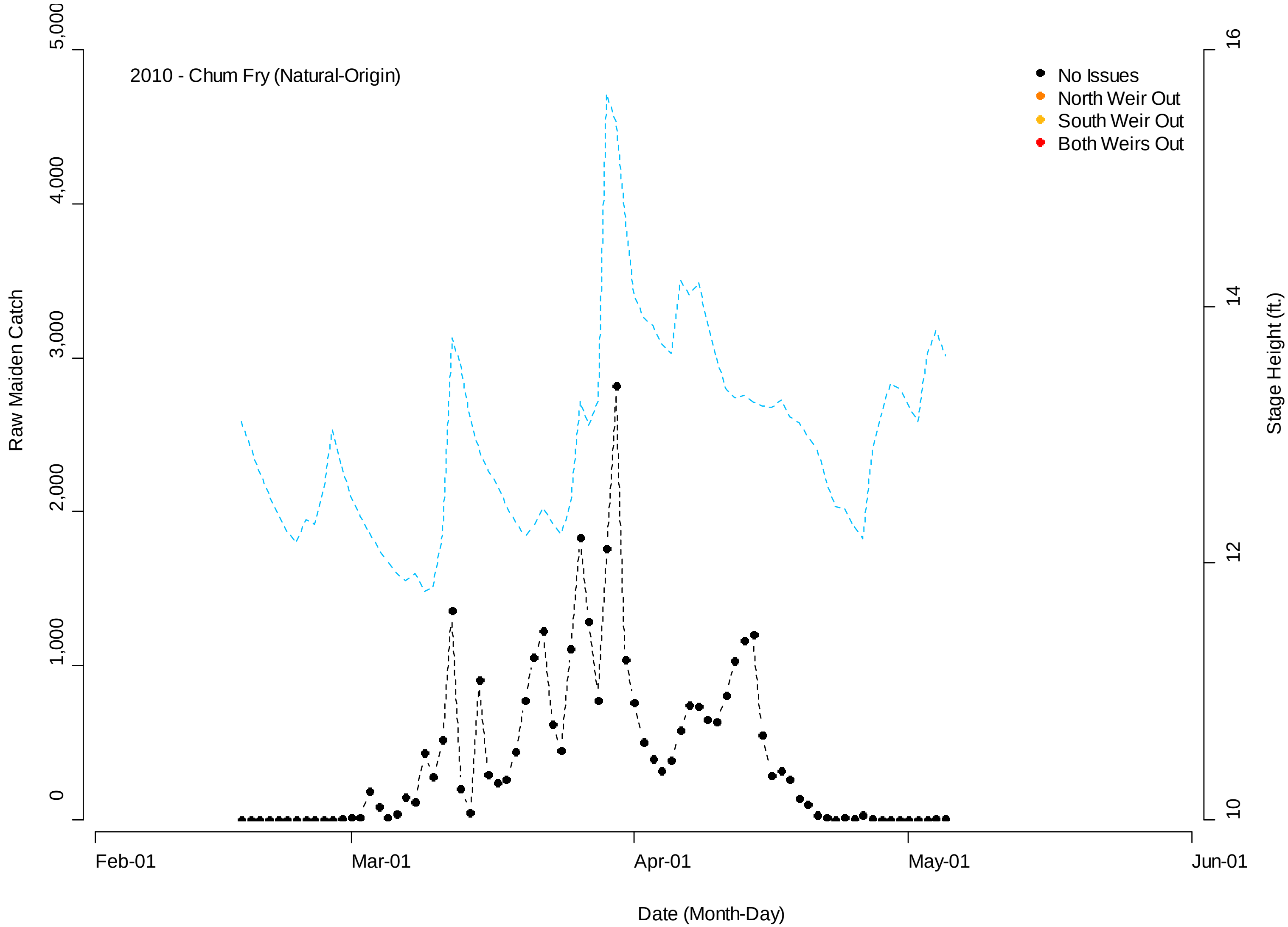

Figure B95. Combined raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) captured at the Duncan Creek spawning channel traps in 2010.

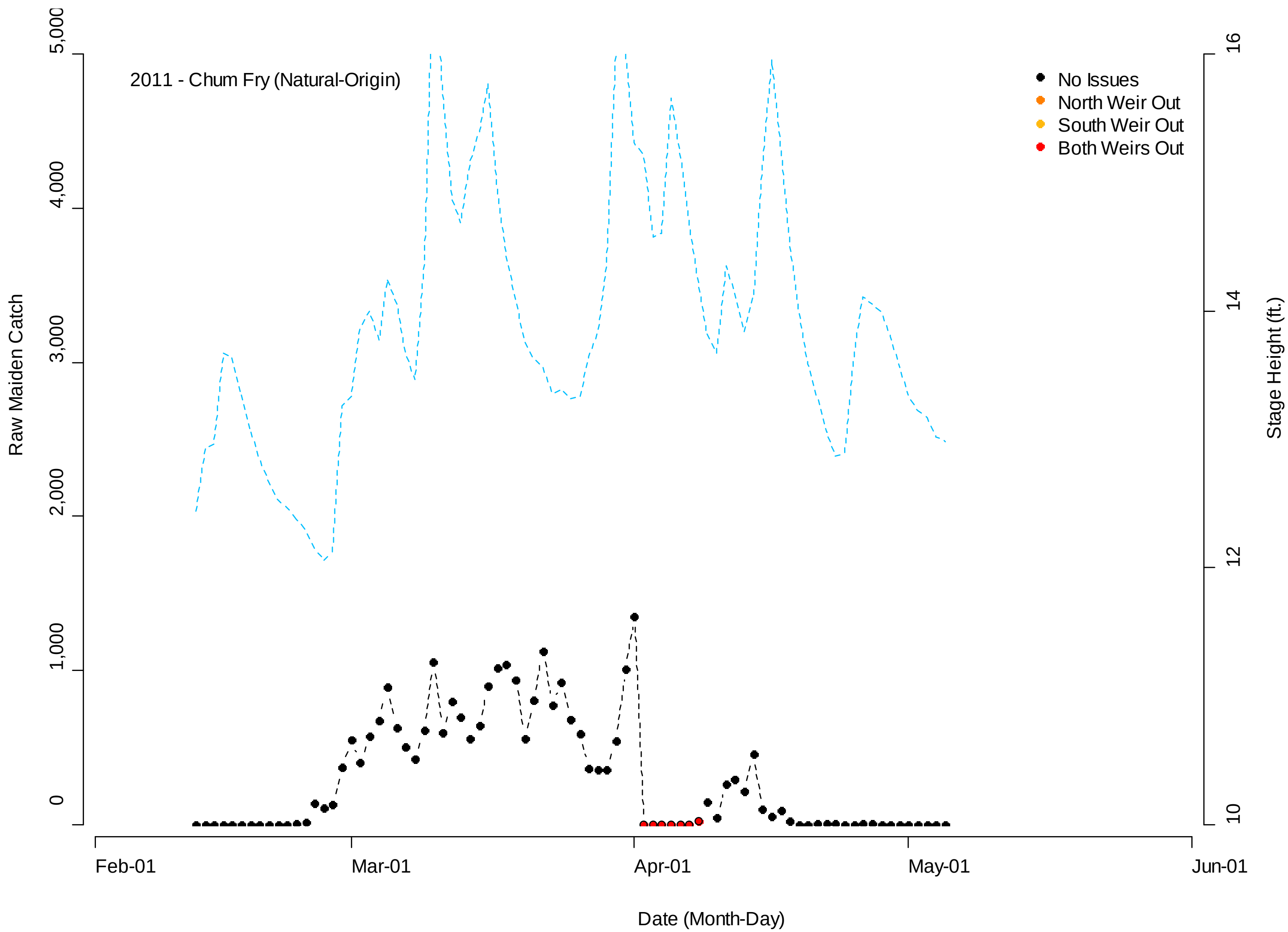

Figure B96. Combined raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) captured at the Duncan Creek spawning channel traps in 2011.

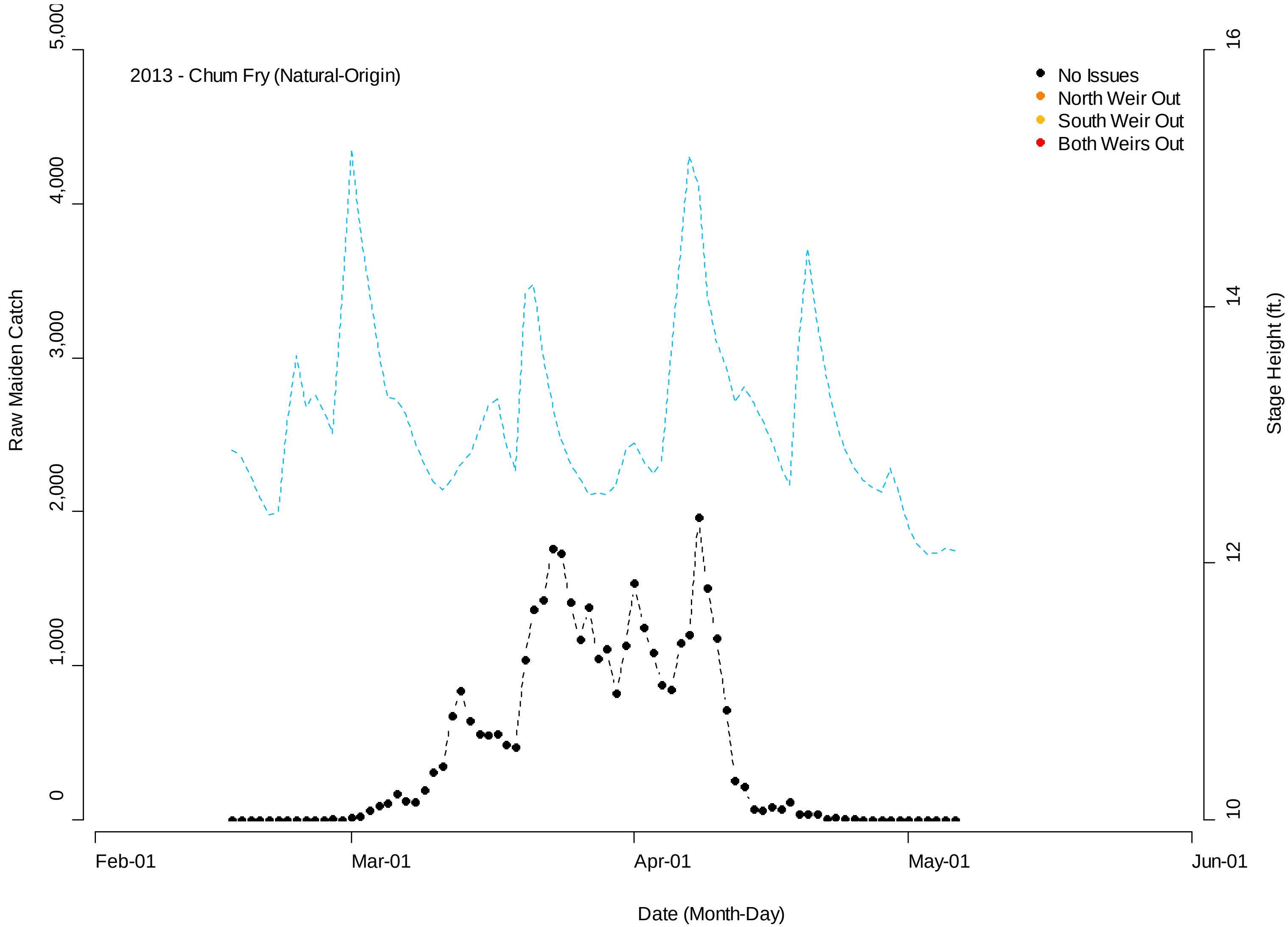

Figure B97. Combined raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) captured at the Duncan Creek spawning channel traps in 2012.

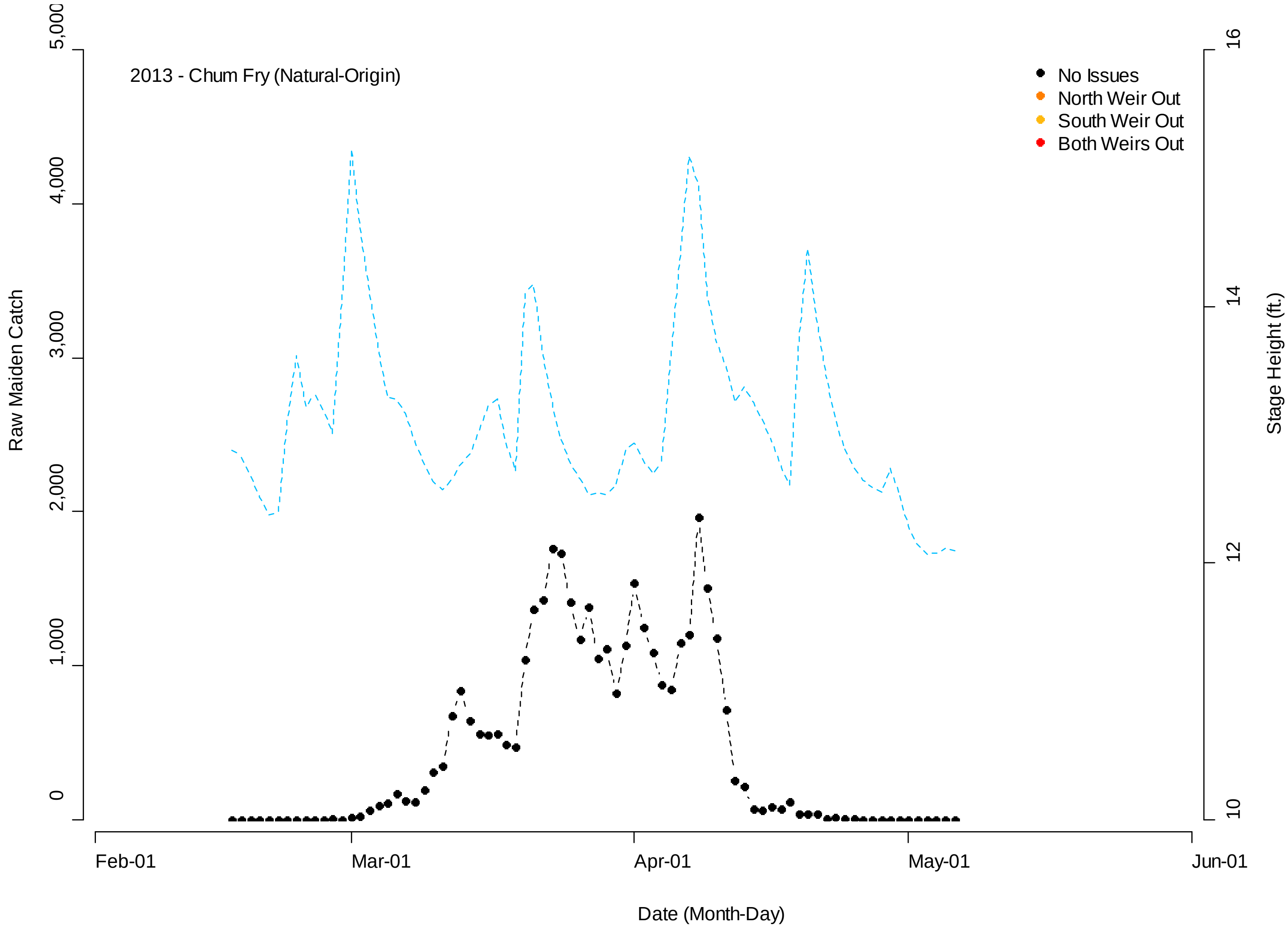

Figure B98. Combined raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) captured at the Duncan Creek spawning channel traps in 2013.

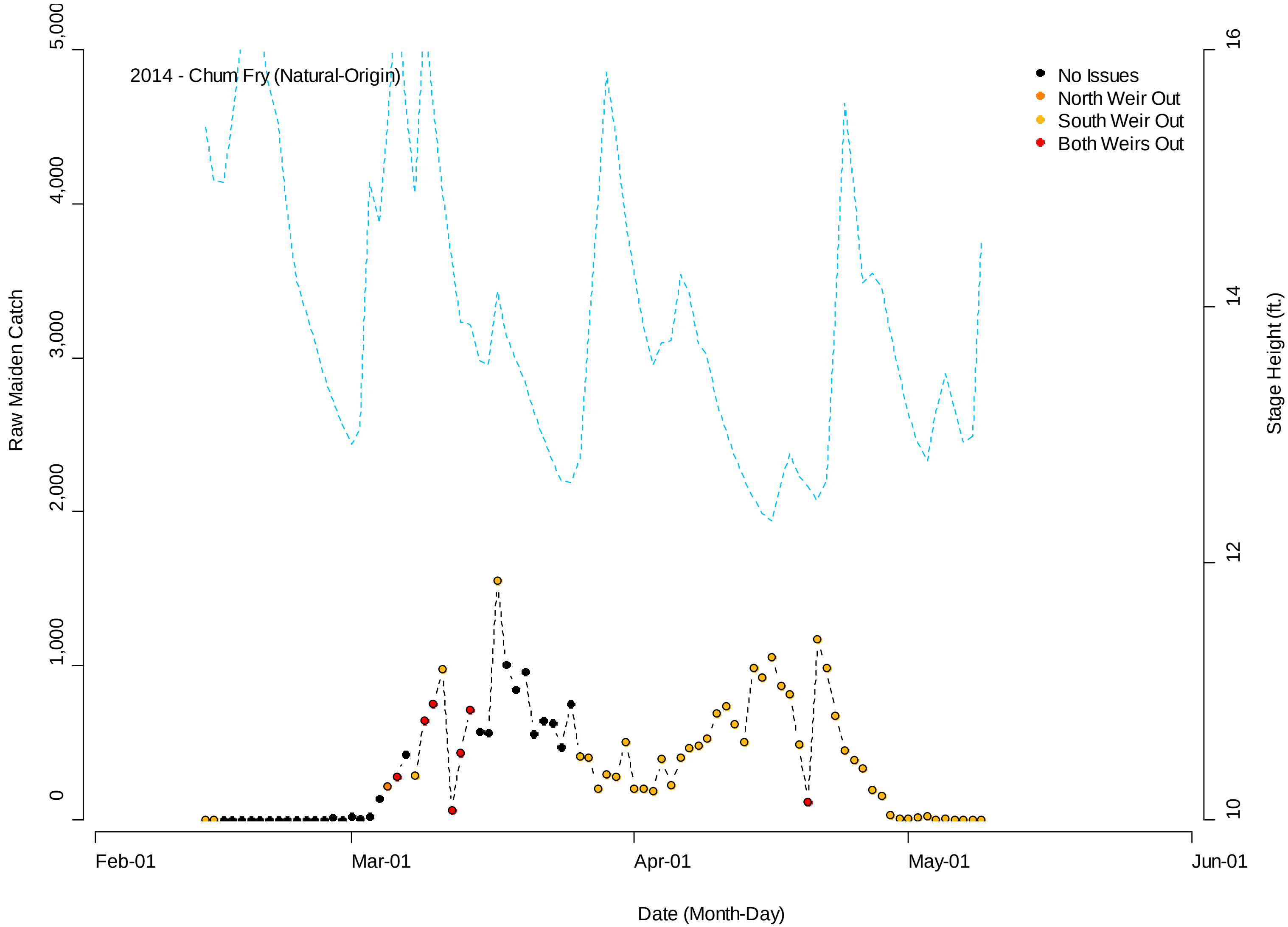

Figure B99. Combined raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) captured at the Duncan Creek spawning channel traps in 2014.

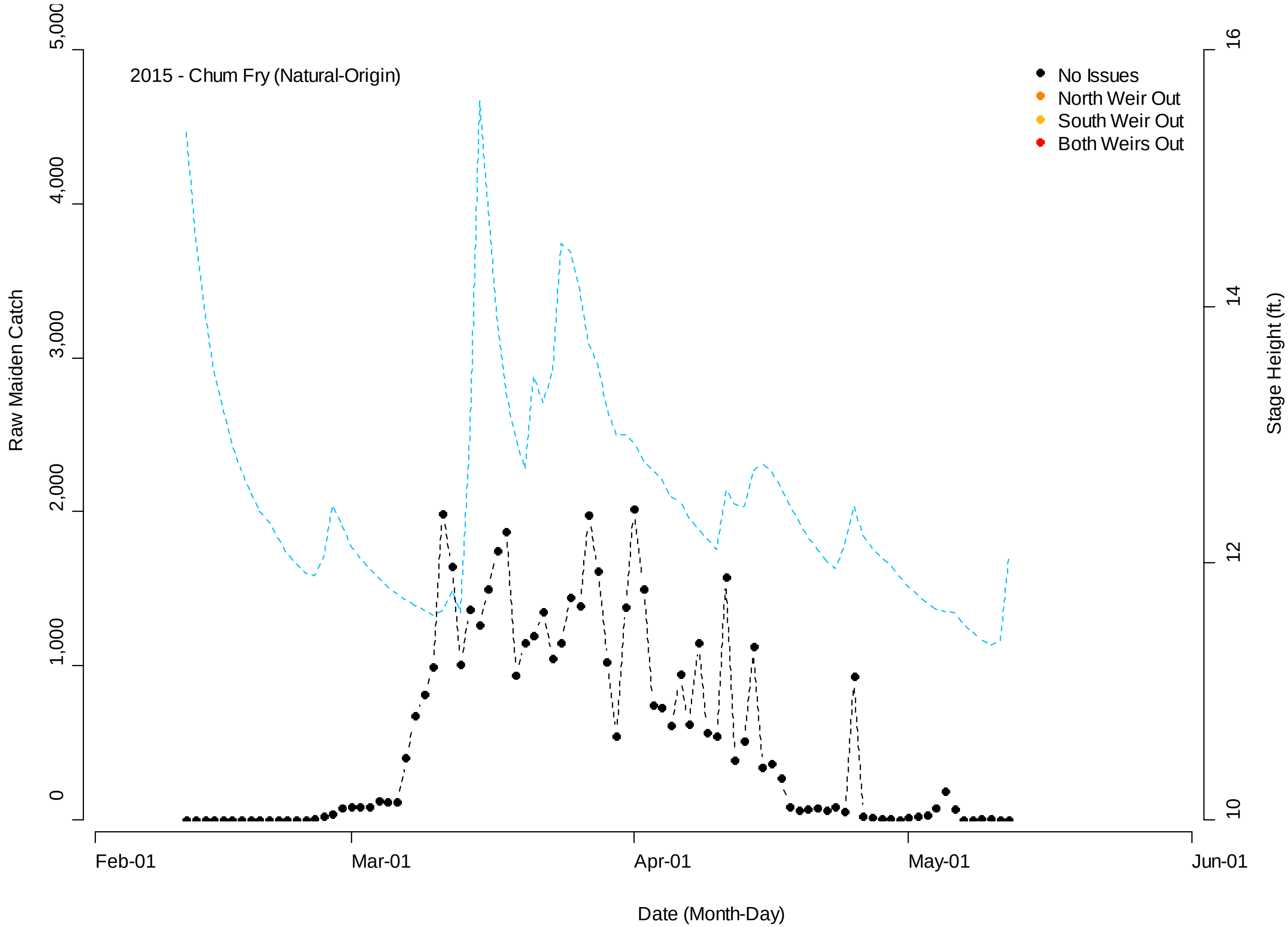

Figure B100. Combined raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) captured at the Duncan Creek spawning channel traps in 2015.

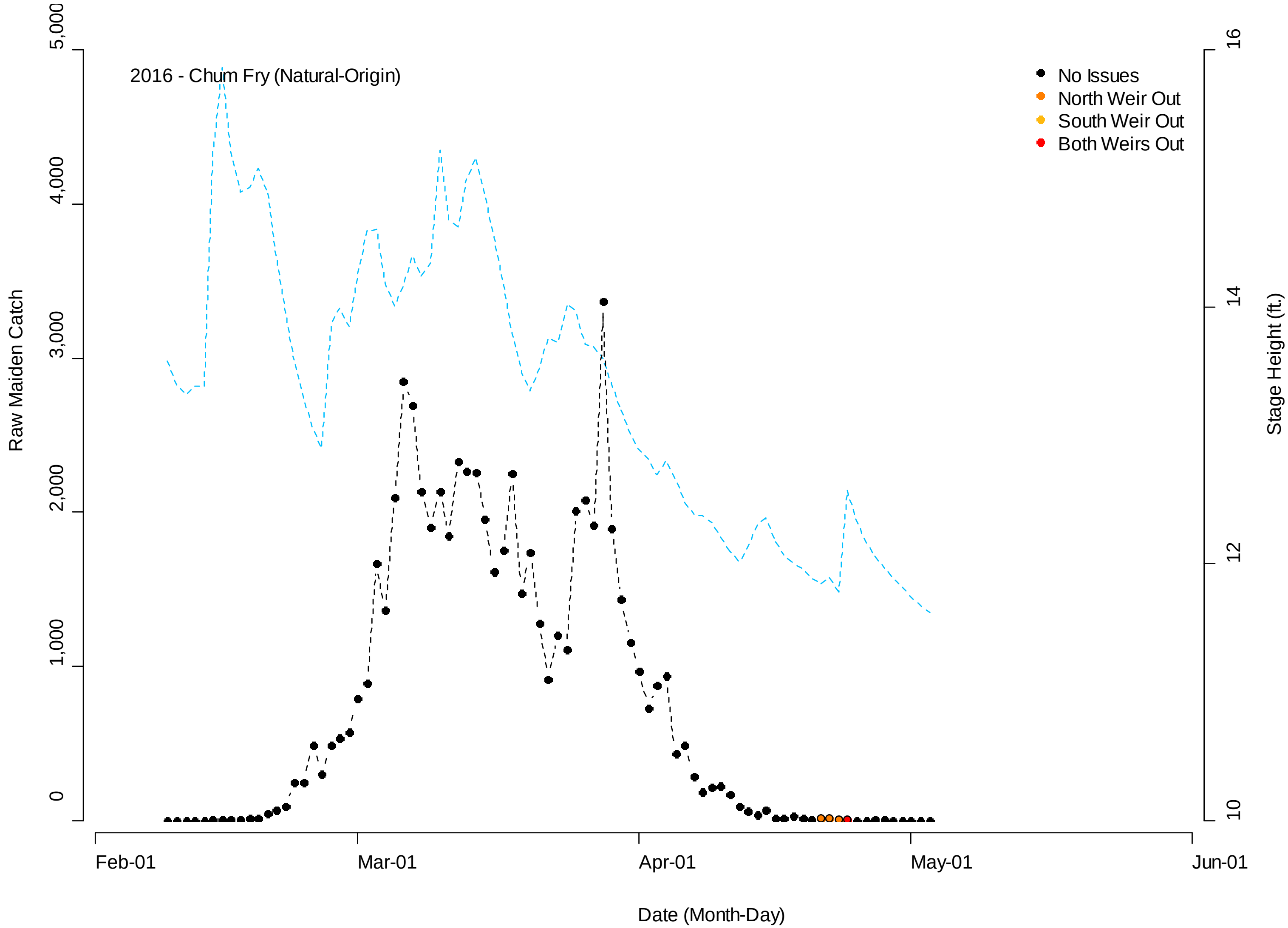

Figure B101. Combined raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) captured at the Duncan Creek spawning channel traps in 2016.

Hamilton Creek

Coho salmon (Natural-Origin, Transitional/Smolt, Yearling)

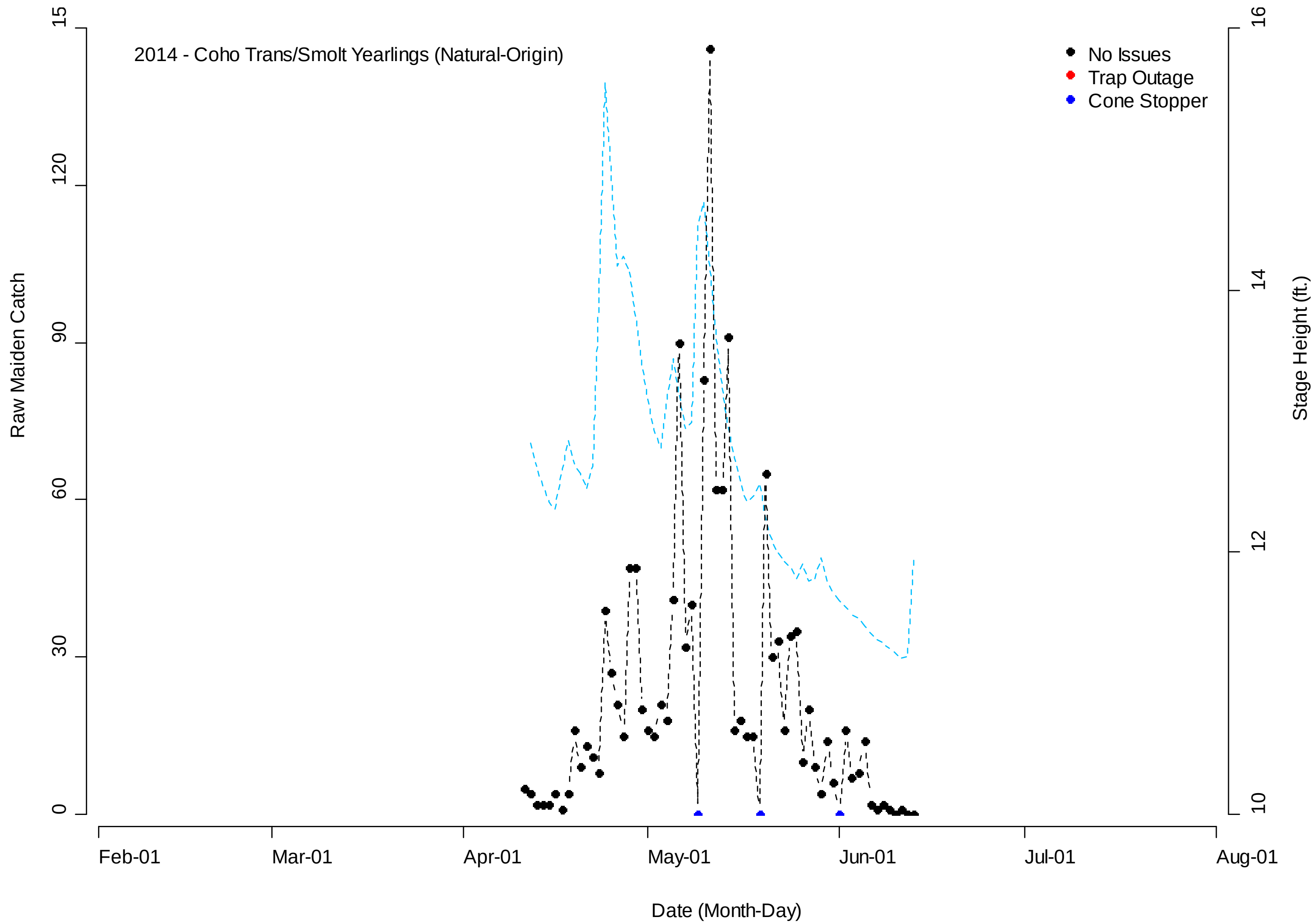

Figure B102. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the Hamilton Creek screw trap in 2014.

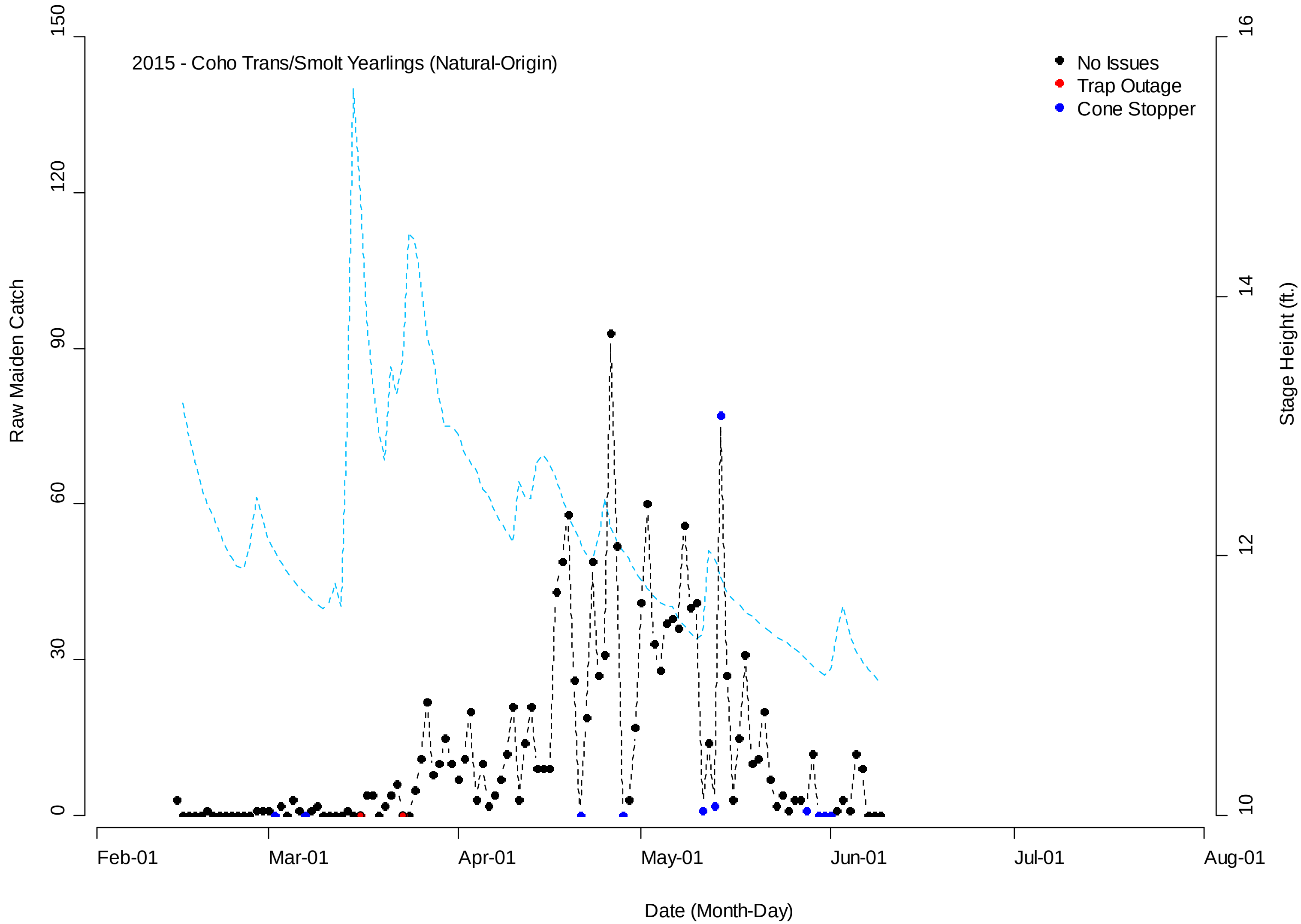

Figure B103. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin coho salmon (life-stage = transitional/smolts; age-class = yearlings) captured at the Hamilton Creek screw trap in 2015.

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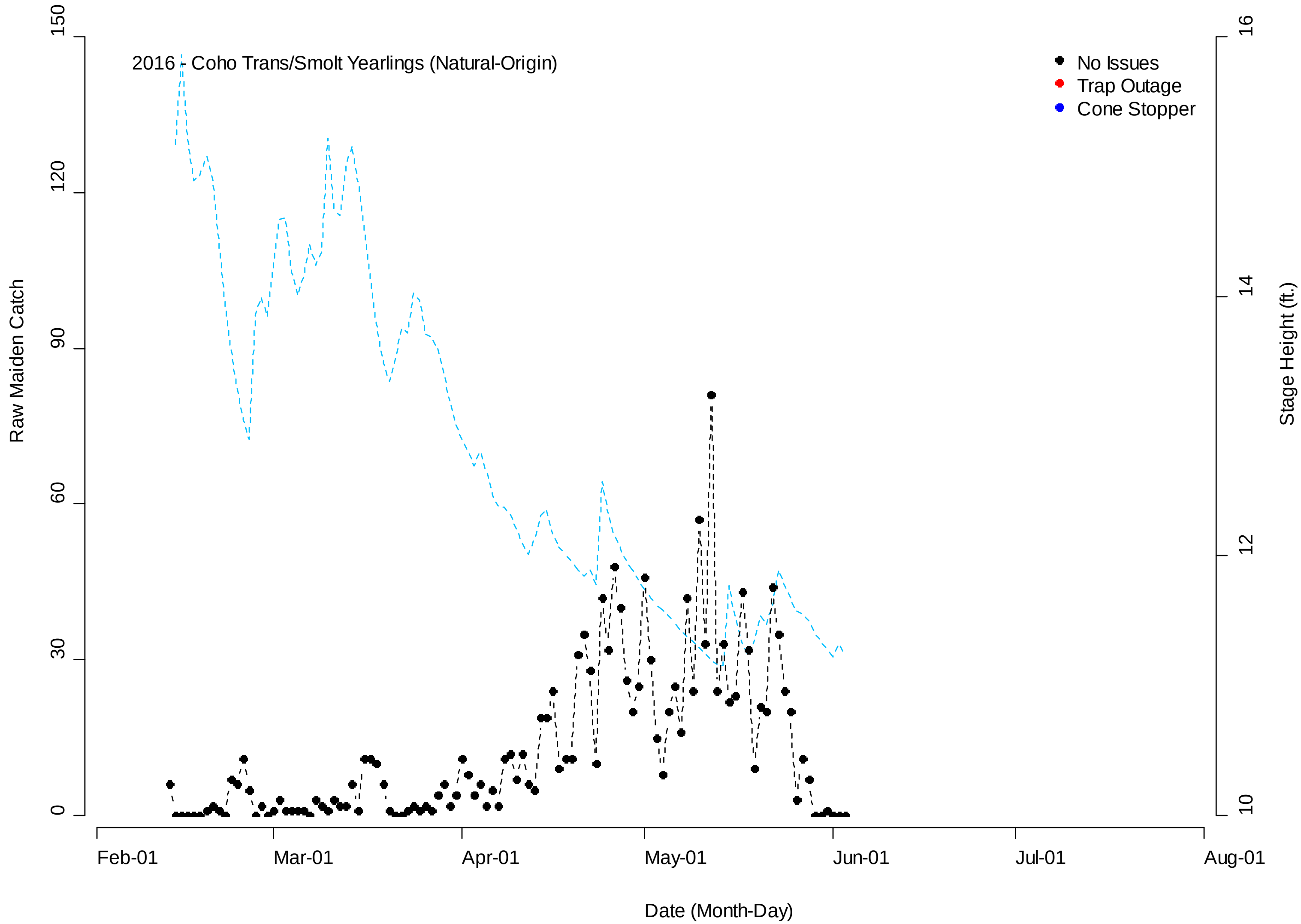

Figure B104. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin coho salmon (life-stage = transitional/smolts; age-class = yearlings) captured at the Hamilton Creek screw trap in 2016.

Steelhead (Natural-Origin, Transitional/Smolt, Yearling)

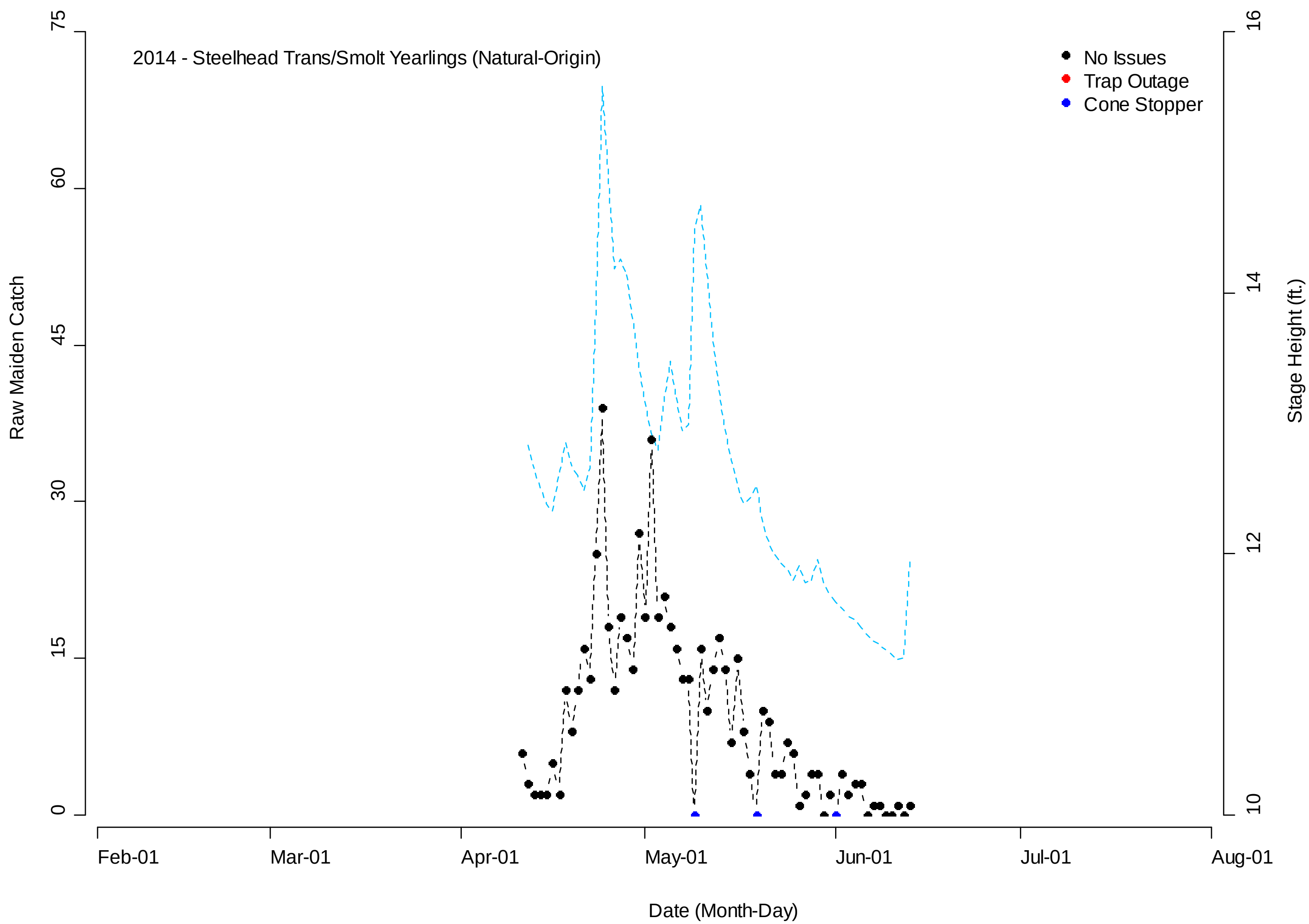

Figure B105. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the Hamilton Creek screw trap in 2014.

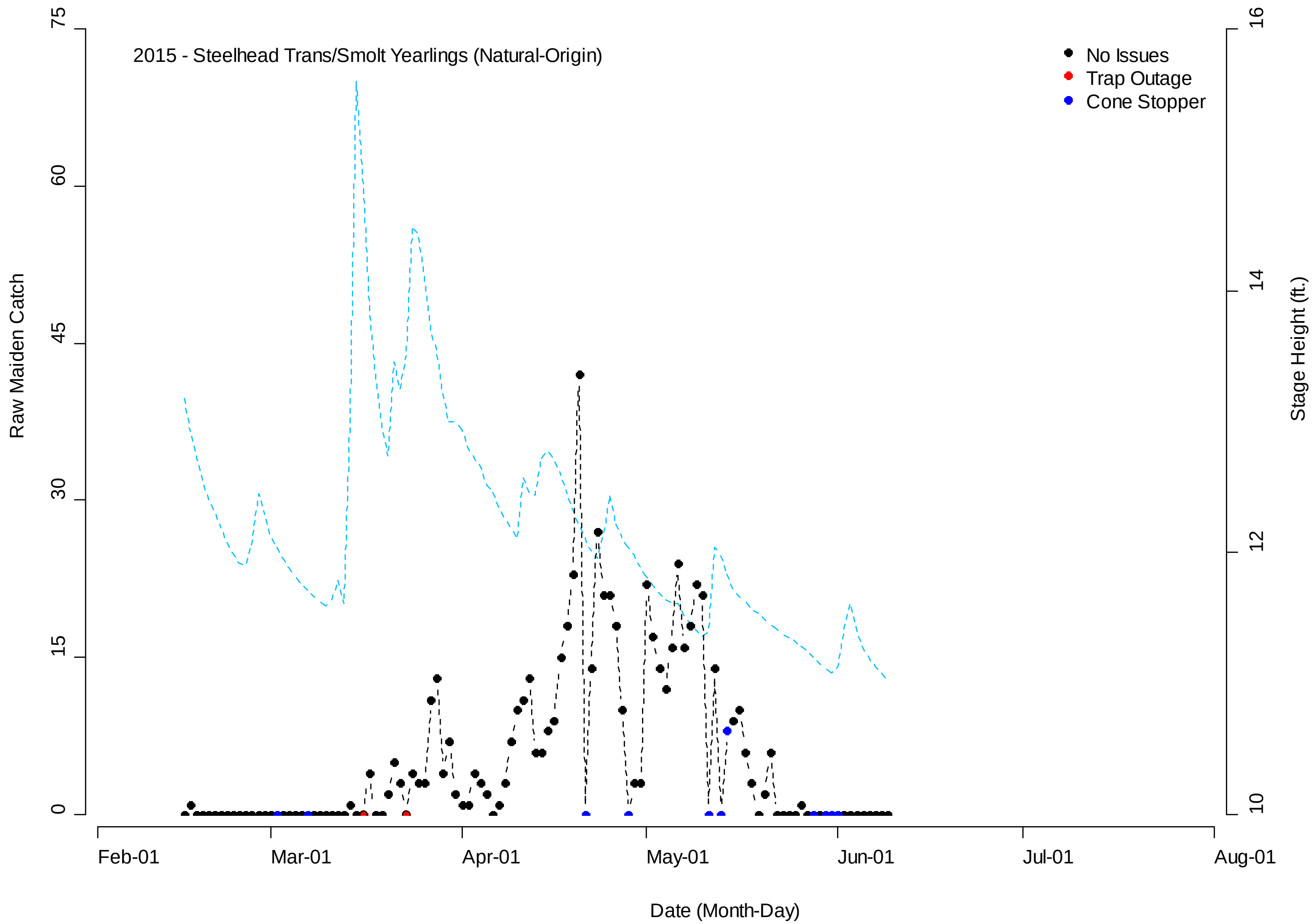

Figure B106. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the Hamilton Creek screw trap in 2015.

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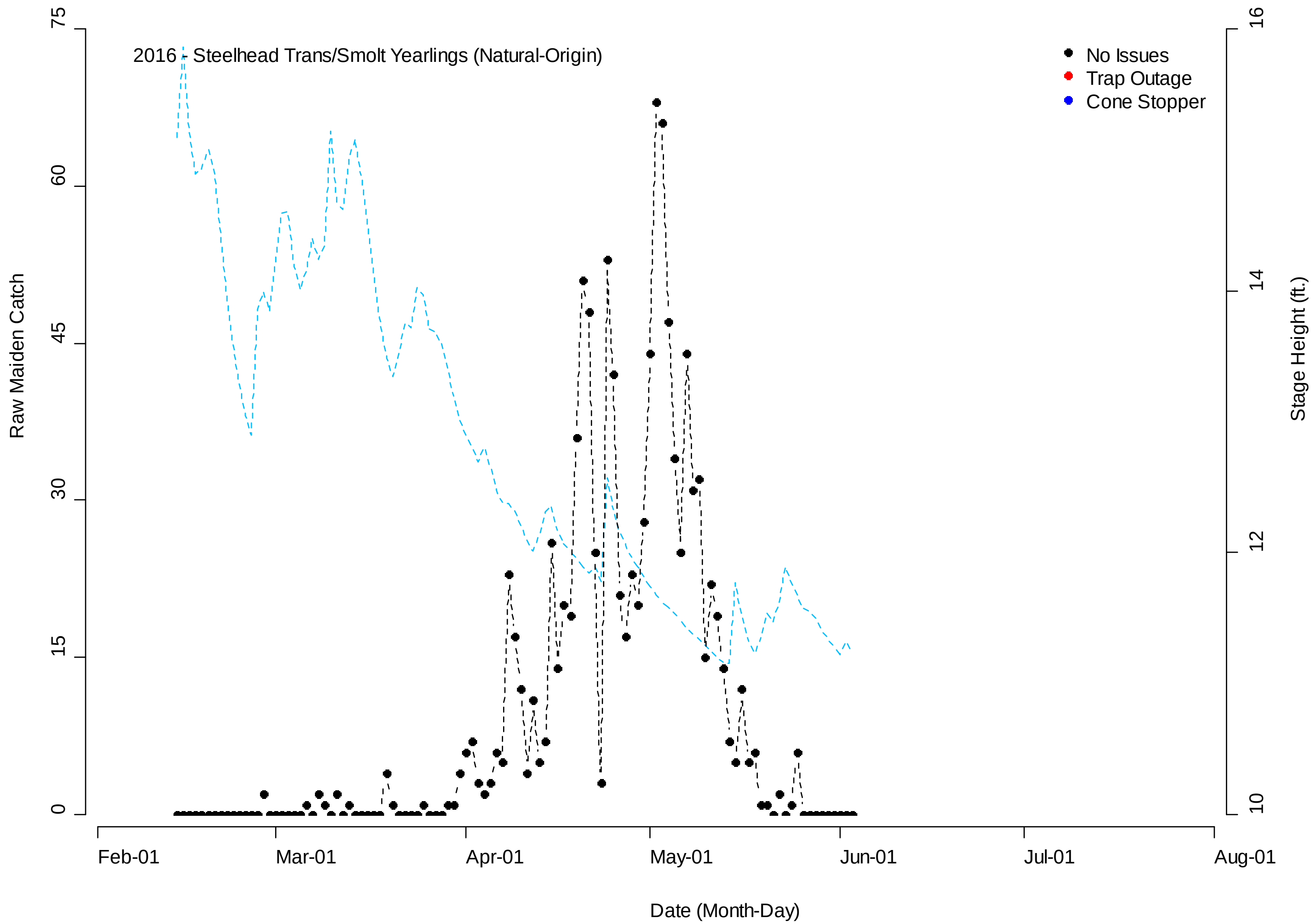

Figure B107. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the Hamilton Creek screw trap in 2016.

Hamilton Springs

Chum salmon (Natural-Origin, Fry)

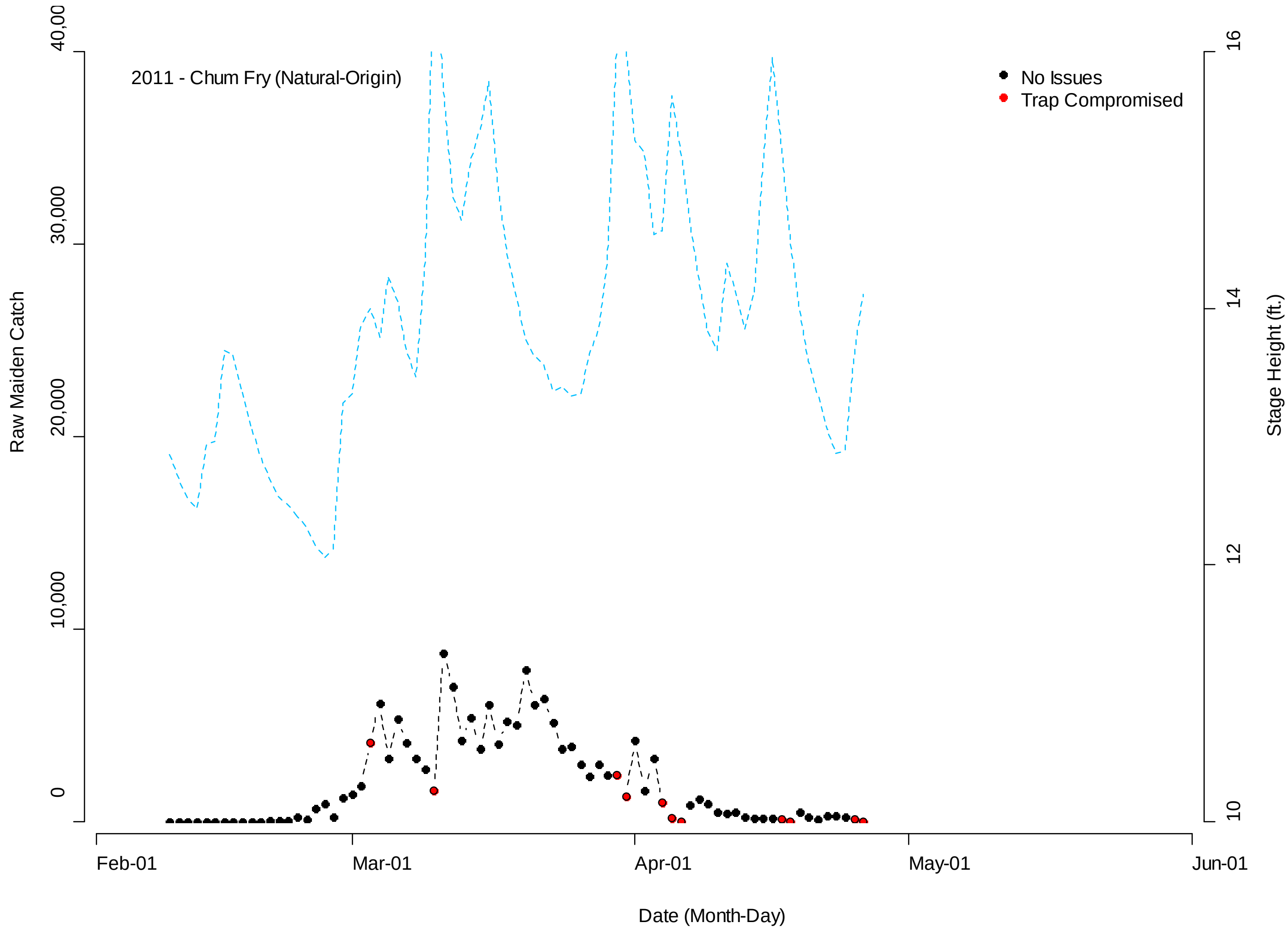

Figure B108. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), Hamilton Springs, 2011.

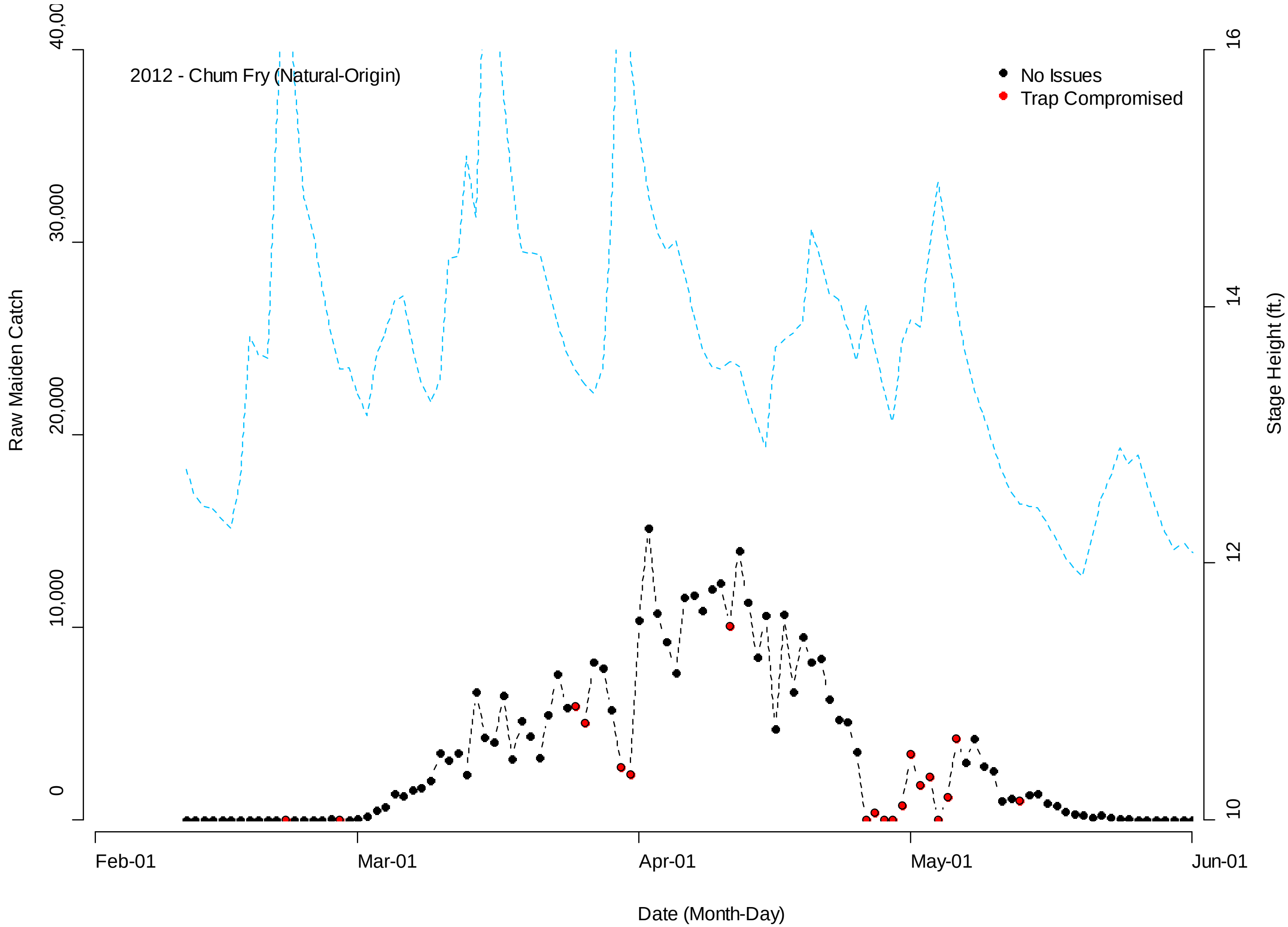

Figure B109. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), Hamilton Springs, 2012.

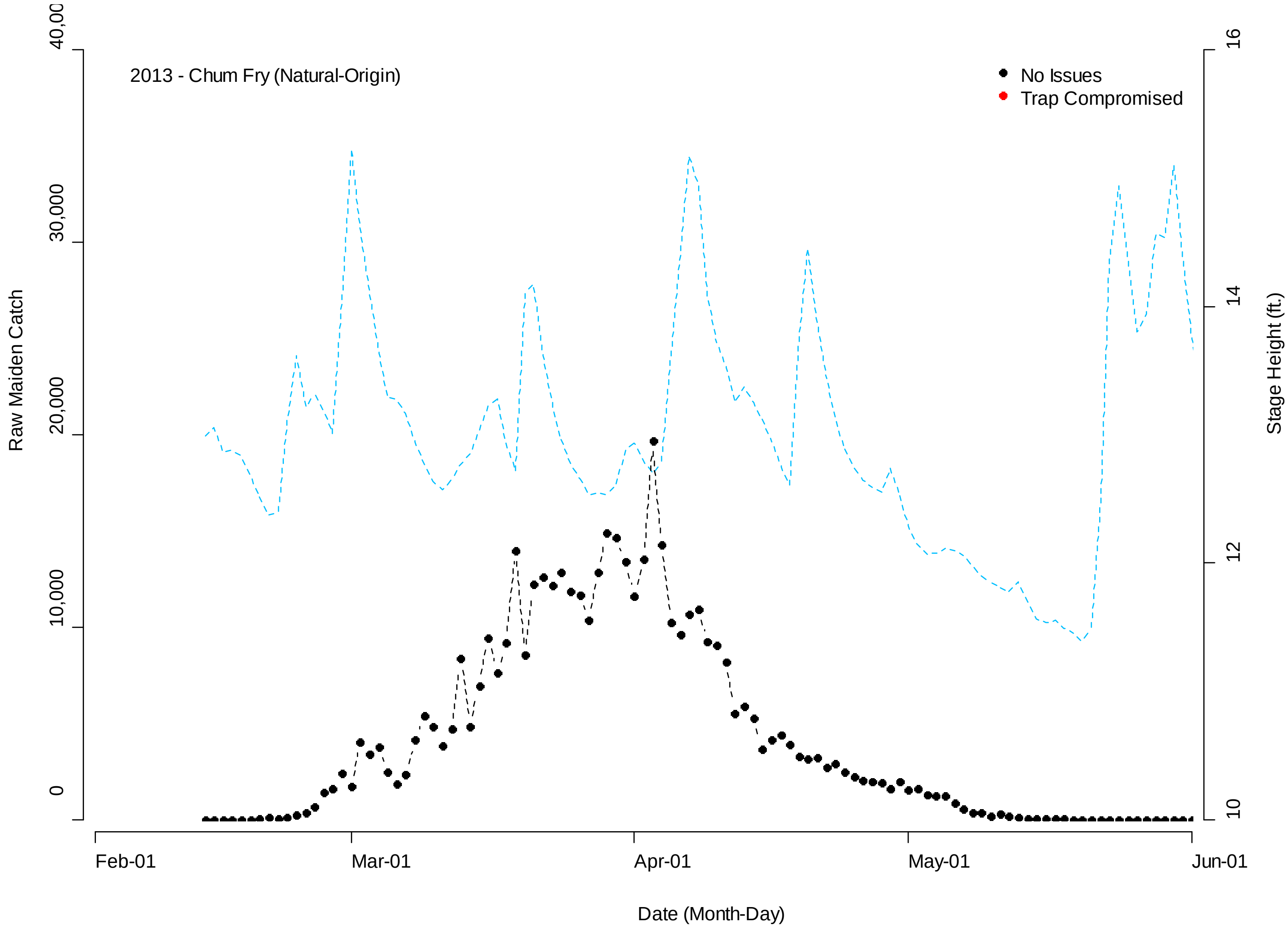

Figure B110. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), Hamilton Springs, 2013.

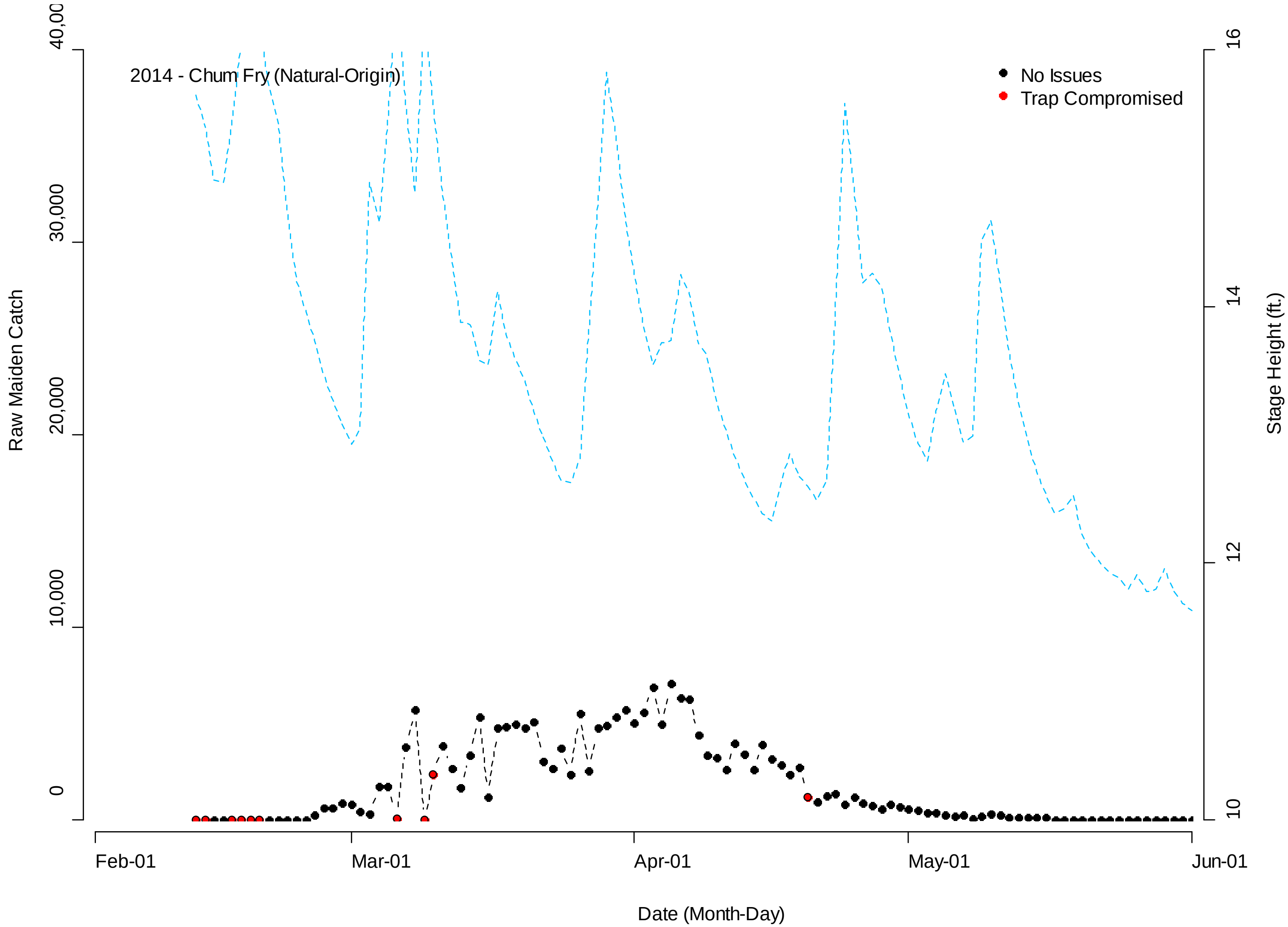

Figure B111. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), Hamilton Springs, 2014.

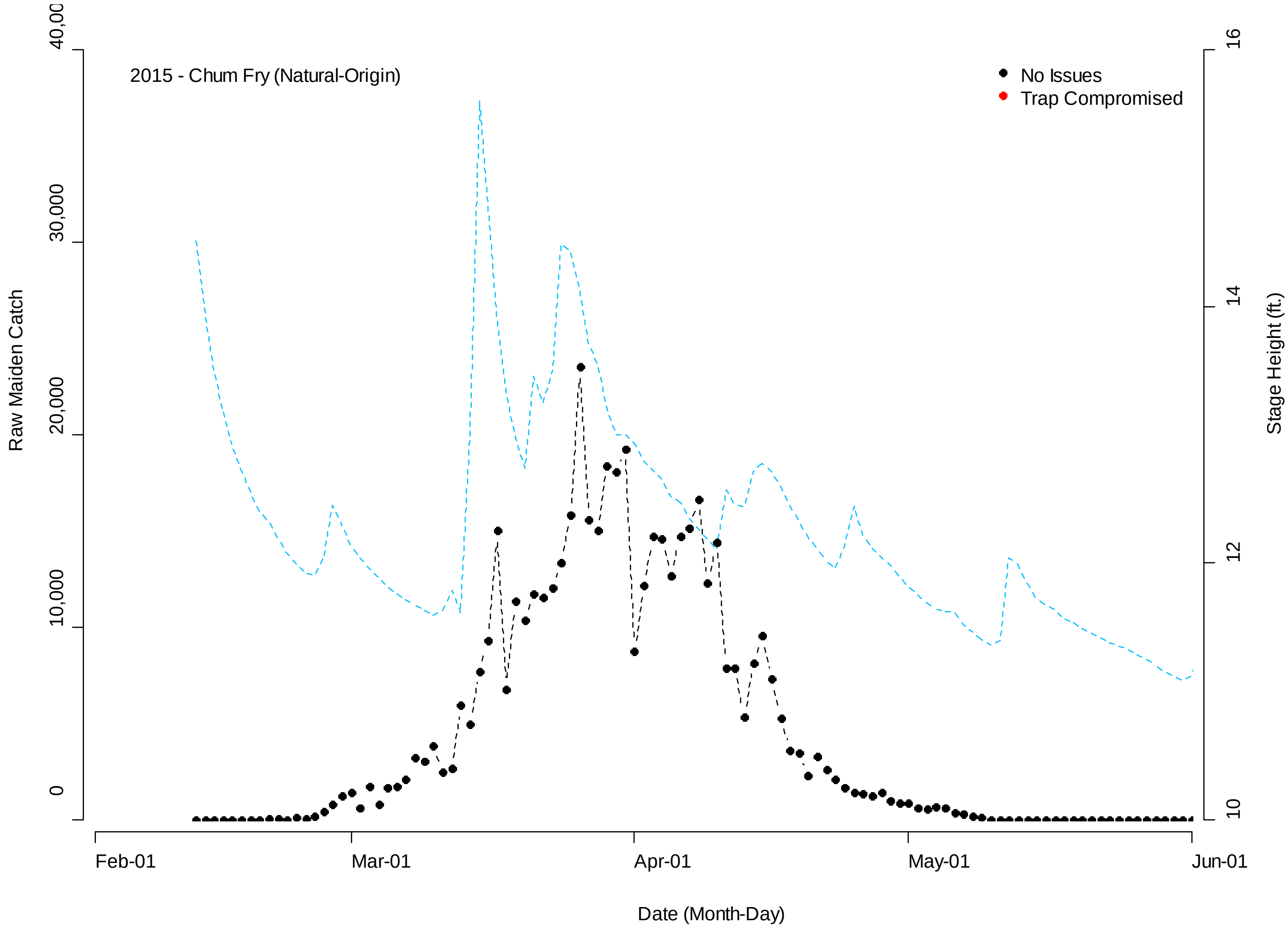

Figure B112. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), Hamilton Springs, 2015.

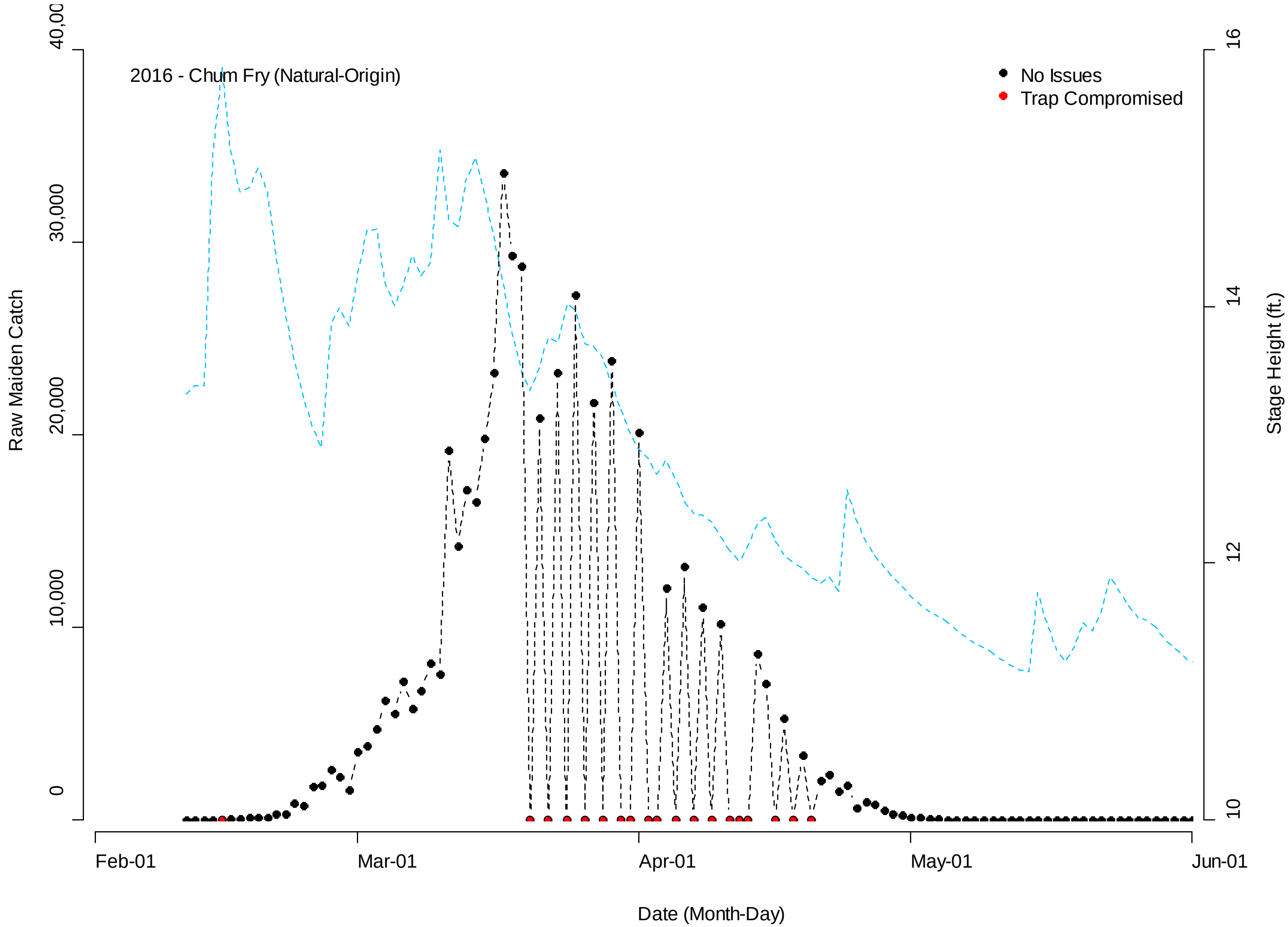

Figure B113. Raw maiden catch (black dashed) and mean daily stage height (blue dashed) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), Hamilton Springs, 2016. Note: All Trap Compromised days in March and April were intentional, implemented an alternate-day trapping schedule.

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Appendix C – Summary BTPSAS and Catch Tables

Prior to analysis, raw trap data were summarized and subsequently formatted for data analysis. Specifically, screw trap data were formatted into a "BTSPAS table" format while weir data were formatted into a "catch table". BTSPAS tables include the number of captured, marked, and recaptured fish plus the sample proportion (i.e., proportion of days successful sampled) by period (date) . Note: marked individuals can be recaptured in the same period as they were marked (i.e., Period.Plus.0) or periods following the one in which they were marked (e.g., Period.Plus.1, Period.Plus.2, etc.). In some cases, the number of marked and recaptured fish for a particular period can be greater than the number of (maiden) captures if (1) multiple groupings were combined to make a single mark efficiency estimate (e.g., hatchery and wild fish), or (2) the mark efficiency trials for particular grouping was used as a surrogate for another (e.g., chum salmon fry efficiency trials used for Chinook salmon fry). Catch tables include the raw number of fish captured on each individual day and whether the trap was properly functioning (Y) or not (N).

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Grays River

Chum salmon (Natural-Origin, Fry)

Table C1. BTSPAS table for Grays River natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2008.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0
1	2/21	2/22	2	1.000	442	232	5	5
2	2/23	2/25	3	1.000	622	202	13	13
3	2/26	2/28	3	1.000	1,186	554	17	17
4	2/29	3/2	3	1.000	1,549	622	31	31
5	3/3	3/5	3	1.000	2,015	758	22	22
6	3/6	3/9	4	1.000	5,710	801	22	22
7	3/10	3/12	3	1.000	3,207	1,110	22	2
8	3/13	3/15	3	0.670	2,440	717	13	13
9	3/16	3/18	3	1.000	1,465	0	0	0
10	3/19	3/20	2	1.000	1,971	541	11	11
11	3/21	3/23	3	0.667	2,381	838	12	12
12	3/24	3/25	2	0.500	414	0	0	0
13	3/26	3/27	2	1.000	1,478	412	11	11
14	3/28	3/30	3	0.667	1,184	0	0	0
15	3/31	4/1	2	1.000	1,650	542	9	9
16	4/2	4/3	2	1.000	2,573	998	26	26
17	4/4	4/6	3	1.000	3,337	1,345	37	37
18	4/7	4/8	2	1.000	952	763	9	9
19	4/9	4/11	3	0.667	605	450	11	11
20	4/12	4/13	2	1.000	543	263	12	12
21	4/14	4/15	2	1.000	381	226	3	3
22	4/16	4/16	1	1.000	267	200	8	8
23	4/17	4/23	7	0.286	328	0	0	0

Table C1. Continued

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0
24	4/24	4/30	7	0.857	0	0	0	0
25	5/1	5/7	7	1.000	0	0	0	0
26	5/8	5/14	7	1.000	0	0	0	0
27	5/15	5/21	7	0.857	0	0	0	0
28	5/22	5/28	7	1.000	0	0	0	0
29	5/29	6/4	7	1.000	0	0	0	0
30	6/5	6/11	7	0.857	0	0	0	0
31	6/12	6/18	7	1.000	0	0	0	0
32	6/19	6/25	7	1.000	0	0	0	0
33	6/26	7/2	7	1.000	0	0	0	0
34	7/3	7/9	7	1.000	0	0	0	0
35	7/10	7/16	7	1.000	0	0	0	0
36	7/17	7/23	7	1.000	0	0	0	0
37	7/24	7/30	7	0.857	0	0	0	0
38	7/31	8/6	7	1.000	0	0	0	0
39	8/7	8/13	7	0.857	0	0	0	0
40	8/14	8/20	2	1.000	0	0	0	0

Table C2. BTSPAS table for Grays River natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2009.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0
1	2/8	2/21	13	1.000	298	0	0	0
2	2/22	2/24	3	1.000	349	186	18	18
3	2/25	2/27	3	1.000	231	92	6	6
4	2/28	3/1	2	1.000	620	148	7	7
5	3/2	3/3	2	1.000	1,051	414	45	45
6	3/4	3/5	2	1.000	1,633	214	18	18
7	3/6	3/7	2	1.000	2,094	831	63	63
8	3/8	3/10	3	1.000	2,660	1,224	148	148
9	3/11	3/12	2	1.000	3,183	911	83	83
10	3/13	3/14	2	1.000	4,782	1,873	147	147
11	3/15	3/16	2	0.000	0	0	0	0
12	3/17	3/18	2	0.500	1,011	0	0	0
13	3/19	3/20	2	1.000	5,089	965	50	50
14	3/21	3/22	2	1.000	3,754	3,389	90	90
15	3/23	3/24	2	1.000	5,426	1,805	0	0
16	3/25	3/26	2	1.000	5,148	3,292	242	242
17	3/27	3/28	2	1.000	6,359	2,213	179	179
18	3/29	3/30	2	1.000	6,330	3,094	169	169
19	3/31	4/1	2	1.000	6,329	3,580	263	263
20	4/2	4/4	3	0.667	1,611	2,889	0	0
21	4/5	4/6	2	1.000	3,237	1,267	76	76
22	4/7	4/8	2	1.000	3,323	1,889	111	111
23	4/9	4/10	2	1.000	1,946	1,700	104	104
24	4/11	4/12	2	1.000	3,958	990	115	115
25	4/13	4/14	2	0.500	163	0	0	0
26	4/15	4/17	2	1.000	569	157	4	4
27	4/18	4/19	2	1.000	354	308	18	18
28	4/20	4/21	2	1.000	311	195	6	6

Table C2. Continued

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0
29	4/22	4/26	5	1.000	300	162	6	6
30	4/27	4/29	3	1.000	196	106	4	4
31	4/30	4/30	1	1.000	54	82	8	8
32	5/1	5/7	7	0.857	68	0	0	0
33	5/8	5/14	7	0.857	5	0	0	0
34	5/15	5/21	7	1.000	2	0	0	0
35	5/22	5/28	7	1.000	2	0	0	0
36	5/29	6/4	7	1.000	0	0	0	0
37	6/5	6/11	7	1.000	1	0	0	0
38	6/12	6/18	7	0.857	0	0	0	0
39	6/19	6/25	7	1.000	0	0	0	0
40	6/26	7/2	7	0.857	0	0	0	0
41	7/3	7/9	7	0.857	0	0	0	0
42	7/10	7/16	7	0.857	1	0	0	0
43	7/17	7/23	7	1.000	0	0	0	0
44	7/24	7/30	7	0.857	0	0	0	0
45	7/31	8/6	1	1.000	0	0	0	0

Table C3. BTSPAS table for Grays River natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2010.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0
1	2/4	2/11	8	1.000	253	0	0	0
2	2/12	2/13	2	1.000	128	138	8	8
3	2/14	2/17	4	1.000	146	127	10	10
4	2/18	2/19	2	1.000	189	100	4	4
5	2/20	2/21	2	1.000	509	188	10	10
6	2/22	2/23	2	1.000	869	508	0	0
7	2/24	2/25	2	1.000	1,113	522	25	25
8	2/26	2/27	2	1.000	891	479	16	16
9	2/28	3/1	2	1.000	985	434	25	25
10	3/2	3/3	2	1.000	3,301	695	23	23
11	3/4	3/5	2	1.000	5,297	1,971	88	88
12	3/6	3/7	2	1.000	8,470	2,794	167	167
13	3/8	3/9	2	1.000	9,794	4,240	368	368
14	3/10	3/11	2	1.000	11,131	4,637	350	350
15	3/12	3/13	2	1.000	5,450	5,696	200	200
16	3/14	3/15	2	1.000	6,661	1,992	73	73
17	3/16	3/17	2	1.000	8,375	3,638	153	153
18	3/18	3/19	2	1.000	9,297	4,536	244	244
19	3/20	3/21	2	1.000	8,356	4,580	256	256
20	3/22	3/23	2	1.000	10,931	4,374	241	241
21	3/24	3/24	1	1.000	4,333	0	0	0
22	3/25	3/26	2	1.000	9,762	4,333	346	346
23	3/27	3/28	2	0.500	3,168	0	0	0
24	3/29	3/30	2	0.500	1,042	0	0	0
25	3/31	4/1	2	1.000	3,262	1,042	20	20
26	4/2	4/3	2	1.000	3,454	3,262	99	99
27	4/4	4/5	2	1.000	1,099	1,150	13	13
28	4/6	4/7	2	1.000	1,368	627	11	11

Table C3. Continued

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0
29	4/8	4/9	2	1.000	692	544	13	13
30	4/10	4/11	2	1.000	145	689	4	4
31	4/12	4/14	3	1.000	122	142	2	2
32	4/15	4/21	7	1.000	356	120	0	0
33	4/22	4/22	1	1.000	64	196	7	7
34	4/23	4/29	7	1.000	150	0	0	0
35	4/30	5/6	7	0.714	19	0	0	0
36	5/7	5/13	7	1.000	4	0	0	0
37	5/14	5/20	7	1.000	1	0	0	0
38	5/21	5/27	7	1.000	5	0	0	0
39	5/28	6/3	7	0.571	0	0	0	0
40	6/4	6/10	7	0.857	0	0	0	0
41	6/11	6/17	7	1.000	0	0	0	0
42	6/18	6/24	7	1.000	0	0	0	0
43	6/25	7/1	7	1.000	0	0	0	0
44	7/2	7/8	7	1.000	0	0	0	0
45	7/9	7/15	7	1.000	0	0	0	0
46	7/16	7/22	7	0.857	0	0	0	0
47	7/23	7/29	7	0.714	0	0	0	0
48	7/30	8/5	2	1.000	0	0	0	0

Table C4. BTSPAS table for Grays River natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2011.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0
1	2/5	2/19	15	0.933	320	0	0	0
2	2/20	2/21	2	1.000	63	132	0	0
3	2/22	2/26	5	1.000	307	53	0	0
4	2/27	2/28	2	1.000	667	220	3	3
5	3/1	3/2	2	1.000	767	663	10	10
6	3/3	3/4	2	0.500	431	0	0	0
7	3/5	3/6	2	0.500	640	0	0	0
8	3/7	3/9	3	1.000	1,987	635	7	7
9	3/10	3/11	2	0.500	398	0	0	0
10	3/12	3/13	2	0.000	0	0	0	0
11	3/14	3/16	3	0.000	0	0	0	0
12	3/17	3/18	2	1.000	1,642	248	1	1
13	3/19	3/20	2	1.000	1,215	1,641	15	15
14	3/21	3/22	2	1.000	2,312	885	29	29
15	3/23	3/24	2	1.000	2,323	1,077	21	21
16	3/25	3/26	2	1.000	2,672	1,437	32	32
17	3/27	3/28	2	1.000	1,898	864	9	9
18	3/29	3/30	2	1.000	2,148	760	12	12
19	3/31	4/1	2	0.000	0	0	0	0
20	4/2	4/3	2	0.000	0	0	0	0
21	4/4	4/5	2	1.000	578	0	0	0
22	4/6	4/7	2	1.000	610	578	9	9
23	4/8	4/9	2	1.000	496	610	2	2
24	4/10	4/11	2	1.000	476	496	9	9
25	4/12	4/13	2	1.000	237	476	5	5
26	4/14	4/15	2	1.000	293	237	2	2
27	4/16	4/17	2	1.000	103	198	2	2
28	4/18	4/19	2	1.000	157	198	0	0

Table C4. Continued

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0
29	4/20	4/22	3	1.000	142	157	7	7
30	4/23	4/24	2	1.000	114	142	1	1
31	4/25	4/25	1	1.000	20	112	4	4
32	4/26	5/2	7	1.000	82	0	0	0
33	5/3	5/9	7	1.000	12	0	0	0
34	5/10	5/16	7	0.857	2	0	0	0
35	5/17	5/23	7	1.000	0	0	0	0
36	5/24	5/30	7	0.714	1	0	0	0
37	5/31	6/6	7	0.714	0	0	0	0
38	6/7	6/13	7	1.000	0	0	0	0
39	6/14	6/20	7	1.000	0	0	0	0
40	6/21	6/27	7	1.000	0	0	0	0
41	6/28	7/4	7	0.857	0	0	0	0
42	7/5	7/11	7	0.714	0	0	0	0
43	7/12	7/18	7	0.857	0	0	0	0
44	7/19	7/25	7	1.000	0	0	0	0
45	7/26	8/1	7	1.000	0	0	0	0
46	8/2	8/8	7	1.000	0	0	0	0
47	8/9	8/15	5	0.800	0	0	0	0

Table C5. BTSPAS table for Grays River natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2012.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0
1	2/12	3/5	23	0.565	788	0	0	0
2	3/6	3/7	2	1.000	159	143	0	0
3	3/8	3/9	2	1.000	505	155	0	0
4	3/10	3/11	2	1.000	2,515	496	27	27
5	3/12	3/13	2	1.000	221	645	6	6
6	3/14	3/19	6	0.333	693	219	4	4
7	3/20	3/21	2	1.000	600	289	0	0
8	3/22	3/22	1	1.000	198	226	6	6
9	3/23	3/23	1	1.000	155	111	0	0
10	3/24	3/25	2	1.000	168	179	0	0
11	3/26	3/27	2	1.000	140	151	0	0
12	3/28	4/1	5	0.600	1,468	139	1	1
13	4/2	4/3	2	1.000	664	328	1	1
14	4/4	4/5	2	1.000	944	651	6	6
15	4/6	4/7	2	1.000	3,157	936	41	41
16	4/8	4/9	2	1.000	1,684	1,959	61	61
17	4/10	4/11	2	1.000	1,335	1,051	35	35
18	4/12	4/13	2	1.000	306	1,322	30	30
19	4/14	4/15	2	1.000	184	299	3	3
20	4/16	4/17	2	1.000	1,087	179	2	2
21	4/18	4/19	2	1.000	166	655	20	20
22	4/20	4/22	3	1.000	288	141	0	0
23	4/23	4/23	1	1.000	29	103	0	0
24	4/24	4/30	7	1.000	55	0	0	0
25	5/1	5/7	7	1.000	13	0	0	0
26	5/8	5/14	7	1.000	4	0	0	0
27	5/15	5/21	7	1.000	5	0	0	0
28	5/22	5/28	7	0.714	0	0	0	0

Table C5. Continued

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0
29	5/29	6/4	7	1.000	0	0	0	0
30	6/5	6/11	7	1.000	0	0	0	0
31	6/12	6/18	7	1.000	0	0	0	0
32	6/19	6/25	7	1.000	0	0	0	0
33	6/26	7/2	7	1.000	0	0	0	0
34	7/3	7/9	7	1.000	0	0	0	0
35	7/10	7/16	7	1.000	0	0	0	0
36	7/17	7/23	7	1.000	0	0	0	0
37	7/24	7/30	7	1.000	0	0	0	0
38	7/31	8/6	7	0.714	0	0	0	0
39	8/7	8/13	1	0.000	0	0	0	0

Table C6. BTSPAS table for Grays River natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2013.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0
1	2/9	2/14	6	1.000	418	0	0	0
2	2/15	2/16	2	1.000	449	242	7	7
3	2/17	2/19	3	1.000	883	434	13	13
4	2/20	2/21	2	1.000	875	0	0	0
5	2/22	2/23	2	1.000	1,221	717	22	22
6	2/24	2/25	2	1.000	681	0	0	0
7	2/26	2/27	2	1.000	1,270	638	20	20
8	2/28	3/1	2	1.000	853	1,224	37	37
9	3/2	3/3	2	1.000	442	0	0	0
10	3/4	3/5	2	1.000	2,389	385	13	13
11	3/6	3/7	2	1.000	4,661	2,225	154	154
12	3/8	3/9	2	1.000	5,351	0	0	0
13	3/10	3/11	2	1.000	6,056	2,656	109	109
14	3/12	3/13	2	1.000	5,285	3,649	109	109
15	3/14	3/15	2	1.000	5,198	0	0	0
16	3/16	3/17	2	1.000	3,516	3,460	73	73
17	3/18	3/20	3	0.667	8,760	1,469	55	55
18	3/21	3/22	2	1.000	640	0	0	0
19	3/23	3/25	3	1.000	3,877	449	13	13
20	3/26	3/27	2	1.000	6,672	0	0	0
21	3/28	3/29	2	1.000	4,712	5,121	138	138
22	3/30	4/1	3	1.000	3,986	1,885	55	55
23	4/2	4/3	2	1.000	371	0	0	0
24	4/4	4/6	3	0.667	250	246	0	0
25	4/7	4/9	3	1.000	50	0	0	0
26	4/10	4/11	2	1.000	111	3,000	48	48
27	4/12	4/13	2	1.000	44	0	0	0
28	4/14	4/15	2	1.000	67	1,067	20	20

Table C6. Continued

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0
29	4/16	4/17	2	1.000	42	0	0	0
30	4/18	4/18	1	1.000	25	186	6	6
31	4/19	4/25	7	1.000	10	0	0	0
32	4/26	5/2	7	1.000	8	0	0	0
33	5/3	5/9	7	1.000	0	0	0	0
34	5/10	5/16	7	1.000	0	0	0	0
35	5/17	5/23	7	1.000	2	0	0	0
36	5/24	5/30	7	1.000	0	0	0	0
37	5/31	6/6	7	1.000	0	0	0	0
38	6/7	6/13	7	1.000	0	0	0	0
39	6/14	6/20	6	1.000	0	0	0	0
40	6/21	6/27	7	1.000	0	0	0	0
41	6/28	7/4	7	1.000	0	0	0	0
42	7/5	7/11	7	1.000	0	0	0	0
43	7/12	7/18	7	1.000	0	0	0	0
44	7/19	7/25	7	1.000	0	0	0	0
45	7/26	8/1	6	1.000	0	0	0	0

Table C7. BTSPAS table for Grays River natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2014.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0
1	2/12	2/20	9	0.444	350	0	0	0
2	2/21	2/24	4	1.000	309	244	0	0
3	2/25	2/26	2	1.000	108	204	0	0
4	2/27	3/2	4	1.000	1,245	1,000	27	27
5	3/3	3/14	12	0.667	1,311	684	2	2
6	3/15	3/16	2	1.000	321	1,729	2	2
7	3/17	3/20	4	1.000	557	1,500	7	7
8	3/21	3/23	3	1.000	1,060	2,000	24	24
9	3/24	3/26	3	1.000	12,528	2,000	29	29
10	3/27	3/28	2	1.000	4,624	4,000	110	110
11	3/29	3/31	3	1.000	310	419	0	0
12	4/1	4/5	5	1.000	836	2,000	14	14
13	4/6	4/6	1	1.000	107	2,112	10	10
14	4/7	4/11	5	1.000	2,601	2,065	0	0
15	4/12	4/14	3	1.000	595	2,266	10	10
16	4/15	4/18	4	1.000	153	2,029	4	4
17	4/19	4/20	2	1.000	10	1,304	9	9
18	4/21	4/21	1	1.000	1	284	2	2
19	4/22	4/28	8	0.750	6	0	0	0
20	4/29	5/5	8	1.000	4	0	0	0
21	5/6	5/12	7	1.000	0	0	0	0
22	5/13	5/19	7	1.000	4	0	0	0
23	5/20	5/26	7	0.714	0	0	0	0
24	5/27	6/2	7	1.000	0	0	0	0
25	6/3	6/9	7	1.000	0	0	0	0
26	6/10	6/16	7	0.857	0	0	0	0
27	6/17	6/23	7	1.000	0	0	0	0
28	6/24	6/30	7	0.714	0	0	0	0

Table C7. Continued

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0
29	7/1	7/7	7	1.000	0	0	0	0
30	7/8	7/14	7	0.857	0	0	0	0
31	7/15	7/21	7	1.000	0	0	0	0
32	7/22	7/28	7	1.000	0	0	0	0
33	7/29	8/4	3	1.000	0	0	0	0

Table C8. BTSPAS table for Grays River natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2015.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0
1	2/12	2/17	6	1.000	493	0	0	0
2	2/18	2/22	5	0.800	448	0	0	0
3	2/23	2/26	4	1.000	5,897	374	36	36
4	2/27	3/2	4	1.000	4,441	890	44	44
5	3/3	3/6	4	1.000	6,184	536	31	31
6	3/7	3/10	4	1.000	12,236	1,019	69	69
7	3/11	3/15	5	0.600	13,212	1,500	220	220
8	3/16	3/20	5	0.600	346	0	0	0
9	3/21	3/24	4	1.000	620	1,998	28	28
10	3/25	3/29	5	0.800	54	609	5	5
11	3/30	4/2	4	1.000	65	353	6	6
12	4/3	4/7	5	1.000	104	390	10	10
13	4/8	4/13	7	1.000	5	58	1	1
14	4/14	4/22	9	1.000	1	0	0	0
15	4/23	4/29	7	1.000	8	0	0	0
16	4/30	5/6	7	0.857	0	0	0	0
17	5/7	5/13	7	0.857	0	0	0	0
18	5/14	5/20	7	0.857	0	0	0	0
19	5/21	5/27	7	0.857	0	0	0	0
20	5/28	6/3	7	1.000	0	0	0	0
21	6/4	6/10	7	0.714	0	0	0	0
22	6/11	6/17	7	0.857	0	0	0	0
23	6/18	6/24	7	0.571	0	0	0	0
24	6/25	7/1	7	1.000	0	0	0	0
25	7/2	7/8	7	0.857	0	0	0	0
26	7/9	7/15	7	0.857	0	0	0	0
27	7/16	7/22	7	0.857	0	0	0	0
28	7/23	7/29	7	1.000	0	0	0	0
29	7/30	8/5	2	0.500	0	0	0	0

Table C9. BTSPAS table for Grays River natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2016.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0
1	2/8	2/10	3	1.000	0	0	0	0
2	2/11	2/13	3	1.000	112	832	2	2
3	2/14	2/15	2	0.000	0	0	0	0
4	2/16	2/17	2	0.000	0	0	0	0
5	2/18	2/19	2	1.000	72	1,622	4	4
6	2/20	2/21	2	0.500	74	0	0	0
7	2/22	2/23	2	1.000	125	1,500	12	12
8	2/24	2/25	2	1.000	103	0	0	0
9	2/26	2/27	2	1.000	2,083	1,500	65	65
10	2/28	2/29	2	1.000	3,763	1,986	158	158
11	3/1	3/2	2	0.500	2,530	0	0	0
12	3/3	3/4	2	1.000	125	823	1	1
13	3/5	3/6	2	1.000	489	1,500	5	5
14	3/7	3/8	2	1.000	1,258	0	0	0
15	3/9	3/10	2	0.500	1,505	0	0	0
16	3/11	3/12	2	0.500	114	0	0	0
17	3/13	3/14	2	1.000	224	1,500	2	2
18	3/15	3/16	2	1.000	356	0	0	0
19	3/17	3/18	2	1.000	295	1,500	6	6
20	3/19	3/20	2	1.000	767	1,500	43	43
21	3/21	3/22	2	1.000	677	0	0	0
22	3/23	3/24	2	1.000	600	1,500	11	11
23	3/25	3/27	3	1.000	218	5,520	56	56
24	3/28	3/29	2	1.000	43	0	0	0
25	3/30	3/31	2	1.000	29	295	3	3
26	4/1	4/2	2	1.000	12	275	0	0

Table C9. Continued

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0
27	4/3	4/4	2	1.000	128	0	0	0
28	4/5	4/7	3	1.000	125	358	17	17
29	4/8	4/9	2	1.000	109	0	0	0
30	4/10	4/11	2	1.000	46	315	12	12
31	4/12	4/17	6	1.000	33	0	0	0
32	4/18	4/24	7	1.000	15	0	0	0
33	4/25	5/1	7	1.000	23	0	0	0
34	5/2	5/8	7	0.857	1	0	0	0
35	5/9	5/15	7	0.857	0	0	0	0
36	5/16	5/22	7	1.000	3	0	0	0
37	5/23	5/29	7	1.000	1	0	0	0
38	5/30	6/5	7	0.857	0	0	0	0
39	6/6	6/12	7	1.000	0	0	0	0
40	6/13	6/19	7	1.000	3	0	0	0
41	6/20	6/26	7	1.000	0	0	0	0
42	6/27	7/3	7	1.000	0	0	0	0
43	7/4	7/10	7	1.000	0	0	0	0
44	7/11	7/17	7	0.857	0	0	0	0
45	7/18	7/24	7	1.000	0	0	0	0
46	7/25	7/31	5	1.000	0	0	0	0

Chinook salmon (Natural-Origin, Fry)

Table C10. BTSPAS table for Grays River natural-origin Chinook salmon (life-stage = fry; age-class = sub-yearling), 2009.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0
1	2/8	2/21	13	1.000	26	0	0	0
2	2/22	2/24	3	1.000	40	186	18	18
3	2/25	2/27	3	1.000	10	92	6	6
4	2/28	3/1	2	1.000	12	148	7	7
5	3/2	3/3	2	1.000	14	414	45	45
6	3/4	3/5	2	1.000	76	214	18	18
7	3/6	3/7	2	1.000	20	831	63	63
8	3/8	3/10	3	1.000	19	1,224	148	148
9	3/11	3/12	2	1.000	10	911	83	83
10	3/13	3/14	2	1.000	20	1,873	147	147
11	3/15	3/16	2	0.000	7	0	0	0
12	3/17	3/18	2	0.500	1	0	0	0
13	3/19	3/20	2	1.000	6	965	50	50
14	3/21	3/22	2	1.000	23	3,389	90	90
15	3/23	3/24	2	1.000	23	1,805	0	0
16	3/25	3/26	2	1.000	32	3,292	242	242
17	3/27	3/28	2	1.000	35	2,213	179	179
18	3/29	3/30	2	1.000	61	3,094	169	169
19	3/31	4/1	2	1.000	21	3,580	263	263
20	4/2	4/4	3	0.667	9	2,889	0	0
21	4/5	4/6	2	1.000	17	1,267	76	76
22	4/7	4/8	2	1.000	12	1,889	111	111
23	4/9	4/10	2	1.000	5	1,700	104	104
24	4/11	4/12	2	1.000	17	990	115	115
25	4/13	4/14	2	0.500	0	0	0	0
26	4/15	4/17	2	1.000	0	157	4	4
27	4/18	4/19	2	1.000	0	308	18	18
28	4/20	4/21	2	1.000	0	195	6	6

Table C10. Continued

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0
29	4/22	4/26	5	1.000	6	162	6	6
30	4/27	4/29	3	1.000	2	106	4	4
31	4/30	4/30	1	1.000	0	82	8	8
32	5/1	5/7	7	0.857	5	0	0	0
33	5/8	5/14	7	0.857	3	0	0	0
34	5/15	5/21	7	1.000	3	0	0	0
35	5/22	5/28	7	1.000	27	0	0	0
36	5/29	6/4	7	1.000	1	0	0	0
37	6/5	6/11	7	1.000	1	0	0	0
38	6/12	6/18	7	0.857	0	0	0	0
39	6/19	6/25	7	1.000	0	0	0	0
40	6/26	7/2	7	0.857	0	0	0	0

Table C11. BTSPAS table for Grays River natural-origin Chinook salmon (life-stage = fry; age-class = sub-yearling), 2010.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0
1	2/4	2/11	8	1.000	67	0	0	0
2	2/12	2/13	2	1.000	92	138	8	8
3	2/14	2/17	4	1.000	151	127	10	10
4	2/18	2/19	2	1.000	53	100	4	4
5	2/20	2/21	2	1.000	120	188	10	10
6	2/22	2/23	2	1.000	55	508	0	0
7	2/24	2/25	2	1.000	61	522	25	25
8	2/26	2/27	2	1.000	72	479	16	16
9	2/28	3/1	2	1.000	90	434	25	25
10	3/2	3/3	2	1.000	229	695	23	23
11	3/4	3/5	2	1.000	213	1,971	88	88
12	3/6	3/7	2	1.000	160	2,794	167	167
13	3/8	3/9	2	1.000	143	4,240	368	368
14	3/10	3/11	2	1.000	191	4,637	350	350
15	3/12	3/13	2	1.000	239	5,696	200	200
16	3/14	3/15	2	1.000	166	1,992	73	73
17	3/16	3/17	2	1.000	114	3,638	153	153
18	3/18	3/19	2	1.000	99	4,536	244	244
19	3/20	3/21	2	1.000	42	4,580	256	256
20	3/22	3/23	2	1.000	195	4,374	241	241
21	3/24	3/24	1	1.000	31	0	0	0
22	3/25	3/26	2	1.000	70	4,333	346	346
23	3/27	3/28	2	0.500	12	0	0	0
24	3/29	3/30	2	0.500	5	0	0	0
25	3/31	4/1	2	1.000	3	1,042	20	20
26	4/2	4/3	2	1.000	6	3,262	99	99
27	4/4	4/5	2	1.000	2	1,150	13	13
28	4/6	4/7	2	1.000	5	627	11	11

Table C11. Continued

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0
29	4/8	4/9	2	1.000	2	544	13	13
30	4/10	4/11	2	1.000	1	689	4	4
31	4/12	4/14	3	1.000	0	142	2	2
32	4/15	4/21	7	1.000	10	120	0	0
33	4/22	4/22	1	1.000	0	196	7	7
34	4/23	4/29	7	1.000	0	0	0	0
35	4/30	5/6	7	0.714	8	0	0	0
36	5/7	5/13	7	1.000	12	0	0	0
37	5/14	5/20	7	1.000	13	0	0	0
38	5/21	5/27	7	1.000	2	0	0	0
39	5/28	6/3	7	0.571	0	0	0	0
40	6/4	6/10	7	0.857	1	0	0	0
41	6/11	6/17	7	1.000	0	0	0	0
42	6/18	6/24	7	1.000	0	0	0	0
43	6/25	7/1	7	1.000	0	0	0	0
44	7/2	7/8	7	1.000	0	0	0	0
45	7/9	7/15	7	1.000	0	0	0	0
46	7/16	7/22	7	0.857	0	0	0	0
47	7/23	7/29	7	0.714	0	0	0	0
48	7/30	8/5	2	1.000	0	0	0	0

Table C12. BTSPAS table for Grays River natural-origin Chinook salmon (life-stage = fry; age-class = sub-yearling), 2011.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0
1	2/5	2/19	15	0.933	28	0	0	0
2	2/20	2/21	2	1.000	2	132	0	0
3	2/22	2/26	5	1.000	2	53	0	0
4	2/27	2/28	2	1.000	4	220	3	3
5	3/1	3/2	2	1.000	1	663	10	10
6	3/3	3/4	2	0.500	2	0	0	0
7	3/5	3/6	2	0.500	5	0	0	0
8	3/7	3/9	3	1.000	85	635	7	7
9	3/10	3/11	2	0.500	0	0	0	0
10	3/12	3/13	2	0.000	0	0	0	0
11	3/14	3/16	3	0.000	6	0	0	0
12	3/17	3/18	2	1.000	28	248	1	1
13	3/19	3/20	2	1.000	19	1,641	15	15
14	3/21	3/22	2	1.000	54	885	29	29
15	3/23	3/24	2	1.000	54	1,077	21	21
16	3/25	3/26	2	1.000	33	1,437	32	32
17	3/27	3/28	2	1.000	34	864	9	9
18	3/29	3/30	2	1.000	58	760	12	12
19	3/31	4/1	2	0.000	0	0	0	0
20	4/2	4/3	2	0.000	0	0	0	0
21	4/4	4/5	2	1.000	31	0	0	0
22	4/6	4/7	2	1.000	15	578	9	9
23	4/8	4/9	2	1.000	30	610	2	2
24	4/10	4/11	2	1.000	21	496	9	9
25	4/12	4/13	2	1.000	20	476	5	5
26	4/14	4/15	2	1.000	48	237	2	2
27	4/16	4/17	2	1.000	33	198	2	2
28	4/18	4/19	2	1.000	18	198	0	0

Table C12. Continued

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0
29	4/20	4/22	3	1.000	7	157	7	7
30	4/23	4/24	2	1.000	40	142	1	1
31	4/25	4/25	1	1.000	15	112	4	4
32	4/26	5/2	7	1.000	45	0	0	0
33	5/3	5/9	7	1.000	11	0	0	0
34	5/10	5/16	7	0.857	13	0	0	0
35	5/17	5/23	7	1.000	18	0	0	0
36	5/24	5/30	7	0.714	7	0	0	0
37	5/31	6/6	7	0.714	1	0	0	0
38	6/7	6/13	7	1.000	0	0	0	0
39	6/14	6/20	7	1.000	0	0	0	0
40	6/21	6/27	7	1.000	1	0	0	0
41	6/28	7/4	7	0.857	0	0	0	0
42	7/5	7/11	7	0.714	1	0	0	0
43	7/12	7/18	7	0.857	1	0	0	0
44	7/19	7/25	7	1.000	0	0	0	0
45	7/26	8/1	7	1.000	0	0	0	0
46	8/2	8/8	7	1.000	0	0	0	0
47	8/9	8/15	5	0.800	0	0	0	0

Table C13. BTSPAS table for Grays River natural-origin Chinook salmon (life-stage = fry; age-class = sub-yearling), 2013.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0
1	2/9	2/14	6	1.000	0	0	0	0
2	2/15	2/16	2	1.000	0	242	7	7
3	2/17	2/19	3	1.000	0	434	13	13
4	2/20	2/21	2	1.000	0	0	0	0
5	2/22	2/23	2	1.000	0	717	22	22
6	2/24	2/25	2	1.000	0	0	0	0
7	2/26	2/27	2	1.000	0	638	20	20
8	2/28	3/1	2	1.000	1	1,224	37	37
9	3/2	3/3	2	1.000	0	0	0	0
10	3/4	3/5	2	1.000	0	385	13	13
11	3/6	3/7	2	1.000	0	2,225	154	154
12	3/8	3/9	2	1.000	0	0	0	0
13	3/10	3/11	2	1.000	0	2,656	109	109
14	3/12	3/13	2	1.000	0	3,649	109	109
15	3/14	3/15	2	1.000	0	0	0	0
16	3/16	3/17	2	1.000	24	3,460	73	73
17	3/18	3/20	3	0.667	0	1,469	55	55
18	3/21	3/22	2	1.000	9	0	0	0
19	3/23	3/25	3	1.000	6	449	13	13
20	3/26	3/27	2	1.000	5	0	0	0
21	3/28	3/29	2	1.000	9	5,121	138	138
22	3/30	4/1	3	1.000	6	1,885	55	55
23	4/2	4/3	2	1.000	0	0	0	0
24	4/4	4/6	3	0.667	10	246	0	0
25	4/7	4/9	3	1.000	4	0	0	0
26	4/10	4/11	2	1.000	3	3,000	48	48
27	4/12	4/13	2	1.000	0	0	0	0
28	4/14	4/15	2	1.000	0	1,067	20	20

Table C13. Continued

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0
29	4/16	4/17	2	1.000	0	0	0	0
30	4/18	4/18	1	1.000	1	186	6	6
31	4/19	4/25	7	1.000	2	0	0	0
32	4/26	5/2	7	1.000	0	0	0	0
33	5/3	5/9	7	1.000	1	0	0	0
34	5/10	5/16	7	1.000	1	0	0	0
35	5/17	5/23	7	1.000	2	0	0	0
36	5/24	5/30	7	1.000	0	0	0	0
37	5/31	6/6	7	1.000	3	0	0	0
38	6/7	6/13	7	1.000	0	0	0	0
39	6/14	6/20	6	1.000	1	0	0	0
40	6/21	6/27	7	1.000	0	0	0	0
41	6/28	7/4	7	1.000	0	0	0	0
42	7/5	7/11	7	1.000	0	0	0	0
43	7/12	7/18	7	1.000	0	0	0	0
44	7/19	7/25	7	1.000	0	0	0	0
45	7/26	8/1	6	1.000	0	0	0	0

Table C14. BTSPAS table for Grays River natural-origin Chinook salmon (life-stage = fry; age-class = sub-yearling), 2014.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0
1	2/12	2/14	3	0.667	4	0	0	0
2	2/15	2/17	3	0.330	12	0	0	0
3	2/18	2/20	3	0.330	5	0	0	0
4	2/21	2/22	2	1.000	2	244	0	0
5	2/23	2/24	2	1.000	7	0	0	0
6	2/25	2/26	2	1.000	16	204	0	0
7	2/27	2/28	2	1.000	3	1,000	27	27
8	3/1	3/2	2	1.000	21	0	0	0
9	3/3	3/5	3	1.000	23	684	2	2
10	3/6	3/8	3	0.330	2	0	0	0
11	3/9	3/11	3	0.330	19	0	0	0
12	3/12	3/14	3	1.000	160	0	0	0
13	3/15	3/16	2	1.000	23	1,729	2	2
14	3/17	3/18	2	1.000	19	1,500	7	7
15	3/19	3/20	2	1.000	19	0	0	0
16	3/21	3/23	3	1.000	40	2,000	24	24
17	3/24	3/26	3	1.000	754	2,000	29	29
18	3/27	3/28	2	1.000	440	4,000	110	110
19	3/29	3/31	3	1.000	40	419	0	0
20	4/1	4/3	3	1.000	26	2,000	14	14
21	4/4	4/5	2	1.000	41	0	0	0
22	4/6	4/6	1	1.000	16	2,112	10	10
23	4/7	4/9	3	1.000	31	2,065	0	0
24	4/10	4/11	2	1.000	67	0	0	0
25	4/12	4/14	3	1.000	24	2,266	10	10
26	4/15	4/16	2	1.000	1	2,029	4	4
27	4/17	4/18	2	1.000	30	0	0	0
28	4/19	4/20	2	1.000	4	1,304	9	9

Table C14. Continued

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0
29	4/21	4/21	1	1.000	5	284	2	2
30	4/22	4/28	8	0.750	1	0	0	0
31	4/29	5/5	8	1.000	5	0	0	0
32	5/6	5/12	7	1.000	2	0	0	0
33	5/13	5/19	7	1.000	0	0	0	0
34	5/20	5/26	7	0.714	4	0	0	0
35	5/27	6/2	7	1.000	0	0	0	0
36	6/3	6/9	7	1.000	1	0	0	0
37	6/10	6/16	7	0.857	0	0	0	0
38	6/17	6/23	7	1.000	0	0	0	0
39	6/24	6/30	7	0.714	0	0	0	0
40	7/1	7/7	7	1.000	0	0	0	0
41	7/8	7/14	7	0.857	0	0	0	0
42	7/15	7/21	7	1.000	0	0	0	0
43	7/22	7/28	7	1.000	0	0	0	0
44	7/29	8/4	3	1.000	0	0	0	0

Table C15. BTSPAS table for Grays River natural-origin Chinook salmon (life-stage = fry; age-class = sub-yearling), 2016.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0
1	2/8	2/10	3	1.000	0	0	0	0
2	2/11	2/13	3	1.000	4	832	2	2
3	2/14	2/15	2	0.000	0	0	0	0
4	2/16	2/17	2	0.000	0	0	0	0
5	2/18	2/19	2	1.000	0	1,622	4	4
6	2/20	2/21	2	0.500	0	0	0	0
7	2/22	2/23	2	1.000	0	1,500	12	12
8	2/24	2/25	2	1.000	0	0	0	0
9	2/26	2/27	2	1.000	0	1,500	65	65
10	2/28	2/29	2	1.000	0	1,986	158	158
11	3/1	3/2	2	0.500	0	0	0	0
12	3/3	3/4	2	1.000	1	823	1	1
13	3/5	3/6	2	1.000	1	1,500	5	5
14	3/7	3/8	2	1.000	2	0	0	0
15	3/9	3/10	2	0.500	0	0	0	0
16	3/11	3/12	2	0.500	2	0	0	0
17	3/13	3/14	2	1.000	5	1,500	2	2
18	3/15	3/16	2	1.000	0	0	0	0
19	3/17	3/18	2	1.000	1	1,500	6	6
20	3/19	3/20	2	1.000	0	1,500	43	43
21	3/21	3/22	2	1.000	4	0	0	0
22	3/23	3/24	2	1.000	1	1,500	11	11
23	3/25	3/27	3	1.000	0	5,520	56	56
24	3/28	3/29	2	1.000	1	0	0	0
25	3/30	3/31	2	1.000	2	295	3	3
26	4/1	4/2	2	1.000	1	275	0	0
27	4/3	4/4	2	1.000	16	0	0	0
28	4/5	4/7	3	NA	3	358	17	17

Table C15. Continued

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0
29	4/8	4/9	2	1.000	0	0	0	0
30	4/10	4/11	2	1.000	1	315	12	12
31	4/12	4/17	6	1.000	4	0	0	0
32	4/18	4/24	7	1.000	0	0	0	0
33	4/25	5/1	7	1.000	11	0	0	0
34	5/2	5/8	7	0.857	1	0	0	0
35	5/9	5/15	7	0.857	1	0	0	0
36	5/16	5/22	7	1.000	0	0	0	0
37	5/23	5/29	7	1.000	1	0	0	0
38	5/30	6/5	7	0.857	0	0	0	0
39	6/6	6/12	7	1.000	0	0	0	0
40	6/13	6/19	7	1.000	0	0	0	0
41	6/20	6/26	7	1.000	0	0	0	0
42	6/27	7/3	7	1.000	0	0	0	0
43	7/4	7/10	7	1.000	0	0	0	0
44	7/11	7/17	7	0.857	0	0	0	0
45	7/18	7/24	7	1.000	0	0	0	0
46	7/25	7/31	5	1.000	0	0	0	0

Chinook salmon (Natural-Origin, Parr/Transitional/Smolt, Sub-Yearling)

Table C16. BTSPAS table for Grays River natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling), 2008.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/24	3/1	7	1.000	0	0	0	0	0	0	0	0
2	3/2	3/8	7	1.000	7	0	0	0	0	0	0	0
3	3/9	3/15	7	1.000	2	0	0	0	0	0	0	0
4	3/16	3/22	7	1.000	2	0	0	0	0	0	0	0
5	3/23	3/29	7	1.000	1	0	0	0	0	0	0	0
6	3/30	4/5	7	1.000	0	0	0	0	0	0	0	0
7	4/6	4/12	7	1.000	0	0	0	0	0	0	0	0
8	4/13	4/19	7	0.714	0	0	0	0	0	0	0	0
9	4/20	5/2	13	0.769	0	0	0	0	0	0	0	0
10	5/3	5/9	7	1.000	0	0	0	0	0	0	0	0
11	5/10	5/16	7	1.000	0	0	0	0	0	0	0	0
12	5/17	5/23	7	1.000	18	3	0	0	0	0	0	0
13	5/24	5/30	7	1.000	102	91	24	24	0	0	0	0
14	5/31	6/6	7	1.000	279	213	92	92	0	0	0	0
15	6/7	6/13	7	1.000	47	128	12	12	0	0	0	0
16	6/14	6/20	7	1.000	23	28	5	5	0	0	0	0
17	6/21	6/27	7	1.000	196	170	65	65	0	0	0	0
18	6/28	7/4	7	1.000	96	84	20	20	0	0	0	0
19	7/5	7/11	7	1.000	120	154	46	46	0	0	0	0
20	7/12	7/18	7	1.000	95	83	29	29	0	0	0	0
21	7/19	7/25	7	1.000	99	101	40	40	0	0	0	0
22	7/26	8/1	7	1.000	20	29	5	5	0	0	0	0
23	8/2	8/8	7	1.000	2	3	1	1	0	0	0	0
24	8/9	8/15	7	1.000	0	0	0	0	0	0	0	0

Table C17. BTSPAS table for Grays River natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling), 2009.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/7	2/13	7	1.000	0	0	0	0	0	0	0	0
2	2/14	2/21	8	1.000	0	0	0	0	0	0	0	0
3	2/22	2/28	7	1.000	5	0	0	0	0	0	0	0
4	3/1	3/7	7	1.000	15	0	0	0	0	0	0	0
5	3/8	3/14	7	1.000	12	0	0	0	0	0	0	0
6	3/15	3/21	7	0.714	1	0	0	0	0	0	0	0
7	3/22	3/28	7	1.000	0	0	0	0	0	0	0	0
8	3/29	4/4	7	0.857	1	0	0	0	0	0	0	0
9	4/5	4/11	7	1.000	0	0	0	0	0	0	0	0
10	4/12	4/18	6	1.000	0	0	0	0	0	0	0	0
11	4/19	4/25	7	1.000	1	0	0	0	0	0	0	0
12	4/26	5/2	7	1.000	2	0	0	0	0	0	0	0
13	5/3	5/9	7	0.714	1	0	0	0	0	0	0	0
14	5/10	5/16	7	1.000	15	4	0	0	0	0	0	0
15	5/17	5/23	7	1.000	12	9	0	0	0	0	0	0
16	5/24	5/30	7	1.000	19	10	0	0	0	0	0	0
17	5/31	6/6	7	1.000	55	33	0	0	0	0	0	0
18	6/7	6/13	7	1.000	59	79	8	8	0	0	0	0
19	6/14	6/20	7	1.000	29	26	1	1	0	0	0	0
20	6/21	6/27	7	1.000	25	27	8	8	0	0	0	0
21	6/28	7/4	7	1.000	10	10	3	3	0	0	0	0
22	7/5	7/11	7	1.000	29	26	0	0	0	0	0	0
23	7/12	7/18	7	1.000	23	23	4	4	0	0	0	0
24	7/19	7/25	7	1.000	15	15	0	0	0	0	0	0
25	7/26	8/1	6	1.000	14	13	1	1	0	0	0	0

Table C18. BTSPAS table for Grays River natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling), 2010.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/5	2/11	7	1.000	0	0	0	0	0	0	0	0
2	2/12	2/18	7	1.000	0	0	0	0	0	0	0	0
3	2/19	2/25	7	1.000	1	0	0	0	0	0	0	0
4	2/26	3/4	7	1.000	3	0	0	0	0	0	0	0
5	3/5	3/11	7	1.000	2	0	0	0	0	0	0	0
6	3/12	3/18	7	1.000	0	0	0	0	0	0	0	0
7	3/19	3/25	7	1.000	0	0	0	0	0	0	0	0
8	3/26	4/1	7	1.000	0	0	0	0	0	0	0	0
9	4/2	4/8	7	1.000	1	0	0	0	0	0	0	0
10	4/9	4/15	7	1.000	5	0	0	0	0	0	0	0
11	4/16	4/22	7	1.000	4	0	0	0	0	0	0	0
12	4/23	4/29	7	1.000	4	0	0	0	0	0	0	0
13	4/30	5/6	7	0.857	4	0	0	0	0	0	0	0
14	5/7	5/19	13	1.000	63	0	0	0	0	0	0	0
15	5/20	5/26	7	1.000	53	56	3	3	0	0	0	0
16	5/27	6/2	7	0.857	17	30	7	7	0	0	0	0
17	6/3	6/9	7	0.714	5	5	0	0	0	0	0	0
18	6/10	6/16	7	1.000	3	3	0	0	0	0	0	0
19	6/17	6/23	7	1.000	23	1	0	0	0	0	0	0
20	6/24	6/30	7	1.000	70	41	7	7	0	0	0	0
21	7/1	7/10	10	1.000	40	41	4	4	0	0	0	0
22	7/11	7/13	3	1.000	58	17	1	1	0	0	0	0
23	7/14	7/20	7	1.000	88	104	11	8	3	0	0	0
24	7/21	7/29	9	1.000	14	23	1	1	0	0	0	0
25	7/30	7/31	2	1.000	3	5	0	0	0	0	0	0

Table C19. BTSPAS table for Grays River natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling), 2011.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/6	2/12	7	1.000	0	0	0	0	0	0	0	0
2	2/13	2/19	7	1.000	0	0	0	0	0	0	0	0
3	2/20	2/26	7	1.000	0	0	0	0	0	0	0	0
4	2/27	3/5	7	1.000	2	0	0	0	0	0	0	0
5	3/6	3/12	7	0.571	52	0	0	0	0	0	0	0
6	3/13	3/19	7	0.571	27	0	0	0	0	0	0	0
7	3/20	3/26	7	1.000	6	0	0	0	0	0	0	0
8	3/27	4/2	7	0.571	0	0	0	0	0	0	0	0
9	4/3	4/9	7	0.857	0	0	0	0	0	0	0	0
10	4/10	4/16	7	1.000	0	0	0	0	0	0	0	0
11	4/17	4/23	7	1.000	7	0	0	0	0	0	0	0
12	4/24	5/2	9	1.000	41	0	0	0	0	0	0	0
13	5/3	5/18	16	1.000	146	391	27	27	0	0	0	0
14	5/19	5/24	6	1.000	20	413	41	36	0	1	4	0
15	5/25	5/31	7	1.000	115	279	57	55	2	0	0	0
16	6/1	6/7	7	1.000	77	177	48	44	4	0	0	0
17	6/8	6/15	8	1.000	167	218	41	36	5	0	0	0
18	6/16	6/21	6	1.000	109	179	30	19	9	2	0	0
19	6/22	6/28	7	1.000	812	1,086	233	209	23	1	0	0
20	6/29	7/6	8	1.000	753	1,155	202	191	4	7	0	0
21	7/7	7/12	6	1.000	648	566	159	118	35	6	0	0
22	7/13	7/19	7	1.000	414	655	103	97	6	0	0	0
23	7/20	7/27	8	1.000	521	489	104	97	7	0	0	0
24	7/28	8/1	5	1.000	353	153	34	34	0	0	0	0
25	8/2	8/8	7	1.000	217	0	0	0	0	0	0	0
26	8/9	8/15	5	1.000	99	0	0	0	0	0	0	0

Table C20. BTSPAS table for Grays River natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling), 2012.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/12	2/18	7	1.000	0	0	0	0	0	0	0	0
2	2/19	2/25	7	0.429	0	0	0	0	0	0	0	0
3	2/26	3/3	7	0.143	0	0	0	0	0	0	0	0
4	3/4	3/10	7	1.000	0	0	0	0	0	0	0	0
5	3/11	3/17	7	0.571	0	0	0	0	0	0	0	0
6	3/18	3/24	7	0.857	0	0	0	0	0	0	0	0
7	3/25	3/31	7	0.714	0	0	0	0	0	0	0	0
8	4/1	4/7	7	1.000	1	0	0	0	0	0	0	0
9	4/8	4/14	7	1.000	1	0	0	0	0	0	0	0
10	4/15	4/21	7	1.000	4	0	0	0	0	0	0	0
11	4/22	4/28	7	1.000	1	0	0	0	0	0	0	0
12	4/29	5/5	7	1.000	2	0	0	0	0	0	0	0
13	5/6	5/12	7	1.000	5	0	0	0	0	0	0	0
14	5/13	5/19	7	1.000	17	0	0	0	0	0	0	0
15	5/20	5/26	7	0.857	38	0	0	0	0	0	0	0
16	5/27	6/7	12	1.000	91	0	0	0	0	0	0	0
17	6/8	6/14	7	1.000	129	127	6	6	0	0	0	0
18	6/15	6/22	8	1.000	83	80	8	8	0	0	0	0
19	6/23	6/28	6	1.000	153	150	31	31	0	0	0	0
20	6/29	7/6	8	1.000	98	116	22	22	0	0	0	0
21	7/7	7/12	6	1.000	32	34	5	5	0	0	0	0
22	7/13	7/19	7	1.000	149	143	8	8	0	0	0	0
23	7/20	7/27	8	1.000	97	115	14	14	0	0	0	0
24	7/28	8/3	7	0.857	47	45	5	5	0	0	0	0
25	8/4	8/5	2	0.500	3	2	0	0	0	0	0	0
26	8/6	8/12	2	0.500	2	0	0	0	0	0	0	0

Table C21. BTSPAS table for Grays River natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling), 2013.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/15	2/21	7	1.000	2	0	0	0	0	0	0	0
2	2/22	2/28	7	1.000	81	0	0	0	0	0	0	0
3	3/1	3/7	7	1.000	2	0	0	0	0	0	0	0
4	3/8	3/14	7	1.000	0	0	0	0	0	0	0	0
5	3/15	3/21	7	1.000	1	0	0	0	0	0	0	0
6	3/22	3/28	7	1.000	1	0	0	0	0	0	0	0
7	3/29	4/4	7	1.000	0	0	0	0	0	0	0	0
8	4/5	4/11	7	0.857	2	0	0	0	0	0	0	0
9	4/12	4/18	7	1.000	0	0	0	0	0	0	0	0
10	4/19	4/25	7	1.000	2	0	0	0	0	0	0	0
11	4/26	5/2	7	1.000	3	0	0	0	0	0	0	0
12	5/3	5/9	7	1.000	6	0	0	0	0	0	0	0
13	5/10	5/16	7	1.000	25	3	1	1	0	0	0	0
14	5/17	5/26	10	1.000	91	87	25	25	0	0	0	0
15	5/27	6/7	12	1.000	47	39	9	9	0	0	0	0
16	6/8	6/14	7	1.000	48	38	9	9	0	0	0	0
17	6/15	6/19	4	1.000	32	31	11	11	0	0	0	0
18	6/20	6/27	8	1.000	17	37	11	11	0	0	0	0
19	6/28	7/3	6	1.000	21	18	4	4	0	0	0	0
20	7/4	7/10	7	1.000	66	57	12	12	0	0	0	0
21	7/11	7/19	9	1.000	92	109	23	23	0	0	0	0
22	7/20	7/24	5	1.000	9	10	3	3	0	0	0	0
23	7/25	7/31	7	1.000	33	44	8	8	0	0	0	0

Table C22. BTSPAS table for Grays River natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling), 2014.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/12	2/18	7	0.429	4	0	0	0	0	0	0	0
2	2/19	2/25	7	0.857	7	0	0	0	0	0	0	0
3	2/26	3/4	7	1.000	7	0	0	0	0	0	0	0
4	3/5	3/11	7	0.429	6	0	0	0	0	0	0	0
5	3/12	3/18	7	1.000	59	0	0	0	0	0	0	0
6	3/19	3/25	7	1.000	37	0	0	0	0	0	0	0
7	3/26	4/1	7	1.000	502	0	0	0	0	0	0	0
8	4/2	4/8	7	1.000	23	0	0	0	0	0	0	0
9	4/9	4/15	7	1.000	23	0	0	0	0	0	0	0
10	4/16	4/22	7	1.000	11	0	0	0	0	0	0	0
11	4/23	4/29	9	0.778	14	0	0	0	0	0	0	0
12	4/30	5/7	8	1.000	35	0	0	0	0	0	0	0
13	5/8	5/19	12	1.000	45	30	5	5	0	0	0	0
14	5/20	5/21	2	1.000	34	29	7	7	0	0	0	0
15	5/22	5/29	8	1.000	65	61	12	12	0	0	0	0
16	5/30	6/4	6	1.000	51	43	6	6	0	0	0	0
17	6/5	6/12	8	1.000	142	153	29	29	0	0	0	0
18	6/13	6/18	6	1.000	128	165	24	24	0	0	0	0
19	6/19	6/25	7	1.000	131	132	14	13	1	0	0	0
20	6/26	7/2	7	1.000	132	164	37	36	1	0	0	0
21	7/3	7/9	7	1.000	80	98	9	9	0	0	0	0
22	7/10	7/16	7	1.000	47	96	21	19	2	0	0	0
23	7/17	7/23	7	1.000	68	64	17	16	1	0	0	0
24	7/24	7/30	7	1.000	21	44	7	7	0	0	0	0
25	7/31	7/31	1	1.000	1	1	0	0	0	0	0	0

Table C23. BTSPAS table for Grays River natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling), 2015.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/4	2/10	7	0.286	0	0	0	0	0	0	0	0
2	2/11	2/17	7	0.857	3	0	0	0	0	0	0	0
3	2/18	2/24	7	1.000	0	0	0	0	0	0	0	0
4	2/25	3/3	7	1.000	1	0	0	0	0	0	0	0
5	3/4	3/10	7	1.000	5	0	0	0	0	0	0	0
6	3/11	3/17	7	0.857	1	0	0	0	0	0	0	0
7	3/18	3/24	7	1.000	3	0	0	0	0	0	0	0
8	3/25	3/31	7	0.857	0	0	0	0	0	0	0	0
9	4/1	4/7	7	1.000	1	0	0	0	0	0	0	0
10	4/8	4/16	9	1.000	1	0	0	0	0	0	0	0
11	4/17	4/23	7	1.000	4	3	0	0	0	0	0	0
12	4/24	4/30	7	1.000	36	8	1	1	0	0	0	0
13	5/1	5/7	7	1.000	21	13	0	0	0	0	0	0
14	5/8	5/14	7	1.000	34	32	3	3	0	0	0	0
15	5/15	5/21	7	1.000	102	78	7	7	0	0	0	0
16	5/22	5/29	8	1.000	72	82	18	18	0	0	0	0
17	5/30	6/2	4	1.000	30	36	6	6	0	0	0	0
18	6/3	6/11	9	1.000	105	75	7	7	0	0	0	0
19	6/12	6/16	5	1.000	106	119	8	7	1	0	0	0
20	6/17	6/24	8	1.000	97	98	10	10	0	0	0	0
21	6/25	6/30	6	1.000	45	53	10	9	1	0	0	0
22	7/1	7/7	7	1.000	58	59	10	9	1	0	0	0
23	7/8	7/9	2	1.000	2	4	0	0	0	0	0	0
24	7/10	7/16	7	1.000	1	0	0	0	0	0	0	0
25	7/17	7/23	7	1.000	0	0	0	0	0	0	0	0
26	7/24	7/30	7	1.000	0	0	0	0	0	0	0	0
27	7/31	8/6	1	1.000	0	0	0	0	0	0	0	0

Table C24. BTSPAS table for Grays River natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling), 2016.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/12	2/18	7	0.429	0	0	0	0	0	0	0	0
2	2/19	2/25	7	0.857	0	0	0	0	0	0	0	0
3	2/26	3/3	7	0.857	0	0	0	0	0	0	0	0
4	3/4	3/10	7	0.857	0	0	0	0	0	0	0	0
5	3/11	3/17	7	0.857	0	0	0	0	0	0	0	0
6	3/18	3/24	7	1.000	0	0	0	0	0	0	0	0
7	3/25	4/4	11	1.000	2	0	0	0	0	0	0	0
8	4/5	4/11	7	1.000	0	1	0	0	0	0	0	0
9	4/12	4/18	7	1.000	1	0	0	0	0	0	0	0
10	4/19	4/25	7	1.000	9	6	1	1	0	0	0	0
11	4/26	5/6	11	0.909	35	19	3	3	0	0	0	0
12	5/7	5/13	7	1.000	106	87	15	15	0	0	0	0
13	5/14	5/19	6	0.833	131	114	19	19	0	0	0	0
14	5/20	5/27	8	1.000	75	208	52	52	0	0	0	0
15	5/28	6/4	8	0.875	43	50	10	10	0	0	0	0
16	6/5	6/10	6	1.000	129	80	18	18	0	0	0	0
17	6/11	6/16	6	1.000	134	198	56	56	0	0	0	0
18	6/17	6/23	7	1.000	38	38	13	13	0	0	0	0
19	6/24	6/30	7	1.000	26	28	10	10	0	0	0	0
20	7/1	7/7	7	1.000	22	19	9	9	0	0	0	0
21	7/8	7/14	7	0.857	11	13	1	1	0	0	0	0
22	7/15	7/21	7	1.000	5	4	1	1	0	0	0	0
23	7/22	7/28	7	1.000	8	9	0	0	0	0	0	0
24	7/29	8/4	1	1.000	0	0	0	0	0	0	0	0

Chinook salmon (Hatchery-Origin, Parr/Transitional/Smolt, Sub-Yearling)

Table C25. BTSPAS table for Grays River hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling), 2008.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/24	3/1	7	1.000	0	0	0	0	0	0	0	0
2	3/2	3/8	7	1.000	0	0	0	0	0	0	0	0
3	3/9	3/15	7	1.000	0	0	0	0	0	0	0	0
4	3/16	3/22	7	1.000	0	0	0	0	0	0	0	0
5	3/23	3/29	7	1.000	0	0	0	0	0	0	0	0
6	3/30	4/5	7	1.000	0	0	0	0	0	0	0	0
7	4/6	4/12	7	1.000	0	0	0	0	0	0	0	0
8	4/13	4/19	7	0.714	0	0	0	0	0	0	0	0
9	4/20	5/2	13	0.769	0	0	0	0	0	0	0	0
10	5/3	5/9	7	1.000	0	0	0	0	0	0	0	0
11	5/10	5/16	7	1.000	0	0	0	0	0	0	0	0
12	5/17	5/23	7	1.000	0	3	0	0	0	0	0	0
13	5/24	5/30	7	1.000	3	91	24	24	0	0	0	0
14	5/31	6/6	7	1.000	0	213	92	92	0	0	0	0
15	6/7	6/13	7	1.000	0	128	12	12	0	0	0	0
16	6/14	6/20	7	1.000	0	28	5	5	0	0	0	0
17	6/21	6/27	7	1.000	6	170	65	65	0	0	0	0
18	6/28	7/4	7	1.000	0	84	20	20	0	0	0	0
19	7/5	7/11	7	1.000	0	154	46	46	0	0	0	0
20	7/12	7/18	7	1.000	0	83	29	29	0	0	0	0
21	7/19	7/25	7	1.000	0	101	40	40	0	0	0	0
22	7/26	8/1	7	1.000	9	29	5	5	0	0	0	0
23	8/2	8/8	7	1.000	1	3	1	1	0	0	0	0
24	8/9	8/15	7	1.000	0	0	0	0	0	0	0	0

Table C26. BTSPAS table for Grays River hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling), 2009.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/7	2/13	7	1.000	0	0	0	0	0	0	0	0
2	2/14	2/21	8	1.000	0	0	0	0	0	0	0	0
3	2/22	2/28	7	1.000	0	0	0	0	0	0	0	0
4	3/1	3/7	7	1.000	0	0	0	0	0	0	0	0
5	3/8	3/14	7	1.000	0	0	0	0	0	0	0	0
6	3/15	3/21	7	0.714	0	0	0	0	0	0	0	0
7	3/22	3/28	7	1.000	0	0	0	0	0	0	0	0
8	3/29	4/4	7	0.857	0	0	0	0	0	0	0	0
9	4/5	4/11	7	1.000	0	0	0	0	0	0	0	0
10	4/12	4/18	6	1.000	0	0	0	0	0	0	0	0
11	4/19	4/25	7	1.000	0	0	0	0	0	0	0	0
12	4/26	5/2	7	1.000	0	0	0	0	0	0	0	0
13	5/3	5/9	7	0.714	2	0	0	0	0	0	0	0
14	5/10	5/16	7	1.000	2	4	0	0	0	0	0	0
15	5/17	5/23	7	1.000	2	9	0	0	0	0	0	0
16	5/24	5/30	7	1.000	0	10	0	0	0	0	0	0
17	5/31	6/6	7	1.000	0	33	0	0	0	0	0	0
18	6/7	6/13	7	1.000	0	79	8	8	0	0	0	0
19	6/14	6/20	7	1.000	0	26	1	1	0	0	0	0
20	6/21	6/27	7	1.000	0	27	8	8	0	0	0	0
21	6/28	7/4	7	1.000	0	10	3	3	0	0	0	0
22	7/5	7/11	7	1.000	0	26	0	0	0	0	0	0
23	7/12	7/18	7	1.000	2	23	4	4	0	0	0	0
24	7/19	7/25	7	1.000	0	15	0	0	0	0	0	0
25	7/26	8/1	6	1.000	0	13	1	1	0	0	0	0

Table C27. BTSPAS table for Grays River hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling), 2010.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/5	2/11	7	1.000	0	0	0	0	0	0	0	0
2	2/12	2/18	7	1.000	0	0	0	0	0	0	0	0
3	2/19	2/25	7	1.000	0	0	0	0	0	0	0	0
4	2/26	3/4	7	1.000	25	0	0	0	0	0	0	0
5	3/5	3/11	7	1.000	120	0	0	0	0	0	0	0
6	3/12	3/18	7	1.000	31	0	0	0	0	0	0	0
7	3/19	3/25	7	1.000	7	0	0	0	0	0	0	0
8	3/26	4/1	7	1.000	2	0	0	0	0	0	0	0
9	4/2	4/8	7	1.000	0	0	0	0	0	0	0	0
10	4/9	4/15	7	1.000	0	0	0	0	0	0	0	0
11	4/16	4/22	7	1.000	0	0	0	0	0	0	0	0
12	4/23	4/29	7	1.000	0	0	0	0	0	0	0	0
13	4/30	5/6	7	0.857	0	0	0	0	0	0	0	0
14	5/7	5/19	13	1.000	4	0	0	0	0	0	0	0
15	5/20	5/26	7	1.000	3	56	3	3	0	0	0	0
16	5/27	6/2	7	0.857	19	30	7	7	0	0	0	0
17	6/3	6/9	7	0.714	1	5	0	0	0	0	0	0
18	6/10	6/16	7	1.000	0	3	0	0	0	0	0	0
19	6/17	6/23	7	1.000	0	1	0	0	0	0	0	0
20	6/24	6/30	7	1.000	1	41	7	7	0	0	0	0
21	7/1	7/10	10	1.000	0	41	4	4	0	0	0	0
22	7/11	7/13	3	1.000	0	17	1	1	0	0	0	0
23	7/14	7/20	7	1.000	0	104	11	8	3	0	0	0
24	7/21	7/29	9	1.000	0	23	1	1	0	0	0	0
25	7/30	7/31	2	1.000	0	5	0	0	0	0	0	0

Table C28. BTSPAS table for Grays River hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling), 2011.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/6	2/12	7	1.000	0	0	0	0	0	0	0	0
2	2/13	2/19	7	1.000	0	0	0	0	0	0	0	0
3	2/20	2/26	7	1.000	0	0	0	0	0	0	0	0
4	2/27	3/5	7	1.000	0	0	0	0	0	0	0	0
5	3/6	3/12	7	0.571	0	0	0	0	0	0	0	0
6	3/13	3/19	7	0.571	0	0	0	0	0	0	0	0
7	3/20	3/26	7	1.000	14	0	0	0	0	0	0	0
8	3/27	4/2	7	0.571	0	0	0	0	0	0	0	0
9	4/3	4/9	7	0.857	4	0	0	0	0	0	0	0
10	4/10	4/16	7	1.000	0	0	0	0	0	0	0	0
11	4/17	4/23	7	1.000	0	0	0	0	0	0	0	0
12	4/24	5/2	9	1.000	14	0	0	0	0	0	0	0
13	5/3	5/18	16	1.000	504	391	27	27	0	0	0	0
14	5/19	5/24	6	1.000	209	413	41	36	0	1	4	0
15	5/25	5/31	7	1.000	242	279	57	55	2	0	0	0
16	6/1	6/7	7	1.000	82	177	48	44	4	0	0	0
17	6/8	6/15	8	1.000	47	218	41	36	5	0	0	0
18	6/16	6/21	6	1.000	103	179	30	19	9	2	0	0
19	6/22	6/28	7	1.000	408	1,086	233	209	23	1	0	0
20	6/29	7/6	8	1.000	300	1,155	202	191	4	7	0	0
21	7/7	7/12	6	1.000	106	566	159	118	35	6	0	0
22	7/13	7/19	7	1.000	110	655	103	97	6	0	0	0
23	7/20	7/27	8	1.000	27	489	104	97	7	0	0	0
24	7/28	8/1	5	1.000	3	153	34	34	0	0	0	0
25	8/2	8/8	7	1.000	194	0	0	0	0	0	0	0
26	8/9	8/15	5	1.000	292	0	0	0	0	0	0	0

Table C29. BTSPAS table for Grays River hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling), 2012.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/12	2/18	7	1.000	0	0	0	0	0	0	0	0
2	2/19	2/25	7	0.429	0	0	0	0	0	0	0	0
3	2/26	3/3	7	0.143	0	0	0	0	0	0	0	0
4	3/4	3/10	7	1.000	1	0	0	0	0	0	0	0
5	3/11	3/17	7	0.571	2	0	0	0	0	0	0	0
6	3/18	3/24	7	0.857	2	0	0	0	0	0	0	0
7	3/25	3/31	7	0.714	0	0	0	0	0	0	0	0
8	4/1	4/7	7	1.000	0	0	0	0	0	0	0	0
9	4/8	4/14	7	1.000	0	0	0	0	0	0	0	0
10	4/15	4/21	7	1.000	0	0	0	0	0	0	0	0
11	4/22	4/28	7	1.000	0	0	0	0	0	0	0	0
12	4/29	5/5	7	1.000	0	0	0	0	0	0	0	0
13	5/6	5/12	7	1.000	0	0	0	0	0	0	0	0
14	5/13	5/19	7	1.000	0	0	0	0	0	0	0	0
15	5/20	5/26	7	0.857	0	0	0	0	0	0	0	0
16	5/27	6/7	12	1.000	0	0	0	0	0	0	0	0
17	6/8	6/14	7	1.000	9	127	6	6	0	0	0	0
18	6/15	6/22	8	1.000	15	80	8	8	0	0	0	0
19	6/23	6/28	6	1.000	6	150	31	31	0	0	0	0
20	6/29	7/6	8	1.000	8	116	22	22	0	0	0	0
21	7/7	7/12	6	1.000	15	34	5	5	0	0	0	0
22	7/13	7/19	7	1.000	3	143	8	8	0	0	0	0
23	7/20	7/27	8	1.000	0	115	14	14	0	0	0	0
24	7/28	8/3	7	0.857	1	45	5	5	0	0	0	0
25	8/4	8/5	2	0.500	0	2	0	0	0	0	0	0
26	8/6	8/12	2	0.500	0	0	0	0	0	0	0	0

Table C30. BTSPAS table for Grays River hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling), 2013.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/15	2/21	7	1.000	0	0	0	0	0	0	0	0
2	2/22	2/28	7	1.000	3	0	0	0	0	0	0	0
3	3/1	3/7	7	1.000	0	0	0	0	0	0	0	0
4	3/8	3/14	7	1.000	1	0	0	0	0	0	0	0
5	3/15	3/21	7	1.000	0	0	0	0	0	0	0	0
6	3/22	3/28	7	1.000	0	0	0	0	0	0	0	0
7	3/29	4/4	7	1.000	0	0	0	0	0	0	0	0
8	4/5	4/11	7	0.857	0	0	0	0	0	0	0	0
9	4/12	4/18	7	1.000	0	0	0	0	0	0	0	0
10	4/19	4/25	7	1.000	1	0	0	0	0	0	0	0
11	4/26	5/2	7	1.000	0	0	0	0	0	0	0	0
12	5/3	5/9	7	1.000	0	0	0	0	0	0	0	0
13	5/10	5/16	7	1.000	0	3	1	1	0	0	0	0
14	5/17	5/26	10	1.000	2	87	25	25	0	0	0	0
15	5/27	6/7	12	1.000	0	39	9	9	0	0	0	0
16	6/8	6/14	7	1.000	0	38	9	9	0	0	0	0
17	6/15	6/19	4	1.000	9	31	11	11	0	0	0	0
18	6/20	6/27	8	1.000	5	37	11	11	0	0	0	0
19	6/28	7/3	6	1.000	2	18	4	4	0	0	0	0
20	7/4	7/10	7	1.000	0	57	12	12	0	0	0	0
21	7/11	7/19	9	1.000	8	109	23	23	0	0	0	0
22	7/20	7/24	5	1.000	1	10	3	3	0	0	0	0
23	7/25	7/31	7	1.000	19	44	8	8	0	0	0	0

Table C31. BTSPAS table for Grays River hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling), 2014.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/12	2/18	7	0.429	0	0	0	0	0	0	0	0
2	2/19	2/25	7	0.857	0	0	0	0	0	0	0	0
3	2/26	3/4	7	1.000	0	0	0	0	0	0	0	0
4	3/5	3/11	7	0.429	0	0	0	0	0	0	0	0
5	3/12	3/18	7	1.000	0	0	0	0	0	0	0	0
6	3/19	3/25	7	1.000	0	0	0	0	0	0	0	0
7	3/26	4/1	7	1.000	0	0	0	0	0	0	0	0
8	4/2	4/8	7	1.000	0	0	0	0	0	0	0	0
9	4/9	4/15	7	1.000	0	0	0	0	0	0	0	0
10	4/16	4/22	7	1.000	0	0	0	0	0	0	0	0
11	4/23	4/29	9	0.778	0	0	0	0	0	0	0	0
12	4/30	5/7	8	1.000	0	0	0	0	0	0	0	0
13	5/8	5/19	12	1.000	0	30	5	5	0	0	0	0
14	5/20	5/21	2	1.000	1	29	7	7	0	0	0	0
15	5/22	5/29	8	1.000	0	61	12	12	0	0	0	0
16	5/30	6/4	6	1.000	0	43	6	6	0	0	0	0
17	6/5	6/12	8	1.000	14	153	29	29	0	0	0	0
18	6/13	6/18	6	1.000	51	165	24	24	0	0	0	0
19	6/19	6/25	7	1.000	8	132	14	13	1	0	0	0
20	6/26	7/2	7	1.000	35	164	37	36	1	0	0	0
21	7/3	7/9	7	1.000	10	98	9	9	0	0	0	0
22	7/10	7/16	7	1.000	44	96	21	19	2	0	0	0
23	7/17	7/23	7	1.000	8	64	17	16	1	0	0	0
24	7/24	7/30	7	1.000	6	44	7	7	0	0	0	0
25	7/31	7/31	1	1.000	0	1	0	0	0	0	0	0

Table C32. BTSPAS table for Grays River hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling), 2015.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/4	2/10	7	0.286	0	0	0	0	0	0	0	0
2	2/11	2/17	7	0.857	0	0	0	0	0	0	0	0
3	2/18	2/24	7	1.000	0	0	0	0	0	0	0	0
4	2/25	3/3	7	1.000	0	0	0	0	0	0	0	0
5	3/4	3/10	7	1.000	0	0	0	0	0	0	0	0
6	3/11	3/17	7	0.857	0	0	0	0	0	0	0	0
7	3/18	3/24	7	1.000	0	0	0	0	0	0	0	0
8	3/25	3/31	7	0.857	0	0	0	0	0	0	0	0
9	4/1	4/7	7	1.000	0	0	0	0	0	0	0	0
10	4/8	4/16	9	1.000	0	0	0	0	0	0	0	0
11	4/17	4/23	7	1.000	0	3	0	0	0	0	0	0
12	4/24	4/30	7	1.000	0	8	1	1	0	0	0	0
13	5/1	5/7	7	1.000	0	13	0	0	0	0	0	0
14	5/8	5/14	7	1.000	0	32	3	3	0	0	0	0
15	5/15	5/21	7	1.000	0	78	7	7	0	0	0	0
16	5/22	5/29	8	1.000	0	82	18	18	0	0	0	0
17	5/30	6/2	4	1.000	0	36	6	6	0	0	0	0
18	6/3	6/11	9	1.000	0	75	7	7	0	0	0	0
19	6/12	6/16	5	1.000	0	119	8	7	1	0	0	0
20	6/17	6/24	8	1.000	0	98	10	10	0	0	0	0
21	6/25	6/30	6	1.000	2	53	10	9	1	0	0	0
22	7/1	7/7	7	1.000	3	59	10	9	1	0	0	0
23	7/8	7/9	2	1.000	0	4	0	0	0	0	0	0
24	7/10	7/16	7	1.000	0	0	0	0	0	0	0	0
25	7/17	7/23	7	1.000	0	0	0	0	0	0	0	0
26	7/24	7/30	7	1.000	0	0	0	0	0	0	0	0
27	7/31	8/6	1	1.000	0	0	0	0	0	0	0	0

Table C33. BTSPAS table for Grays River hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling), 2016.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/12	2/18	7	0.429	0	0	0	0	0	0	0	0
2	2/19	2/25	7	0.857	0	0	0	0	0	0	0	0
3	2/26	3/3	7	0.857	0	0	0	0	0	0	0	0
4	3/4	3/10	7	0.857	0	0	0	0	0	0	0	0
5	3/11	3/17	7	0.857	0	0	0	0	0	0	0	0
6	3/18	3/24	7	1.000	0	0	0	0	0	0	0	0
7	3/25	4/4	11	1.000	0	0	0	0	0	0	0	0
8	4/5	4/11	7	1.000	0	1	0	0	0	0	0	0
9	4/12	4/18	7	1.000	0	0	0	0	0	0	0	0
10	4/19	4/25	7	1.000	0	6	1	1	0	0	0	0
11	4/26	5/6	11	0.909	1	19	3	3	0	0	0	0
12	5/7	5/13	7	1.000	5	87	15	15	0	0	0	0
13	5/14	5/19	6	0.833	15	114	19	19	0	0	0	0
14	5/20	5/27	8	1.000	139	208	52	52	0	0	0	0
15	5/28	6/4	8	0.875	10	50	10	10	0	0	0	0
16	6/5	6/10	6	1.000	8	80	18	18	0	0	0	0
17	6/11	6/16	6	1.000	9	198	56	56	0	0	0	0
18	6/17	6/23	7	1.000	0	38	13	13	0	0	0	0
19	6/24	6/30	7	1.000	8	28	10	10	0	0	0	0
20	7/1	7/7	7	1.000	2	19	9	9	0	0	0	0
21	7/8	7/14	7	0.857	1	13	1	1	0	0	0	0
22	7/15	7/21	7	1.000	1	4	1	1	0	0	0	0
23	7/22	7/28	7	1.000	0	9	0	0	0	0	0	0
24	7/29	8/4	1	1.000	0	0	0	0	0	0	0	0

Coho salmon (Natural-Origin, Transitional/Smolt, Yearling)

Table C34. BTSPAS table for Grays River natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling), 2008.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/23	2/29	7	1.000	0	0	0	0	0	0	0	0
2	3/1	3/7	7	1.000	0	0	0	0	0	0	0	0
3	3/8	3/14	7	0.857	0	0	0	0	0	0	0	0
4	3/15	3/21	7	1.000	0	0	0	0	0	0	0	0
5	3/22	3/28	7	0.571	0	0	0	0	0	0	0	0
6	3/29	4/4	7	1.000	0	0	0	0	0	0	0	0
7	4/5	4/11	7	0.857	0	0	0	0	0	0	0	0
8	4/12	4/23	12	0.583	2	0	0	0	0	0	0	0
9	4/24	5/1	8	0.875	3	1,030	0	0	0	0	0	0
10	5/2	5/5	4	1.000	10	1,045	14	13	0	1	0	0
11	5/6	5/13	8	1.000	9	1,047	4	3	0	0	0	1
12	5/14	5/20	7	0.857	28	38	3	1	0	2	0	0
13	5/21	5/27	7	1.000	259	257	52	40	9	3	0	0
14	5/28	6/3	7	1.000	122	202	50	41	9	0	0	0
15	6/4	6/21	18	0.944	38	50	5	5	0	0	0	0
16	6/22	6/24	3	1.000	0	1	0	0	0	0	0	0
17	6/25	7/2	8	1.000	0	1	0	0	0	0	0	0
18	7/3	7/8	6	1.000	0	0	0	0	0	0	0	0
19	7/9	7/15	7	1.000	0	0	0	0	0	0	0	0
20	7/16	7/22	7	1.000	0	0	0	0	0	0	0	0
21	7/23	7/28	6	1.000	0	0	0	0	0	0	0	0
22	7/29	7/30	2	0.500	0	0	0	0	0	0	0	0
23	7/31	8/6	7	1.000	0	0	0	0	0	0	0	0
24	8/7	8/13	7	0.857	0	0	0	0	0	0	0	0
25	8/14	8/20	2	1.000	0	0	0	0	0	0	0	0

Table C35. BTSPAS table for Grays River natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling), 2009.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/7	2/13	7	1.000	0	0	0	0	0	0	0	0
2	2/14	2/20	7	1.000	1	0	0	0	0	0	0	0
3	2/21	2/27	7	1.000	1	0	0	0	0	0	0	0
4	2/28	3/6	7	1.000	1	0	0	0	0	0	0	0
5	3/7	3/13	7	1.000	0	0	0	0	0	0	0	0
6	3/14	3/20	7	0.714	0	0	0	0	0	0	0	0
7	3/21	3/27	7	1.000	1	0	0	0	0	0	0	0
8	3/28	4/3	7	0.857	0	0	0	0	0	0	0	0
9	4/4	4/14	11	0.909	2	0	0	0	0	0	0	0
10	4/15	4/30	15	1.000	6	726	0	0	0	0	0	0
11	5/1	5/5	5	1.000	9	2,001	6	5	1	0	0	0
12	5/6	5/13	8	0.750	6	962	9	8	1	0	0	0
13	5/14	5/19	6	1.000	14	53	0	0	0	0	0	0
14	5/20	5/27	8	1.000	0	6	2	0	0	2	0	0
15	5/28	6/2	6	1.000	13	44	5	4	0	1	0	0
16	6/3	6/10	8	1.000	4	45	6	6	0	0	0	0
17	6/11	6/19	9	0.889	0	1	0	0	0	0	0	0
18	6/20	6/23	4	1.000	0	0	0	0	0	0	0	0
19	6/24	6/30	7	0.857	0	0	0	0	0	0	0	0
20	7/1	7/7	7	0.857	0	0	0	0	0	0	0	0
21	7/8	7/14	7	0.857	0	0	0	0	0	0	0	0
22	7/15	7/23	9	1.000	0	0	0	0	0	0	0	0
23	7/24	7/28	5	0.800	0	0	0	0	0	0	0	0
24	7/29	8/4	3	1.000	0	0	0	0	0	0	0	0

Table C36. BTSPAS table for Grays River natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling), 2010.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/4	2/10	7	1.000	0	0	0	0	0	0	0	0
2	2/11	2/17	7	1.000	0	0	0	0	0	0	0	0
3	2/18	2/24	7	1.000	0	0	0	0	0	0	0	0
4	2/25	3/3	7	1.000	0	0	0	0	0	0	0	0
5	3/4	3/10	7	1.000	0	0	0	0	0	0	0	0
6	3/11	3/17	7	1.000	2	0	0	0	0	0	0	0
7	3/18	3/24	7	1.000	6	0	0	0	0	0	0	0
8	3/25	3/31	7	0.714	2	0	0	0	0	0	0	0
9	4/1	4/7	7	1.000	6	0	0	0	0	0	0	0
10	4/8	4/14	7	1.000	1	0	0	0	0	0	0	0
11	4/15	4/21	7	1.000	0	0	0	0	0	0	0	0
12	4/22	4/28	7	1.000	0	2,352	19	19	0	0	0	0
13	4/29	5/4	6	0.667	3	206	0	0	0	0	0	0
14	5/5	5/11	7	1.000	6	14	0	0	0	0	0	0
15	5/12	5/12	1	1.000	6	3	2	0	1	1	0	0
16	5/13	5/18	6	1.000	68	59	0	0	0	0	0	0
17	5/19	5/26	8	1.000	92	133	6	6	0	0	0	0
18	5/27	6/1	6	0.833	28	33	2	2	0	0	0	0
19	6/2	6/8	7	0.571	0	0	0	0	0	0	0	0
20	6/9	6/16	8	1.000	1	4	0	0	0	0	0	0
21	6/17	6/23	7	1.000	0	0	0	0	0	0	0	0
22	6/24	6/30	7	1.000	0	4	0	0	0	0	0	0
23	7/1	7/6	6	1.000	0	1	0	0	0	0	0	0
24	7/7	7/13	7	1.000	0	1	0	0	0	0	0	0
25	7/14	7/20	7	0.857	0	0	0	0	0	0	0	0
26	7/21	7/29	9	0.778	0	0	0	0	0	0	0	0
27	7/30	7/31	2	1.000	1	1	0	0	0	0	0	0

Table C37. BTSPAS table for Grays River natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling), 2011.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/4	2/10	7	1.000	1	0	0	0	0	0	0	0
2	2/11	2/17	7	1.000	1	0	0	0	0	0	0	0
3	2/18	2/24	7	1.000	1	0	0	0	0	0	0	0
4	2/25	3/3	7	1.000	1	0	0	0	0	0	0	0
5	3/4	3/10	7	0.857	2	0	0	0	0	0	0	0
6	3/11	3/17	7	0.286	2	0	0	0	0	0	0	0
7	3/18	3/24	7	1.000	0	0	0	0	0	0	0	0
8	3/25	3/31	7	0.857	3	0	0	0	0	0	0	0
9	4/1	4/7	7	0.571	0	0	0	0	0	0	0	0
10	4/8	4/14	7	1.000	1	0	0	0	0	0	0	0
11	4/15	4/21	7	1.000	0	0	0	0	0	0	0	0
12	4/22	5/1	10	1.000	4	0	0	0	0	0	0	0
13	5/2	5/3	2	1.000	0	1878	30	30	0	0	0	0
14	5/4	5/7	4	1.000	6	244	12	8	2	0	1	1
15	5/8	5/12	5	1.000	2	72	1	1	0	0	0	0
16	5/13	5/18	6	1.000	12	14	1	1	0	0	0	0
17	5/19	5/20	2	1.000	2	7	1	0	0	0	1	0
18	5/21	5/24	4	1.000	32	29	2	2	0	0	0	0
19	5/25	5/31	7	1.000	173	187	20	19	1	0	0	0
20	6/1	6/7	7	1.000	99	2178	267	256	11	0	0	0
21	6/8	6/14	7	1.000	66	106	23	19	4	0	0	0
22	6/15	6/21	7	1.000	52	84	21	16	4	1	0	0
23	6/22	6/28	7	1.000	54	66	17	15	2	0	0	0
24	6/29	7/6	8	1.000	5	9	1	1	0	0	0	0
25	7/7	7/17	11	1.000	0	0	0	0	0	0	0	0
26	7/18	7/24	7	1.000	0	0	0	0	0	0	0	0
27	7/25	7/31	7	1.000	0	0	0	0	0	0	0	0
28	8/1	8/7	7	1.000	0	0	0	0	0	0	0	0
29	8/8	8/14	6	1.000	0	0	0	0	0	0	0	0

Table C38. BTSPAS table for Grays River natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling), 2012.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/12	2/18	7	1.000	0	0	0	0	0	0	0	0
2	2/19	2/25	7	0.429	3	0	0	0	0	0	0	0
3	2/26	3/3	7	0.143	0	0	0	0	0	0	0	0
4	3/4	3/10	7	1.000	1	0	0	0	0	0	0	0
5	3/11	3/17	7	0.571	0	0	0	0	0	0	0	0
6	3/18	3/24	7	0.286	1	0	0	0	0	0	0	0
7	3/25	3/31	7	0.714	0	0	0	0	0	0	0	0
8	4/1	4/7	7	1.000	8	0	0	0	0	0	0	0
9	4/8	4/14	7	0.857	1	0	0	0	0	0	0	0
10	4/15	4/21	7	0.714	4	0	0	0	0	0	0	0
11	4/22	5/3	12	1.000	33	1,056	26	25	1	0	0	0
12	5/4	5/15	12	1.000	24	2,222	40	13	0	26	1	0
13	5/16	5/17	2	1.000	2	2	0	0	0	0	0	0
14	5/18	5/24	7	0.714	49	28	2	2	0	0	0	0
15	5/25	6/1	8	1.000	19	21	2	1	1	0	0	0
16	6/2	6/8	7	1.000	19	15	0	0	0	0	0	0
17	6/9	6/14	6	1.000	3	12	0	0	0	0	0	0
18	6/15	6/21	7	1.000	1	2	0	0	0	0	0	0
19	6/22	6/28	7	1.000	0	0	0	0	0	0	0	0
20	6/29	7/6	8	1.000	1	3	1	1	0	0	0	0
21	7/7	7/12	6	1.000	1	0	0	0	0	0	0	0
22	7/13	7/19	7	1.000	0	1	0	0	0	0	0	0
23	7/20	7/26	7	1.000	0	1	0	0	0	0	0	0
24	7/27	8/3	8	0.875	0	0	0	0	0	0	0	0
25	8/4	8/5	2	0.500	0	0	0	0	0	0	0	0
26	8/6	8/12	2	0.500	0	0	0	0	0	0	0	0

Table C39. BTSPAS table for Grays River natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling), 2013.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/9	2/15	7	1.000	4	0	0	0	0	0	0	0
2	2/16	2/22	7	1.000	1	0	0	0	0	0	0	0
3	2/23	3/1	7	1.000	0	0	0	0	0	0	0	0
4	3/2	3/8	7	1.000	0	0	0	0	0	0	0	0
5	3/9	3/15	7	1.000	1	0	0	0	0	0	0	0
6	3/16	3/22	7	1.000	3	0	0	0	0	0	0	0
7	3/23	3/29	7	1.000	7	0	0	0	0	0	0	0
8	3/30	4/5	7	1.000	0	0	0	0	0	0	0	0
9	4/6	4/12	7	0.857	3	0	0	0	0	0	0	0
10	4/13	4/19	7	1.000	0	0	0	0	0	0	0	0
11	4/20	5/2	13	1.000	18	1,235	27	21	2	0	1	0
12	5/3	5/5	3	1.000	7	427	13	13	0	0	0	0
13	5/6	5/8	3	1.000	5	108	1	1	0	0	0	0
14	5/9	5/15	7	1.000	88	365	34	29	2	3	0	0
15	5/16	5/22	7	1.000	180	374	84	72	11	0	0	1
16	5/23	5/29	7	1.000	200	371	32	31	1	0	0	0
17	5/30	6/5	7	1.000	26	32	5	3	2	0	0	0
18	6/6	6/12	7	1.000	16	18	2	2	0	0	0	0
19	6/13	6/19	6	1.000	11	12	1	1	0	0	0	0
20	6/20	6/26	7	1.000	3	4	0	0	0	0	0	0
21	6/27	7/3	7	1.000	6	7	0	0	0	0	0	0
22	7/4	7/10	7	1.000	1	1	0	0	0	0	0	0
23	7/11	7/17	7	1.000	1	2	0	0	0	0	0	0
24	7/18	7/24	7	1.000	0	0	0	0	0	0	0	0
25	7/25	7/31	7	1.000	0	0	0	0	0	0	0	0

Table C40. BTSPAS table for Grays River natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling), 2014.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/12	2/18	7	0.429	1	0	0	0	0	0	0	0
2	2/19	2/25	7	0.857	3	0	0	0	0	0	0	0
3	2/26	3/4	7	1.000	4	0	0	0	0	0	0	0
4	3/5	3/11	7	0.429	6	0	0	0	0	0	0	0
5	3/12	3/18	7	1.000	3	0	0	0	0	0	0	0
6	3/19	3/25	7	1.000	10	0	0	0	0	0	0	0
7	3/26	4/1	7	1.000	12	0	0	0	0	0	0	0
8	4/2	4/8	7	1.000	8	0	0	0	0	0	0	0
9	4/9	4/15	7	1.000	2	0	0	0	0	0	0	0
10	4/16	4/22	7	1.000	7	0	0	0	0	0	0	0
11	4/23	5/2	12	0.833	8	1,035	21	9	11	1	0	0
12	5/3	5/7	5	1.000	12	525	18	13	5	0	0	0
13	5/8	5/14	7	1.000	25	158	7	7	0	0	0	0
14	5/15	5/21	7	1.000	46	54	11	10	0	0	0	1
15	5/22	5/28	7	0.714	38	20	0	0	0	0	0	0
16	5/29	6/4	7	1.000	38	43	4	3	1	0	0	0
17	6/5	6/11	7	1.000	41	60	10	10	0	0	0	0
18	6/12	6/18	7	0.857	13	33	6	5	1	0	0	0
19	6/19	6/25	7	1.000	6	8	0	0	0	0	0	0
20	6/26	7/2	7	0.714	1	5	0	0	0	0	0	0
21	7/3	7/9	7	0.857	0	0	0	0	0	0	0	0
22	7/10	7/16	7	1.000	0	0	0	0	0	0	0	0
23	7/17	7/23	7	1.000	0	0	0	0	0	0	0	0
24	7/24	7/30	7	1.000	0	0	0	0	0	0	0	0
25	7/31	7/31	1	1.000	0	0	0	0	0	0	0	0

Table C41. BTSPAS table for Grays River natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling), 2015.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/4	2/11	8	0.250	2	0	0	0	0	0	0	0
2	2/12	2/18	7	1.000	0	0	0	0	0	0	0	0
3	2/19	2/25	7	0.857	0	0	0	0	0	0	0	0
4	2/26	3/4	7	1.000	1	0	0	0	0	0	0	0
5	3/5	3/11	7	1.000	3	0	0	0	0	0	0	0
6	3/12	3/18	7	0.429	2	0	0	0	0	0	0	0
7	3/19	3/25	7	1.000	2	0	0	0	0	0	0	0
8	3/26	4/1	7	0.857	3	0	0	0	0	0	0	0
9	4/2	4/11	10	1.000	2	0	0	0	0	0	0	0
10	4/12	4/19	8	1.000	3	3	0	0	0	0	0	0
11	4/20	4/28	9	1.000	26	1,486	52	44	6	2	0	0
12	4/29	5/5	7	0.857	10	289	14	10	4	0	0	0
13	5/6	5/12	7	0.857	23	141	6	5	0	0	0	1
14	5/13	5/19	7	0.857	34	80	8	7	1	0	0	0
15	5/20	5/26	7	1.000	119	208	28	26	2	0	0	0
16	5/27	6/2	7	0.857	57	96	20	18	2	0	0	0
17	6/3	6/11	9	0.778	23	49	6	4	2	0	0	0
18	6/12	6/16	5	0.800	4	7	0	0	0	0	0	0
19	6/17	6/24	8	0.625	4	9	0	0	0	0	0	0
20	6/25	6/30	6	1.000	1	1	1	1	0	0	0	0
21	7/1	7/7	7	0.857	0	0	0	0	0	0	0	0
22	7/8	7/14	7	0.857	0	0	0	0	0	0	0	0
23	7/15	7/21	7	0.857	0	0	0	0	0	0	0	0
24	7/22	7/28	7	1.000	0	0	0	0	0	0	0	0
25	7/29	8/4	3	0.667	0	0	0	0	0	0	0	0

Table C42. BTSPAS table for Grays River natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling), 2016.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/20	2/27	8	0.875	3	0	0	0	0	0	0	0
2	2/28	3/5	7	0.857	1	0	0	0	0	0	0	0
3	3/6	3/12	7	0.714	0	0	0	0	0	0	0	0
4	3/13	3/19	7	1.000	5	0	0	0	0	0	0	0
5	3/20	3/31	12	1.000	11	0	0	0	0	0	0	0
6	4/1	4/9	9	1.000	7	8	1	1	0	0	0	0
7	4/10	4/17	8	1.000	2	6	0	0	0	0	0	0
8	4/18	4/21	4	1.000	2	4	0	0	0	0	0	0
9	4/22	4/28	7	1.000	10	2,471	62	51	7	2	0	0
10	4/29	5/5	7	0.857	11	103	6	2	3	0	0	1
11	5/6	5/12	7	1.000	94	253	21	14	7	0	0	0
12	5/13	5/19	7	0.857	68	159	25	18	7	0	0	0
13	5/20	5/26	7	1.000	60	127	6	6	0	0	0	0
14	5/27	6/2	7	0.857	29	65	8	7	1	0	0	0
15	6/3	6/9	7	1.000	14	36	4	2	2	0	0	0
16	6/10	6/16	7	1.000	12	52	10	7	2	1	0	0
17	6/17	6/23	7	1.000	1	11	3	3	0	0	0	0
18	6/24	6/30	7	1.000	5	12	0	0	0	0	0	0
19	7/1	7/7	7	1.000	0	12	3	1	2	0	0	0
20	7/8	7/14	7	0.857	0	14	4	3	1	0	0	0
21	7/15	7/21	7	1.000	0	8	0	0	0	0	0	0
22	7/22	7/29	8	1.000	0	7	0	0	0	0	0	0

Coho salmon (Natural-Origin, Transitional/Smolt, Sub-Yearling)

Table C43. BTSPAS table for Grays River natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling), 2008.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/23	2/29	7	1.000	0	0	0	0	0	0	0	0
2	3/1	3/7	7	1.000	0	0	0	0	0	0	0	0
3	3/8	3/14	7	0.857	0	0	0	0	0	0	0	0
4	3/15	3/21	7	1.000	0	0	0	0	0	0	0	0
5	3/22	3/28	7	0.571	0	0	0	0	0	0	0	0
6	3/29	4/4	7	1.000	0	0	0	0	0	0	0	0
7	4/5	4/11	7	0.857	0	0	0	0	0	0	0	0
8	4/12	4/23	12	0.583	0	0	0	0	0	0	0	0
9	4/24	5/1	8	0.875	0	0	0	0	0	0	0	0
10	5/2	5/5	4	1.000	0	0	0	0	0	0	0	0
11	5/6	5/13	8	1.000	0	0	0	0	0	0	0	0
12	5/14	5/20	7	0.857	0	0	0	0	0	0	0	0
13	5/21	5/27	7	1.000	0	0	0	0	0	0	0	0
14	5/28	6/3	7	1.000	3	2	0	0	0	0	0	0
15	6/4	6/21	18	0.944	3	3	0	0	0	0	0	0
16	6/22	6/24	3	1.000	2	1	0	0	0	0	0	0
17	6/25	7/2	8	1.000	12	11	5	4	1	0	0	0
18	7/3	7/8	6	1.000	19	25	11	7	4	0	0	0
19	7/9	7/15	7	1.000	16	17	7	5	2	0	0	0
20	7/16	7/22	7	1.000	17	32	11	9	2	0	0	0
21	7/23	7/28	6	1.000	3	13	3	3	0	0	0	0
22	7/29	7/30	2	0.500	1	1	0	0	0	0	0	0
23	7/31	8/6	7	1.000	0	0	0	0	0	0	0	0
24	8/7	8/13	7	0.857	0	0	0	0	0	0	0	0
25	8/14	8/20	2	1.000	0	0	0	0	0	0	0	0

Table C44. BTSPAS table for Grays River natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling), 2009.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/7	2/13	7	1.000	0	0	0	0	0	0	0	0
2	2/14	2/20	7	1.000	0	0	0	0	0	0	0	0
3	2/21	2/27	7	1.000	0	0	0	0	0	0	0	0
4	2/28	3/6	7	1.000	0	0	0	0	0	0	0	0
5	3/7	3/13	7	1.000	0	0	0	0	0	0	0	0
6	3/14	3/20	7	0.714	0	0	0	0	0	0	0	0
7	3/21	3/27	7	1.000	0	0	0	0	0	0	0	0
8	3/28	4/3	7	0.857	0	0	0	0	0	0	0	0
9	4/4	4/14	11	0.909	0	0	0	0	0	0	0	0
10	4/15	4/30	15	1.000	0	0	0	0	0	0	0	0
11	5/1	5/5	5	1.000	0	0	0	0	0	0	0	0
12	5/6	5/13	8	0.750	0	0	0	0	0	0	0	0
13	5/14	5/19	6	1.000	1	1	0	0	0	0	0	0
14	5/20	5/27	8	1.000	0	0	0	0	0	0	0	0
15	5/28	6/2	6	1.000	0	1	1	0	0	1	0	0
16	6/3	6/10	8	1.000	3	3	0	0	0	0	0	0
17	6/11	6/19	9	0.889	1	0	0	0	0	0	0	0
18	6/20	6/23	4	1.000	2	4	0	0	0	0	0	0
19	6/24	6/30	7	0.857	10	9	0	0	0	0	0	0
20	7/1	7/7	7	0.857	11	11	1	0	1	0	0	0
21	7/8	7/14	7	0.857	14	9	0	0	0	0	0	0
22	7/15	7/23	9	1.000	13	13	1	1	0	0	0	0
23	7/24	7/28	5	0.800	3	3	0	0	0	0	0	0
24	7/29	8/4	3	1.000	1	0	0	0	0	0	0	0

Table C45. BTSPAS table for Grays River natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling), 2010.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/4	2/10	7	1.000	0	0	0	0	0	0	0	0
2	2/11	2/17	7	1.000	0	0	0	0	0	0	0	0
3	2/18	2/24	7	1.000	0	0	0	0	0	0	0	0
4	2/25	3/3	7	1.000	0	0	0	0	0	0	0	0
5	3/4	3/10	7	1.000	0	0	0	0	0	0	0	0
6	3/11	3/17	7	1.000	0	0	0	0	0	0	0	0
7	3/18	3/24	7	1.000	0	0	0	0	0	0	0	0
8	3/25	3/31	7	1.000	0	0	0	0	0	0	0	0
9	4/1	4/7	7	1.000	0	0	0	0	0	0	0	0
10	4/8	4/14	7	1.000	0	0	0	0	0	0	0	0
11	4/15	4/21	7	1.000	0	0	0	0	0	0	0	0
12	4/22	4/28	7	1.000	0	0	0	0	0	0	0	0
13	4/29	5/4	6	0.833	0	0	0	0	0	0	0	0
14	5/5	5/11	7	1.000	0	0	0	0	0	0	0	0
15	5/12	5/12	1	1.000	0	0	0	0	0	0	0	0
16	5/13	5/18	6	1.000	0	1	0	0	0	0	0	0
17	5/19	5/26	8	1.000	1	1	0	0	0	0	0	0
18	5/27	6/1	6	1.000	0	0	0	0	0	0	0	0
19	6/2	6/8	7	0.571	0	0	0	0	0	0	0	0
20	6/9	6/16	8	1.000	2	0	0	0	0	0	0	0
21	6/17	6/23	7	1.000	0	2	0	0	0	0	0	0
22	6/24	6/30	7	1.000	14	10	0	0	0	0	0	0
23	7/1	7/6	6	1.000	58	45	2	2	0	0	0	0
24	7/7	7/13	7	1.000	90	80	10	10	0	0	0	0
25	7/14	7/20	7	1.000	33	56	11	10	1	0	0	0
26	7/21	7/29	9	1.000	16	18	0	0	0	0	0	0
27	7/30	7/31	2	1.000	2	6	0	0	0	0	0	0

Table C46. BTSPAS table for Grays River natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling), 2011.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/4	2/10	7	1.000	0	0	0	0	0	0	0	0
2	2/11	2/17	7	1.000	0	0	0	0	0	0	0	0
3	2/18	2/24	7	1.000	0	0	0	0	0	0	0	0
4	2/25	3/3	7	1.000	0	0	0	0	0	0	0	0
5	3/4	3/10	7	0.857	0	0	0	0	0	0	0	0
6	3/11	3/17	7	0.286	0	0	0	0	0	0	0	0
7	3/18	3/24	7	1.000	0	0	0	0	0	0	0	0
8	3/25	3/31	7	0.857	0	0	0	0	0	0	0	0
9	4/1	4/7	7	0.571	0	0	0	0	0	0	0	0
10	4/8	4/14	7	1.000	0	0	0	0	0	0	0	0
11	4/15	4/21	7	1.000	0	0	0	0	0	0	0	0
12	4/22	5/1	10	1.000	0	0	0	0	0	0	0	0
13	5/2	5/3	2	1.000	0	0	0	0	0	0	0	0
14	5/4	5/7	4	1.000	0	0	0	0	0	0	0	0
15	5/8	5/12	5	1.000	0	0	0	0	0	0	0	0
16	5/13	5/18	6	1.000	0	0	0	0	0	0	0	0
17	5/19	5/20	2	1.000	0	0	0	0	0	0	0	0
18	5/21	5/24	4	1.000	0	0	0	0	0	0	0	0
19	5/25	5/31	7	1.000	0	0	0	0	0	0	0	0
20	6/1	6/7	7	1.000	0	1	0	0	0	0	0	0
21	6/8	6/14	7	1.000	0	0	0	0	0	0	0	0
22	6/15	6/21	7	1.000	4	4	0	0	0	0	0	0
23	6/22	6/28	7	1.000	24	23	3	3	0	0	0	0
24	6/29	7/6	8	1.000	53	56	1	0	1	0	0	0
25	7/7	7/19	13	1.000	181	183	14	13	1	0	0	0
26	7/20	7/27	8	1.000	59	65	23	23	0	0	0	0
27	7/28	8/1	5	1.000	17	12	2	2	0	0	0	0
28	8/2	8/8	7	1.000	1	0	0	0	0	0	0	0
29	8/9	8/15	5	1.000	0	0	0	0	0	0	0	0

Table C47. BTSPAS table for Grays River natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling), 2012.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/12	2/18	7	1.000	0	0	0	0	0	0	0	0
2	2/19	2/25	7	0.429	0	0	0	0	0	0	0	0
3	2/26	3/3	7	0.143	0	0	0	0	0	0	0	0
4	3/4	3/10	7	1.000	0	0	0	0	0	0	0	0
5	3/11	3/17	7	0.571	0	0	0	0	0	0	0	0
6	3/18	3/24	7	0.286	0	0	0	0	0	0	0	0
7	3/25	3/31	7	0.714	0	0	0	0	0	0	0	0
8	4/1	4/7	7	1.000	0	0	0	0	0	0	0	0
9	4/8	4/14	7	0.857	0	0	0	0	0	0	0	0
10	4/15	4/21	7	0.714	0	0	0	0	0	0	0	0
11	4/22	5/3	12	1.000	0	0	0	0	0	0	0	0
12	5/4	5/15	12	1.000	0	0	0	0	0	0	0	0
13	5/16	5/17	2	1.000	0	0	0	0	0	0	0	0
14	5/18	5/24	7	0.714	0	0	0	0	0	0	0	0
15	5/25	6/1	8	1.000	0	0	0	0	0	0	0	0
16	6/2	6/8	7	1.000	1	0	0	0	0	0	0	0
17	6/9	6/14	6	1.000	1	1	0	0	0	0	0	0
18	6/15	6/21	7	1.000	10	5	1	0	1	0	0	0
19	6/22	6/28	7	1.000	23	17	2	2	0	0	0	0
20	6/29	7/6	8	1.000	21	19	1	1	0	0	0	0
21	7/7	7/12	6	1.000	23	11	3	1	2	0	0	0
22	7/13	7/19	7	1.000	51	63	10	9	1	0	0	0
23	7/20	7/26	7	1.000	41	41	10	10	0	0	0	0
24	7/27	8/3	8	0.875	11	14	3	3	0	0	0	0
25	8/4	8/5	2	0.500	5	2	0	0	0	0	0	0
26	8/6	8/12	2	0.500	0	0	0	0	0	0	0	0

Table C48. BTSPAS table for Grays River natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling), 2013.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/9	2/15	7	1.000	0	0	0	0	0	0	0	0
2	2/16	2/22	7	1.000	0	0	0	0	0	0	0	0
3	2/23	3/1	7	1.000	0	0	0	0	0	0	0	0
4	3/2	3/8	7	1.000	0	0	0	0	0	0	0	0
5	3/9	3/15	7	1.000	0	0	0	0	0	0	0	0
6	3/16	3/22	7	1.000	0	0	0	0	0	0	0	0
7	3/23	3/29	7	1.000	0	0	0	0	0	0	0	0
8	3/30	4/5	7	1.000	0	0	0	0	0	0	0	0
9	4/6	4/12	7	0.857	0	0	0	0	0	0	0	0
10	4/13	4/19	7	1.000	0	0	0	0	0	0	0	0
11	4/20	5/2	13	1.000	0	0	0	0	0	0	0	0
12	5/3	5/5	3	1.000	0	0	0	0	0	0	0	0
13	5/6	5/8	3	1.000	0	0	0	0	0	0	0	0
14	5/9	5/15	7	1.000	0	0	0	0	0	0	0	0
15	5/16	5/22	7	1.000	4	5	0	0	0	0	0	0
16	5/23	5/29	7	1.000	14	3	0	0	0	0	0	0
17	5/30	6/5	7	1.000	5	1	0	0	0	0	0	0
18	6/6	6/12	7	1.000	7	0	0	0	0	0	0	0
19	6/13	6/19	6	1.000	23	10	1	1	0	0	0	0
20	6/20	6/26	7	1.000	21	15	3	1	2	0	0	0
21	6/27	7/3	7	1.000	73	72	12	11	1	0	0	0
22	7/4	7/10	7	1.000	119	119	34	34	0	0	0	0
23	7/11	7/17	7	1.000	38	48	10	10	0	0	0	0
24	7/18	7/24	7	1.000	11	27	9	7	2	0	0	0
25	7/25	7/31	7	1.000	8	14	3	3	0	0	0	0

Table C49. BTSPAS table for Grays River natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling), 2014.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/12	2/18	7	0.429	0	0	0	0	0	0	0	0
2	2/19	2/25	7	0.857	0	0	0	0	0	0	0	0
3	2/26	3/4	7	1.000	0	0	0	0	0	0	0	0
4	3/5	3/11	7	0.429	0	0	0	0	0	0	0	0
5	3/12	3/18	7	1.000	0	0	0	0	0	0	0	0
6	3/19	3/25	7	1.000	0	0	0	0	0	0	0	0
7	3/26	4/1	7	1.000	0	0	0	0	0	0	0	0
8	4/2	4/8	7	1.000	0	0	0	0	0	0	0	0
9	4/9	4/15	7	1.000	0	0	0	0	0	0	0	0
10	4/16	4/22	7	1.000	0	0	0	0	0	0	0	0
11	4/23	5/2	12	0.833	0	0	0	0	0	0	0	0
12	5/3	5/7	5	1.000	0	0	0	0	0	0	0	0
13	5/8	5/14	7	1.000	0	0	0	0	0	0	0	0
14	5/15	5/21	7	1.000	0	0	0	0	0	0	0	0
15	5/22	5/28	7	0.714	0	0	0	0	0	0	0	0
16	5/29	6/4	7	1.000	0	0	0	0	0	0	0	0
17	6/5	6/11	7	1.000	0	0	0	0	0	0	0	0
18	6/12	6/18	7	0.857	27	0	0	0	0	0	0	0
19	6/19	6/25	7	1.000	81	44	2	1	1	0	0	0
20	6/26	7/2	7	0.714	68	43	5	4	1	0	0	0
21	7/3	7/9	7	0.857	67	87	10	5	5	0	0	0
22	7/10	7/16	7	1.000	73	112	14	12	2	0	0	0
23	7/17	7/23	7	1.000	38	98	14	14	0	0	0	0
24	7/24	7/30	7	1.000	8	47	7	7	0	0	0	0
25	7/31	7/31	1	1.000	0	2	0	0	0	0	0	0

Table C50. BTSPAS table for Grays River natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling), 2015.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/4	2/10	7	0.286	0	0	0	0	0	0	0	0
2	2/11	2/17	7	0.857	0	0	0	0	0	0	0	0
3	2/18	2/24	7	0.857	0	0	0	0	0	0	0	0
4	2/25	3/3	7	1.000	0	0	0	0	0	0	0	0
5	3/4	3/10	7	1.000	0	0	0	0	0	0	0	0
6	3/11	3/17	7	0.429	0	0	0	0	0	0	0	0
7	3/18	3/24	7	1.000	0	0	0	0	0	0	0	0
8	3/25	3/31	7	0.857	0	0	0	0	0	0	0	0
9	4/1	4/11	11	1.000	0	0	0	0	0	0	0	0
10	4/12	4/19	8	1.000	0	0	0	0	0	0	0	0
11	4/20	4/28	9	1.000	0	0	0	0	0	0	0	0
12	4/29	5/5	7	0.857	0	0	0	0	0	0	0	0
13	5/6	5/12	7	0.857	0	0	0	0	0	0	0	0
14	5/13	5/19	7	0.857	0	0	0	0	0	0	0	0
15	5/20	5/26	7	1.000	1	0	0	0	0	0	0	0
16	5/27	6/2	7	0.857	2	0	0	0	0	0	0	0
17	6/3	6/11	9	0.778	22	7	1	1	0	0	0	0
18	6/12	6/16	5	0.800	51	45	3	2	1	0	0	0
19	6/17	6/24	8	0.625	95	72	4	4	0	0	0	0
20	6/25	6/30	6	1.000	89	97	17	12	3	2	0	0
21	7/1	7/7	7	0.857	60	65	20	19	1	0	0	0
22	7/8	7/14	7	0.857	15	18	0	0	0	0	0	0
23	7/15	7/21	7	0.857	3	3	0	0	0	0	0	0
24	7/22	7/28	7	1.000	0	0	0	0	0	0	0	0
25	7/29	8/4	3	0.667	0	0	0	0	0	0	0	0

Table C51. BTSPAS table for Grays River natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling), 2016.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/20	2/27	8	0.875	0	0	0	0	0	0	0	0
2	2/28	3/5	7	0.857	0	0	0	0	0	0	0	0
3	3/6	3/12	7	0.714	0	0	0	0	0	0	0	0
4	3/13	3/19	7	1.000	0	0	0	0	0	0	0	0
5	3/20	3/31	12	1.000	0	0	0	0	0	0	0	0
6	4/1	4/9	9	1.000	0	0	0	0	0	0	0	0
7	4/10	4/17	8	1.000	0	0	0	0	0	0	0	0
8	4/18	4/21	4	1.000	0	0	0	0	0	0	0	0
9	4/22	4/28	7	1.000	0	0	0	0	0	0	0	0
10	4/29	5/5	7	0.857	0	0	0	0	0	0	0	0
11	5/6	5/12	7	1.000	0	0	0	0	0	0	0	0
12	5/13	5/19	7	0.857	0	0	0	0	0	0	0	0
13	5/20	5/26	7	1.000	2	1	0	0	0	0	0	0
14	5/27	6/2	7	0.857	5	0	0	0	0	0	0	0
15	6/3	6/9	7	1.000	27	5	0	0	0	0	0	0
16	6/10	6/16	7	1.000	93	119	34	20	2	11	0	1
17	6/17	6/23	7	1.000	24	34	1	1	0	0	0	0
18	6/24	6/30	7	1.000	57	280	64	43	17	3	0	1
19	7/1	7/7	7	1.000	12	217	55	43	7	4	1	0
20	7/8	7/14	7	0.857	4	108	17	9	6	2	0	0
21	7/15	7/21	7	1.000	0	64	17	13	4	0	0	0
22	7/22	7/29	8	1.000	4	61	8	8	0	0	0	0

Coho salmon (Hatchery-Origin, Transitional/Smolt, Yearling)

Table C52. BTSPAS table for Grays River hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling), 2008.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/23	2/29	7	1.000	0	0	0	0	0	0	0	0
2	3/1	3/7	7	1.000	0	0	0	0	0	0	0	0
3	3/8	3/14	7	0.857	0	0	0	0	0	0	0	0
4	3/15	3/21	7	1.000	0	0	0	0	0	0	0	0
5	3/22	3/28	7	0.571	0	0	0	0	0	0	0	0
6	3/29	4/4	7	1.000	0	0	0	0	0	0	0	0
7	4/5	4/11	7	0.857	0	0	0	0	0	0	0	0
8	4/12	4/23	12	0.583	0	0	0	0	0	0	0	0
9	4/24	5/1	8	0.875	0	1,030	0	0	0	0	0	0
10	5/2	5/5	4	1.000	2,384	1,045	14	13	0	1	0	0
11	5/6	5/13	8	1.000	25	1,047	4	3	0	0	0	1
12	5/14	5/20	7	0.857	18	38	3	1	0	2	0	0
13	5/21	5/27	7	1.000	63	257	52	40	9	3	0	0
14	5/28	6/3	7	1.000	48	202	50	41	9	0	0	0
15	6/4	6/21	18	0.944	8	50	5	5	0	0	0	0
16	6/22	6/24	3	1.000	1	1	0	0	0	0	0	0
17	6/25	7/2	8	1.000	1	1	0	0	0	0	0	0
18	7/3	7/8	6	1.000	0	0	0	0	0	0	0	0
19	7/9	7/15	7	1.000	0	0	0	0	0	0	0	0
20	7/16	7/22	7	1.000	0	0	0	0	0	0	0	0
21	7/23	7/28	6	1.000	0	0	0	0	0	0	0	0
22	7/29	7/30	2	0.500	0	0	0	0	0	0	0	0
23	7/31	8/6	7	1.000	0	0	0	0	0	0	0	0
24	8/7	8/13	7	0.857	0	0	0	0	0	0	0	0
25	8/14	8/20	2	1.000	0	0	0	0	0	0	0	0

Table C53. BTSPAS table for Grays River hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling),2009.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/7	2/13	7	1.000	0	0	0	0	0	0	0	0
2	2/14	2/20	7	1.000	2	0	0	0	0	0	0	0
3	2/21	2/27	7	1.000	2	0	0	0	0	0	0	0
4	2/28	3/6	7	1.000	2	0	0	0	0	0	0	0
5	3/7	3/13	7	1.000	0	0	0	0	0	0	0	0
6	3/14	3/20	7	0.714	0	0	0	0	0	0	0	0
7	3/21	3/27	7	1.000	0	0	0	0	0	0	0	0
8	3/28	4/3	7	0.857	0	0	0	0	0	0	0	0
9	4/4	4/14	11	0.909	0	0	0	0	0	0	0	0
10	4/15	4/30	15	1.000	1	726	0	0	0	0	0	0
11	5/1	5/5	5	1.000	3,479	2,001	6	5	1	0	0	0
12	5/6	5/13	8	0.750	170	962	9	8	1	0	0	0
13	5/14	5/19	6	1.000	37	53	0	0	0	0	0	0
14	5/20	5/27	8	1.000	7	6	2	0	0	2	0	0
15	5/28	6/2	6	1.000	43	44	5	4	0	1	0	0
16	6/3	6/10	8	1.000	29	45	6	6	0	0	0	0
17	6/11	6/19	9	0.889	1	1	0	0	0	0	0	0
18	6/20	6/23	4	1.000	0	0	0	0	0	0	0	0
19	6/24	6/30	7	0.857	0	0	0	0	0	0	0	0
20	7/1	7/7	7	0.857	0	0	0	0	0	0	0	0
21	7/8	7/14	7	0.857	0	0	0	0	0	0	0	0
22	7/15	7/23	9	1.000	0	0	0	0	0	0	0	0
23	7/24	7/28	5	0.800	0	0	0	0	0	0	0	0
24	7/29	8/4	3	1.000	0	0	0	0	0	0	0	0

Table C54. BTSPAS table for Grays River hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling), 2010.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/4	2/10	7	1.000	0	0	0	0	0	0	0	0
2	2/11	2/17	7	1.000	0	0	0	0	0	0	0	0
3	2/18	2/24	7	1.000	0	0	0	0	0	0	0	0
4	2/25	3/3	7	1.000	0	0	0	0	0	0	0	0
5	3/4	3/10	7	1.000	10	0	0	0	0	0	0	0
6	3/11	3/17	7	1.000	2	0	0	0	0	0	0	0
7	3/18	3/24	7	1.000	0	0	0	0	0	0	0	0
8	3/25	3/31	7	0.714	0	0	0	0	0	0	0	0
9	4/1	4/7	7	1.000	0	0	0	0	0	0	0	0
10	4/8	4/14	7	1.000	0	0	0	0	0	0	0	0
11	4/15	4/21	7	1.000	0	0	0	0	0	0	0	0
12	4/22	4/28	7	1.000	3,216	2,352	19	19	0	0	0	0
13	4/29	5/4	6	0.667	10	206	0	0	0	0	0	0
14	5/5	5/11	7	1.000	7	14	0	0	0	0	0	0
15	5/12	5/12	1	1.000	0	3	2	0	1	1	0	0
16	5/13	5/18	6	1.000	18	59	0	0	0	0	0	0
17	5/19	5/26	8	1.000	17	133	6	6	0	0	0	0
18	5/27	6/1	6	0.833	13	33	2	2	0	0	0	0
19	6/2	6/8	7	0.571	3	0	0	0	0	0	0	0
20	6/9	6/16	8	1.000	0	4	0	0	0	0	0	0
21	6/17	6/23	7	1.000	2	0	0	0	0	0	0	0
22	6/24	6/30	7	1.000	3	4	0	0	0	0	0	0
23	7/1	7/6	6	1.000	1	1	0	0	0	0	0	0
24	7/7	7/13	7	1.000	1	1	0	0	0	0	0	0
25	7/14	7/20	7	0.857	0	0	0	0	0	0	0	0
26	7/21	7/29	9	0.778	0	0	0	0	0	0	0	0
27	7/30	7/31	2	1.000	0	1	0	0	0	0	0	0

Table C55. BTSPAS table for Grays River hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling), 2011.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/4	2/10	7	1.000	0	0	0	0	0	0	0	0
2	2/11	2/17	7	1.000	0	0	0	0	0	0	0	0
3	2/18	2/24	7	1.000	86	0	0	0	0	0	0	0
4	2/25	3/3	7	1.000	10	0	0	0	0	0	0	0
5	3/4	3/10	7	0.857	3	0	0	0	0	0	0	0
6	3/11	3/17	7	0.286	1	0	0	0	0	0	0	0
7	3/18	3/24	7	1.000	0	0	0	0	0	0	0	0
8	3/25	3/31	7	0.857	0	0	0	0	0	0	0	0
9	4/1	4/7	7	0.571	0	0	0	0	0	0	0	0
10	4/8	4/14	7	1.000	0	0	0	0	0	0	0	0
11	4/15	4/21	7	1.000	0	0	0	0	0	0	0	0
12	4/22	5/1	10	1.000	0	0	0	0	0	0	0	0
13	5/2	5/3	2	1.000	858	1878	30	30	0	0	0	0
14	5/4	5/7	4	1.000	194	244	12	8	2	0	1	1
15	5/8	5/12	5	1.000	56	72	1	1	0	0	0	0
16	5/13	5/18	6	1.000	5	14	1	1	0	0	0	0
17	5/19	5/20	2	1.000	2	7	1	0	0	0	1	0
18	5/21	5/24	4	1.000	4	29	2	2	0	0	0	0
19	5/25	5/31	7	1.000	25	187	20	19	1	0	0	0
20	6/1	6/7	7	1.000	266	2178	267	256	11	0	0	0
21	6/8	6/14	7	1.000	28	106	23	19	4	0	0	0
22	6/15	6/21	7	1.000	29	84	21	16	4	1	0	0
23	6/22	6/28	7	1.000	7	66	17	15	2	0	0	0
24	6/29	7/6	8	1.000	2	9	1	1	0	0	0	0
25	7/7	7/17	11	1.000	0	0	0	0	0	0	0	0
26	7/18	7/24	7	1.000	0	0	0	0	0	0	0	0
27	7/25	7/31	7	1.000	0	0	0	0	0	0	0	0
28	8/1	8/7	7	1.000	0	0	0	0	0	0	0	0
29	8/8	8/14	6	1.000	0	0	0	0	0	0	0	0

Table C56. BTSPAS table for Grays River hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling), 2012.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/12	2/18	7	1.000	0	0	0	0	0	0	0	0
2	2/19	2/25	7	0.429	0	0	0	0	0	0	0	0
3	2/26	3/3	7	0.143	0	0	0	0	0	0	0	0
4	3/4	3/10	7	1.000	1	0	0	0	0	0	0	0
5	3/11	3/17	7	0.571	0	0	0	0	0	0	0	0
6	3/18	3/24	7	0.286	1	0	0	0	0	0	0	0
7	3/25	3/31	7	0.714	0	0	0	0	0	0	0	0
8	4/1	4/7	7	1.000	2	0	0	0	0	0	0	0
9	4/8	4/14	7	0.857	0	0	0	0	0	0	0	0
10	4/15	4/21	7	0.714	0	0	0	0	0	0	0	0
11	4/22	5/3	12	1.000	9,064	1,056	26	25	1	0	0	0
12	5/4	5/15	12	1.000	280	2,222	40	13	0	26	1	0
13	5/16	5/17	2	1.000	0	2	0	0	0	0	0	0
14	5/18	5/24	7	0.714	17	28	2	2	0	0	0	0
15	5/25	6/1	8	1.000	4	21	2	1	1	0	0	0
16	6/2	6/8	7	1.000	3	15	0	0	0	0	0	0
17	6/9	6/14	6	1.000	3	12	0	0	0	0	0	0
18	6/15	6/21	7	1.000	0	2	0	0	0	0	0	0
19	6/22	6/28	7	1.000	0	0	0	0	0	0	0	0
20	6/29	7/6	8	1.000	2	3	1	1	0	0	0	0
21	7/7	7/12	6	1.000	0	0	0	0	0	0	0	0
22	7/13	7/19	7	1.000	1	1	0	0	0	0	0	0
23	7/20	7/26	7	1.000	0	1	0	0	0	0	0	0
24	7/27	8/3	8	0.875	0	0	0	0	0	0	0	0
25	8/4	8/5	2	0.500	0	0	0	0	0	0	0	0
26	8/6	8/12	2	0.500	0	0	0	0	0	0	0	0

Table C57. BTSPAS table for Grays River hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling), 2013.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/9	2/15	7	1.000	0	0	0	0	0	0	0	0
2	2/16	2/22	7	1.000	0	0	0	0	0	0	0	0
3	2/23	3/1	7	1.000	1	0	0	0	0	0	0	0
4	3/2	3/8	7	1.000	0	0	0	0	0	0	0	0
5	3/9	3/15	7	1.000	0	0	0	0	0	0	0	0
6	3/16	3/22	7	1.000	0	0	0	0	0	0	0	0
7	3/23	3/29	7	1.000	0	0	0	0	0	0	0	0
8	3/30	4/5	7	1.000	0	0	0	0	0	0	0	0
9	4/6	4/12	7	0.857	0	0	0	0	0	0	0	0
10	4/13	4/19	7	1.000	0	0	0	0	0	0	0	0
11	4/20	5/2	13	1.000	3,532	1,235	27	21	2	0	1	0
12	5/3	5/5	3	1.000	547	427	13	13	0	0	0	0
13	5/6	5/8	3	1.000	51	108	1	1	0	0	0	0
14	5/9	5/15	7	1.000	358	365	34	29	2	3	0	0
15	5/16	5/22	7	1.000	188	374	84	72	11	0	0	1
16	5/23	5/29	7	1.000	158	371	32	31	1	0	0	0
17	5/30	6/5	7	1.000	0	32	5	3	2	0	0	0
18	6/6	6/12	7	1.000	1	18	2	2	0	0	0	0
19	6/13	6/19	6	1.000	0	12	1	1	0	0	0	0
20	6/20	6/26	7	1.000	0	4	0	0	0	0	0	0
21	6/27	7/3	7	1.000	0	7	0	0	0	0	0	0
22	7/4	7/10	7	1.000	0	1	0	0	0	0	0	0
23	7/11	7/17	7	1.000	1	2	0	0	0	0	0	0
24	7/18	7/24	7	1.000	0	0	0	0	0	0	0	0
25	7/25	7/31	7	1.000	0	0	0	0	0	0	0	0

Table C58. BTSPAS table for Grays River hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling), 2014.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/12	2/18	7	0.429	0	0	0	0	0	0	0	0
2	2/19	2/25	7	0.857	0	0	0	0	0	0	0	0
3	2/26	3/4	7	1.000	0	0	0	0	0	0	0	0
4	3/5	3/11	7	0.429	0	0	0	0	0	0	0	0
5	3/12	3/18	7	1.000	0	0	0	0	0	0	0	0
6	3/19	3/25	7	1.000	4	0	0	0	0	0	0	0
7	3/26	4/1	7	1.000	0	0	0	0	0	0	0	0
8	4/2	4/8	7	1.000	1	0	0	0	0	0	0	0
9	4/9	4/15	7	1.000	0	0	0	0	0	0	0	0
10	4/16	4/22	7	1.000	3	0	0	0	0	0	0	0
11	4/23	5/2	12	0.833	4,449	1,035	21	9	11	1	0	0
12	5/3	5/7	5	1.000	2,937	525	18	13	5	0	0	0
13	5/8	5/14	7	1.000	48	158	7	7	0	0	0	0
14	5/15	5/21	7	1.000	29	54	11	10	0	0	0	1
15	5/22	5/28	7	0.714	16	20	0	0	0	0	0	0
16	5/29	6/4	7	1.000	14	43	4	3	1	0	0	0
17	6/5	6/11	7	1.000	18	60	10	10	0	0	0	0
18	6/12	6/18	7	0.857	15	33	6	5	1	0	0	0
19	6/19	6/25	7	1.000	0	8	0	0	0	0	0	0
20	6/26	7/2	7	0.714	0	5	0	0	0	0	0	0
21	7/3	7/9	7	0.857	0	0	0	0	0	0	0	0
22	7/10	7/16	7	1.000	0	0	0	0	0	0	0	0
23	7/17	7/23	7	1.000	0	0	0	0	0	0	0	0
24	7/24	7/30	7	1.000	0	0	0	0	0	0	0	0
25	7/31	7/31	1	1.000	0	0	0	0	0	0	0	0

Table C59. BTSPAS table for Grays River hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling), 2015.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/4	2/11	8	0.25	0	0	0	0	0	0	0	0
2	2/12	2/18	7	1	5	0	0	0	0	0	0	0
3	2/19	2/25	7	0.857	0	0	0	0	0	0	0	0
4	2/26	3/4	7	1	0	0	0	0	0	0	0	0
5	3/5	3/11	7	1	1	0	0	0	0	0	0	0
6	3/12	3/18	7	0.429	1	0	0	0	0	0	0	0
7	3/19	3/25	7	1	0	0	0	0	0	0	0	0
8	3/26	4/1	7	0.857	1	0	0	0	0	0	0	0
9	4/2	4/11	10	1	0	0	0	0	0	0	0	0
10	4/12	4/19	8	1	0	3	0	0	0	0	0	0
11	4/20	4/28	9	1	6438	1486	52	44	6	2	0	0
12	4/29	5/5	7	0.857	386	289	14	10	4	0	0	0
13	5/6	5/12	7	0.857	78	141	6	5	0	0	0	1
14	5/13	5/19	7	0.857	43	80	8	7	1	0	0	0
15	5/20	5/26	7	1	116	208	28	26	2	0	0	0
16	5/27	6/2	7	0.857	45	96	20	18	2	0	0	0
17	6/3	6/11	9	0.778	27	49	6	4	2	0	0	0
18	6/12	6/16	5	0.8	7	7	0	0	0	0	0	0
19	6/17	6/24	8	0.625	3	9	0	0	0	0	0	0
20	6/25	6/30	6	1	0	1	1	1	0	0	0	0
21	7/1	7/7	7	0.857	1	0	0	0	0	0	0	0
22	7/8	7/14	7	0.857	0	0	0	0	0	0	0	0
23	7/15	7/21	7	0.857	0	0	0	0	0	0	0	0
24	7/22	7/28	7	1	0	0	0	0	0	0	0	0
25	7/29	8/4	3	0.667	0	0	0	0	0	0	0	0

Table C60. BTSPAS table for Grays River hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling), 2016.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/20	2/27	8	0.875	1	0	0	0	0	0	0	0
2	2/28	3/5	7	0.857	2	0	0	0	0	0	0	0
3	3/6	3/12	7	0.714	0	0	0	0	0	0	0	0
4	3/13	3/19	7	1.000	1	0	0	0	0	0	0	0
5	3/20	3/31	12	1.000	1	0	0	0	0	0	0	0
6	4/1	4/9	9	1.000	3	8	1	1	0	0	0	0
7	4/10	4/17	8	1.000	2	6	0	0	0	0	0	0
8	4/18	4/21	4	1.000	2	4	0	0	0	0	0	0
9	4/22	4/28	7	1.000	5,528	2,471	62	51	7	2	0	0
10	4/29	5/5	7	0.857	103	103	6	2	3	0	0	1
11	5/6	5/12	7	1.000	206	253	21	14	7	0	0	0
12	5/13	5/19	7	0.857	80	159	25	18	7	0	0	0
13	5/20	5/26	7	1.000	66	127	6	6	0	0	0	0
14	5/27	6/2	7	0.857	22	65	8	7	1	0	0	0
15	6/3	6/9	7	1.000	28	36	4	2	2	0	0	0
16	6/10	6/16	7	1.000	34	52	10	7	2	1	0	0
17	6/17	6/23	7	1.000	10	11	3	3	0	0	0	0
18	6/24	6/30	7	1.000	18	12	0	0	0	0	0	0
19	7/1	7/7	7	1.000	17	12	3	1	2	0	0	0
20	7/8	7/14	7	0.857	19	14	4	3	1	0	0	0
21	7/15	7/21	7	1.000	6	8	0	0	0	0	0	0
22	7/22	7/29	8	1.000	7	7	0	0	0	0	0	0

Coho salmon (Hatchery-Origin, Transitional/Smolt, Sub-Yearling)

Table C61. BTSPAS table for Grays River hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling), 2008.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/23	2/29	7	1.000	0	0	0	0	0	0	0	0
2	3/1	3/7	7	1.000	0	0	0	0	0	0	0	0
3	3/8	3/14	7	0.857	0	0	0	0	0	0	0	0
4	3/15	3/21	7	1.000	0	0	0	0	0	0	0	0
5	3/22	3/28	7	0.571	0	0	0	0	0	0	0	0
6	3/29	4/4	7	1.000	0	0	0	0	0	0	0	0
7	4/5	4/11	7	0.857	0	0	0	0	0	0	0	0
8	4/12	4/23	12	0.583	0	0	0	0	0	0	0	0
9	4/24	5/1	8	0.875	0	0	0	0	0	0	0	0
10	5/2	5/5	4	1.000	0	0	0	0	0	0	0	0
11	5/6	5/13	8	1.000	0	0	0	0	0	0	0	0
12	5/14	5/20	7	0.857	0	0	0	0	0	0	0	0
13	5/21	5/27	7	1.000	0	0	0	0	0	0	0	0
14	5/28	6/3	7	1.000	0	2	0	0	0	0	0	0
15	6/4	6/21	18	0.944	0	3	0	0	0	0	0	0
16	6/22	6/24	3	1.000	0	1	0	0	0	0	0	0
17	6/25	7/2	8	1.000	3	11	5	4	1	0	0	0
18	7/3	7/8	6	1.000	3	25	11	7	4	0	0	0
19	7/9	7/15	7	1.000	7	17	7	5	2	0	0	0
20	7/16	7/22	7	1.000	10	32	11	9	2	0	0	0
21	7/23	7/28	6	1.000	9	13	3	3	0	0	0	0
22	7/29	7/30	2	0.500	1	1	0	0	0	0	0	0
23	7/31	8/6	7	1.000	0	0	0	0	0	0	0	0
24	8/7	8/13	7	0.857	0	0	0	0	0	0	0	0
25	8/14	8/20	2	1.000	0	0	0	0	0	0	0	0

Table C62. BTSPAS table for Grays River hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling), 2009.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/7	2/13	7	1.000	0	0	0	0	0	0	0	0
2	2/14	2/20	7	1.000	0	0	0	0	0	0	0	0
3	2/21	2/27	7	1.000	0	0	0	0	0	0	0	0
4	2/28	3/6	7	1.000	0	0	0	0	0	0	0	0
5	3/7	3/13	7	1.000	0	0	0	0	0	0	0	0
6	3/14	3/20	7	0.714	0	0	0	0	0	0	0	0
7	3/21	3/27	7	1.000	0	0	0	0	0	0	0	0
8	3/28	4/3	7	0.857	0	0	0	0	0	0	0	0
9	4/4	4/14	11	0.909	0	0	0	0	0	0	0	0
10	4/15	4/30	15	1.000	0	0	0	0	0	0	0	0
11	5/1	5/5	5	1.000	0	0	0	0	0	0	0	0
12	5/6	5/13	8	0.750	0	0	0	0	0	0	0	0
13	5/14	5/19	6	1.000	0	1	0	0	0	0	0	0
14	5/20	5/27	8	1.000	0	0	0	0	0	0	0	0
15	5/28	6/2	6	1.000	1	1	1	0	0	1	0	0
16	6/3	6/10	8	1.000	0	3	0	0	0	0	0	0
17	6/11	6/19	9	0.889	1	0	0	0	0	0	0	0
18	6/20	6/23	4	1.000	1	4	0	0	0	0	0	0
19	6/24	6/30	7	0.857	0	9	0	0	0	0	0	0
20	7/1	7/7	7	0.857	0	11	1	0	1	0	0	0
21	7/8	7/14	7	0.857	0	9	0	0	0	0	0	0
22	7/15	7/23	9	1.000	0	13	1	1	0	0	0	0
23	7/24	7/28	5	0.800	0	3	0	0	0	0	0	0
24	7/29	8/4	3	1.000	0	0	0	0	0	0	0	0

Table C63. BTSPAS table for Grays River hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling), 2010.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/4	2/10	7	1.000	0	0	0	0	0	0	0	0
2	2/11	2/17	7	1.000	0	0	0	0	0	0	0	0
3	2/18	2/24	7	1.000	0	0	0	0	0	0	0	0
4	2/25	3/3	7	1.000	0	0	0	0	0	0	0	0
5	3/4	3/10	7	1.000	0	0	0	0	0	0	0	0
6	3/11	3/17	7	1.000	0	0	0	0	0	0	0	0
7	3/18	3/24	7	1.000	0	0	0	0	0	0	0	0
8	3/25	3/31	7	1.000	0	0	0	0	0	0	0	0
9	4/1	4/7	7	1.000	0	0	0	0	0	0	0	0
10	4/8	4/14	7	1.000	0	0	0	0	0	0	0	0
11	4/15	4/21	7	1.000	0	0	0	0	0	0	0	0
12	4/22	4/28	7	1.000	0	0	0	0	0	0	0	0
13	4/29	5/4	6	0.833	0	0	0	0	0	0	0	0
14	5/5	5/11	7	1.000	0	0	0	0	0	0	0	0
15	5/12	5/12	1	1.000	0	0	0	0	0	0	0	0
16	5/13	5/18	6	1.000	1	1	0	0	0	0	0	0
17	5/19	5/26	8	1.000	0	1	0	0	0	0	0	0
18	5/27	6/1	6	1.000	0	0	0	0	0	0	0	0
19	6/2	6/8	7	0.571	0	0	0	0	0	0	0	0
20	6/9	6/16	8	1.000	0	0	0	0	0	0	0	0
21	6/17	6/23	7	1.000	3	2	0	0	0	0	0	0
22	6/24	6/30	7	1.000	4	10	0	0	0	0	0	0
23	7/1	7/6	6	1.000	0	45	2	2	0	0	0	0
24	7/7	7/13	7	1.000	0	80	10	10	0	0	0	0
25	7/14	7/20	7	1.000	0	56	11	10	1	0	0	0
26	7/21	7/29	9	1.000	0	18	0	0	0	0	0	0
27	7/30	7/31	2	1.000	0	6	0	0	0	0	0	0

Table C64. BTSPAS table for Grays River hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling), 2011.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/4	2/10	7	1.000	0	0	0	0	0	0	0	0
2	2/11	2/17	7	1.000	0	0	0	0	0	0	0	0
3	2/18	2/24	7	1.000	0	0	0	0	0	0	0	0
4	2/25	3/3	7	1.000	0	0	0	0	0	0	0	0
5	3/4	3/10	7	0.857	0	0	0	0	0	0	0	0
6	3/11	3/17	7	0.286	0	0	0	0	0	0	0	0
7	3/18	3/24	7	1.000	0	0	0	0	0	0	0	0
8	3/25	3/31	7	0.857	0	0	0	0	0	0	0	0
9	4/1	4/7	7	0.571	0	0	0	0	0	0	0	0
10	4/8	4/14	7	1.000	0	0	0	0	0	0	0	0
11	4/15	4/21	7	1.000	0	0	0	0	0	0	0	0
12	4/22	5/1	10	1.000	0	0	0	0	0	0	0	0
13	5/2	5/3	2	1.000	0	0	0	0	0	0	0	0
14	5/4	5/7	4	1.000	0	0	0	0	0	0	0	0
15	5/8	5/12	5	1.000	0	0	0	0	0	0	0	0
16	5/13	5/18	6	1.000	0	0	0	0	0	0	0	0
17	5/19	5/20	2	1.000	0	0	0	0	0	0	0	0
18	5/21	5/24	4	1.000	0	0	0	0	0	0	0	0
19	5/25	5/31	7	1.000	0	0	0	0	0	0	0	0
20	6/1	6/7	7	1.000	1	1	0	0	0	0	0	0
21	6/8	6/14	7	1.000	1	0	0	0	0	0	0	0
22	6/15	6/21	7	1.000	0	4	0	0	0	0	0	0
23	6/22	6/28	7	1.000	1	23	3	3	0	0	0	0
24	6/29	7/6	8	1.000	3	56	1	0	1	0	0	0
25	7/7	7/19	13	1.000	16	183	14	13	1	0	0	0
26	7/20	7/27	8	1.000	3	65	23	23	0	0	0	0
27	7/28	8/1	5	1.000	0	12	2	2	0	0	0	0
28	8/2	8/8	7	1.000	0	0	0	0	0	0	0	0
29	8/9	8/15	5	1.000	0	0	0	0	0	0	0	0

Table C65. BTSPAS table for Grays River hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling), 2012.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/12	2/18	7	1.000	0	0	0	0	0	0	0	0
2	2/19	2/25	7	0.429	0	0	0	0	0	0	0	0
3	2/26	3/3	7	0.143	0	0	0	0	0	0	0	0
4	3/4	3/10	7	1.000	0	0	0	0	0	0	0	0
5	3/11	3/17	7	0.571	0	0	0	0	0	0	0	0
6	3/18	3/24	7	0.286	0	0	0	0	0	0	0	0
7	3/25	3/31	7	0.714	0	0	0	0	0	0	0	0
8	4/1	4/7	7	1.000	0	0	0	0	0	0	0	0
9	4/8	4/14	7	0.857	0	0	0	0	0	0	0	0
10	4/15	4/21	7	0.714	0	0	0	0	0	0	0	0
11	4/22	5/3	12	1.000	0	0	0	0	0	0	0	0
12	5/4	5/15	12	1.000	0	0	0	0	0	0	0	0
13	5/16	5/17	2	1.000	0	0	0	0	0	0	0	0
14	5/18	5/24	7	0.714	8	0	0	0	0	0	0	0
15	5/25	6/1	8	1.000	3	0	0	0	0	0	0	0
16	6/2	6/8	7	1.000	0	0	0	0	0	0	0	0
17	6/9	6/14	6	1.000	3	1	0	0	0	0	0	0
18	6/15	6/21	7	1.000	0	5	1	0	1	0	0	0
19	6/22	6/28	7	1.000	2	17	2	2	0	0	0	0
20	6/29	7/6	8	1.000	2	19	1	1	0	0	0	0
21	7/7	7/12	6	1.000	2	11	3	1	2	0	0	0
22	7/13	7/19	7	1.000	13	63	10	9	1	0	0	0
23	7/20	7/26	7	1.000	6	41	10	10	0	0	0	0
24	7/27	8/3	8	0.875	5	14	3	3	0	0	0	0
25	8/4	8/5	2	0.500	0	2	0	0	0	0	0	0
26	8/6	8/12	2	0.500	0	0	0	0	0	0	0	0

Table C66. BTSPAS table for Grays River hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling), 2013.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/9	2/15	7	1.000	0	0	0	0	0	0	0	0
2	2/16	2/22	7	1.000	0	0	0	0	0	0	0	0
3	2/23	3/1	7	1.000	0	0	0	0	0	0	0	0
4	3/2	3/8	7	1.000	0	0	0	0	0	0	0	0
5	3/9	3/15	7	1.000	0	0	0	0	0	0	0	0
6	3/16	3/22	7	1.000	0	0	0	0	0	0	0	0
7	3/23	3/29	7	1.000	0	0	0	0	0	0	0	0
8	3/30	4/5	7	1.000	0	0	0	0	0	0	0	0
9	4/6	4/12	7	0.857	0	0	0	0	0	0	0	0
10	4/13	4/19	7	1.000	0	0	0	0	0	0	0	0
11	4/20	5/2	13	1.000	0	0	0	0	0	0	0	0
12	5/3	5/5	3	1.000	0	0	0	0	0	0	0	0
13	5/6	5/8	3	1.000	0	0	0	0	0	0	0	0
14	5/9	5/15	7	1.000	0	0	0	0	0	0	0	0
15	5/16	5/22	7	1.000	2	5	0	0	0	0	0	0
16	5/23	5/29	7	1.000	3	3	0	0	0	0	0	0
17	5/30	6/5	7	1.000	14	1	0	0	0	0	0	0
18	6/6	6/12	7	1.000	1	0	0	0	0	0	0	0
19	6/13	6/19	6	1.000	1	10	1	1	0	0	0	0
20	6/20	6/26	7	1.000	0	15	3	1	2	0	0	0
21	6/27	7/3	7	1.000	2	72	12	11	1	0	0	0
22	7/4	7/10	7	1.000	2	119	34	34	0	0	0	0
23	7/11	7/17	7	1.000	10	48	10	10	0	0	0	0
24	7/18	7/24	7	1.000	20	27	9	7	2	0	0	0
25	7/25	7/31	7	1.000	4	14	3	3	0	0	0	0

Table C67. BTSPAS table for Grays River hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling), 2014.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/12	2/18	7	0.429	0	0	0	0	0	0	0	0
2	2/19	2/25	7	0.857	0	0	0	0	0	0	0	0
3	2/26	3/4	7	1.000	0	0	0	0	0	0	0	0
4	3/5	3/11	7	0.429	0	0	0	0	0	0	0	0
5	3/12	3/18	7	1.000	0	0	0	0	0	0	0	0
6	3/19	3/25	7	1.000	0	0	0	0	0	0	0	0
7	3/26	4/1	7	1.000	0	0	0	0	0	0	0	0
8	4/2	4/8	7	1.000	0	0	0	0	0	0	0	0
9	4/9	4/15	7	1.000	0	0	0	0	0	0	0	0
10	4/16	4/22	7	1.000	0	0	0	0	0	0	0	0
11	4/23	5/2	12	0.833	0	0	0	0	0	0	0	0
12	5/3	5/7	5	1.000	0	0	0	0	0	0	0	0
13	5/8	5/14	7	1.000	0	0	0	0	0	0	0	0
14	5/15	5/21	7	1.000	0	0	0	0	0	0	0	0
15	5/22	5/28	7	0.714	0	0	0	0	0	0	0	0
16	5/29	6/4	7	1.000	0	0	0	0	0	0	0	0
17	6/5	6/11	7	1.000	0	0	0	0	0	0	0	0
18	6/12	6/18	7	0.857	0	0	0	0	0	0	0	0
19	6/19	6/25	7	1.000	1	44	2	1	1	0	0	0
20	6/26	7/2	7	0.714	1	43	5	4	1	0	0	0
21	7/3	7/9	7	0.857	30	87	10	5	5	0	0	0
22	7/10	7/16	7	1.000	41	112	14	12	2	0	0	0
23	7/17	7/23	7	1.000	59	98	14	14	0	0	0	0
24	7/24	7/30	7	1.000	25	47	7	7	0	0	0	0
25	7/31	7/31	1	1.000	0	2	0	0	0	0	0	0

Table C68. BTSPAS table for Grays River hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling), 2015.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/4	2/10	7	0.286	0	0	0	0	0	0	0	0
2	2/11	2/17	7	0.857	0	0	0	0	0	0	0	0
3	2/18	2/24	7	0.857	0	0	0	0	0	0	0	0
4	2/25	3/3	7	1.000	0	0	0	0	0	0	0	0
5	3/4	3/10	7	1.000	0	0	0	0	0	0	0	0
6	3/11	3/17	7	0.429	0	0	0	0	0	0	0	0
7	3/18	3/24	7	1.000	0	0	0	0	0	0	0	0
8	3/25	3/31	7	0.857	0	0	0	0	0	0	0	0
9	4/1	4/11	11	1.000	0	0	0	0	0	0	0	0
10	4/12	4/19	8	1.000	0	0	0	0	0	0	0	0
11	4/20	4/28	9	1.000	0	0	0	0	0	0	0	0
12	4/29	5/5	7	0.857	0	0	0	0	0	0	0	0
13	5/6	5/12	7	0.857	0	0	0	0	0	0	0	0
14	5/13	5/19	7	0.857	0	0	0	0	0	0	0	0
15	5/20	5/26	7	1.000	0	0	0	0	0	0	0	0
16	5/27	6/2	7	0.857	0	0	0	0	0	0	0	0
17	6/3	6/11	9	0.778	2	7	1	1	0	0	0	0
18	6/12	6/16	5	0.800	1	45	3	2	1	0	0	0
19	6/17	6/24	8	0.625	1	72	4	4	0	0	0	0
20	6/25	6/30	6	1.000	0	97	17	12	3	2	0	0
21	7/1	7/7	7	0.857	1	65	20	19	1	0	0	0
22	7/8	7/14	7	0.857	0	18	0	0	0	0	0	0
23	7/15	7/21	7	0.857	0	3	0	0	0	0	0	0
24	7/22	7/28	7	1.000	0	0	0	0	0	0	0	0
25	7/29	8/4	3	0.667	0	0	0	0	0	0	0	0

Table C69. BTSPAS table for Grays River hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling), 2016.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/20	2/27	8	0.875	0	0	0	0	0	0	0	0
2	2/28	3/5	7	0.857	0	0	0	0	0	0	0	0
3	3/6	3/12	7	0.714	0	0	0	0	0	0	0	0
4	3/13	3/19	7	1.000	0	0	0	0	0	0	0	0
5	3/20	3/31	12	1.000	0	0	0	0	0	0	0	0
6	4/1	4/9	9	1.000	0	0	0	0	0	0	0	0
7	4/10	4/17	8	1.000	0	0	0	0	0	0	0	0
8	4/18	4/21	4	1.000	0	0	0	0	0	0	0	0
9	4/22	4/28	7	1.000	0	0	0	0	0	0	0	0
10	4/29	5/5	7	0.857	0	0	0	0	0	0	0	0
11	5/6	5/12	7	1.000	0	0	0	0	0	0	0	0
12	5/13	5/19	7	0.857	0	0	0	0	0	0	0	0
13	5/20	5/26	7	1.000	1	1	0	0	0	0	0	0
14	5/27	6/2	7	0.857	2	0	0	0	0	0	0	0
15	6/3	6/9	7	1.000	10	5	0	0	0	0	0	0
16	6/10	6/16	7	1.000	49	119	34	20	2	11	0	1
17	6/17	6/23	7	1.000	13	34	1	1	0	0	0	0
18	6/24	6/30	7	1.000	333	280	64	43	17	3	0	1
19	7/1	7/7	7	1.000	190	217	55	43	7	4	1	0
20	7/8	7/14	7	0.857	119	108	17	9	6	2	0	0
21	7/15	7/21	7	1.000	60	64	17	13	4	0	0	0
22	7/22	7/29	8	1.000	53	61	8	8	0	0	0	0

Steelhead (Natural-Origin, Transitional/Smolt, Yearling)

Table C70. BTSPAS table for Grays River natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling), 2008.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	3/4	3/10	7	1.000	0	0	0	0	0	0	0	0
2	3/11	3/17	7	0.857	0	0	0	0	0	0	0	0
3	3/18	3/24	7	0.714	0	0	0	0	0	0	0	0
4	3/25	3/31	7	0.857	0	0	0	0	0	0	0	0
5	4/1	4/7	7	1.000	0	0	0	0	0	0	0	0
6	4/8	4/14	7	0.857	0	0	0	0	0	0	0	0
7	4/15	4/26	12	0.500	0	0	0	0	0	0	0	0
8	4/27	5/1	5	1.000	1	1	0	0	0	0	0	0
9	5/2	5/5	4	1.000	7	1,031	13	13	0	0	0	0
10	5/6	5/13	8	1.000	8	1,106	15	14	0	0	1	0
11	5/14	5/20	7	0.857	19	35	2	0	0	2	0	0
12	5/21	5/27	7	1.000	140	209	18	14	3	1	0	0
13	5/28	6/3	7	1.000	92	214	27	23	4	0	0	0
14	6/4	6/21	18	0.944	12	26	3	3	0	0	0	0
15	6/22	6/26	5	1.000	0	0	0	0	0	0	0	0
16	6/27	6/27	1	1.000	0	0	0	0	0	0	0	0
17	6/28	7/4	7	1.000	0	0	0	0	0	0	0	0
18	7/5	7/11	7	1.000	0	0	0	0	0	0	0	0
19	7/12	7/18	7	1.000	0	0	0	0	0	0	0	0
20	7/19	7/25	7	1.000	0	0	0	0	0	0	0	0
21	7/26	8/1	7	0.857	0	0	0	0	0	0	0	0
22	8/2	8/8	7	1.000	0	0	0	0	0	0	0	0
23	8/9	8/15	7	0.857	0	0	0	0	0	0	0	0

Table C71. BTSPAS table for Grays River natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling), 2009.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/7	2/13	7	1.000	0	0	0	0	0	0	0	0
2	2/14	2/20	7	1.000	0	0	0	0	0	0	0	0
3	2/21	2/27	7	1.000	0	0	0	0	0	0	0	0
4	2/28	3/6	7	1.000	0	0	0	0	0	0	0	0
5	3/7	3/13	7	1.000	0	0	0	0	0	0	0	0
6	3/14	3/20	7	0.714	1	0	0	0	0	0	0	0
7	3/21	3/27	7	1.000	4	0	0	0	0	0	0	0
8	3/28	4/3	7	0.857	0	0	0	0	0	0	0	0
9	4/4	4/14	11	0.909	6	0	0	0	0	0	0	0
10	4/15	4/29	14	1.000	2	773	1	1	0	0	0	0
11	4/30	5/5	6	1.000	13	175	4	3	1	0	0	0
12	5/6	5/12	7	0.714	13	77	0	0	0	0	0	0
13	5/13	5/19	7	1.000	33	715	4	4	0	0	0	0
14	5/20	5/27	8	1.000	4	4	0	0	0	0	0	0
15	5/28	6/2	6	1.000	23	23	1	1	0	0	0	0
16	6/3	6/11	9	1.000	12	18	3	3	0	0	0	0
17	6/12	6/13	2	1.000	1	2	0	0	0	0	0	0
18	6/14	6/20	7	0.857	0	0	0	0	0	0	0	0
19	6/21	6/27	7	1.000	0	0	0	0	0	0	0	0
20	6/28	7/4	7	0.714	0	0	0	0	0	0	0	0
21	7/5	7/11	7	0.857	0	0	0	0	0	0	0	0
22	7/12	7/18	7	1.000	0	0	0	0	0	0	0	0
23	7/19	7/25	7	0.857	0	0	0	0	0	0	0	0
24	7/26	8/1	6	1.000	0	0	0	0	0	0	0	0

Table C72. BTSPAS table for Grays River natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling), 2010.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/4	2/10	7	1.000	0	0	0	0	0	0	0	0
2	2/11	2/17	7	1.000	0	0	0	0	0	0	0	0
3	2/18	2/24	7	1.000	0	0	0	0	0	0	0	0
4	2/25	3/3	7	1.000	0	0	0	0	0	0	0	0
5	3/4	3/10	7	1.000	0	0	0	0	0	0	0	0
6	3/11	3/17	7	1.000	0	0	0	0	0	0	0	0
7	3/18	3/24	7	1.000	0	0	0	0	0	0	0	0
8	3/25	3/31	7	1.000	0	0	0	0	0	0	0	0
9	4/1	4/7	7	1.000	1	0	0	0	0	0	0	0
10	4/8	4/14	7	1.000	1	0	0	0	0	0	0	0
11	4/15	4/27	13	1.000	5	0	0	0	0	0	0	0
12	4/28	5/4	7	0.860	5	1,039	11	11	0	0	0	0
13	5/5	5/11	7	1.000	14	7	0	0	0	0	0	0
14	5/12	5/18	7	1.000	107	107	10	6	4	0	0	0
15	5/19	5/26	8	1.000	42	57	7	7	0	0	0	0
16	5/27	6/2	7	0.710	9	13	0	0	0	0	0	0
17	6/3	6/9	7	1.000	0	0	0	0	0	0	0	0
18	6/10	6/16	7	1.000	0	0	0	0	0	0	0	0
19	6/17	6/23	7	1.000	0	0	0	0	0	0	0	0
20	6/24	6/30	7	1.000	0	0	0	0	0	0	0	0
21	7/1	7/10	10	1.000	0	0	0	0	0	0	0	0
22	7/11	7/13	3	1.000	0	0	0	0	0	0	0	0
23	7/14	7/21	8	1.000	0	0	0	0	0	0	0	0
24	7/22	7/27	6	1.000	0	1	0	0	0	0	0	0
25	7/28	7/30	3	1.000	0	1	0	0	0	0	0	0
26	7/31	8/6	7	1.000	0	0	0	0	0	0	0	0

Table C73. BTSPAS table for Grays River natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling), 2011.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/8	2/14	7	1.000	0	0	0	0	0	0	0	0
2	2/15	2/21	7	0.857	0	0	0	0	0	0	0	0
3	2/22	2/28	7	1.000	0	0	0	0	0	0	0	0
4	3/1	3/7	7	0.714	0	0	0	0	0	0	0	0
5	3/8	3/14	7	0.286	0	0	0	0	0	0	0	0
6	3/15	3/21	7	0.857	1	0	0	0	0	0	0	0
7	3/22	3/28	7	1.000	0	0	0	0	0	0	0	0
8	3/29	4/4	7	0.429	0	0	0	0	0	0	0	0
9	4/5	4/11	7	1.000	2	0	0	0	0	0	0	0
10	4/12	4/18	7	1.000	4	0	0	0	0	0	0	0
11	4/19	5/1	13	1.000	16	0	0	0	0	0	0	0
12	5/2	5/3	2	1.000	31	28	0	0	0	0	0	0
13	5/4	5/7	4	1.000	8	40	0	0	0	0	0	0
14	5/8	5/12	5	1.000	17	23	1	1	0	0	0	0
15	5/13	5/18	6	0.833	16	12	0	0	0	0	0	0
16	5/19	5/20	2	1.000	17	16	1	0	1	0	0	0
17	5/21	5/24	4	1.000	55	44	2	2	0	0	0	0
18	5/25	5/31	7	0.714	127	134	4	4	0	0	0	0
19	6/1	6/7	7	0.714	76	34	11	10	1	0	0	0
20	6/8	6/14	7	1.000	86	88	9	9	0	0	0	0
21	6/15	6/21	7	1.000	35	51	5	4	1	0	0	0
22	6/22	6/28	7	1.000	7	9	1	1	0	0	0	0
23	6/29	7/5	7	0.714	0	0	0	0	0	0	0	0
24	7/6	7/12	7	0.857	0	0	0	0	0	0	0	0
25	7/13	7/19	7	0.857	0	0	0	0	0	0	0	0
26	7/20	7/26	7	1.000	0	0	0	0	0	0	0	0
27	7/27	8/2	7	1.000	0	0	0	0	0	0	0	0
28	8/3	8/9	7	1.000	0	0	0	0	0	0	0	0
29	8/10	8/16	4	0.750	0	0	0	0	0	0	0	0

Table C74. BTSPAS table for Grays River natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling), 2012.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/12	2/18	7	1.000	0	0	0	0	0	0	0	0
2	2/19	2/25	7	0.429	1	0	0	0	0	0	0	0
3	2/26	3/3	7	0.143	0	0	0	0	0	0	0	0
4	3/4	3/10	7	1.000	0	0	0	0	0	0	0	0
5	3/11	3/17	7	0.571	0	0	0	0	0	0	0	0
6	3/18	3/24	7	0.857	0	0	0	0	0	0	0	0
7	3/25	3/31	7	0.714	0	0	0	0	0	0	0	0
8	4/1	4/7	7	1.000	1	0	0	0	0	0	0	0
9	4/8	4/14	7	1.000	3	0	0	0	0	0	0	0
10	4/15	4/21	7	1.000	7	0	0	0	0	0	0	0
11	4/22	5/3	12	1.000	22	1,022	9	7	2	0	0	0
12	5/4	5/14	11	1.000	25	149	1	1	0	0	0	0
13	5/15	5/17	3	1.000	2	3	0	0	0	0	0	0
14	5/18	5/25	8	0.875	30	1,095	13	12	0	0	0	1
15	5/26	5/31	6	1.000	20	19	0	0	0	0	0	0
16	6/1	6/9	9	1.000	8	10	1	0	1	0	0	0
17	6/10	6/15	6	1.000	2	2	0	0	0	0	0	0
18	6/16	6/21	6	1.000	0	0	0	0	0	0	0	0
19	6/22	6/29	8	1.000	0	0	0	0	0	0	0	0
20	6/30	7/5	6	1.000	0	1	0	0	0	0	0	0
21	7/6	7/12	7	1.000	0	1	0	0	0	0	0	0
22	7/13	7/19	7	1.000	0	3	1	0	1	0	0	0
23	7/20	7/26	7	1.000	0	0	0	0	0	0	0	0
24	7/27	8/4	9	0.889	0	0	0	0	0	0	0	0
25	8/5	8/5	1	0.000	0	0	0	0	0	0	0	0
26	8/6	8/12	2	0.500	0	0	0	0	0	0	0	0

Table C75. BTSPAS table for Grays River natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling), 2013.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/9	2/15	7	1.000	0	0	0	0	0	0	0	0
2	2/16	2/22	7	1.000	0	0	0	0	0	0	0	0
3	2/23	3/1	7	1.000	0	0	0	0	0	0	0	0
4	3/2	3/8	7	1.000	0	0	0	0	0	0	0	0
5	3/9	3/15	7	1.000	1	0	0	0	0	0	0	0
6	3/16	3/22	7	1.000	4	0	0	0	0	0	0	0
7	3/23	3/29	7	1.000	3	0	0	0	0	0	0	0
8	3/30	4/5	7	1.000	10	0	0	0	0	0	0	0
9	4/6	4/12	7	0.857	12	0	0	0	0	0	0	0
10	4/13	4/19	7	1.000	10	0	0	0	0	0	0	0
11	4/20	5/2	13	1.000	53	1,139	10	7	3	0	0	0
12	5/3	5/5	3	1.000	30	306	3	2	1	0	0	0
13	5/6	5/8	3	1.000	23	50	2	2	0	0	0	0
14	5/9	5/15	7	1.000	148	152	16	13	2	0	0	1
15	5/16	5/22	7	1.000	141	163	26	22	2	0	1	1
16	5/23	5/29	7	1.000	28	37	1	1	0	0	0	0
17	5/30	6/5	7	1.000	8	8	1	1	0	0	0	0
18	6/6	6/12	7	1.000	15	14	1	1	0	0	0	0
19	6/13	6/19	6	1.000	1	5	0	0	0	0	0	0
20	6/20	6/27	8	1.000	0	0	0	0	0	0	0	0
21	6/28	7/3	6	1.000	0	0	0	0	0	0	0	0
22	7/4	7/11	8	1.000	0	0	0	0	0	0	0	0
23	7/12	7/18	7	1.000	0	0	0	0	0	0	0	0
24	7/19	7/24	6	1.000	0	0	0	0	0	0	0	0
25	7/25	7/31	7	1.000	0	0	0	0	0	0	0	0

Table C76. BTSPAS table for Grays River natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling), 2014.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/12	2/18	7	0.429	1	0	0	0	0	0	0	0
2	2/19	2/25	7	0.857	2	0	0	0	0	0	0	0
3	2/26	3/4	7	1.000	5	0	0	0	0	0	0	0
4	3/5	3/11	7	0.429	0	0	0	0	0	0	0	0
5	3/12	3/18	7	1.000	11	0	0	0	0	0	0	0
6	3/19	3/25	7	1.000	9	0	0	0	0	0	0	0
7	3/26	4/1	7	1.000	8	0	0	0	0	0	0	0
8	4/2	4/8	7	1.000	6	0	0	0	0	0	0	0
9	4/9	4/15	7	1.000	12	0	0	0	0	0	0	0
10	4/16	4/22	7	1.000	25	0	0	0	0	0	0	0
11	4/23	5/2	10	0.833	53	776	17	14	3	0	0	0
12	5/3	5/7	5	1.000	31	65	0	0	0	0	0	0
13	5/8	5/16	9	1.000	17	50	0	0	0	0	0	0
14	5/17	5/21	5	1.000	38	30	1	1	0	0	0	0
15	5/22	5/28	7	0.714	14	7	0	0	0	0	0	0
16	5/29	6/4	7	1.000	14	12	0	0	0	0	0	0
17	6/5	6/11	7	1.000	9	12	1	1	0	0	0	0
18	6/12	6/18	7	0.857	4	4	0	0	0	0	0	0
19	6/19	6/25	7	1.000	0	1	0	0	0	0	0	0
20	6/26	7/2	7	0.714	0	0	0	0	0	0	0	0
21	7/3	7/9	7	0.857	0	0	0	0	0	0	0	0
22	7/10	7/16	7	1.000	0	0	0	0	0	0	0	0
23	7/17	7/23	7	1.000	0	0	0	0	0	0	0	0
24	7/24	7/30	7	1.000	0	0	0	0	0	0	0	0
25	7/31	7/31	1	1.000	0	0	0	0	0	0	0	0

Table C77. BTSPAS table for Grays River natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling), 2015.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/4	2/11	8	0.250	0	0	0	0	0	0	0	0
2	2/12	2/18	7	1.000	2	0	0	0	0	0	0	0
3	2/19	2/25	7	0.857	0	0	0	0	0	0	0	0
4	2/26	3/4	7	1.000	0	0	0	0	0	0	0	0
5	3/5	3/11	7	1.000	6	0	0	0	0	0	0	0
6	3/12	3/18	7	0.429	5	0	0	0	0	0	0	0
7	3/19	3/25	7	1.000	0	0	0	0	0	0	0	0
8	3/26	4/1	7	0.857	2	0	0	0	0	0	0	0
9	4/2	4/11	10	1.000	2	0	0	0	0	0	0	0
10	4/12	4/18	7	1.000	2	3	0	0	0	0	0	0
11	4/19	4/26	8	1.000	9	8	0	0	0	0	0	0
12	4/27	4/28	2	1.000	19	209	5	5	0	0	0	0
13	4/29	5/5	7	0.857	12	152	2	2	0	0	0	0
14	5/6	5/12	7	0.857	31	31	0	0	0	0	0	0
15	5/13	5/19	7	0.857	52	54	1	1	0	0	0	0
16	5/20	5/26	7	1.000	143	134	7	7	0	0	0	0
17	5/27	6/2	7	0.857	36	37	3	3	0	0	0	0
18	6/3	6/9	7	0.714	14	14	1	1	0	0	0	0
19	6/10	6/16	7	0.857	5	2	0	0	0	0	0	0
20	6/17	6/24	8	0.625	0	0	0	0	0	0	0	0
21	6/25	7/2	8	1.000	0	0	0	0	0	0	0	0
22	7/3	7/7	5	0.800	0	0	0	0	0	0	0	0
23	7/8	7/14	7	0.857	0	0	0	0	0	0	0	0
24	7/15	7/23	9	0.889	0	0	0	0	0	0	0	0
25	7/24	7/25	2	1.000	0	0	0	0	0	0	0	0
26	7/26	8/1	6	0.833	0	0	0	0	0	0	0	0

Table C78. BTSPAS table for Grays River natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling), 2016.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/10	2/17	8	0.500	0	0	0	0	0	0	0	0
2	2/18	2/24	7	0.857	2	0	0	0	0	0	0	0
3	2/25	3/2	7	0.857	1	0	0	0	0	0	0	0
4	3/3	3/9	7	1.000	0	0	0	0	0	0	0	0
5	3/10	3/16	7	0.714	0	0	0	0	0	0	0	0
6	3/17	3/23	7	1.000	2	0	0	0	0	0	0	0
7	3/24	3/31	8	1.000	6	0	0	0	0	0	0	0
8	4/1	4/9	9	1.000	8	8	0	0	0	0	0	0
9	4/10	4/15	6	1.000	6	4	0	0	0	0	0	0
10	4/16	4/21	6	1.000	5	6	0	0	0	0	0	0
11	4/22	4/28	7	1.000	10	12	0	0	0	0	0	0
12	4/29	5/5	7	0.857	28	23	2	0	2	0	0	0
13	5/6	5/12	7	1.000	221	191	14	5	9	0	0	0
14	5/13	5/19	7	0.857	149	156	8	7	1	0	0	0
15	5/20	5/26	7	1.000	45	53	0	0	0	0	0	0
16	5/27	6/2	7	0.857	32	32	1	1	0	0	0	0
17	6/3	6/9	7	1.000	21	18	1	1	0	0	0	0
18	6/10	6/16	7	1.000	11	14	0	0	0	0	0	0
19	6/17	6/23	7	1.000	0	0	0	0	0	0	0	0
20	6/24	6/30	7	1.000	0	0	0	0	0	0	0	0
21	7/1	7/7	7	1.000	0	0	0	0	0	0	0	0
22	7/8	7/15	8	0.875	0	0	0	0	0	0	0	0
23	7/16	7/22	7	1.000	0	0	0	0	0	0	0	0
24	7/23	7/29	7	1.000	0	0	0	0	0	0	0	0

Steelhead (Hatchery-Origin, Transitional/Smolt, Yearling)

Table C79. BTSPAS table for Grays River hatchery-origin steelhead (life-stage = transitional/smolt; age-class = yearling), 2008.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	3/4	3/10	7	1.000	1	0	0	0	0	0	0	0
2	3/11	3/17	7	0.857	1	0	0	0	0	0	0	0
3	3/18	3/24	7	0.714	0	0	0	0	0	0	0	0
4	3/25	3/31	7	0.857	1	0	0	0	0	0	0	0
5	4/1	4/7	7	1.000	1	0	0	0	0	0	0	0
6	4/8	4/14	7	0.857	1	0	0	0	0	0	0	0
7	4/15	4/26	12	0.500	2	0	0	0	0	0	0	0
8	4/27	5/1	5	1.000	4	1	0	0	0	0	0	0
9	5/2	5/5	4	1.000	423	1,031	13	13	0	0	0	0
10	5/6	5/13	8	1.000	56	1,106	15	14	0	0	1	0
11	5/14	5/20	7	0.857	26	35	2	0	0	2	0	0
12	5/21	5/27	7	1.000	121	209	18	14	3	1	0	0
13	5/28	6/3	7	1.000	87	214	27	23	4	0	0	0
14	6/4	6/21	18	0.944	11	26	3	3	0	0	0	0
15	6/22	6/26	5	1.000	1	0	0	0	0	0	0	0
16	6/27	6/27	1	1.000	0	0	0	0	0	0	0	0
17	6/28	7/4	7	1.000	1	0	0	0	0	0	0	0
18	7/5	7/11	7	1.000	0	0	0	0	0	0	0	0
19	7/12	7/18	7	1.000	1	0	0	0	0	0	0	0
20	7/19	7/25	7	1.000	1	0	0	0	0	0	0	0
21	7/26	8/1	7	0.857	0	0	0	0	0	0	0	0
22	8/2	8/8	7	1.000	1	0	0	0	0	0	0	0
23	8/9	8/15	7	0.857	0	0	0	0	0	0	0	0

Table C80. BTSPAS table for Grays River hatchery-origin steelhead (life-stage = transitional/smolt; age-class = yearling), 2009.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/7	2/13	7	1.000	0	0	0	0	0	0	0	0
2	2/14	2/20	7	1.000	0	0	0	0	0	0	0	0
3	2/21	2/27	7	1.000	0	0	0	0	0	0	0	0
4	2/28	3/6	7	1.000	0	0	0	0	0	0	0	0
5	3/7	3/13	7	1.000	0	0	0	0	0	0	0	0
6	3/14	3/20	7	0.714	0	0	0	0	0	0	0	0
7	3/21	3/27	7	1.000	0	0	0	0	0	0	0	0
8	3/28	4/3	7	0.857	0	0	0	0	0	0	0	0
9	4/4	4/14	11	0.909	0	0	0	0	0	0	0	0
10	4/15	4/29	14	1.000	0	773	1	1	0	0	0	0
11	4/30	5/5	6	1.000	1,116	175	4	3	1	0	0	0
12	5/6	5/12	7	0.714	38	77	0	0	0	0	0	0
13	5/13	5/19	7	1.000	10	715	4	4	0	0	0	0
14	5/20	5/27	8	1.000	0	4	0	0	0	0	0	0
15	5/28	6/2	6	1.000	3	23	1	1	0	0	0	0
16	6/3	6/11	9	1.000	3	18	3	3	0	0	0	0
17	6/12	6/13	2	1.000	0	2	0	0	0	0	0	0
18	6/14	6/20	7	0.857	0	0	0	0	0	0	0	0
19	6/21	6/27	7	1.000	1	0	0	0	0	0	0	0
20	6/28	7/4	7	0.714	0	0	0	0	0	0	0	0
21	7/5	7/11	7	0.857	0	0	0	0	0	0	0	0
22	7/12	7/18	7	1.000	0	0	0	0	0	0	0	0
23	7/19	7/25	7	0.857	1	0	0	0	0	0	0	0
24	7/26	8/1	6	1.000	0	0	0	0	0	0	0	0

Table C81. BTSPAS table for Grays River hatchery-origin steelhead (life-stage = transitional/smolt; age-class = yearling), 2010.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/4	2/10	7	1.000	0	0	0	0	0	0	0	0
2	2/11	2/17	7	1.000	0	0	0	0	0	0	0	0
3	2/18	2/24	7	1.000	0	0	0	0	0	0	0	0
4	2/25	3/3	7	1.000	0	0	0	0	0	0	0	0
5	3/4	3/10	7	1.000	0	0	0	0	0	0	0	0
6	3/11	3/17	7	1.000	0	0	0	0	0	0	0	0
7	3/18	3/24	7	1.000	0	0	0	0	0	0	0	0
8	3/25	3/31	7	1.000	0	0	0	0	0	0	0	0
9	4/1	4/7	7	1.000	0	0	0	0	0	0	0	0
10	4/8	4/14	7	1.000	0	0	0	0	0	0	0	0
11	4/15	4/27	13	1.000	2	0	0	0	0	0	0	0
12	4/28	5/4	7	0.860	727	1,039	11	11	0	0	0	0
13	5/5	5/11	7	1.000	1	7	0	0	0	0	0	0
14	5/12	5/18	7	1.000	5	107	10	6	4	0	0	0
15	5/19	5/26	8	1.000	2	57	7	7	0	0	0	0
16	5/27	6/2	7	0.710	0	13	0	0	0	0	0	0
17	6/3	6/9	7	1.000	0	0	0	0	0	0	0	0
18	6/10	6/16	7	1.000	0	0	0	0	0	0	0	0
19	6/17	6/23	7	1.000	0	0	0	0	0	0	0	0
20	6/24	6/30	7	1.000	0	0	0	0	0	0	0	0
21	7/1	7/10	10	1.000	0	0	0	0	0	0	0	0
22	7/11	7/13	3	1.000	0	0	0	0	0	0	0	0
23	7/14	7/21	8	1.000	0	0	0	0	0	0	0	0
24	7/22	7/27	6	1.000	1	1	0	0	0	0	0	0
25	7/28	7/30	3	1.000	1	1	0	0	0	0	0	0
26	7/31	8/6	1	1.000	0	0	0	0	0	0	0	0

Table C82. BTSPAS table for Grays River hatchery-origin steelhead (life-stage = transitional/smolt; age-class = yearling), 2011.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/8	2/14	7	1.000	0	0	0	0	0	0	0	0
2	2/15	2/21	7	0.857	0	0	0	0	0	0	0	0
3	2/22	2/28	7	1.000	0	0	0	0	0	0	0	0
4	3/1	3/7	7	0.714	0	0	0	0	0	0	0	0
5	3/8	3/14	7	0.286	0	0	0	0	0	0	0	0
6	3/15	3/21	7	0.857	0	0	0	0	0	0	0	0
7	3/22	3/28	7	1.000	0	0	0	0	0	0	0	0
8	3/29	4/4	7	0.429	0	0	0	0	0	0	0	0
9	4/5	4/11	7	1.000	0	0	0	0	0	0	0	0
10	4/12	4/18	7	1.000	0	0	0	0	0	0	0	0
11	4/19	5/1	13	1.000	0	0	0	0	0	0	0	0
12	5/2	5/3	2	1.000	313	314	11	11	0	0	0	0
13	5/4	5/7	4	1.000	27	40	0	0	0	0	0	0
14	5/8	5/12	5	1.000	4	23	1	1	0	0	0	0
15	5/13	5/18	6	0.833	2	12	0	0	0	0	0	0
16	5/19	5/20	2	1.000	1	16	1	0	1	0	0	0
17	5/21	5/24	4	1.000	0	44	2	2	0	0	0	0
18	5/25	5/31	7	0.714	6	134	4	4	0	0	0	0
19	6/1	6/7	7	0.714	25	233	16	14	2	0	0	0
20	6/8	6/14	7	1.000	3	88	9	9	0	0	0	0
21	6/15	6/21	7	1.000	0	51	5	4	1	0	0	0
22	6/22	6/28	7	1.000	0	9	1	1	0	0	0	0
23	6/29	7/5	7	0.714	0	0	0	0	0	0	0	0
24	7/6	7/12	7	0.857	0	0	0	0	0	0	0	0
25	7/13	7/19	7	0.857	0	0	0	0	0	0	0	0
26	7/20	7/26	7	1.000	0	0	0	0	0	0	0	0
27	7/27	8/2	7	1.000	0	0	0	0	0	0	0	0
28	8/3	8/9	7	1.000	0	0	0	0	0	0	0	0
29	8/10	8/16	4	0.750	0	0	0	0	0	0	0	0

Table C83. BTSPAS table for Grays River hatchery-origin steelhead (life-stage = transitional/smolt; age-class = yearling), 2012.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/12	2/18	7	1.000	0	0	0	0	0	0	0	0
2	2/19	2/25	7	0.429	1	0	0	0	0	0	0	0
3	2/26	3/3	7	0.143	0	0	0	0	0	0	0	0
4	3/4	3/10	7	1.000	0	0	0	0	0	0	0	0
5	3/11	3/17	7	0.571	0	0	0	0	0	0	0	0
6	3/18	3/24	7	0.857	0	0	0	0	0	0	0	0
7	3/25	3/31	7	0.714	0	0	0	0	0	0	0	0
8	4/1	4/7	7	1.000	0	0	0	0	0	0	0	0
9	4/8	4/14	7	1.000	0	0	0	0	0	0	0	0
10	4/15	4/21	7	1.000	0	0	0	0	0	0	0	0
11	4/22	5/3	12	1.000	595	1,022	9	7	2	0	0	0
12	5/4	5/14	11	1.000	45	149	1	1	0	0	0	0
13	5/15	5/17	3	1.000	0	3	0	0	0	0	0	0
14	5/18	5/25	8	0.875	7	1,095	13	12	0	0	0	1
15	5/26	5/31	6	1.000	0	19	0	0	0	0	0	0
16	6/1	6/9	9	1.000	0	10	1	0	1	0	0	0
17	6/10	6/15	6	1.000	0	2	0	0	0	0	0	0
18	6/16	6/21	6	1.000	0	0	0	0	0	0	0	0
19	6/22	6/29	8	1.000	0	0	0	0	0	0	0	0
20	6/30	7/5	6	1.000	2	1	0	0	0	0	0	0
21	7/6	7/12	7	1.000	0	1	0	0	0	0	0	0
22	7/13	7/19	7	1.000	3	3	1	0	1	0	0	0
23	7/20	7/26	7	1.000	0	0	0	0	0	0	0	0
24	7/27	8/4	9	0.889	1	0	0	0	0	0	0	0
25	8/5	8/5	1	0.000	0	0	0	0	0	0	0	0
26	8/6	8/12	2	0.500	0	0	0	0	0	0	0	0

Table C84. BTSPAS table for Grays River hatchery-origin steelhead (life-stage = transitional/smolt; age-class = yearling), 2013.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/9	2/15	7	1.000	0	0	0	0	0	0	0	0
2	2/16	2/22	7	1.000	0	0	0	0	0	0	0	0
3	2/23	3/1	7	1.000	0	0	0	0	0	0	0	0
4	3/2	3/8	7	1.000	0	0	0	0	0	0	0	0
5	3/9	3/15	7	1.000	0	0	0	0	0	0	0	0
6	3/16	3/22	7	1.000	0	0	0	0	0	0	0	0
7	3/23	3/29	7	1.000	0	0	0	0	0	0	0	0
8	3/30	4/5	7	1.000	0	0	0	0	0	0	0	0
9	4/6	4/12	7	0.857	0	0	0	0	0	0	0	0
10	4/13	4/19	7	1.000	1	0	0	0	0	0	0	0
11	4/20	5/2	13	1.000	716	1,139	10	7	3	0	0	0
12	5/3	5/5	3	1.000	310	306	3	2	1	0	0	0
13	5/6	5/8	3	1.000	14	50	2	2	0	0	0	0
14	5/9	5/15	7	1.000	22	152	16	13	2	0	0	1
15	5/16	5/22	7	1.000	12	163	26	22	2	0	1	1
16	5/23	5/29	7	1.000	2	37	1	1	0	0	0	0
17	5/30	6/5	7	1.000	0	8	1	1	0	0	0	0
18	6/6	6/12	7	1.000	0	14	1	1	0	0	0	0
19	6/13	6/19	6	1.000	0	5	0	0	0	0	0	0
20	6/20	6/27	8	1.000	0	0	0	0	0	0	0	0
21	6/28	7/3	6	1.000	0	0	0	0	0	0	0	0
22	7/4	7/11	8	1.000	0	0	0	0	0	0	0	0
23	7/12	7/18	7	1.000	1	0	0	0	0	0	0	0
24	7/19	7/24	6	1.000	0	0	0	0	0	0	0	0
25	7/25	7/31	7	1.000	0	0	0	0	0	0	0	0

Table C85. BTSPAS table for Grays River hatchery-origin steelhead (life-stage = transitional/smolt; age-class = yearling), 2014.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/12	2/18	7	0.429	0	0	0	0	0	0	0	0
2	2/19	2/25	7	0.857	0	0	0	0	0	0	0	0
3	2/26	3/4	7	1.000	0	0	0	0	0	0	0	0
4	3/5	3/11	7	0.429	0	0	0	0	0	0	0	0
5	3/12	3/18	7	1.000	0	0	0	0	0	0	0	0
6	3/19	3/25	7	1.000	0	0	0	0	0	0	0	0
7	3/26	4/1	7	1.000	0	0	0	0	0	0	0	0
8	4/2	4/8	7	1.000	1	0	0	0	0	0	0	0
9	4/9	4/15	7	1.000	0	0	0	0	0	0	0	0
10	4/16	4/22	7	1.000	0	0	0	0	0	0	0	0
11	4/23	5/2	10	0.833	595	776	17	14	3	0	0	0
12	5/3	5/7	5	1.000	157	65	0	0	0	0	0	0
13	5/8	5/16	9	1.000	9	50	0	0	0	0	0	0
14	5/17	5/21	5	1.000	2	30	1	1	0	0	0	0
15	5/22	5/28	7	0.714	1	7	0	0	0	0	0	0
16	5/29	6/4	7	1.000	0	12	0	0	0	0	0	0
17	6/5	6/11	7	1.000	1	12	1	1	0	0	0	0
18	6/12	6/18	7	0.857	0	4	0	0	0	0	0	0
19	6/19	6/25	7	1.000	1	1	0	0	0	0	0	0
20	6/26	7/2	7	0.714	0	0	0	0	0	0	0	0
21	7/3	7/9	7	0.857	0	0	0	0	0	0	0	0
22	7/10	7/16	7	1.000	0	0	0	0	0	0	0	0
23	7/17	7/23	7	1.000	0	0	0	0	0	0	0	0
24	7/24	7/30	7	1.000	0	0	0	0	0	0	0	0
25	7/31	7/31	1	1.000	0	0	0	0	0	0	0	0

Table C86. BTSPAS table for Grays River hatchery-origin steelhead (life-stage = transitional/smolt; age-class = yearling), 2015.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/4	2/11	8	0.250	0	0	0	0	0	0	0	0
2	2/12	2/18	7	1.000	0	0	0	0	0	0	0	0
3	2/19	2/25	7	0.857	0	0	0	0	0	0	0	0
4	2/26	3/4	7	1.000	0	0	0	0	0	0	0	0
5	3/5	3/11	7	1.000	0	0	0	0	0	0	0	0
6	3/12	3/18	7	0.429	0	0	0	0	0	0	0	0
7	3/19	3/25	7	1.000	0	0	0	0	0	0	0	0
8	3/26	4/1	7	0.857	0	0	0	0	0	0	0	0
9	4/2	4/11	10	1.000	0	0	0	0	0	0	0	0
10	4/12	4/18	7	1.000	0	3	0	0	0	0	0	0
11	4/19	4/26	8	1.000	0	8	0	0	0	0	0	0
12	4/27	4/28	2	1.000	101	209	5	5	0	0	0	0
13	4/29	5/5	7	0.857	28	152	2	2	0	0	0	0
14	5/6	5/12	7	0.857	6	31	0	0	0	0	0	0
15	5/13	5/19	7	0.857	5	54	1	1	0	0	0	0
16	5/20	5/26	7	1.000	6	134	7	7	0	0	0	0
17	5/27	6/2	7	0.857	1	37	3	3	0	0	0	0
18	6/3	6/9	7	0.714	0	14	1	1	0	0	0	0
19	6/10	6/16	7	0.857	0	2	0	0	0	0	0	0
20	6/17	6/24	8	0.625	0	0	0	0	0	0	0	0
21	6/25	7/2	8	1.000	0	0	0	0	0	0	0	0
22	7/3	7/7	5	0.800	0	0	0	0	0	0	0	0
23	7/8	7/14	7	0.857	0	0	0	0	0	0	0	0
24	7/15	7/23	9	0.889	0	0	0	0	0	0	0	0
25	7/24	7/25	2	1.000	0	0	0	0	0	0	0	0
26	7/26	8/1	6	0.833	0	0	0	0	0	0	0	0

Table C87. BTSPAS table for Grays River hatchery-origin steelhead (life-stage = transitional/smolt; age-class = yearling), 2016.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/10	2/17	8	0.500	0	0	0	0	0	0	0	0
2	2/18	2/24	7	0.857	0	0	0	0	0	0	0	0
3	2/25	3/2	7	0.857	0	0	0	0	0	0	0	0
4	3/3	3/9	7	1.000	0	0	0	0	0	0	0	0
5	3/10	3/16	7	0.714	2	0	0	0	0	0	0	0
6	3/17	3/23	7	1.000	0	0	0	0	0	0	0	0
7	3/24	3/31	8	1.000	0	0	0	0	0	0	0	0
8	4/1	4/9	9	1.000	0	0	0	0	0	0	0	0
9	4/10	4/15	6	1.000	0	0	0	0	0	0	0	0
10	4/16	4/21	6	1.000	1	1	0	0	0	0	0	0
11	4/22	4/28	7	1.000	1	0	0	0	0	0	0	0
12	4/29	5/5	7	0.857	2	1	0	0	0	0	0	0
13	5/6	5/12	7	1.000	2	2	1	1	0	0	0	0
14	5/13	5/19	7	0.857	0	0	0	0	0	0	0	0
15	5/20	5/26	7	1.000	3	2	0	0	0	0	0	0
16	5/27	6/2	7	0.857	0	0	0	0	0	0	0	0
17	6/3	6/9	7	1.000	1	0	0	0	0	0	0	0
18	6/10	6/16	7	1.000	0	0	0	0	0	0	0	0
19	6/17	6/23	7	1.000	0	0	0	0	0	0	0	0
20	6/24	6/30	7	1.000	0	0	0	0	0	0	0	0
21	7/1	7/7	7	1.000	0	0	0	0	0	0	0	0
22	7/8	7/15	8	0.875	1	1	0	0	0	0	0	0
23	7/16	7/22	7	1.000	0	0	0	0	0	0	0	0
24	7/23	7/29	7	1.000	0	0	0	0	0	0	0	0

Chum salmon (Natural-Origin, Fry)

Table C88. Summary of daily maiden captures and weir status (Y = census count, N = <100% efficient) for Crazy Johnson natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2012.

Date	Maiden Captures	Weir Status (Y/N)	Date	Maiden Captures	Weir Status (Y/N)	Date	Maiden Captures	Weir Status (Y/N)
2/19	7	Y	3/18	NA	N	4/15	NA	N
2/20	8	Y	3/19	NA	N	4/16	8,344	Y
2/21	NA	N	3/20	NA	N	4/17	NA	N
2/22	NA	N	3/21	8,200	Y	4/18	3,426	Y
2/23	NA	N	3/22	8,714	Y	4/19	3,720	Y
2/24	NA	N	3/23	8,329	Y	4/20	NA	N
2/25	3	Y	3/24	7,725	Y	4/21	NA	N
2/26	4	Y	3/25	8,320	Y	4/22	2,231	Y
2/27	10	Y	3/26	9,982	Y	4/23	2,234	Y
2/28	NA	N	3/27	12,251	Y	4/24	1,245	Y
2/29	NA	N	3/28	13,561	Y	4/25	875	Y
3/1	NA	N	3/29	NA	N	4/26	NA	N
3/2	NA	N	3/30	NA	N	4/27	318	Y
3/3	108	Y	3/31	NA	N	4/28	105	Y
3/4	14	Y	4/1	NA	N	4/29	24	Y
3/5	66	Y	4/2	NA	N	4/30	55	Y
3/6	NA	N	4/3	NA	N	5/1	25	Y
3/7	86	Y	4/4	NA	N	5/2	6	Y
3/8	8	Y	4/5	17,282	Y	5/3	10	Y
3/9	556	Y	4/6	24,140	Y	5/4	2	Y
3/10	1,709	Y	4/7	NA	N	5/5	5	Y
3/11	1,973	Y	4/8	24,297	Y			
3/12	NA	N	4/9	NA	N			
3/13	NA	N	4/10	20,835	Y			
3/14	NA	N	4/11	NA	N			
3/15	NA	N	4/12	NA	N			
3/16	NA	N	4/13	NA	N			
3/17	NA	N	4/14	13,799	Y			

Table C89. BTSPAS table for Crazy Johnson natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2013.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0
1	2/9	2/11	3	1.000	1,168	0	0	0
2	2/12	2/19	8	1.000	19,749	520	402	402
3	2/20	2/23	4	0.750	22,981	100	79	79
4	2/24	3/1	6	0.667	48,864	100	73	73
5	3/2	3/7	6	0.500	61,718	100	24	24
6	3/8	3/13	6	0.500	101,689	100	65	65
7	3/14	3/19	6	0.333	55,266	100	73	73
8	3/20	3/25	6	0.333	46,584	100	67	67
9	3/26	4/1	7	0.286	47,238	100	72	72
10	4/2	4/12	11	0.364	36,577	100	77	77
11	4/13	4/16	4	0.500	1,349	100	69	69
12	4/17	4/18	2	0.500	187	100	33	33
13	4/19	4/25	7	0.857	40	0	0	0
14	4/26	5/2	7	1.000	10	0	0	0
15	5/3	5/9	2	1.000	4	0	0	0

Table C90. BTSPAS table for Crazy Johnson natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2014.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0
1	2/8	2/13	6	0.667	33	0	0	0
2	2/14	2/19	6	0.167	6	0	0	0
3	2/20	2/25	6	0.833	4,664	0	0	0
4	2/26	2/28	3	1.000	7,042	100	14	14
5	3/1	3/6	6	0.667	9,681	100	60	60
6	3/7	3/12	6	0.167	3,581	0	0	0
7	3/13	3/18	6	1.000	87,590	100	66	66
8	3/19	3/24	6	0.667	71,979	96	41	41
9	3/25	3/29	5	0.600	52,647	100	50	50
10	3/30	4/3	5	0.600	28,496	0	0	0
11	4/4	4/9	6	0.500	48,159	110	64	64
12	4/10	4/16	7	0.857	16,422	100	52	52
13	4/17	4/22	6	1.000	4,193	100	37	37
14	4/23	4/28	6	0.667	370	99	15	15
15	4/29	5/4	6	1.000	11	0	0	0
16	5/5	5/10	6	0.500	3	0	0	0

Table C91. BTSPAS table for Crazy Johnson natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2015.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0
1	2/12	2/12	1	1.000	1,045	0	0	0
2	2/13	2/17	5	0.800	7,008	0	0	0
3	2/18	2/19	2	0.500	1,960	100	43	43
4	2/20	2/24	5	0.400	16,037	0	0	0
5	2/25	2/28	4	0.750	17,322	100	38	38
6	3/1	3/4	4	1.000	7,284	100	18	18
7	3/5	3/8	4	1.000	6,376	100	11	11
8	3/9	3/12	4	1.000	8,346	100	57	57
9	3/13	3/15	3	0.330	3,878	100	48	48
10	3/16	3/18	3	0.670	14,520	0	0	0
11	3/19	3/22	4	1.000	23,700	100	1	1
12	3/23	3/27	5	0.600	4,098	0	0	0
13	3/28	3/31	4	1.000	2,954	100	28	28
14	4/1	4/4	4	1.000	1,570	0	0	0
15	4/5	4/6	2	1.000	90	100	52	52
16	4/7	4/13	7	1.000	17	0	0	0
17	4/14	4/20	7	1.000	2	0	0	0
18	4/21	4/27	1	1.000	0	0	0	0

Table C92. BTSPAS table for Crazy Johnson natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2016.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0
1	2/3	2/5	3	1.000	260	0	0	0
2	2/6	2/7	2	1.000	114	146	10	10
3	2/8	2/17	10	0.800	13,118	88	20	20
4	2/18	2/23	6	1.000	21,385	109	37	37
5	2/24	2/29	6	1.000	50,103	100	35	35
6	3/1	3/7	7	0.571	53,881	100	37	37
7	3/8	3/14	7	0.714	64,921	100	38	38
8	3/15	3/20	6	0.833	51,942	100	24	24
9	3/21	3/26	6	1.000	39,099	100	37	37
10	3/27	4/2	7	1.000	3,483	100	32	32
11	4/3	4/6	4	1.000	835	100	35	35
12	4/7	4/8	2	1.000	372	97	51	51
13	4/9	4/15	7	1.000	290	0	0	0
14	4/16	4/22	7	1.000	18	0	0	0
15	4/23	4/29	3	1.000	3	0	0	0

Chum salmon (Natural-Origin, Fry)

Table C93. Summary of daily maiden captures and weir status (Y = census count, N = <100% efficient) for Duncan Creek Channels natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2002.

	South		North			South		North			South		North	
Date	Maiden Captures	Y/N	Maiden Captures	Y/N	Date	Maiden Captures	Y/N	Maiden Captures	Y/N	Date	Maiden Captures	Y/N	Maiden Captures	Y/N
3/19	1	Y	0	Y	4/14	327	Y	4,235	N	5/10	45	Y	45	Y
3/20	1	Y	0	Y	4/15	417	Y	577	Y	5/11	5	Y	5	Y
3/21	0	Y	0	Y	4/16	0	N	0	N	5/12	2	Y	2	Y
3/22	0	Y	1	Y	4/17	21	Y	21	Y	5/13	1	Y	1	Y
3/23	1	Y	0	Y	4/18	0	N	0	N	5/14	2	Y	2	Y
3/24	0	Y	0	Y	4/19	0	N	0	N	5/15	0	Y	1	Y
3/25	0	Y	0	Y	4/20	0	N	0	N	5/16	0	Y	9	Y
3/26	0	Y	0	Y	4/21	0	N	0	N	5/17	2	Y	7	Y
3/27	0	Y	0	Y	4/22	0	Y	0	Y	5/18	1	Y	12	Y
3/28	0	Y	0	Y	4/23	13	Y	13	Y	5/19	0	Y	49	Y
3/29	0	Y	12	Y	4/24	17	Y	17	Y	5/20	0	Y	14	Y
3/30	0	Y	124	Y	4/25	11	Y	11	Y	5/21	1	Y	28	Y
3/31	0	Y	18	Y	4/26	5	Y	5	Y	5/22	0	Y	20	Y
4/1	0	Y	100	Y	4/27	3	Y	3	Y	5/23	5	Y	69	Y
4/2	0	Y	79	Y	4/28	4	Y	4	Y					
4/3	0	Y	27	Y	4/29	3	Y	3	Y					
4/4	0	Y	67	Y	4/30	0	Y	0	Y					
4/5	0	Y	43	Y	5/1	2	Y	2	Y					
4/6	0	Y	0	Y	5/2	3	Y	3	Y					
4/7	0	Y	0	Y	5/3	4	Y	4	Y					
4/8	0	Y	204	Y	5/4	0	Y	0	Y					
4/9	0	Y	0	Y	5/5	0	Y	0	Y					
4/10	24	Y	613	Y	5/6	3	Y	3	Y					
4/11	35	Y	267	Y	5/7	23	Y	23	Y					
4/12	115	Y	197	Y	5/8	2	Y	2	Y					
4/13	1	Y	250	Y	5/9	0	Y	0	Y					

Table C94. Summary of daily maiden captures and weir status (Y = census count, N = <100% efficient) for Duncan Creek Channels natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2003.

	South		North			South		North			South		North	
Date	Maiden Captures	Y/N	Maiden Captures	Y/N	Date	Maiden Captures	Y/N	Maiden Captures	Y/N	Date	Maiden Captures	Y/N	Maiden Captures	Y/N
2/11	---	---	0	Y	3/13	---	---	0	Y	4/12	118	Y	46	Y
2/12	---	---	0	Y	3/14	---	---	2	Y	4/13	209	Y	4	Y
2/13	---	---	0	Y	3/15	---	---	5	Y	4/14	589	Y	54	Y
2/14	---	---	0	Y	3/16	---	---	3	Y	4/15	192	Y	96	Y
2/15	---	---	0	Y	3/17	---	---	50	Y	4/16	1,083	Y	187	Y
2/16	---	---	0	Y	3/18	---	---	69	Y	4/17	1,194	Y	31	Y
2/17	---	---	0	Y	3/19	---	---	12	Y	4/18	1,023	Y	3,049	Y
2/18	---	---	0	Y	3/20	---	---	79	Y	4/19	169	Y	9	Y
2/19	---	---	0	Y	3/21	---	---	131	Y	4/20	80	Y	8	Y
2/20	---	---	0	Y	3/22	---	---	280	Y	4/21	675	Y	7	Y
2/21	---	---	0	Y	3/23	---	---	177	Y	4/22	289	Y	0	Y
2/22	---	---	0	Y	3/24	---	---	196	Y	4/23	102	Y	39	Y
2/23	---	---	0	Y	3/25	---	---	319	Y	4/24	545	Y	428	Y
2/24	---	---	0	Y	3/26	91	Y	441	Y	4/25	150	Y	61	Y
2/25	---	---	0	Y	3/27	55	Y	416	Y	4/26	73	Y	1	Y
2/26	---	---	0	Y	3/28	28	Y	1,827	Y	4/27	88	Y	893	Y
2/27	---	---	0	Y	3/29	11	Y	201	Y	4/28	516	Y	32	Y
2/28	---	---	0	Y	3/30	9	Y	199	Y	4/29	164	Y	219	Y
3/1	---	---	0	Y	3/31	6	Y	569	Y	4/30	79	Y	0	Y
3/2	---	---	0	Y	4/1	14	Y	1,241	Y	5/1	67	Y	73	Y
3/3	---	---	0	Y	4/2	9	Y	554	Y	5/2	29	Y	0	Y
3/4	---	---	0	Y	4/3	13	Y	655	Y	5/3	20	Y	5	Y
3/5	---	---	0	Y	4/4	4	Y	340	Y	5/4	17	Y	73	Y
3/6	---	---	0	Y	4/5	2	Y	95	Y	5/5	293	Y	245	Y
3/7	---	---	5	Y	4/6	22	Y	306	Y	5/6	64	Y	2	Y
3/8	---	---	4	Y	4/7	45	Y	114	Y	5/7	17	Y	14	Y
3/9	---	---	19	Y	4/8	74	Y	34	Y	5/8	4	Y	0	Y
3/10	---	---	7	Y	4/9	215	Y	199	Y	5/9	4	Y	47	Y
3/11	---	---	2	Y	4/10	164	Y	788	Y	5/10	14	Y	7	Y
3/12	---	---	1	Y	4/11	315	Y	841	Y	5/11	0	Y	11	Y

Table C94. Continued.

	South		North			South		North			South		North	
Date	Maiden Captures	Y/N	Maiden Captures	Y/N	Date	Maiden Captures	Y/N	Maiden Captures	Y/N	Date	Maiden Captures	Y/N	Maiden Captures	Y/N
5/12	0	Y	0	Y										
5/13	11	Y	1	Y										
5/14	0	Y	0	Y										
5/15	3	Y	0	Y										
5/16	3	Y	3	Y										
5/17	60	Y	29	Y										
5/18	2	Y	60	Y										
5/19	0	Y	0	Y										
5/20	0	Y	0	Y										

Table C95. Summary of daily maiden captures and weir status (Y = census count, N = <100% efficient) for Duncan Creek Channels natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2004.

	South		North			South		North			South		North	
Date	Maiden Captures	Y/N	Maiden Captures	Y/N	Date	Maiden Captures	Y/N	Maiden Captures	Y/N	Date	Maiden Captures	Y/N	Maiden Captures	Y/N
2/27	0	Y	0	Y	3/28	728	Y	1,646	Y	4/27	31	Y	41	Y
2/28	0	Y	0	Y	3/29	836	Y	1,312	Y	4/28	5	Y	20	Y
2/29	0	Y	0	Y	3/30	531	Y	574	Y					
3/1	0	Y	0	Y	3/31	815	Y	732	Y					
3/2	0	Y	0	Y	4/1	729	Y	716	Y					
3/3	0	Y	0	Y	4/2	895	Y	1,130	Y					
3/4	0	Y	0	Y	4/3	505	Y	586	Y					
3/5	0	Y	0	Y	4/4	205	Y	697	Y					
3/6	0	Y	0	Y	4/5	252	Y	1,266	Y					
3/7	0	Y	0	Y	4/6	217	Y	1,392	Y					
3/8	0	Y	0	Y	4/7	334	Y	916	Y					
3/9	0	Y	0	Y	4/8	280	Y	948	Y					
3/10	1	Y	0	Y	4/9	185	Y	459	Y					
3/11	0	Y	0	Y	4/10	198	Y	676	Y					
3/12	5	Y	0	Y	4/11	101	Y	376	Y					
3/13	6	Y	0	Y	4/12	76	Y	343	Y					
3/14	10	Y	0	Y	4/13	116	Y	898	Y					
3/15	35	Y	17	Y	4/14	81	Y	1,535	Y					
3/16	131	Y	41	Y	4/15	107	Y	2,082	Y					
3/17	302	Y	70	Y	4/16	61	Y	1,861	Y					
3/18	571	Y	60	Y	4/17	102	Y	590	Y					
3/19	1,055	Y	176	Y	4/18	354	Y	847	Y					
3/20	494	Y	94	Y	4/19	53	Y	196	Y					
3/21	470	Y	28	Y	4/20	91	Y	224	Y					
3/22	951	Y	2	Y	4/21	18	Y	119	Y					
3/23	929	Y	263	Y	4/22	69	Y	78	Y					
3/24	470	Y	569	Y	4/23	50	Y	36	Y					
3/25	671	Y	546	Y	4/24	14	Y	40	Y					
3/26	337	Y	1,737	Y	4/25	77	Y	14	Y					
3/27	449	Y	2,352	Y	4/26	13	Y	70	Y					

Table C96. Summary of daily maiden captures and weir status (Y = census count, N = <100% efficient) for Duncan Creek Channels natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2005.

	South		North			South		North			South		North	
Date	Maiden Captures	Y/N	Maiden Captures	Y/N	Date	Maiden Captures	Y/N	Maiden Captures	Y/N	Date	Maiden Captures	Y/N	Maiden Captures	Y/N
2/11	0	Y	0	Y	3/13	96	Y	638	Y	4/12	160	Y	1	Y
2/12	0	Y	0	Y	3/14	88	Y	466	Y	4/13	71	Y	39	Y
2/13	0	Y	0	Y	3/15	88	Y	329	Y	4/14	56	Y	96	Y
2/14	0	Y	0	Y	3/16	133	Y	94	Y	4/15	127	Y	29	Y
2/15	0	Y	0	Y	3/17	79	Y	710	Y	4/16	79	Y	10	Y
2/16	0	Y	0	Y	3/18	161	Y	303	Y	4/17	256	Y	6	Y
2/17	0	Y	0	Y	3/19	79	Y	72	Y	4/18	42	Y	6	Y
2/18	0	Y	0	Y	3/20	730	Y	84	Y	4/19	117	Y	9	Y
2/19	0	Y	0	Y	3/21	442	Y	73	Y	4/20	57	Y	5	Y
2/20	0	Y	0	Y	3/22	764	Y	63	Y	4/21	8	Y	0	Y
2/21	3	Y	0	Y	3/23	111	Y	72	Y	4/22	46	Y	1	Y
2/22	0	Y	0	Y	3/24	66	Y	37	Y	4/23	0	Y	0	Y
2/23	0	Y	0	Y	3/25	63	Y	155	Y	4/24	33	Y	1	Y
2/24	0	Y	0	Y	3/26	47	Y	153	Y	4/25	34	Y	4	Y
2/25	1	Y	0	Y	3/27	2,783	Y	1,285	Y	4/26	206	Y	3	Y
2/26	2	Y	0	Y	3/28	1,158	Y	1,147	Y	4/27	2	Y	4	Y
2/27	9	Y	0	Y	3/29	778	Y	179	Y	4/28	10	Y	0	Y
2/28	25	Y	0	Y	3/30	810	Y	168	Y	4/29	8	Y	0	Y
3/1	71	Y	1	Y	3/31	304	Y	81	Y	4/30	18	Y	0	Y
3/2	75	Y	0	Y	4/1	191	Y	213	Y	5/1	13	Y	0	Y
3/3	27	Y	2	Y	4/2	201	Y	198	Y	5/2	0	Y	0	Y
3/4	23	Y	2	Y	4/3	189	Y	60	Y	5/3	9	Y	0	Y
3/5	20	Y	1	Y	4/4	173	Y	59	Y	5/4	0	Y	0	Y
3/6	41	Y	2	Y	4/5	213	Y	22	Y	5/5	0	Y	0	Y
3/7	41	Y	6	Y	4/6	302	Y	187	Y	5/6	0	Y	0	Y
3/8	40	Y	7	Y	4/7	231	Y	119	Y					
3/9	36	Y	11	Y	4/8	186	Y	299	Y					
3/10	38	Y	51	Y	4/9	183	Y	40	Y					
3/11	13	Y	180	Y	4/10	101	Y	47	Y					
3/12	79	Y	502	Y	4/11	121	Y	63	Y					

Table C97. Summary of daily maiden captures and weir status (Y = census count, N = <100% efficient) for Duncan Creek Channels natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2006.

	South		North			South		North			South		North	
Date	Maiden Captures	Y/N	Maiden Captures	Y/N	Date	Maiden Captures	Y/N	Maiden Captures	Y/N	Date	Maiden Captures	Y/N	Maiden Captures	Y/N
2/11	0	Y	0	Y	3/13	43	Y	99	Y	4/12	18	Y	347	Y
2/12	0	Y	0	Y	3/14	23	Y	184	Y	4/13	23	Y	662	Y
2/13	0	Y	0	Y	3/15	65	Y	174	Y	4/14	24	Y	247	Y
2/14	0	Y	0	Y	3/16	87	Y	700	Y	4/15	31	Y	74	Y
2/15	0	Y	0	Y	3/17	85	Y	568	Y	4/16	17	Y	62	Y
2/16	0	Y	0	Y	3/18	61	Y	636	Y	4/17	0	N	0	N
2/17	0	Y	0	Y	3/19	22	Y	1,742	Y	4/18	0	N	0	N
2/18	0	Y	0	Y	3/20	31	Y	953	Y	4/19	0	N	0	N
2/19	0	Y	0	Y	3/21	36	Y	2,263	Y	4/20	2	N	0	N
2/20	0	Y	0	Y	3/22	75	Y	1,549	Y	4/21	0	N	0	N
2/21	0	Y	0	Y	3/23	66	Y	1,105	Y	4/22	10	Y	10	Y
2/22	0	Y	0	Y	3/24	133	Y	910	Y	4/23	0	Y	1	Y
2/23	0	Y	0	Y	3/25	98	Y	728	Y	4/24	0	Y	3	Y
2/24	0	Y	0	Y	3/26	79	Y	793	Y	4/25	3	Y	12	Y
2/25	0	Y	0	Y	3/27	118	Y	449	Y	4/26	17	Y	10	Y
2/26	0	Y	1	Y	3/28	328	Y	1,035	Y	4/27	3	Y	5	Y
2/27	0	Y	0	Y	3/29	447	Y	621	Y	4/28	7	Y	2	Y
2/28	0	Y	2	Y	3/30	199	Y	646	Y	4/29	4	Y	0	Y
3/1	0	Y	4	Y	3/31	318	Y	672	Y	4/30	0	Y	0	Y
3/2	1	Y	7	Y	4/1	136	Y	962	Y	5/1	0	Y	0	Y
3/3	0	Y	4	Y	4/2	251	Y	513	Y	5/2	0	N	0	N
3/4	0	Y	19	Y	4/3	231	Y	746	Y	5/3	0	N	0	N
3/5	0	Y	19	Y	4/4	205	Y	1,004	Y	5/4	0	Y	0	N
3/6	2	Y	9	Y	4/5	157	Y	847	Y	5/5	0	Y	0	Y
3/7	1	Y	18	Y	4/6	113	Y	610	Y					
3/8	0	Y	11	Y	4/7	351	Y	1,341	Y					
3/9	2	Y	30	Y	4/8	310	Y	1,138	Y					
3/10	0	Y	37	Y	4/9	63	Y	754	Y					
3/11	4	Y	29	Y	4/10	133	Y	821	Y					
3/12	17	Y	47	Y	4/11	82	Y	211	Y					

Table C98. Summary of daily maiden captures and weir status (Y = census count, N = <100% efficient) for Duncan Creek Channels natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2007.

	South		North			South		North			South		North	
Date	Maiden Captures	Y/N	Maiden Captures	Y/N	Date	Maiden Captures	Y/N	Maiden Captures	Y/N	Date	Maiden Captures	Y/N	Maiden Captures	Y/N
2/21	0	Y	0	Y	3/23	1,231	Y	57	Y	4/22	0	Y	16	Y
2/22	0	Y	0	Y	3/24	1,050	Y	147	Y	4/23	2	Y	41	Y
2/23	0	Y	0	Y	3/25	1,174	Y	222	Y	4/24	2	Y	16	Y
2/24	0	Y	0	Y	3/26	1,049	Y	252	Y	4/25	0	Y	6	Y
2/25	0	Y	0	Y	3/27	937	Y	467	Y	4/26	0	Y	9	Y
2/26	0	Y	0	Y	3/28	543	Y	323	Y	4/27	1	Y	8	Y
2/27	0	Y	0	Y	3/29	627	Y	492	Y	4/28	0	Y	0	Y
2/28	1	Y	0	Y	3/30	440	Y	727	Y	4/29	0	Y	8	Y
3/1	0	Y	0	Y	3/31	328	Y	881	Y	4/30	0	Y	4	Y
3/2	2	Y	0	Y	4/1	523	Y	371	Y	5/1	0	Y	5	Y
3/3	2	Y	0	Y	4/2	175	Y	338	Y	5/2	0	Y	3	Y
3/4	5	Y	0	Y	4/3	193	Y	246	Y	5/3	1	Y	11	Y
3/5	20	Y	0	Y	4/4	153	Y	265	Y	5/4	4	Y	89	Y
3/6	129	Y	0	Y	4/5	233	Y	533	Y	5/5	0	Y	2	Y
3/7	129	Y	0	Y	4/6	174	Y	240	Y	5/6	0	Y	4	Y
3/8	454	Y	0	Y	4/7	82	Y	302	Y	5/7	0	Y	5	Y
3/9	317	Y	0	Y	4/8	99	Y	819	Y	5/8	0	Y	0	Y
3/10	508	Y	0	Y	4/9	34	Y	410	Y					
3/11	502	Y	0	Y	4/10	56	Y	470	Y					
3/12	387	Y	1	Y	4/11	9	Y	218	Y					
3/13	537	Y	4	Y	4/12	21	Y	173	Y					
3/14	479	Y	1	Y	4/13	0	Y	176	Y					
3/15	500	Y	0	Y	4/14	3	Y	22	Y					
3/16	635	Y	3	Y	4/15	5	Y	124	Y					
3/17	918	Y	3	Y	4/16	0	Y	68	Y					
3/18	1,123	Y	3	Y	4/17	0	Y	28	Y					
3/19	968	Y	15	Y	4/18	0	Y	39	Y					
3/20	1,082	Y	171	Y	4/19	1	Y	59	Y					
3/21	1,172	Y	210	Y	4/20	1	Y	65	Y					
3/22	1,381	Y	104	Y	4/21	0	Y	29	Y					

Table C99. Summary of daily maiden captures and weir status (Y = census count, N = <100% efficient) for Duncan Creek Channels natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2008.

	South		North			South		North			South		North	
Date	Maiden Captures	Y/N	Maiden Captures	Y/N	Date	Maiden Captures	Y/N	Maiden Captures	Y/N	Date	Maiden Captures	Y/N	Maiden Captures	Y/N
2/20	0	Y	0	Y	3/21	751	Y	484	Y	4/20	0	Y	0	Y
2/21	0	Y	0	Y	3/22	491	Y	709	Y	4/21	9	Y	8	Y
2/22	0	Y	0	Y	3/23	1,071	Y	526	Y	4/22	0	Y	5	Y
2/23	0	Y	0	Y	3/24	775	Y	249	Y	4/23	1	Y	3	Y
2/24	0	Y	0	Y	3/25	509	Y	183	Y	4/24	0	Y	0	Y
2/25	0	Y	0	Y	3/26	441	Y	110	Y	4/25	0	Y	0	Y
2/26	0	Y	0	Y	3/27	305	Y	158	Y	4/26	0	Y	2	Y
2/27	0	Y	0	Y	3/28	185	Y	109	Y	4/27	0	Y	2	Y
2/28	0	Y	0	Y	3/29	233	Y	193	Y	4/28	0	Y	2	Y
2/29	0	Y	0	Y	3/30	117	Y	229	Y	4/29	1	Y	0	Y
3/1	0	Y	0	Y	3/31	52	Y	401	Y	4/30	0	Y	0	Y
3/2	0	Y	0	Y	4/1	23	Y	502	Y	5/1	0	Y	0	Y
3/3	1	Y	1	Y	4/2	28	Y	484	Y	5/2	0	Y	0	Y
3/4	0	Y	1	Y	4/3	14	Y	542	Y	5/3	0	Y	0	Y
3/5	0	Y	16	Y	4/4	59	Y	669	Y	5/4	0	Y	0	Y
3/6	1	Y	39	Y	4/5	100	Y	984	Y	5/5	0	Y	2	Y
3/7	3	Y	238	Y	4/6	65	Y	661	Y	5/6	0	Y	0	Y
3/8	3	Y	54	Y	4/7	18	Y	600	Y	5/7	0	Y	0	Y
3/9	9	Y	18	Y	4/8	12	Y	448	Y					
3/10	23	Y	9	Y	4/9	9	Y	766	Y					
3/11	39	Y	41	Y	4/10	6	Y	462	Y					
3/12	124	Y	369	Y	4/11	14	Y	194	Y					
3/13	298	Y	507	Y	4/12	10	Y	27	Y					
3/14	262	Y	298	Y	4/13	2	Y	43	Y					
3/15	332	Y	504	Y	4/14	4	Y	11	Y					
3/16	254	Y	1,017	Y	4/15	1	Y	9	Y					
3/17	330	Y	1,116	Y	4/16	65	Y	10	Y					
3/18	895	Y	1,356	Y	4/17	25	Y	8	Y					
3/19	379	Y	653	Y	4/18	16	Y	3	Y					
3/20	576	Y	663	Y	4/19	14	Y	6	Y					

Table C100. Summary of daily maiden captures and weir status (Y = census count, N = <100% efficient) for Duncan Creek Channels natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2009.

	South		North			South		North			South		North	
Date	Maiden Captures	Y/N	Maiden Captures	Y/N	Date	Maiden Captures	Y/N	Maiden Captures	Y/N	Date	Maiden Captures	Y/N	Maiden Captures	Y/N
2/18	0	Y	0	Y	3/20	69	Y	210	Y	4/19	4	Y	940	Y
2/19	0	Y	0	Y	3/21	85	Y	130	Y	4/20	1	Y	392	Y
2/20	0	Y	0	Y	3/22	131	Y	110	Y	4/21	4	Y	623	Y
2/21	0	Y	0	Y	3/23	186	Y	66	Y	4/22	1	Y	332	Y
2/22	0	Y	0	Y	3/24	156	Y	82	Y	4/23	2	Y	230	Y
2/23	0	Y	0	Y	3/25	244	Y	111	Y	4/24	0	Y	273	Y
2/24	0	Y	0	Y	3/26	386	Y	180	Y	4/25	1	Y	171	Y
2/25	0	Y	0	Y	3/27	298	Y	380	Y	4/26	1	Y	684	Y
2/26	0	Y	0	Y	3/28	211	Y	293	Y	4/27	3	Y	380	Y
2/27	0	Y	0	Y	3/29	328	Y	408	Y	4/28	0	Y	368	Y
2/28	0	Y	0	Y	3/30	316	Y	568	Y	4/29	2	Y	256	Y
3/1	0	Y	0	Y	3/31	340	Y	590	Y	4/30	0	Y	141	Y
3/2	0	Y	0	Y	4/1	529	Y	656	Y	5/1	0	Y	69	Y
3/3	0	Y	0	Y	4/2	433	Y	779	Y	5/2	0	Y	61	Y
3/4	0	Y	0	Y	4/3	686	Y	566	Y	5/3	0	Y	128	Y
3/5	0	Y	1	Y	4/4	432	Y	285	Y	5/4	0	Y	18	Y
3/6	0	Y	0	Y	4/5	186	Y	309	Y	5/5	0	Y	5	Y
3/7	0	Y	0	Y	4/6	251	Y	375	Y	5/6	0	Y	5	Y
3/8	0	Y	2	Y	4/7	128	Y	352	Y	5/7	1	Y	2	Y
3/9	0	Y	4	Y	4/8	46	Y	485	Y	5/8	0	Y	0	Y
3/10	1	Y	29	Y	4/9	21	Y	515	Y	5/9	0	Y	0	Y
3/11	0	Y	42	Y	4/10	61	Y	795	Y	5/10	0	Y	1	Y
3/12	0	Y	43	Y	4/11	45	Y	645	Y	5/11	0	Y	0	Y
3/13	8	Y	154	Y	4/12	13	Y	734	Y	5/12	0	Y	3	Y
3/14	62	Y	271	Y	4/13	11	Y	631	Y					
3/15	100	Y	357	Y	4/14	8	Y	795	Y					
3/16	77	Y	463	Y	4/15	2	Y	614	Y					
3/17	145	Y	724	Y	4/16	5	Y	276	Y					
3/18	18	Y	732	Y	4/17	4	Y	503	Y					
3/19	52	Y	472	Y	4/18	6	Y	627	Y					

Table C101. Summary of daily maiden captures and weir status (Y = census count, N = <100% efficient) for Duncan Creek Channels natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2010.

	South		North			South		North			South		North	
Date	Maiden Captures	Y/N	Maiden Captures	Y/N	Date	Maiden Captures	Y/N	Maiden Captures	Y/N	Date	Maiden Captures	Y/N	Maiden Captures	Y/N
2/17	0	Y	0	Y	3/19	379	Y	64	Y	4/18	0	Y	265	Y
2/18	0	Y	0	Y	3/20	337	Y	442	Y	4/19	0	Y	140	Y
2/19	0	Y	0	Y	3/21	414	Y	643	Y	4/20	0	Y	102	Y
2/20	0	Y	0	Y	3/22	740	Y	484	Y	4/21	0	Y	32	Y
2/21	0	Y	0	Y	3/23	366	Y	255	Y	4/22	0	Y	14	Y
2/22	1	Y	0	Y	3/24	254	Y	199	Y	4/23	0	Y	4	Y
2/23	0	Y	0	Y	3/25	112	Y	996	Y	4/24	0	Y	19	Y
2/24	1	Y	1	Y	3/26	831	Y	999	Y	4/25	0	Y	5	Y
2/25	1	Y	0	Y	3/27	504	Y	788	Y	4/26	0	Y	34	Y
2/26	0	Y	0	Y	3/28	156	Y	624	Y	4/27	0	Y	5	Y
2/27	2	Y	0	Y	3/29	825	Y	941	Y	4/28	0	Y	2	Y
2/28	3	Y	3	Y	3/30	1,349	Y	1,470	Y	4/29	0	Y	2	Y
3/1	13	Y	1	Y	3/31	253	Y	787	Y	4/30	0	Y	4	Y
3/2	14	Y	1	Y	4/1	50	Y	714	Y	5/1	0	Y	3	Y
3/3	189	Y	1	Y	4/2	9	Y	493	Y	5/2	0	Y	0	Y
3/4	87	Y	1	Y	4/3	7	Y	387	Y	5/3	0	Y	4	Y
3/5	12	Y	4	Y	4/4	4	Y	317	Y	5/4	0	Y	9	Y
3/6	35	Y	4	Y	4/5	16	Y	373	Y	5/5	0	Y	6	Y
3/7	146	Y	4	Y	4/6	0	Y	586	Y					
3/8	119	Y	2	Y	4/7	1	Y	746	Y					
3/9	436	Y	0	Y	4/8	3	Y	734	Y					
3/10	274	Y	3	Y	4/9	0	Y	649	Y					
3/11	514	Y	8	Y	4/10	0	Y	638	Y					
3/12	1,347	Y	9	Y	4/11	0	Y	806	Y					
3/13	198	Y	5	Y	4/12	0	Y	1,035	Y					
3/14	39	Y	7	Y	4/13	0	Y	1,166	Y					
3/15	898	Y	13	Y	4/14	0	Y	1,202	Y					
3/16	280	Y	19	Y	4/15	2	Y	552	Y					
3/17	207	Y	36	Y	4/16	0	Y	286	Y					
3/18	170	Y	98	Y	4/17	1	Y	321	Y					

Table C102. Summary of daily maiden captures and weir status (Y = census count, N = <100% efficient) for Duncan Creek Channels natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2011.

	South		North			South		North			South		North	
Date	Maiden Captures	Y/N	Maiden Captures	Y/N	Date	Maiden Captures	Y/N	Maiden Captures	Y/N	Date	Maiden Captures	Y/N	Maiden Captures	Y/N
2/12	0	Y	0	Y	3/14	421	Y	140	Y	4/13	43	Y	176	Y
2/13	0	Y	0	Y	3/15	358	Y	285	Y	4/14	14	Y	445	Y
2/14	0	Y	0	Y	3/16	570	Y	332	Y	4/15	1	Y	98	Y
2/15	0	Y	0	Y	3/17	225	Y	790	Y	4/16	1	Y	54	Y
2/16	0	Y	0	Y	3/18	302	Y	742	Y	4/17	5	Y	89	Y
2/17	0	Y	0	Y	3/19	473	Y	470	Y	4/18	1	Y	22	Y
2/18	0	Y	0	Y	3/20	226	Y	333	Y	4/19	3	Y	1	Y
2/19	1	Y	0	Y	3/21	455	Y	353	Y	4/20	2	Y	1	Y
2/20	1	Y	2	Y	3/22	673	Y	453	Y	4/21	6	Y	0	Y
2/21	2	Y	0	Y	3/23	581	Y	198	Y	4/22	0	Y	8	Y
2/22	1	Y	1	Y	3/24	477	Y	447	Y	4/23	5	Y	0	Y
2/23	7	Y	0	Y	3/25	252	Y	435	Y	4/24	1	Y	1	Y
2/24	9	Y	6	Y	3/26	413	Y	176	Y	4/25	2	Y	2	Y
2/25	126	Y	16	Y	3/27	52	Y	317	Y	4/26	5	Y	0	Y
2/26	83	Y	25	Y	3/28	89	Y	267	Y	4/27	2	Y	3	Y
2/27	78	Y	54	Y	3/29	21	Y	337	Y	4/28	0	Y	0	Y
2/28	209	Y	161	Y	3/30	34	Y	511	Y	4/29	0	Y	0	Y
3/1	264	Y	290	Y	3/31	61	Y	949	Y	4/30	0	Y	0	Y
3/2	246	Y	160	Y	4/1	76	Y	1,278	Y	5/1	0	Y	0	Y
3/3	278	Y	294	Y	4/2	0	N	0	N	5/2	0	Y	2	Y
3/4	546	Y	132	Y	4/3	0	N	0	N	5/3	1	Y	2	Y
3/5	824	Y	67	Y	4/4	0	N	0	N	5/4	1	Y	1	Y
3/6	508	Y	123	Y	4/5	0	N	0	N	5/5	0	Y	1	Y
3/7	351	Y	154	Y	4/6	0	N	0	N					
3/8	313	Y	113	Y	4/7	0	N	0	N					
3/9	503	Y	112	Y	4/8	4	N	23	N					
3/10	912	Y	143	Y	4/9	2	Y	147	Y					
3/11	430	Y	170	Y	4/10	1	Y	46	Y					
3/12	684	Y	118	Y	4/11	8	Y	258	Y					
3/13	584	Y	112	Y	4/12	9	Y	289	Y					

Table C103. Summary of daily maiden captures and weir status (Y = census count, N = <100% efficient) for Duncan Creek Channels natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2012.

	South		North	
Date	Maiden Captures	Y/N	Maiden Captures	Y/N
2/14	0	Y	0	Y
2/15	0	Y	0	Y
2/16	0	Y	0	Y
2/17	0	Y	0	Y
2/18	0	Y	0	Y
2/19	0	Y	0	Y
2/20	0	Y	0	Y
2/21	0	Y	0	Y
2/22	0	Y	0	Y
2/23	0	Y	0	Y
2/24	0	Y	0	Y
2/25	0	Y	0	Y
2/26	0	Y	0	Y
2/27	0	Y	0	Y
2/28	3	Y	2	Y
2/29	2	Y	0	Y
3/1	1	Y	0	Y
3/2	19	Y	1	Y
3/3	13	Y	0	Y
3/4	133	Y	1	Y
3/5	213	Y	8	Y
3/6	309	Y	9	Y
3/7	503	Y	15	Y
3/8	378	Y	23	Y
3/9	782	Y	48	Y
3/10	1,064	Y	64	Y
3/11	887	Y	45	Y
3/12	689	Y	25	Y
3/13	858	Y	58	Y
3/14	879	Y	74	Y

	South		North	
Date	Maiden Captures	Y/N	Maiden Captures	Y/N
3/15	1,142	Y	142	Y
3/16	1,146	Y	176	Y
3/17	1,484	Y	231	Y
3/18	1,415	Y	196	Y
3/19	1,345	Y	217	Y
3/20	1,316	Y	210	Y
3/21	1,179	Y	176	Y
3/22	1,400	Y	183	Y
3/23	1,908	Y	209	Y
3/24	2,154	Y	300	Y
3/25	2,176	Y	389	Y
3/26	1,870	Y	336	Y
3/27	1,647	Y	338	Y
3/28	1,115	Y	398	Y
3/29	1,135	Y	410	Y
3/30	902	Y	375	N
3/31	0	N	0	N
4/1	0	N	0	N
4/2	0	N	0	N
4/3	0	N	0	N
4/4	0	N	0	N
4/5	78	N	72	N
4/6	327	Y	1,275	Y
4/7	169	N	459	N
4/8	244	N	1	N
4/9	155	Y	621	Y
4/10	20	Y	1,574	Y
4/11	17	Y	713	Y
4/12	8	Y	755	Y
4/13	1	Y	1,537	Y

	South		North	
Date	Maiden Captures	Y/N	Maiden Captures	Y/N
4/14	3	Y	1,304	Y
4/15	3	Y	1,484	Y
4/16	1	Y	1,217	Y
4/17	1	Y	764	Y
4/18	1	Y	701	Y
4/19	4	Y	415	Y
4/20	0	Y	297	Y
4/21	0	Y	320	Y
4/22	5	Y	510	Y
4/23	0	Y	45	N
4/24	0	N	0	N
4/25	0	N	3	N
4/26	0	N	0	N
4/27	0	N	0	N

Table C104. Summary of daily maiden captures and weir status (Y = census count, N = <100% efficient) for Duncan Creek Channels natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2013.

	South		North			South		North			South		North	
Date	Maiden Captures	Y/N	Maiden Captures	Y/N	Date	Maiden Captures	Y/N	Maiden Captures	Y/N	Date	Maiden Captures	Y/N	Maiden Captures	Y/N
2/16	0	Y	0	Y	3/18	297	Y	190	Y	4/17	1	Y	73	Y
2/17	0	Y	0	Y	3/19	246	Y	229	Y	4/18	0	Y	120	Y
2/18	0	Y	0	Y	3/20	419	Y	624	Y	4/19	0	Y	36	Y
2/19	0	Y	2	Y	3/21	423	Y	946	Y	4/20	0	Y	41	Y
2/20	0	Y	0	Y	3/22	473	Y	957	Y	4/21	0	Y	36	Y
2/21	0	Y	0	Y	3/23	558	Y	1,207	Y	4/22	0	Y	7	Y
2/22	0	Y	1	Y	3/24	470	Y	1,263	Y	4/23	1	Y	13	Y
2/23	0	Y	2	Y	3/25	336	Y	1,076	Y	4/24	0	Y	7	Y
2/24	0	Y	2	Y	3/26	305	Y	866	Y	4/25	0	Y	6	Y
2/25	0	Y	2	Y	3/27	143	Y	1,238	Y	4/26	0	Y	0	Y
2/26	0	Y	1	Y	3/28	218	Y	832	Y	4/27	0	Y	2	Y
2/27	0	Y	6	Y	3/29	168	Y	940	Y	4/28	0	Y	0	Y
2/28	0	Y	4	Y	3/30	134	Y	688	Y	4/29	0	Y	3	Y
3/1	0	Y	16	Y	3/31	94	Y	1,037	Y	4/30	0	Y	1	Y
3/2	0	Y	21	Y	4/1	49	Y	1,486	Y	5/1	0	Y	0	Y
3/3	1	Y	58	Y	4/2	3	Y	1,245	Y	5/2	0	Y	0	Y
3/4	1	Y	96	Y	4/3	1	Y	1,089	Y	5/3	0	Y	0	Y
3/5	1	Y	107	Y	4/4	1	Y	877	Y	5/4	0	Y	0	Y
3/6	1	Y	173	Y	4/5	4	Y	844	Y	5/5	0	Y	1	Y
3/7	6	Y	119	Y	4/6	1	Y	1,146	Y	5/6	0	Y	0	Y
3/8	15	Y	100	Y	4/7	2	Y	1,198	Y					
3/9	20	Y	176	Y	4/8	2	Y	1,966	Y					
3/10	31	Y	277	Y	4/9	4	Y	1,506	Y					
3/11	139	Y	209	Y	4/10	0	Y	1,179	Y					
3/12	490	Y	187	Y	4/11	2	Y	709	Y					
3/13	606	Y	234	Y	4/12	1	Y	259	Y					
3/14	398	Y	246	Y	4/13	1	Y	220	Y					
3/15	308	Y	253	Y	4/14	0	Y	69	Y					
3/16	352	Y	197	Y	4/15	0	Y	60	Y					
3/17	422	Y	141	Y	4/16	1	Y	89	Y					

Table C105. Summary of daily maiden captures and weir status (Y = census count, N = <100% efficient) for Duncan Creek Channels natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2014.

	South		North			South		North			South		North	
Date	Maiden Captures	Y/N	Maiden Captures	Y/N	Date	Maiden Captures	Y/N	Maiden Captures	Y/N	Date	Maiden Captures	Y/N	Maiden Captures	Y/N
2/13	---	N	0	Y	3/15	346	Y	233	Y	4/14	0	N	984	Y
2/14	---	N	0	Y	3/16	377	Y	191	Y	4/15	0	N	923	Y
2/15	0	Y	0	Y	3/17	239	N	1,311	Y	4/16	0	N	1,057	Y
2/16	0	Y	0	Y	3/18	849	Y	157	Y	4/17	0	N	867	Y
2/17	0	Y	0	Y	3/19	703	Y	140	Y	4/18	0	N	813	Y
2/18	0	Y	0	Y	3/20	794	Y	173	Y	4/19	0	N	489	Y
2/19	2	Y	0	Y	3/21	485	Y	78	Y	4/20	0	N	121	N
2/20	0	Y	0	Y	3/22	366	Y	278	Y	4/21	0	N	1,175	Y
2/21	1	Y	0	Y	3/23	487	Y	146	Y	4/22	0	N	989	Y
2/22	0	Y	0	Y	3/24	328	Y	147	Y	4/23	0	N	676	Y
2/23	2	Y	0	Y	3/25	560	Y	194	Y	4/24	0	N	450	Y
2/24	3	Y	0	Y	3/26	228	N	188	Y	4/25	0	N	389	Y
2/25	2	Y	0	Y	3/27	301	N	102	Y	4/26	0	N	332	Y
2/26	3	Y	0	Y	3/28	44	N	160	Y	4/27	0	N	197	Y
2/27	17	Y	0	Y	3/29	139	N	157	Y	4/28	0	N	153	Y
2/28	3	Y	0	Y	3/30	69	N	214	Y	4/29	0	N	30	Y
3/1	24	Y	0	Y	3/31	2	N	503	Y	4/30	0	N	9	Y
3/2	11	Y	0	Y	4/1	4	N	197	Y	5/1	0	N	8	Y
3/3	22	Y	0	Y	4/2	3	N	203	Y	5/2	0	N	15	Y
3/4	139	Y	3	Y	4/3	1	N	188	Y	5/3	0	N	26	Y
3/5	208	Y	8	N	4/4	0	N	400	Y	5/4	0	N	2	Y
3/6	281	N	3	N	4/5	0	N	225	Y	5/5	0	N	7	Y
3/7	413	Y	17	Y	4/6	0	N	405	Y	5/6	0	N	1	Y
3/8	250	N	38	Y	4/7	0	N	466	Y	5/7	0	N	0	Y
3/9	607	N	40	N	4/8	1	N	482	Y	5/8	0	N	0	Y
3/10	681	N	74	N	4/9	1	N	528	Y	5/9	0	N	0	Y
3/11	928	Y	50	N	4/10	0	N	689	Y					
3/12	38	N	25	N	4/11	0	N	735	Y					
3/13	299	N	138	N	4/12	0	N	620	Y					
3/14	528	N	187	N	4/13	0	N	504	Y					

Table C106. Summary of daily maiden captures and weir status (Y = census count, N = <100% efficient) for Duncan Creek Channels natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2015.

	South		North			South		North			South		North	
Date	Maiden Captures	Y/N	Maiden Captures	Y/N	Date	Maiden Captures	Y/N	Maiden Captures	Y/N	Date	Maiden Captures	Y/N	Maiden Captures	Y/N
2/11	0	Y	1	Y	3/14	975	Y	388	Y	4/14	0	Y	1,126	Y
2/12	0	Y	0	Y	3/15	1,075	Y	188	Y	4/15	0	Y	339	Y
2/13	0	Y	0	Y	3/16	1,031	Y	466	Y	4/16	0	Y	366	Y
2/14	2	Y	0	Y	3/17	1,028	Y	721	Y	4/17	0	Y	269	Y
2/15	0	Y	2	Y	3/18	1,339	Y	534	Y	4/18	1	Y	86	Y
2/16	0	Y	0	Y	3/19	562	Y	377	Y	4/19	0	Y	60	Y
2/17	2	Y	0	Y	3/20	628	Y	523	Y	4/20	1	Y	72	Y
2/18	1	Y	0	Y	3/21	694	Y	504	Y	4/21	1	Y	81	Y
2/19	0	Y	0	Y	3/22	752	Y	598	Y	4/22	1	Y	63	Y
2/20	2	Y	0	Y	3/23	430	Y	621	Y	4/23	0	Y	90	Y
2/21	0	Y	0	Y	3/24	463	Y	689	Y	4/24	2	Y	50	Y
2/22	2	Y	1	Y	3/25	348	Y	1,098	Y	4/25	0	Y	930	Y
2/23	0	Y	0	Y	3/26	248	Y	1,142	Y	4/26	2	Y	22	Y
2/24	2	Y	1	Y	3/27	305	Y	1,673	Y	4/27	0	Y	14	Y
2/25	10	Y	0	Y	3/28	212	Y	1,407	Y	4/28	0	Y	8	Y
2/26	1	Y	20	Y	3/29	264	Y	761	Y	4/29	0	Y	5	Y
2/27	40	Y	2	Y	3/30	226	Y	319	Y	4/30	0	Y	0	Y
2/28	81	Y	0	Y	3/31	307	Y	1,078	Y	5/1	---	---	14	Y
3/1	80	Y	4	Y	4/1	150	Y	1,872	Y	5/2	---	---	26	Y
3/2	81	Y	7	Y	4/2	157	Y	1,344	Y	5/3	---	---	34	Y
3/3	81	Y	4	Y	4/3	193	Y	552	Y	5/4	---	---	81	Y
3/4	121	Y	2	Y	4/4	252	Y	479	Y	5/5	---	---	185	Y
3/5	109	Y	5	Y	4/5	27	Y	586	Y	5/6	---	---	74	Y
3/6	4	Y	113	Y	4/6	396	Y	548	Y	5/7	---	---	0	Y
3/7	384	Y	19	Y	4/7	69	Y	550	Y	5/8	---	---	2	Y
3/8	545	Y	128	Y	4/8	16	Y	1,131	Y	5/9	---	---	6	Y
3/9	606	Y	208	Y	4/9	13	Y	555	Y	5/10	---	---	7	Y
3/10	555	Y	439	Y	4/10	5	Y	539	Y	5/11	---	---	2	Y
3/11	1,197	Y	791	Y	4/11	3	Y	1,574	Y	5/12	---	---	0	Y
3/12	1,181	Y	464	Y	4/12	6	Y	380	Y					
3/13	719	Y	293	Y	4/13	0	Y	512	Y					

Table C107. Summary of daily maiden captures and weir status (Y = census count, N = <100% efficient) for Duncan Creek Channels natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2016.

	South		North			South		North			South		North	
Date	Maiden Captures	Y/N	Maiden Captures	Y/N	Date	Maiden Captures	Y/N	Maiden Captures	Y/N	Date	Maiden Captures	Y/N	Maiden Captures	Y/N
2/9	0	Y	0	Y	3/10	1,256	Y	883	Y	4/9	15	Y	204	Y
2/10	0	Y	0	Y	3/11	1,009	Y	838	Y	4/10	27	Y	199	Y
2/11	0	Y	0	Y	3/12	1,128	Y	1,205	Y	4/11	38	Y	131	Y
2/12	0	Y	0	Y	3/13	891	Y	1,380	Y	4/12	17	Y	75	Y
2/13	1	Y	0	Y	3/14	812	Y	1,449	Y	4/13	36	Y	30	Y
2/14	6	Y	0	Y	3/15	950	Y	1,005	Y	4/14	14	Y	22	Y
2/15	5	Y	0	Y	3/16	879	Y	738	Y	4/15	30	Y	40	Y
2/16	5	Y	0	Y	3/17	929	Y	824	Y	4/16	7	Y	13	Y
2/17	7	Y	0	Y	3/18	807	Y	1,441	Y	4/17	7	Y	7	Y
2/18	13	Y	0	Y	3/19	625	Y	851	Y	4/18	3	Y	27	Y
2/19	16	Y	3	Y	3/20	568	Y	1,174	Y	4/19	1	Y	19	Y
2/20	38	Y	12	Y	3/21	444	Y	838	Y	4/20	1	Y	9	Y
2/21	69	Y	0	Y	3/22	343	Y	576	Y	4/21	8	Y	5	N
2/22	90	Y	4	Y	3/23	573	Y	632	Y	4/22	8	Y	7	N
2/23	241	Y	6	Y	3/24	443	Y	664	Y	4/23	2	Y	3	N
2/24	239	Y	13	Y	3/25	1,090	Y	922	Y	4/24	2	N	4	N
2/25	457	Y	33	Y	3/26	1,282	Y	796	Y	4/25	0	Y	0	Y
2/26	295	Y	10	Y	3/27	746	Y	1,173	Y	4/26	0	Y	1	Y
2/27	457	Y	34	Y	3/28	2,170	Y	1,200	Y	4/27	0	Y	6	Y
2/28	511	Y	28	Y	3/29	1,084	Y	811	Y	4/28	2	Y	6	Y
2/29	535	Y	44	Y	3/30	966	Y	467	Y	4/29	0	Y	2	Y
3/1	709	Y	81	Y	3/31	538	Y	619	Y	4/30	2	Y	2	Y
3/2	760	Y	136	Y	4/1	581	Y	391	Y	5/1	0	Y	1	Y
3/3	1,219	Y	453	Y	4/2	395	Y	335	Y	5/2	0	Y	1	Y
3/4	572	Y	793	Y	4/3	659	Y	216	Y	5/3	0	Y	1	Y
3/5	1,399	Y	700	Y	4/4	250	Y	688	Y					
3/6	1,001	Y	1,849	Y	4/5	67	Y	365	Y					
3/7	1,474	Y	1,218	Y	4/6	104	Y	387	Y					
3/8	1,041	Y	1,097	Y	4/7	65	Y	222	Y					
3/9	1,045	Y	856	Y	4/8	19	Y	165	Y					

Hamilton Creek

Coho salmon (Natural-Origin, Yearling)

Table C108. BTSPAS table for Hamilton Creek natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling), 2014.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	4/12	4/18	7	1.000	19	20	6	5	1	0	0	0
2	4/19	4/25	7	1.000	131	102	16	12	4	0	0	0
3	4/26	5/2	7	1.000	212	222	34	32	2	0	0	0
4	5/3	5/10	8	0.875	327	216	27	25	2	0	0	0
5	5/11	5/16	6	1.000	421	480	95	88	7	0	0	0
6	5/17	5/23	7	0.857	174	160	30	25	3	1	1	0
7	5/24	5/30	7	1.000	140	141	38	35	3	0	0	0
8	5/31	6/6	7	0.857	53	58	14	13	1	0	0	0
9	6/7	6/12	6	1.000	5	7	3	2	1	0	0	0
10	6/13	6/19	1	1.000	0	0	0	0	0	0	0	0

Table C109. BTSPAS table for Hamilton Creek natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling), 2015.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/15	3/1	15	1.000	4	7	1	1	0	0	0	0
2	3/2	3/8	7	0.714	7	5	2	1	0	0	1	0
3	3/9	3/17	9	0.889	7	5	2	2	0	0	0	0
4	3/18	3/22	5	1.000	16	16	2	2	0	0	0	0
5	3/23	3/29	7	0.857	56	50	11	7	2	0	2	0
6	3/30	4/5	7	1.000	76	76	18	14	2	2	0	0
7	4/6	4/12	7	1.000	63	59	18	15	3	0	0	0
8	4/13	4/19	7	1.000	198	155	22	12	7	1	2	0
9	4/20	4/26	7	0.857	245	188	32	25	6	1	0	0
10	4/27	5/3	7	0.857	206	212	33	27	6	0	0	0
11	5/4	5/10	7	1.000	276	264	64	62	2	0	0	0
12	5/11	5/17	7	0.571	59	105	26	22	4	0	0	0
13	5/18	5/24	7	1.000	85	95	24	24	0	0	0	0
14	5/25	6/2	9	0.556	20	9	1	1	0	0	0	0
15	6/3	6/7	5	1.000	25	26	2	2	0	0	0	0
16	6/8	6/14	2	1.000	0	0	0	0	0	0	0	0

Table C110. BTSPAS table for Hamilton Creek natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling), 2016.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/14	2/23	10	1.000	11	10	1	1	0	0	0	0
2	2/24	2/28	5	1.000	24	29	5	5	0	0	0	0
3	2/29	3/6	7	1.000	8	9	1	1	0	0	0	0
4	3/7	3/13	7	1.000	13	12	1	1	0	0	0	0
5	3/14	3/20	7	1.000	46	47	7	7	0	0	0	0
6	3/21	3/27	7	1.000	6	7	0	0	0	0	0	0
7	3/28	4/3	7	1.000	36	36	7	5	0	0	2	0
8	4/4	4/10	7	1.000	45	42	14	10	2	1	1	0
9	4/11	4/17	7	1.000	94	91	38	33	3	1	1	0
10	4/18	4/24	7	1.000	168	132	31	27	4	0	0	0
11	4/25	5/1	7	1.000	232	231	65	63	2	0	0	0
12	5/2	5/8	7	1.000	156	158	44	41	3	0	0	0
13	5/9	5/15	7	1.000	274	287	79	72	2	5	0	0
14	5/16	5/22	7	1.000	186	169	76	74	2	0	0	0
15	5/23	5/31	9	1.000	99	140	55	55	0	0	0	0
16	6/1	6/1	1	1.000	0	1	0	0	0	0	0	0
17	6/2	6/8	2	1.000	0	0	0	0	0	0	0	0

Steelhead (Natural-Origin, Yearling)

Table C111. BTSPAS table for Hamilton Creek natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling), 2014.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	4/12	4/18	7	1.000	28	22	11	7	4	0	0	0
2	4/19	4/25	7	1.000	131	124	22	19	3	0	0	0
3	4/26	5/2	7	1.000	144	126	24	19	5	0	0	0
4	5/3	5/10	8	0.875	116	123	19	17	2	0	0	0
5	5/11	5/16	6	1.000	77	76	15	14	1	0	0	0
6	5/17	5/23	7	0.857	39	46	2	2	0	0	0	0
7	5/24	5/30	7	1.000	24	28	4	4	0	0	0	0
8	5/31	6/7	8	0.875	15	12	1	1	0	0	0	0
9	6/8	6/12	5	1.000	2	3	0	0	0	0	0	0
10	6/13	6/19	1	1.000	1	0	0	0	0	0	0	0

Table C112. BTSPAS table for Hamilton Creek natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling), 2015.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/17	3/14	26	0.923	1	1	0	0	0	0	0	0
2	3/15	3/17	3	0.667	4	1	0	0	0	0	0	0
3	3/18	3/22	5	1.000	10	11	0	0	0	0	0	0
4	3/23	3/29	7	0.857	38	35	8	5	0	0	3	0
5	3/30	4/5	7	1.000	20	22	4	3	0	0	1	0
6	4/6	4/12	7	1.000	45	34	12	11	0	0	1	0
7	4/13	4/19	7	1.000	85	76	12	8	3	0	1	0
8	4/20	4/26	7	0.857	143	104	22	18	1	3	0	0
9	4/27	5/3	7	0.857	69	63	10	6	3	1	0	0
10	5/4	5/10	7	1.000	129	119	13	12	1	0	0	0
11	5/11	5/17	7	0.571	39	27	9	8	1	0	0	0
12	5/18	5/26	9	1.000	12	17	4	4	0	0	0	0
13	5/27	5/27	1	1.000	0	1	0	0	0	0	0	0
14	5/28	6/3	7	0.429	0	0	0	0	0	0	0	0
15	6/4	6/10	6	1.000	0	0	0	0	0	0	0	0

Table C113. BTSPAS table for Hamilton Creek natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling), 2016.

Period	Start Date	End Date	# of Days	Sample Proportion	Maiden Captures	Marks Released	Total Recaptures	Period. Plus.0	Period. Plus.1	Period. Plus.2	Period. Plus.3	Period. Plus.4
1	2/16	2/26	11	1.000	0	0	0	0	0	0	0	0
2	2/27	2/28	2	1.000	2	0	0	0	0	0	0	0
3	2/29	3/6	7	1.000	1	2	0	0	0	0	0	0
4	3/7	3/13	7	1.000	6	6	0	0	0	0	0	0
5	3/14	3/20	7	1.000	5	5	1	1	0	0	0	0
6	3/21	3/29	9	1.000	2	2	1	0	0	1	0	0
7	3/30	4/3	5	1.000	21	19	0	0	0	0	0	0
8	4/4	4/10	7	1.000	68	59	10	8	2	0	0	0
9	4/11	4/17	7	1.000	87	77	24	17	7	0	0	0
10	4/18	4/24	7	1.000	235	198	51	44	6	1	0	0
11	4/25	5/1	7	1.000	195	203	42	36	5	1	0	0
12	5/2	5/8	7	1.000	315	321	57	50	7	0	0	0
13	5/9	5/16	8	1.000	126	140	24	22	1	1	0	0
14	5/17	5/22	6	1.000	14	24	1	1	0	0	0	0
15	5/23	5/26	4	1.000	7	8	0	0	0	0	0	0
16	5/27	6/2	7	1.000	0	0	0	0	0	0	0	0
17	6/3	6/9	1	1.000	0	0	0	0	0	0	0	0

Hamilton Springs

Chum salmon (Natural-Origin, Fry)

Table C114. Summary of daily maiden captures and weir status (Y = census count, N = <100% efficient) for Hamilton Springs Channel natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2011.

Date	Maiden Captures	Weir Status (Y/N)	Date	Maiden Captures	Weir Status (Y/N)	Date	Maiden Captures	Weir Status (Y/N)
2/9	0	Y	3/7	4,102	Y	4/2	1,641	Y
2/10	0	Y	3/8	3,300	Y	4/3	3,316	Y
2/11	0	Y	3/9	2,715	Y	4/4	970	N
2/12	0	Y	3/10	1,630	N	4/5	188	N
2/13	0	Y	3/11	8,753	Y	4/6	13	N
2/14	2	Y	3/12	7,029	Y	4/7	900	Y
2/15	4	Y	3/13	4,236	Y	4/8	1,205	Y
2/16	9	Y	3/14	5,388	Y	4/9	931	Y
2/17	8	Y	3/15	3,779	Y	4/10	527	Y
2/18	8	Y	3/16	6,086	Y	4/11	451	Y
2/19	22	Y	3/17	4,020	Y	4/12	524	Y
2/20	85	Y	3/18	5,204	Y	4/13	259	Y
2/21	58	Y	3/19	5,055	Y	4/14	200	Y
2/22	78	Y	3/20	7,884	Y	4/15	212	Y
2/23	239	Y	3/21	6,109	Y	4/16	220	Y
2/24	152	Y	3/22	6,417	Y	4/17	110	N
2/25	701	Y	3/23	5,156	Y	4/18	32	N
2/26	944	Y	3/24	3,820	Y	4/19	494	Y
2/27	241	Y	3/25	3,943	Y	4/20	270	Y
2/28	1,242	Y	3/26	2,990	Y	4/21	134	Y
3/1	1,444	Y	3/27	2,355	Y	4/22	308	Y
3/2	1,896	Y	3/28	2,978	Y	4/23	340	Y
3/3	4,107	N	3/29	2,410	Y	4/24	271	Y
3/4	6,150	Y	3/30	2,406	N	4/25	136	N
3/5	3,279	Y	3/31	1,327	N	4/26	33	N
3/6	5,370	Y	4/1	4,206	Y			

Table C115. Summary of daily maiden captures and weir status (Y = census count, N = <100% efficient) for Hamilton Springs Channel natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2012.

Date	Maiden Captures	Weir Status (Y/N)	Date	Maiden Captures	Weir Status (Y/N)	Date	Maiden Captures	Weir Status (Y/N)
2/11	0	Y	3/12	3,484	Y	4/11	10,052	N
2/12	0	Y	3/13	2,369	Y	4/12	14,006	Y
2/13	0	Y	3/14	6,636	Y	4/13	11,314	Y
2/14	0	Y	3/15	4,279	Y	4/14	8,444	Y
2/15	0	Y	3/16	4,016	Y	4/15	10,599	Y
2/16	2	Y	3/17	6,485	Y	4/16	4,735	Y
2/17	0	Y	3/18	3,153	Y	4/17	10,715	Y
2/18	3	Y	3/19	5,145	Y	4/18	6,679	Y
2/19	2	Y	3/20	4,328	Y	4/19	9,537	Y
2/20	1	Y	3/21	3,241	Y	4/20	8,183	Y
2/21	3	Y	3/22	5,449	Y	4/21	8,365	Y
2/22	4	N	3/23	7,593	Y	4/22	6,274	Y
2/23	7	Y	3/24	5,850	Y	4/23	5,233	Y
2/24	12	Y	3/25	5,897	N	4/24	5,096	Y
2/25	10	Y	3/26	5,017	N	4/25	3,536	Y
2/26	14	Y	3/27	8,183	Y	4/26	0	N
2/27	58	Y	3/28	7,921	Y	4/27	357	N
2/28	25	N	3/29	5,713	Y	4/28	16	N
2/29	35	Y	3/30	2,739	N	4/29	29	N
3/1	65	Y	3/31	2,363	N	4/30	758	N
3/2	187	Y	4/1	10,350	Y	5/1	3,395	N
3/3	521	Y	4/2	15,164	Y	5/2	1,780	N
3/4	689	Y	4/3	10,735	Y	5/3	2,218	N
3/5	1,388	Y	4/4	9,273	Y	5/4	12	N
3/6	1,259	Y	4/5	7,625	Y	5/5	1,160	N
3/7	1,567	Y	4/6	11,545	Y	5/6	4,235	N
3/8	1,663	Y	4/7	11,675	Y	5/7	2,965	Y
3/9	2,051	Y	4/8	10,874	Y	5/8	4,230	Y
3/10	3,503	Y	4/9	11,996	Y	5/9	2,803	Y
3/11	3,115	Y	4/10	12,281	Y	5/10	2,551	Y

Table C115. Continued.

Date	Maiden Captures	Weir Status (Y/N)	Date	Maiden Captures	Weir Status (Y/N)	Date	Maiden Captures	Weir Status (Y/N)
5/11	1,019	Y	5/28	17	Y	6/14	0	Y
5/12	1,104	Y	5/29	20	Y	6/15	0	Y
5/13	989	N	5/30	19	Y	6/16	0	Y
5/14	1,315	Y	5/31	16	Y	6/17	0	Y
5/15	1,360	Y	6/1	4	Y	6/18	1	Y
5/16	864	Y	6/2	4	Y	6/19	1	Y
5/17	768	Y	6/3	13	Y	6/20	2	Y
5/18	427	Y	6/4	13	Y	6/21	2	Y
5/19	331	Y	6/5	14	Y	6/22	0	Y
5/20	242	Y	6/6	4	Y	6/23	1	Y
5/21	110	Y	6/7	4	Y	6/24	3	Y
5/22	241	Y	6/8	6	Y	6/25	0	Y
5/23	118	Y	6/9	7	Y	6/26	2	Y
5/24	77	Y	6/10	4	Y	6/27	0	Y
5/25	64	Y	6/11	4	Y	6/28	0	N
5/26	22	Y	6/12	2	Y	6/29	1	Y
5/27	3	Y	6/13	0	Y	6/30	0	Y

Table C116. Summary of daily maiden captures and weir status (Y = census count, N = <100% efficient) for Hamilton Springs Channel natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2013.

Date	Maiden Captures	Weir Status (Y/N)	Date	Maiden Captures	Weir Status (Y/N)	Date	Maiden Captures	Weir Status (Y/N)
2/13	7	Y	3/15	6,983	Y	4/14	5,289	Y
2/14	17	Y	3/16	9,465	Y	4/15	3,662	Y
2/15	27	Y	3/17	7,657	Y	4/16	4,176	Y
2/16	28	Y	3/18	9,226	Y	4/17	4,418	Y
2/17	29	Y	3/19	13,991	Y	4/18	3,917	Y
2/18	31	Y	3/20	8,552	Y	4/19	3,299	Y
2/19	66	Y	3/21	12,223	Y	4/20	3,189	Y
2/20	108	Y	3/22	12,609	Y	4/21	3,236	Y
2/21	86	Y	3/23	12,187	Y	4/22	2,733	Y
2/22	149	Y	3/24	12,890	Y	4/23	2,938	Y
2/23	252	Y	3/25	11,882	Y	4/24	2,468	Y
2/24	374	Y	3/26	11,672	Y	4/25	2,253	Y
2/25	679	Y	3/27	10,381	Y	4/26	2,059	Y
2/26	1,458	Y	3/28	12,846	Y	4/27	1,979	Y
2/27	1,629	Y	3/29	14,904	Y	4/28	1,914	Y
2/28	2,458	Y	3/30	14,689	Y	4/29	1,634	Y
3/1	1,724	Y	3/31	13,397	Y	4/30	2,005	Y
3/2	4,051	Y	4/1	11,647	Y	5/1	1,589	Y
3/3	3,446	Y	4/2	13,549	Y	5/2	1,648	Y
3/4	3,797	Y	4/3	19,703	Y	5/3	1,340	Y
3/5	2,478	Y	4/4	14,258	Y	5/4	1,227	Y
3/6	1,895	Y	4/5	10,237	Y	5/5	1,229	Y
3/7	2,351	Y	4/6	9,646	Y	5/6	895	Y
3/8	4,147	Y	4/7	10,682	Y	5/7	565	Y
3/9	5,380	Y	4/8	10,928	Y	5/8	401	Y
3/10	4,837	Y	4/9	9,257	Y	5/9	376	Y
3/11	3,857	Y	4/10	9,059	Y	5/10	223	Y
3/12	4,723	Y	4/11	8,216	Y	5/11	319	Y
3/13	8,388	Y	4/12	5,551	Y	5/12	212	Y
3/14	4,857	Y	4/13	5,881	Y	5/13	132	Y

Table C116. Continued.

Date	Maiden Captures	Weir Status (Y/N)	Date	Maiden Captures	Weir Status (Y/N)	Date	Maiden Captures	Weir Status (Y/N)
5/14	99	Y	5/29	5	Y	6/13	0	Y
5/15	77	Y	5/30	4	Y	6/14	0	Y
5/16	49	Y	5/31	9	Y	6/15	0	Y
5/17	54	Y	6/1	4	Y	6/16	0	Y
5/18	58	Y	6/2	7	Y	6/17	0	Y
5/19	24	Y	6/3	5	Y	6/18	0	Y
5/20	23	Y	6/4	1	Y	6/19	0	Y
5/21	30	Y	6/5	0	Y	6/20	0	Y
5/22	25	Y	6/6	0	Y	6/21	0	Y
5/23	14	Y	6/7	0	Y	6/22	0	Y
5/24	16	Y	6/8	0	Y	6/23	0	Y
5/25	15	Y	6/9	2	Y	6/24	0	Y
5/26	3	Y	6/10	0	Y	6/25	0	Y
5/27	3	Y	6/11	0	Y	6/26	0	Y
5/28	20	Y	6/12	0	Y			

Table C117. Summary of daily maiden captures and weir status (Y = census count, N = <100% efficient) for Hamilton Springs Channel natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2014.

Date	Maiden Captures	Weir Status (Y/N)	Date	Maiden Captures	Weir Status (Y/N)	Date	Maiden Captures	Weir Status (Y/N)
2/12	0	N	3/14	3,385	Y	4/13	3,436	Y
2/13	0	N	3/15	5,331	Y	4/14	2,599	Y
2/14	0	Y	3/16	1,198	Y	4/15	3,899	Y
2/15	0	Y	3/17	4,799	Y	4/16	3,171	Y
2/16	3	N	3/18	4,872	Y	4/17	2,891	Y
2/17	5	N	3/19	5,002	Y	4/18	2,340	Y
2/18	1	N	3/20	4,766	Y	4/19	2,769	Y
2/19	1	N	3/21	5,117	Y	4/20	1,179	N
2/20	3	Y	3/22	3,074	Y	4/21	935	Y
2/21	4	Y	3/23	2,688	Y	4/22	1,248	Y
2/22	26	Y	3/24	3,730	Y	4/23	1,366	Y
2/23	32	Y	3/25	2,393	Y	4/24	789	Y
2/24	18	Y	3/26	5,515	Y	4/25	1,155	Y
2/25	243	Y	3/27	2,562	Y	4/26	883	Y
2/26	633	Y	3/28	4,761	Y	4/27	752	Y
2/27	597	Y	3/29	4,932	Y	4/28	588	Y
2/28	874	Y	3/30	5,377	Y	4/29	793	Y
3/1	813	Y	3/31	5,732	Y	4/30	686	Y
3/2	411	Y	4/1	5,031	Y	5/1	550	Y
3/3	317	Y	4/2	5,567	Y	5/2	493	Y
3/4	1,774	Y	4/3	6,871	Y	5/3	407	Y
3/5	1,764	Y	4/4	4,951	Y	5/4	380	Y
3/6	87	N	4/5	7,109	Y	5/5	272	Y
3/7	3,821	Y	4/6	6,312	Y	5/6	199	Y
3/8	5,689	Y	4/7	6,308	Y	5/7	234	Y
3/9	0	N	4/8	4,431	Y	5/8	61	Y
3/10	2,390	N	4/9	3,330	Y	5/9	181	Y
3/11	3,874	Y	4/10	3,205	Y	5/10	291	Y
3/12	2,685	Y	4/11	2,607	Y	5/11	226	Y
3/13	1,689	Y	4/12	3,999	Y	5/12	145	Y

Table C117. Continued.

Date	Maiden Captures	Weir Status (Y/N)	Date	Maiden Captures	Weir Status (Y/N)	Date	Maiden Captures	Weir Status (Y/N)
5/13	158	Y	5/24	3	Y	6/4	0	Y
5/14	137	Y	5/25	5	Y	6/5	0	Y
5/15	126	Y	5/26	6	Y	6/6	0	Y
5/16	127	Y	5/27	4	Y	6/7	0	Y
5/17	23	Y	5/28	3	Y	6/8	0	Y
5/18	15	Y	5/29	5	Y	6/9	2	Y
5/19	12	Y	5/30	0	Y	6/10	3	Y
5/20	13	Y	5/31	1	Y			
5/21	11	Y	6/1	1	Y			
5/22	9	Y	6/2	0	Y			
5/23	10	Y	6/3	1	Y			

Table C118. Summary of daily maiden captures and weir status (Y = census count, N = <100% efficient) for Hamilton Springs Channel natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2015.

Date	Maiden Captures	Weir Status (Y/N)	Date	Maiden Captures	Weir Status (Y/N)	Date	Maiden Captures	Weir Status (Y/N)
2/12	7	Y	3/14	5,004	Y	4/13	5,330	Y
2/13	8	Y	3/15	7,705	Y	4/14	8,160	Y
2/14	7	Y	3/16	9,324	Y	4/15	9,560	Y
2/15	7	Y	3/17	15,025	Y	4/16	7,311	Y
2/16	18	Y	3/18	6,774	Y	4/17	5,295	Y
2/17	31	Y	3/19	11,382	Y	4/18	3,588	Y
2/18	31	Y	3/20	10,369	Y	4/19	3,469	Y
2/19	35	Y	3/21	11,730	Y	4/20	2,303	Y
2/20	61	Y	3/22	11,563	Y	4/21	3,275	Y
2/21	51	Y	3/23	12,081	Y	4/22	2,586	Y
2/22	28	Y	3/24	13,374	Y	4/23	2,128	Y
2/23	136	Y	3/25	15,842	Y	4/24	1,700	Y
2/24	79	Y	3/26	23,514	Y	4/25	1,453	Y
2/25	164	Y	3/27	15,600	Y	4/26	1,361	Y
2/26	469	Y	3/28	15,022	Y	4/27	1,223	Y
2/27	793	Y	3/29	18,410	Y	4/28	1,458	Y
2/28	1,270	Y	3/30	18,067	Y	4/29	1,020	Y
3/1	1,463	Y	3/31	19,263	Y	4/30	849	Y
3/2	604	Y	4/1	8,734	Y	5/1	880	Y
3/3	1,756	Y	4/2	12,162	Y	5/2	601	Y
3/4	815	Y	4/3	14,718	Y	5/3	554	Y
3/5	1,695	Y	4/4	14,576	Y	5/4	711	Y
3/6	1,726	Y	4/5	12,648	Y	5/5	616	Y
3/7	2,146	Y	4/6	14,743	Y	5/6	351	Y
3/8	3,241	Y	4/7	15,185	Y	5/7	326	Y
3/9	3,026	Y	4/8	16,664	Y	5/8	174	Y
3/10	3,884	Y	4/9	12,331	Y	5/9	142	Y
3/11	2,481	Y	4/10	14,432	Y	5/10	28	Y
3/12	2,650	Y	4/11	7,895	Y	5/11	30	Y
3/13	5,954	Y	4/12	7,897	Y	5/12	12	Y

Table C118. Continued.

Date	Maiden Captures	Weir Status (Y/N)	Date	Maiden Captures	Weir Status (Y/N)	Date	Maiden Captures	Weir Status (Y/N)
5/13	31	Y	5/23	3	Y	6/2	0	Y
5/14	37	Y	5/24	4	Y	6/3	0	Y
5/15	17	Y	5/25	2	Y	6/4	1	Y
5/16	18	Y	5/26	3	Y	6/5	0	Y
5/17	8	Y	5/27	1	Y	6/6	0	Y
5/18	12	Y	5/28	0	Y	6/7	1	Y
5/19	6	Y	5/29	1	Y	6/8	0	Y
5/20	14	Y	5/30	0	Y			
5/21	6	Y	5/31	0	Y			
5/22	0	Y	6/1	0	Y			

Table C119. Summary of daily maiden captures and weir status (Y = census count, N = <100% efficient) for Hamilton Springs Channel natural-origin chum salmon (life-stage = fry; age-class = sub-yearling), 2016.

Date	Maiden Captures	Weir Status (Y/N)	Date	Maiden Captures	Weir Status (Y/N)	Date	Maiden Captures	Weir Status (Y/N)
2/11	7	Y	3/12	14,201	Y	4/11	0	N
2/12	19	Y	3/13	17,152	Y	4/12	0	N
2/13	21	Y	3/14	16,543	Y	4/13	0	N
2/14	16	Y	3/15	19,827	Y	4/14	8,645	Y
2/15	4	N	3/16	23,214	Y	4/15	7,075	Y
2/16	47	Y	3/17	33,589	Y	4/16	0	N
2/17	82	Y	3/18	29,340	Y	4/17	5,278	Y
2/18	128	Y	3/19	28,783	Y	4/18	0	N
2/19	129	Y	3/20	0	N	4/19	3,342	Y
2/20	145	Y	3/21	20,850	Y	4/20	0	N
2/21	294	Y	3/22	0	N	4/21	2,052	Y
2/22	309	Y	3/23	23,249	Y	4/22	2,342	Y
2/23	865	Y	3/24	0	N	4/23	1,474	Y
2/24	731	Y	3/25	27,285	Y	4/24	1,776	Y
2/25	1,728	Y	3/26	0	N	4/25	650	Y
2/26	1,831	Y	3/27	21,701	Y	4/26	924	Y
2/27	2,585	Y	3/28	0	N	4/27	814	Y
2/28	2,220	Y	3/29	23,821	Y	4/28	512	Y
2/29	1,548	Y	3/30	0	N	4/29	328	Y
3/1	3,532	Y	3/31	0	N	4/30	278	Y
3/2	3,862	Y	4/1	20,134	Y	5/1	135	Y
3/3	4,731	Y	4/2	0	N	5/2	113	Y
3/4	6,227	Y	4/3	0	N	5/3	74	Y
3/5	5,527	Y	4/4	12,083	Y	5/4	51	Y
3/6	7,215	Y	4/5	0	N	5/5	37	Y
3/7	5,806	Y	4/6	13,164	Y	5/6	31	Y
3/8	6,705	Y	4/7	0	N	5/7	24	Y
3/9	8,144	Y	4/8	11,032	Y	5/8	4	Y
3/10	7,569	Y	4/9	0	N	5/9	0	Y
3/11	19,199	Y	4/10	10,164	Y	5/10	15	Y

Table C119. Continued.

Date	Maiden Captures	Weir Status (Y/N)	Date	Maiden Captures	Weir Status (Y/N)	Date	Maiden Captures	Weir Status (Y/N)
5/11	4	Y	5/19	4	Y	5/27	7	Y
5/12	4	Y	5/20	3	Y	5/28	1	Y
5/13	3	Y	5/21	3	Y	5/29	0	Y
5/14	3	Y	5/22	3	Y	5/30	0	Y
5/15	3	Y	5/23	5	Y	5/31	0	Y
5/16	1	Y	5/24	2	Y	6/1	0	Y
5/17	5	Y	5/25	2	Y	6/2	2	Y
5/18	2	Y	5/26	1	Y	6/3	0	Y

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Appendix D – Trap Efficiency plots

Plots of trap efficiency (i.e., capture probability) by date are included below for each group of fish in which an abundance estimate was generated. Groups of fish were broken up by (1) Trap Site, (2) Species, (3) Origin, (4) Life-stage/Age-class, and (5) Year. Each plot contains two estimates of trap efficiency: (1) raw and (2) modeled. Raw trap efficiencies are simply the percentage of marked fish that were recaptured for each corresponding period throughout the trapping season while modeled trap efficiency are hierarchically calculated using the Bayesian Time-Stratified Population Analysis (BTSPAS) package in R. Raw trap efficiencies are plotted as white circles and modeled trap efficiencies are plotted as black circles along with 95% credible intervals.

Mean daily stage height are added to the trap efficiency plots for reference and are shown as dashed blue lines. Stage height data used for Grays River and Crazy Johnson Creek plots were collected near the mouth of Grays River by the Washington Department of Ecology (Station ID: 25B060). Hamilton Creek, Duncan Creek and Hamilton Springs do not have a flow monitoring station. Therefore, stage height data collected from the East Fork Lewis River by the USGS (Station ID: 14222500) was used for reference. Notable trap operation events are represented on the plots as follows: no trapping issues (black circle), trap outages/pulled (red circle), and cone stoppers (blue circles). The date(s) flow diverting panels and a second rotary screw were installed (when applicable) are denoted with arrows and a brown "P" or gray "T", respectively.

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Grays River

Chum salmon (Natural-Origin, Fry)

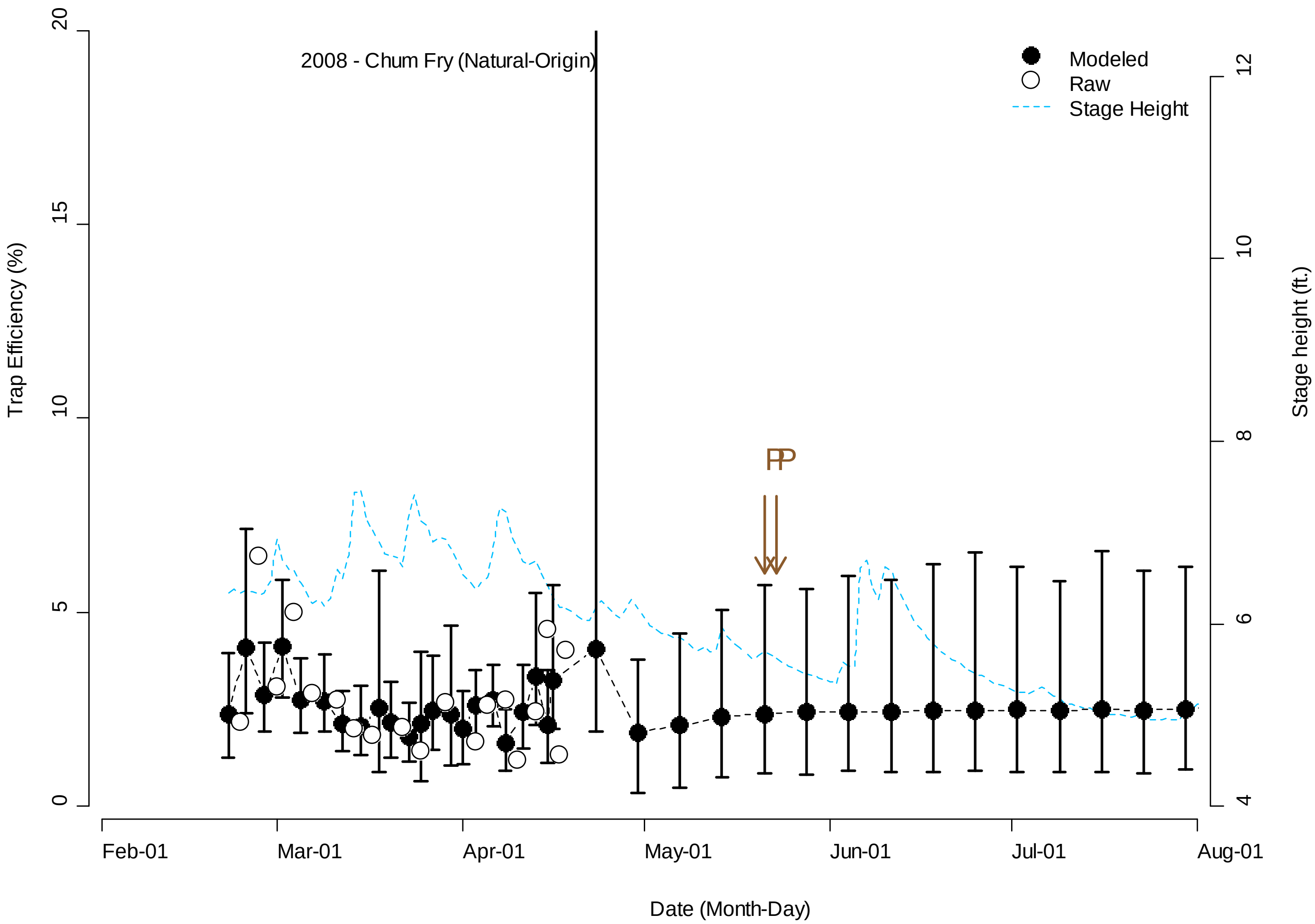

Figure D1. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2008.

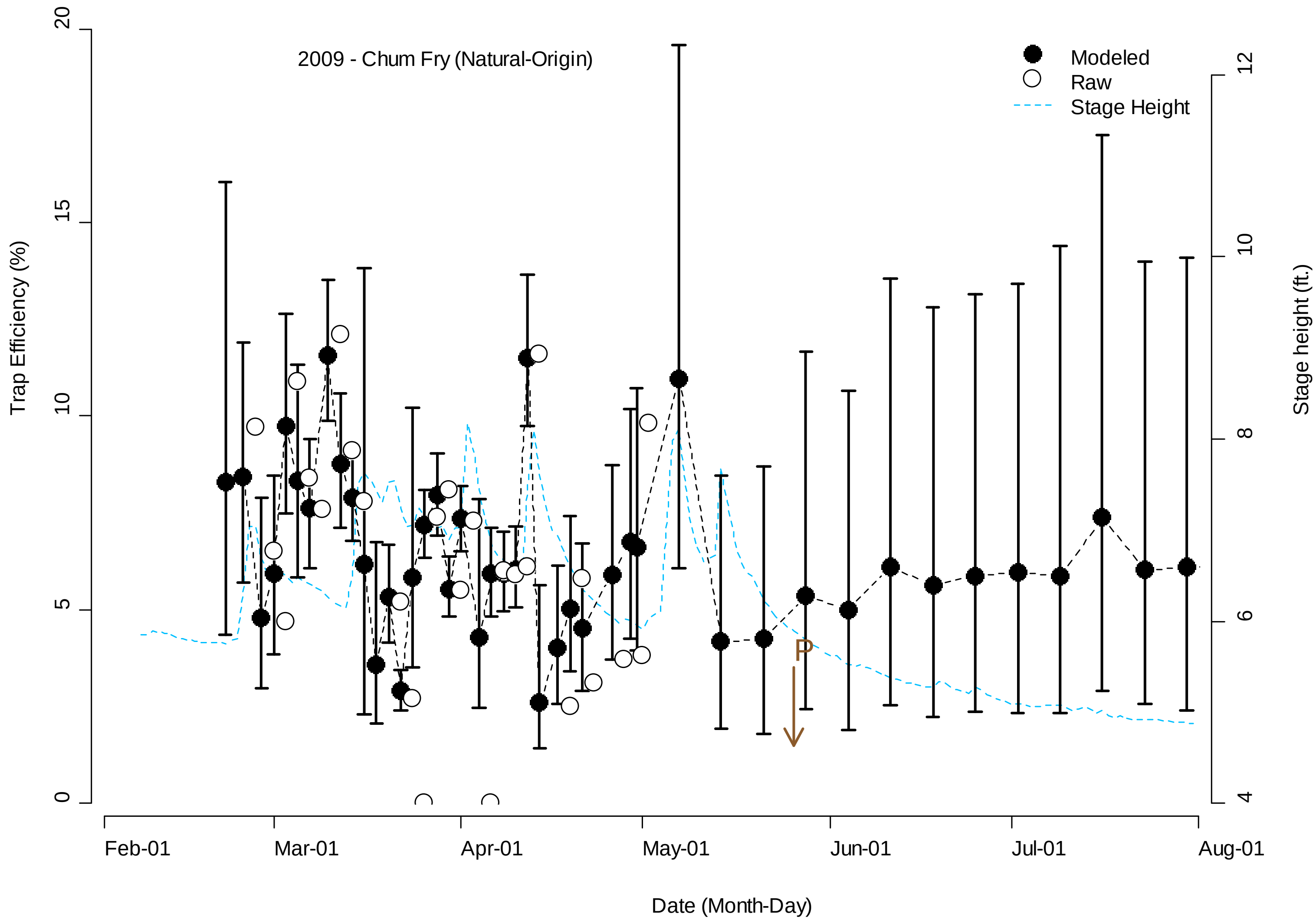

Figure D2. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2009.

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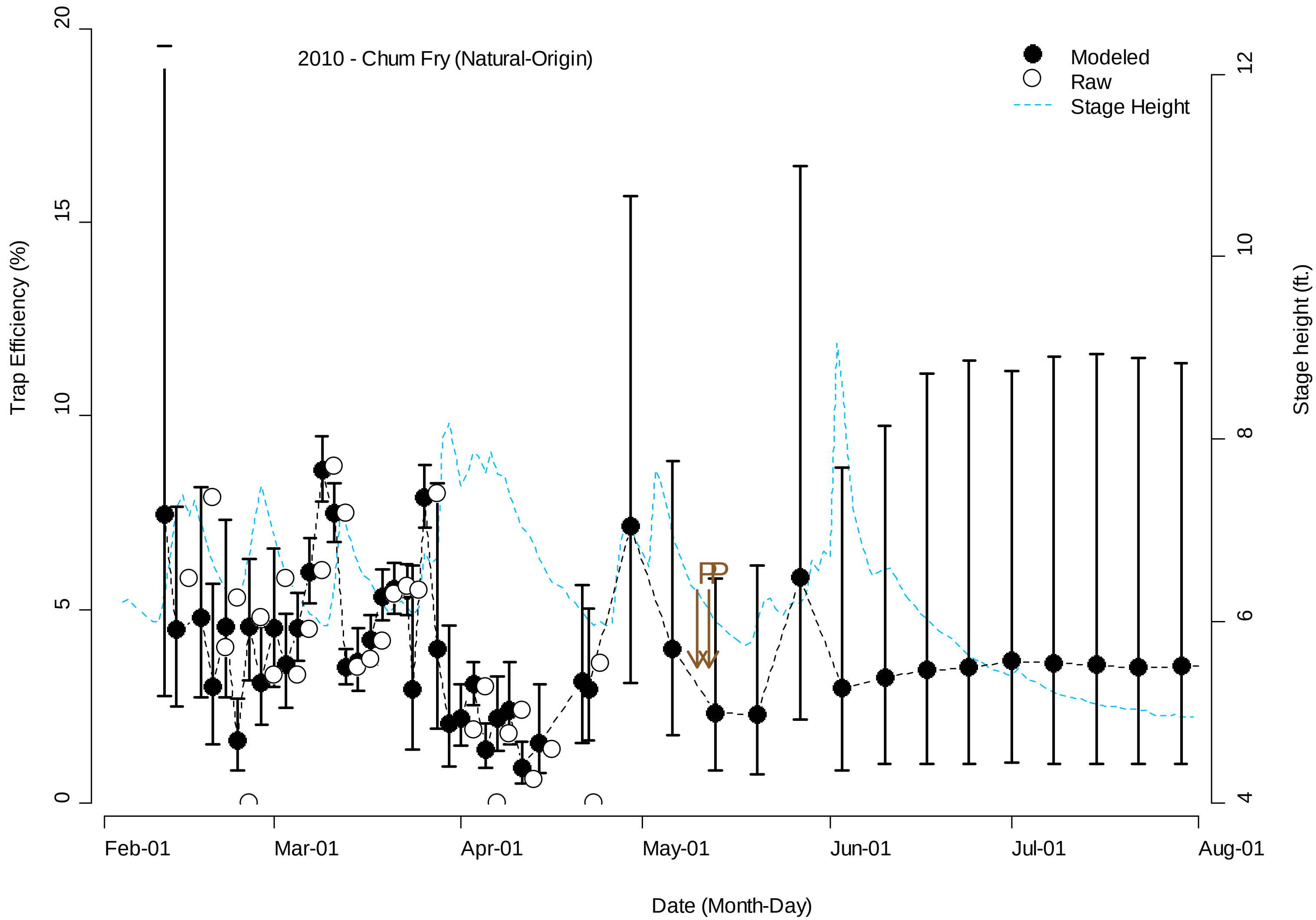

Figure D3. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2010.

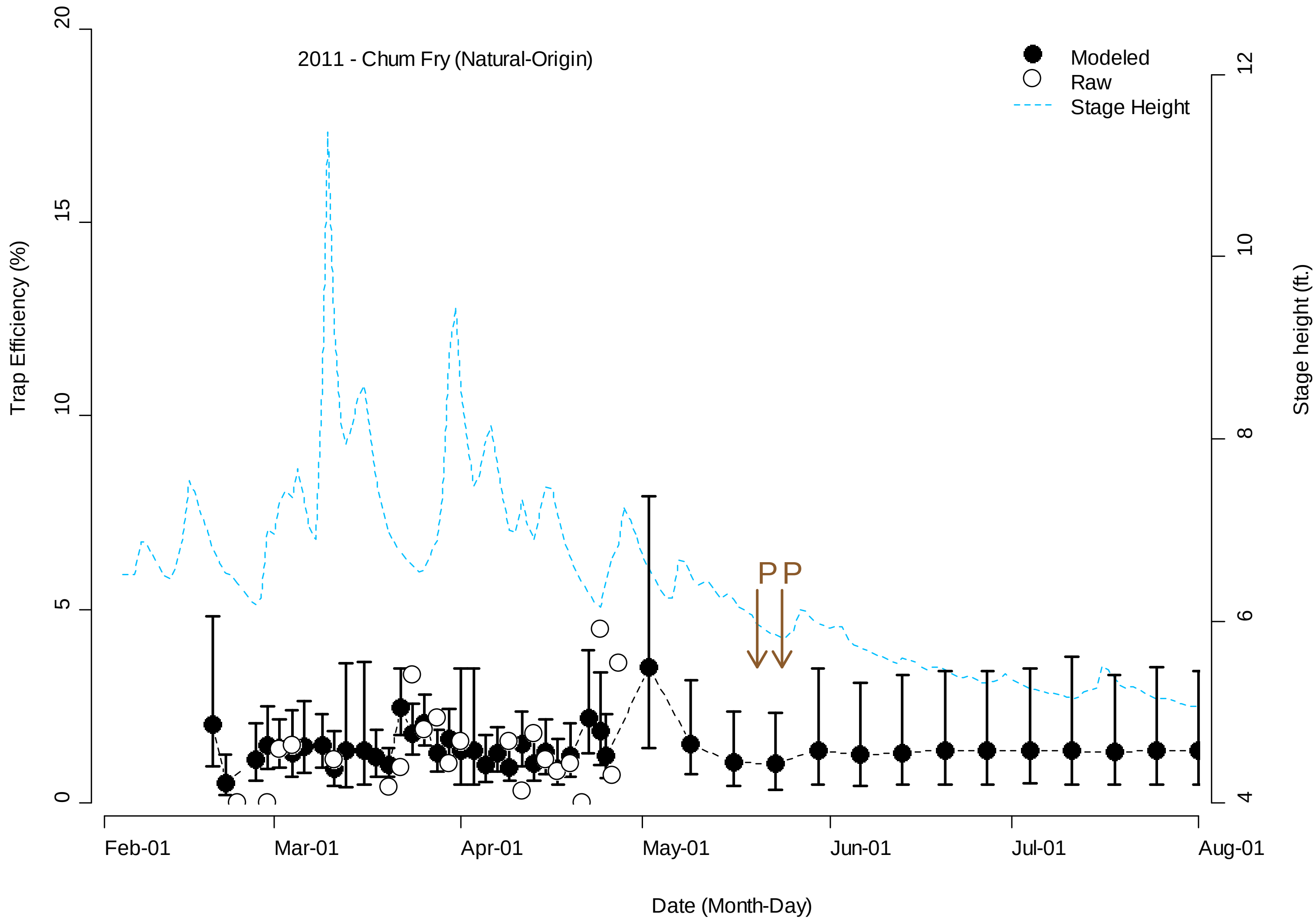

Figure D4. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2011.

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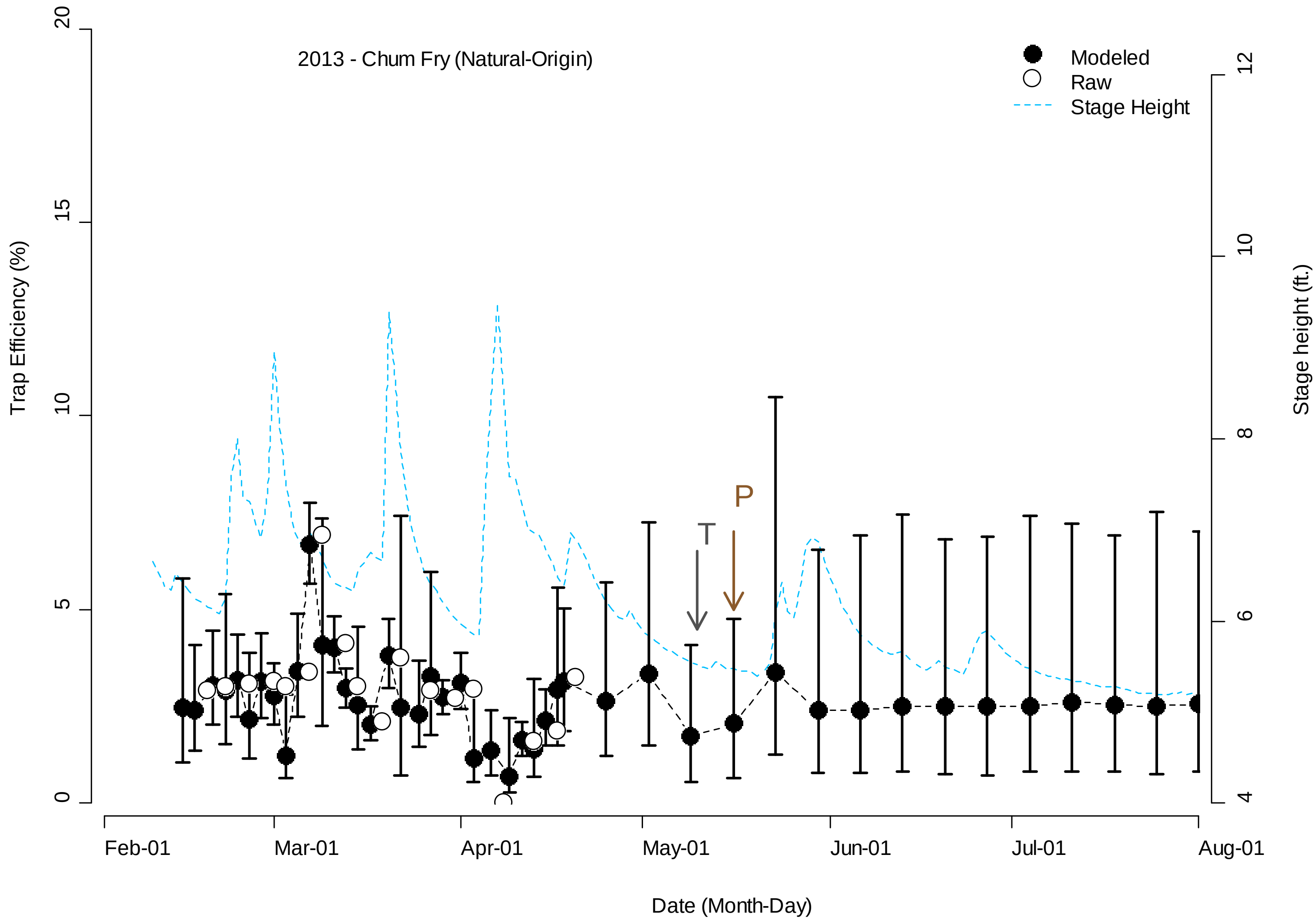

Figure D5. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2013.

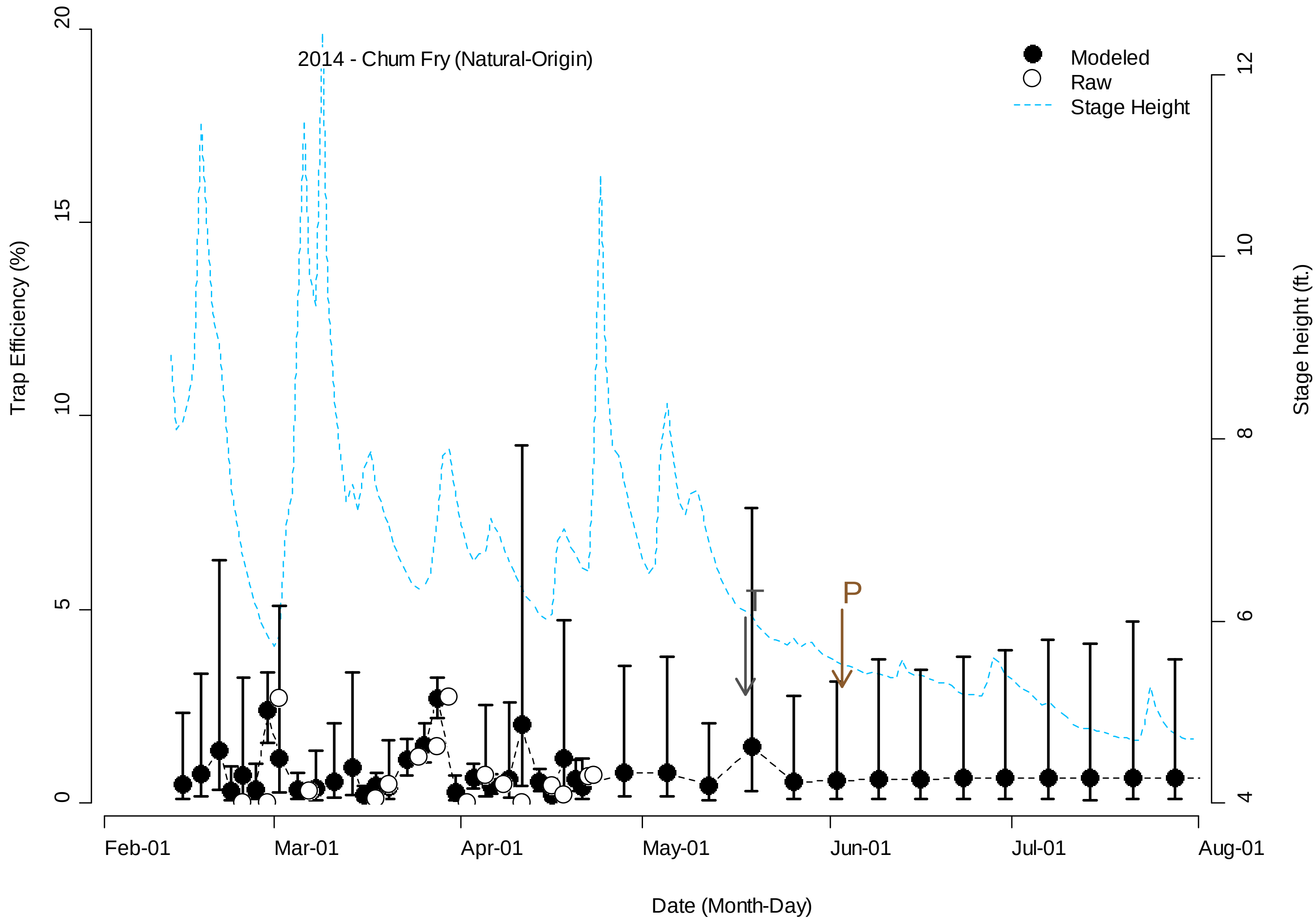

Figure D6. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2014.

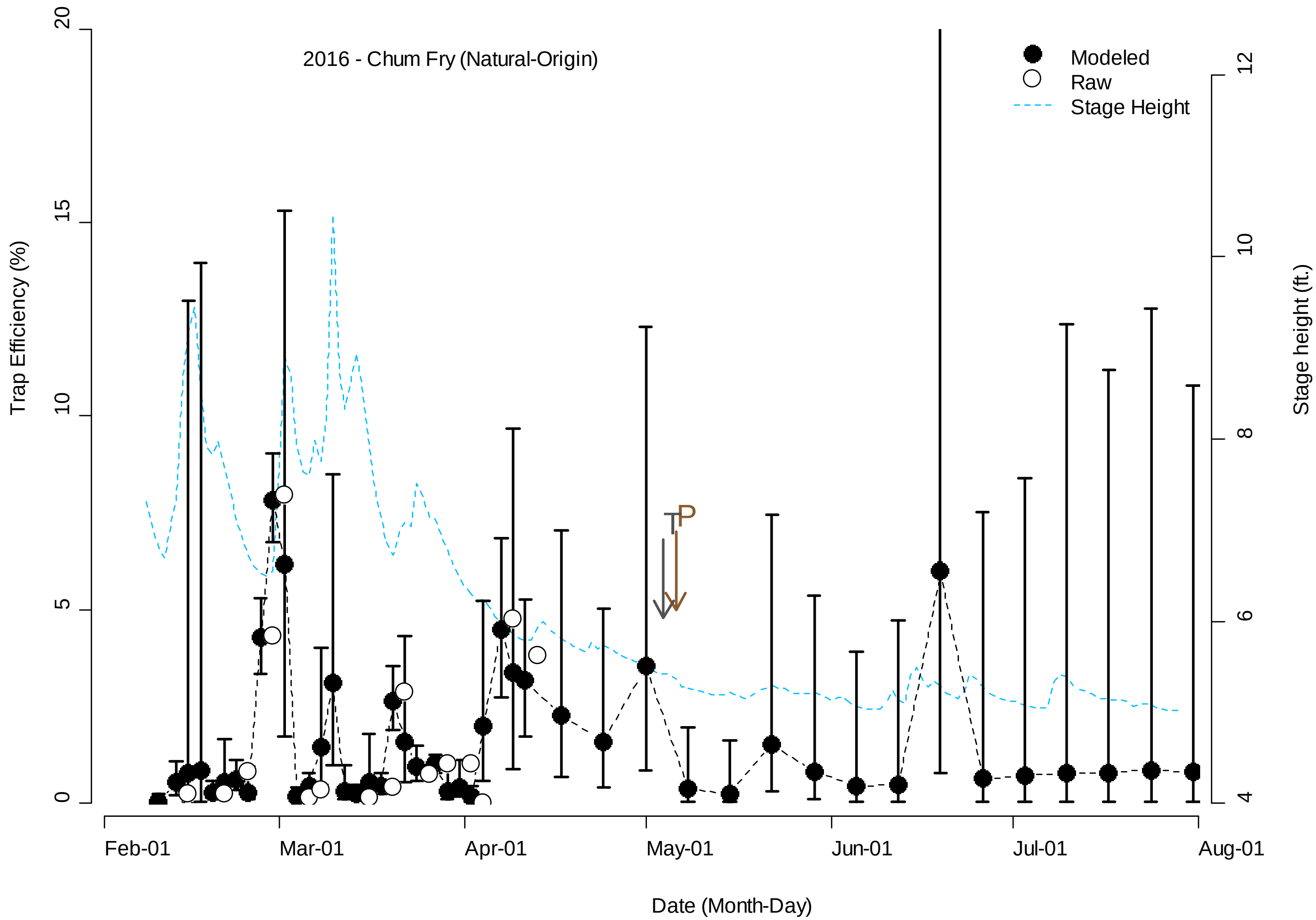

Figure D7. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2016.

Chinook salmon (Natural-Origin, Fry)

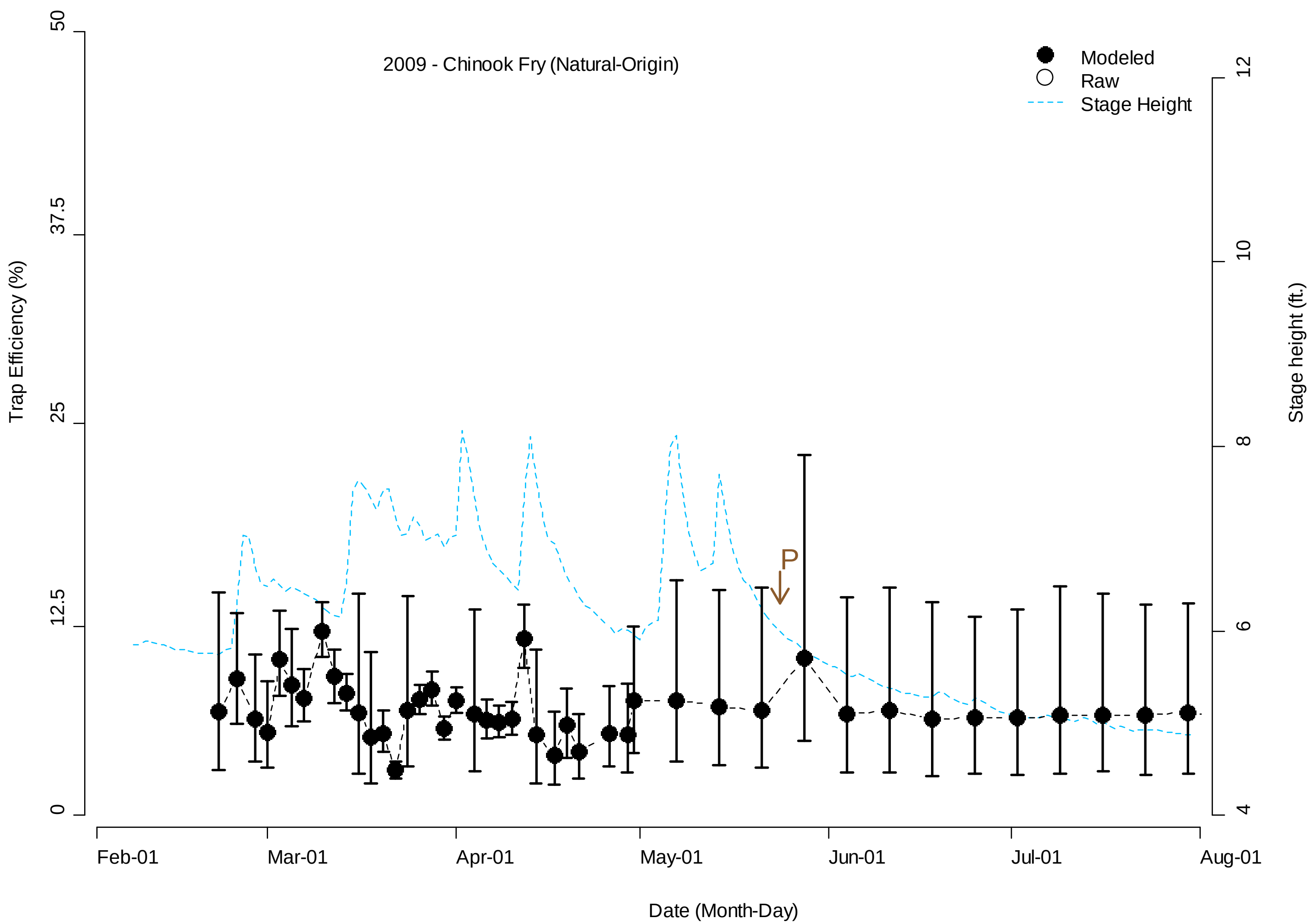

Figure D8. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin Chinook salmon (life-stage = fry; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2009.

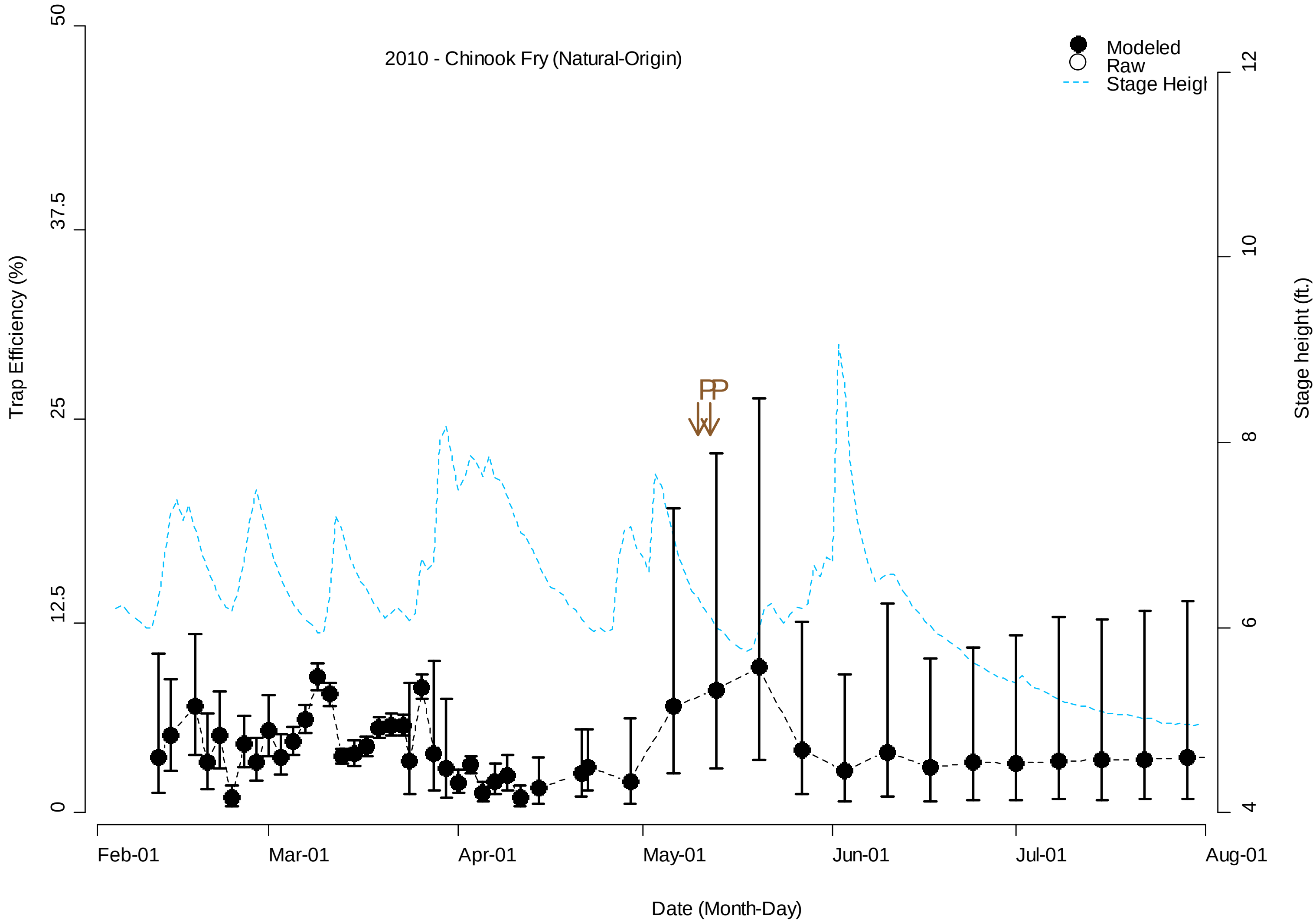

Figure D9. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin Chinook salmon (life-stage = fry; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2010.

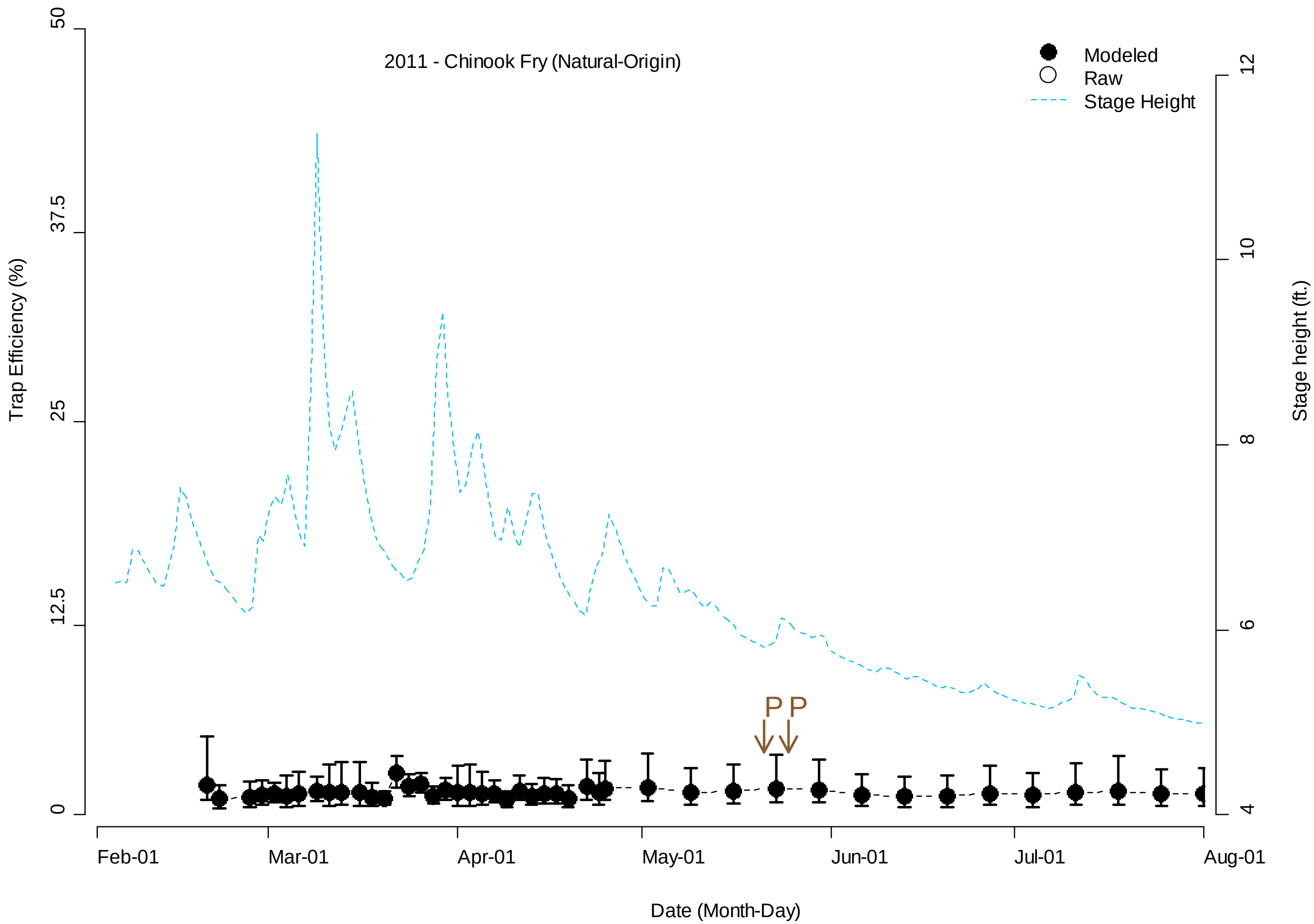

Figure D10. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin Chinook salmon (life-stage = fry; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2011.

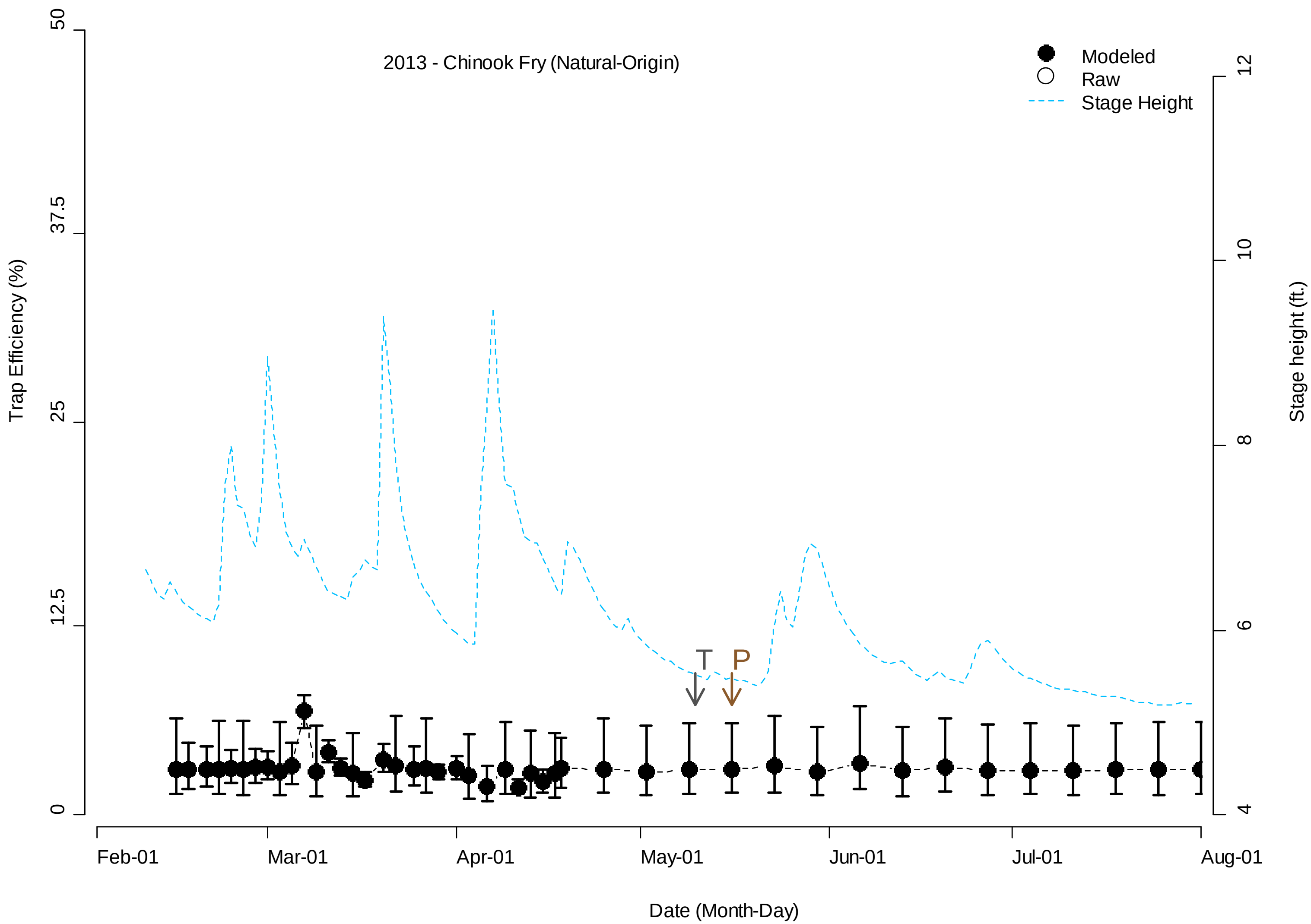

Figure D11. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin Chinook salmon (life-stage = fry; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2013.

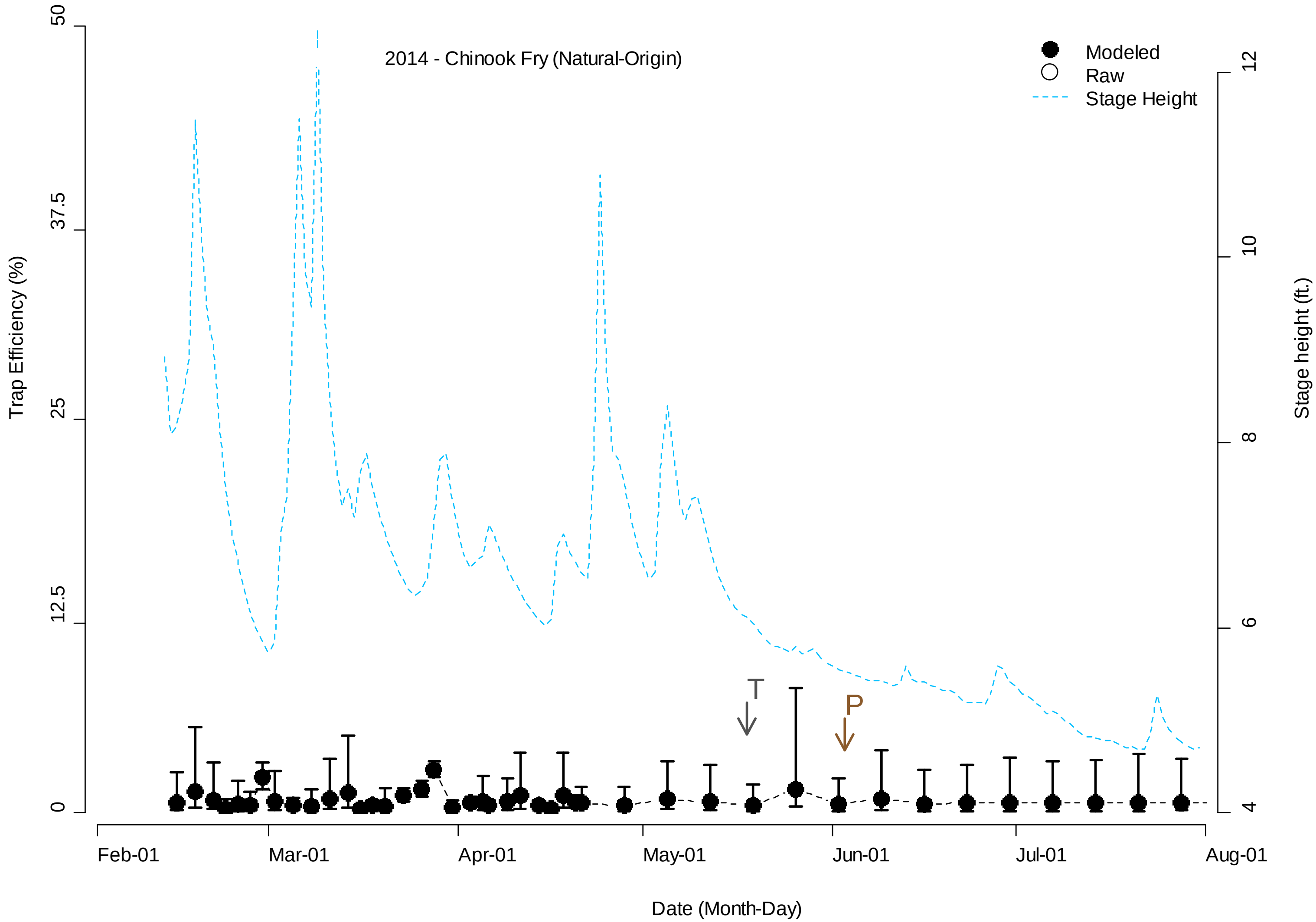

Figure D12. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin Chinook salmon (life-stage = fry; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2014.

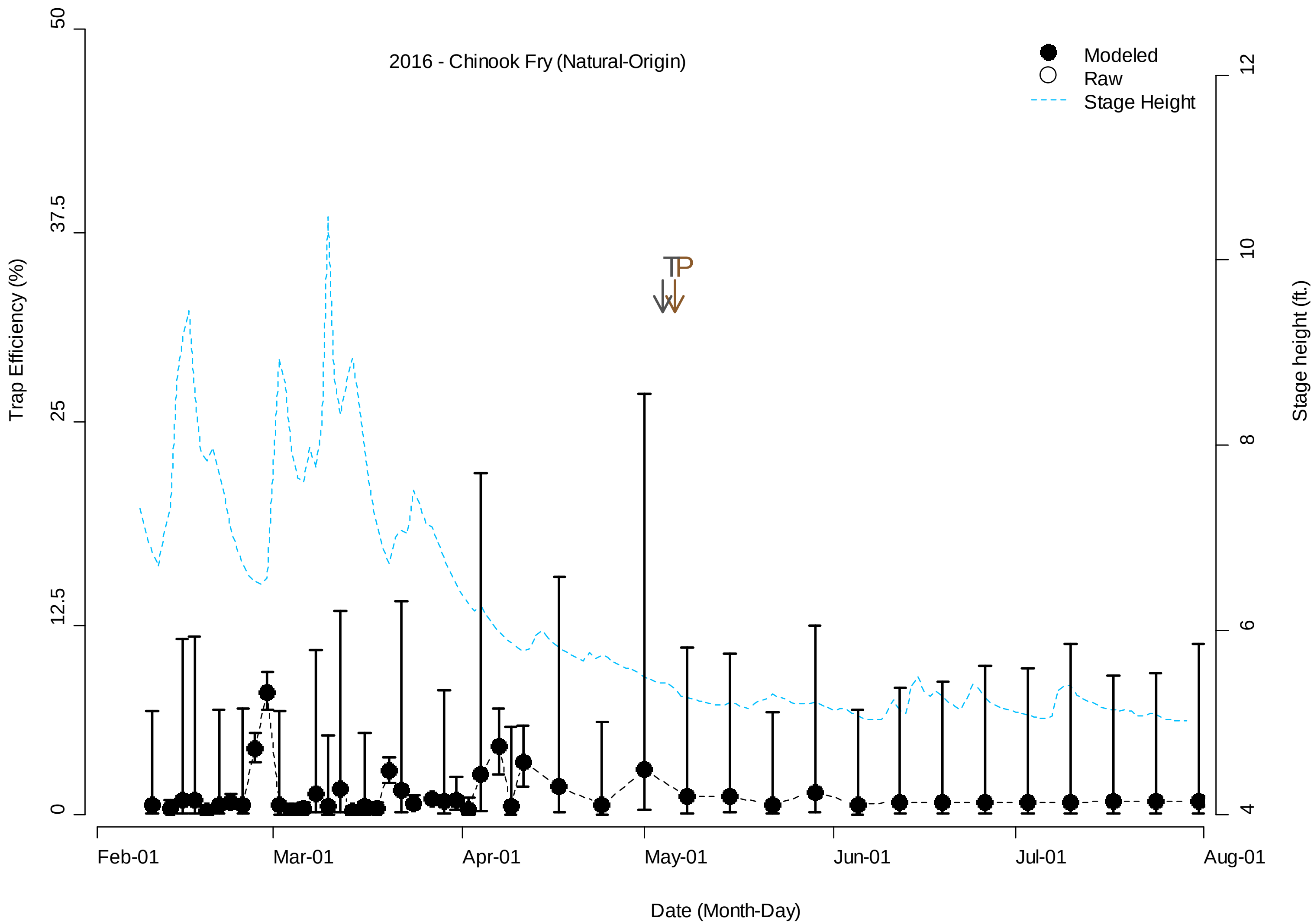

Figure D13. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin Chinook salmon (life-stage = fry; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2016.

Chinook salmon (Natural-Origin, Parr/Transitional/Smolt, Sub-Yearling)

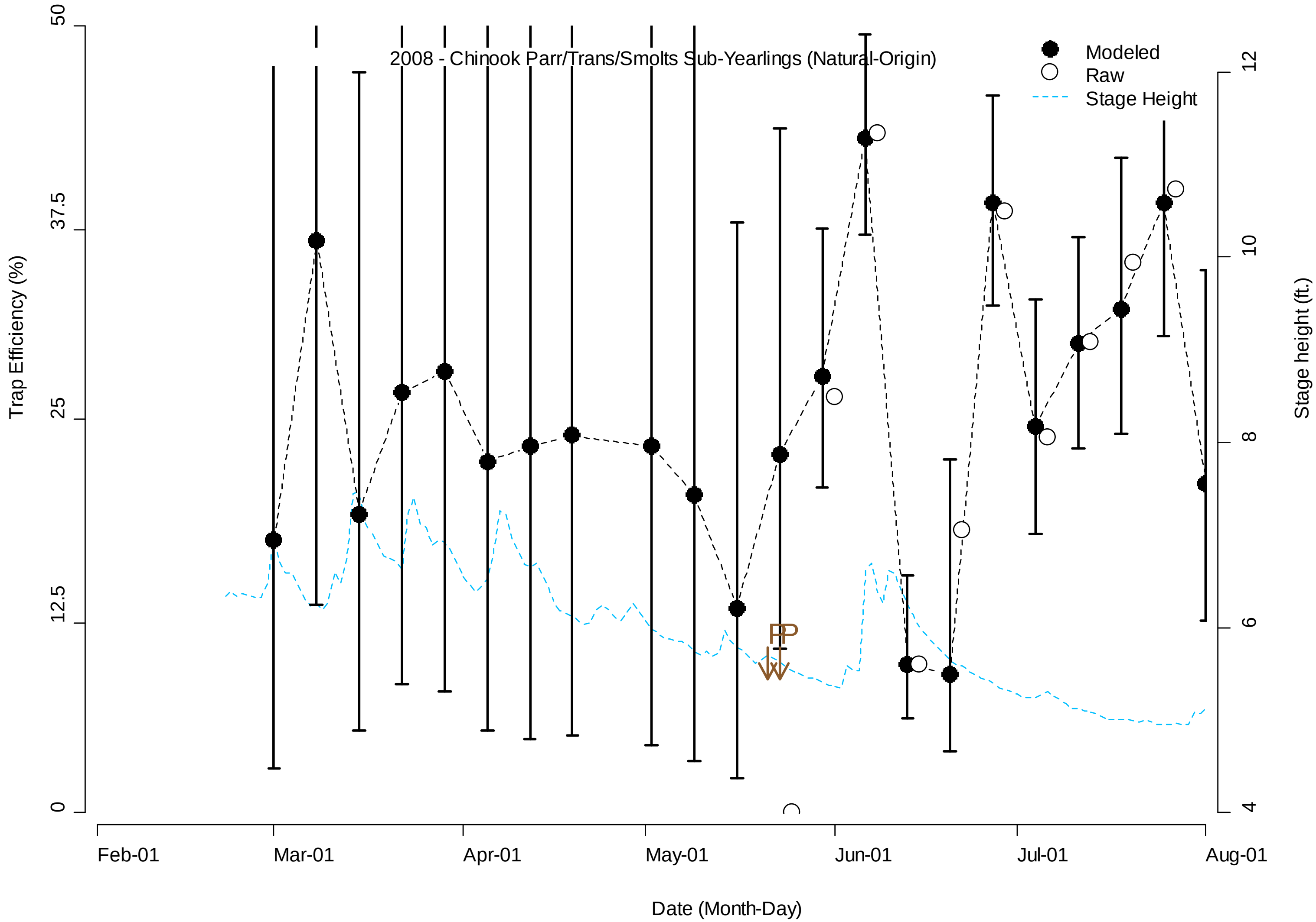

Figure D14. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2008.

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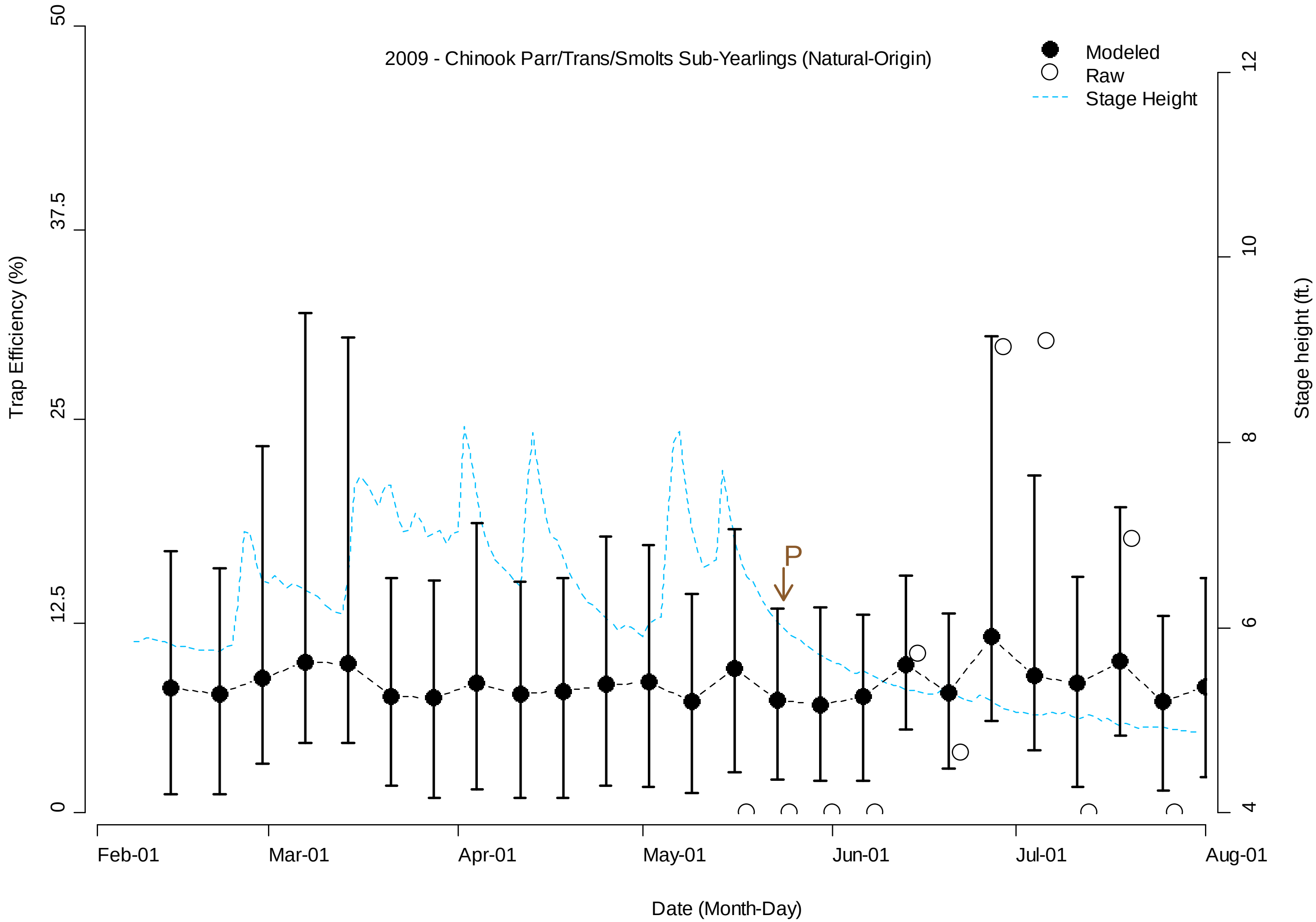

Figure D15. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2009.

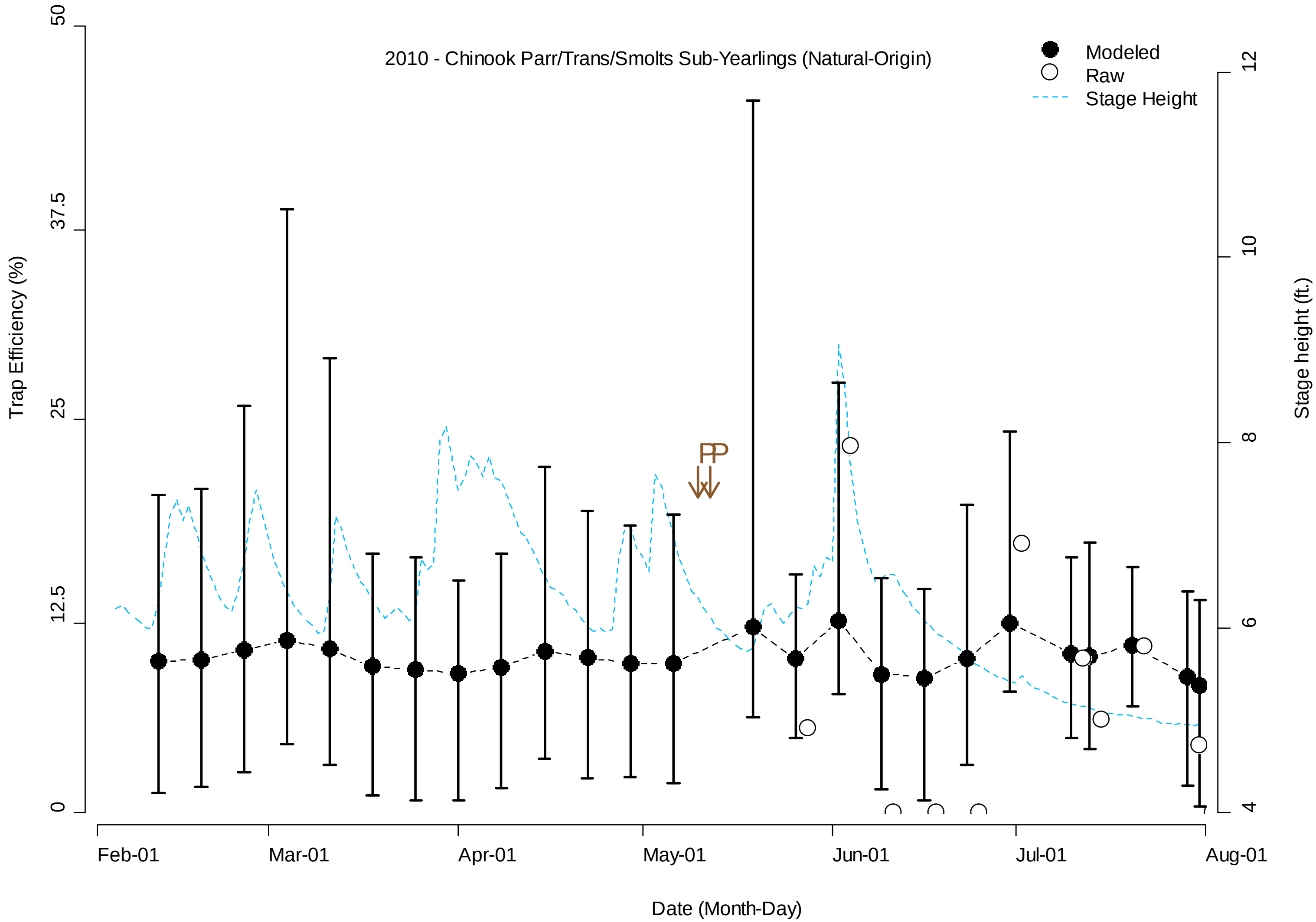

Figure D16. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2010.

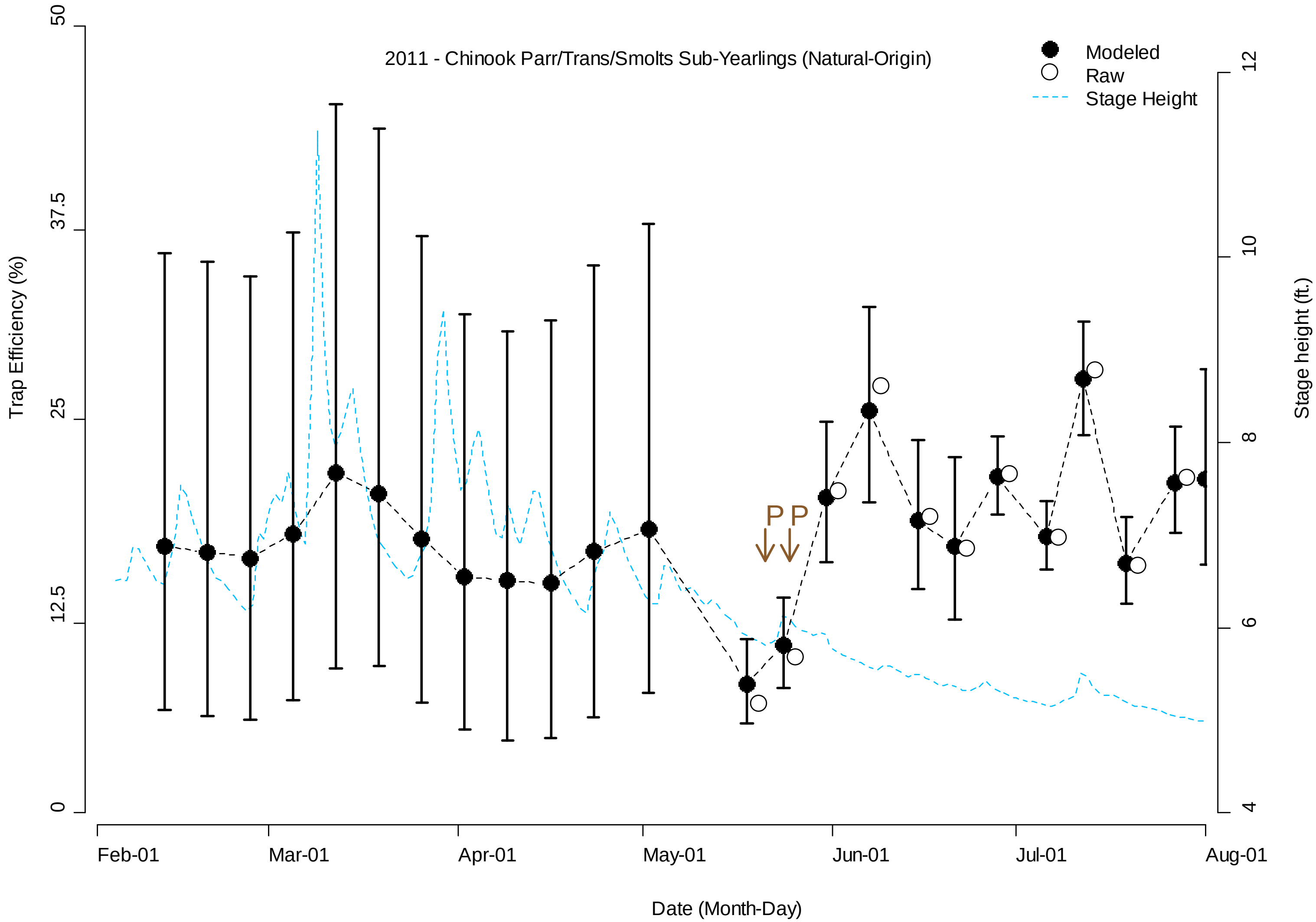

Figure D17. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2011.

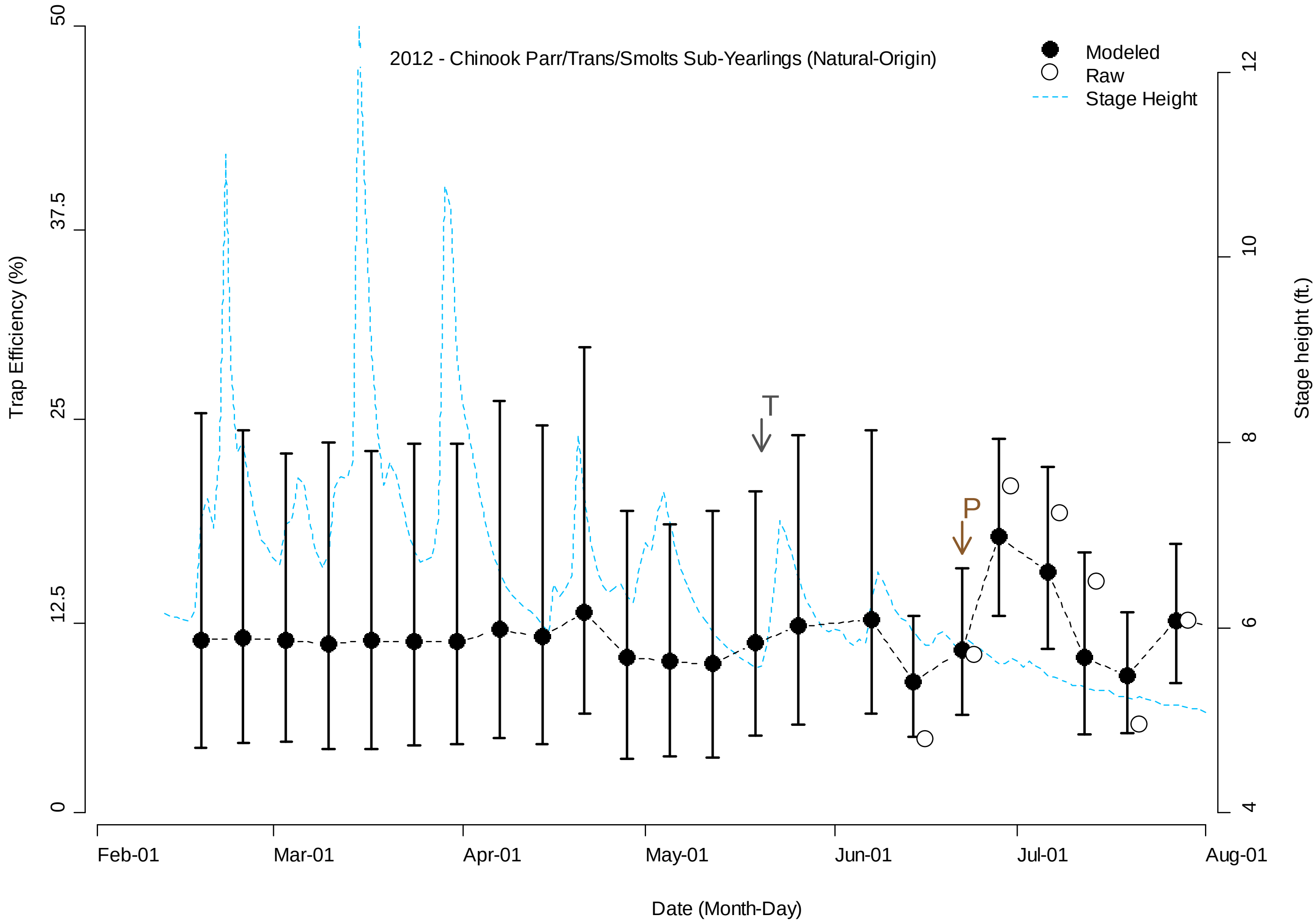

Figure D18. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2012.

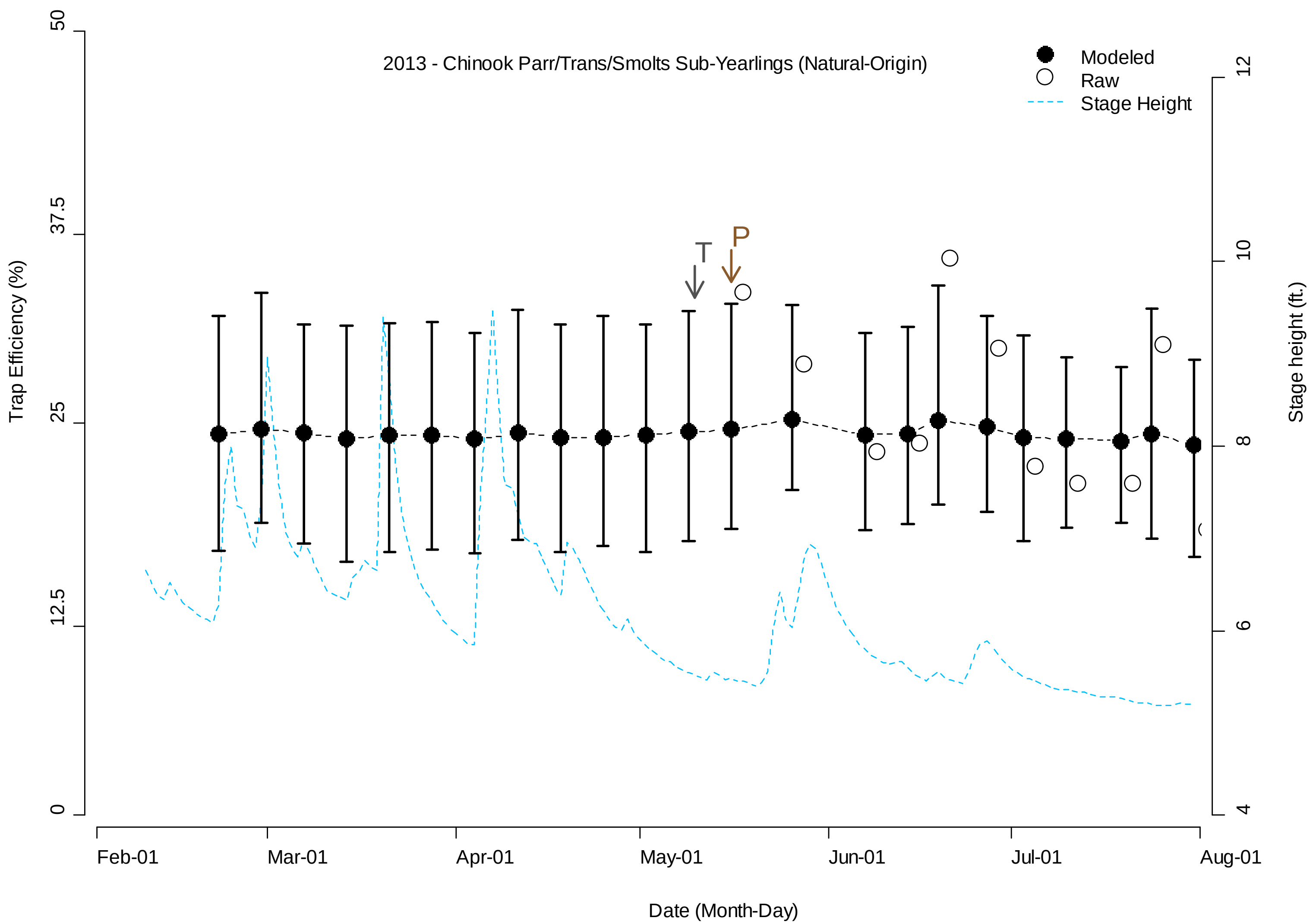

Figure D19. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2013.

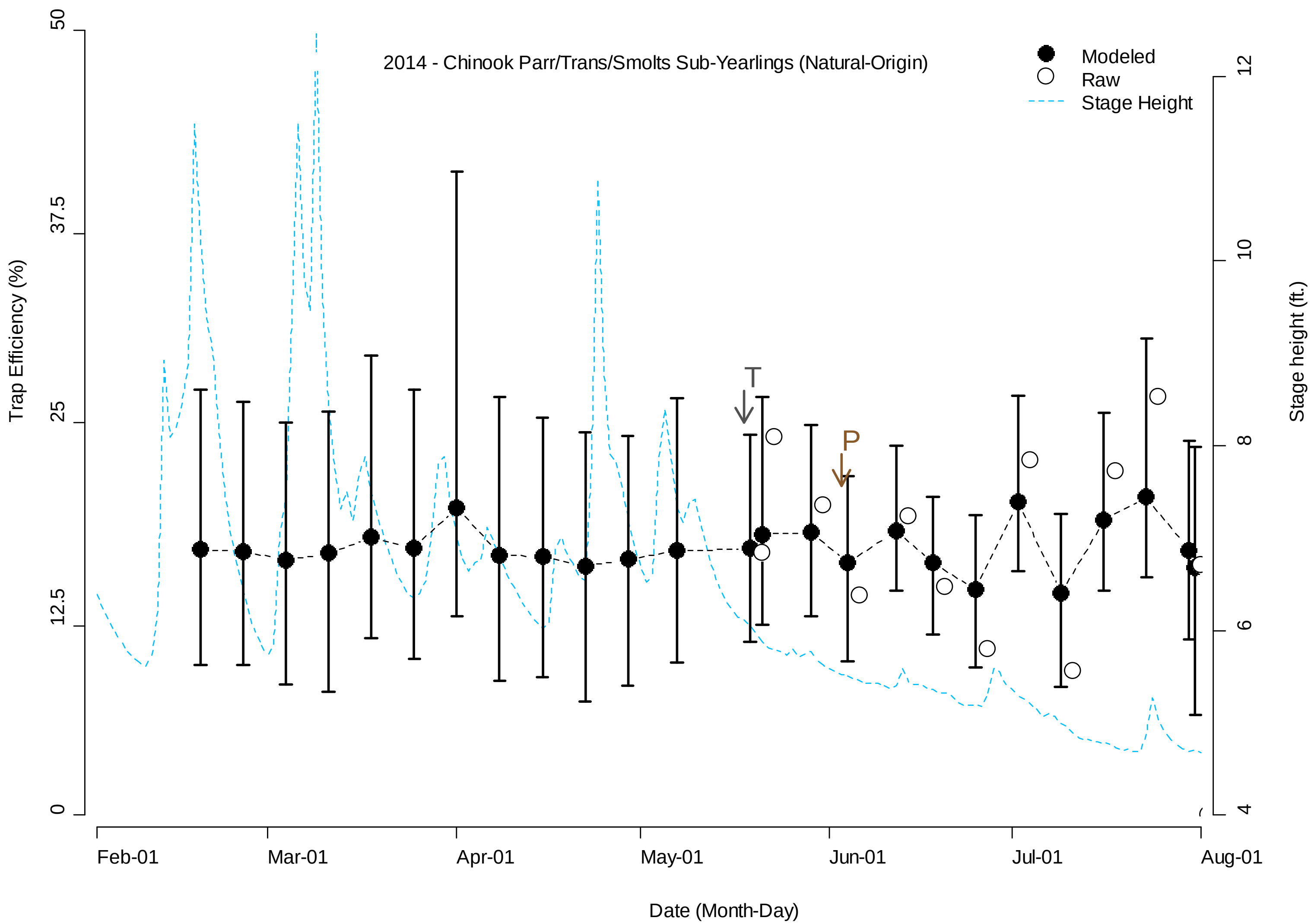

Figure D20. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2014.

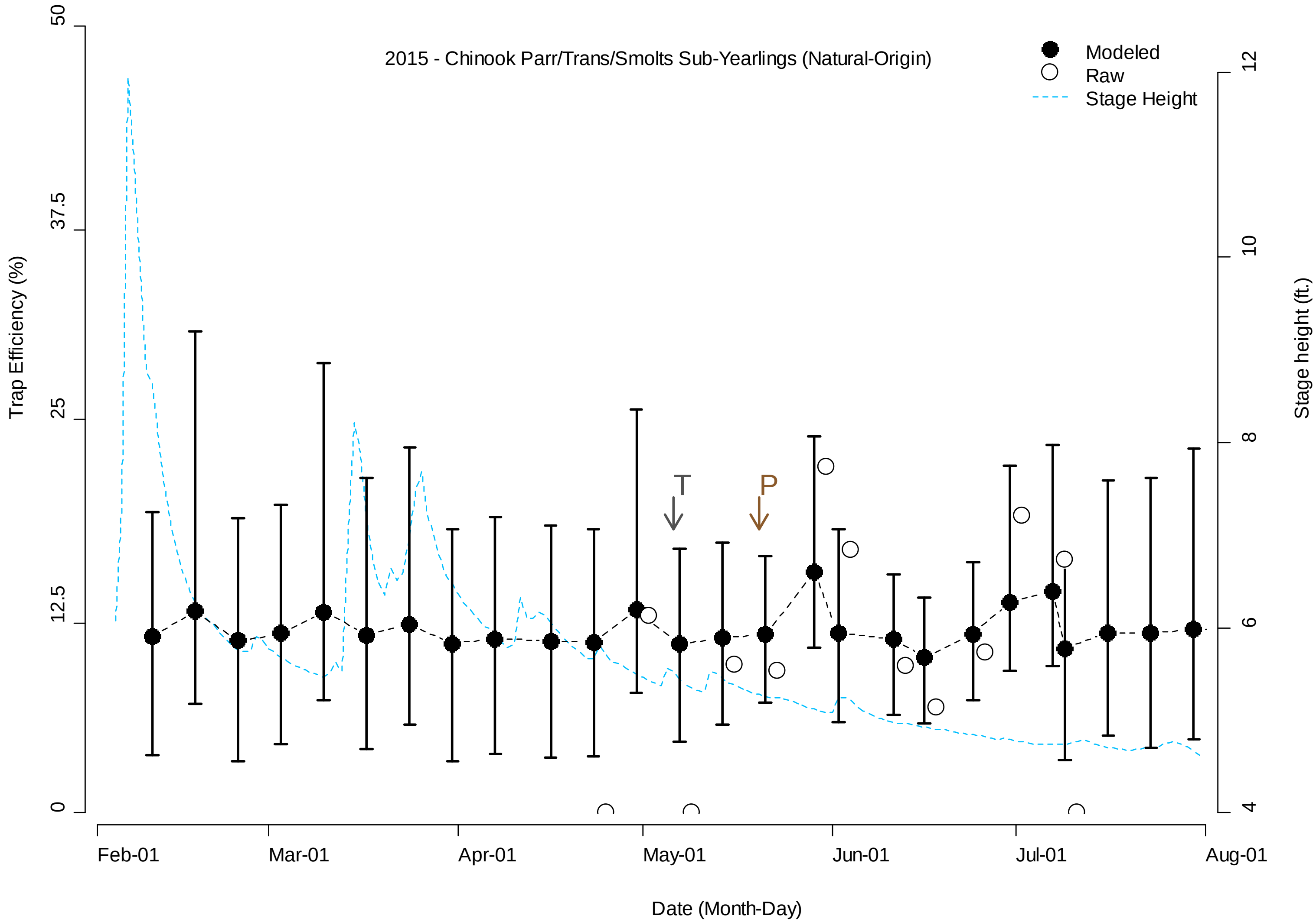

Figure D21. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2015.

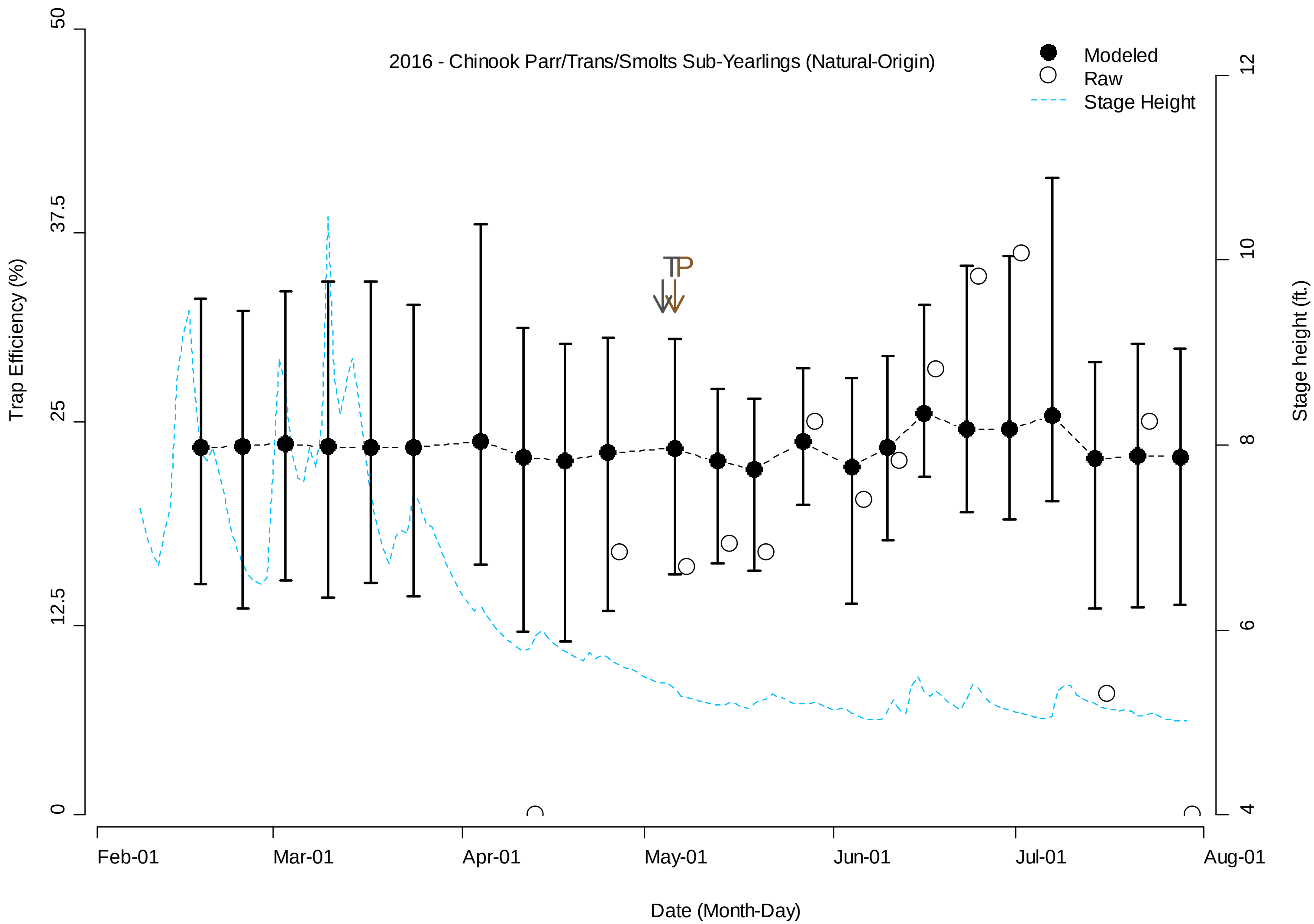

Figure D22. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2016.

Chinook salmon (Hatchery-Origin, Parr/Transitional/Smolt, Sub-Yearling)

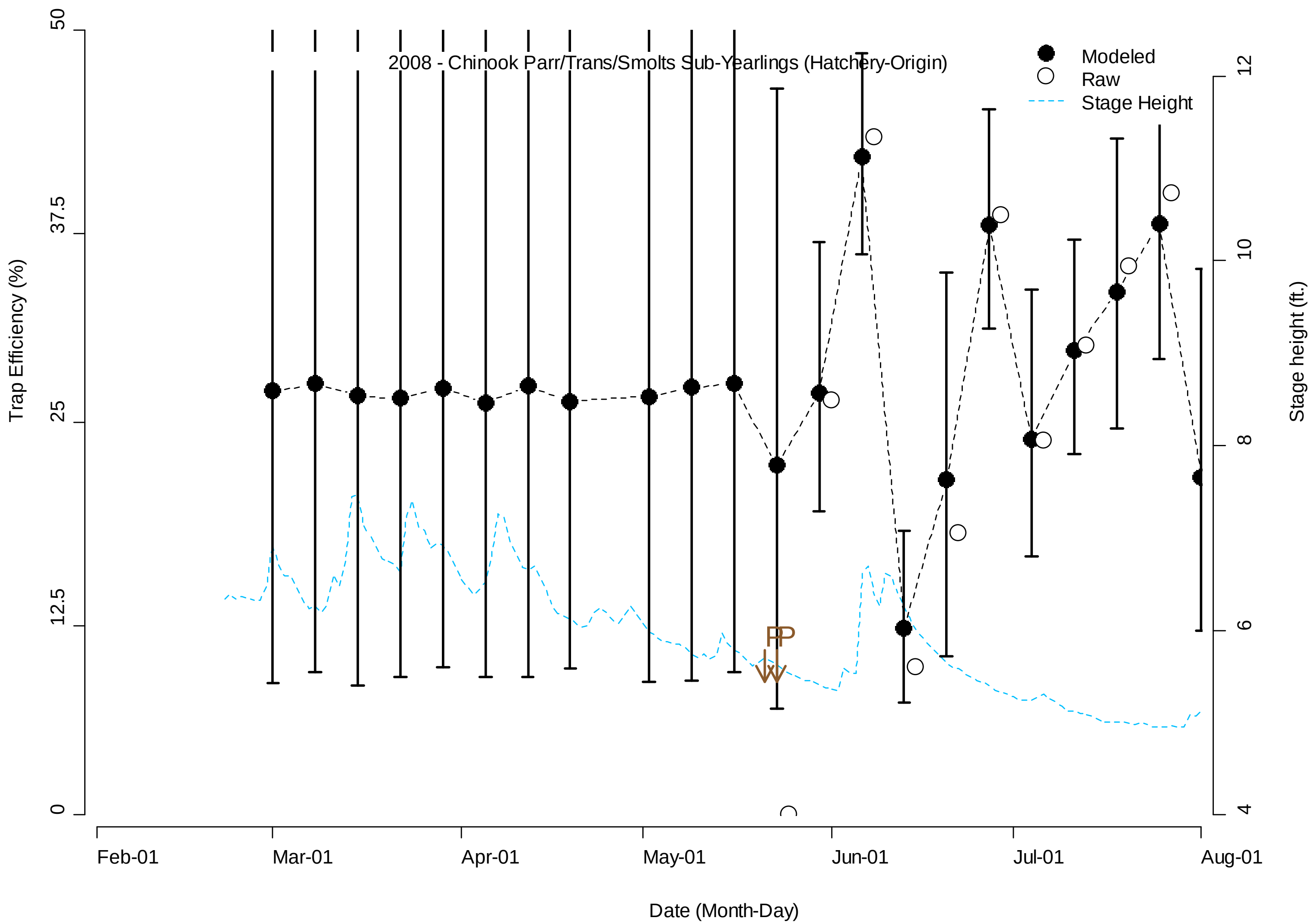

Figure D23. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2008.

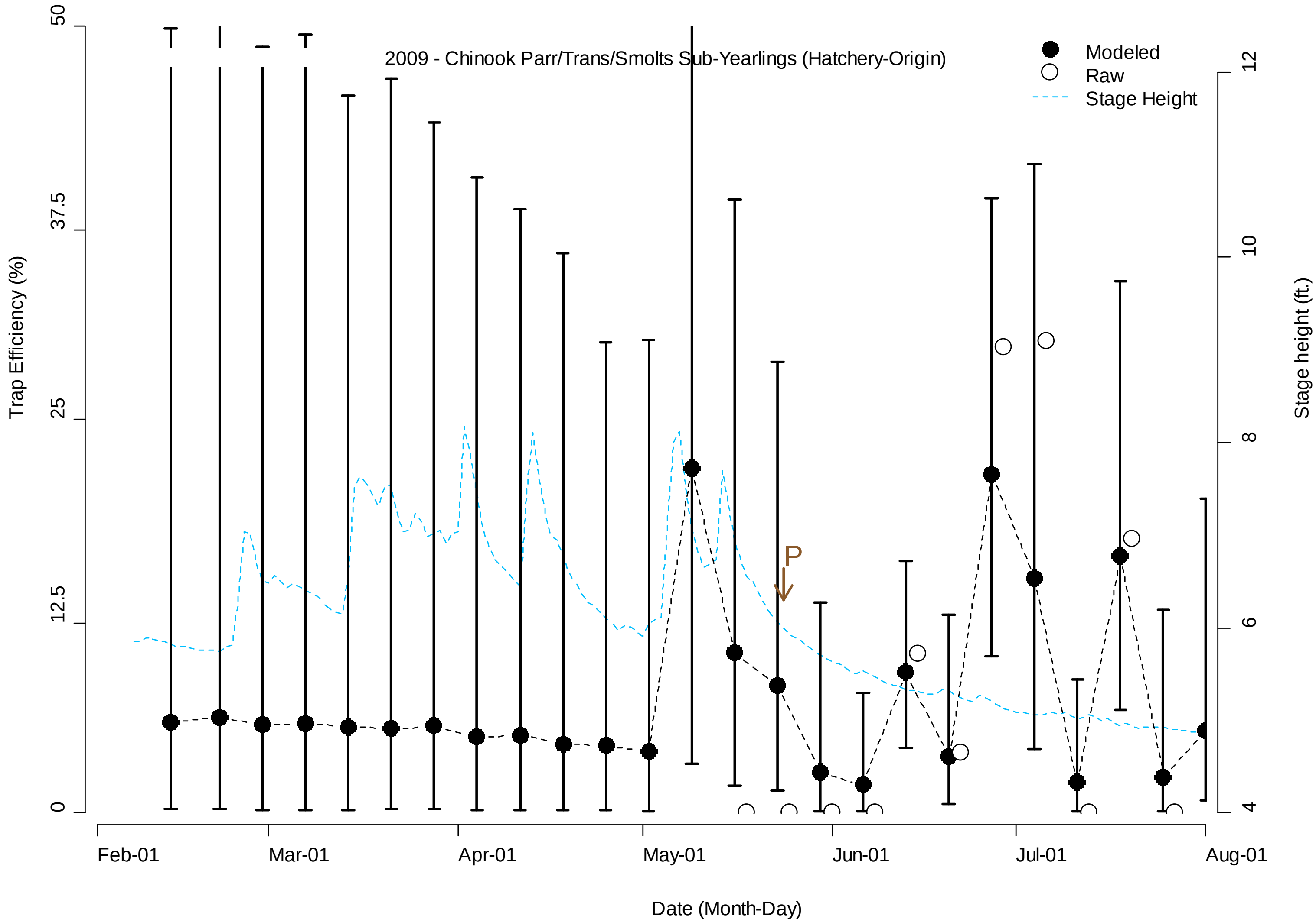

Figure D24. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2009.

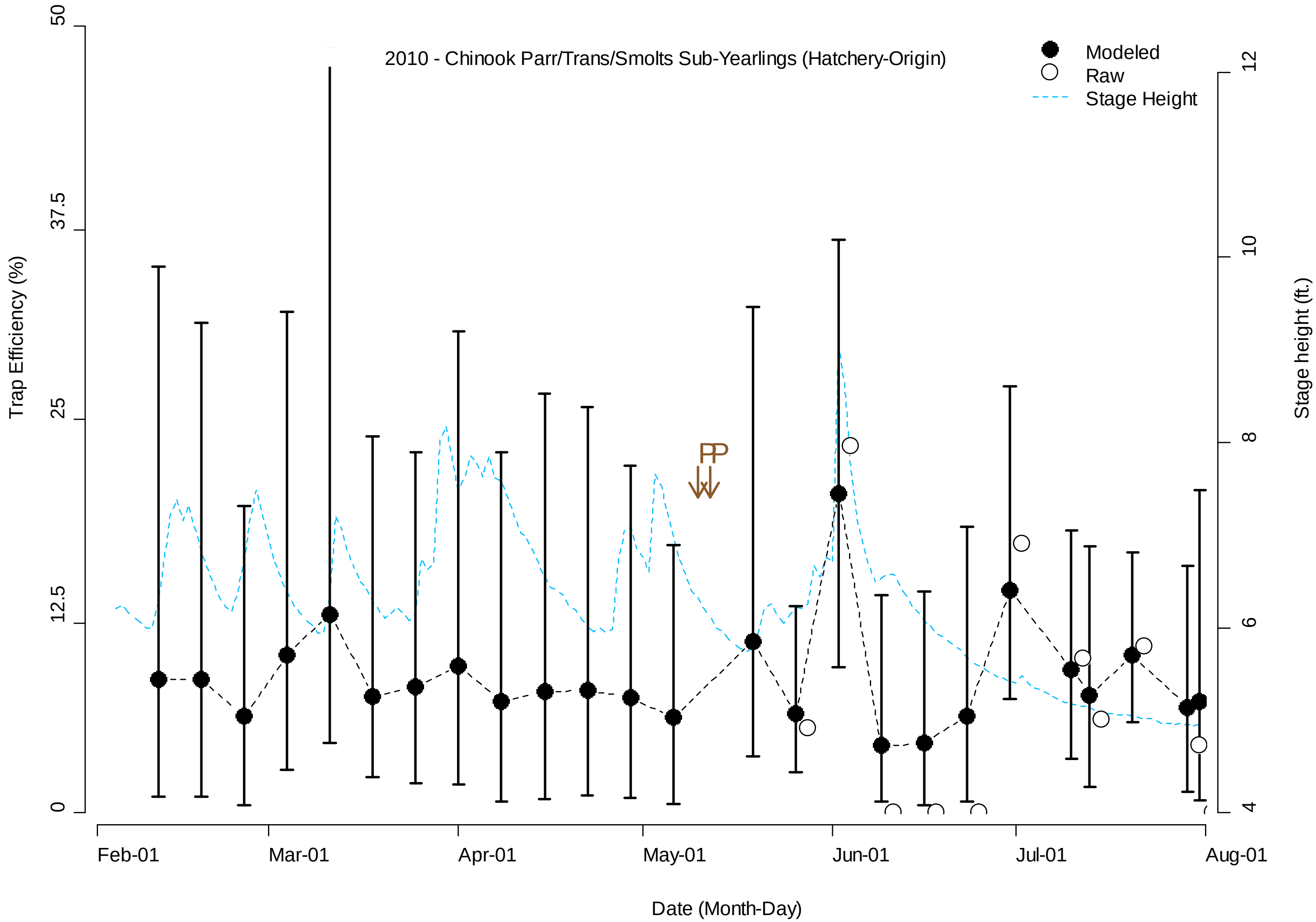

Figure D25. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2010.

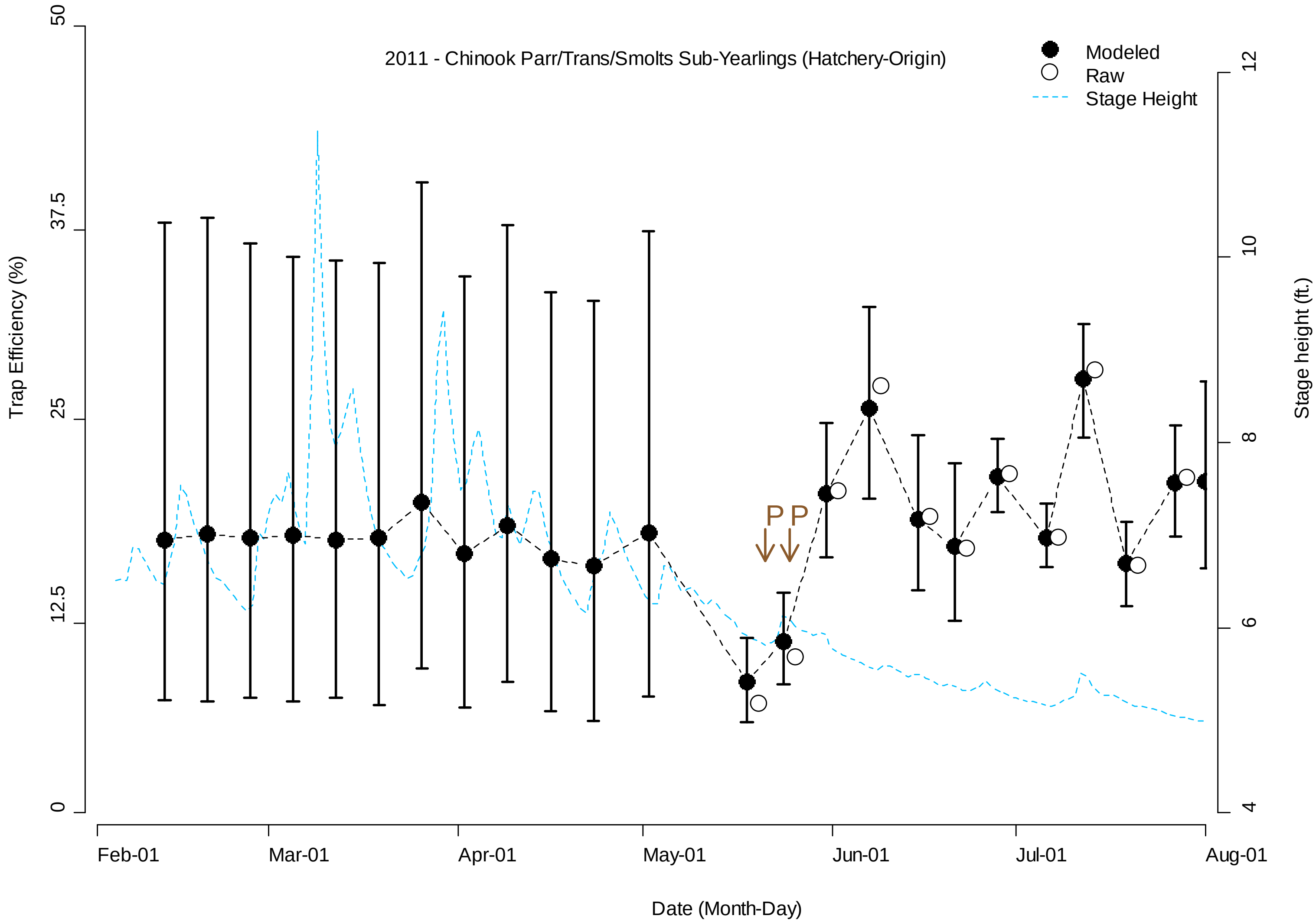

Figure D26. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2011.

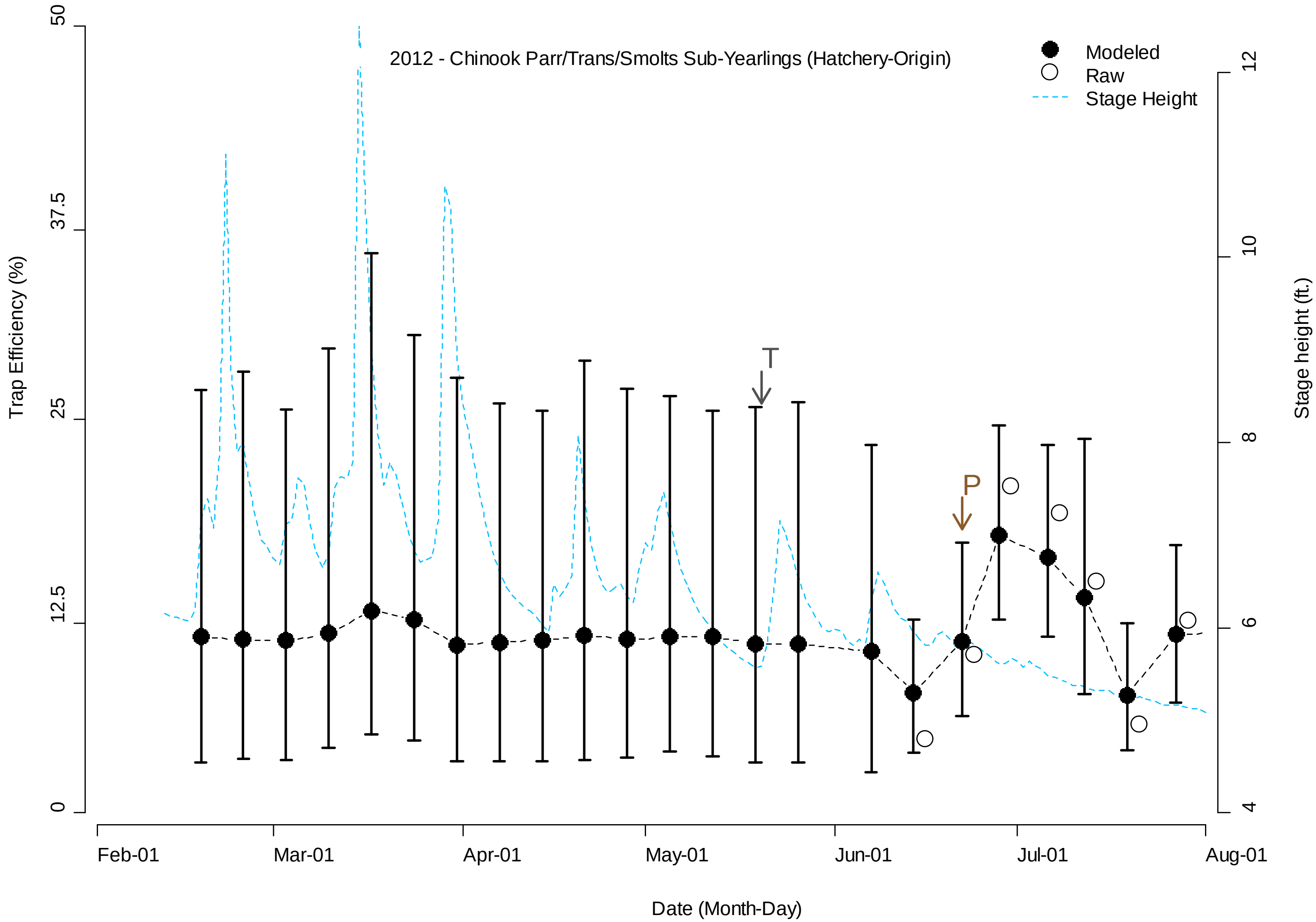

Figure D27. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2012.

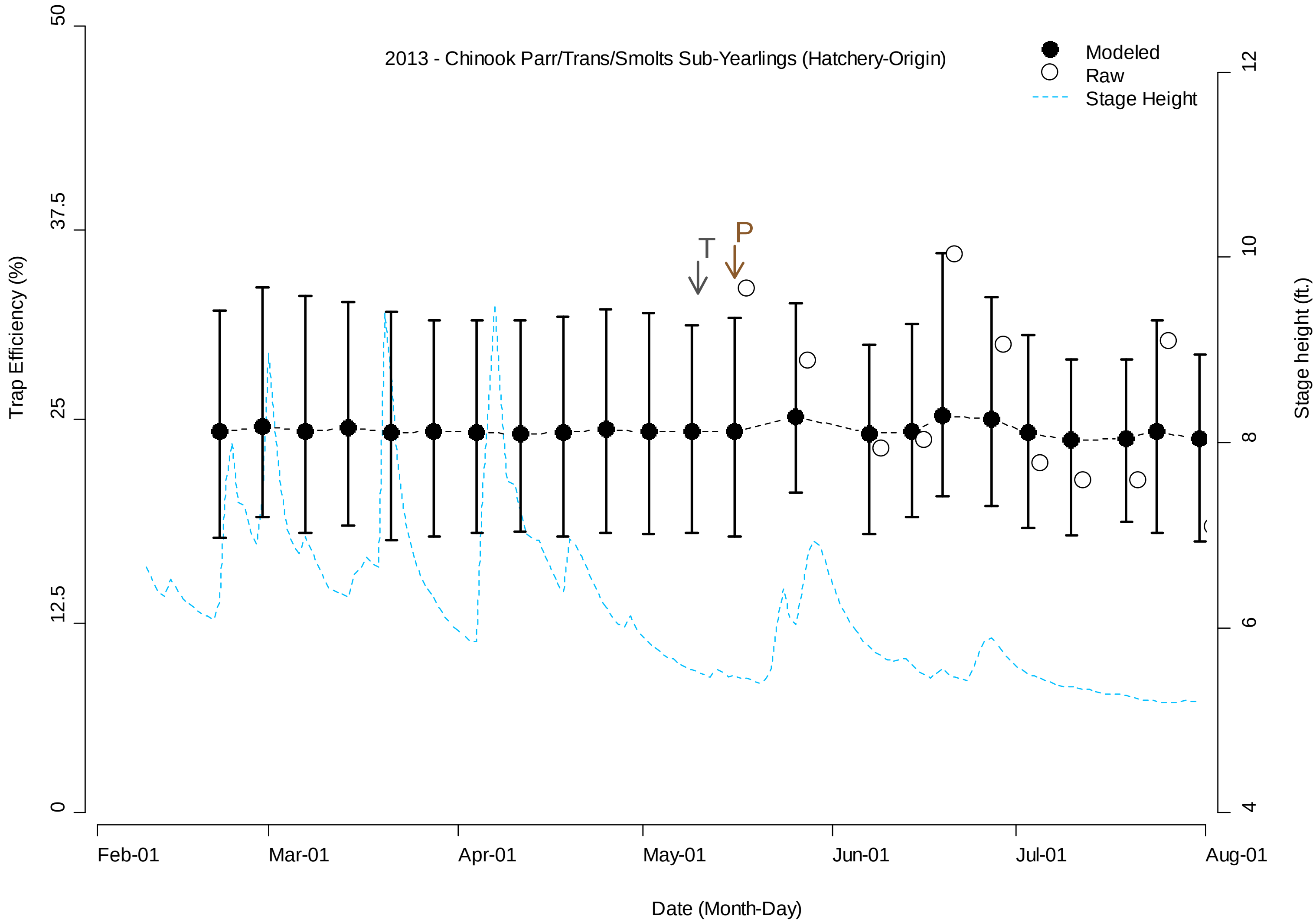

Figure D28. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2013.

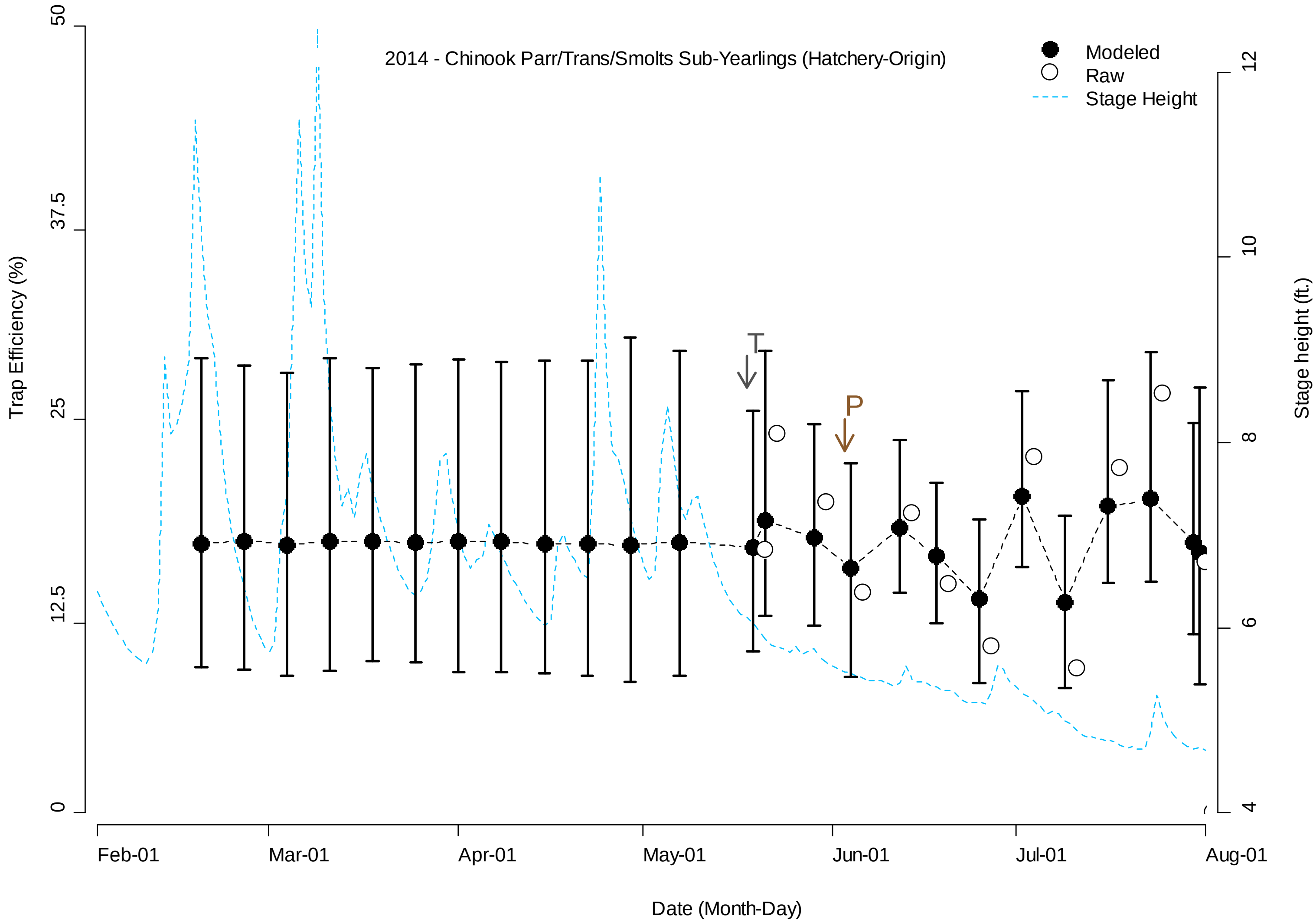

Figure D29. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2014.

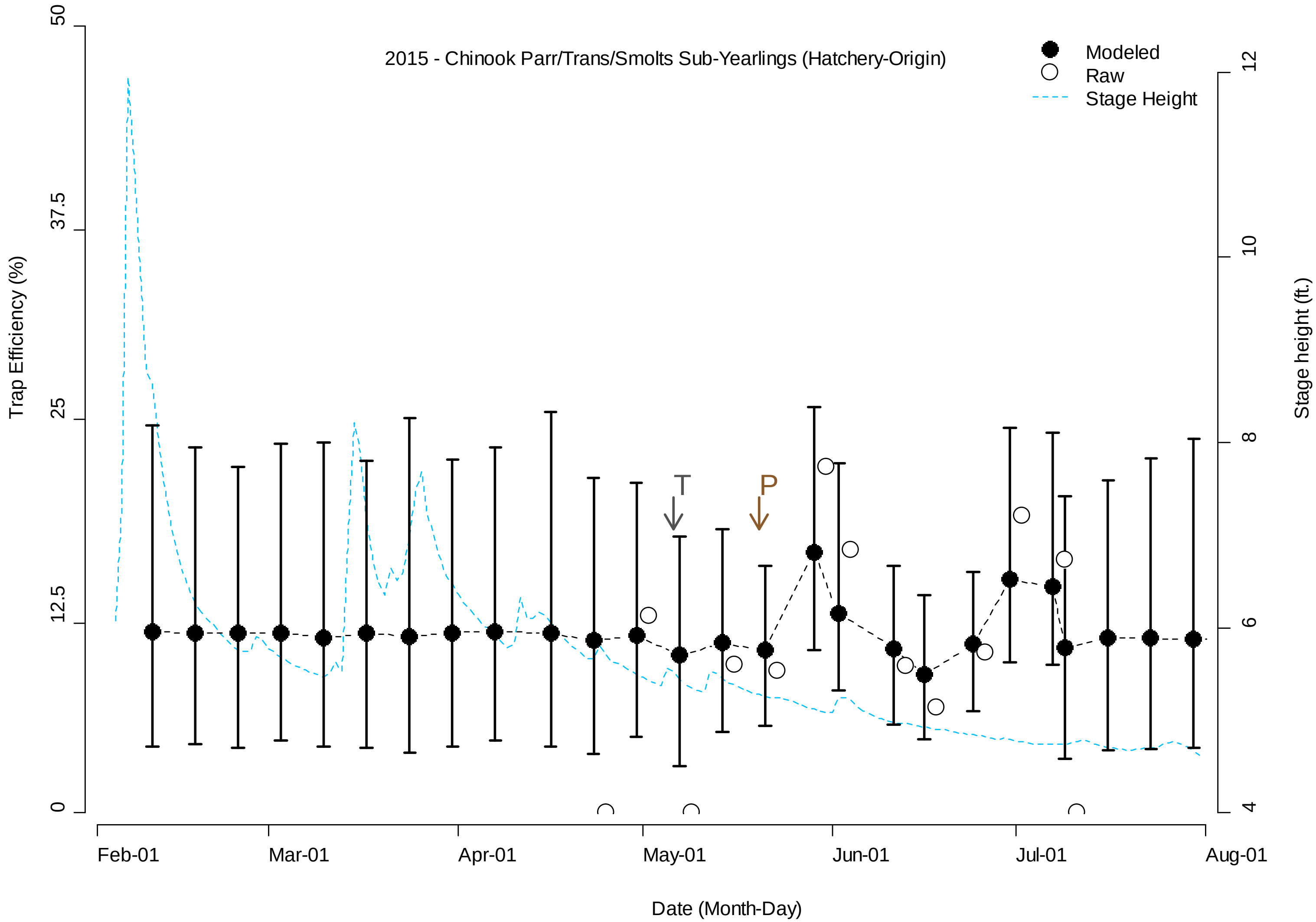

Figure D30. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2015.

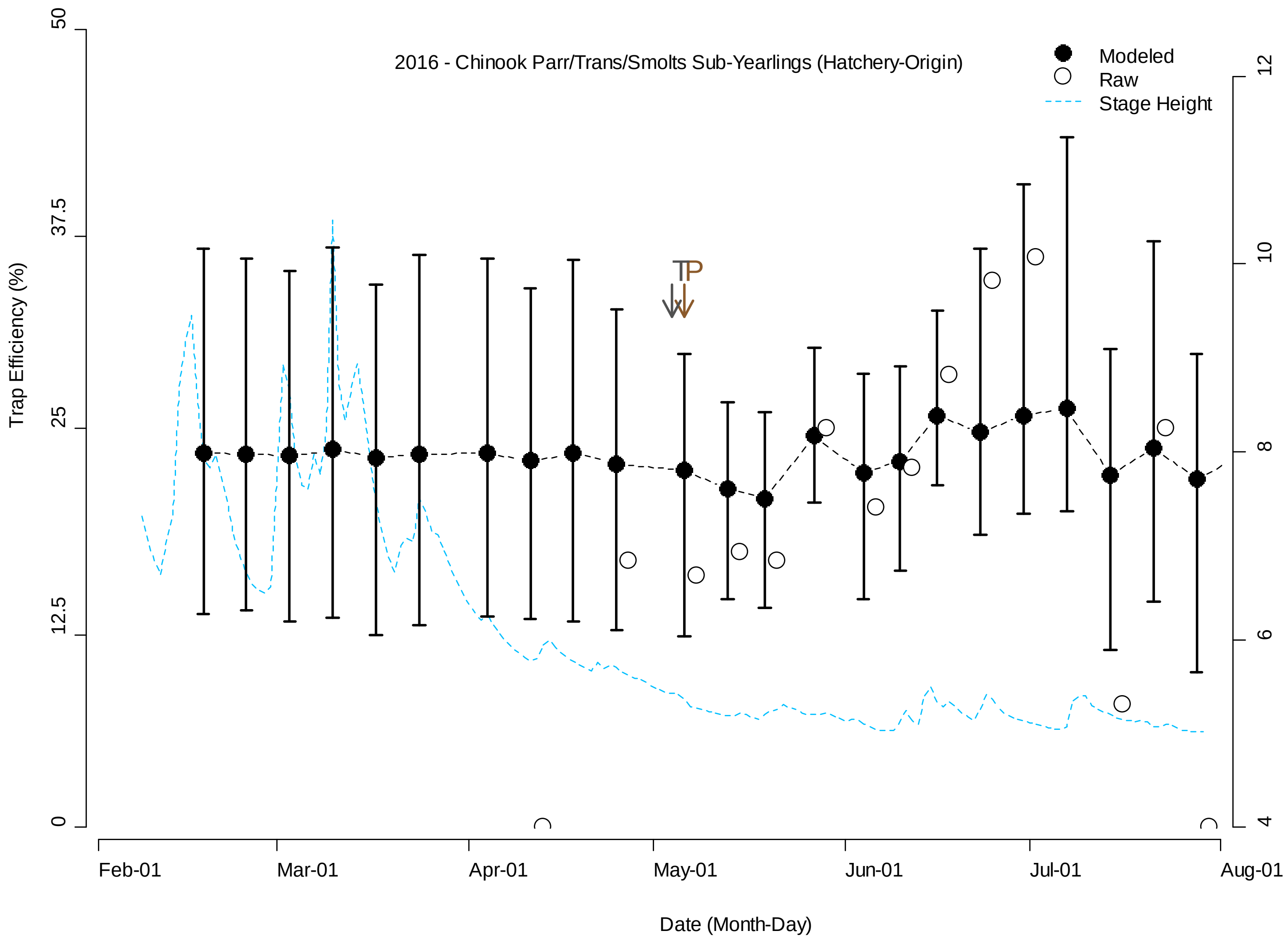

Figure D31. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2016.

Coho salmon (Natural-Origin, Transitional/Smolt, Sub-Yearling)

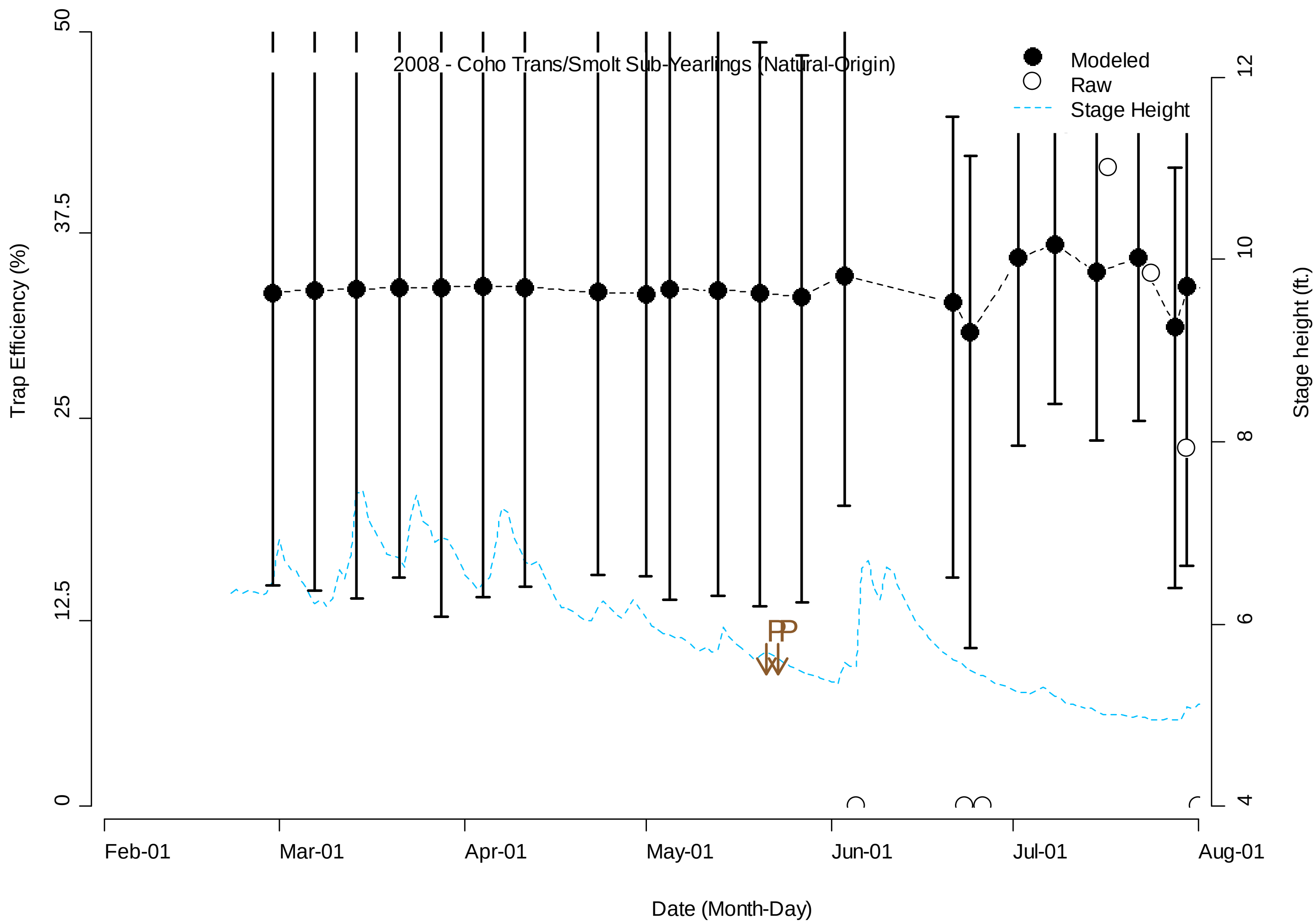

Figure D32. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2008.

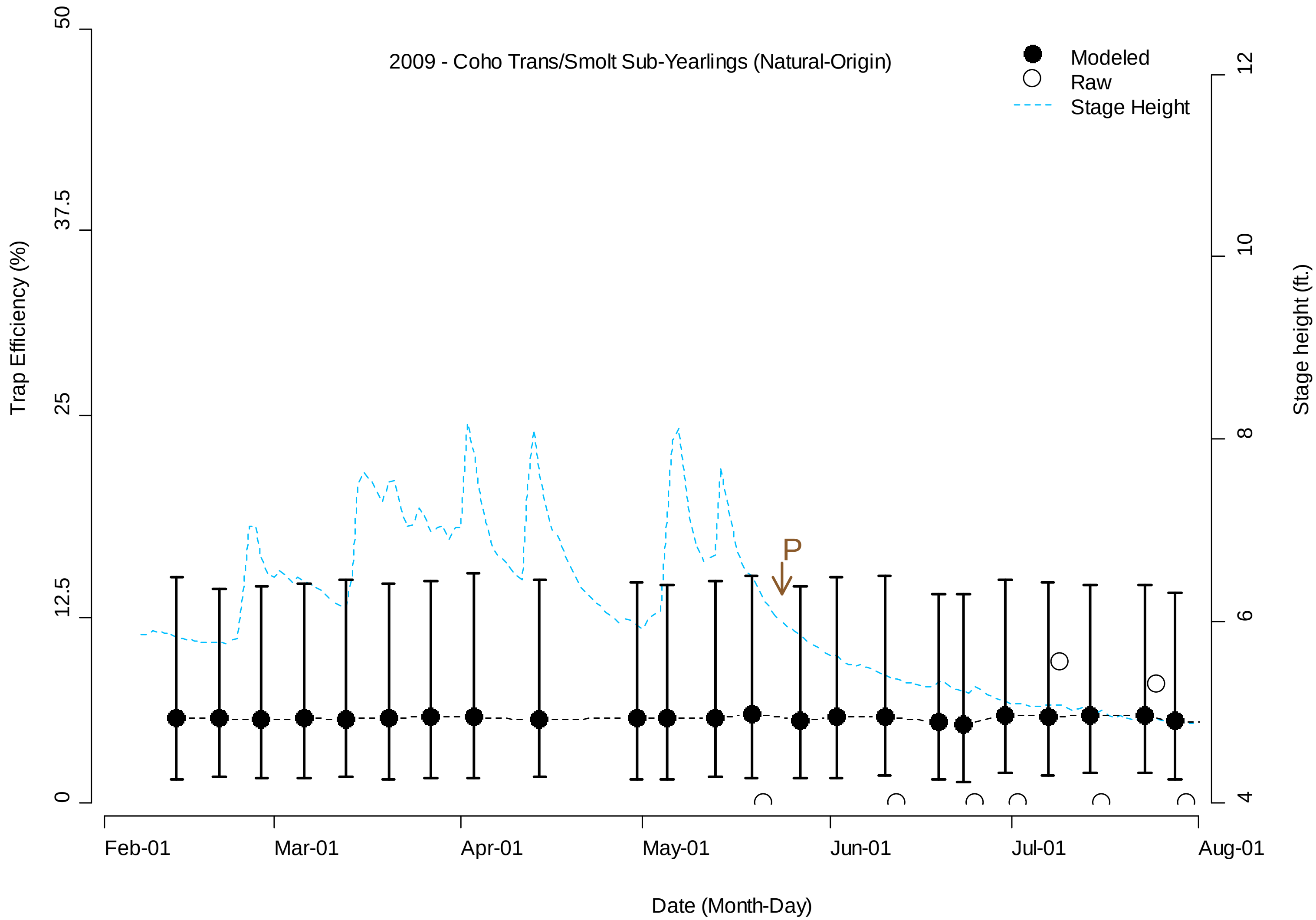

Figure D33. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2009.

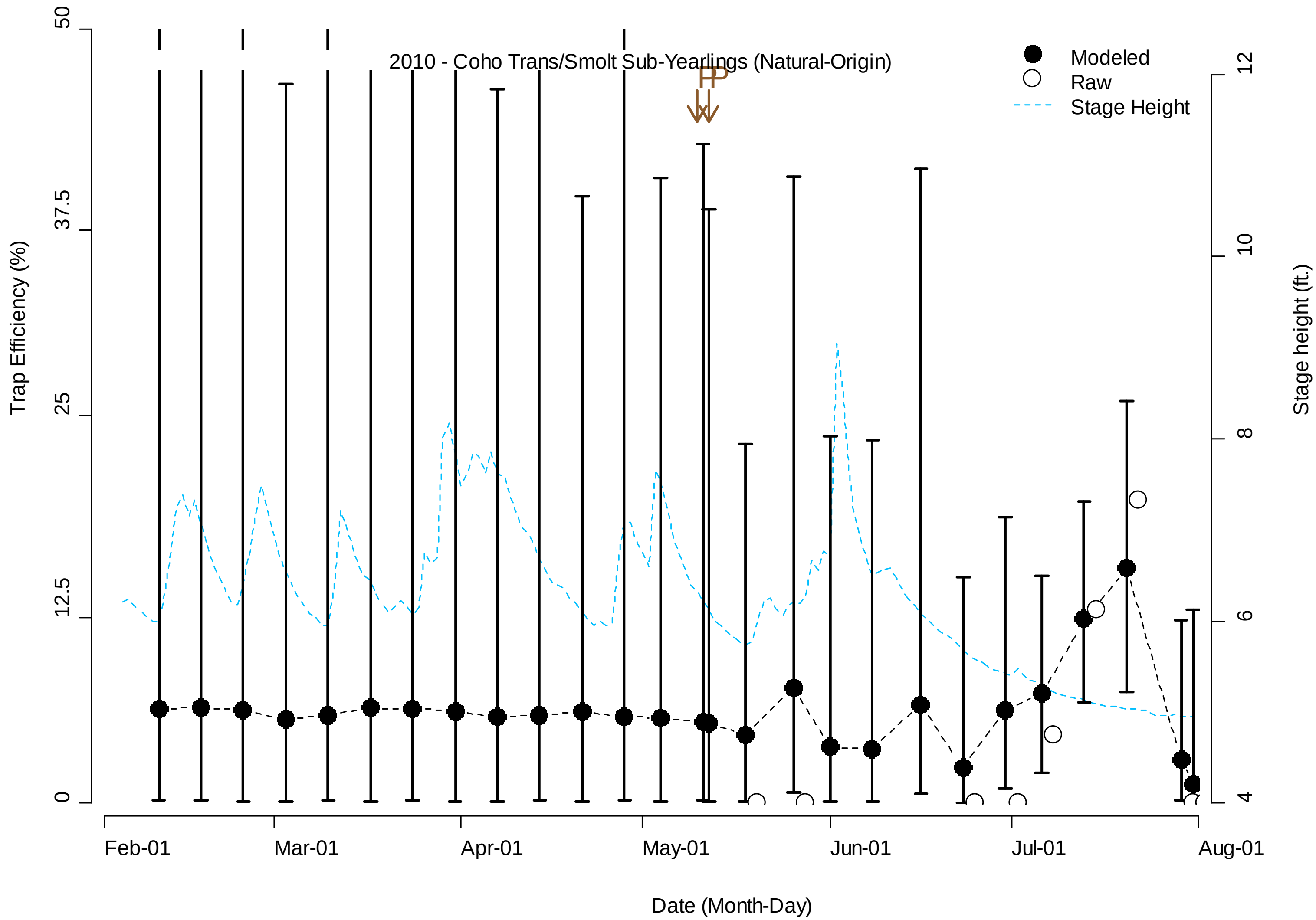

Figure D34. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2010.

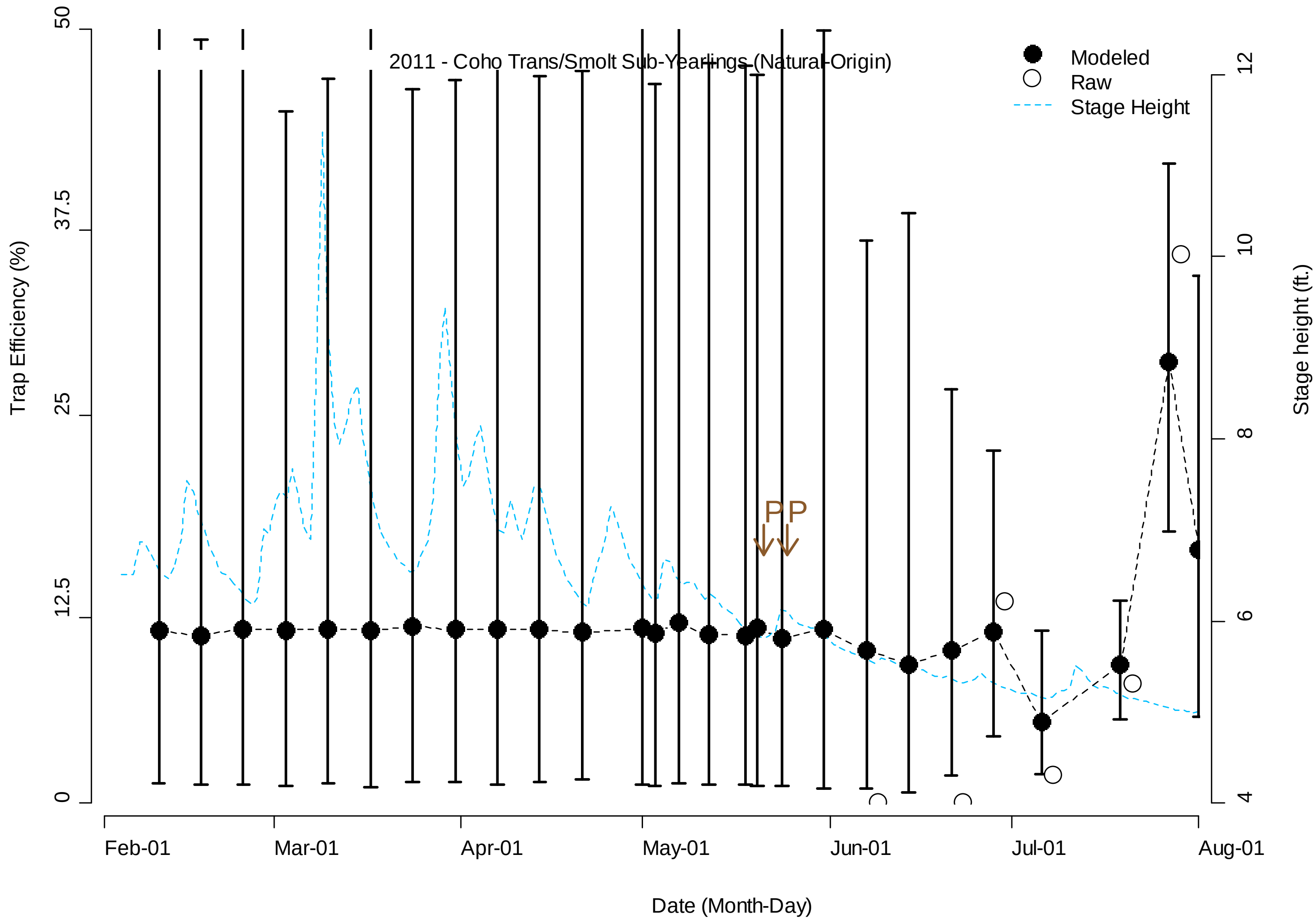

Figure D35. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2011.

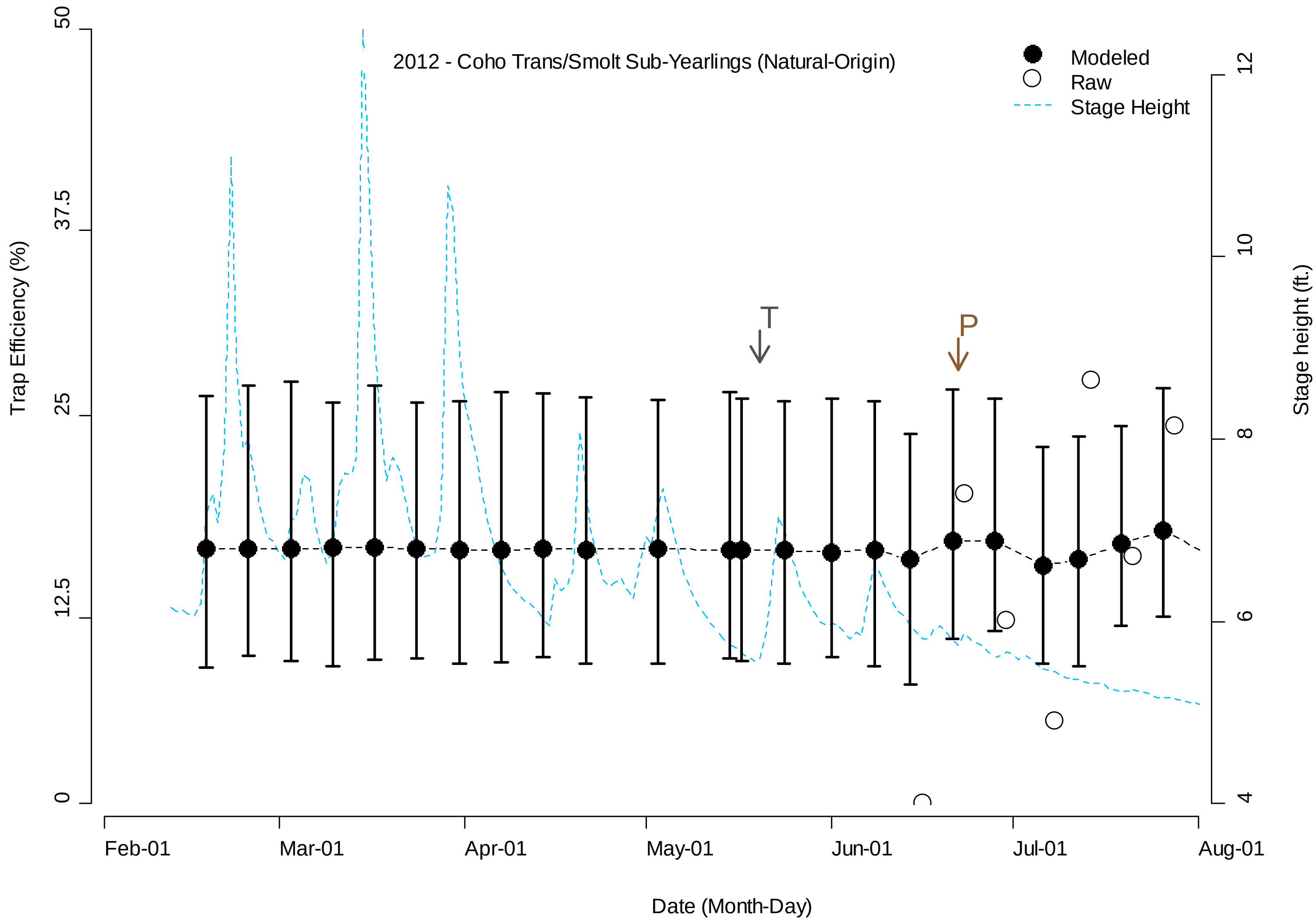

Figure D36. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2012.

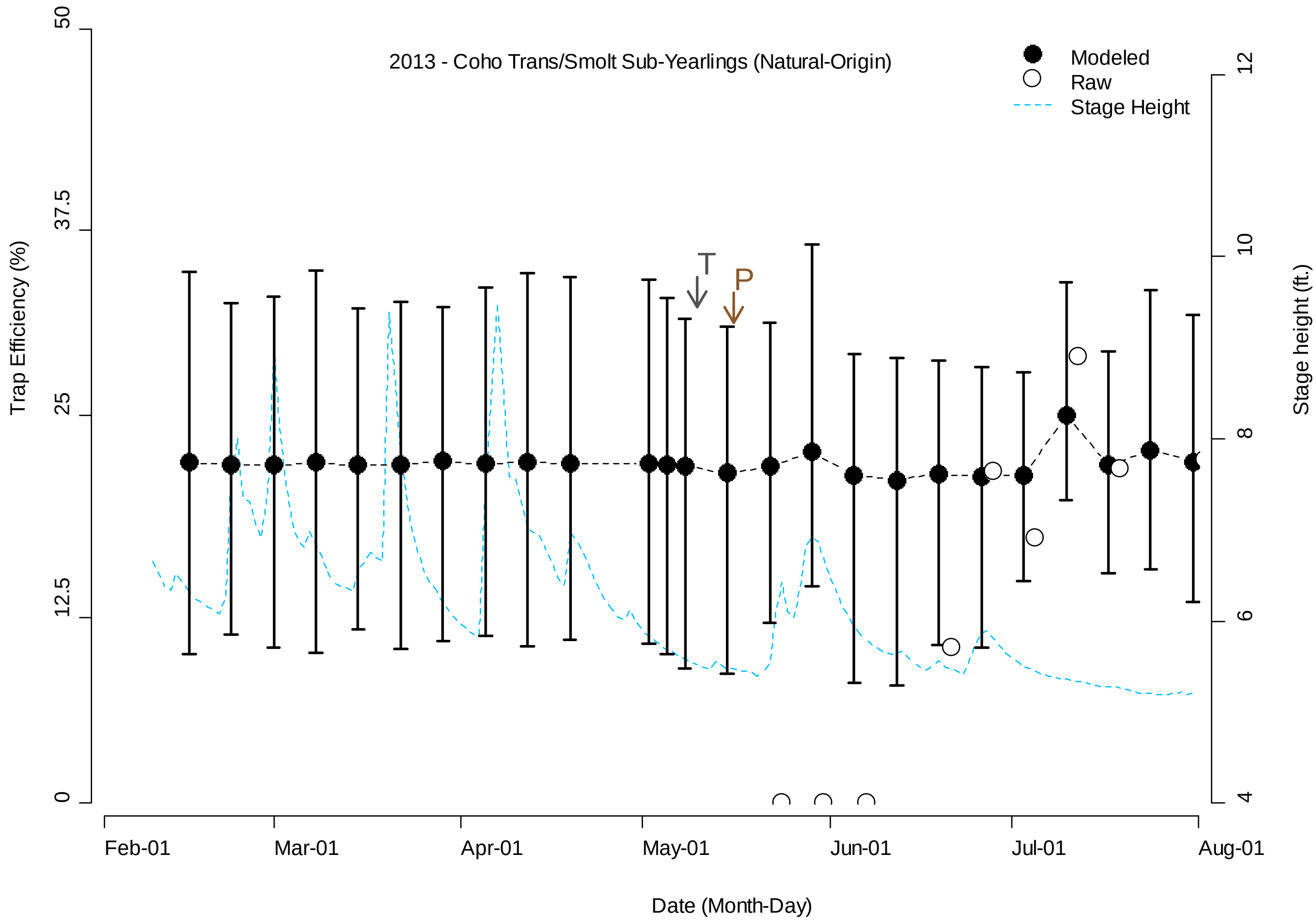

Figure D37. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2013.

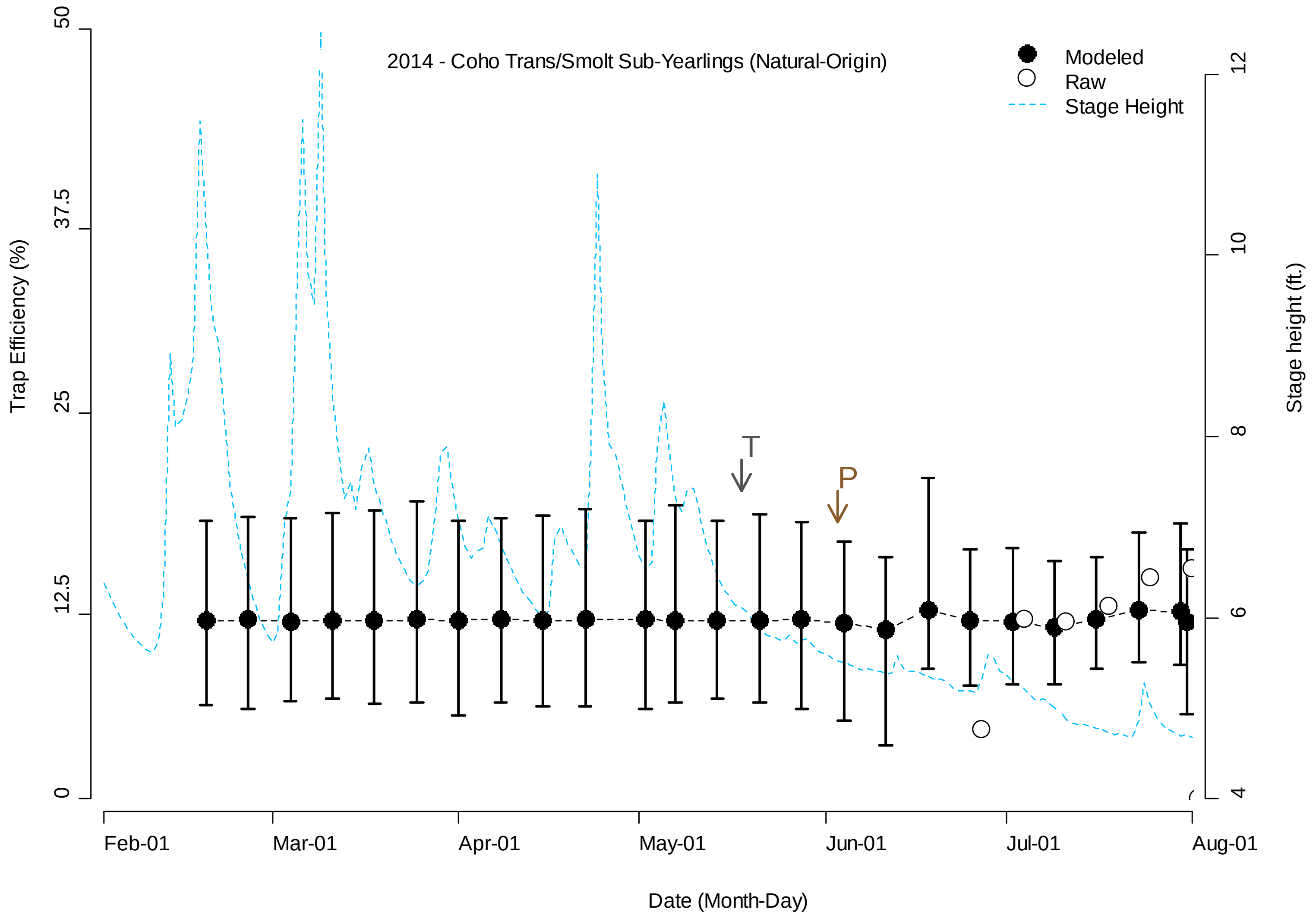

Figure D38. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2014.

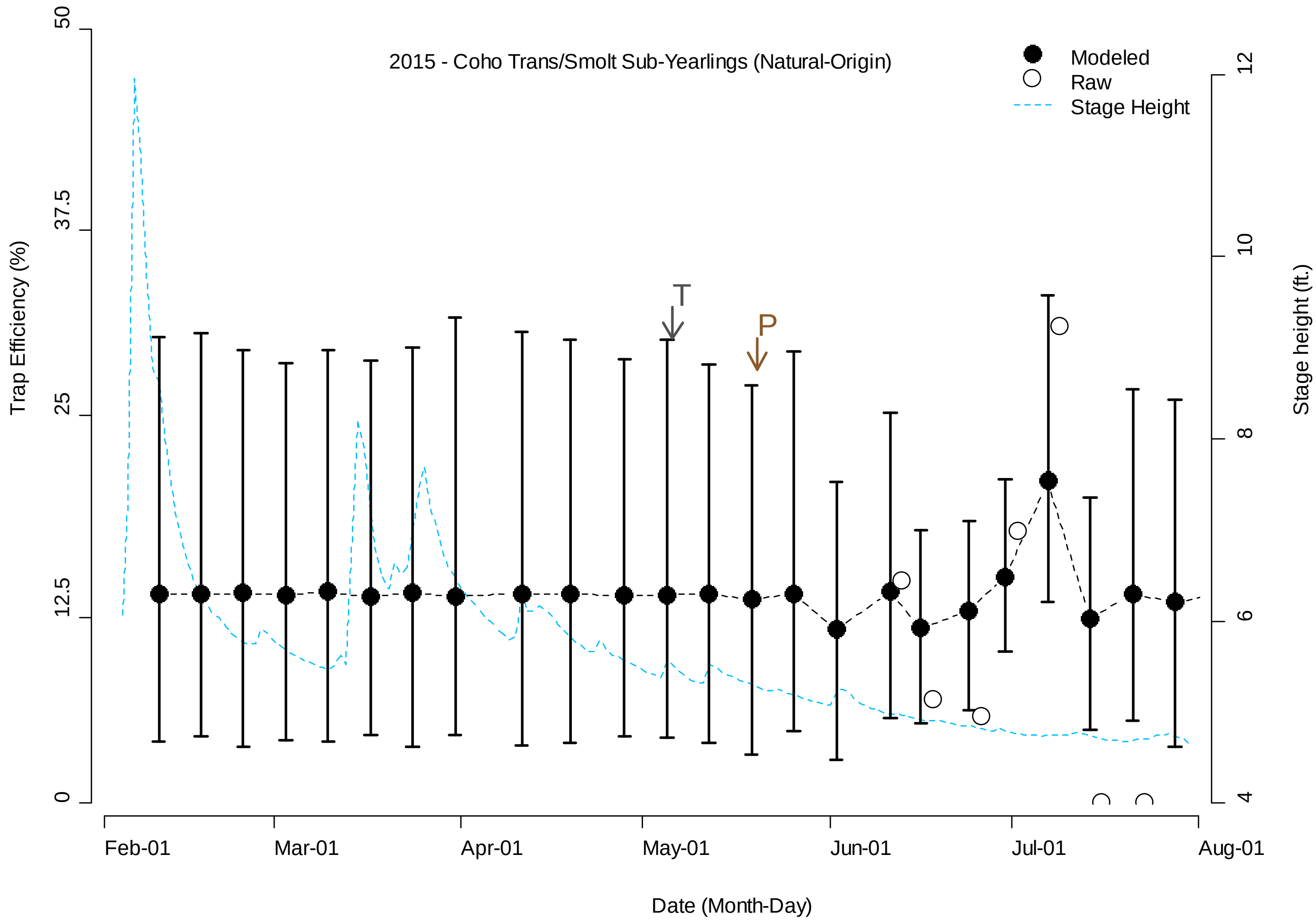

Figure D39. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2015.

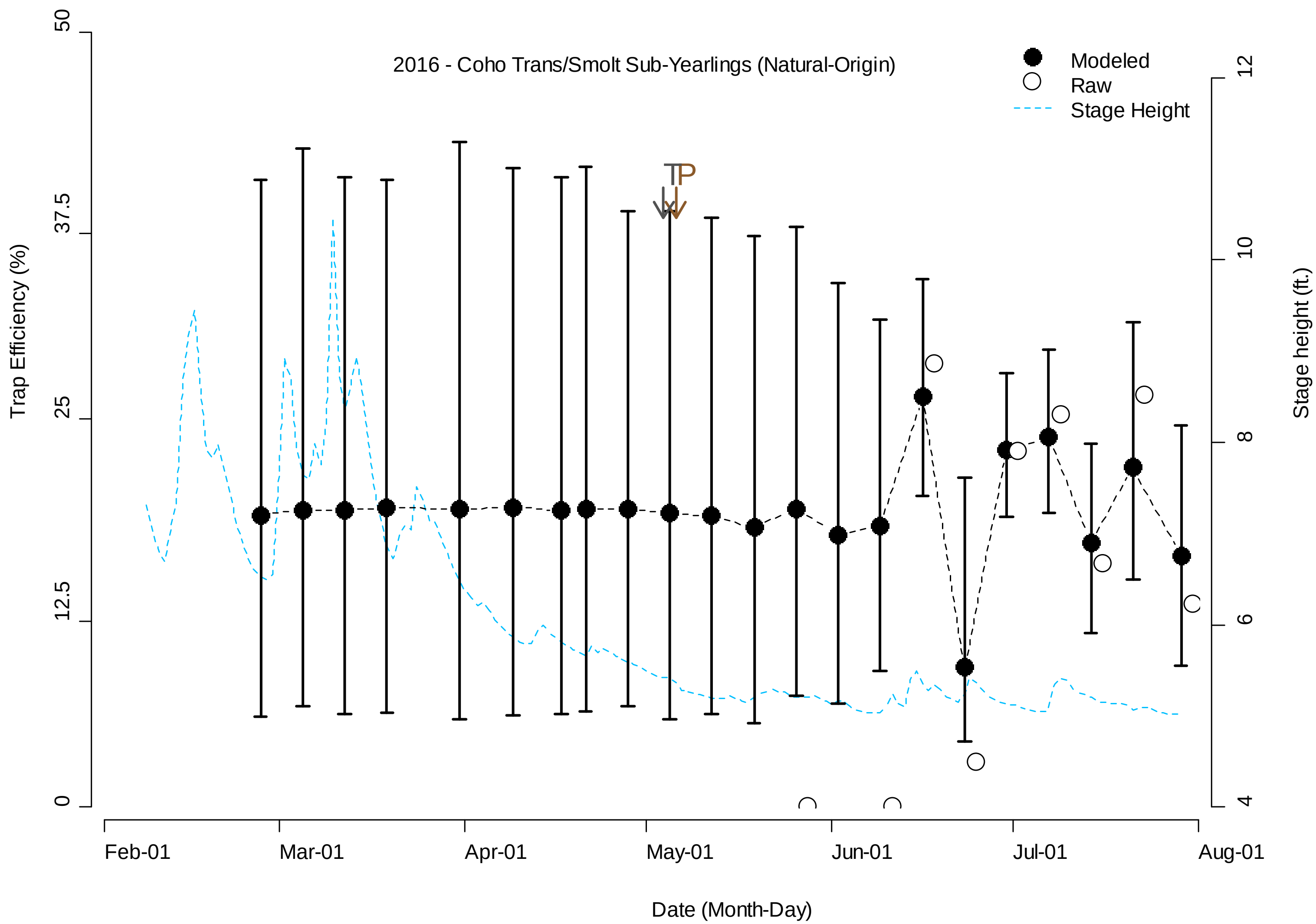

Figure D40. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2016.

Coho salmon (Natural-Origin, Transitional/Smolt, Yearling)

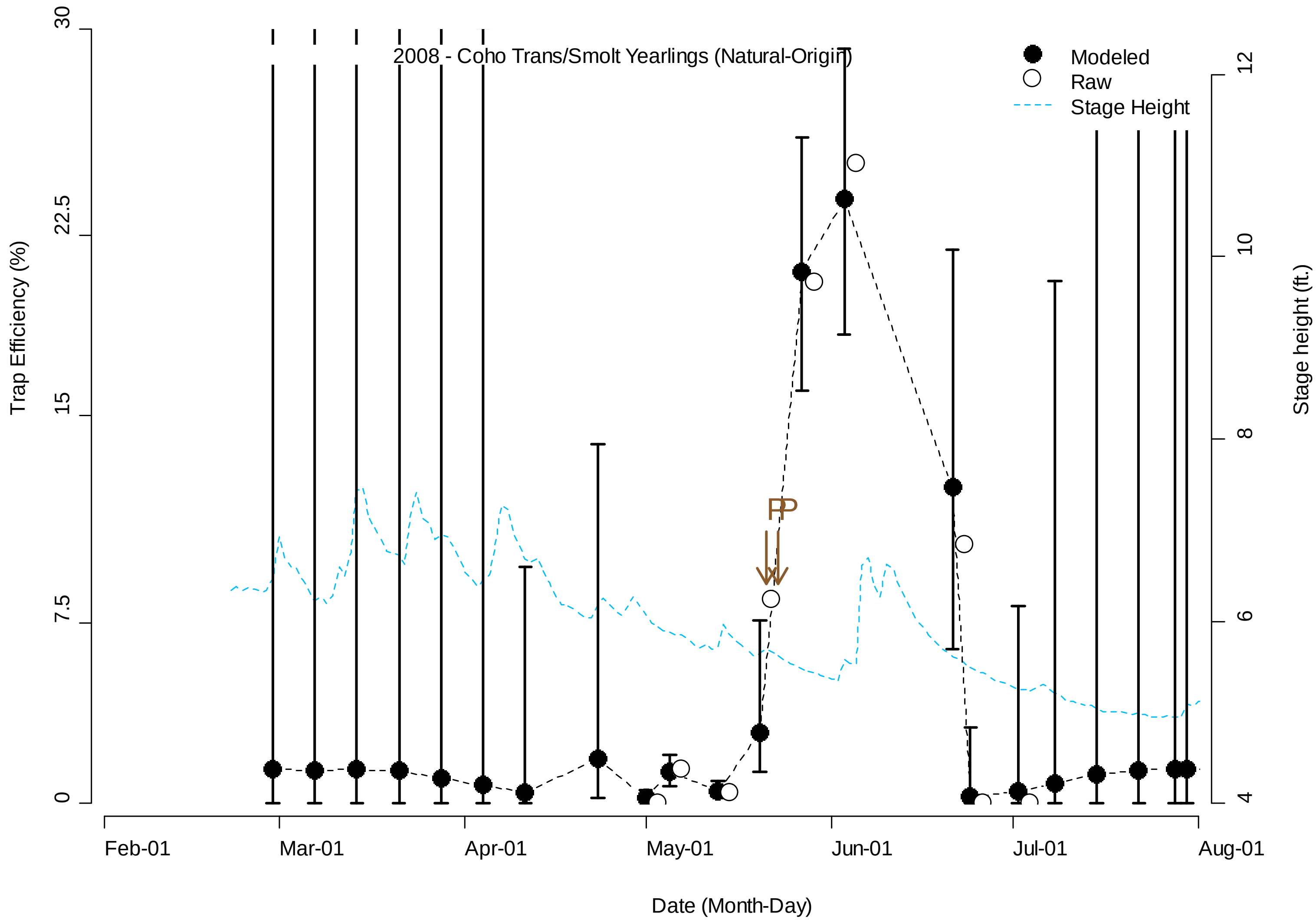

Figure D41. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2008.

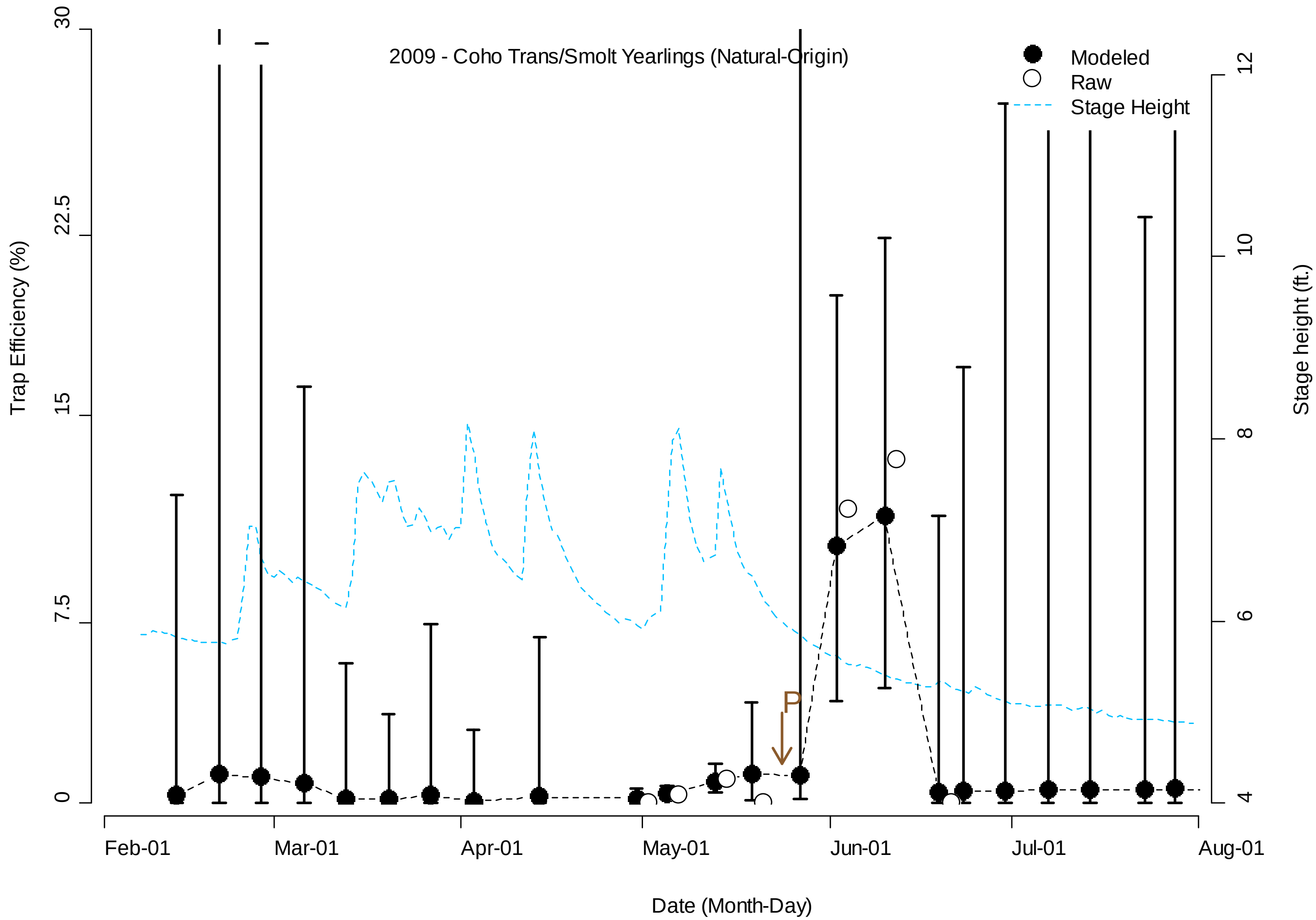

Figure D42. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2009.

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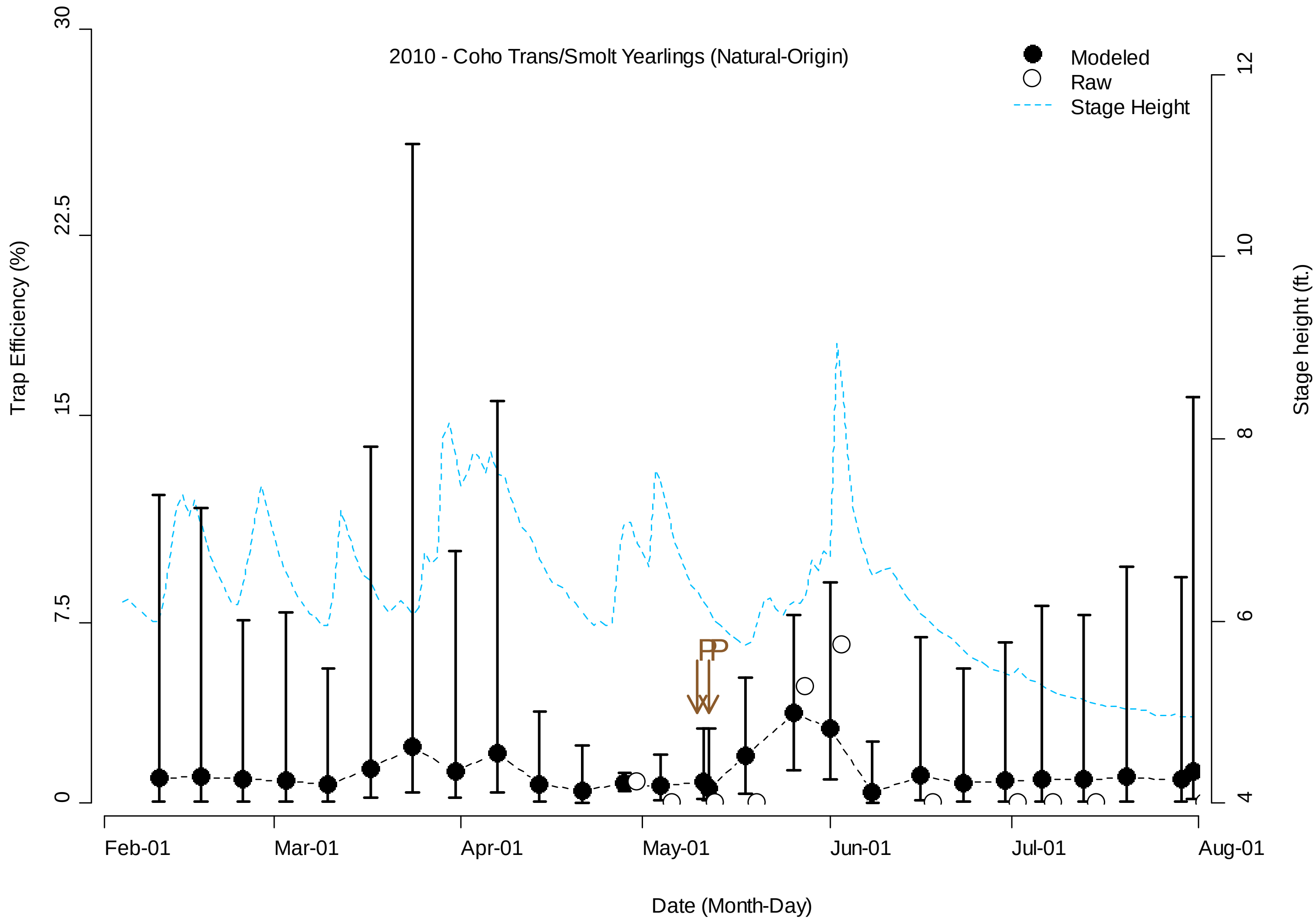

Figure D43. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2010.

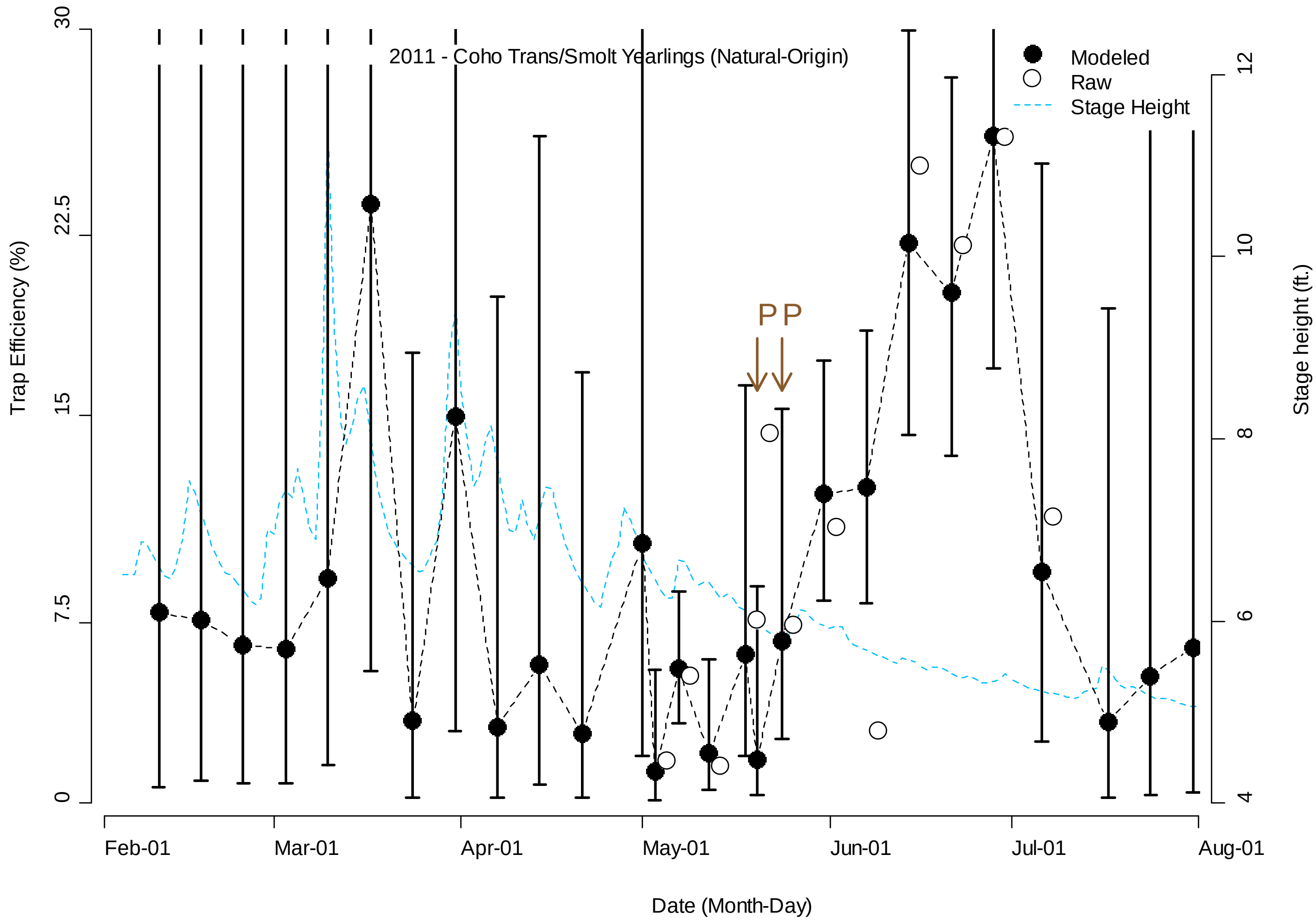

Figure D44. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2011.

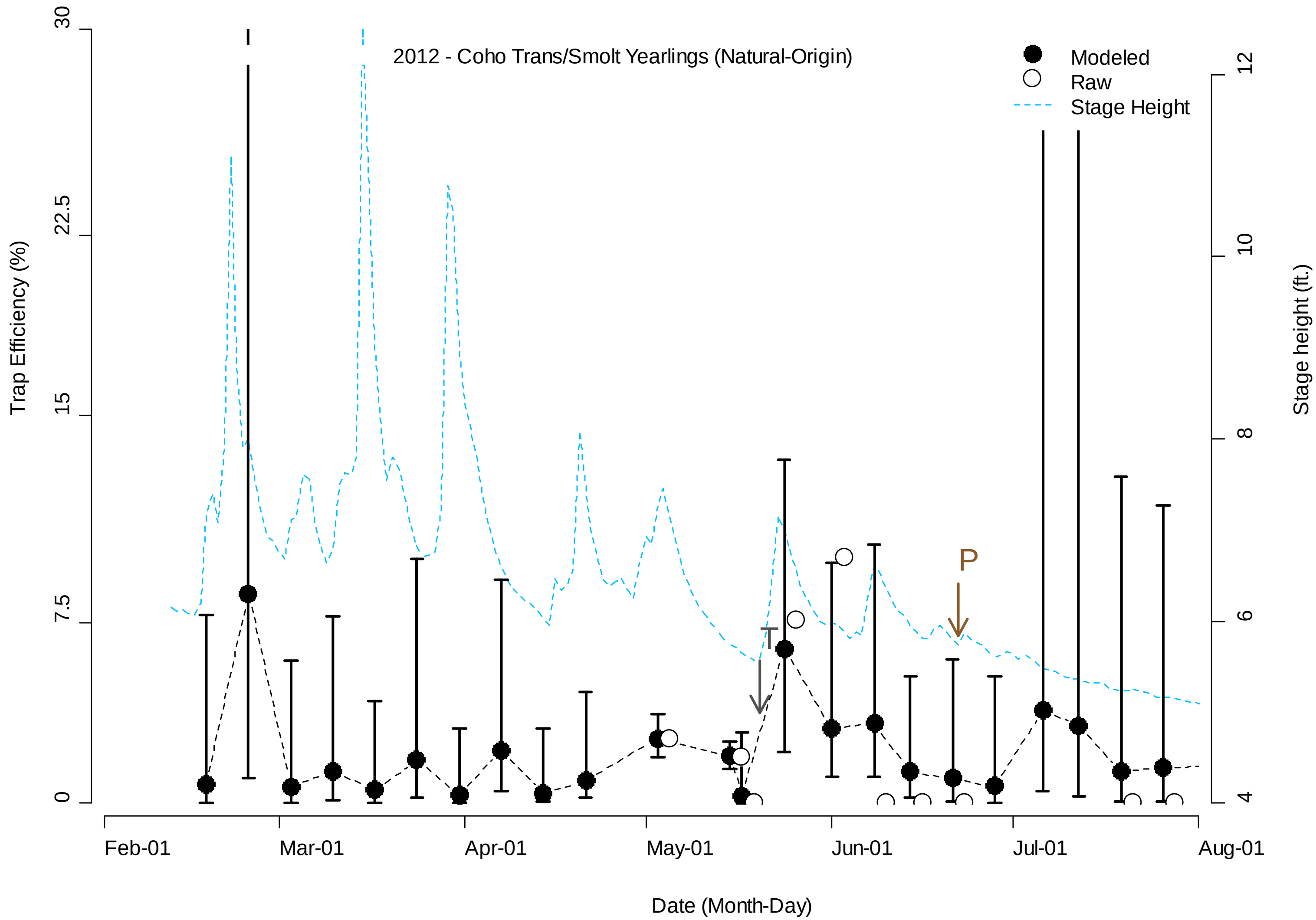

Figure D45. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2012.

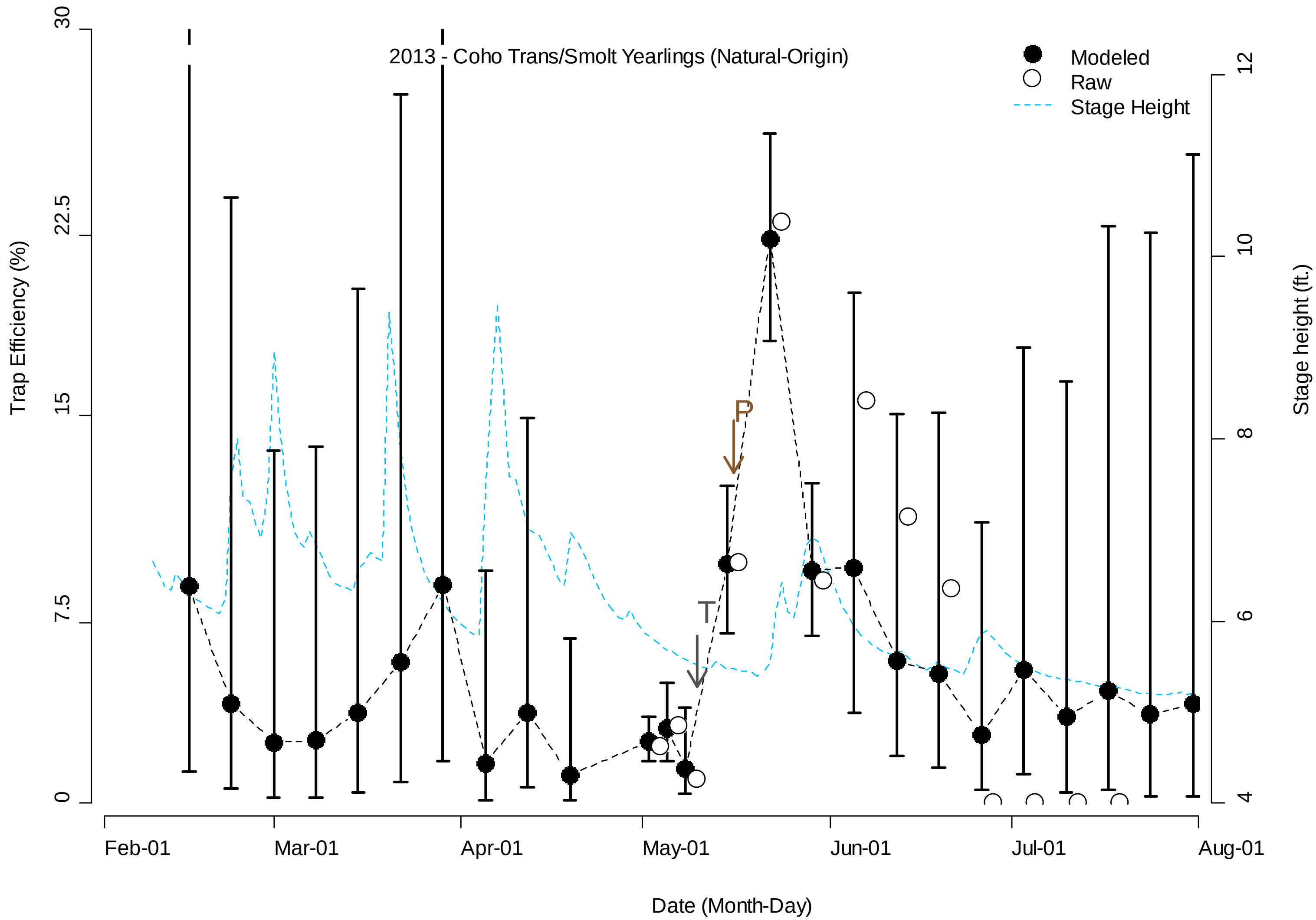

Figure D46. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2013.

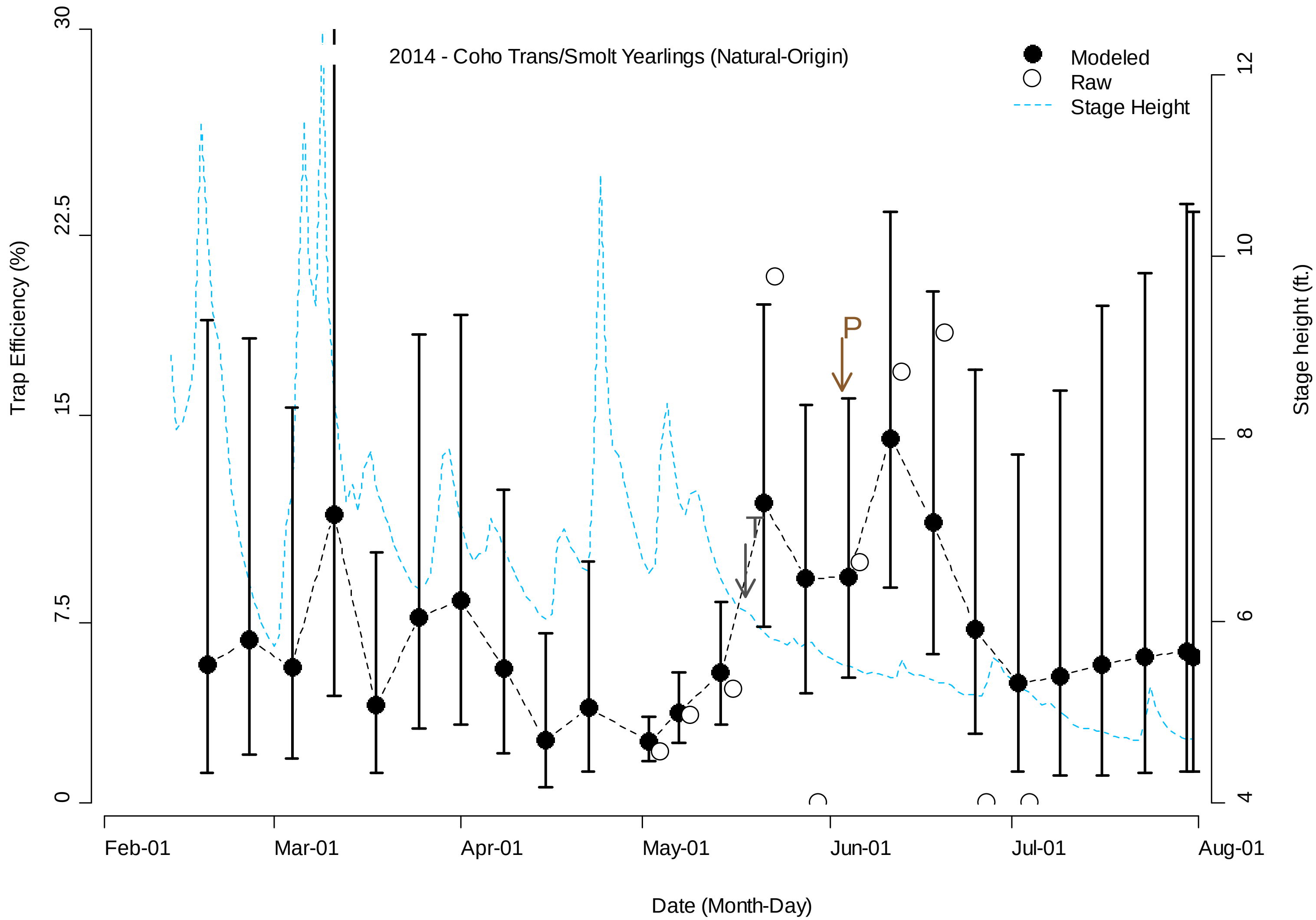

Figure D47. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2014.

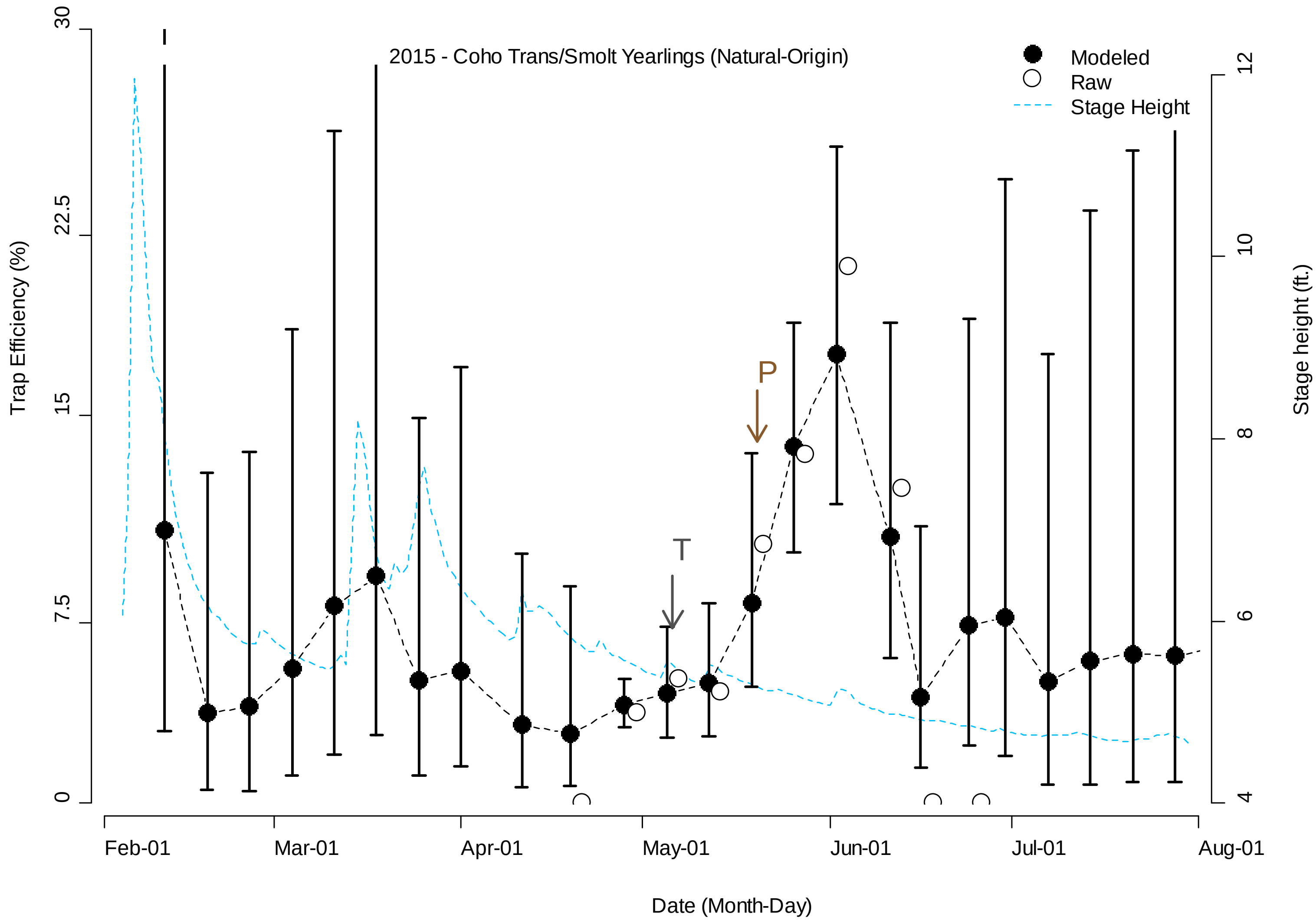

Figure D48. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2015.

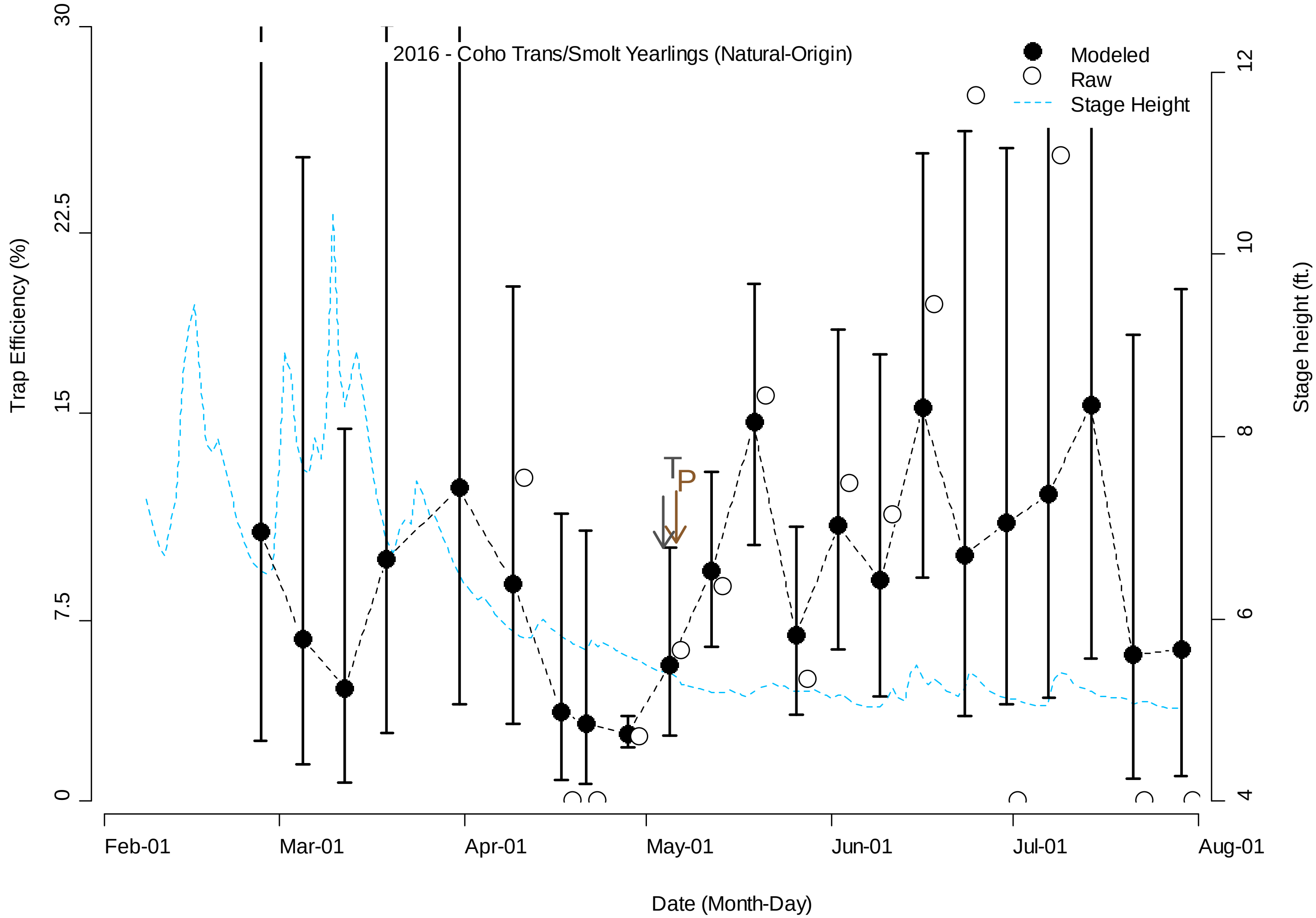

Figure D49. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2016.

Coho salmon (Hatchery-Origin, Transitional/Smolt, Sub-Yearling)

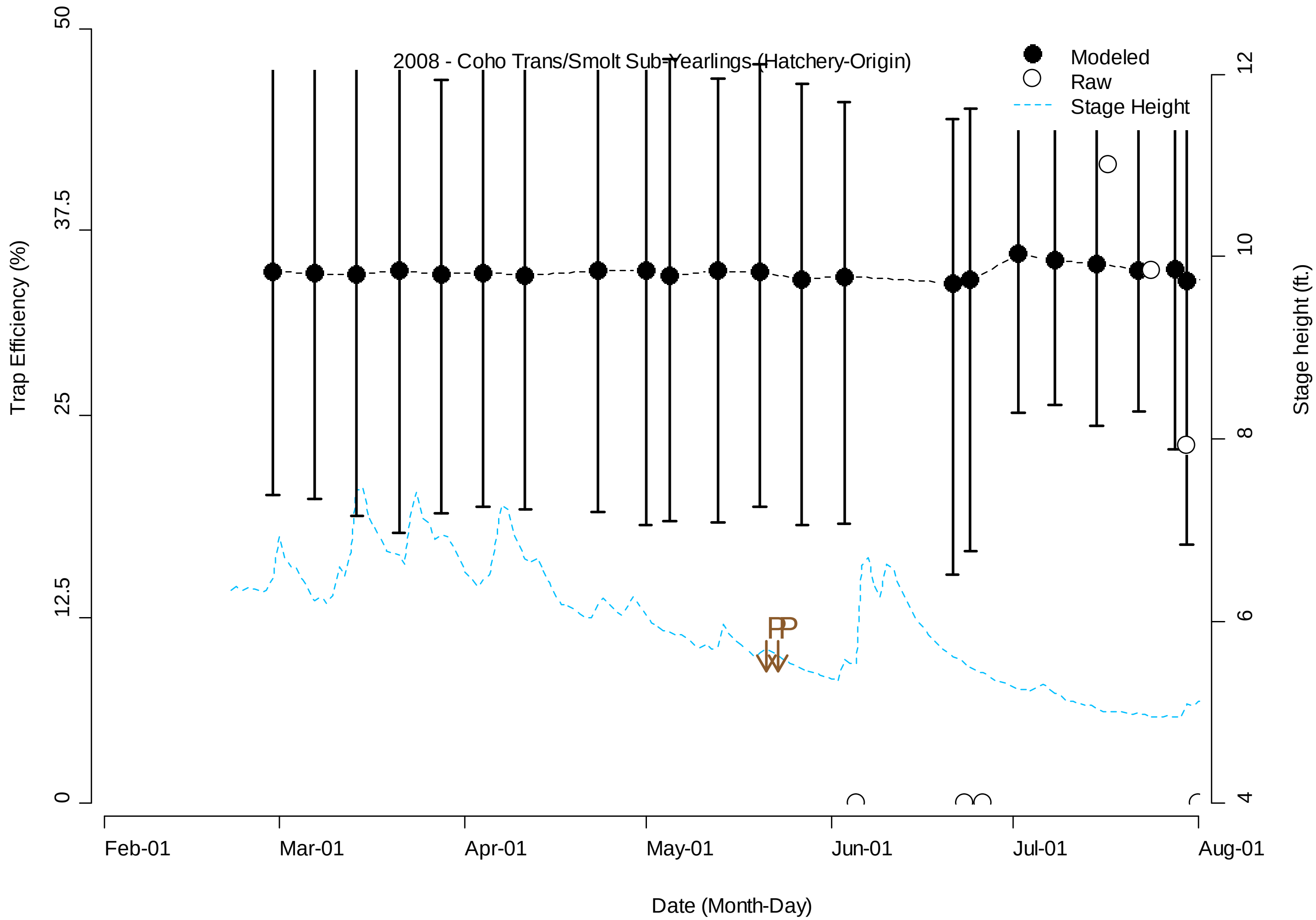

Figure D50. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2008.

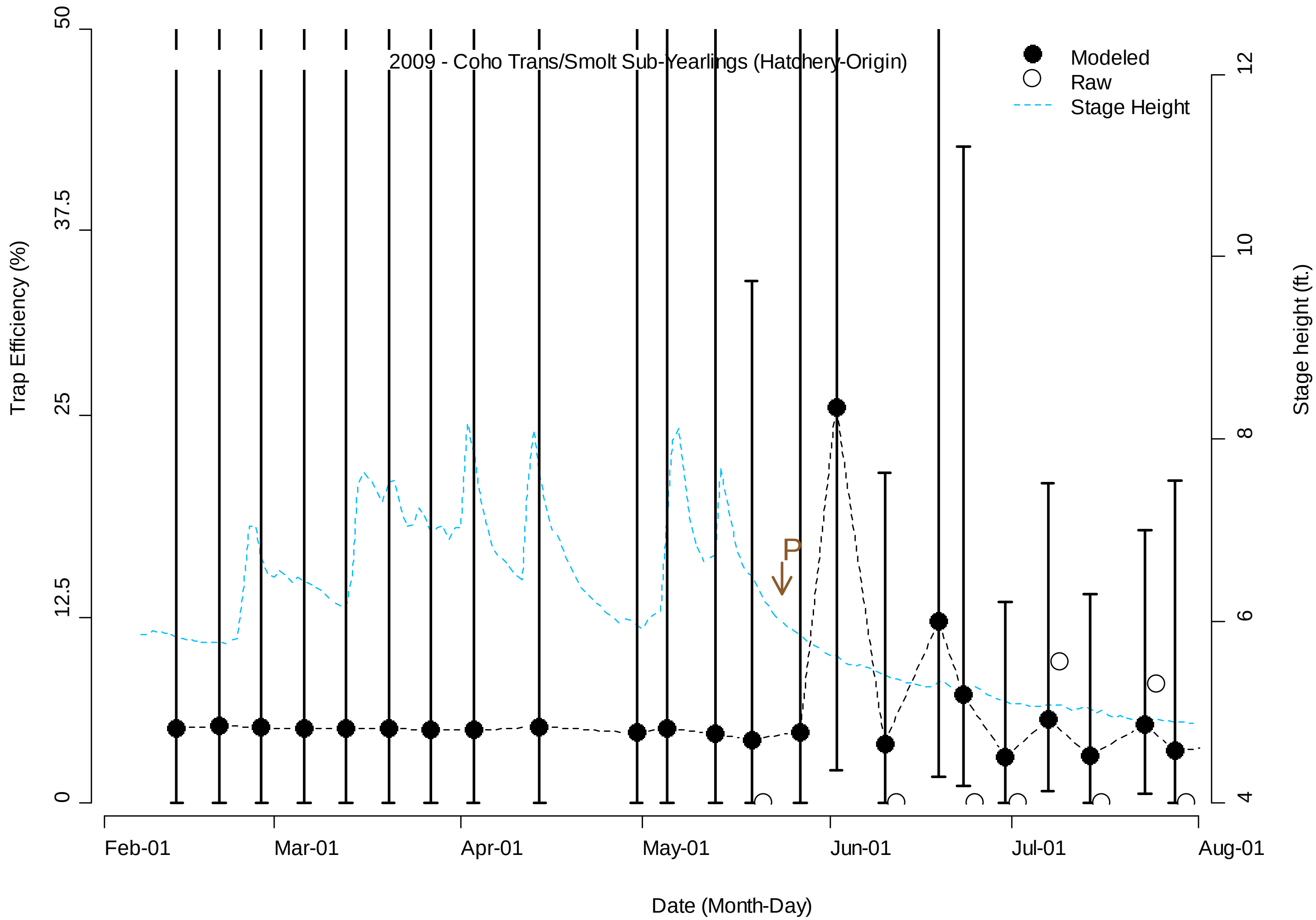

Figure D51. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2009.

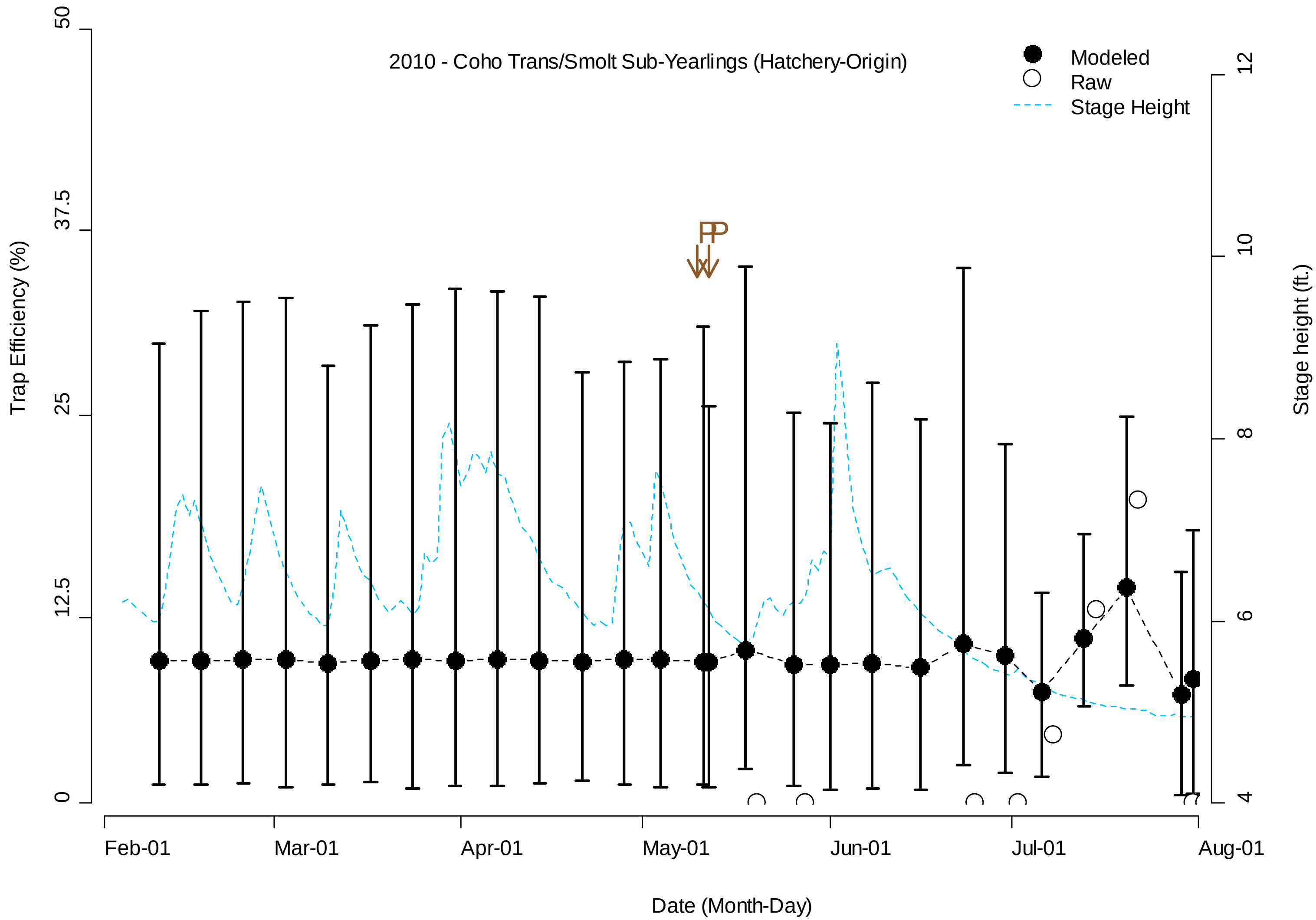

Figure D52. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2010.

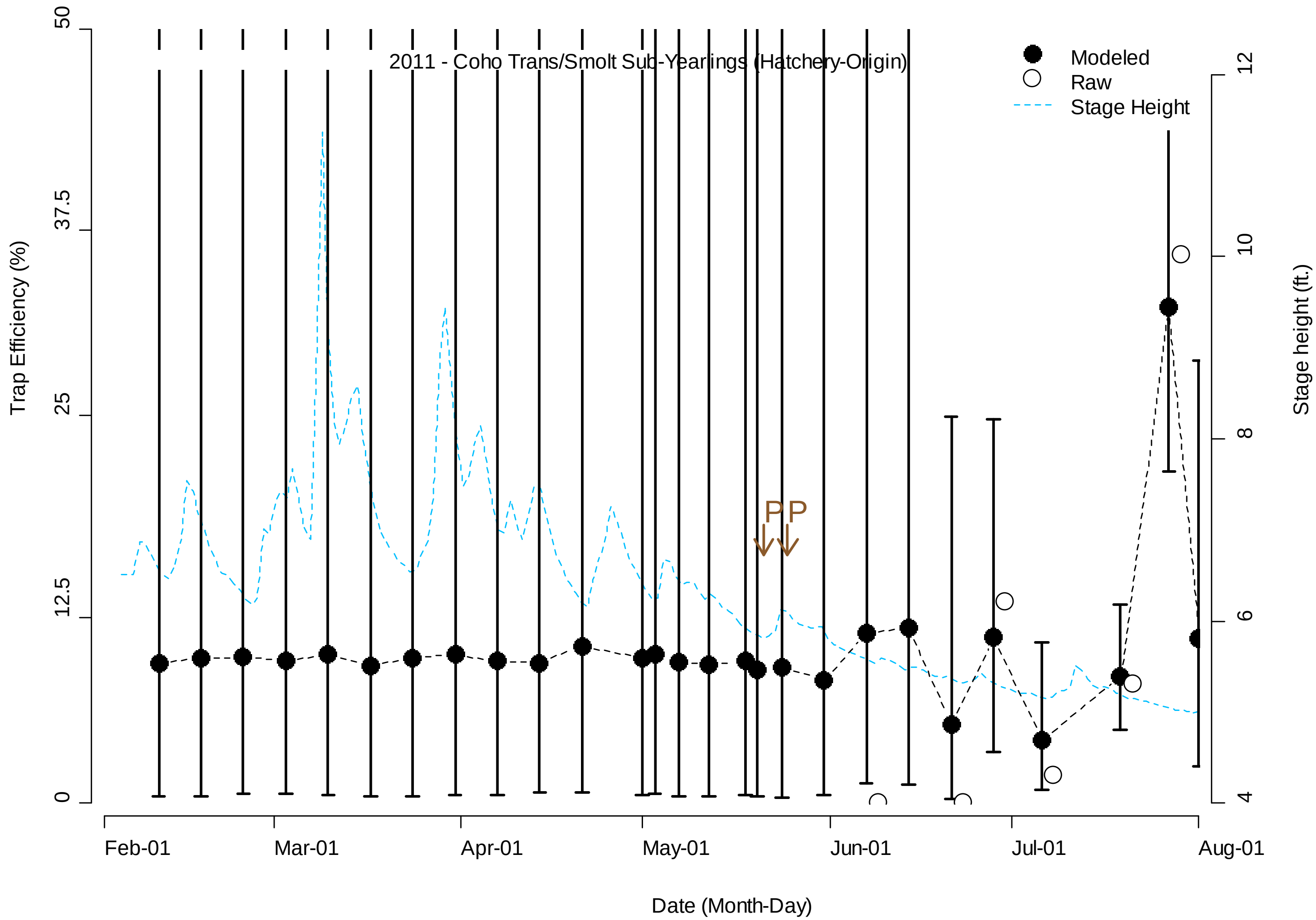

Figure D53. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2011.

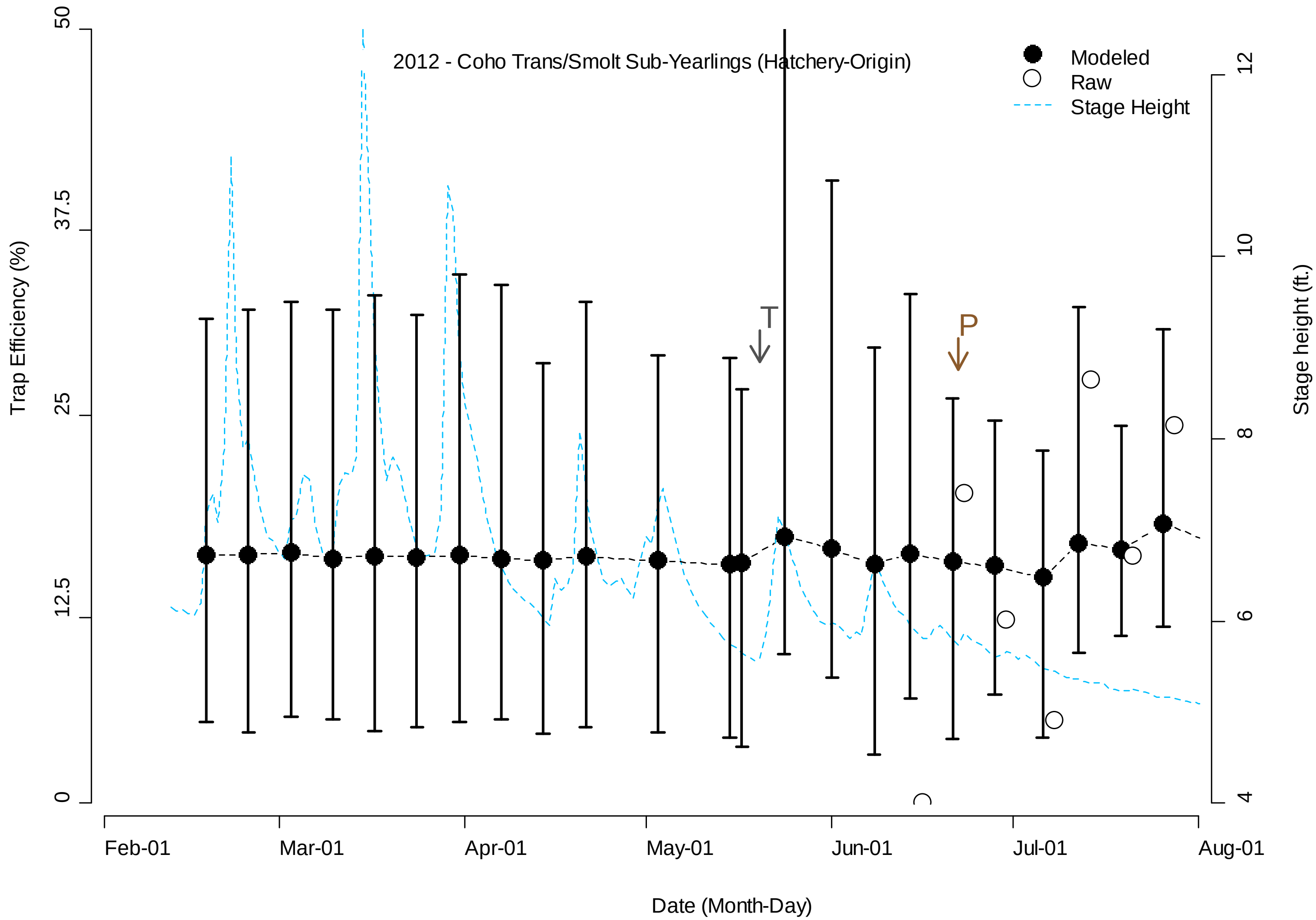

Figure D54. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2012.

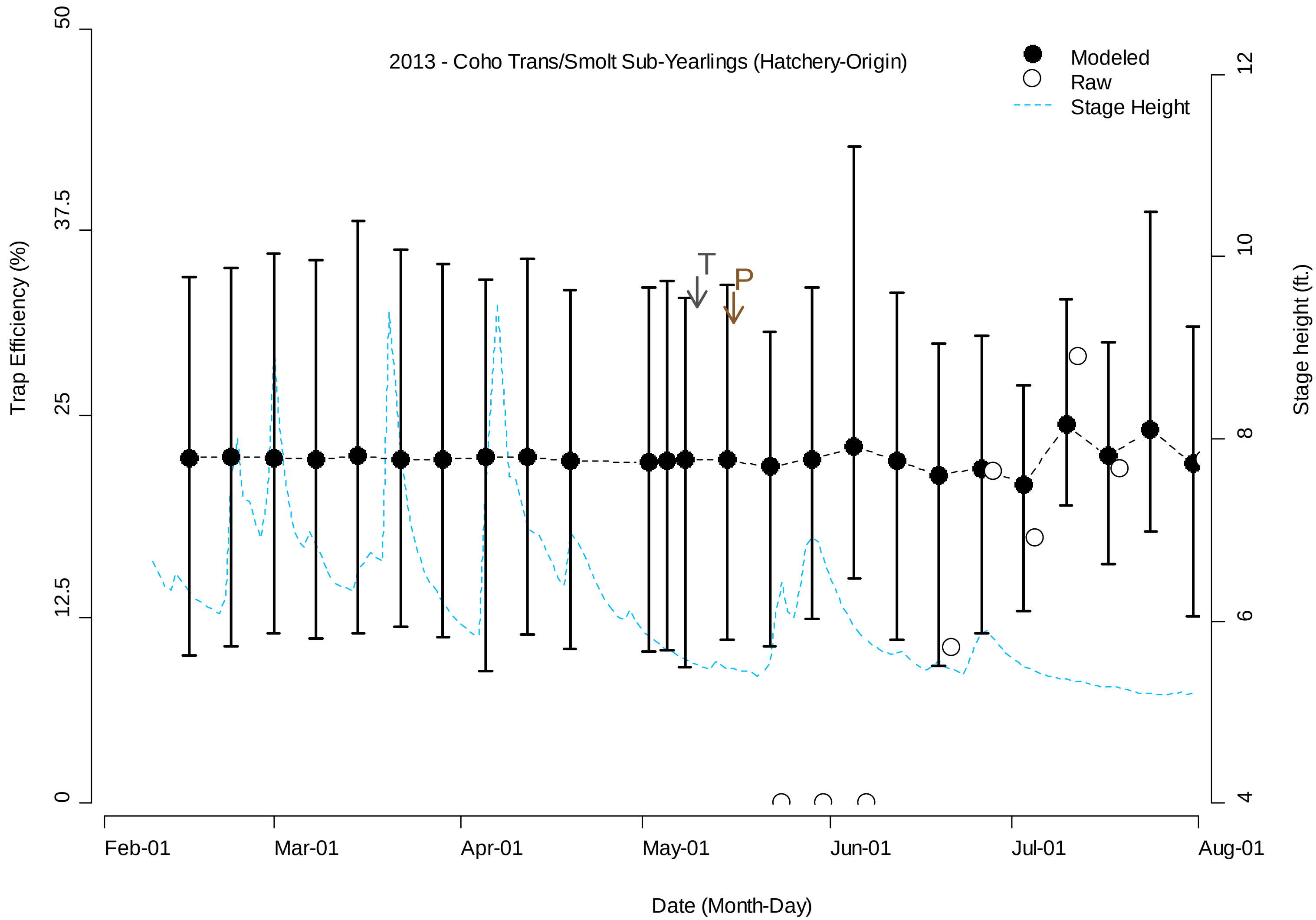

Figure D55. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2013.

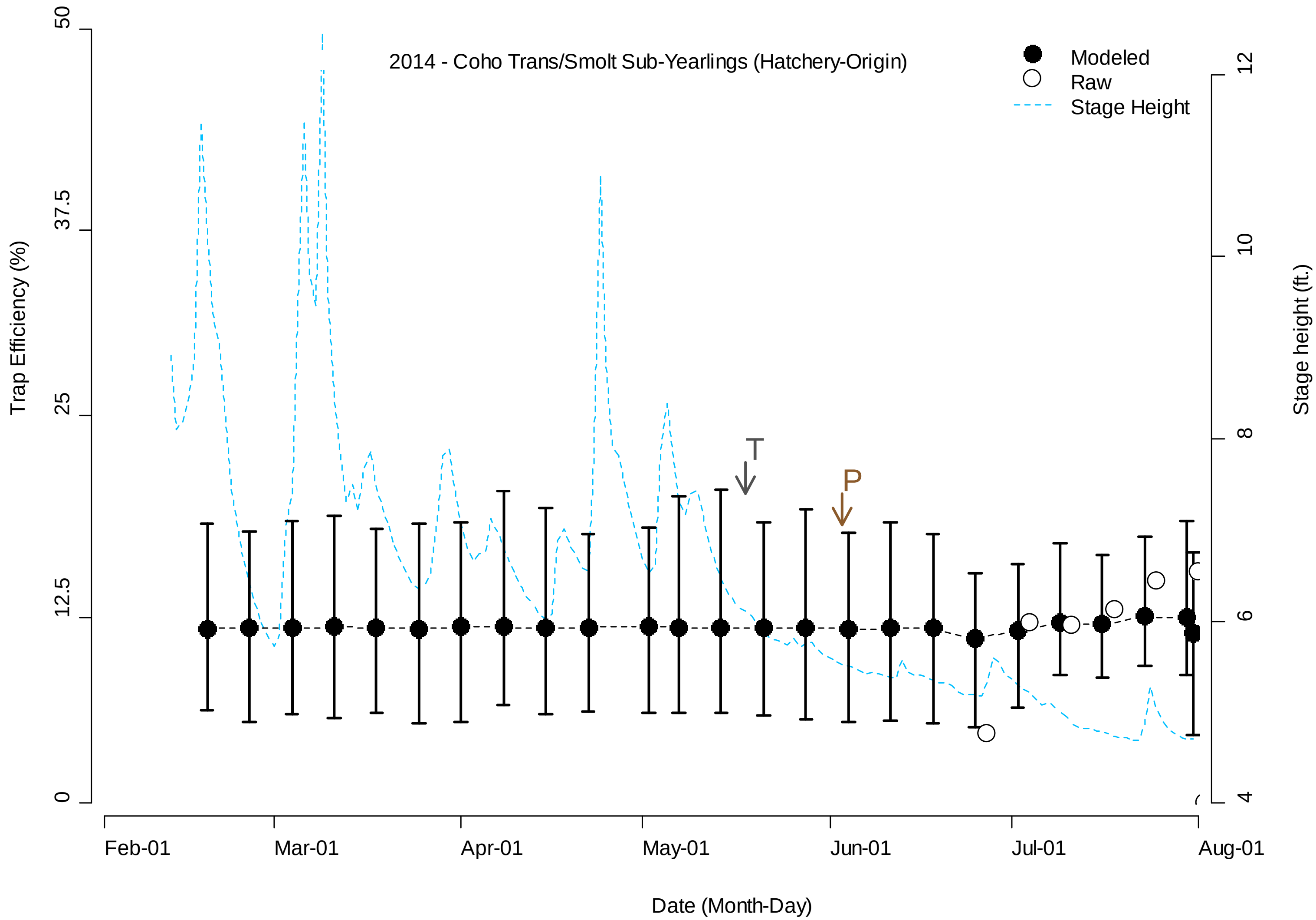

Figure D56. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2014.

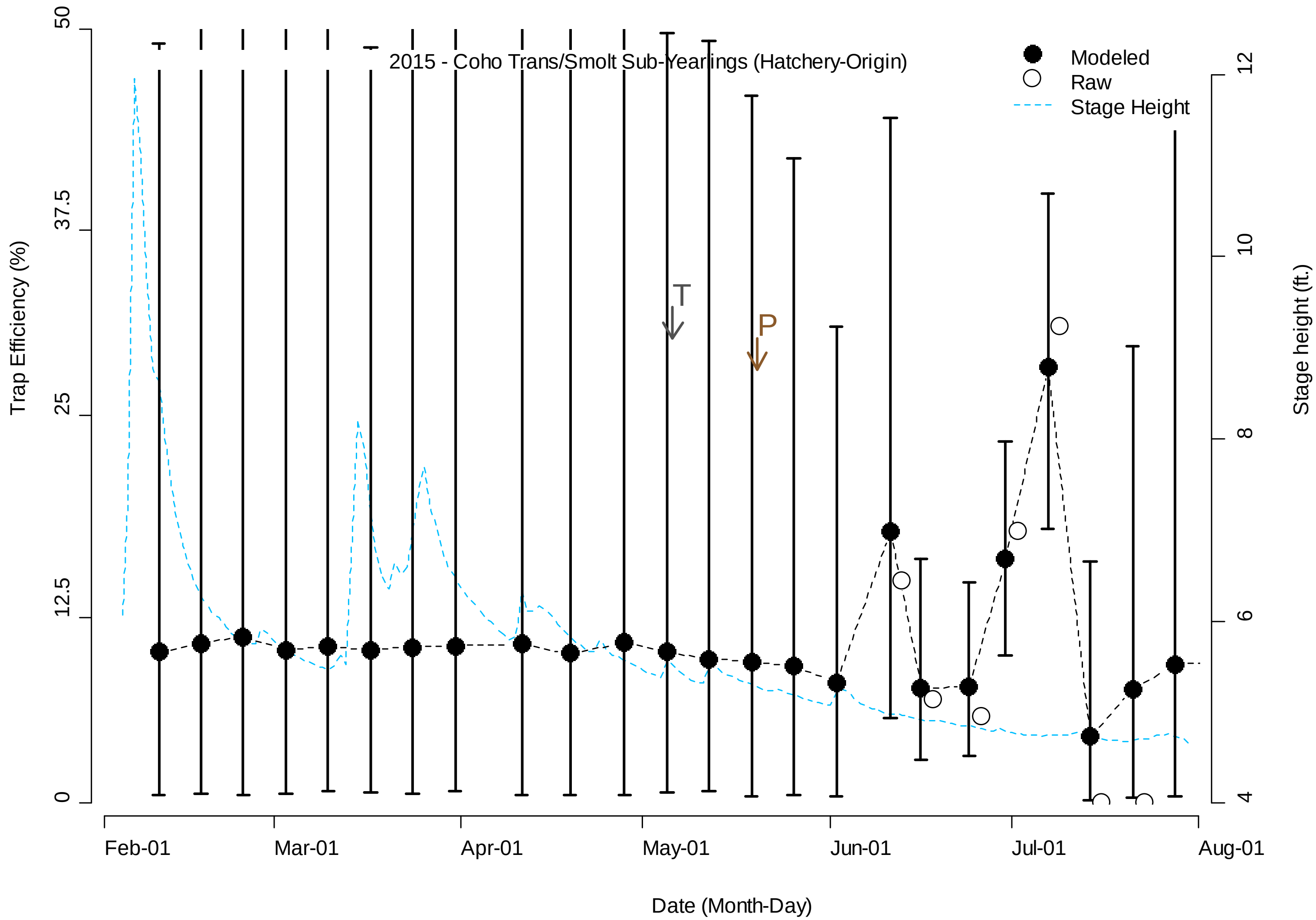

Figure D57. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2015.

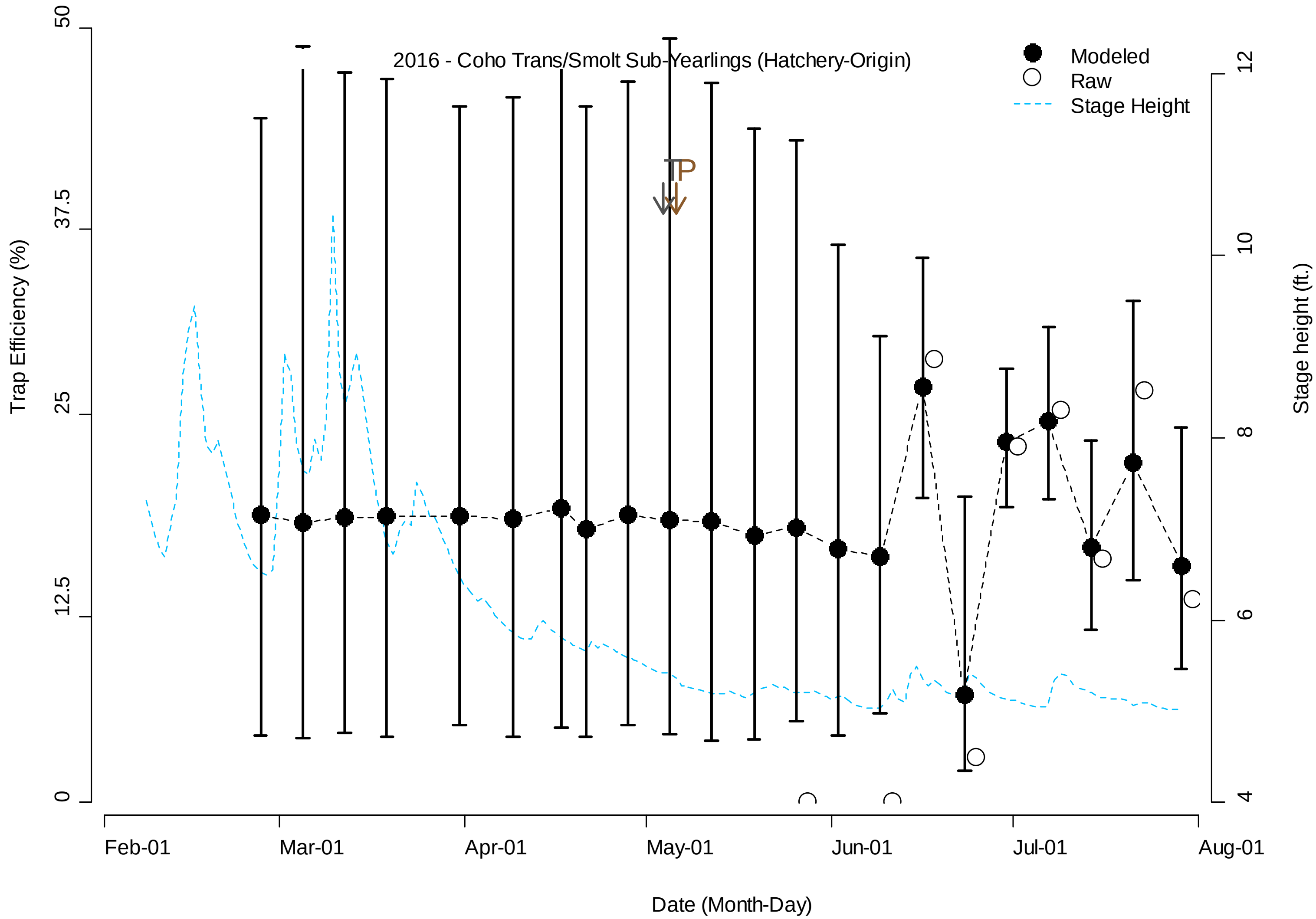

Figure D58. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) captured at the mainstem Grays River screw trap in 2016.

Coho salmon (Hatchery-Origin, Transitional/Smolt, Yearling)

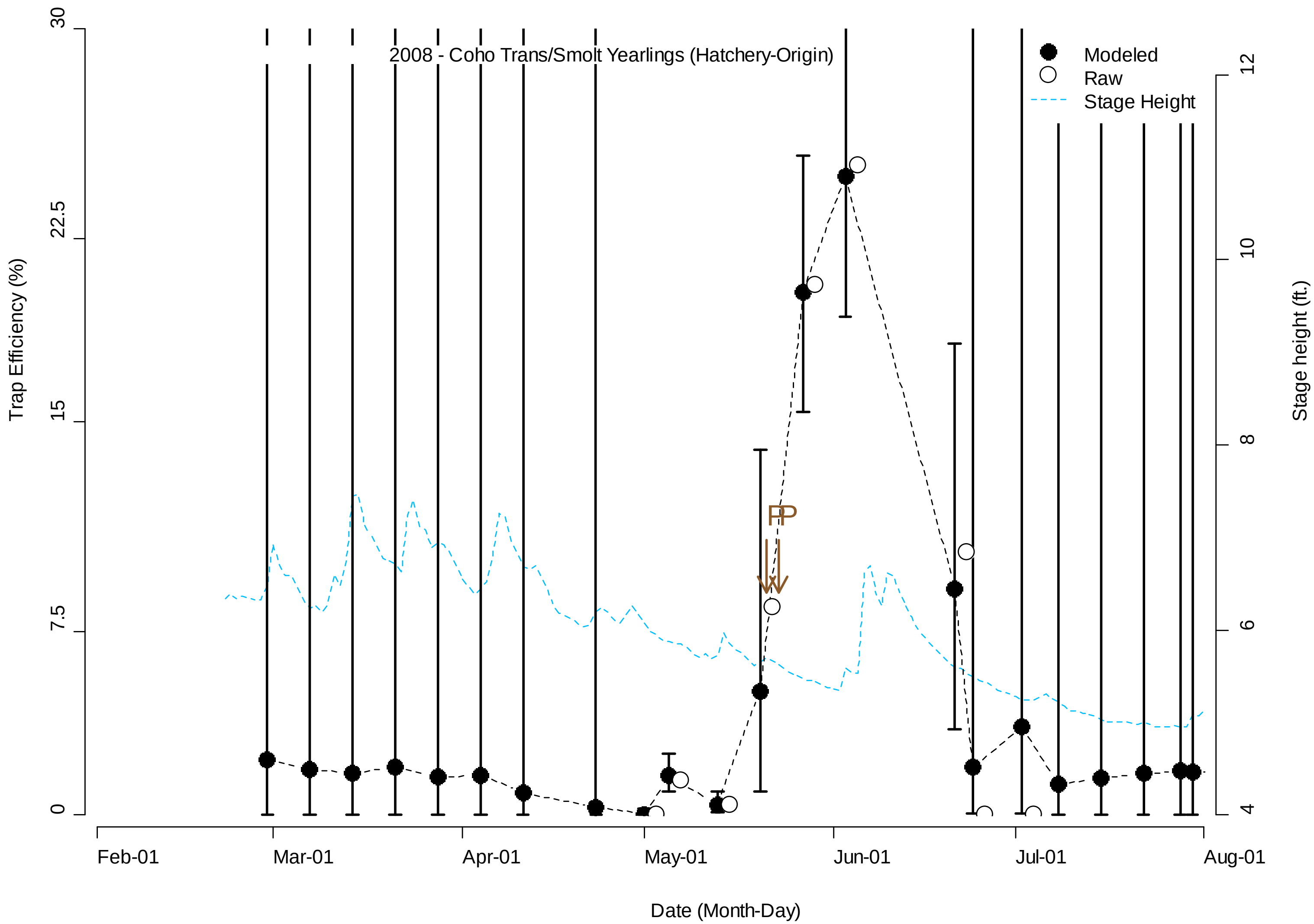

Figure D59. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2008.

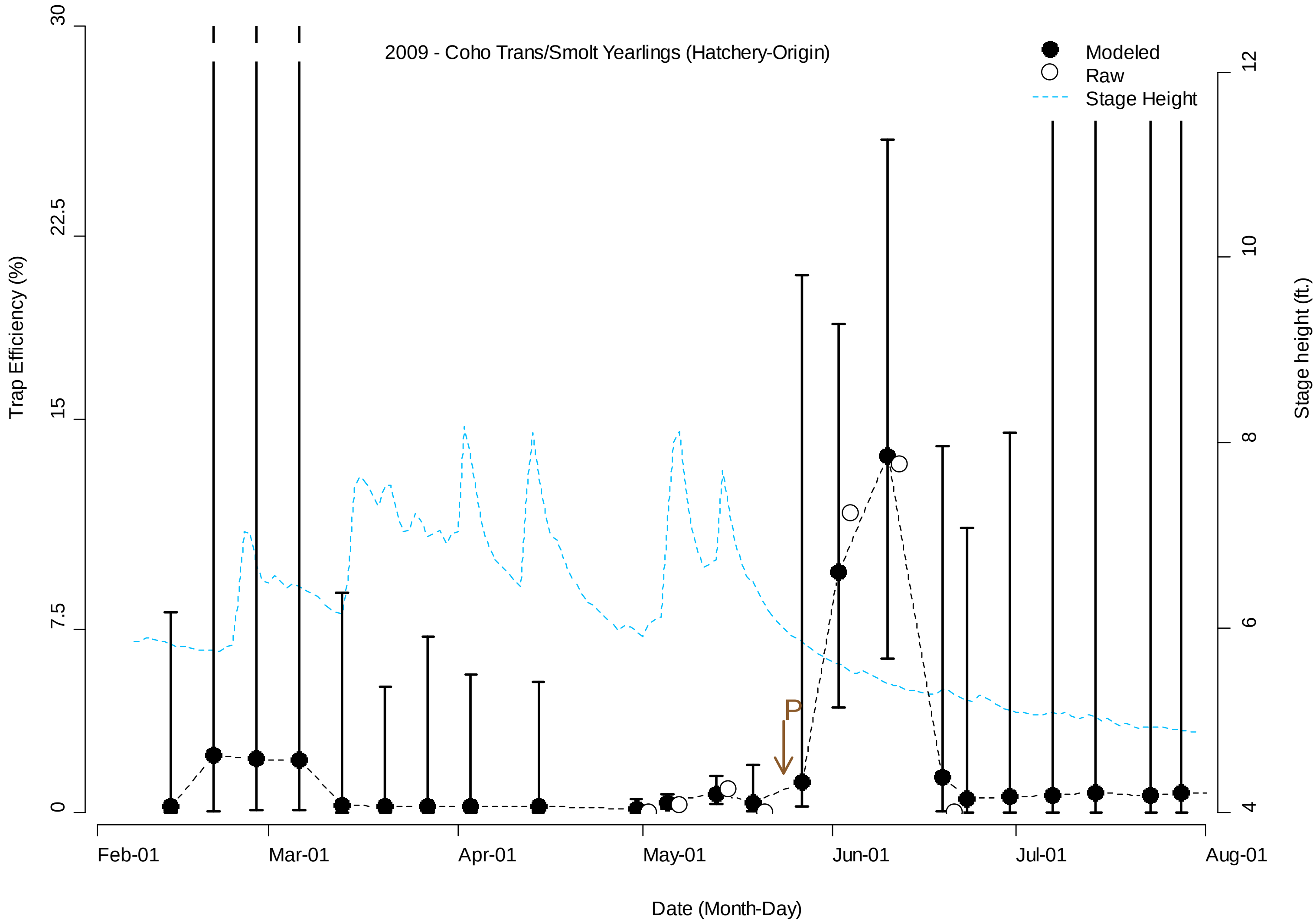

Figure D60. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2009.

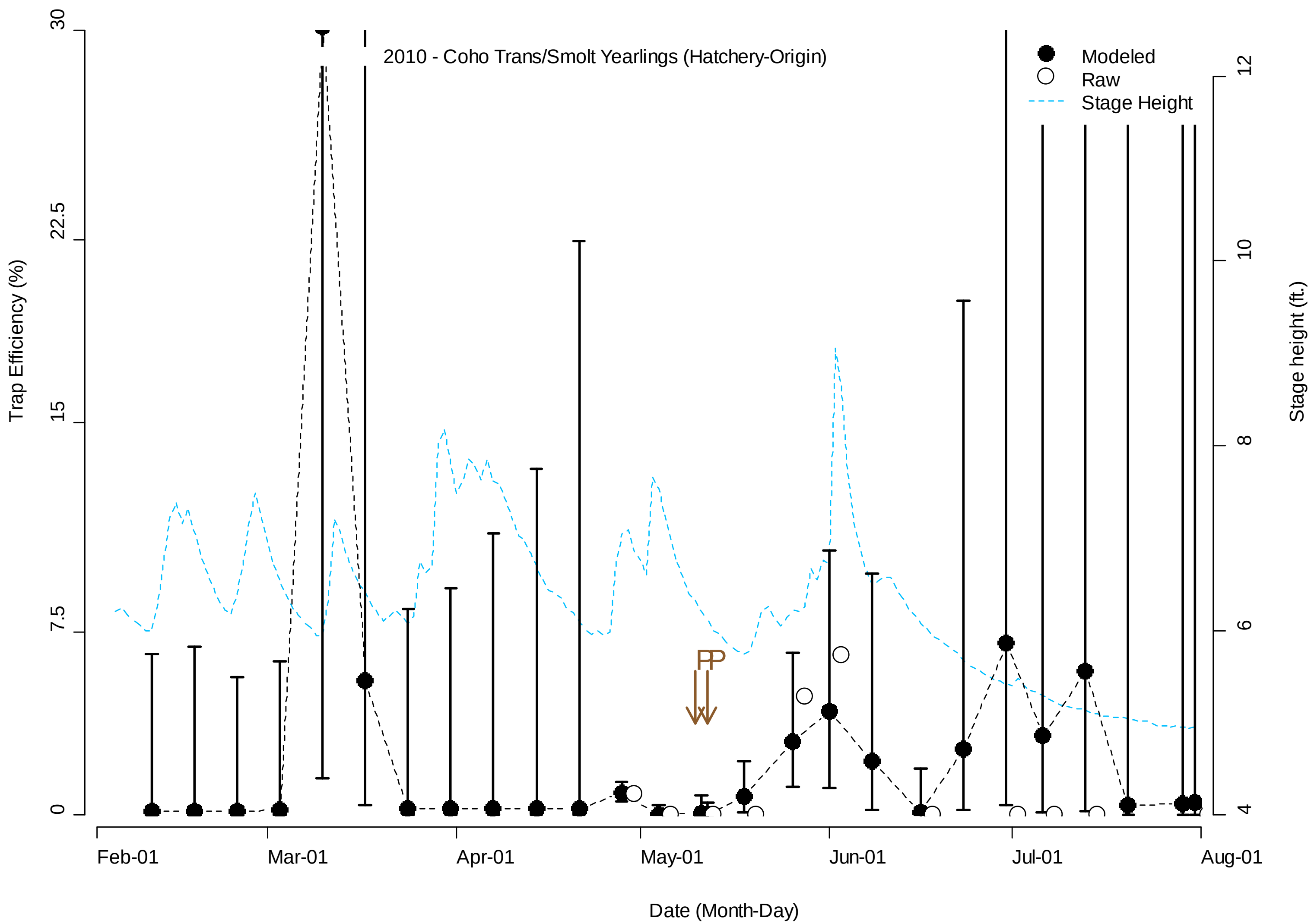

Figure D61. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2010.

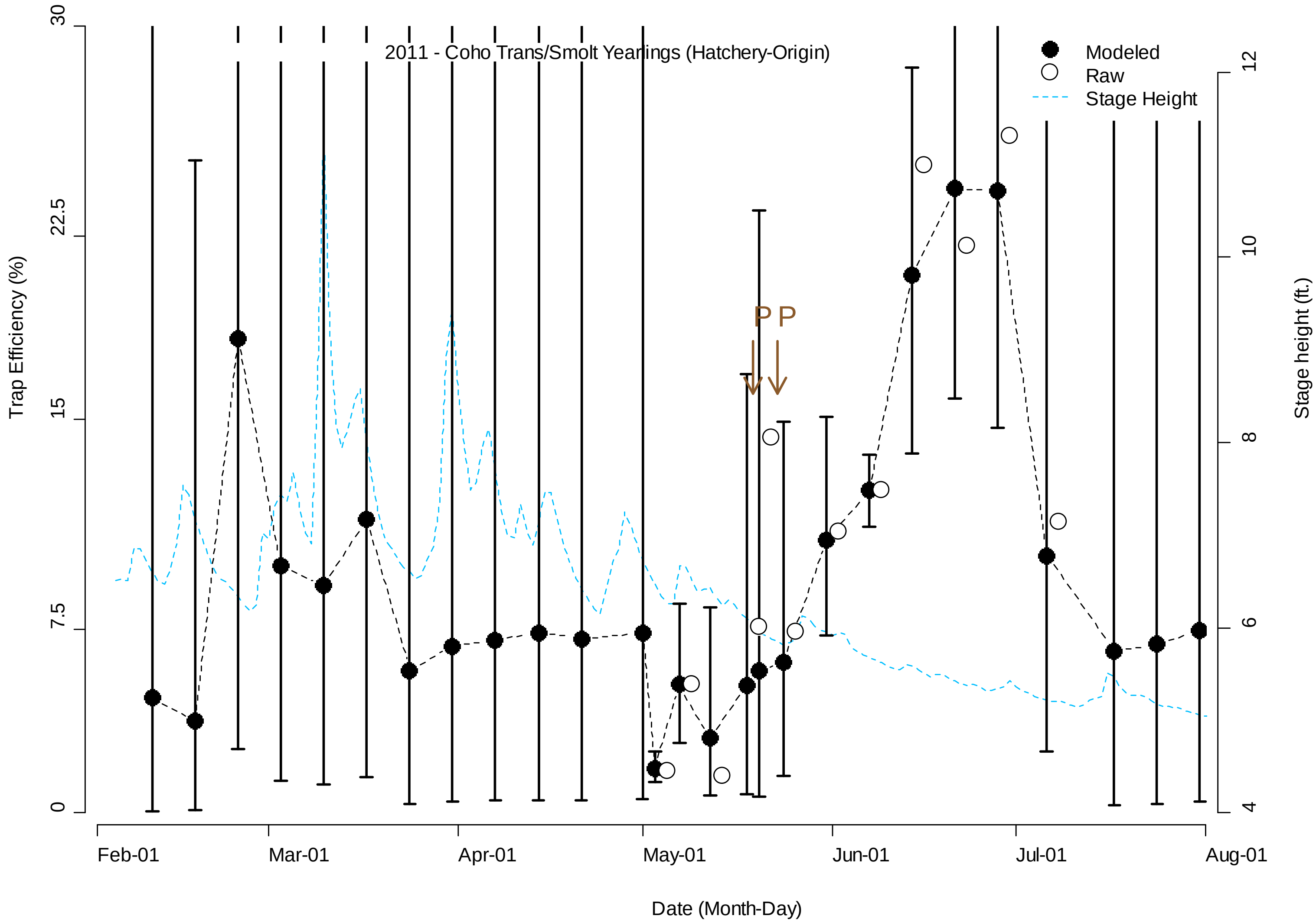

Figure D62. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2011.

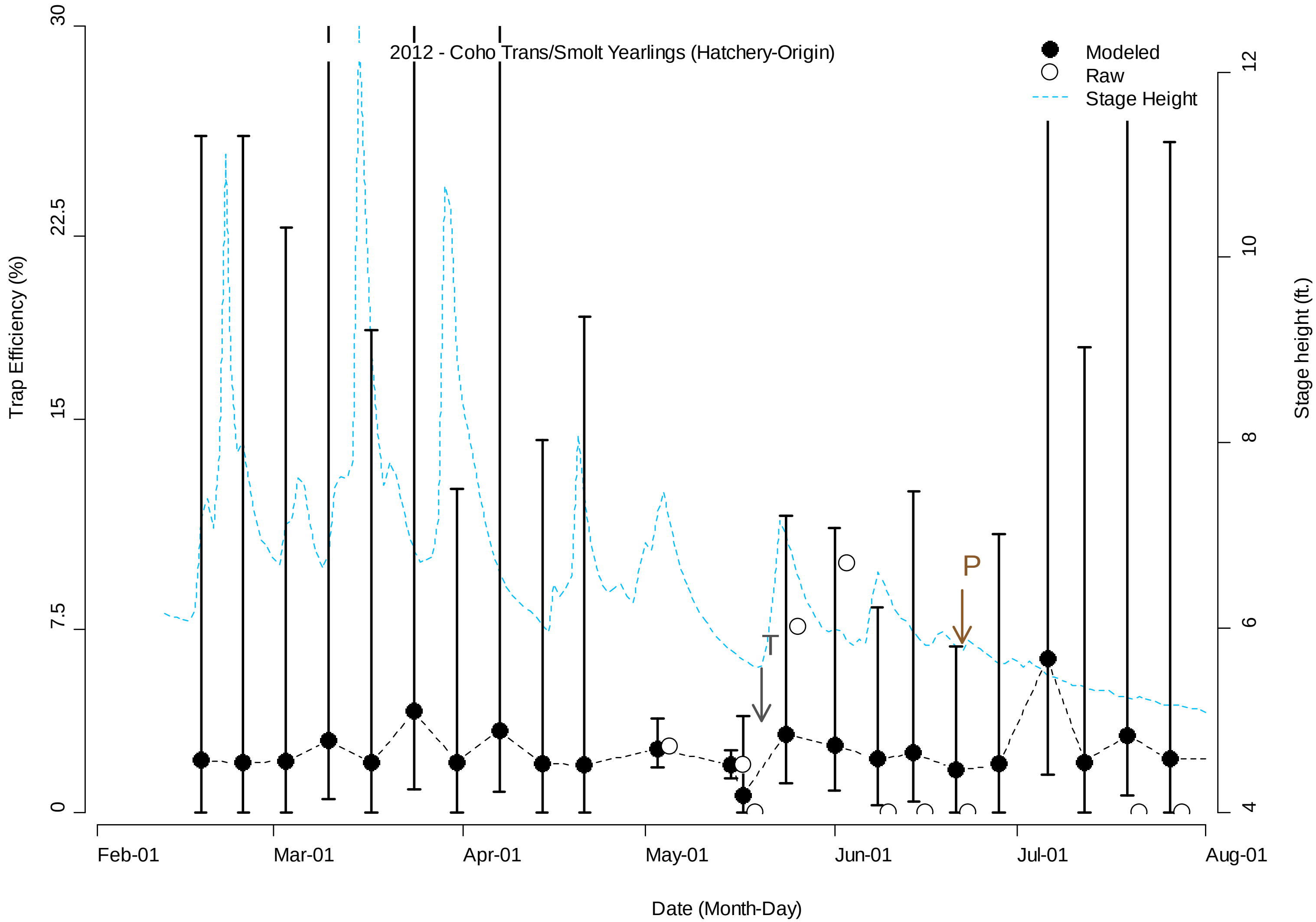

Figure D63. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2012.

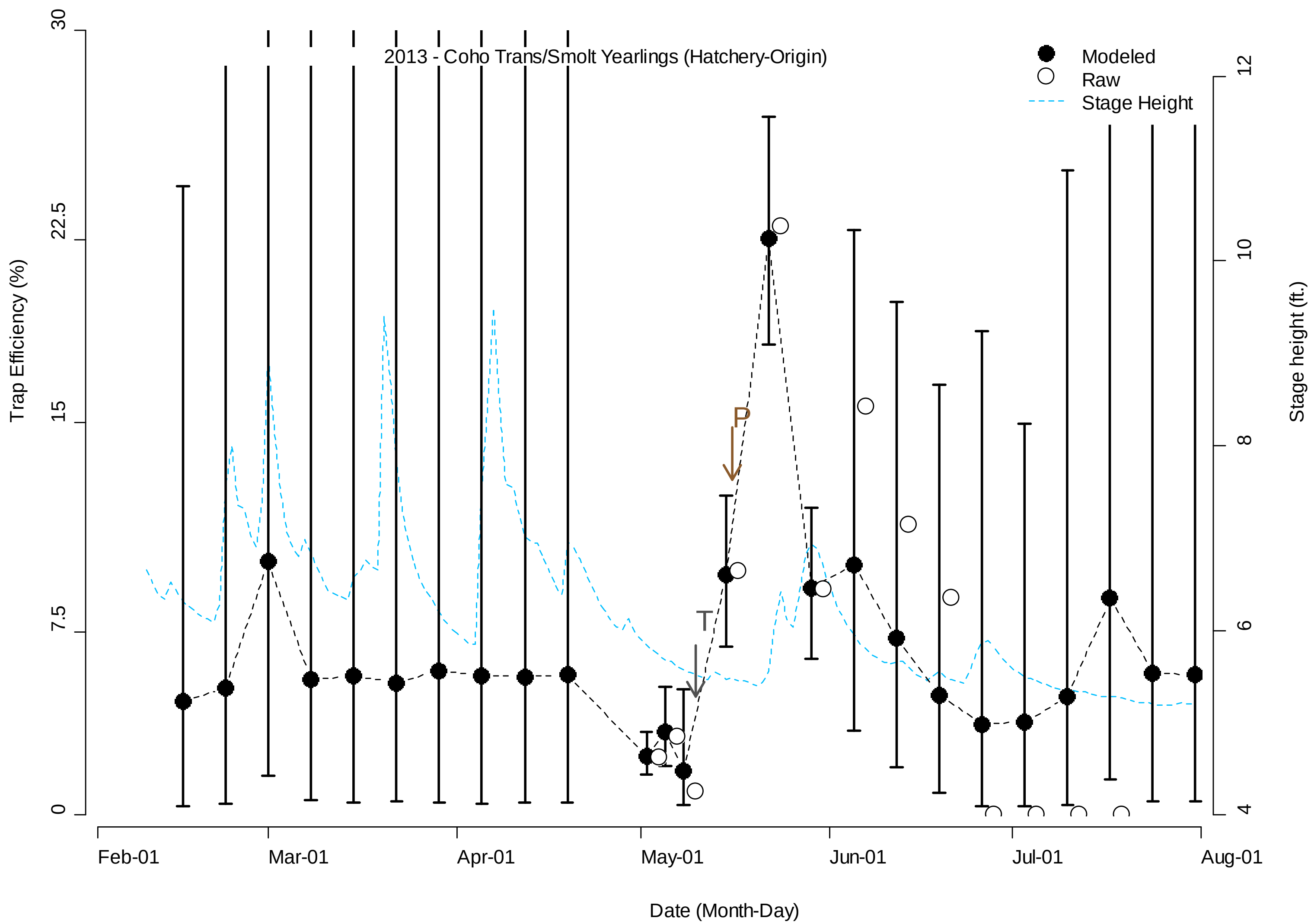

Figure D64. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2013.

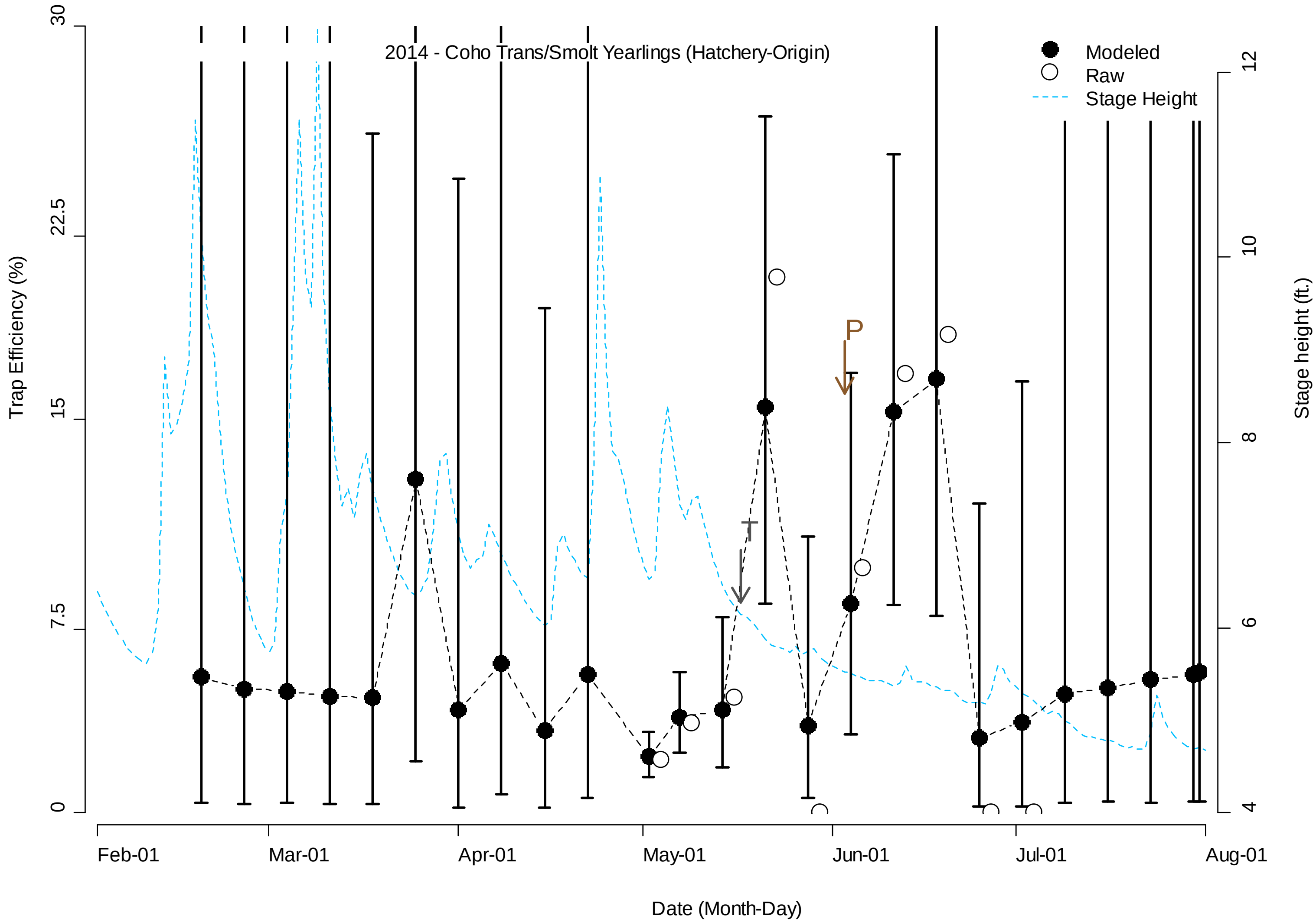

Figure D65. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2014.

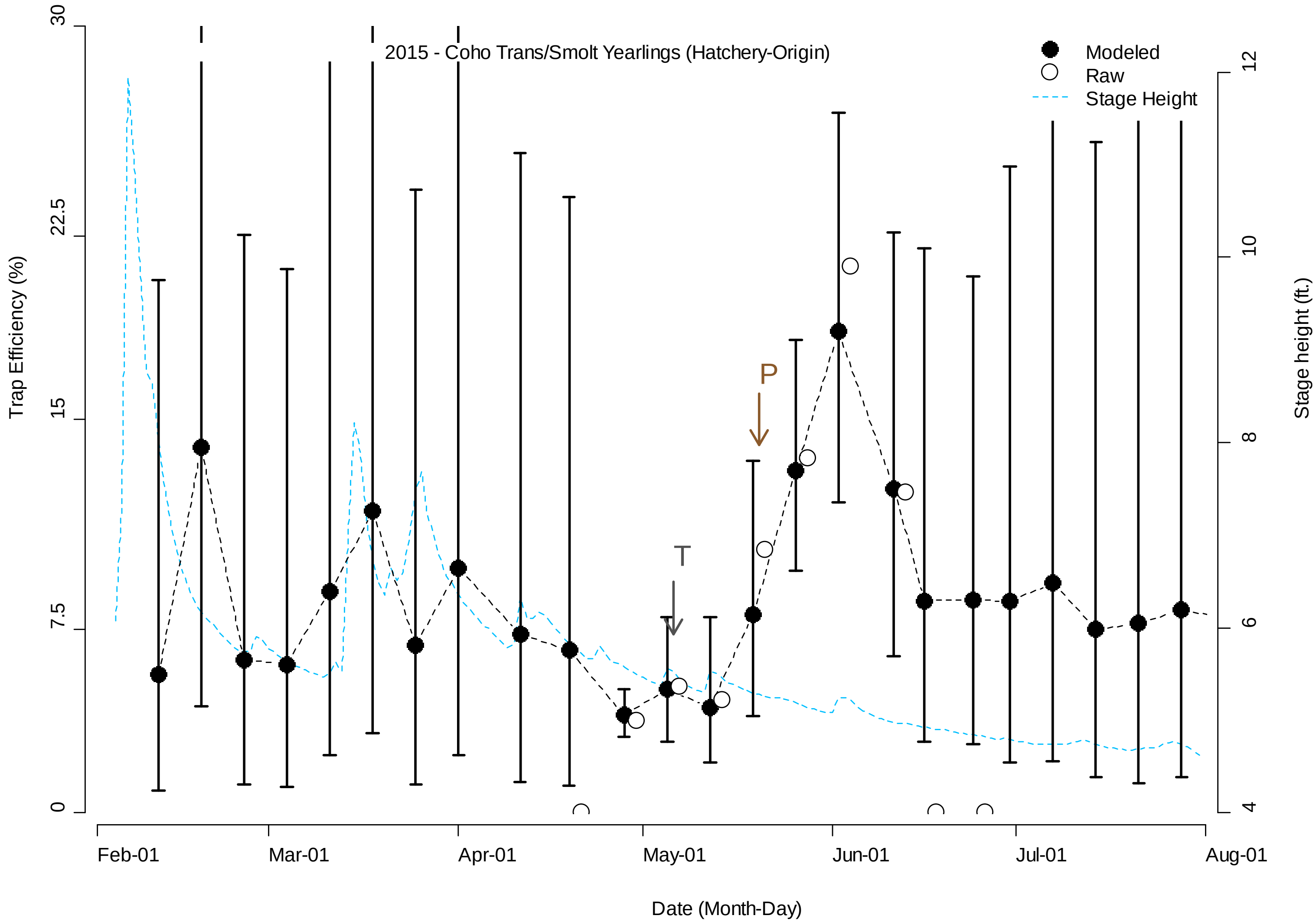

Figure D66. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2015.

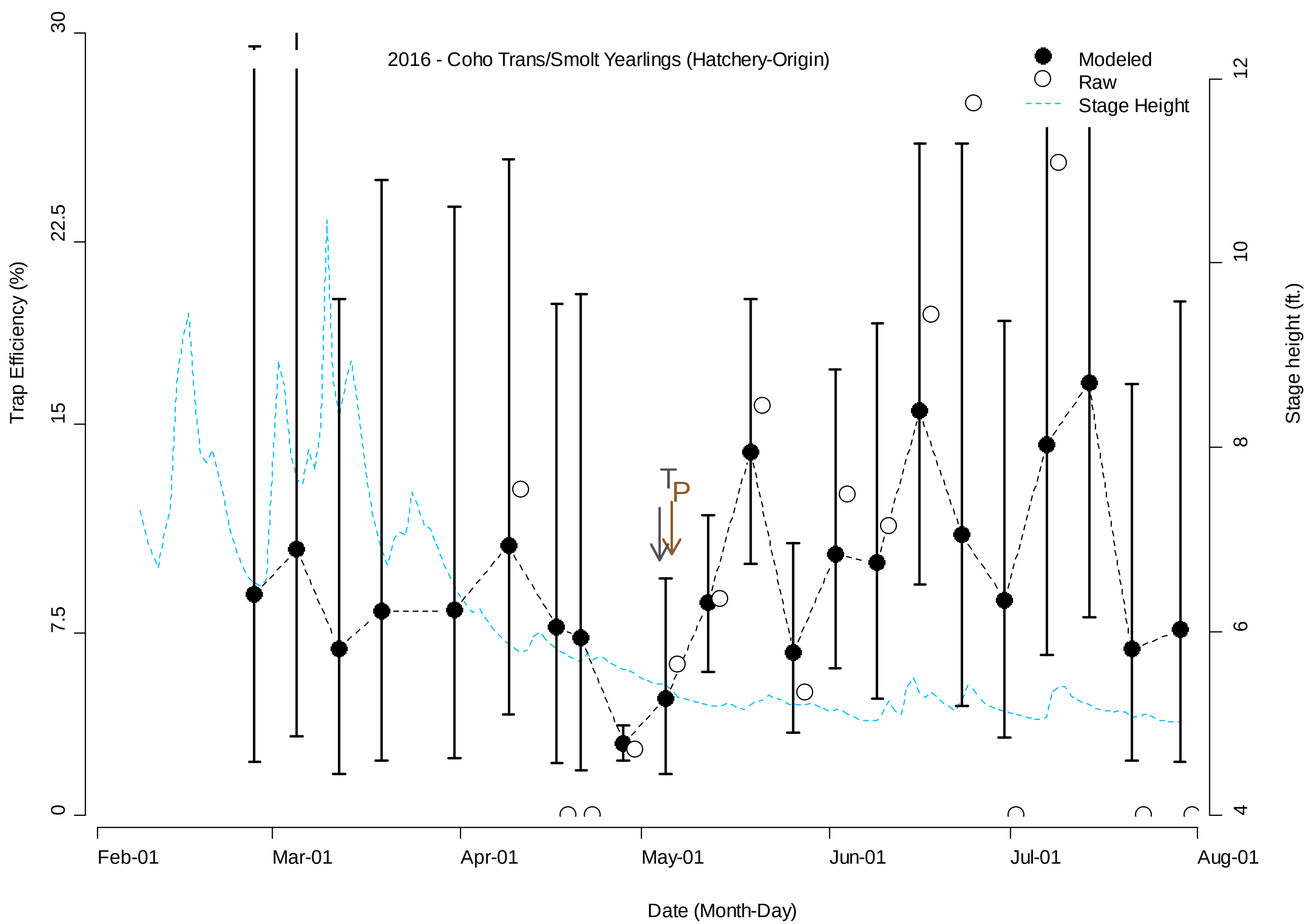

Figure D67. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2016.

Steelhead (Natural-Origin, Transitional/Smolt, Yearling)

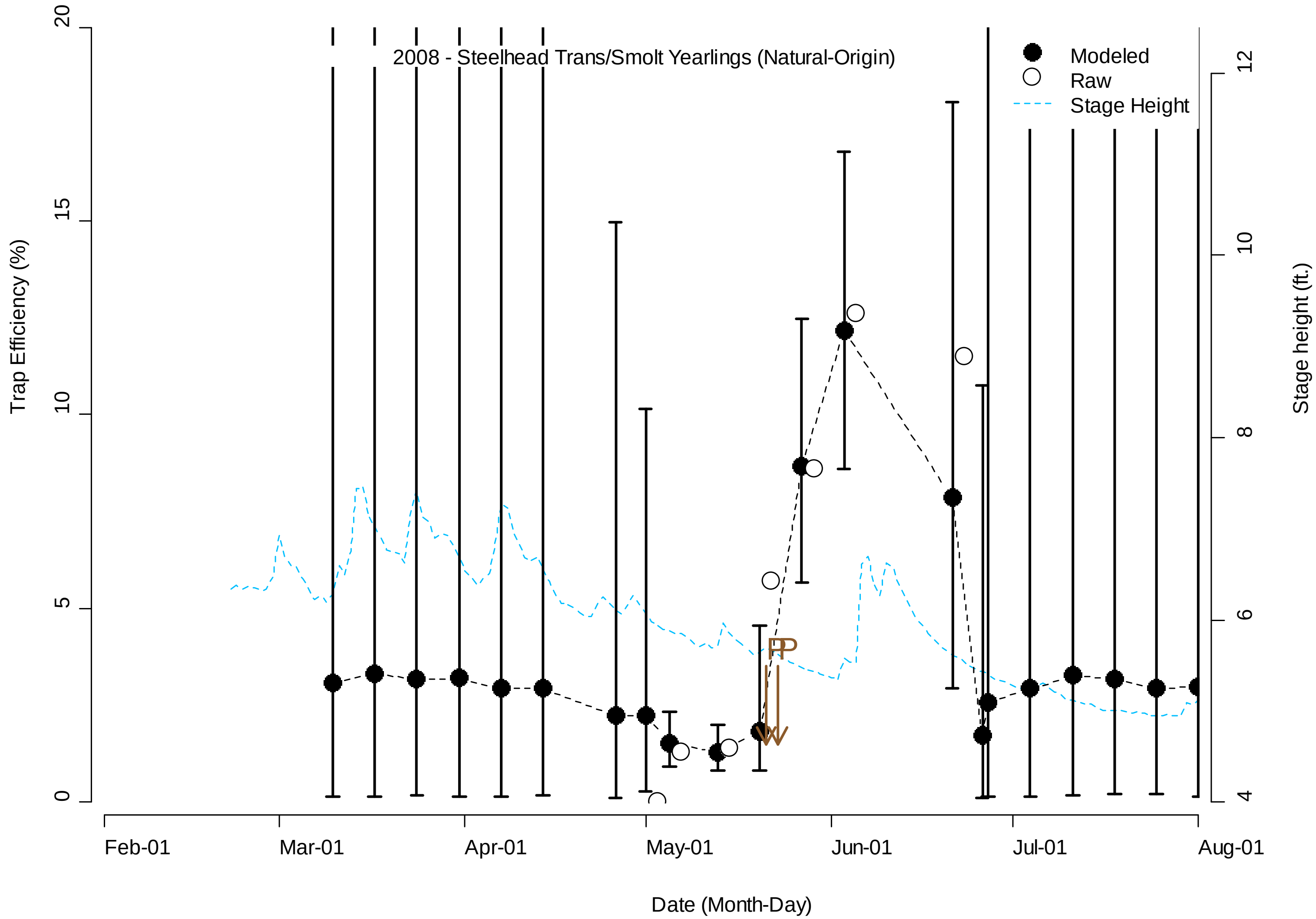

Figure D68. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2008.

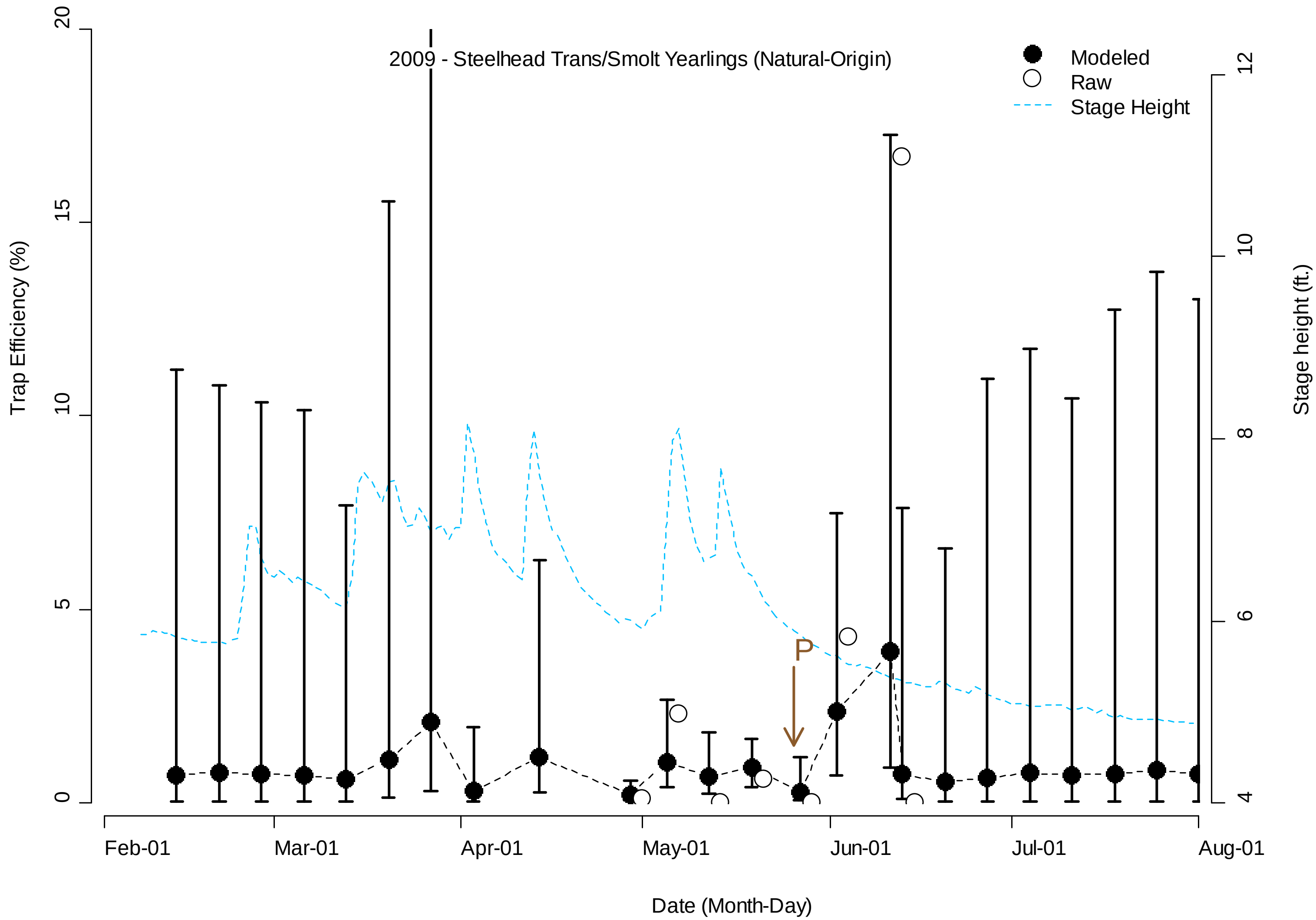

Figure D69. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling lings) captured at the mainstem Grays River screw trap in 2009.

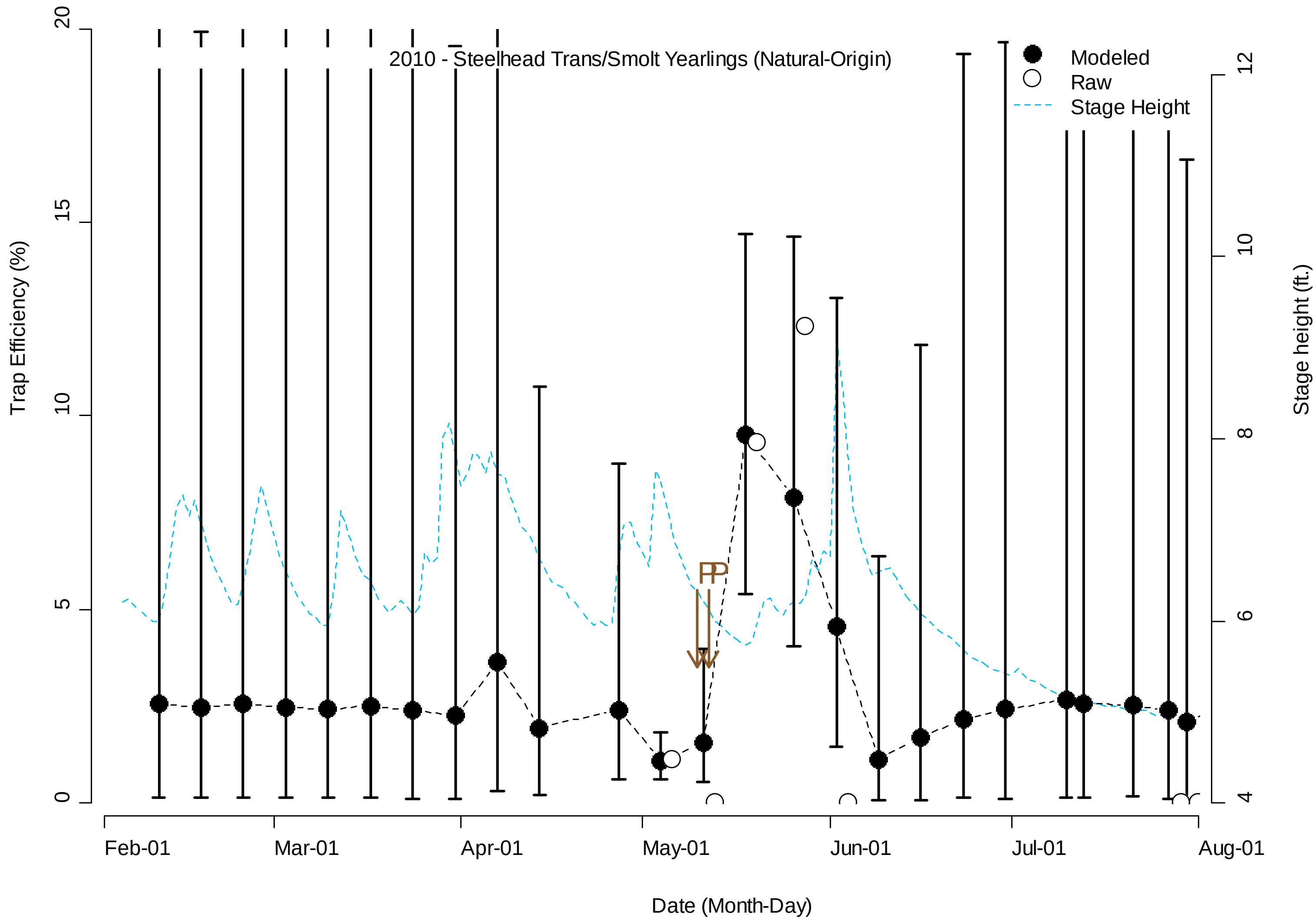

Figure D70. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2010.

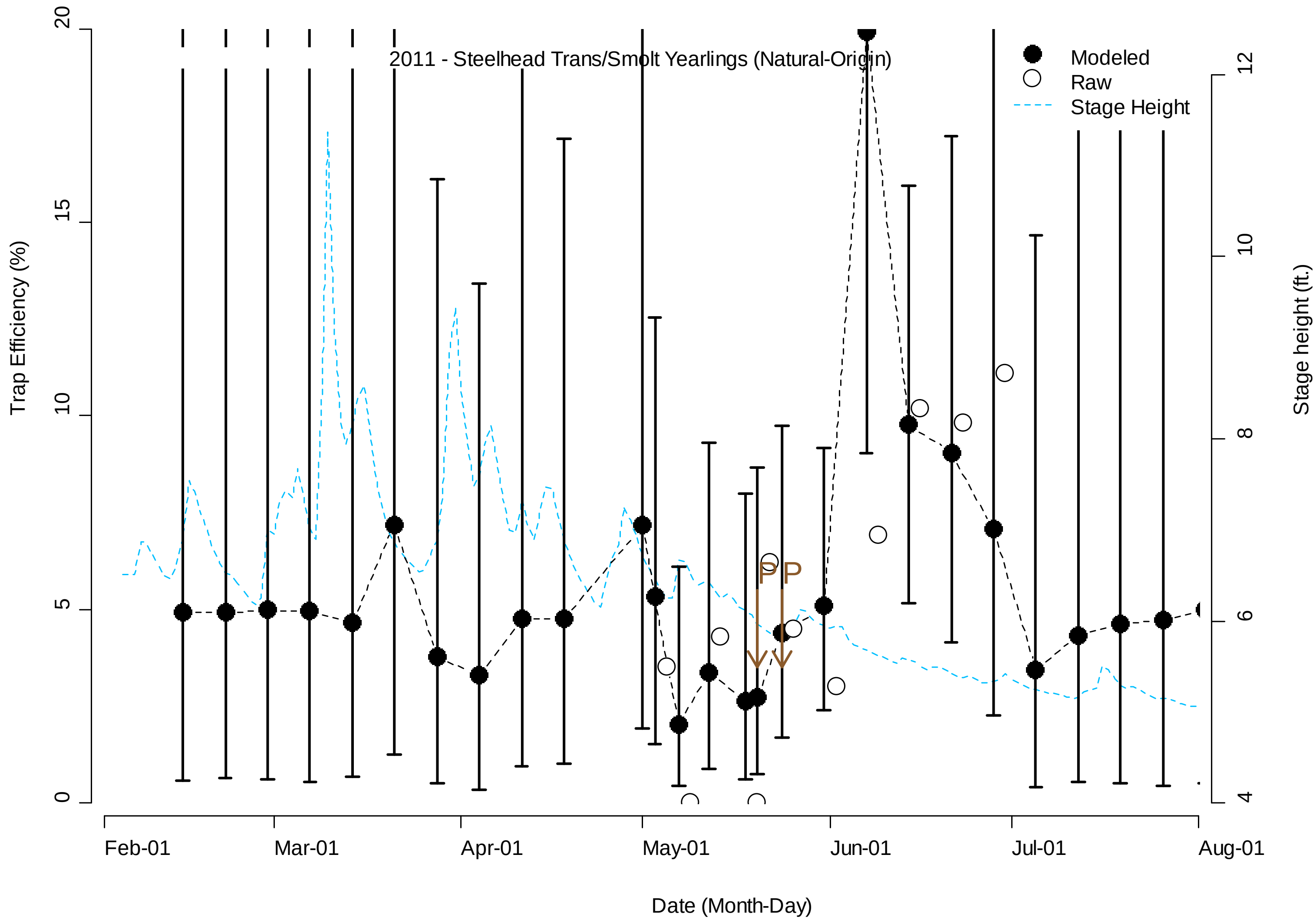

Figure D71. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2011.

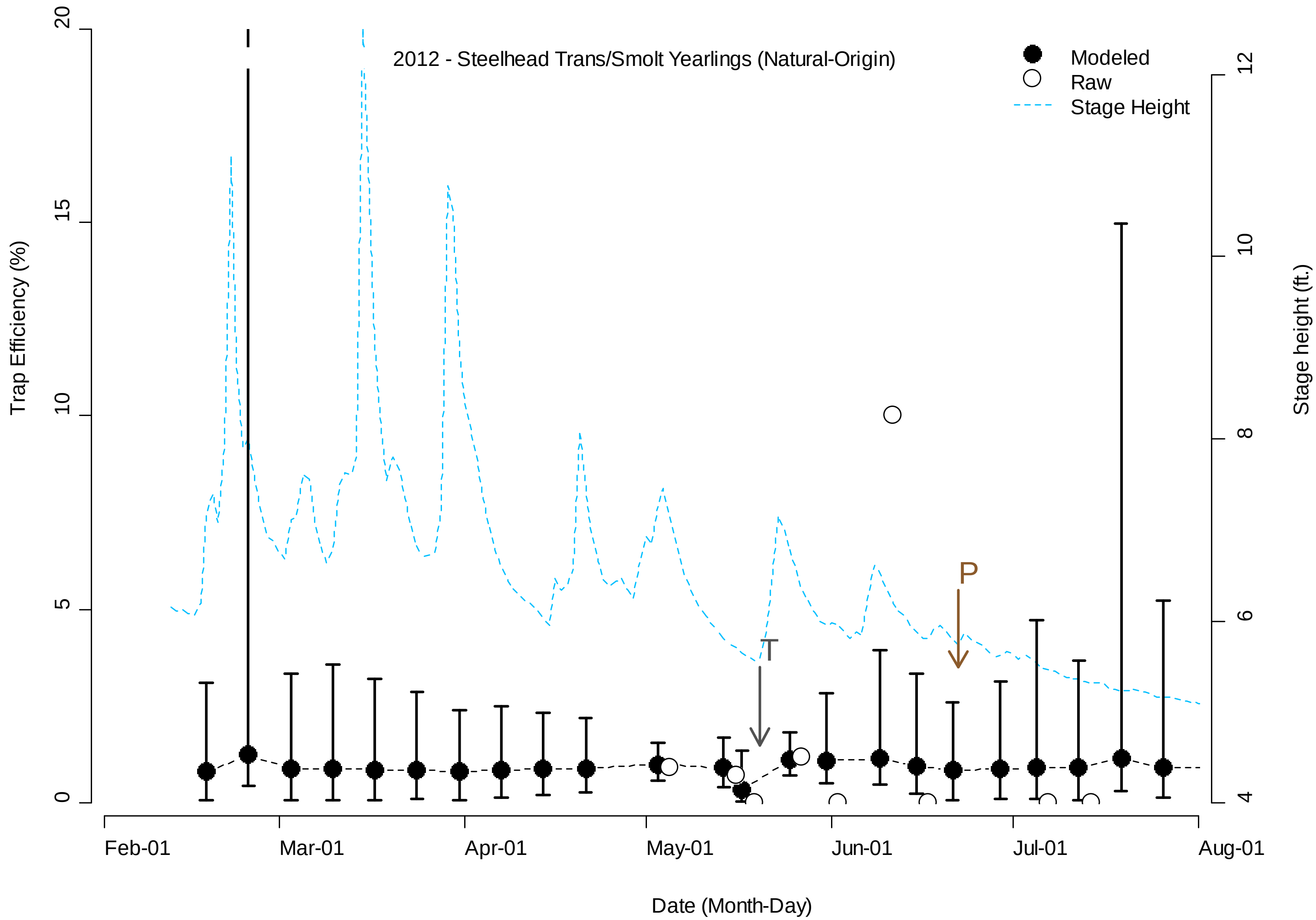

Figure D72. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2012.

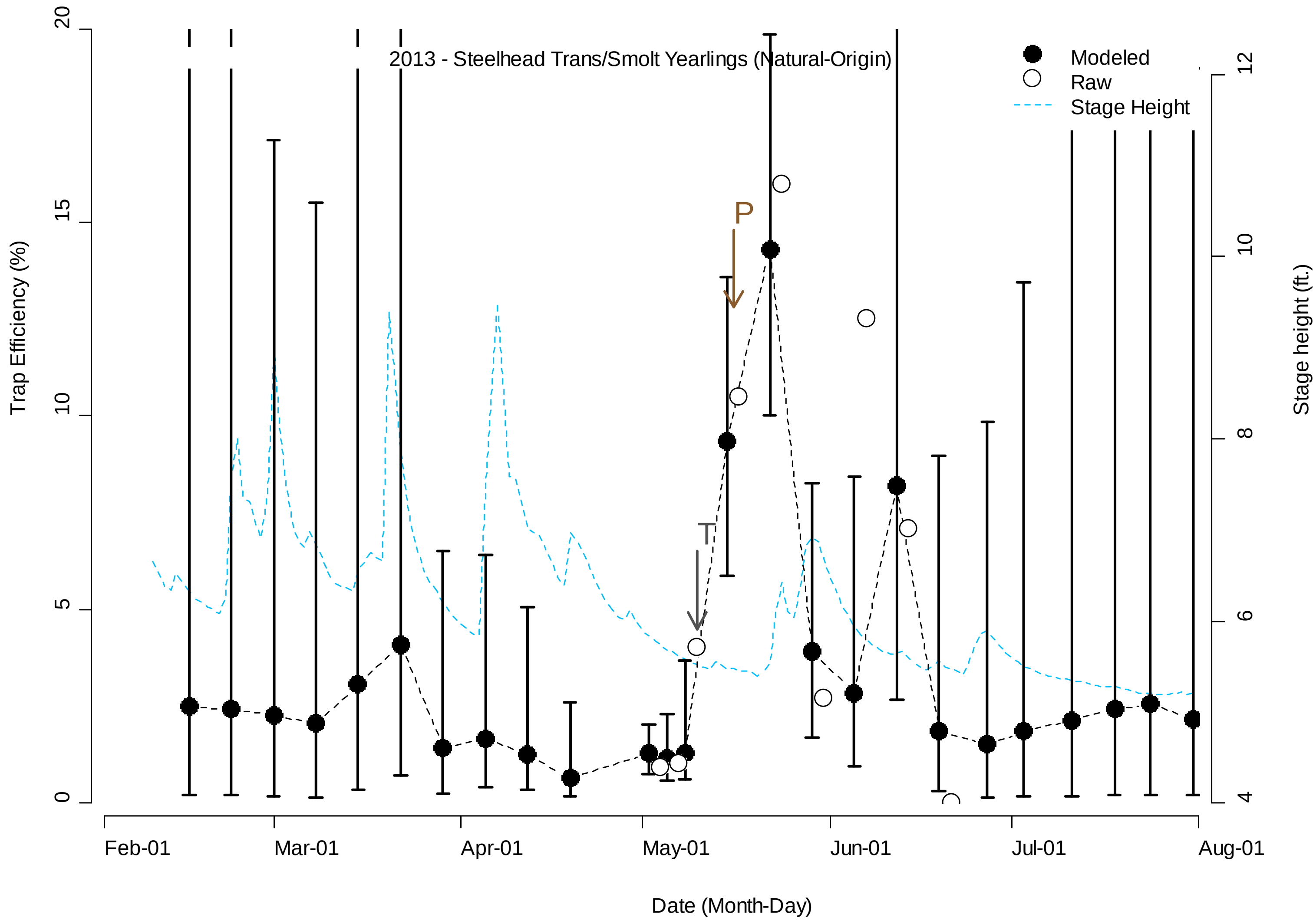

Figure D73. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2013.

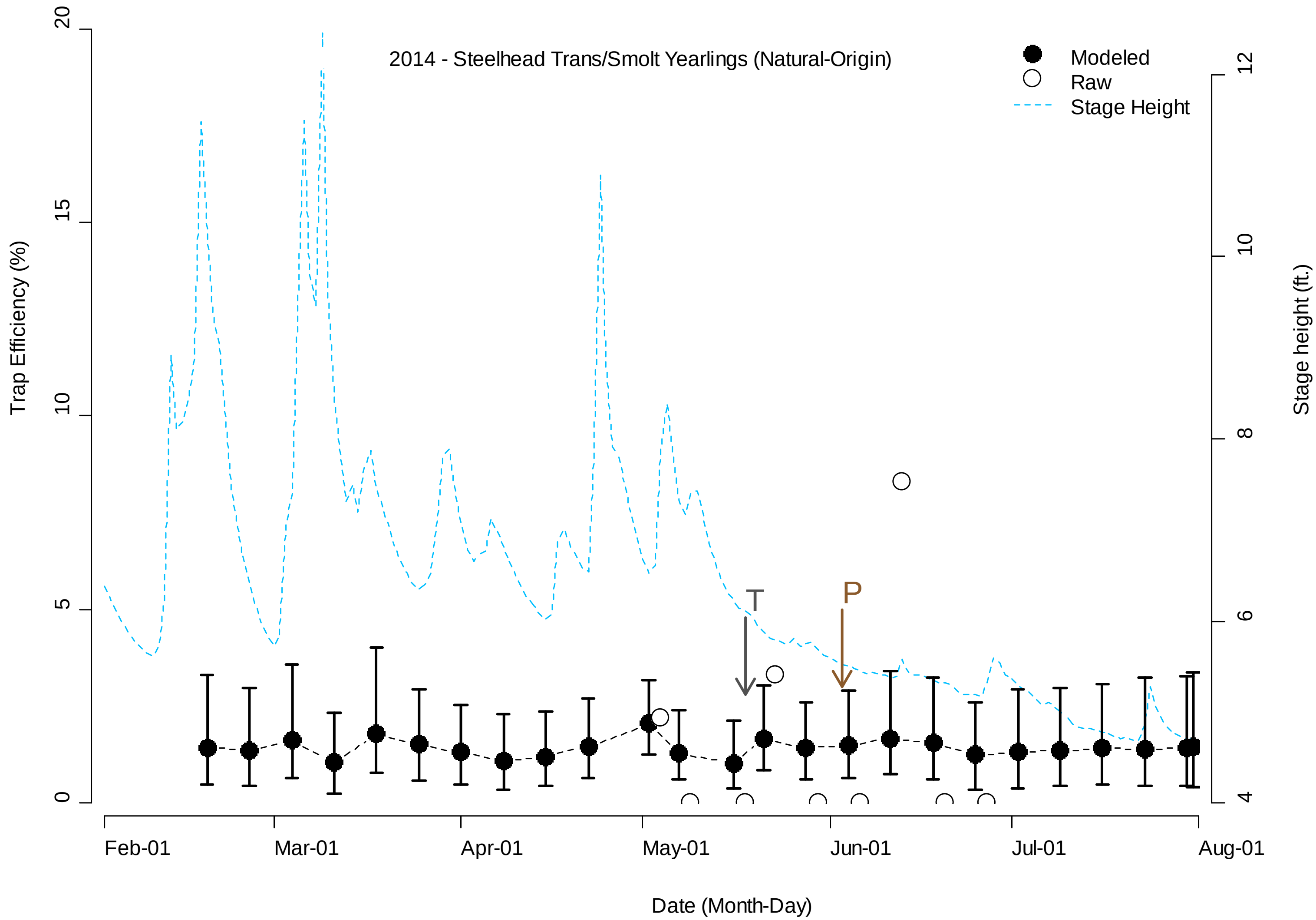

Figure D74. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2014.

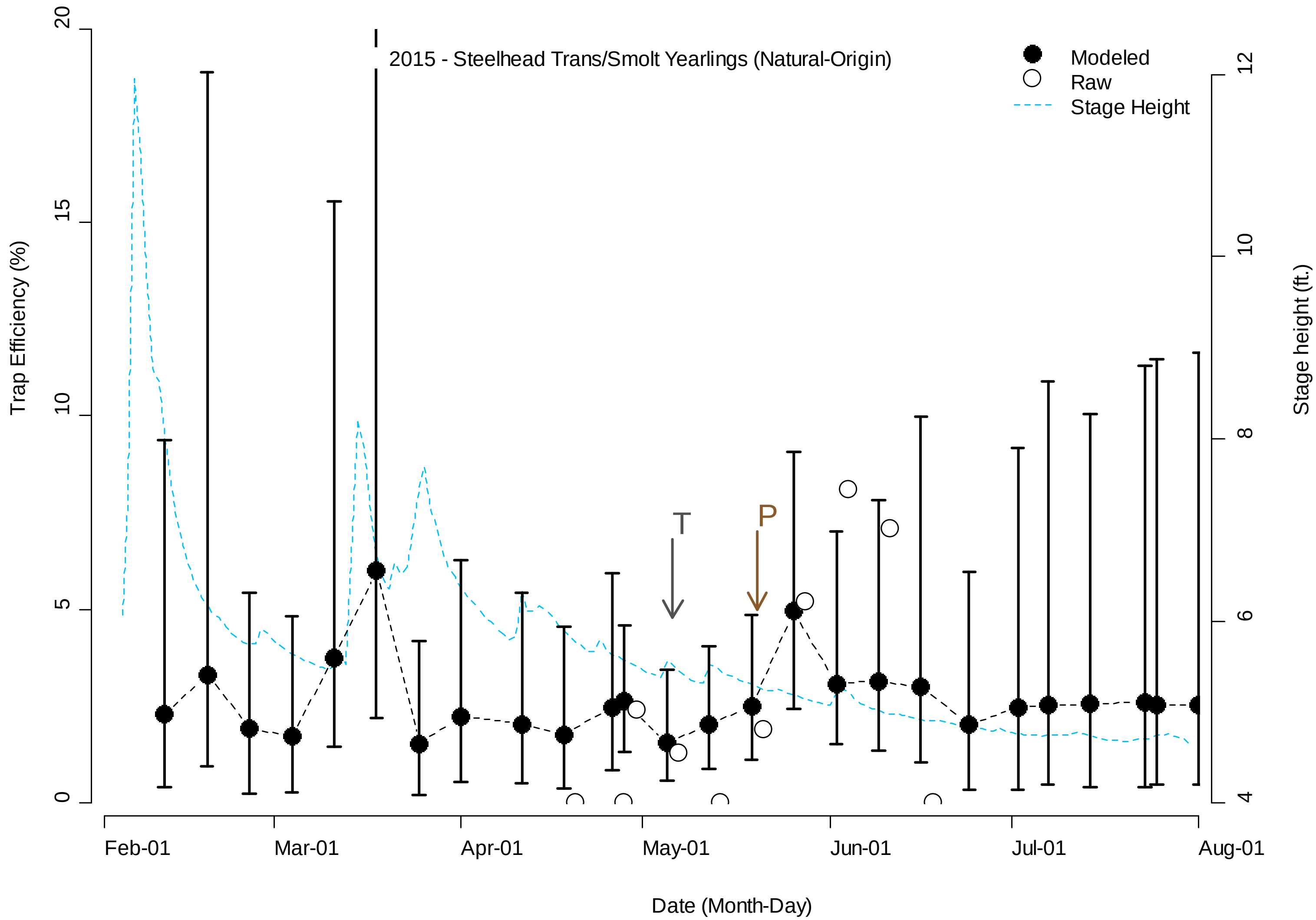

Figure D75. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2015.

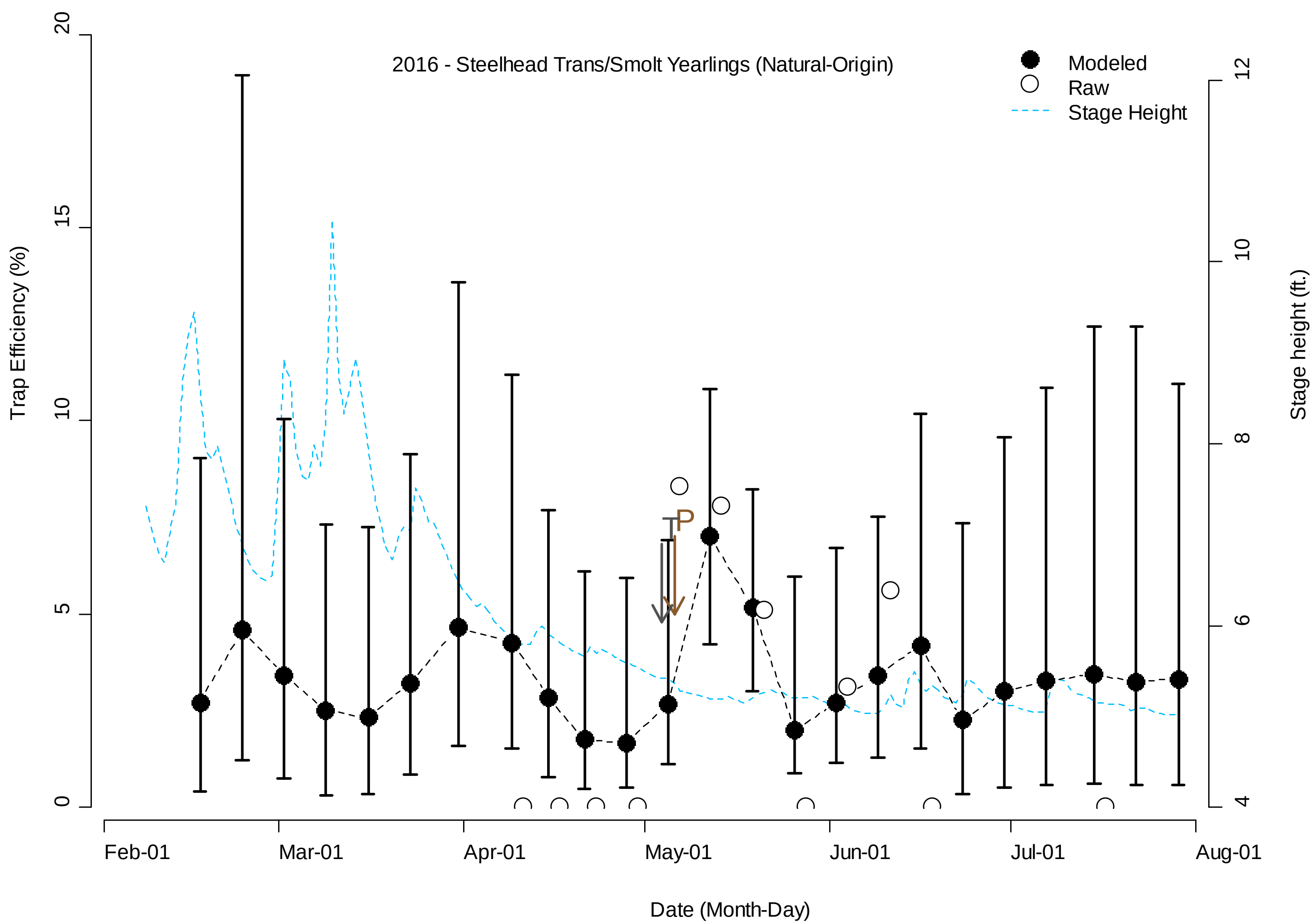

Figure D76. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling ngs) captured at the mainstem Grays River screw trap in 2016.

Steelhead (Hatchery-Origin, Transitional/Smolt, Yearling)

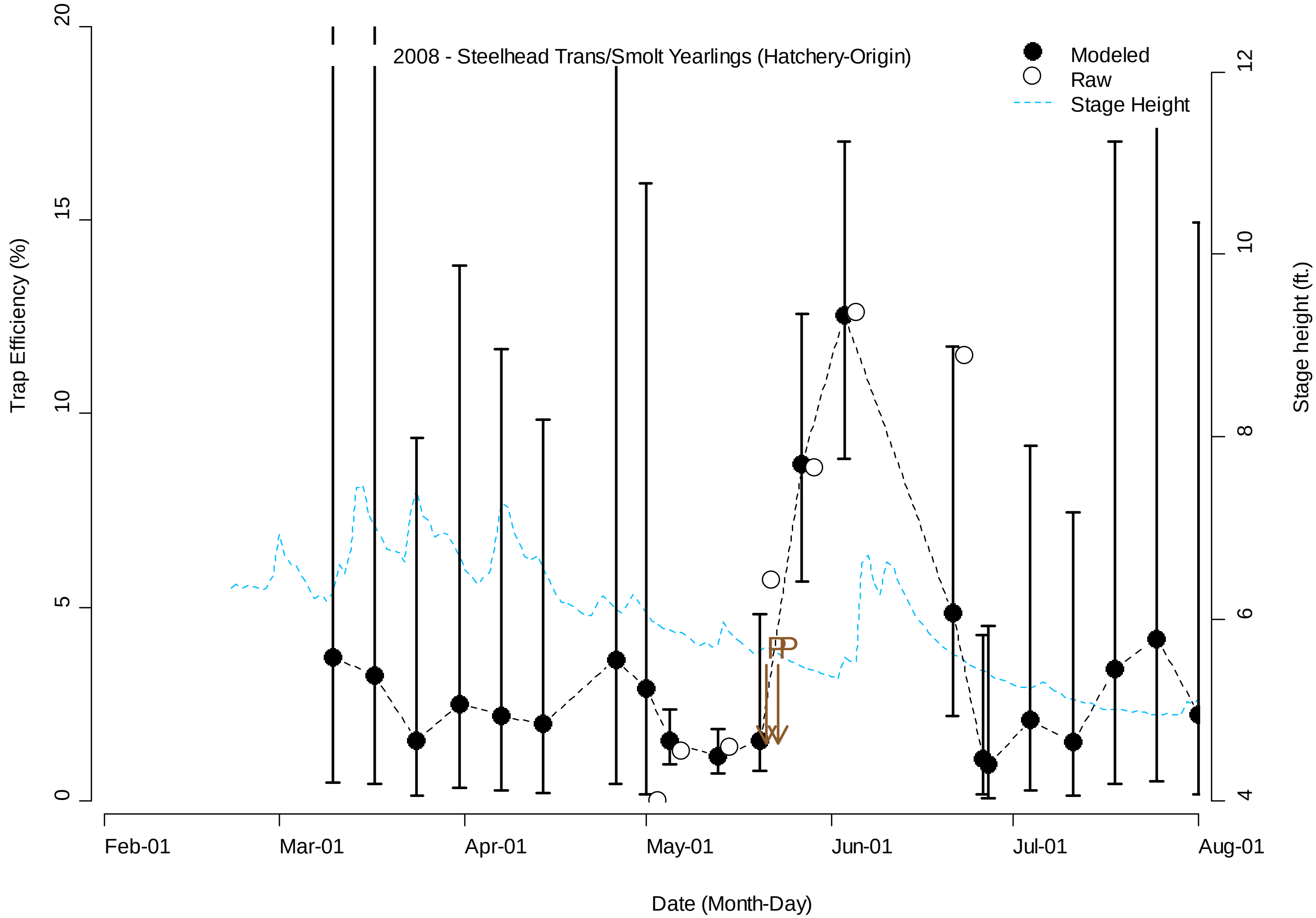

Figure D77. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for hatchery-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2008.

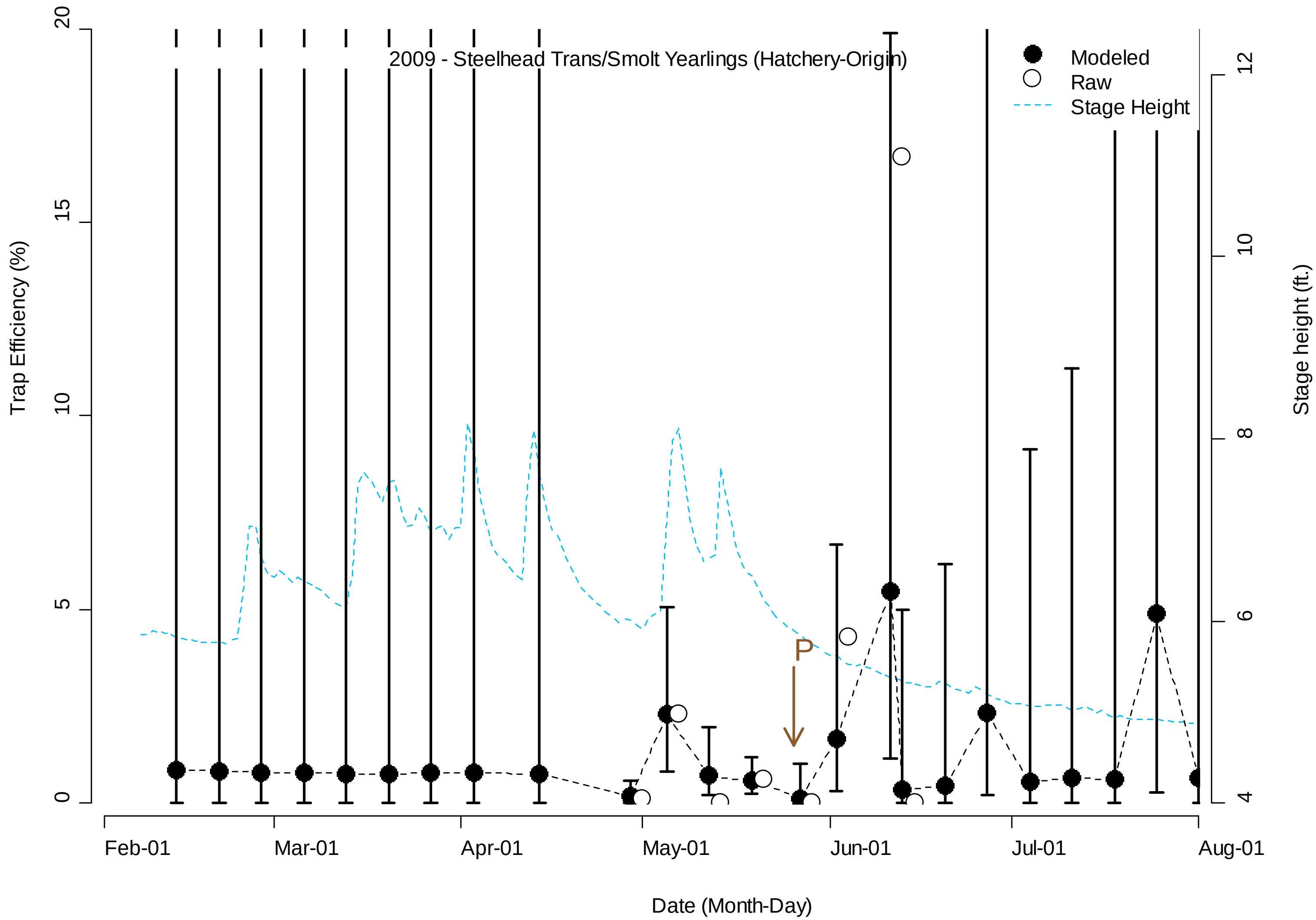

Figure D78. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for hatchery-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2009.

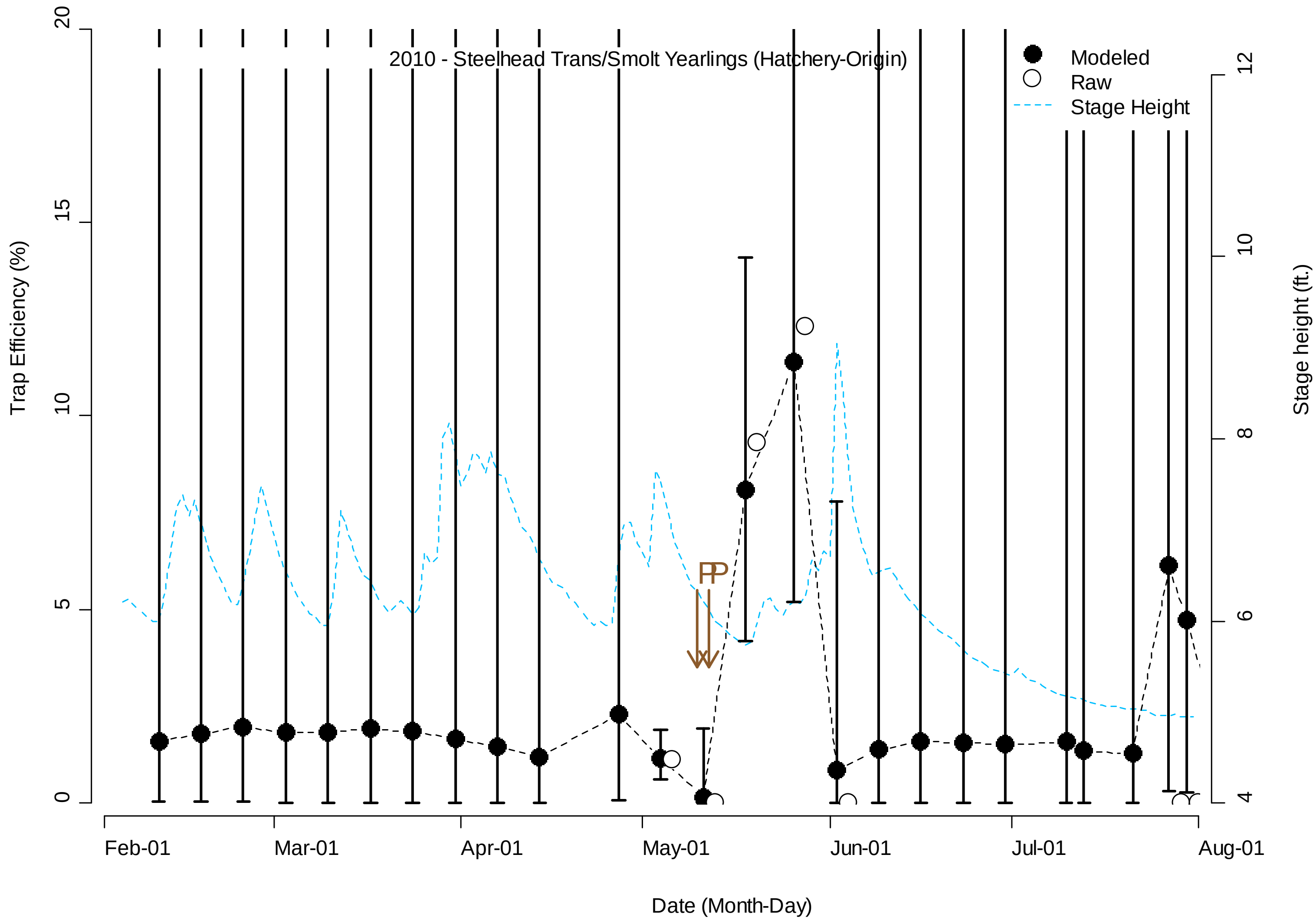

Figure D79. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for hatchery-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2010.

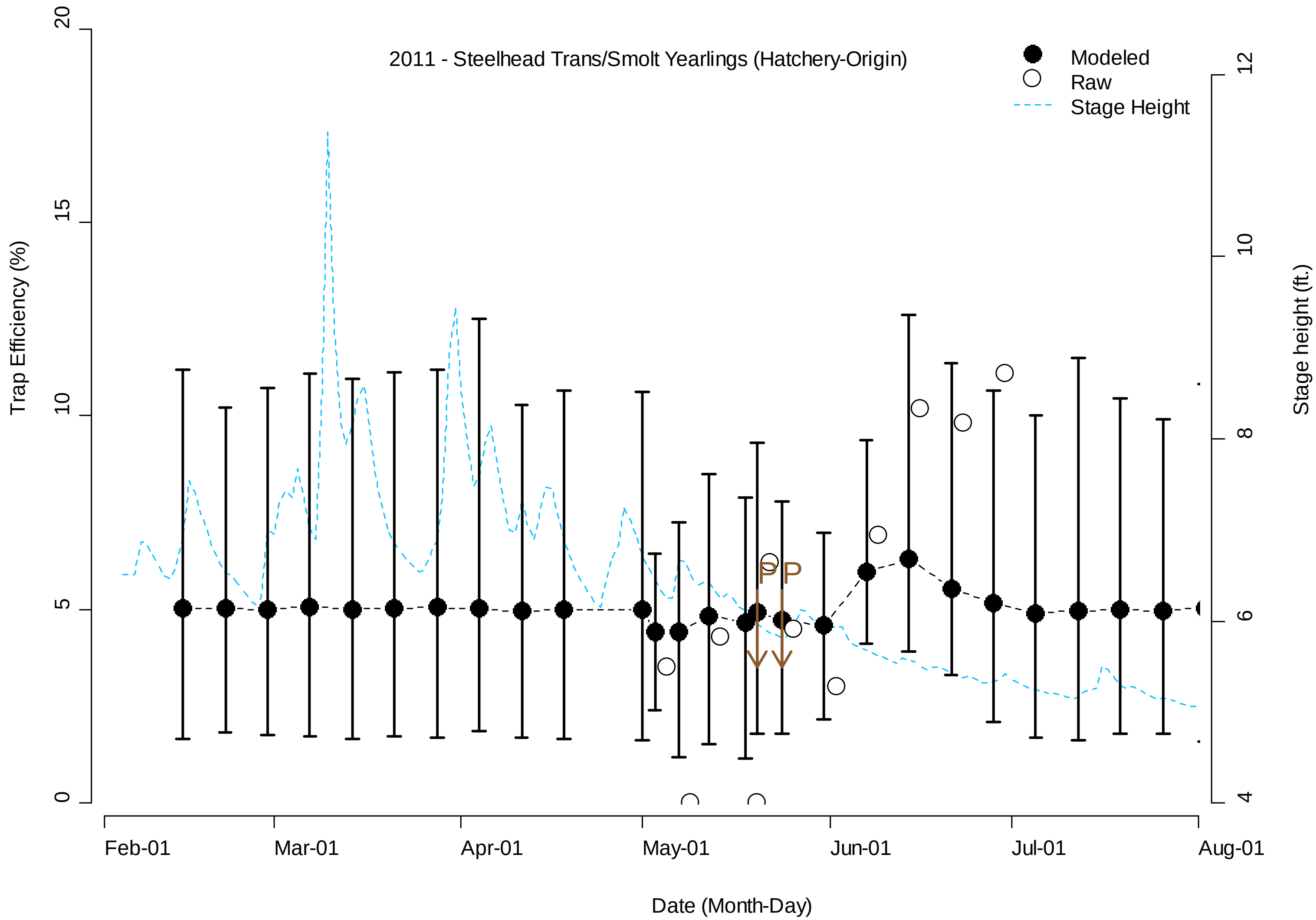

Figure D80. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for hatchery-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2011.

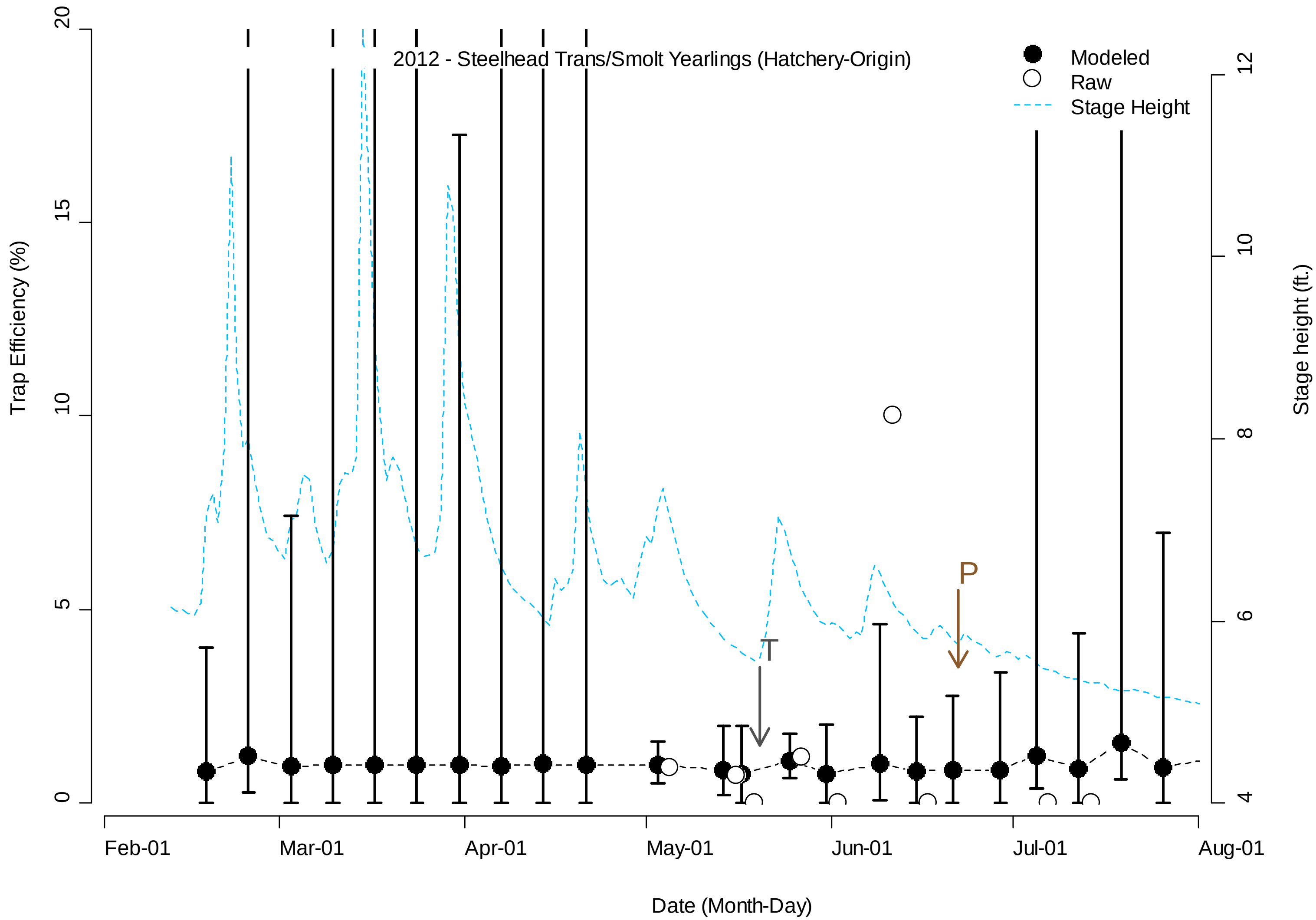

Figure D81. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for hatchery-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2012.

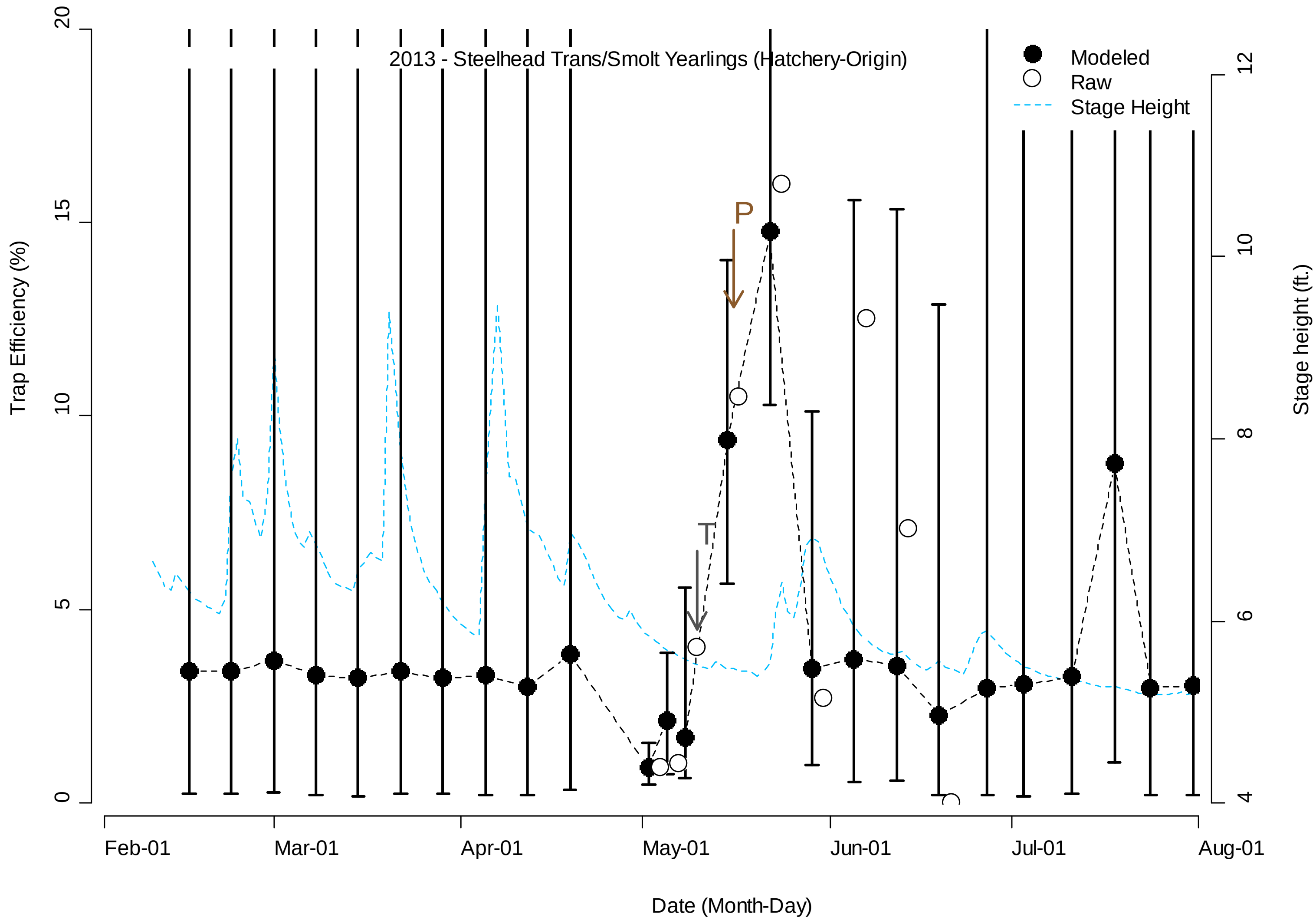

Figure D82. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for hatchery-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2013.

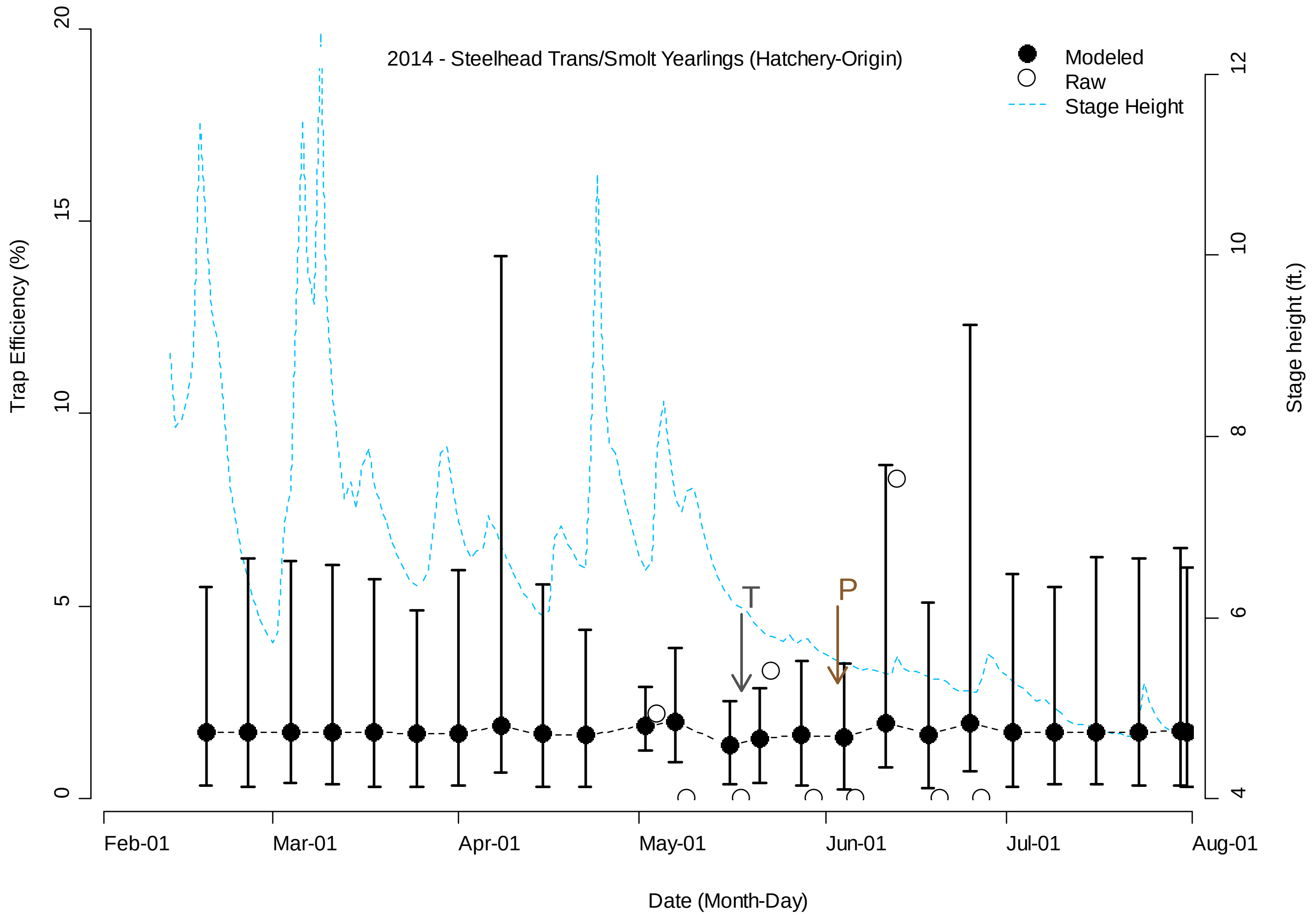

Figure D83. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for hatchery-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2014.

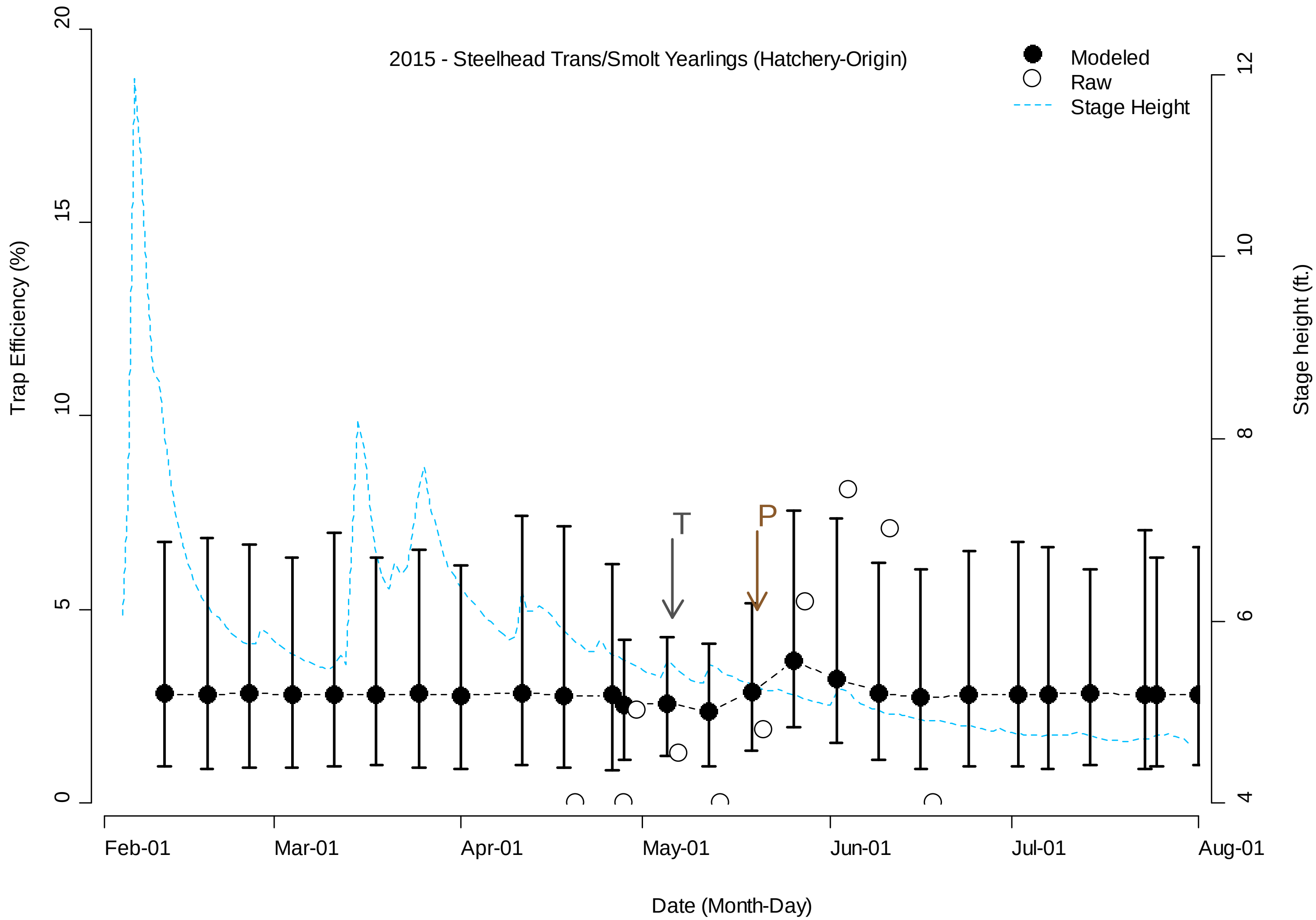

Figure D84. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for hatchery-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the mainstem Grays River screw trap in 2015.

Chum salmon (Natural-Origin, Fry)

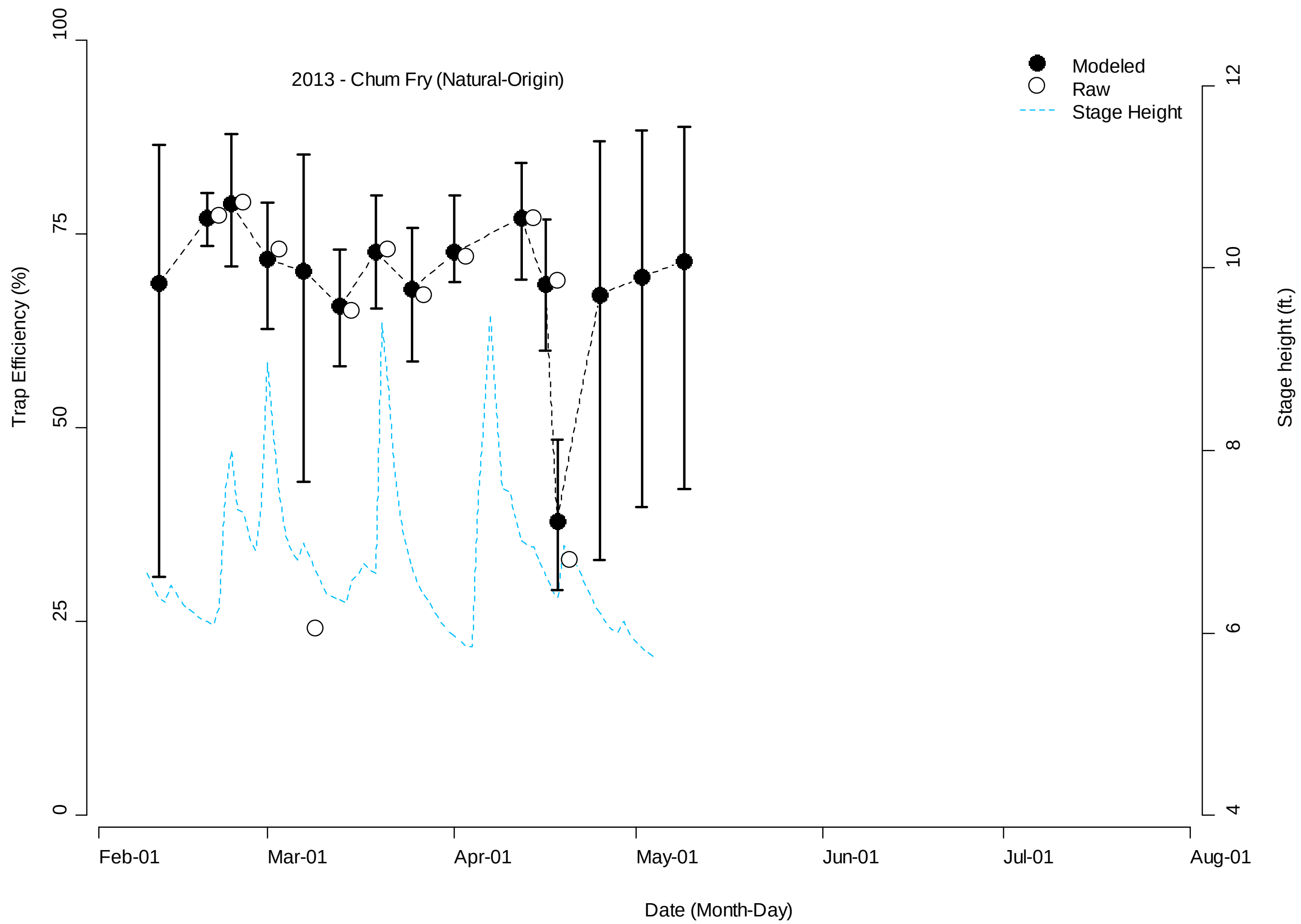

Figure D85. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) captured at the Crazy Johnson Creek screw trap in 2013.

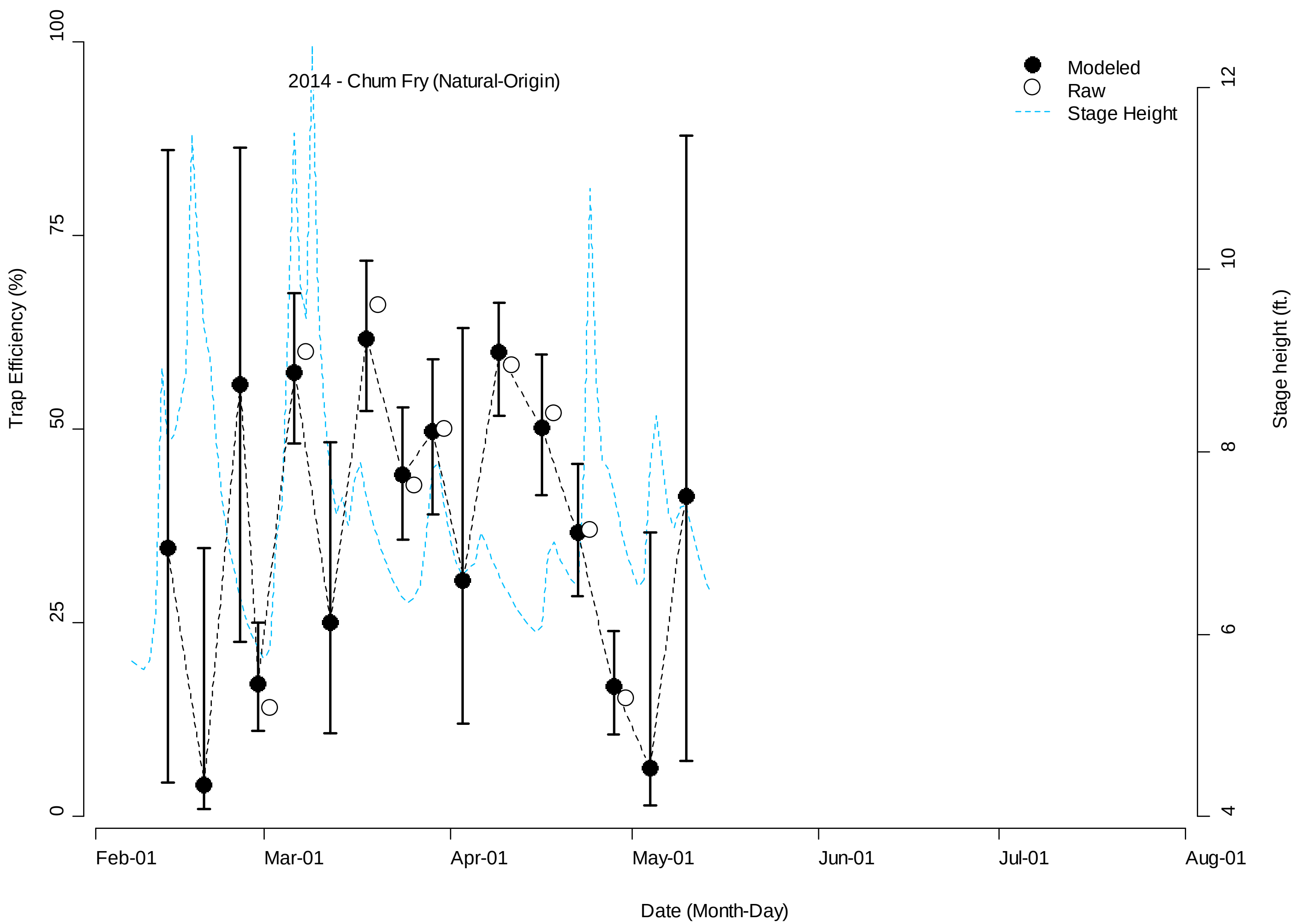

Figure D86. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) captured at the Crazy Johnson Creek screw trap in 2014.

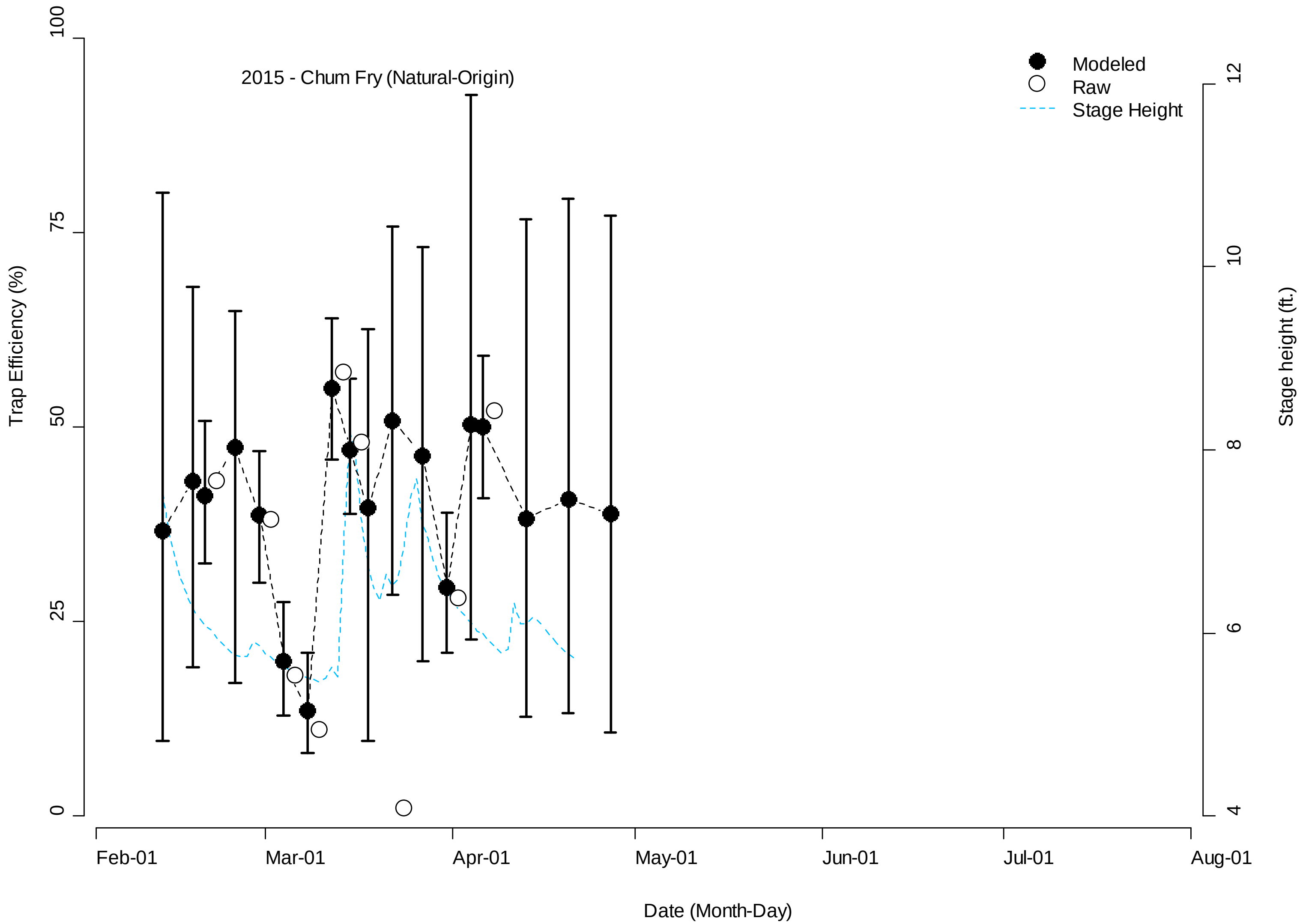

Figure D87. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) captured at the Crazy Johnson Creek screw trap in 2015.

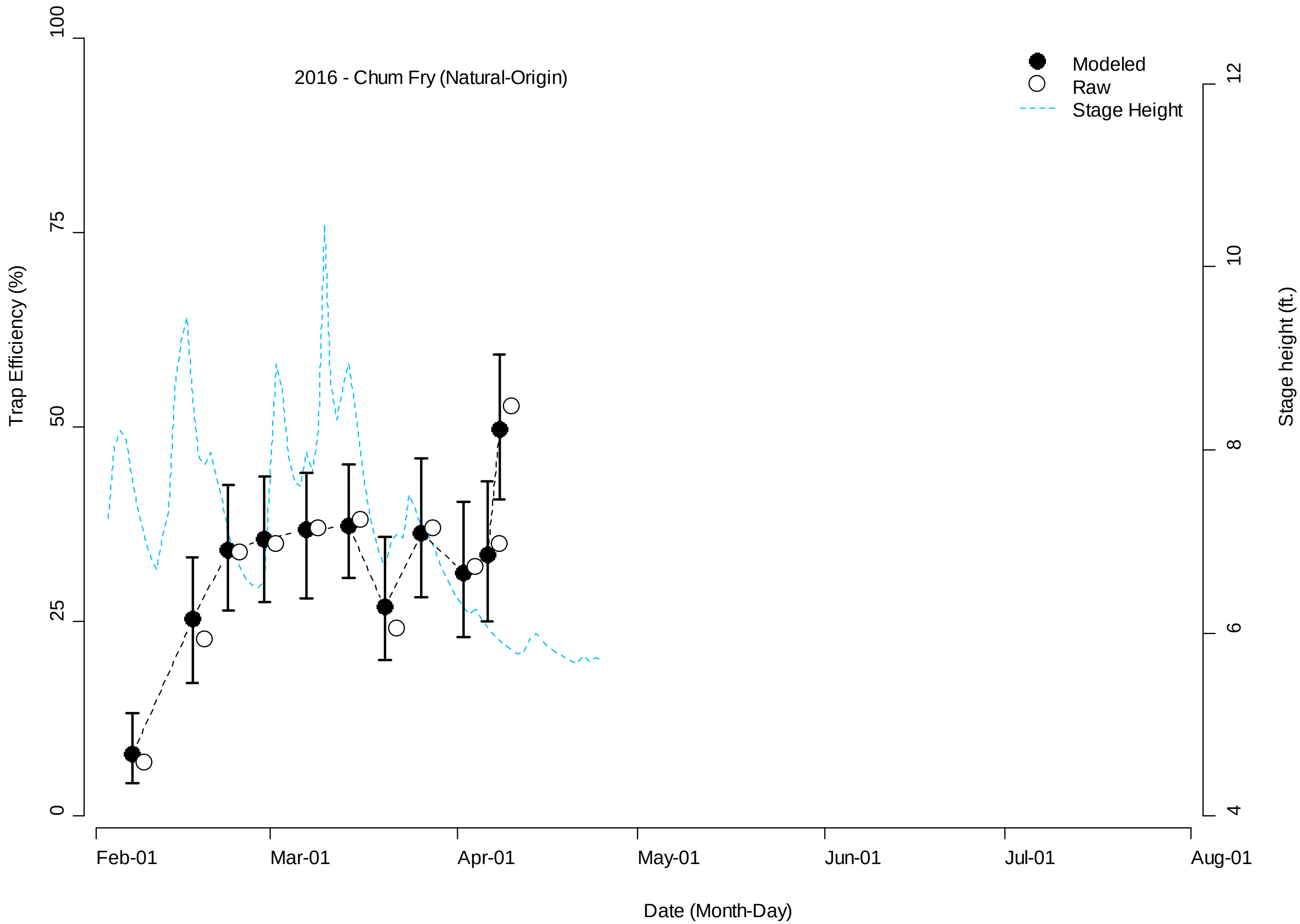

Figure D88. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) captured at the Crazy Johnson Creek screw trap in 2016.

Duncan Channels

Chum salmon (Natural-Origin, Fry)

Juvenile data at the Duncan Channels were collected using a fence-panel weir, which was assumed to have 100% capture efficiency unless the trap was compromised. Daily catch and trap functionality data for each year are reported in Appendix C (Tables C93 – C 107). Therefore, trap efficiency plots were not created for Duncan Channel chum salmon fry.

Coho salmon (Natural-origin, Transitional/Smolt, Yearling)

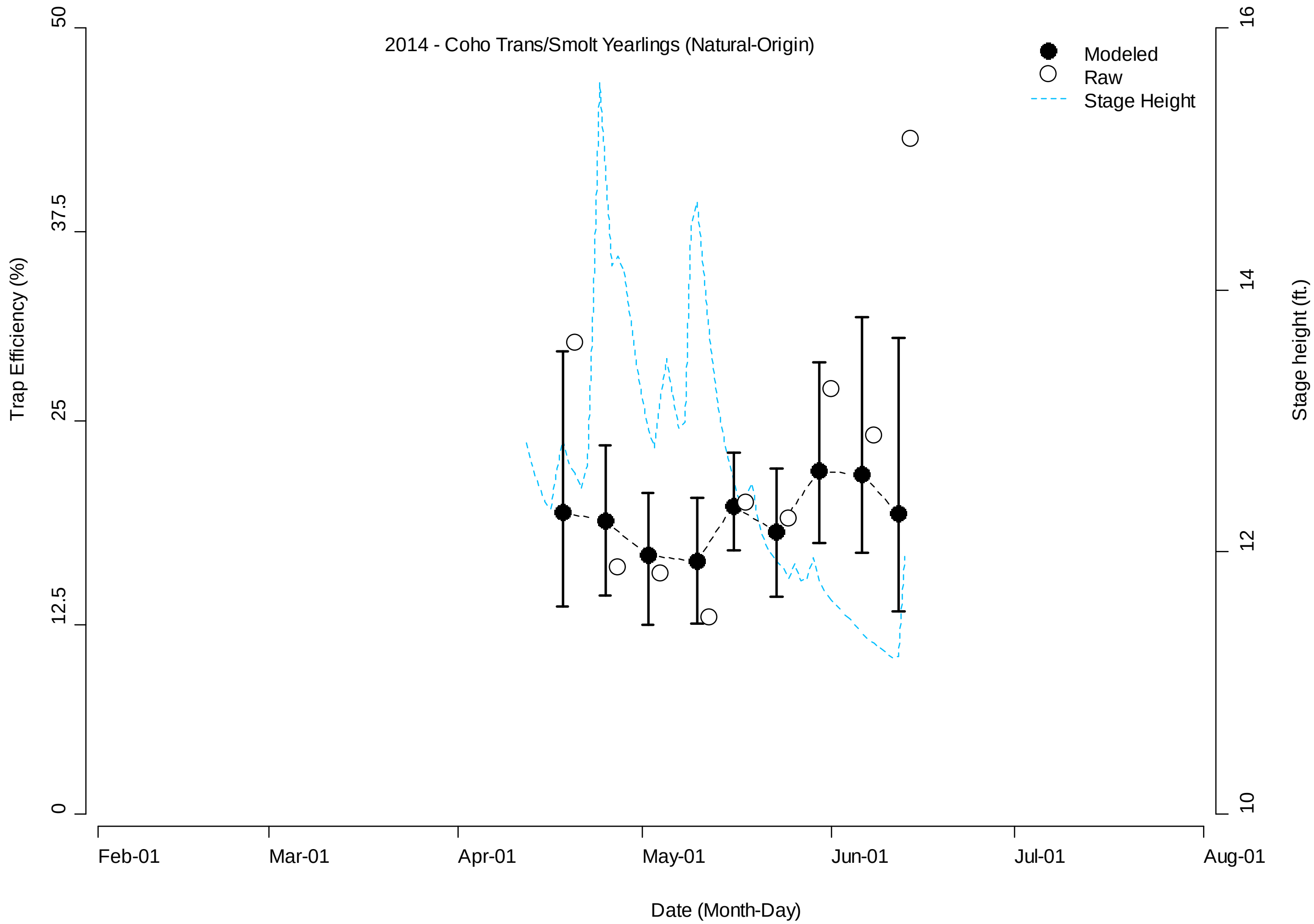

Figure D89. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the Hamilton Creek screw trap in 2014.

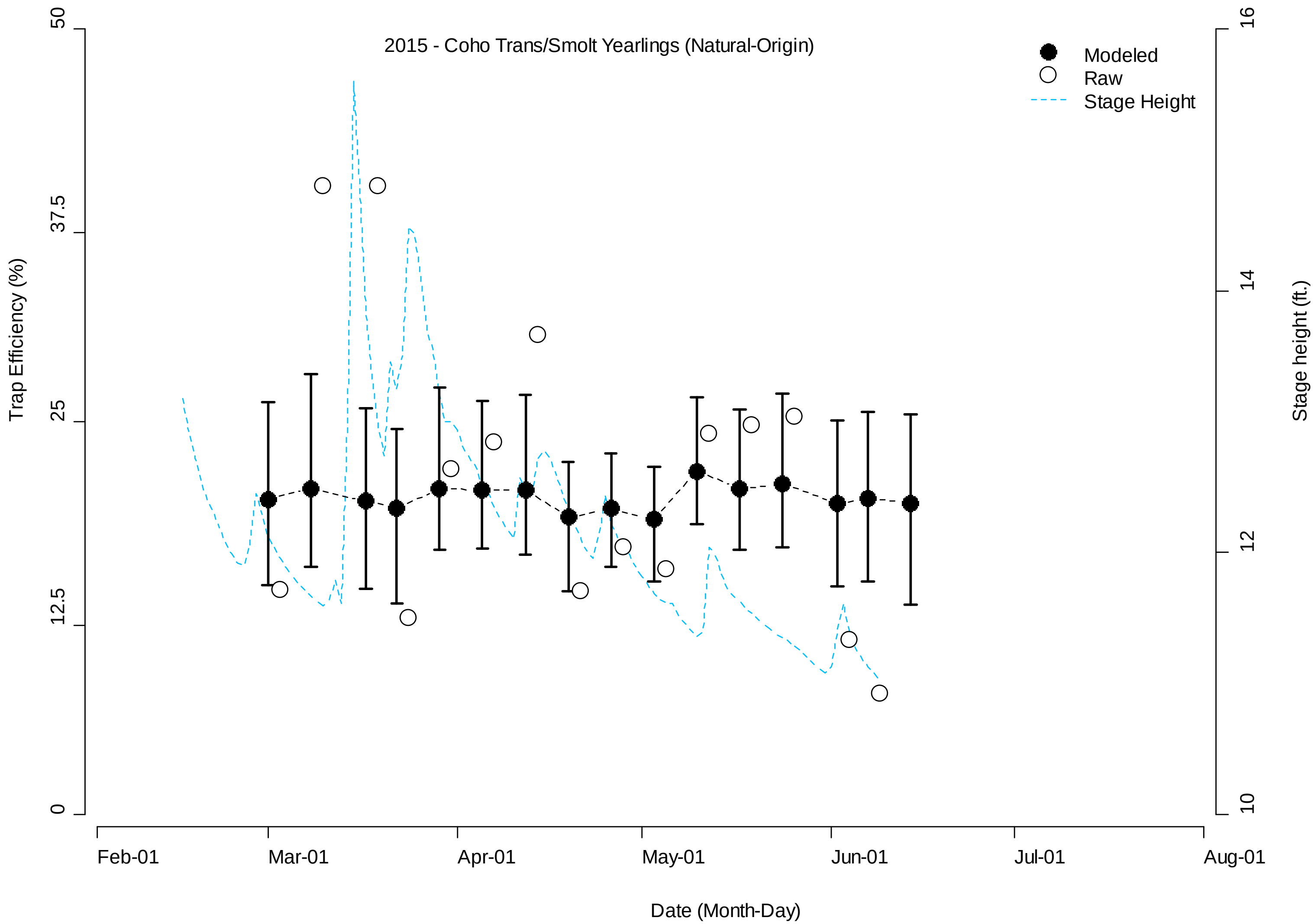

Figure D90. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the Hamilton Creek screw trap in 2015.

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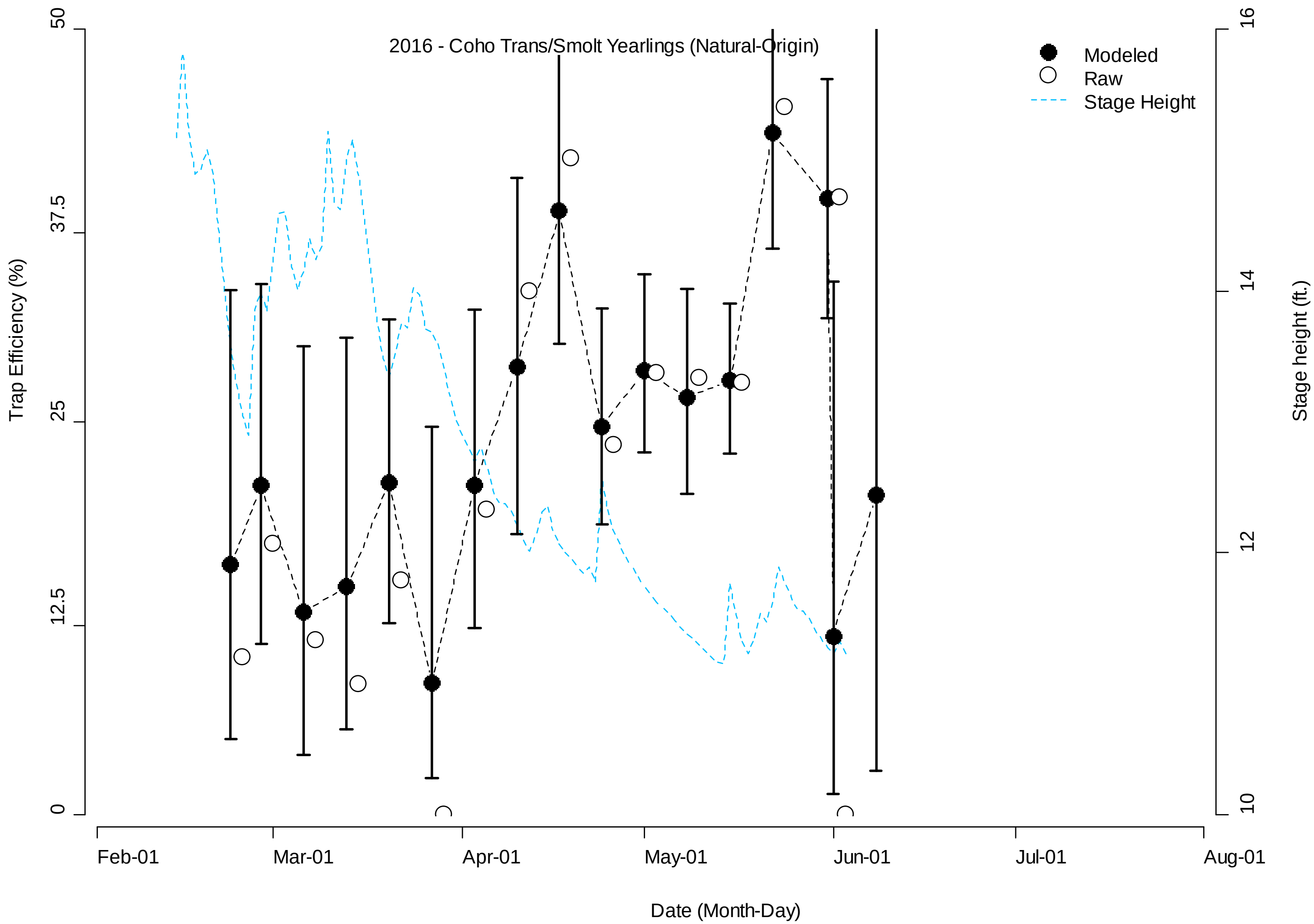

Figure D91. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) captured at the Hamilton Creek screw trap in 2016.

Steelhead (Natural-origin, Transitional/Smolt, Yearling)

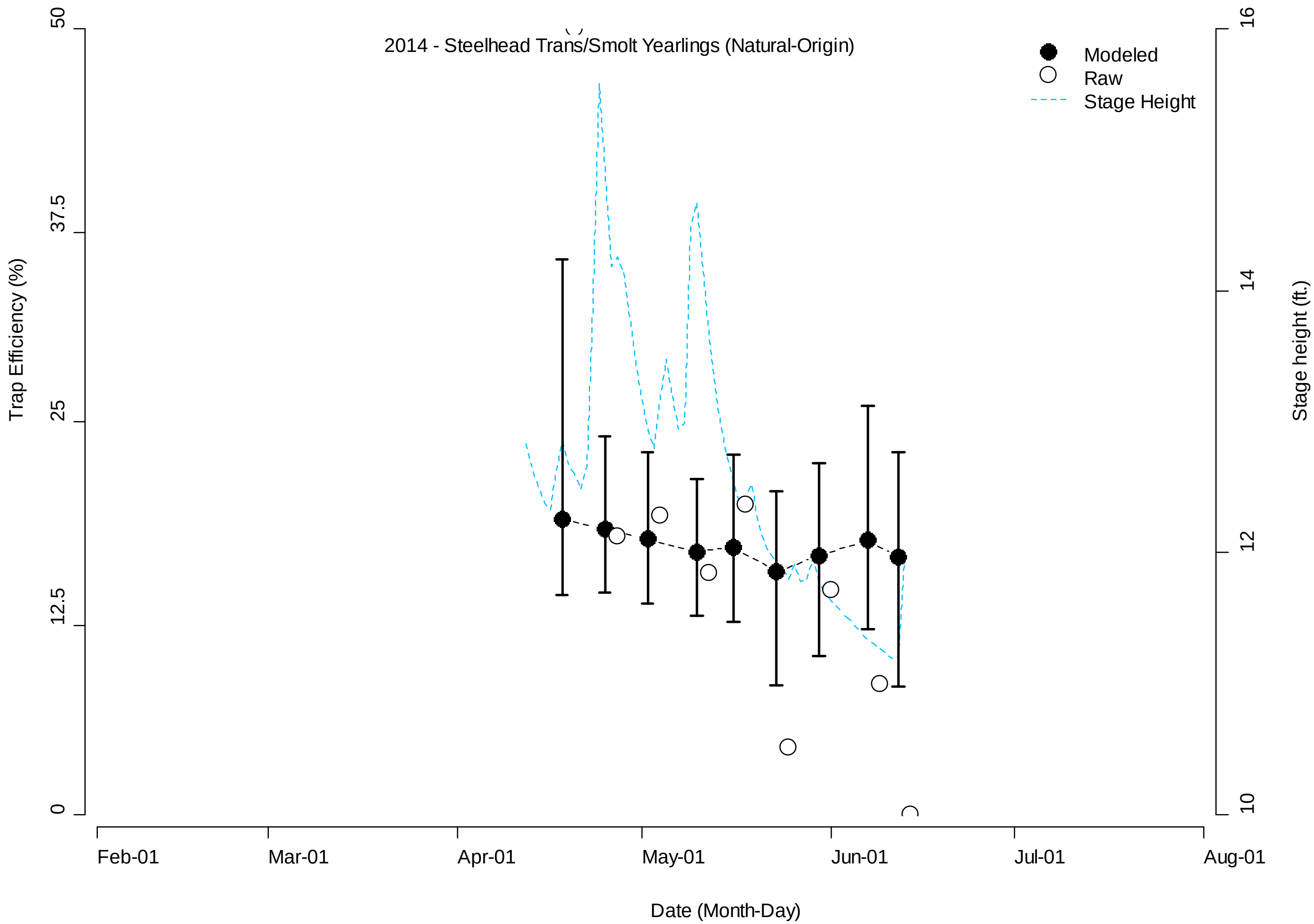

Figure D92. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the Hamilton Creek screw trap in 2014.

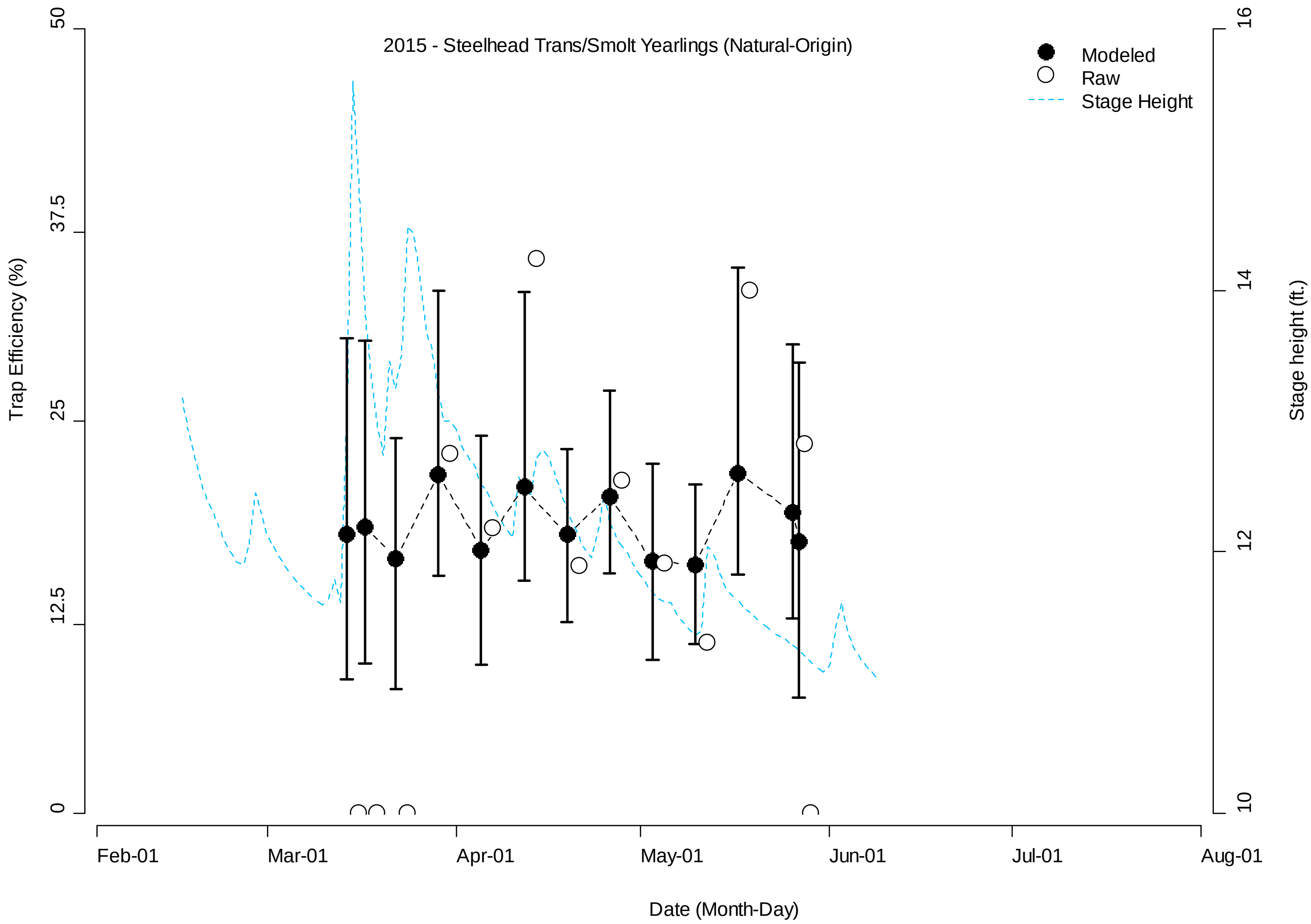

Figure D93. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the Hamilton Creek screw trap in 2015.

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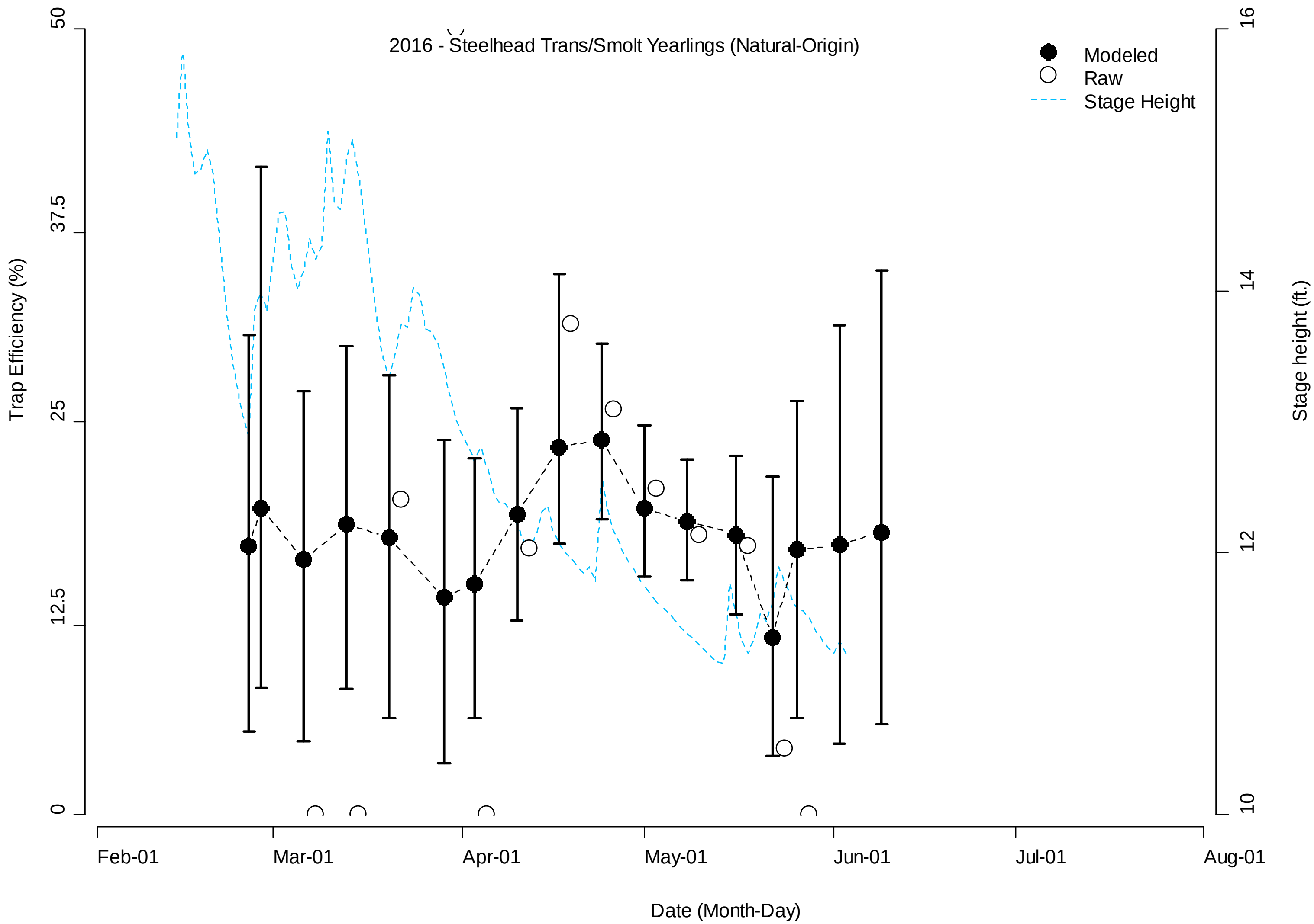

Figure D94. Modeled (black circle, dashed) and raw (white circle) trap efficiency by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) captured at the Hamilton Creek screw trap in 2016.

Hamilton Springs

Chum salmon (Natural-Origin, Fry)

Juvenile data at Hamilton Springs were collected using a fence-panel weir, which was assumed to have 100% capture efficiency unless the trap was compromised. Daily catch and trap functionality data for each year are reported in Appendix C (Tables C114 – C 119). Therefore, trap efficiency plots were not created for Hamilton Springs chum salmon fry.

Appendix E – Estimated Abundance by Period Plots

Plots of estimated abundance by marking period are included below for each group of fish in which an abundance estimate was generated. Groups of fish were broken up by (1) Trap Site, (2) Species, (3) Origin, (4) Life-stage/Age-class, and (5) Year. Abundances were estimated using the Bayesian Time-Stratified Population Analysis (BTSPAS) package in R, which uses hierarchically modeled capture probabilities and a smoothing spline. Estimates of abundance by period are plotted as black circles along with 95% credible intervals. Estimates of total abundance across all periods and its corresponding coefficient of variation (CV) are included on each plot for reference.

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Grays River

Chum salmon (Natural-Origin, Fry)

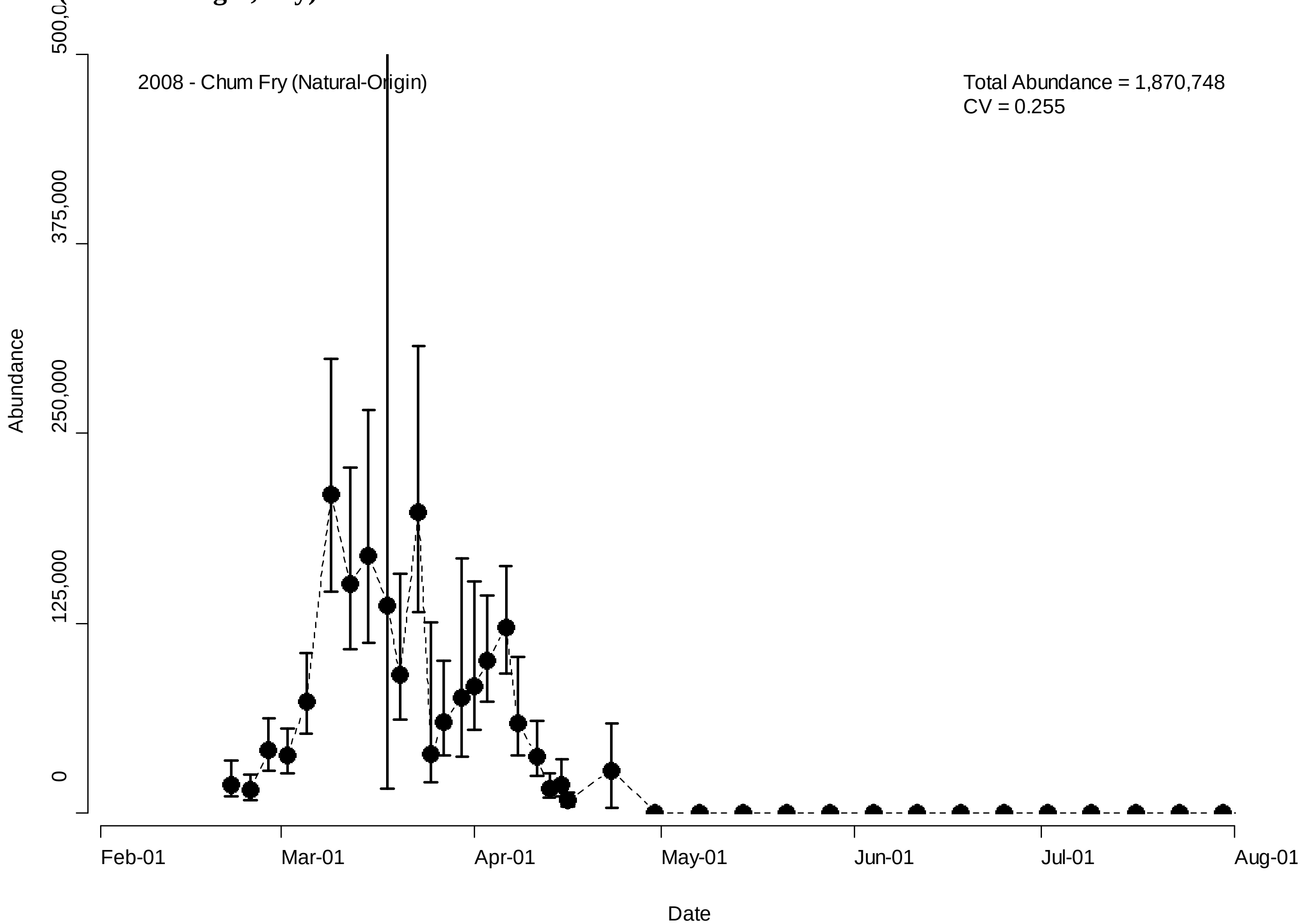

Figure E1. Estimated abundance (± 95% CI) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2008.

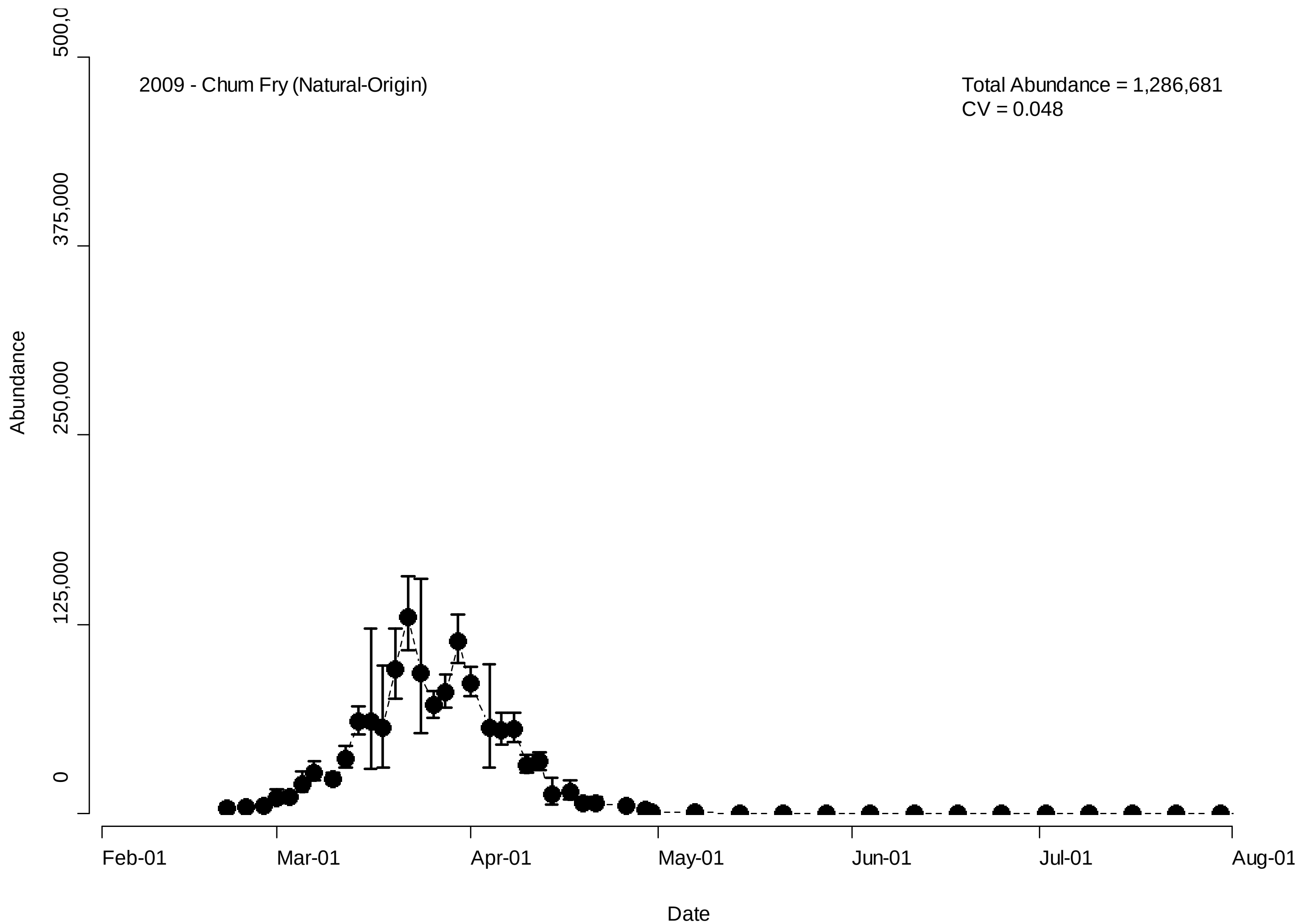

Figure E2. Estimated abundance (± 95% CI) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2009.

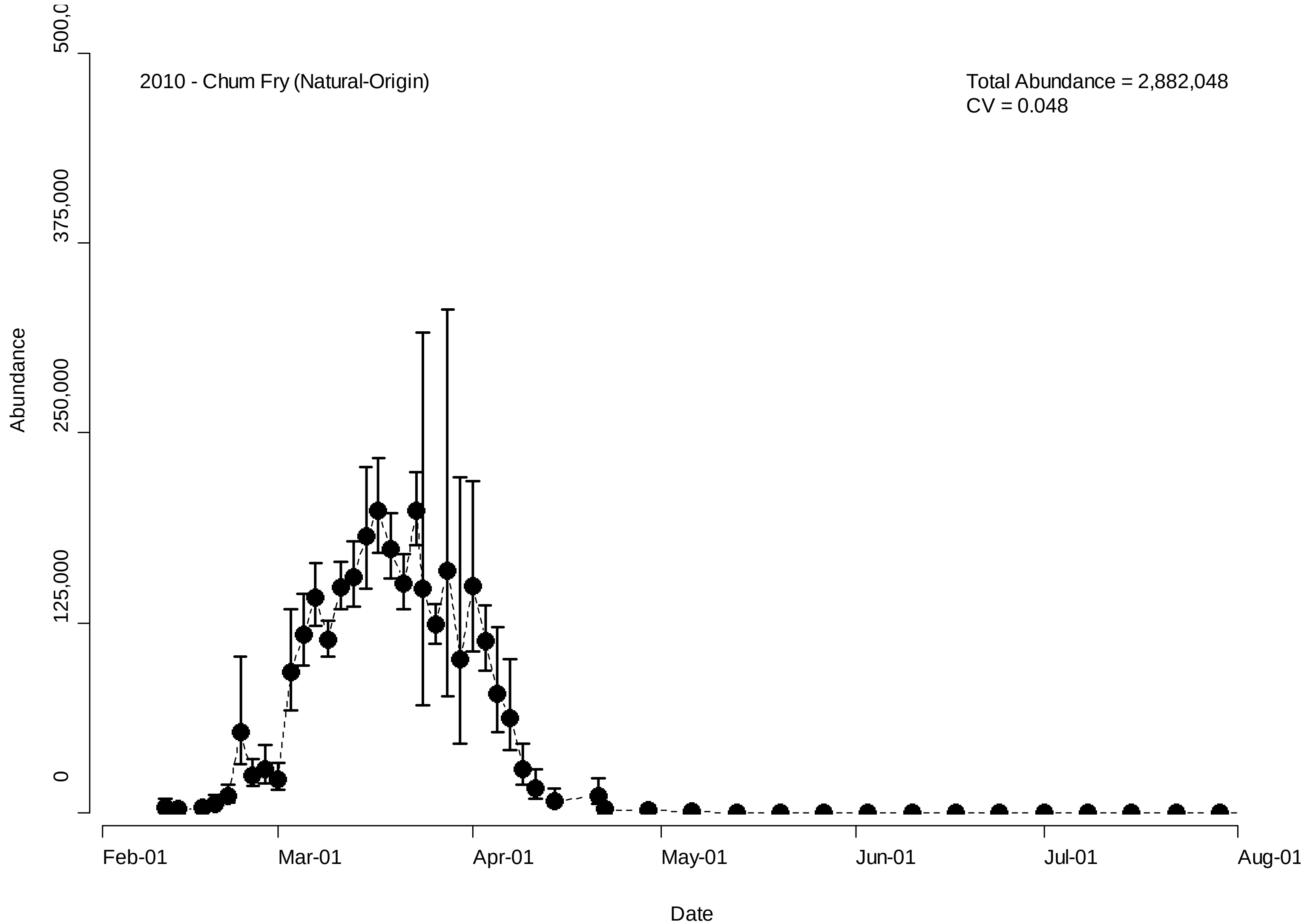

Figure E3. Estimated abundance (± 95% CI) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2010.

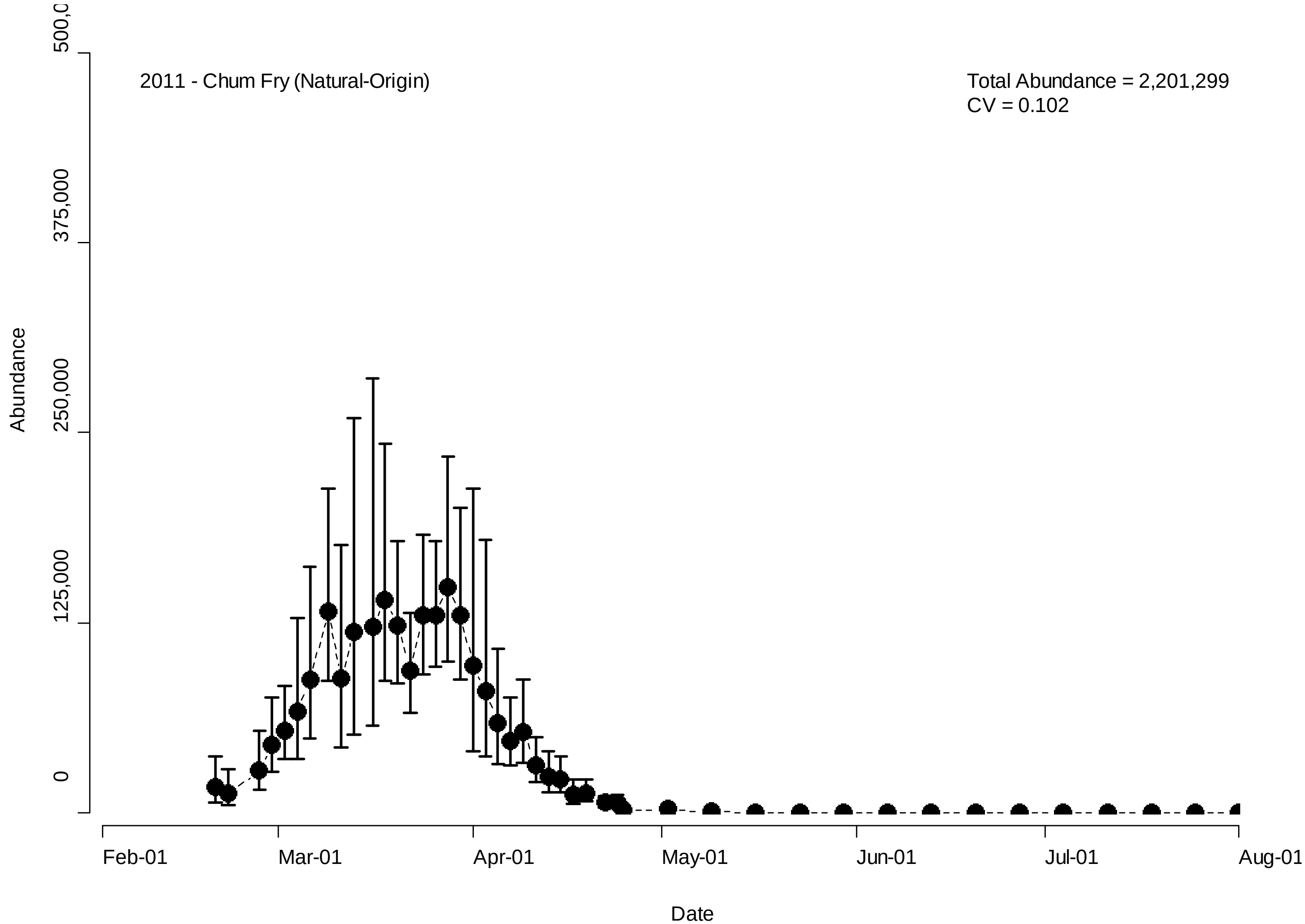

Figure E4. Estimated abundance (± 95% CI) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2011.

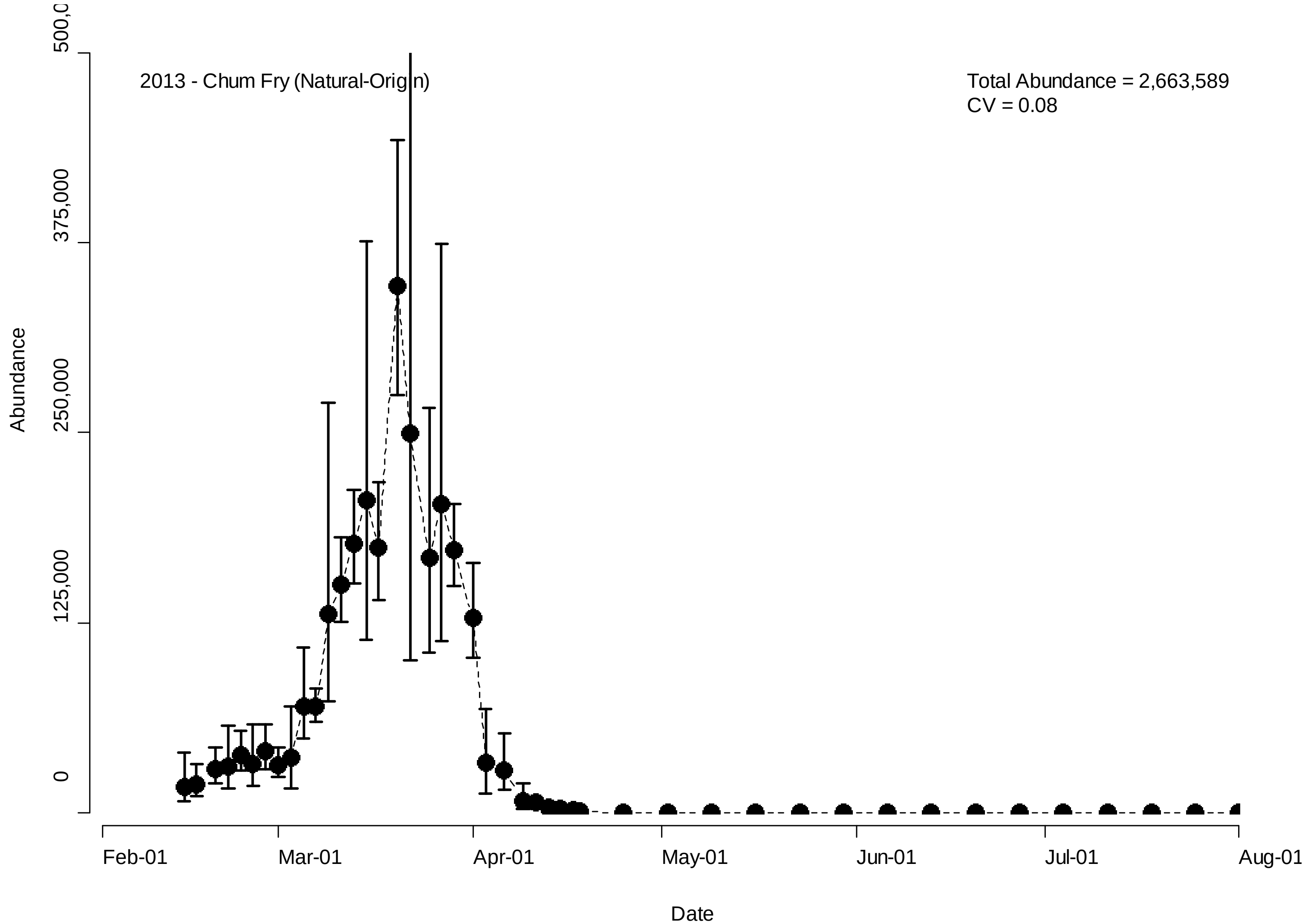

Figure E5. Estimated abundance (± 95% CI) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2013.

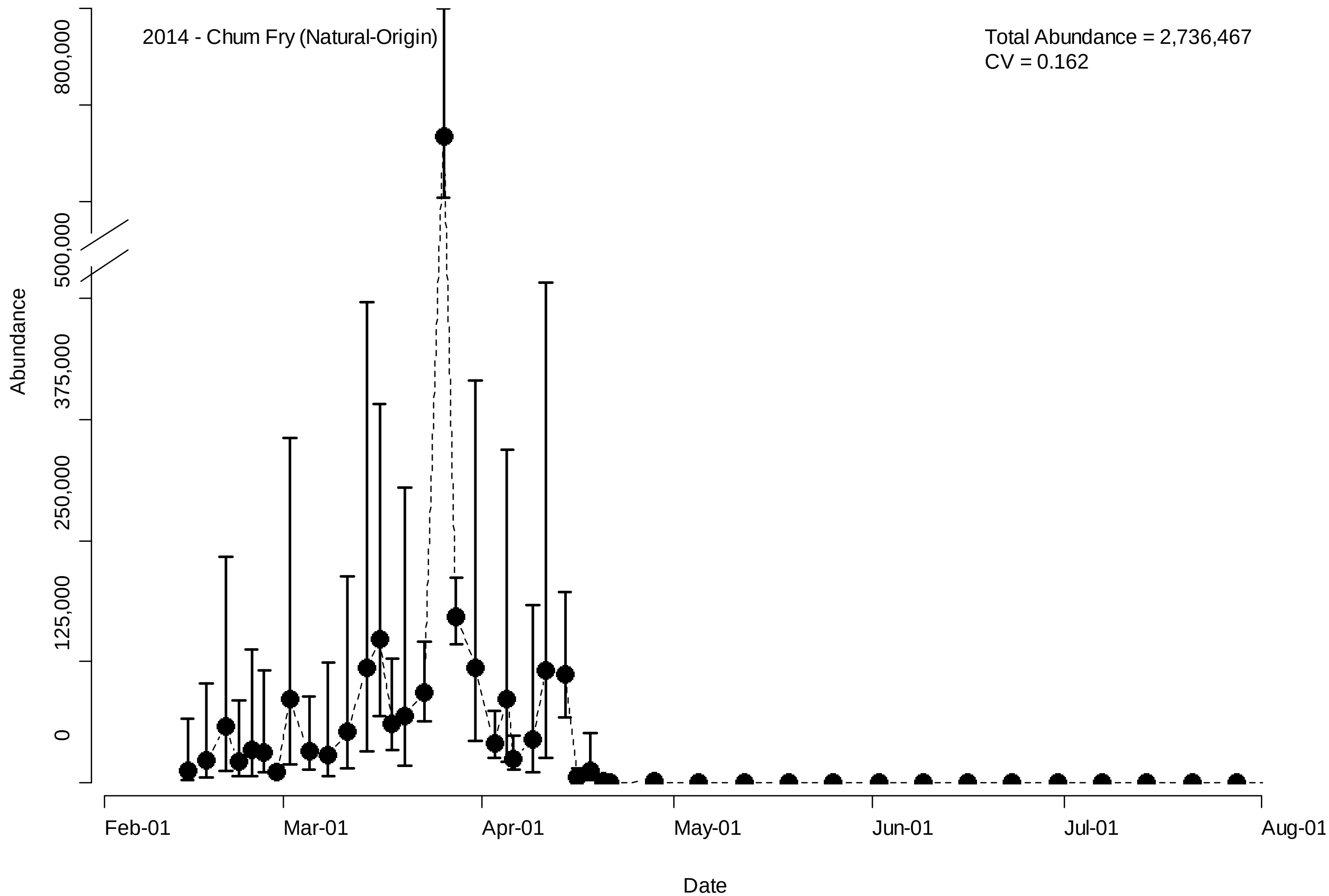

Figure E6. Estimated abundance (± 95% CI) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2014.

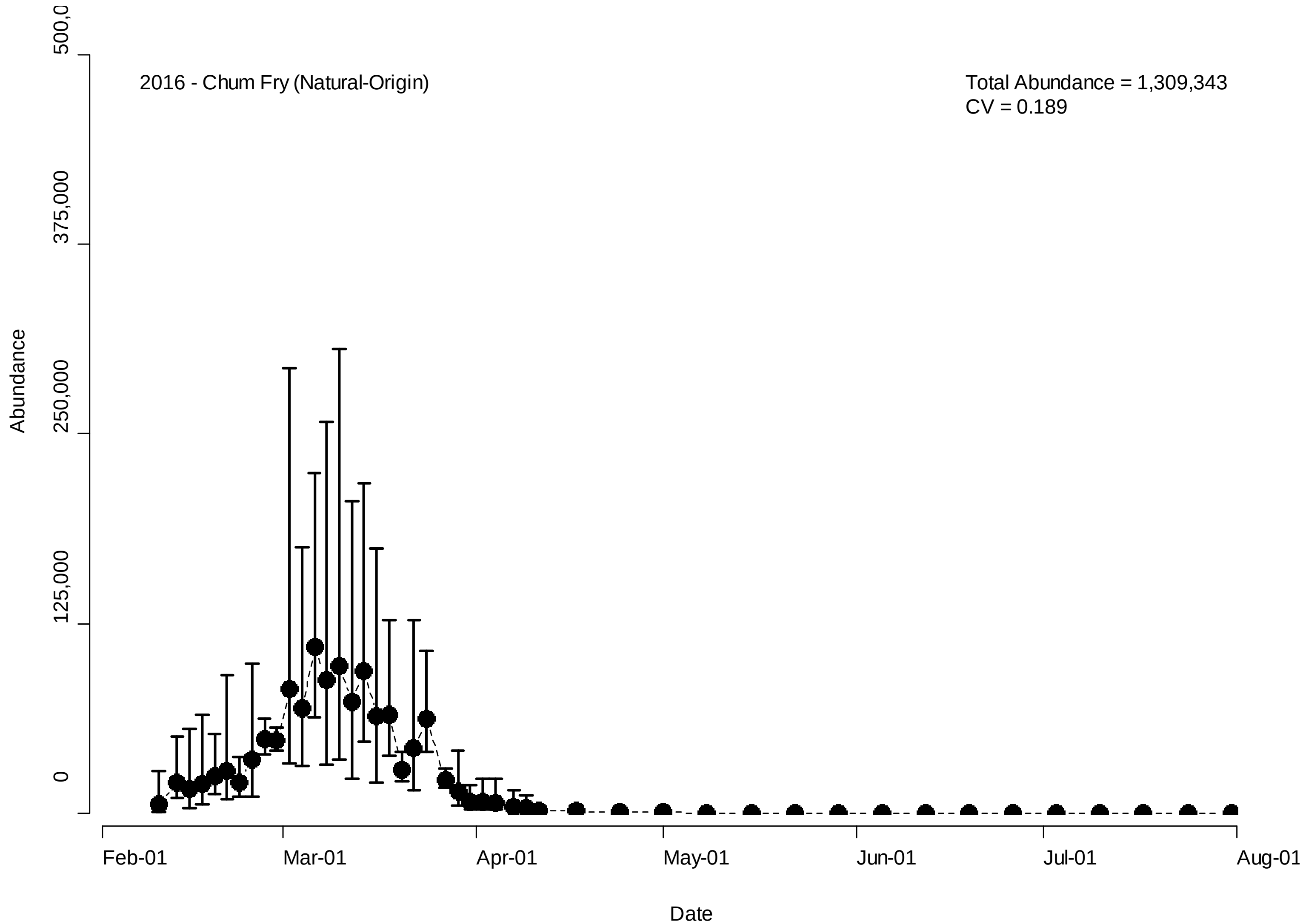

Figure E7. Estimated abundance (± 95% CI) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2016.

Chinook salmon (Natural-Origin, Fry)

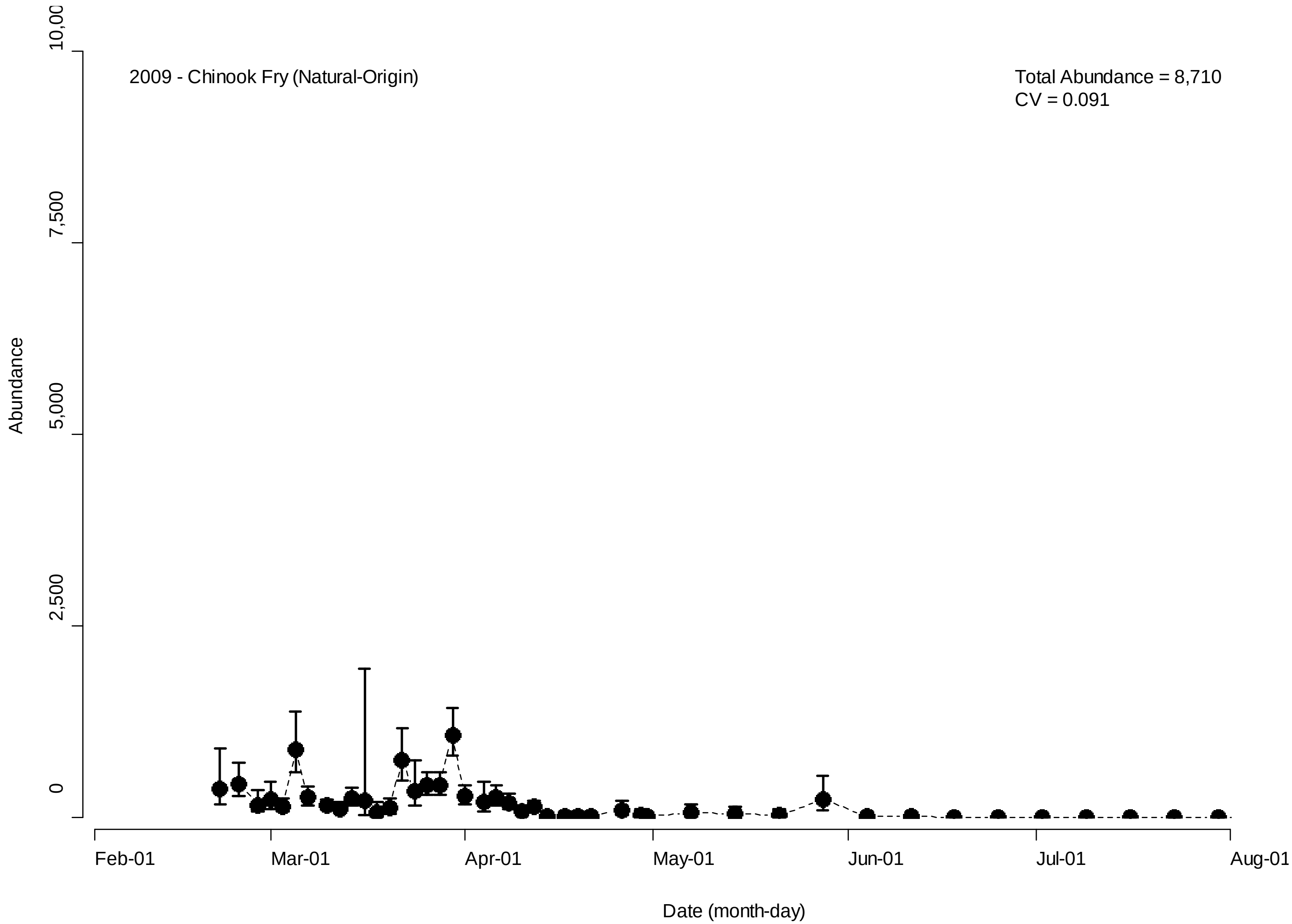

Figure E8. Estimated abundance (± 95% CI) by date for natural-origin Chinook salmon (life-stage = fry; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2009.

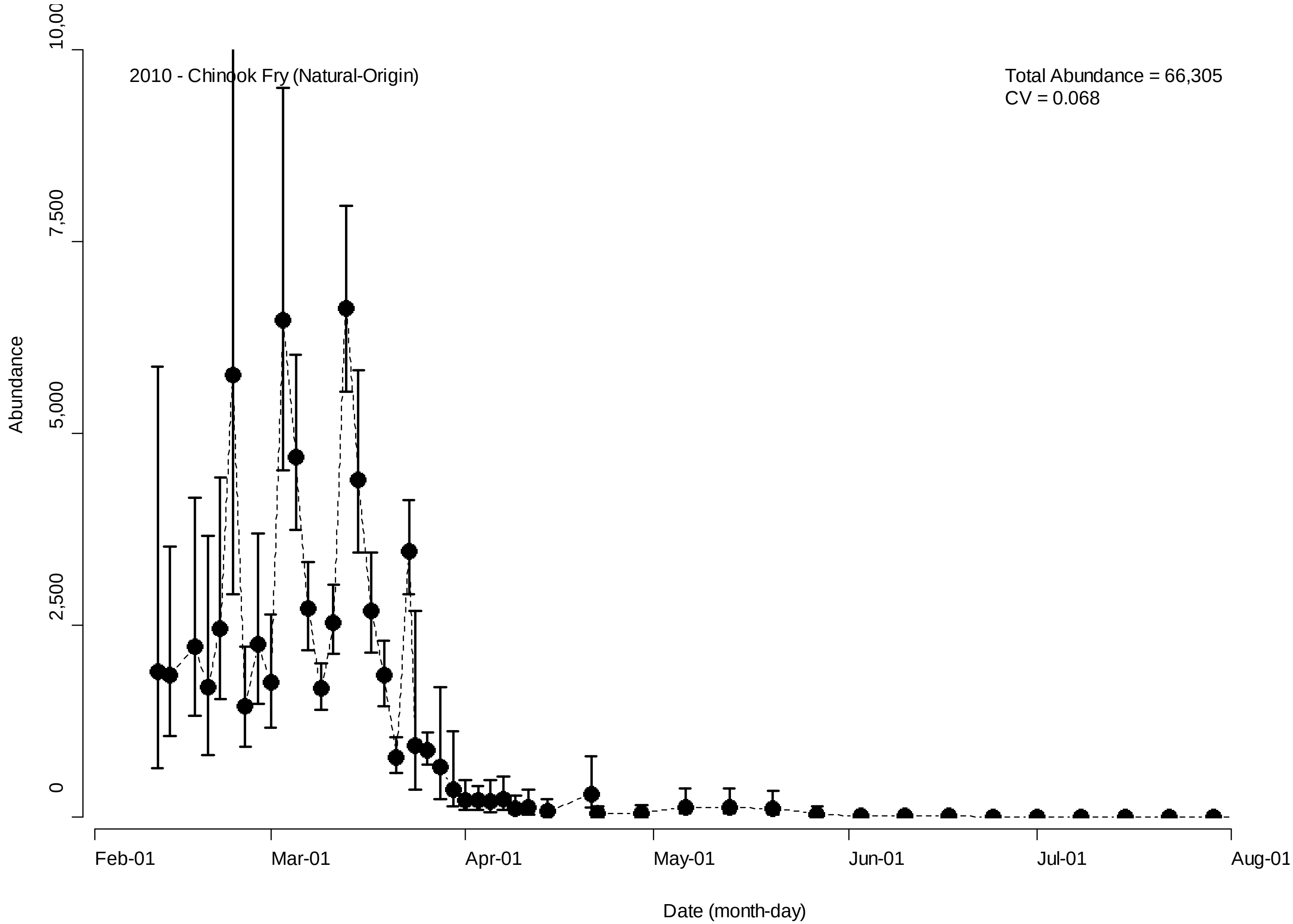

Figure E9. Estimated abundance (± 95% CI) by date for natural-origin Chinook salmon (life-stage = fry; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2010.

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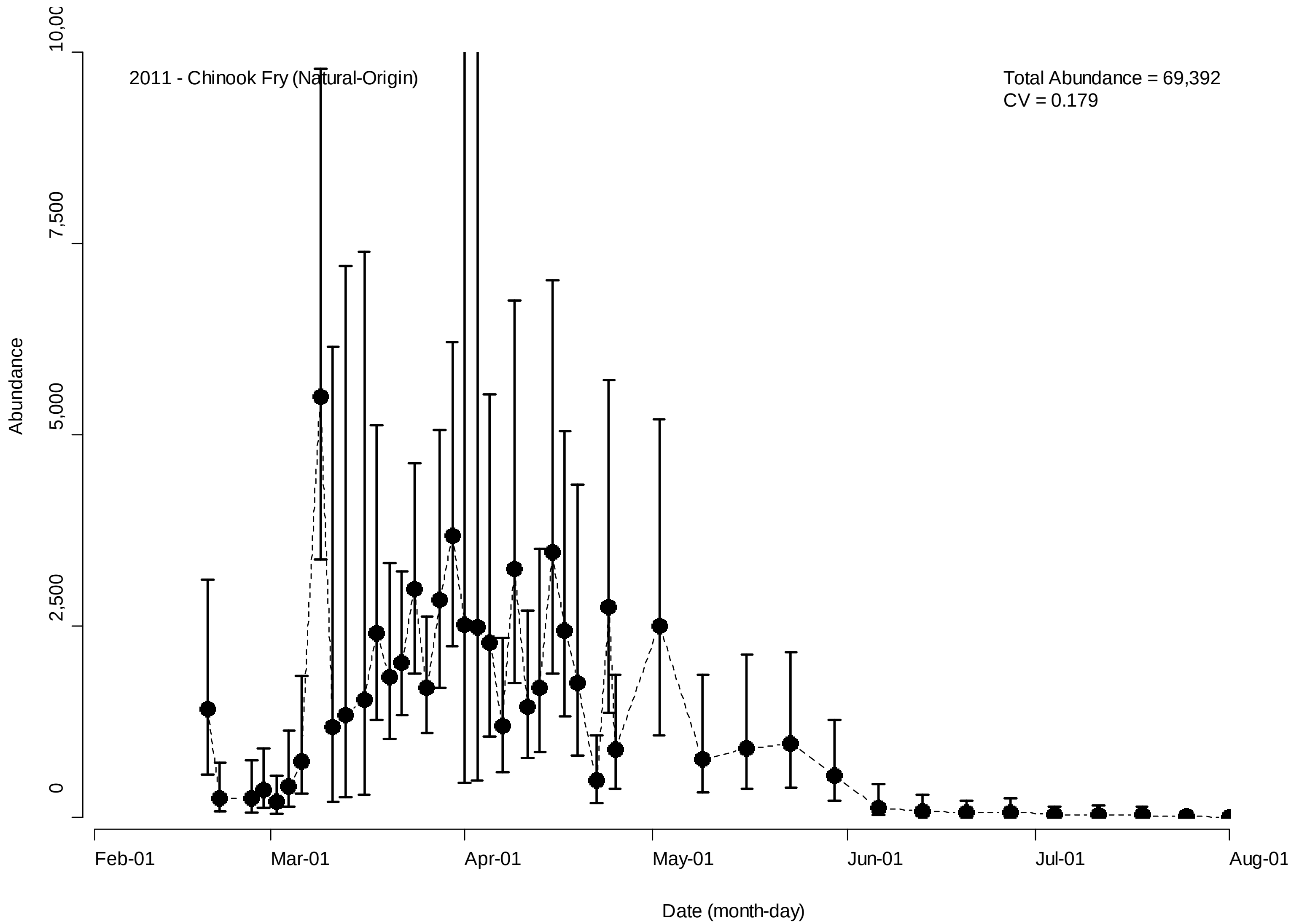

Figure E10. Estimated abundance (± 95% CI) by date for natural-origin Chinook salmon (life-stage = fry; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2011.

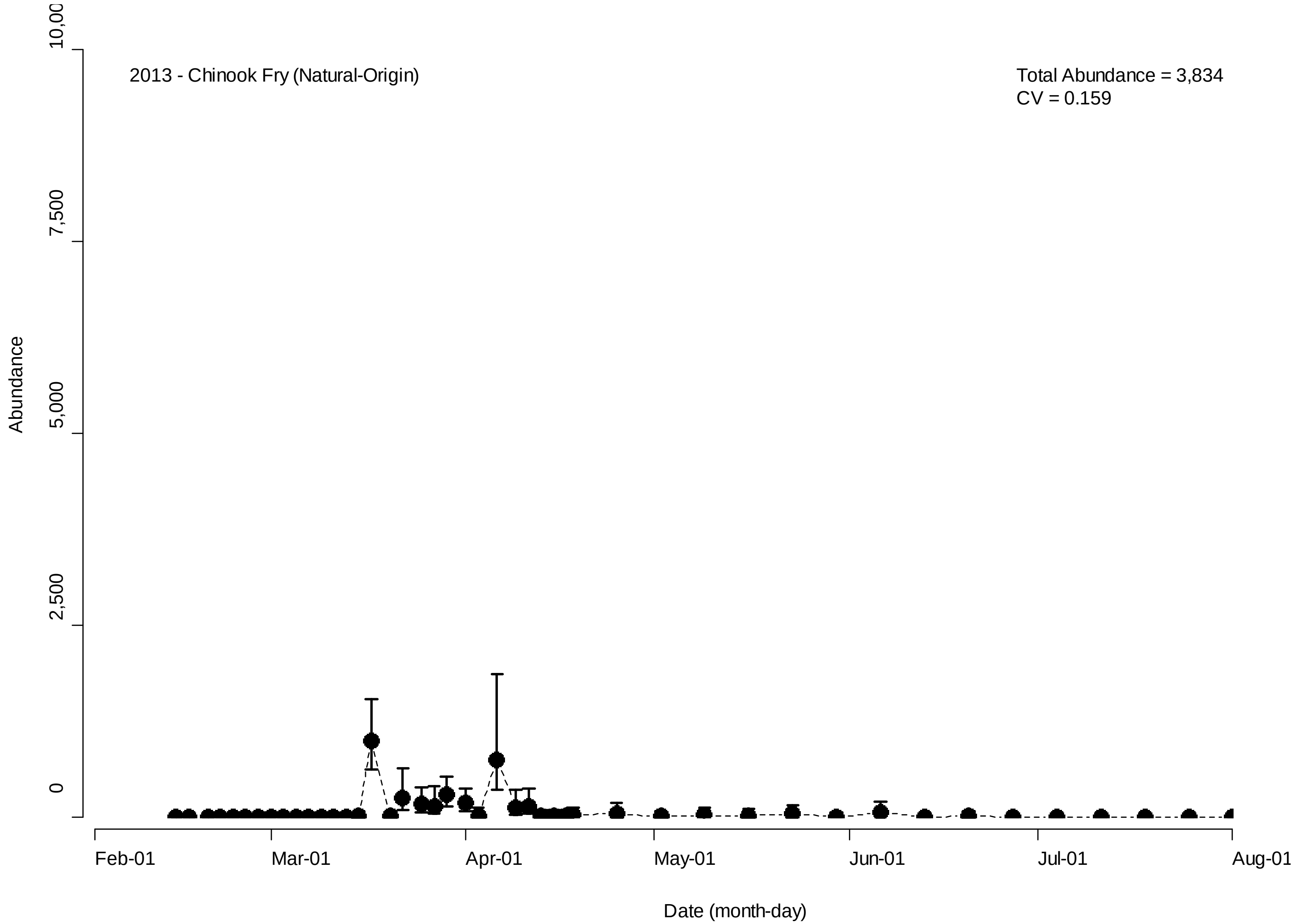

Figure E11. Estimated abundance (± 95% CI) by date for natural-origin Chinook salmon (life-stage = fry; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2013.

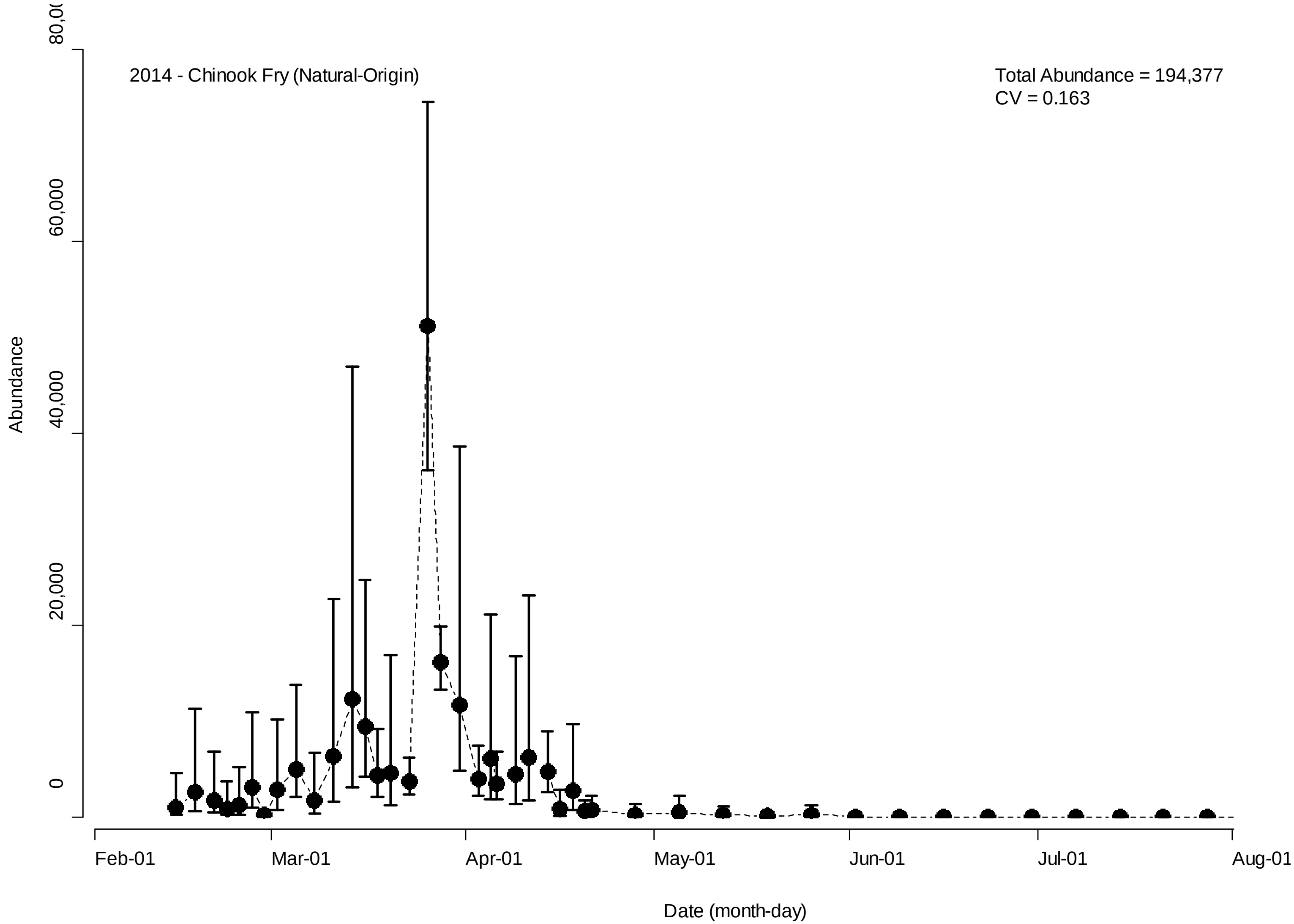

Figure E12. Estimated abundance (± 95% CI) by date for natural-origin Chinook salmon (life-stage = fry; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2014. Note the change in y-axis relative to other years.

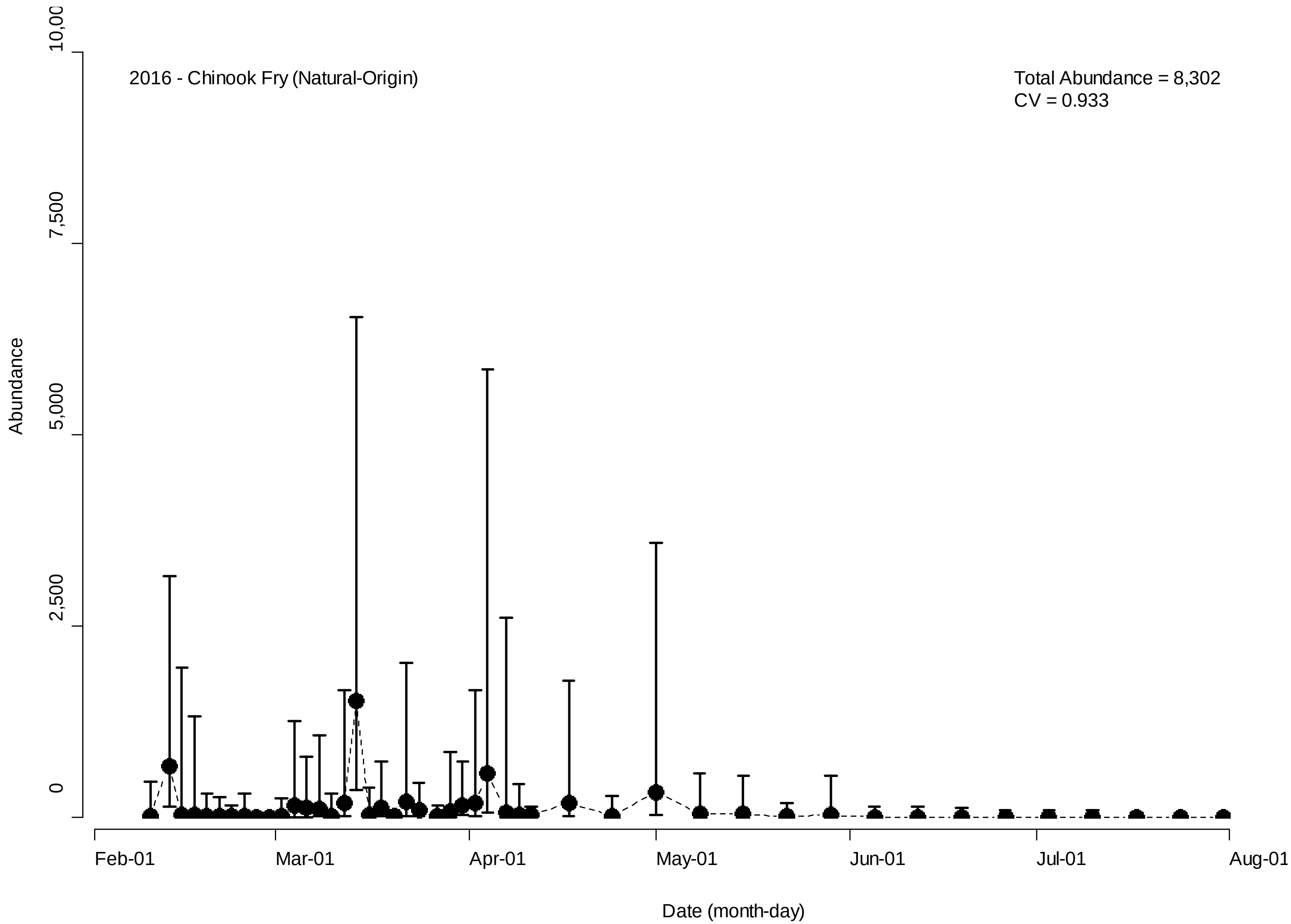

Figure E13. Estimated abundance (± 95% CI) by date for natural-origin Chinook salmon (life-stage = fry; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2016.

Chinook salmon (Natural-Origin, Parr/Transitional/Smolt, Sub-Yearling)

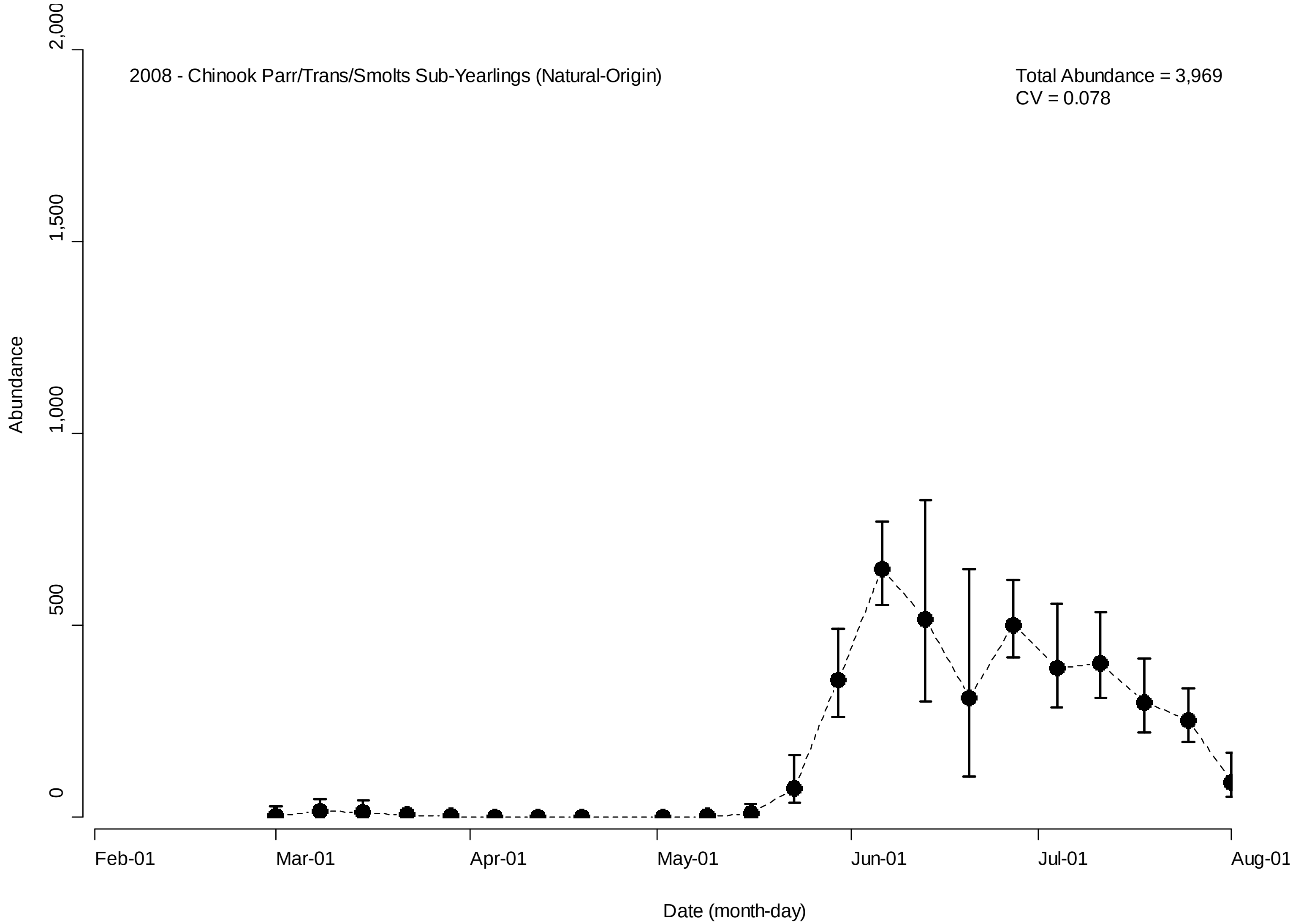

Figure E14. Estimated abundance (± 95% CI) by date for natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2008.

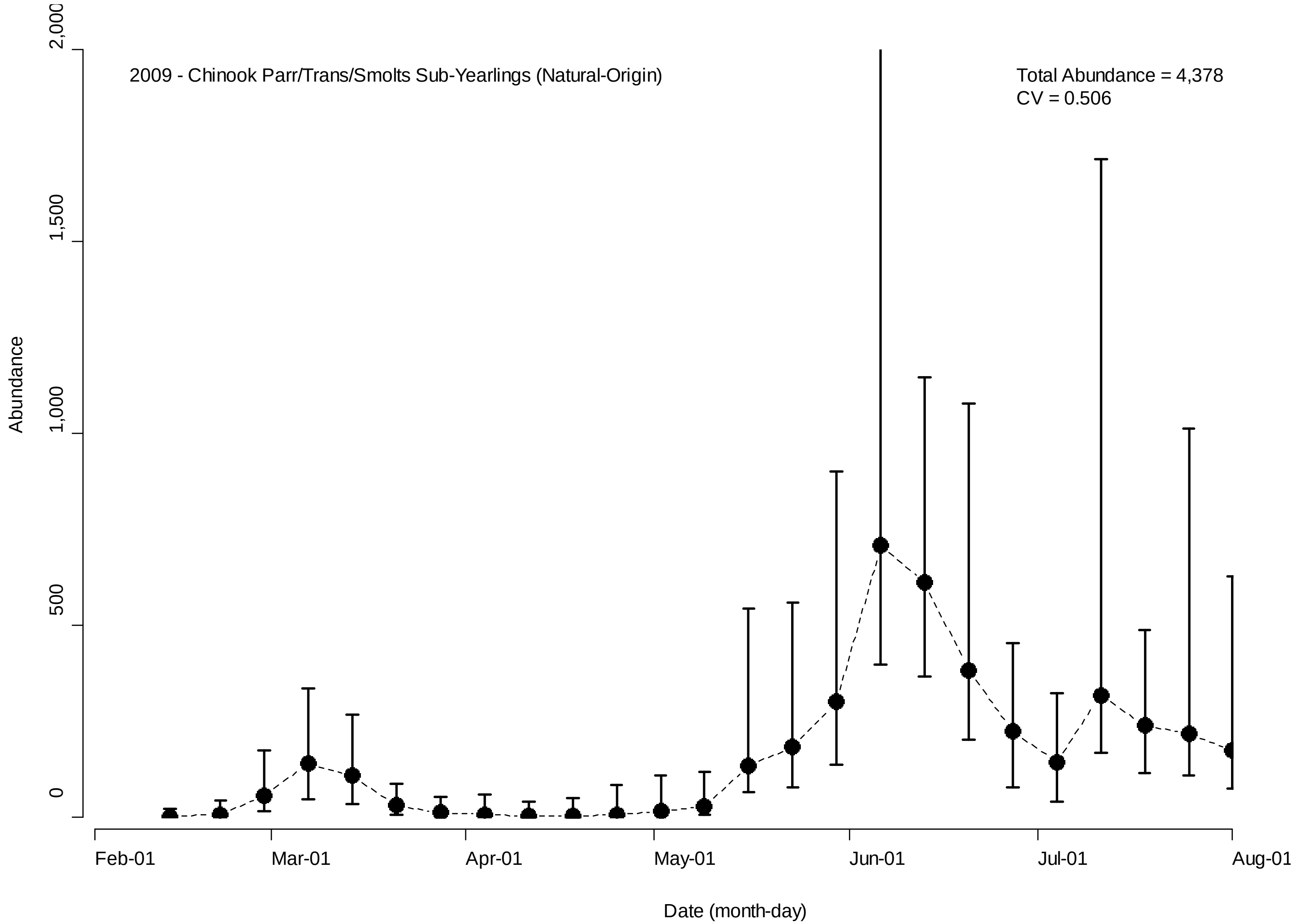

Figure E15. Estimated abundance (± 95% CI) by date for natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2009.

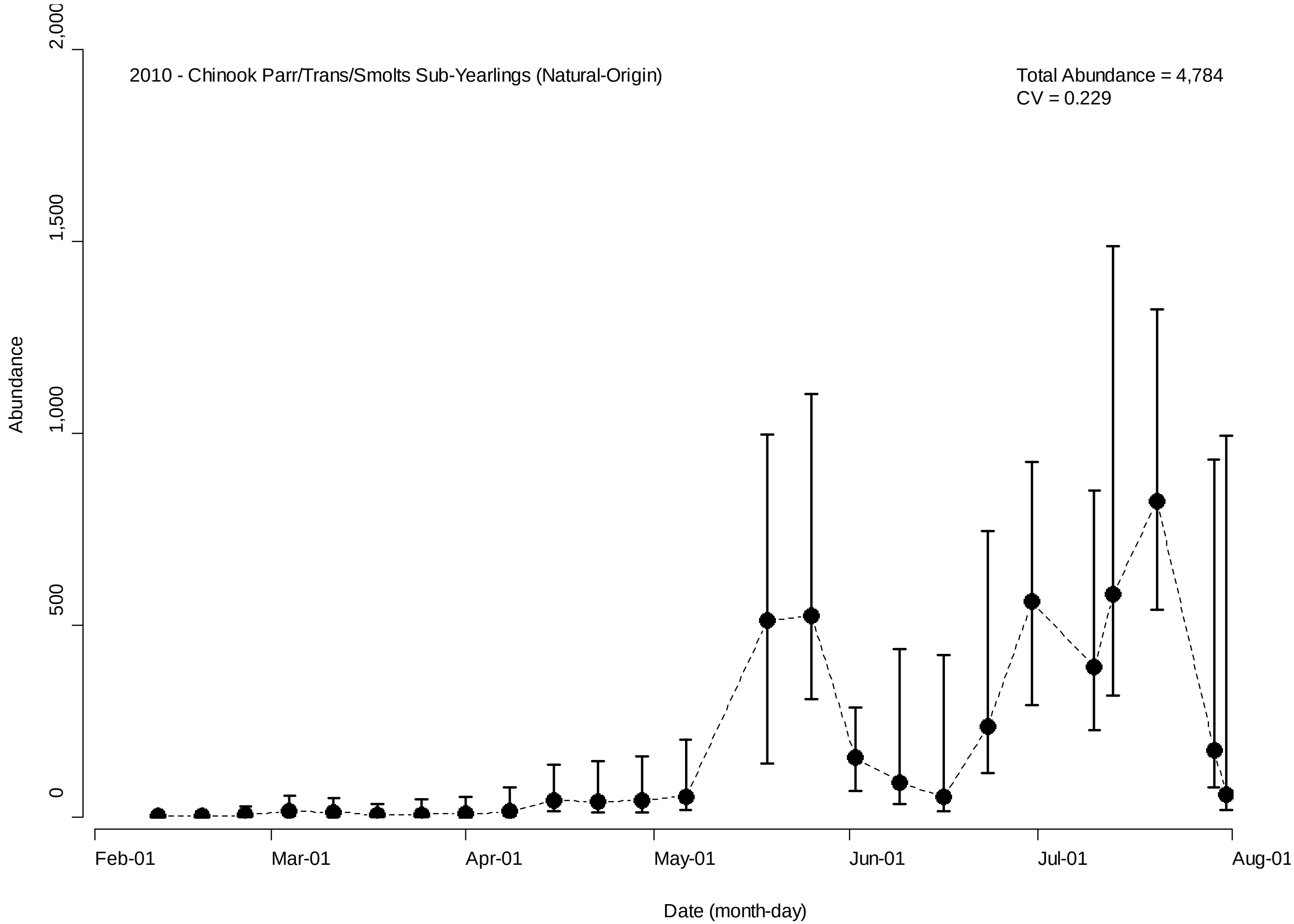

Figure E16. Estimated abundance (± 95% CI) by date for natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2010.

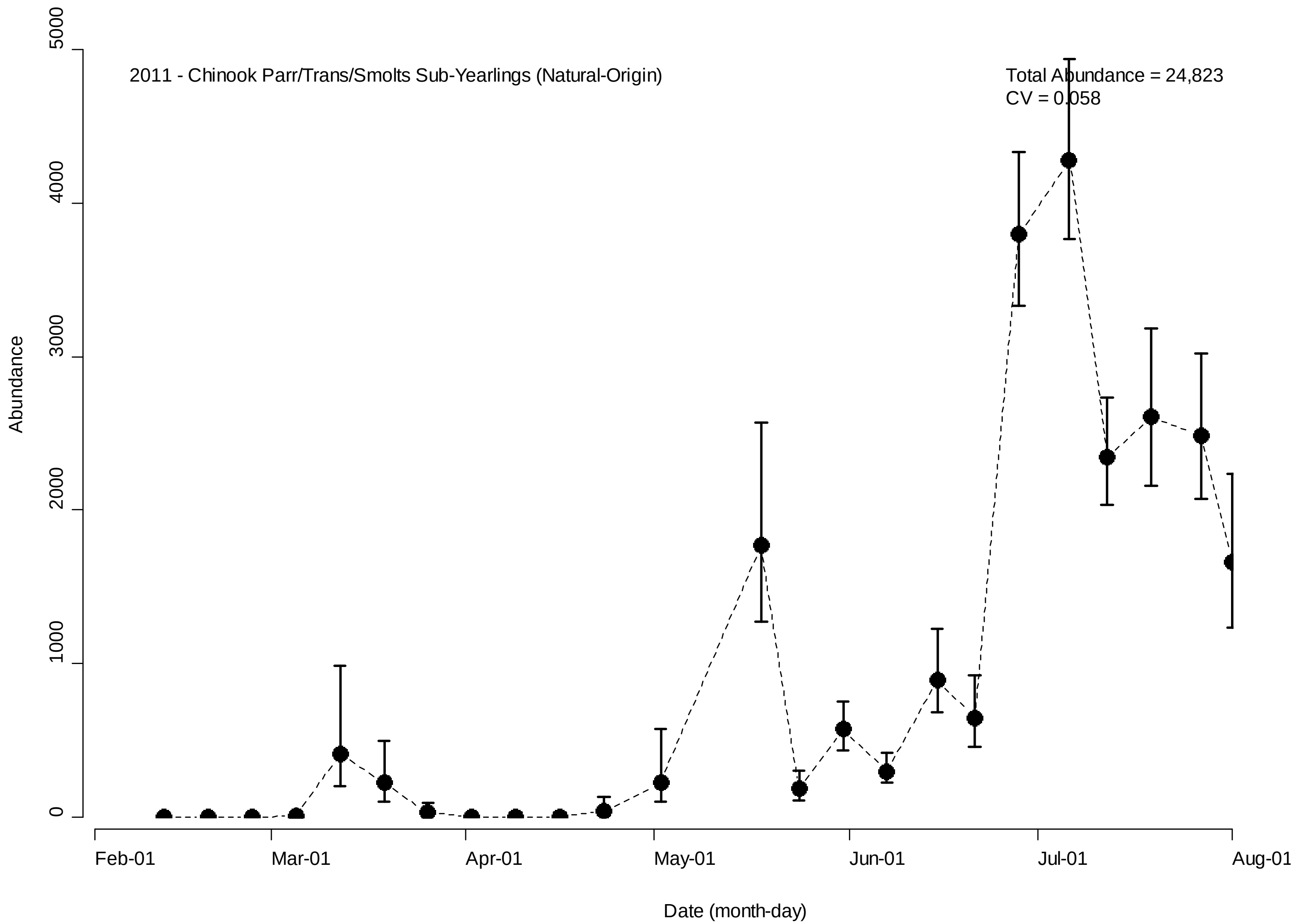

Figure E17. Estimated abundance (± 95% CI) by date for natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2011. Note the change in y-axis relative to other years.

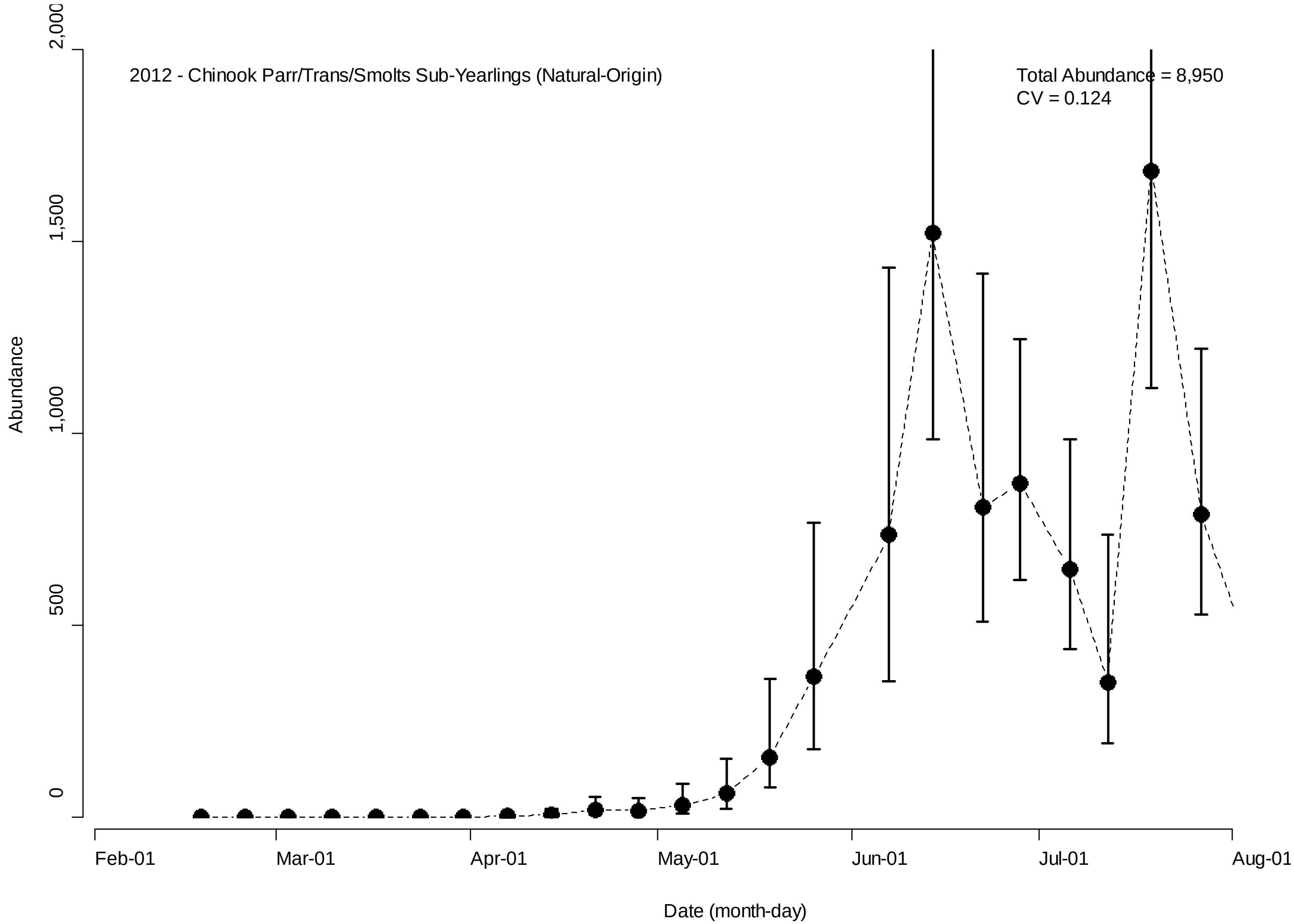

Figure E18. Estimated abundance (± 95% CI) by date for natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2012.

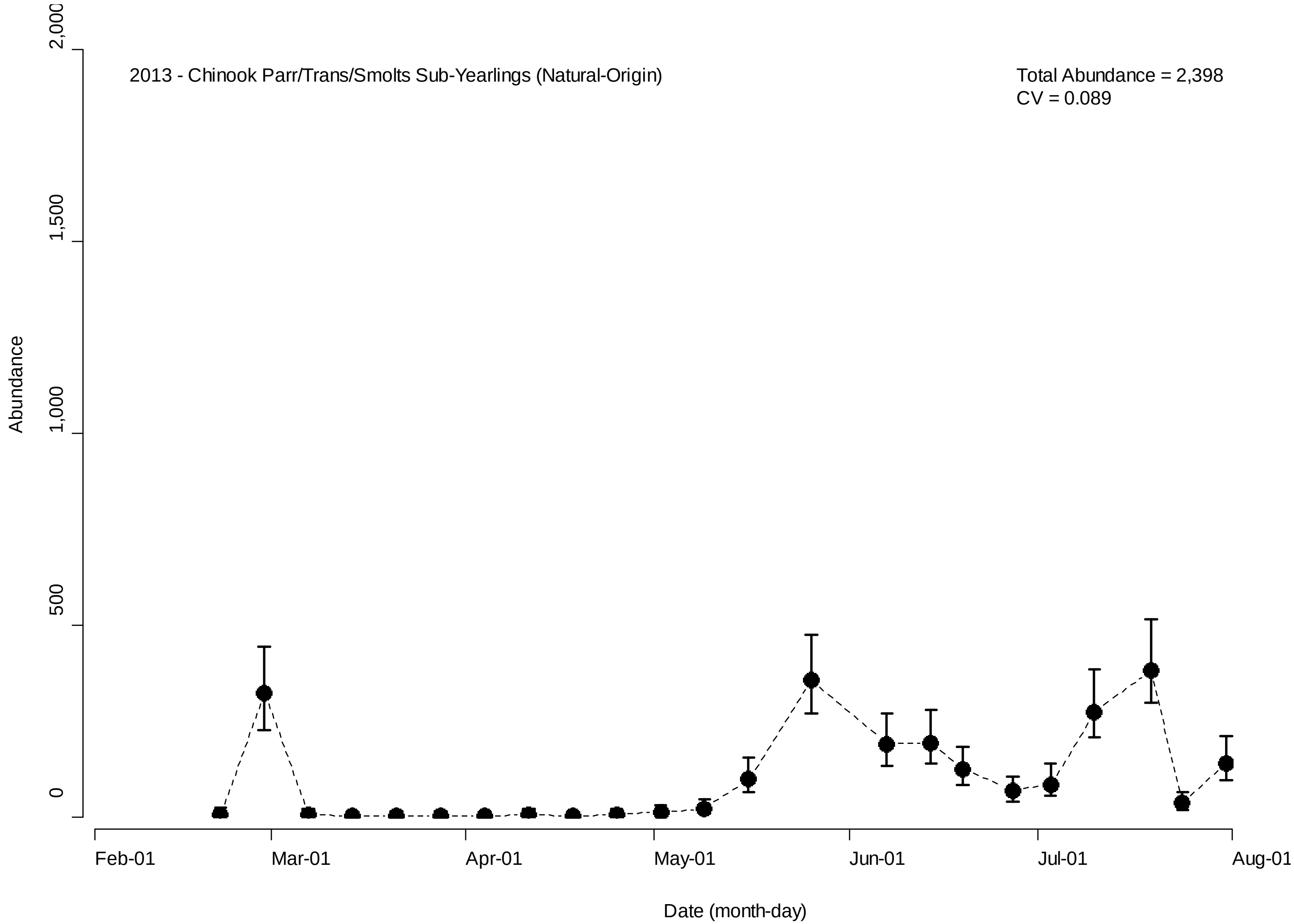

Figure E19. Estimated abundance (± 95% CI) by date for natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2013.

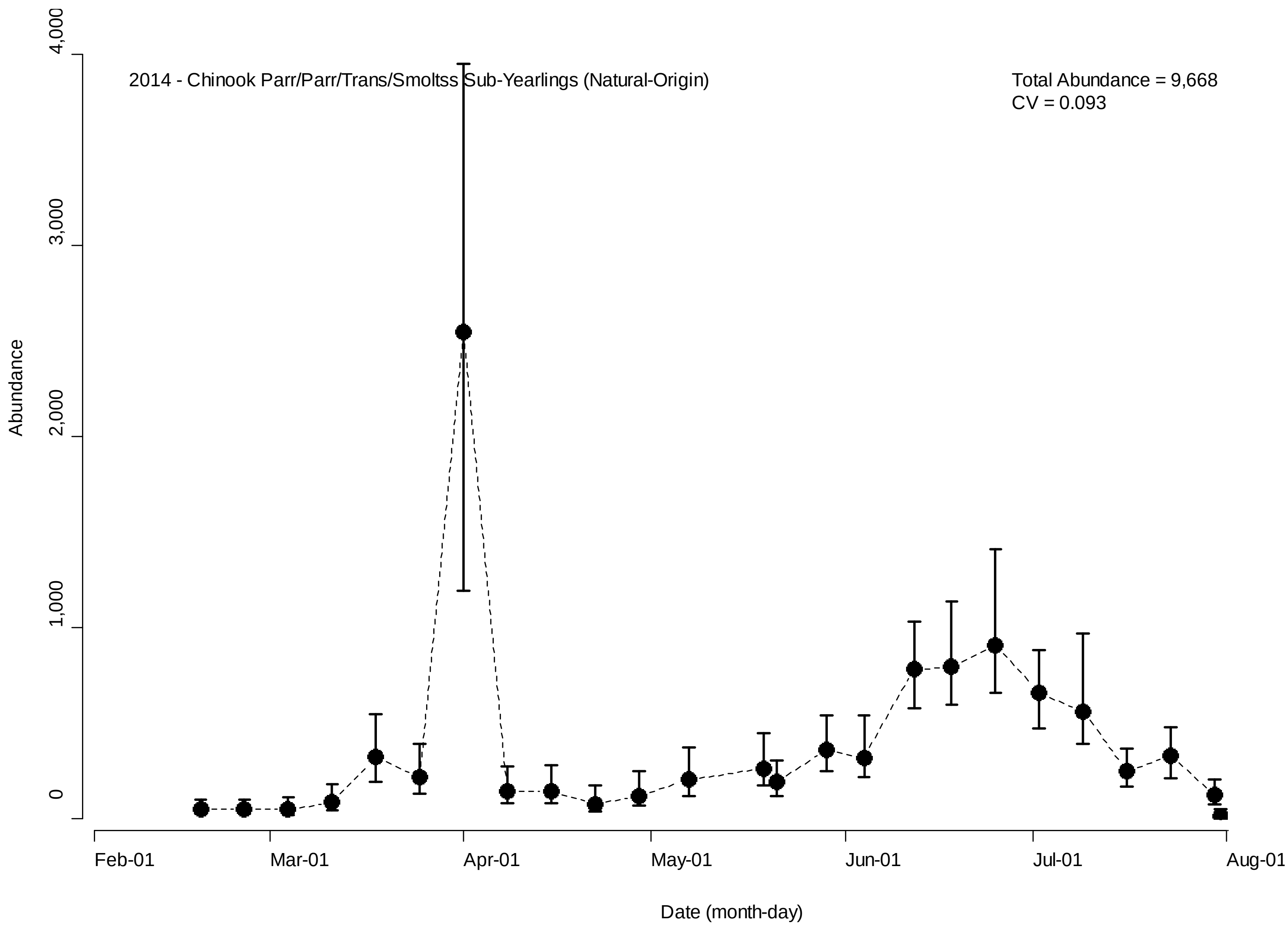

Figure E20. Estimated abundance (± 95% CI) by date for natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2014. Note the change in y-axis relative to other years.

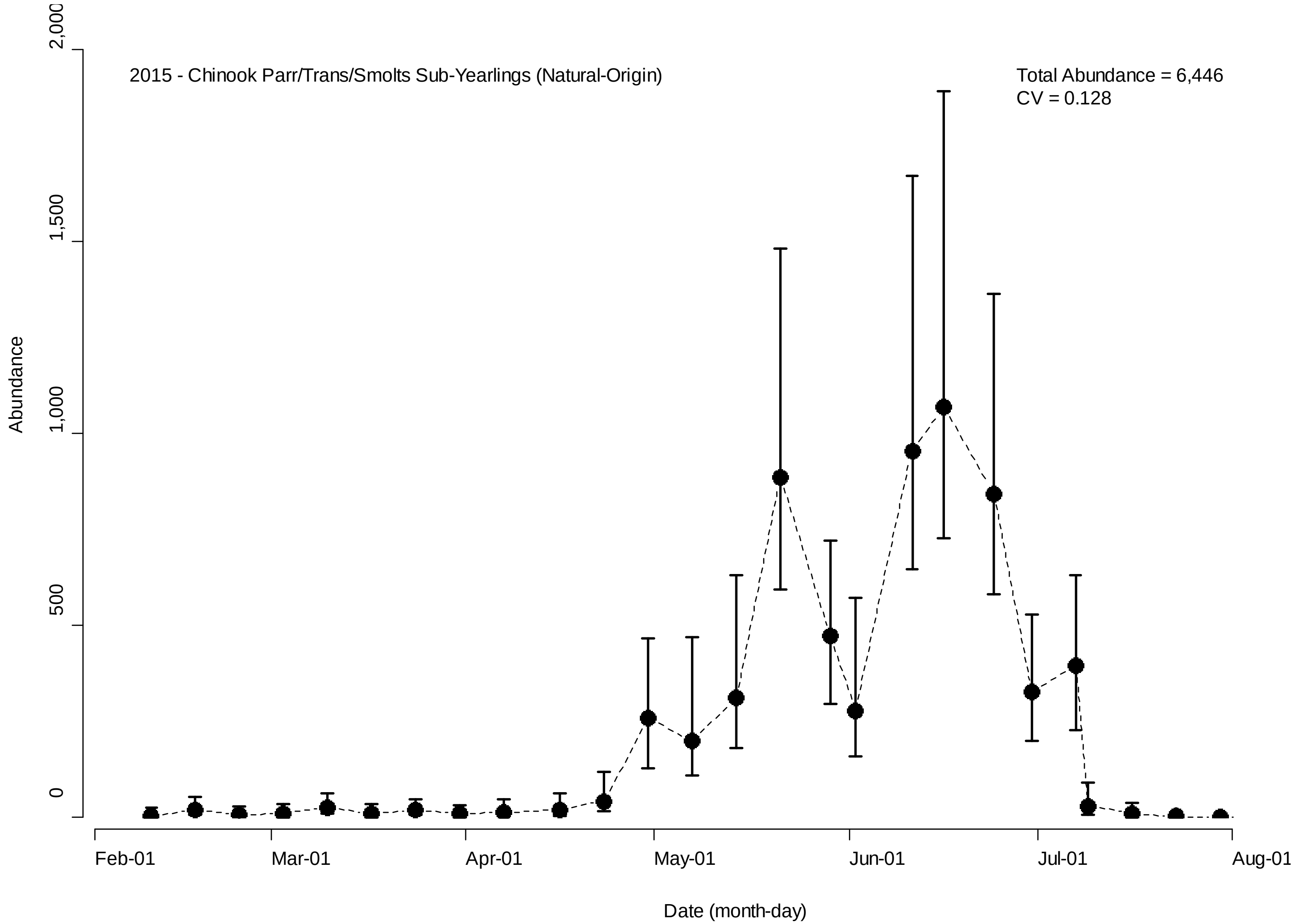

Figure E21. Estimated abundance (± 95% CI) by date for natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2015.

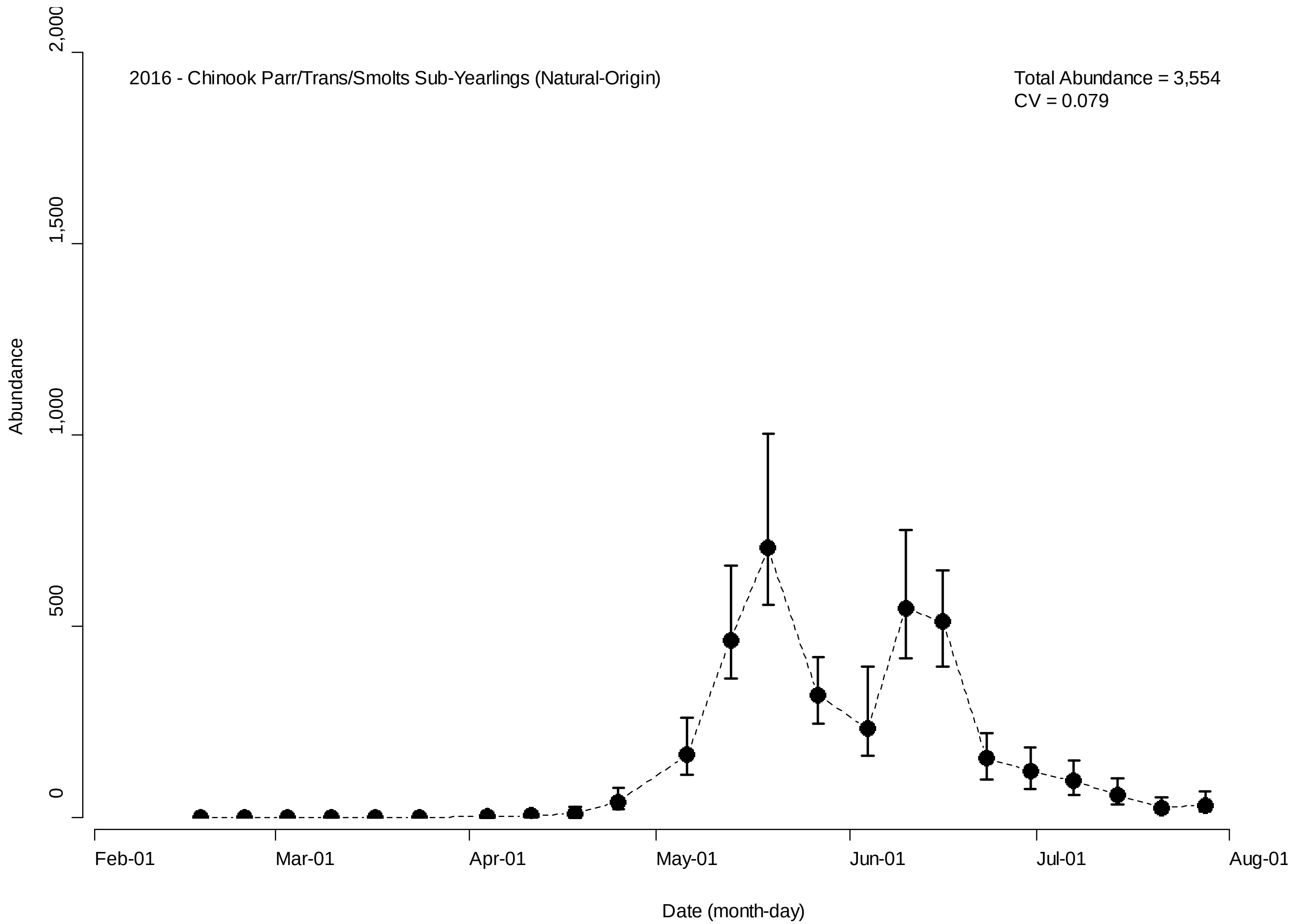

Figure E22. Estimated abundance (± 95% CI) by date for natural-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2016.

Chinook salmon (Hatchery-Origin, Parr/Transitional/Smolt, Sub-Yearling)

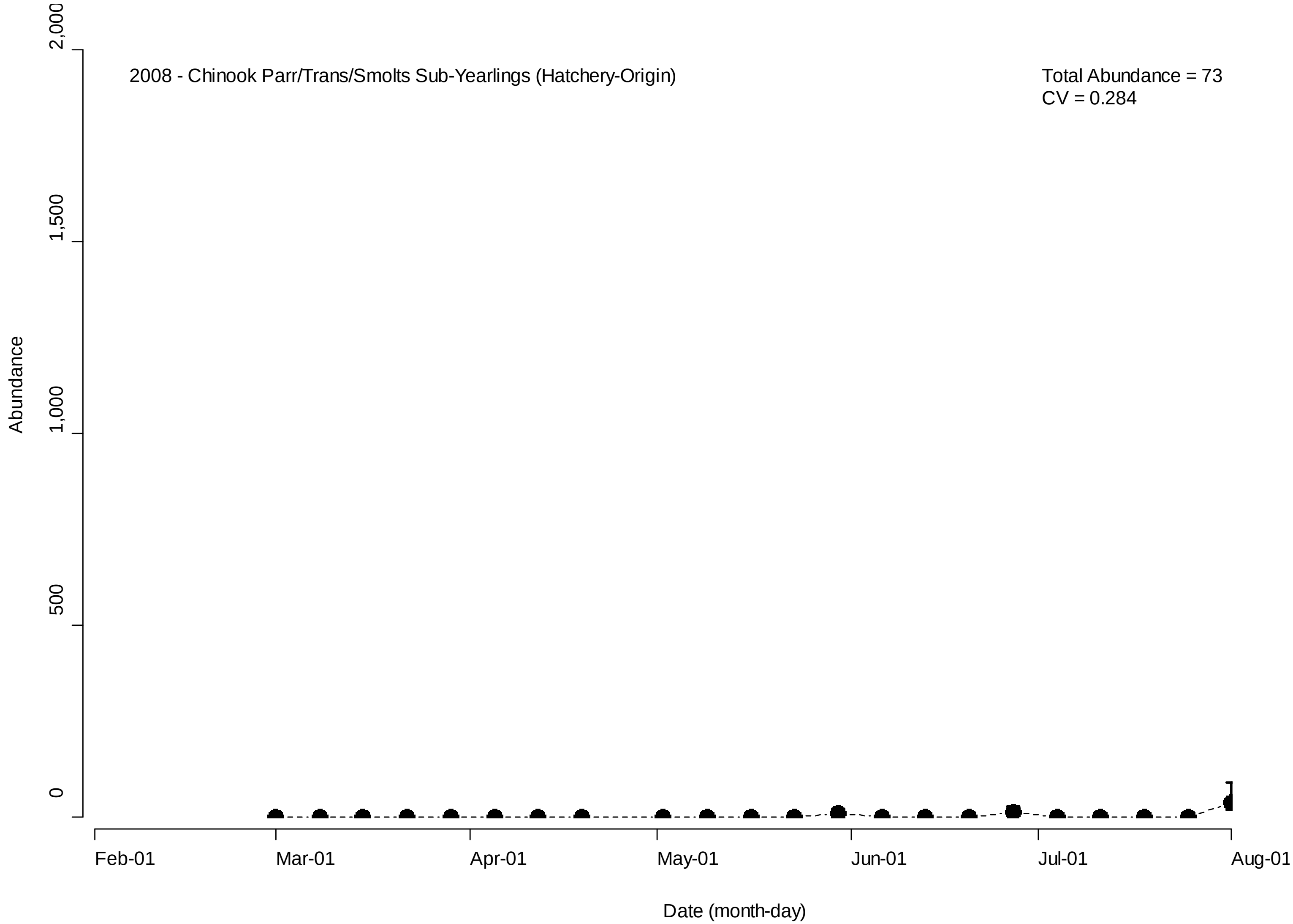

Figure E23. Estimated abundance (± 95% CI) by date for hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2008.

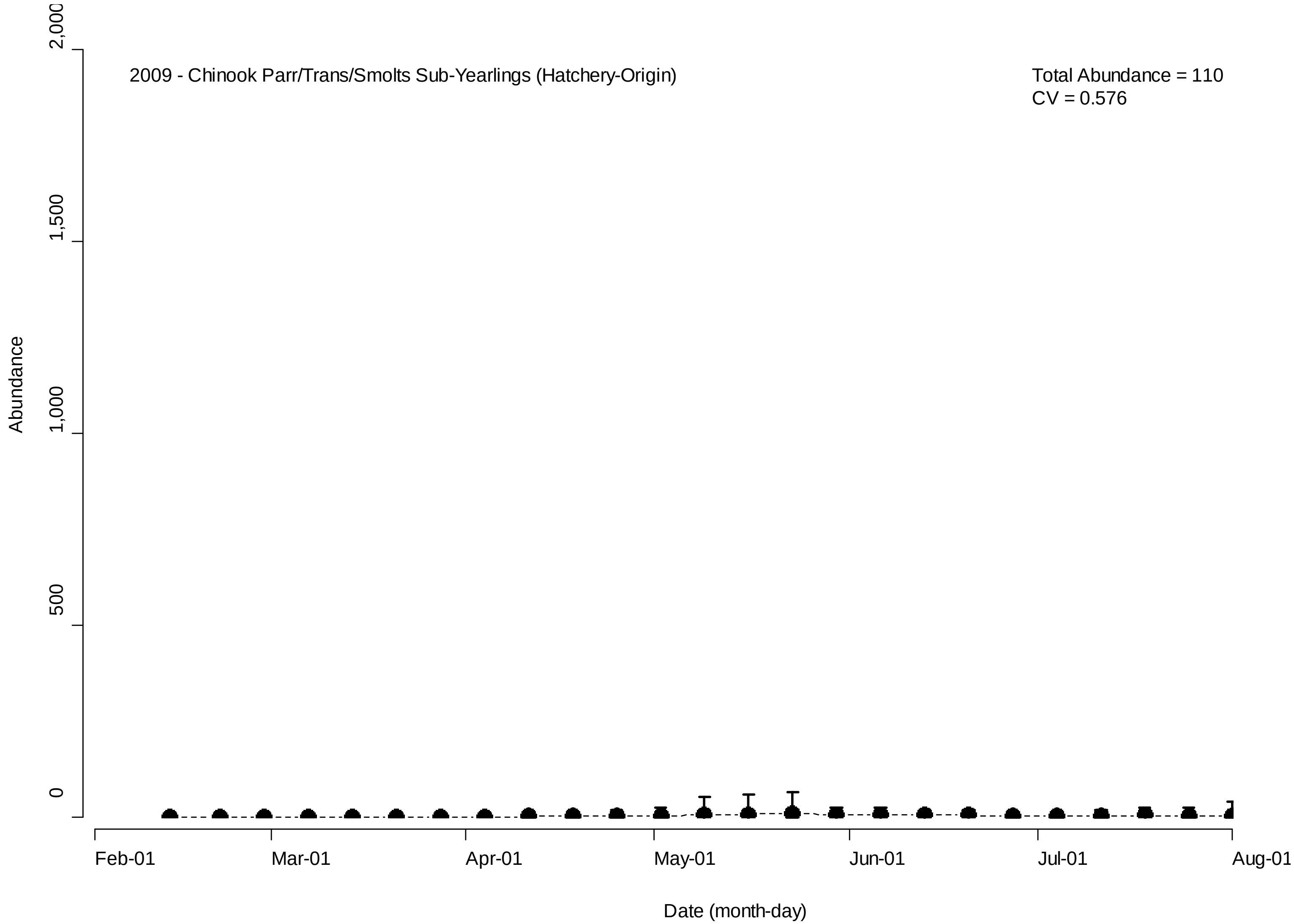

Figure E24. Estimated abundance (± 95% CI) by date for hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2009.

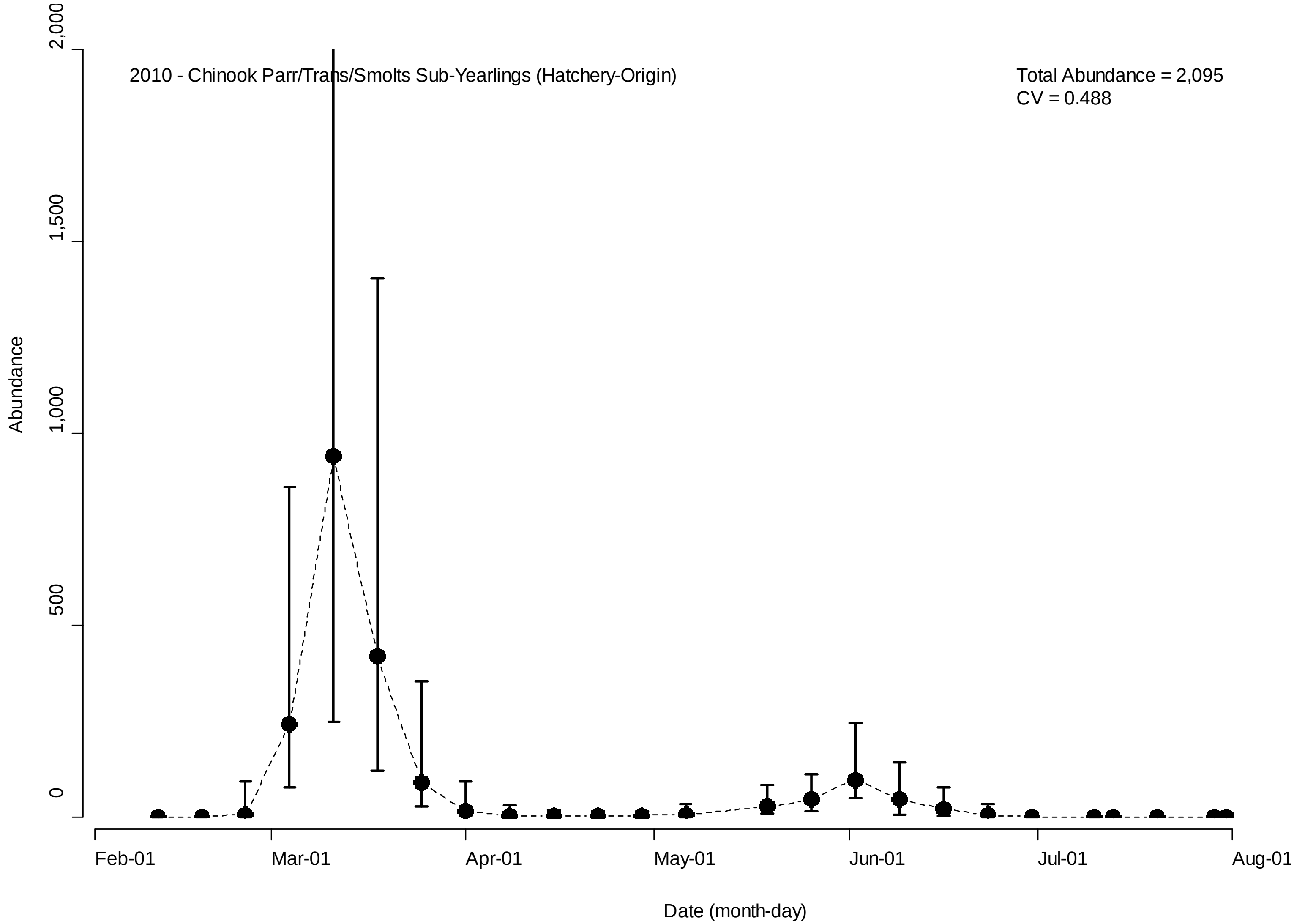

Figure E25. Estimated abundance (± 95% CI) by date for hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2010.

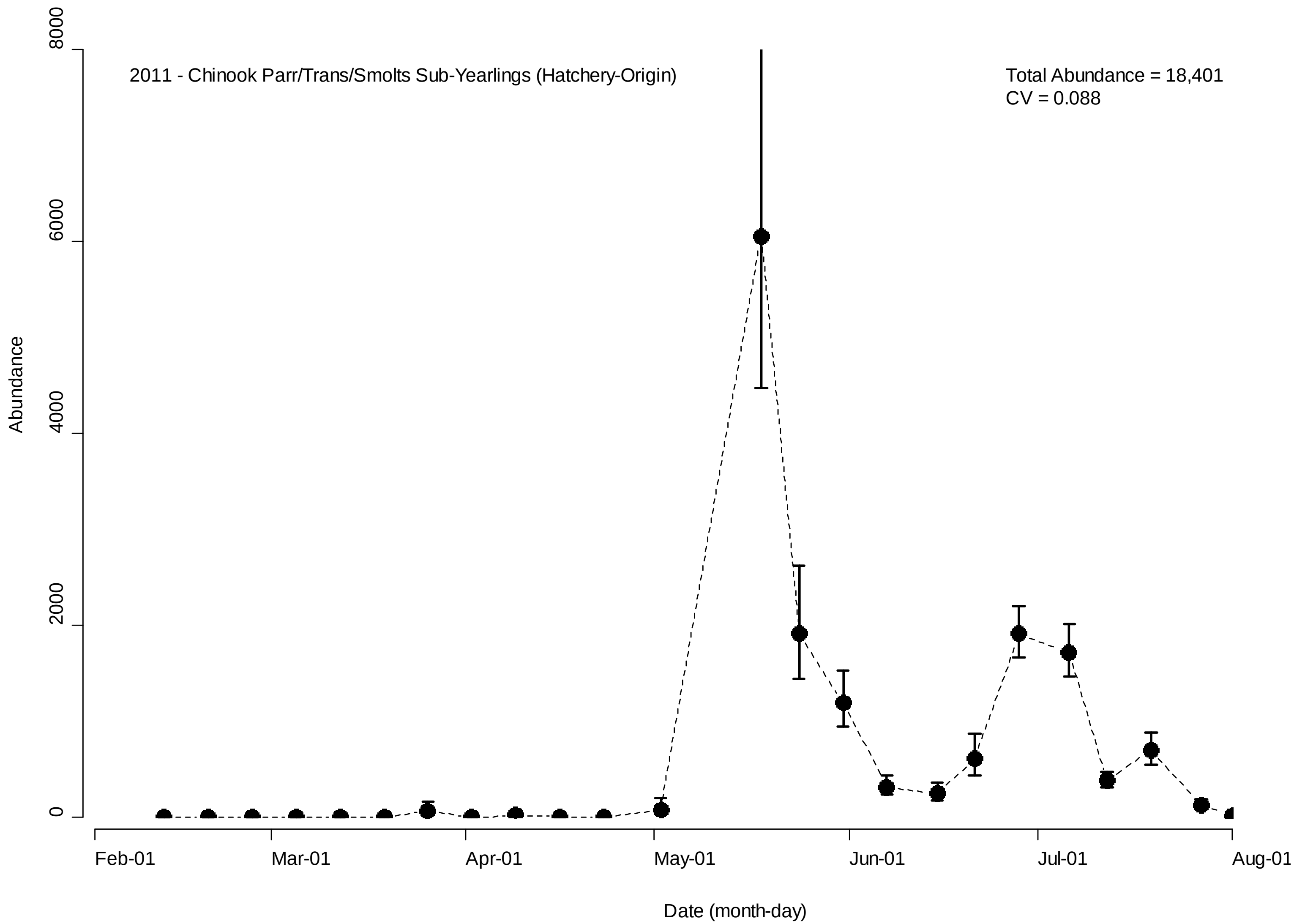

Figure E26. Estimated abundance (± 95% CI) by date for hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2011.

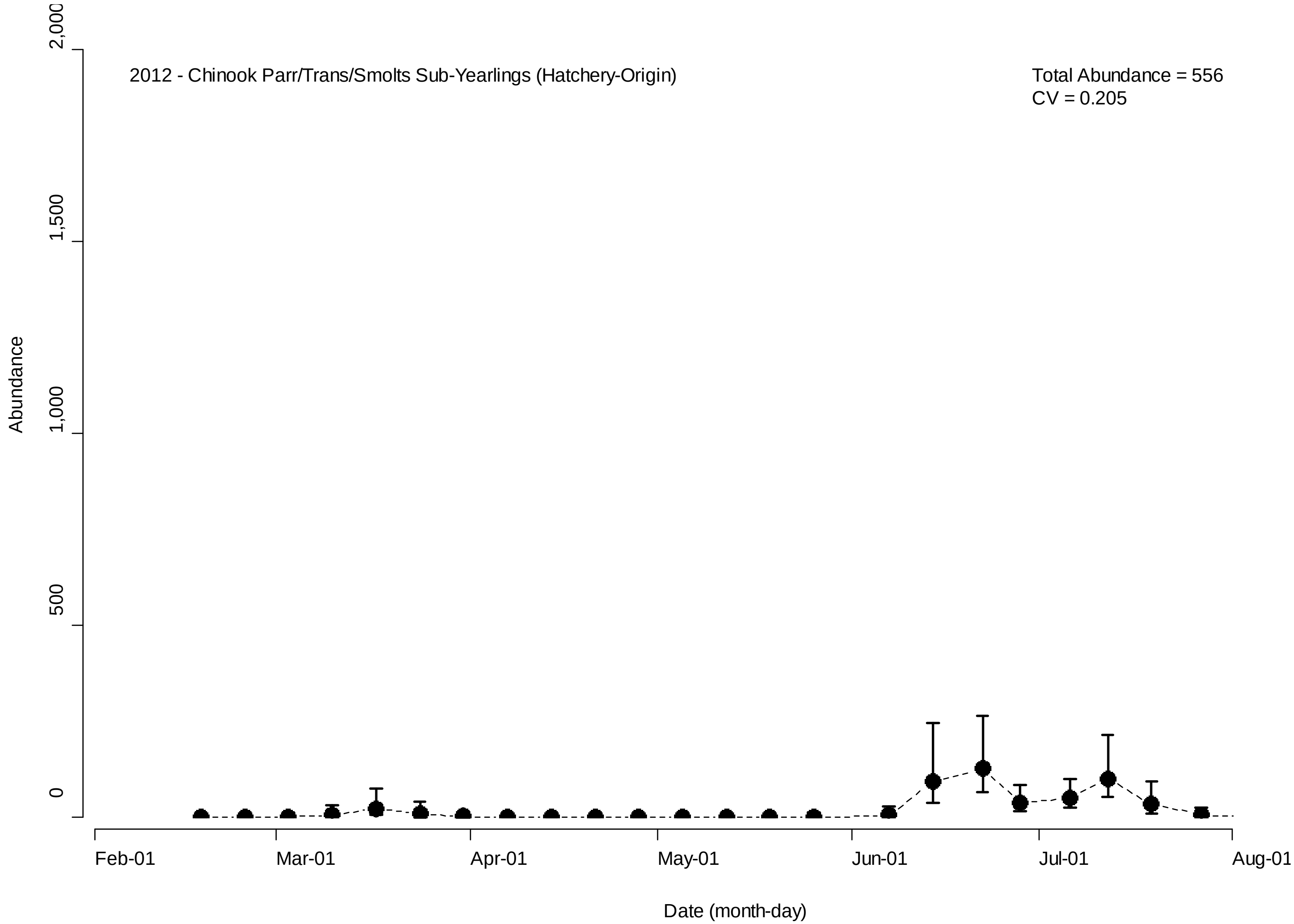

Figure E27. Estimated abundance (± 95% CI) by date for hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2012.

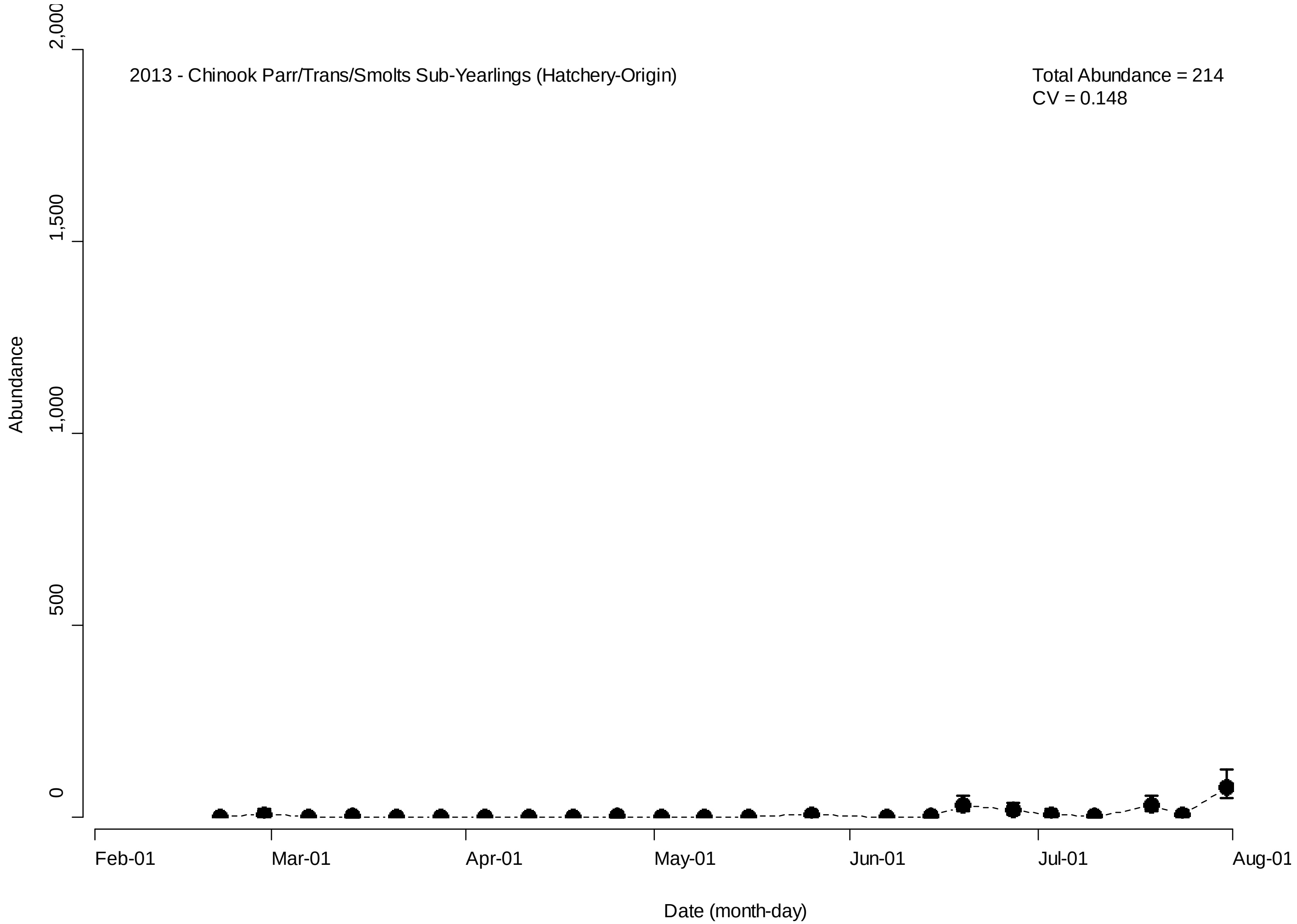

Figure E28. Estimated abundance (± 95% CI) by date for hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2013.

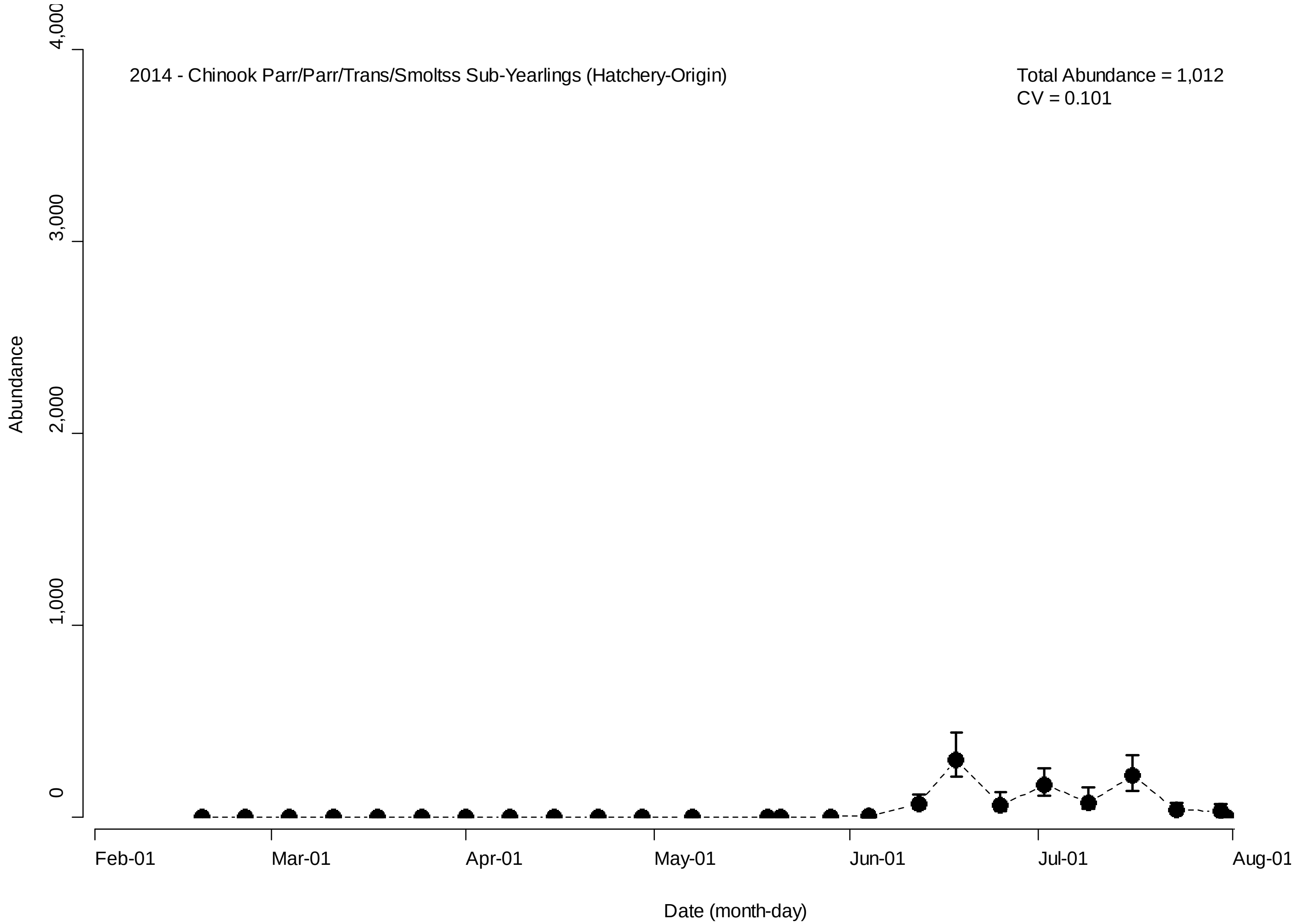

Figure E29. Estimated abundance (± 95% CI) by date for hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2014.

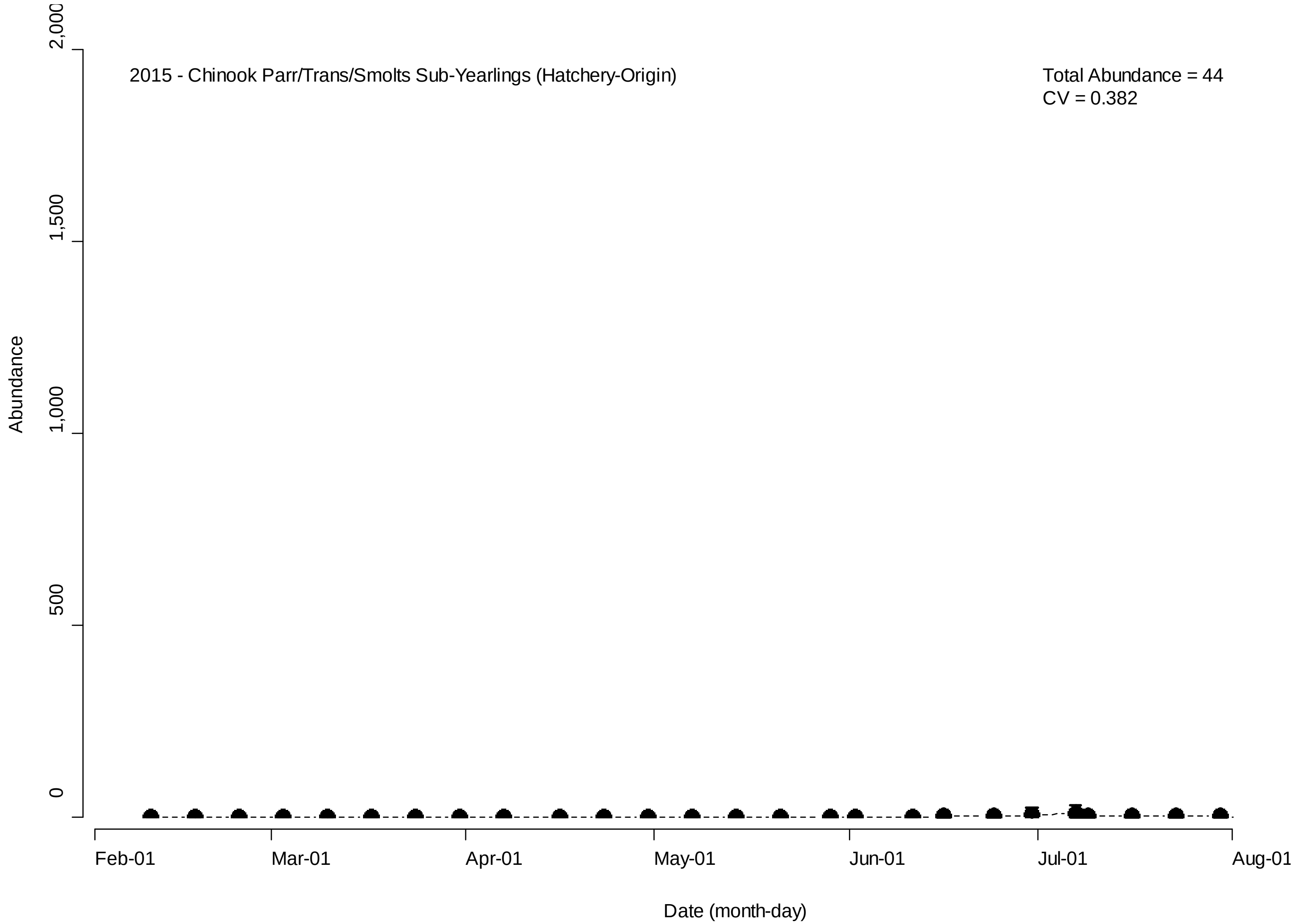

Figure E30. Estimated abundance (± 95% CI) by date for hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2015.

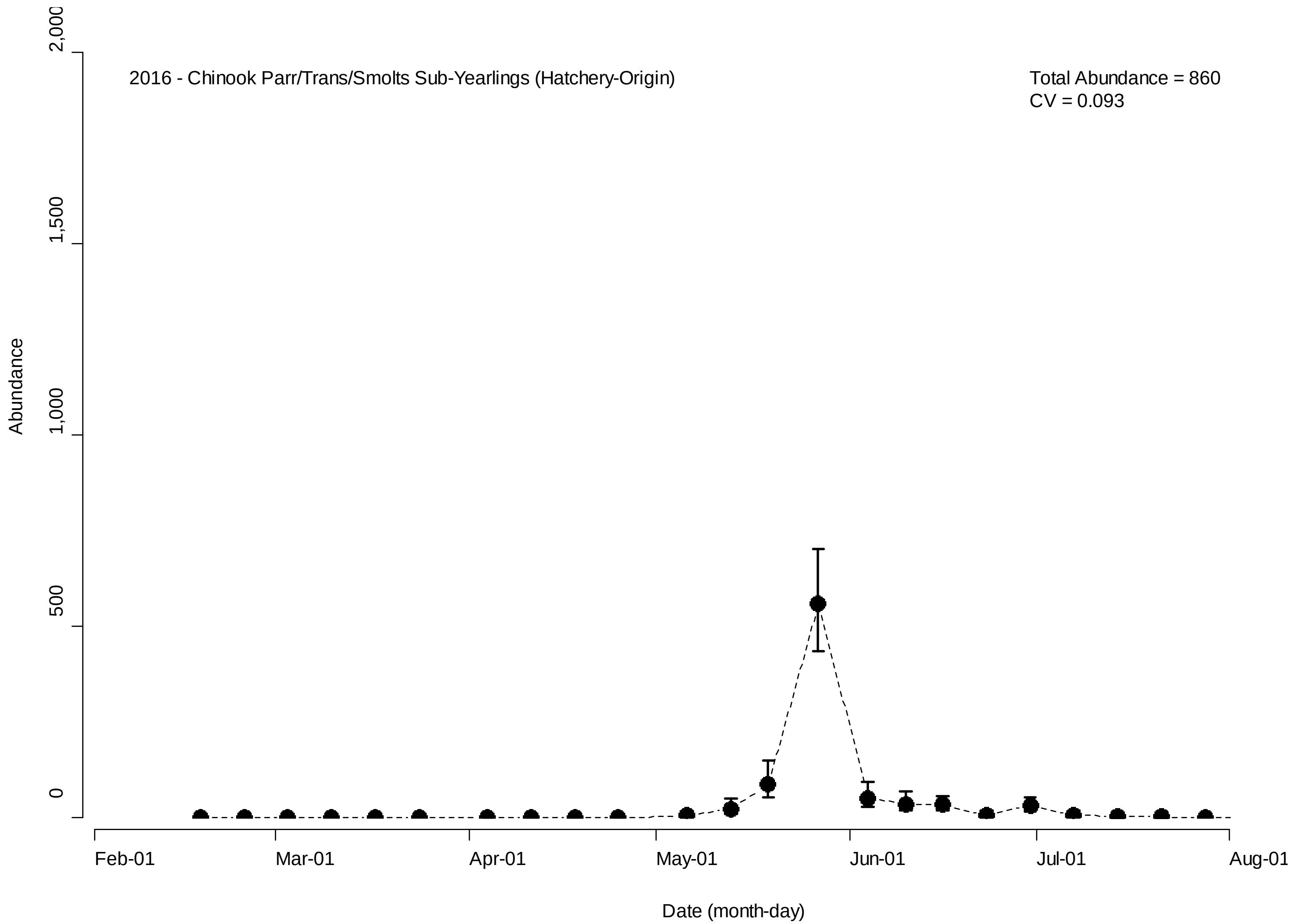

Figure E31. Estimated abundance (± 95% CI) by date for hatchery-origin Chinook salmon (life-stage = parr/transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2016.

Coho salmon (Natural-Origin, Transitional/Smolt, Sub-Yearling)

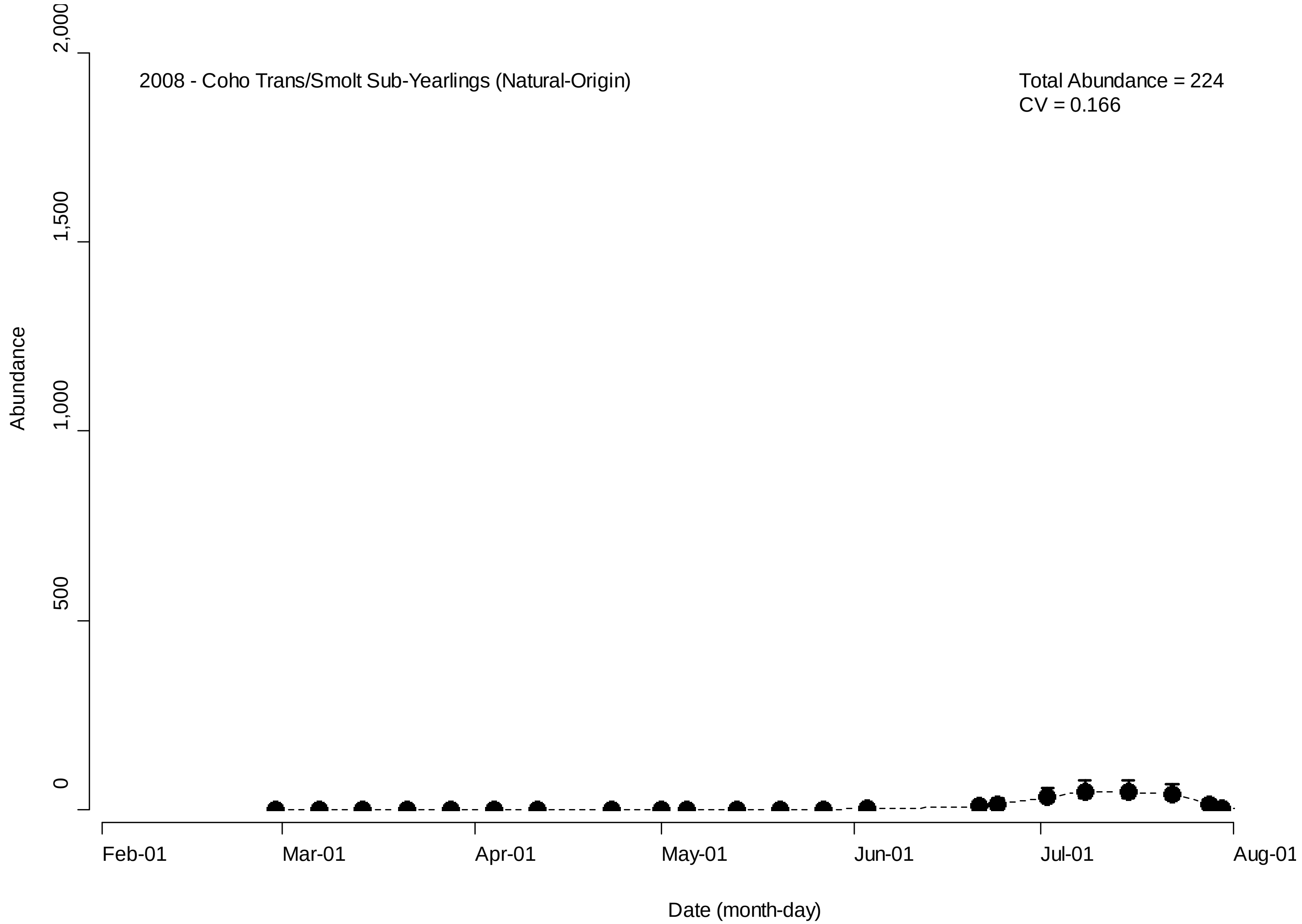

Figure E32. Estimated abundance (± 95% CI) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2008.

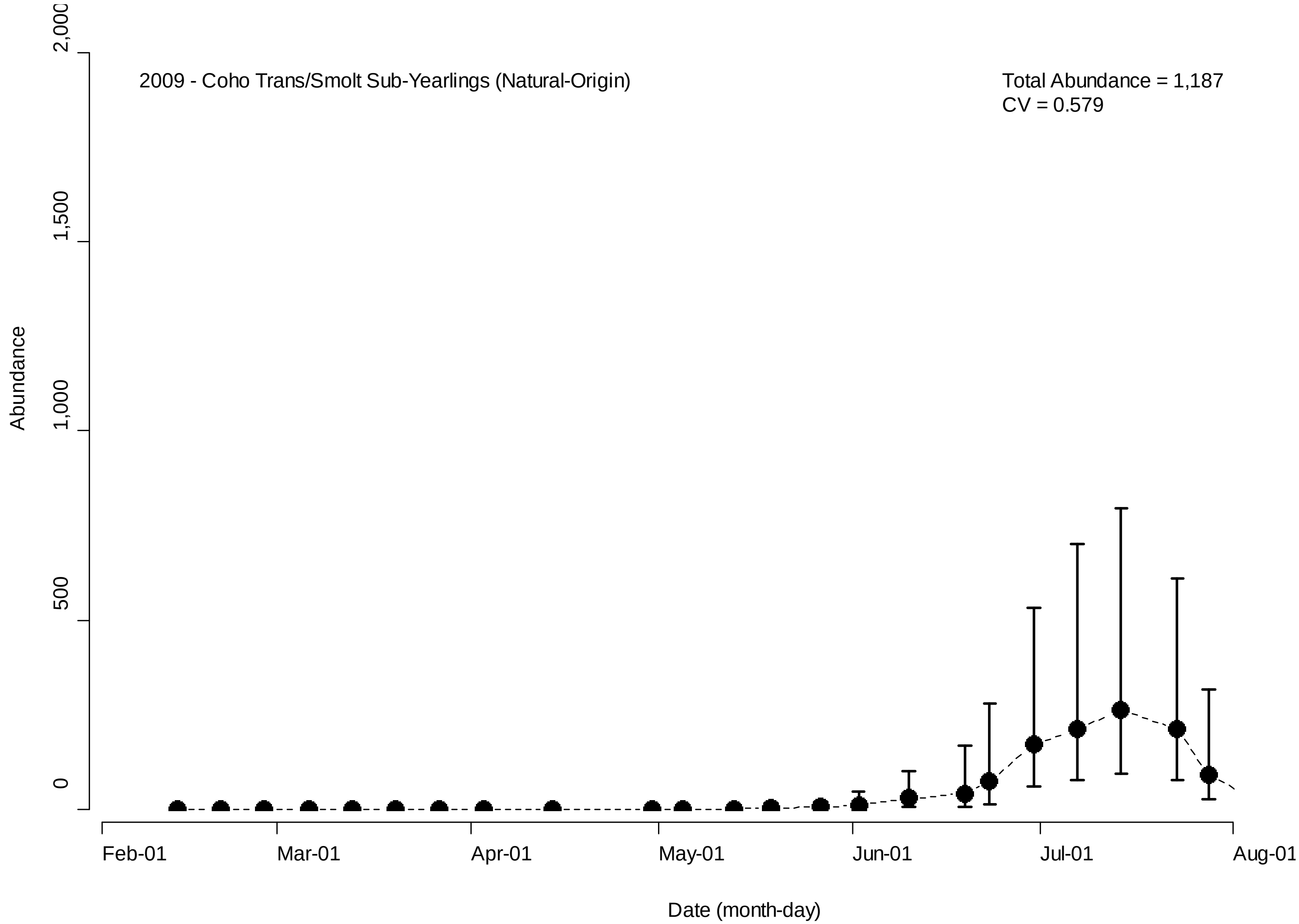

Figure E33. Estimated abundance (± 95% CI) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2009.

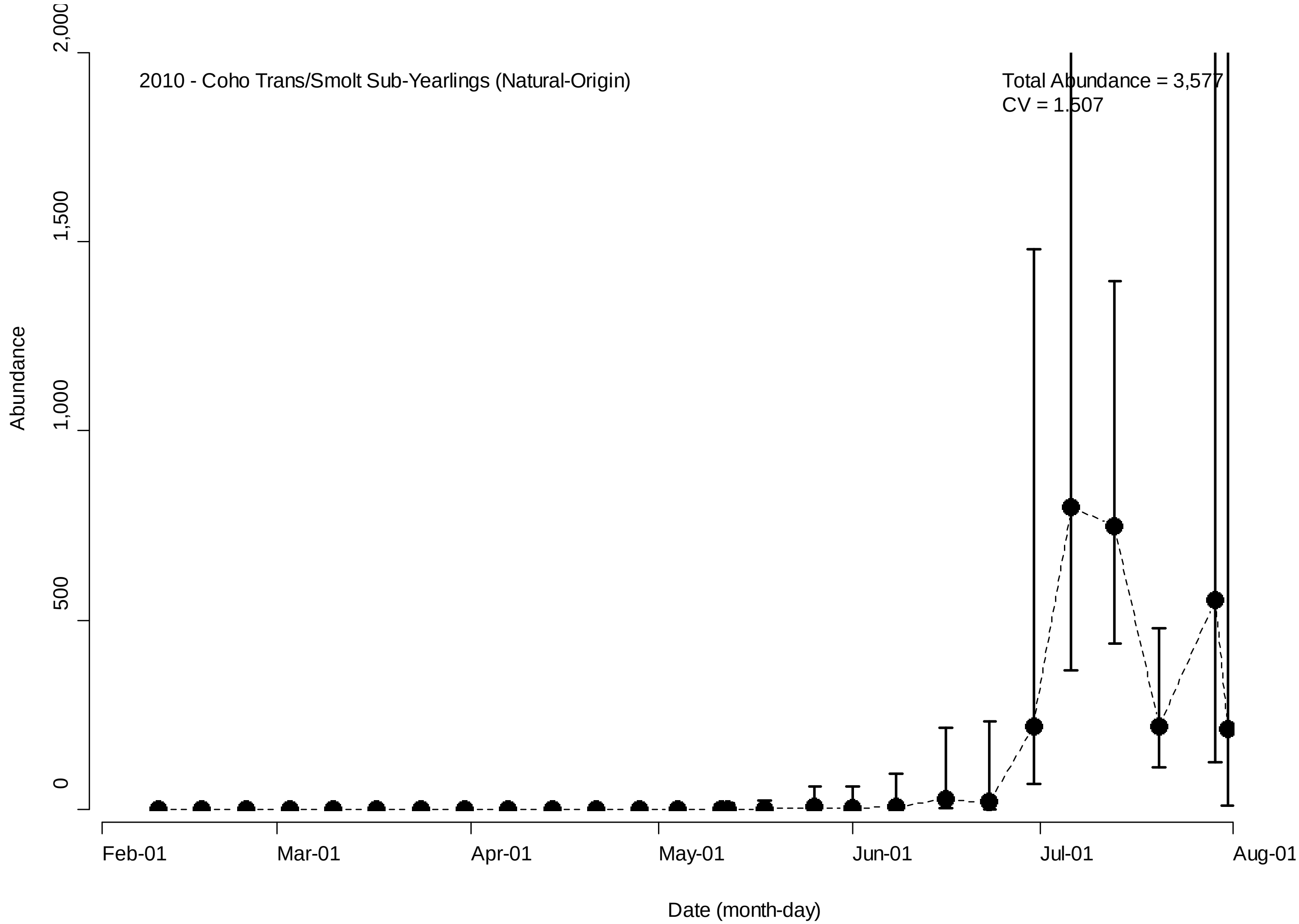

Figure E34. Estimated abundance (± 95% CI) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2010.

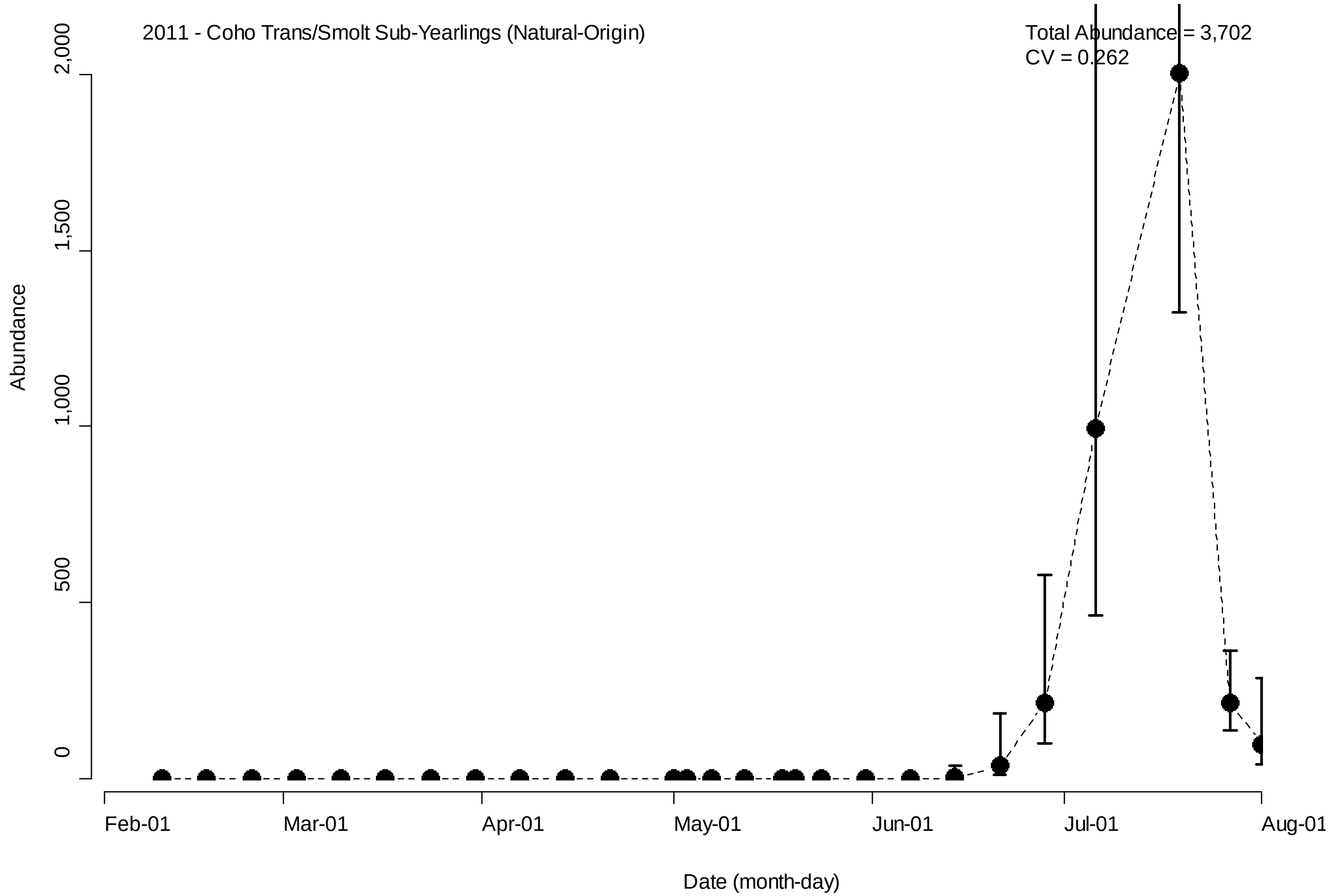

Figure E35. Estimated abundance (± 95% CI) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2011.

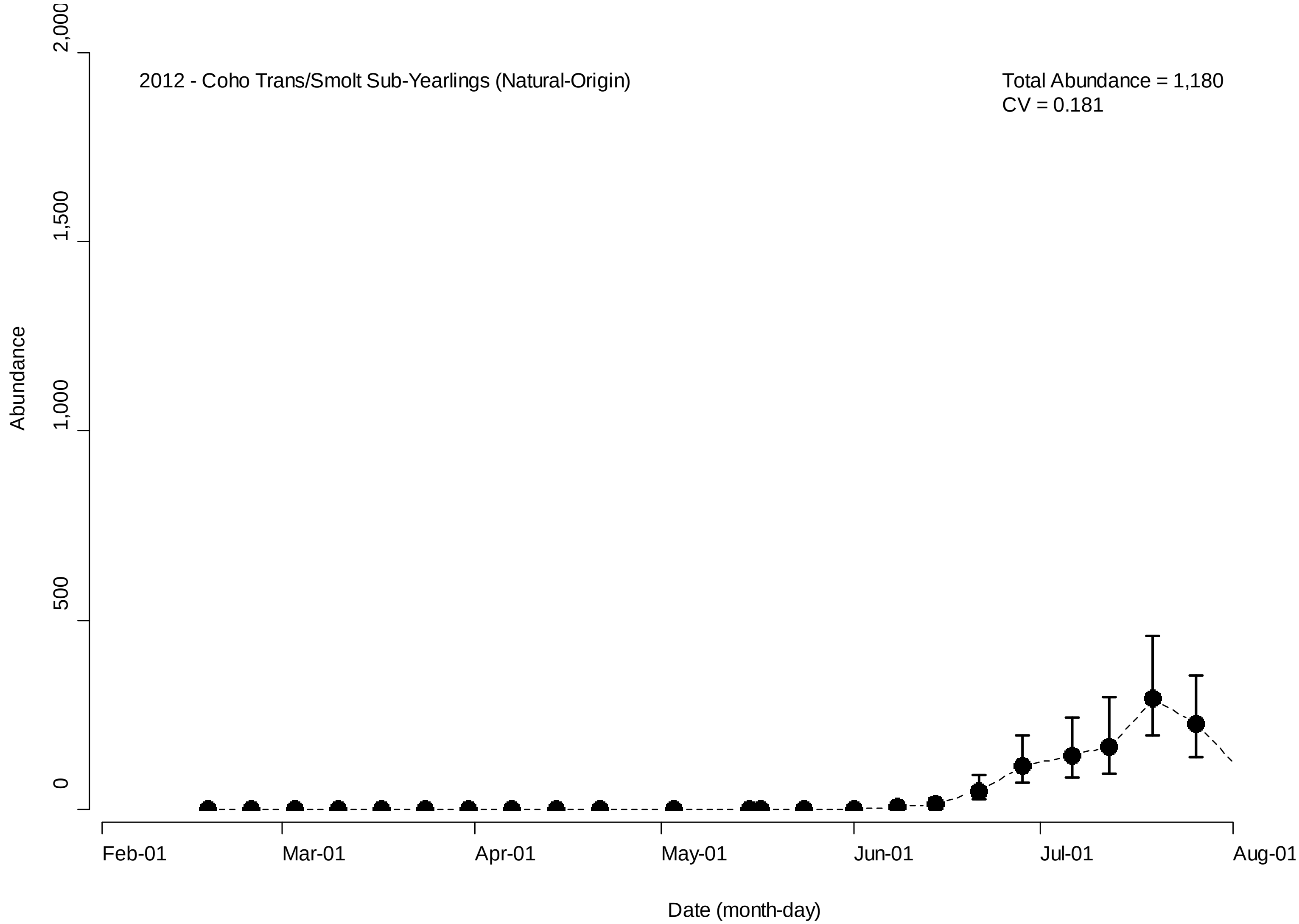

Figure E36. Estimated abundance (± 95% CI) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2012.

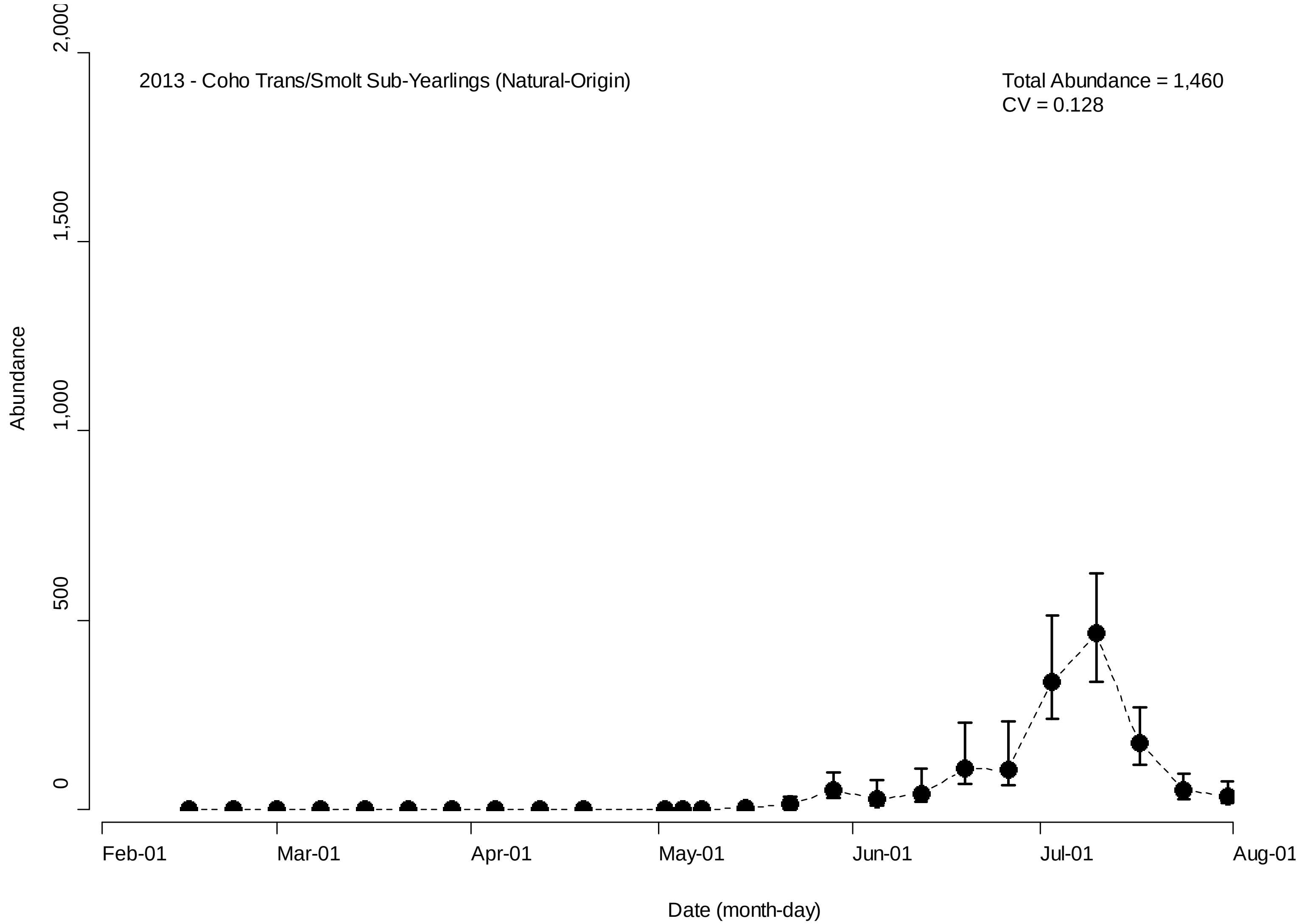

Figure E37. Estimated abundance (± 95% CI) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2013.

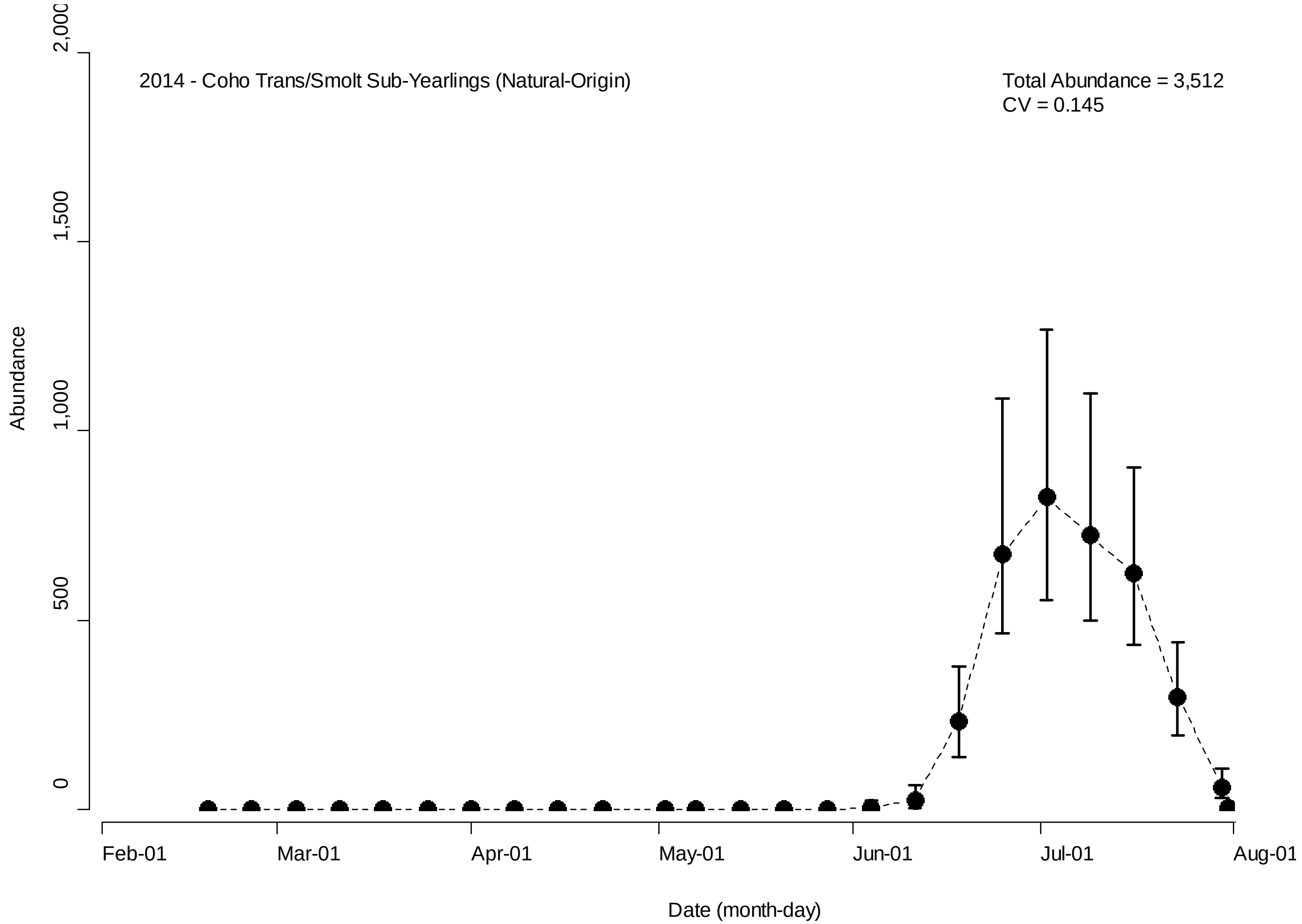

Figure E38. Estimated abundance (± 95% CI) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2014.

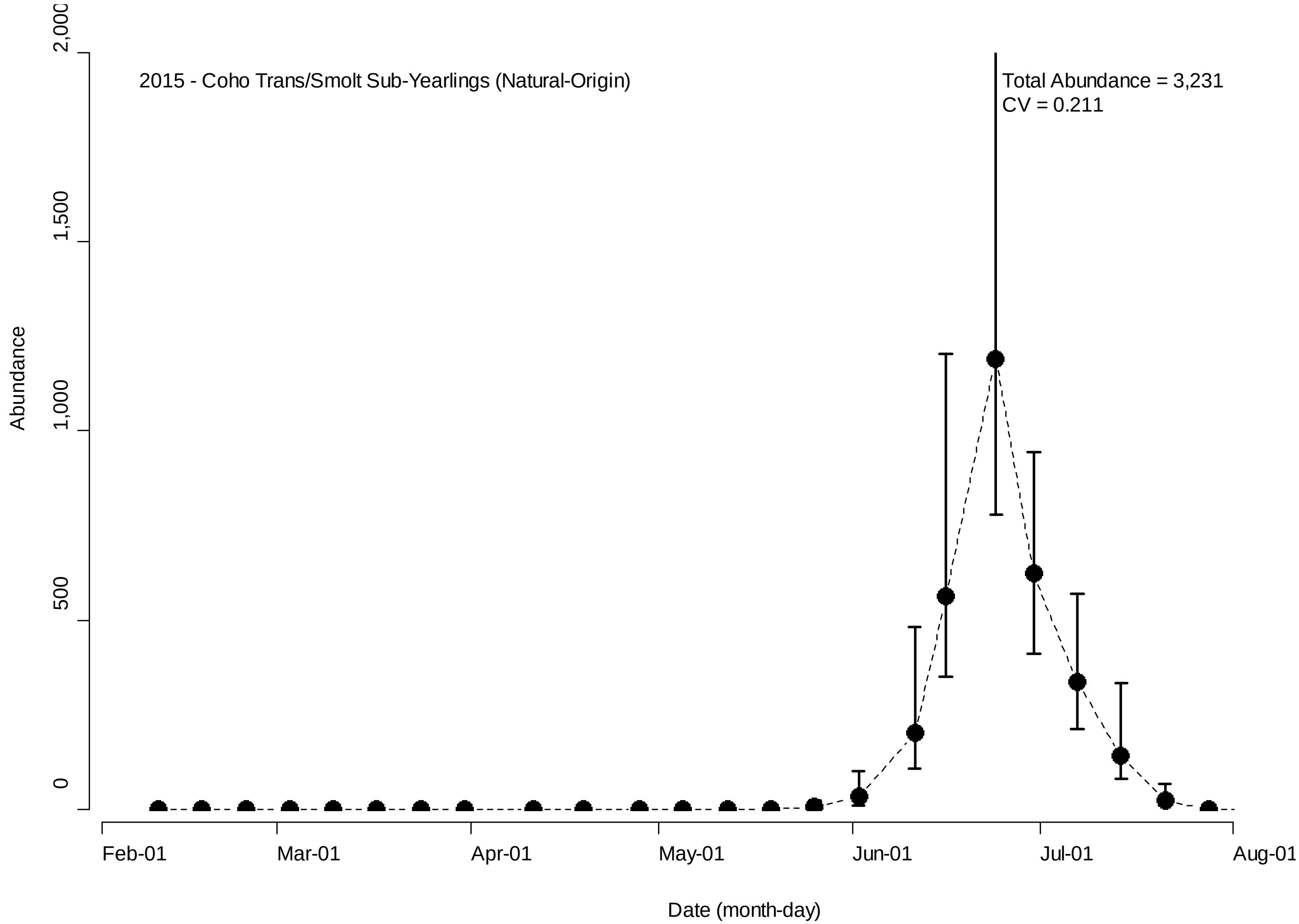

Figure E39. Estimated abundance (± 95% CI) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2015.

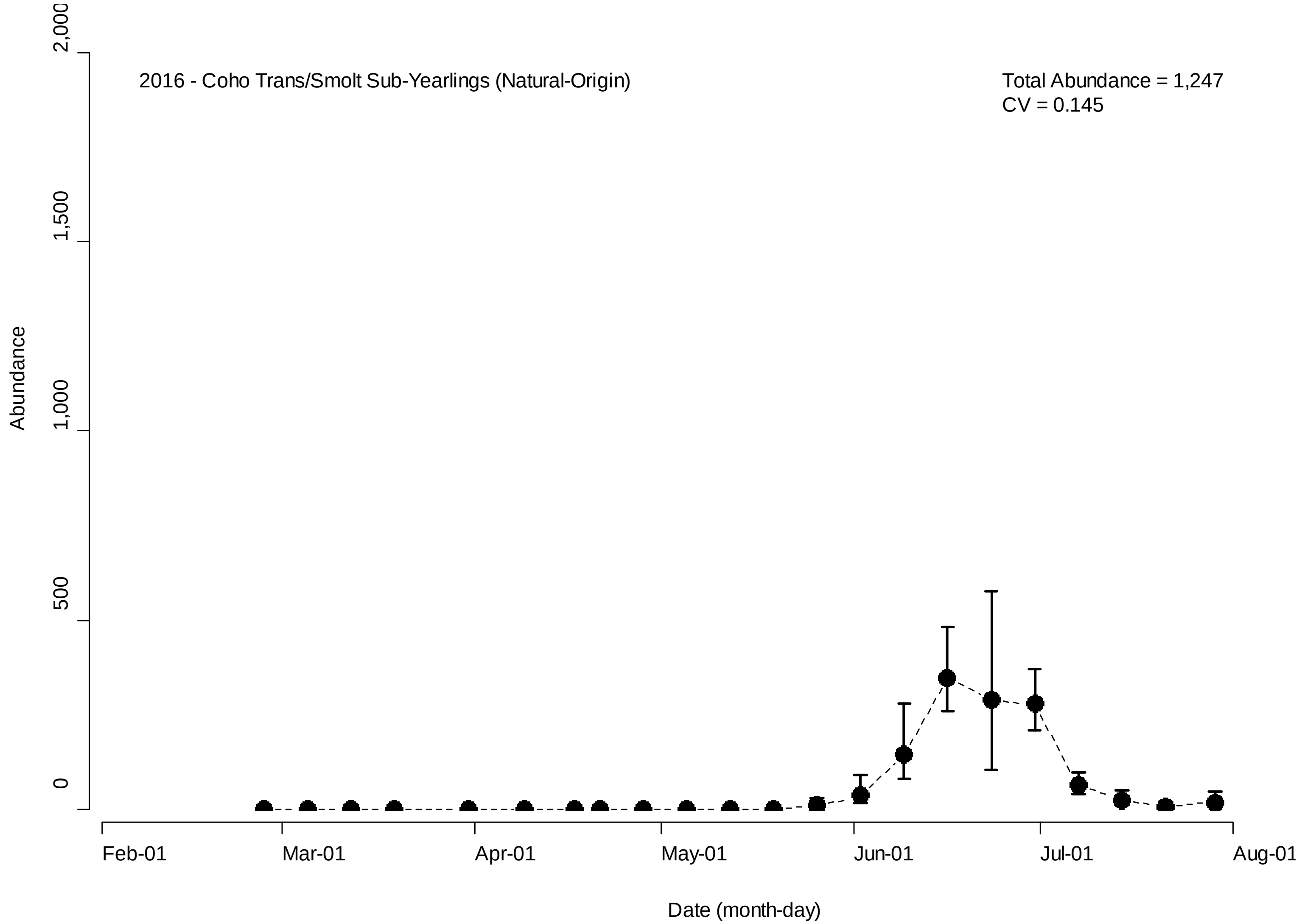

Figure E40. Estimated abundance (± 95% CI) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2016.

Coho salmon (Natural origin, Transitional/smolts, Yearlings)

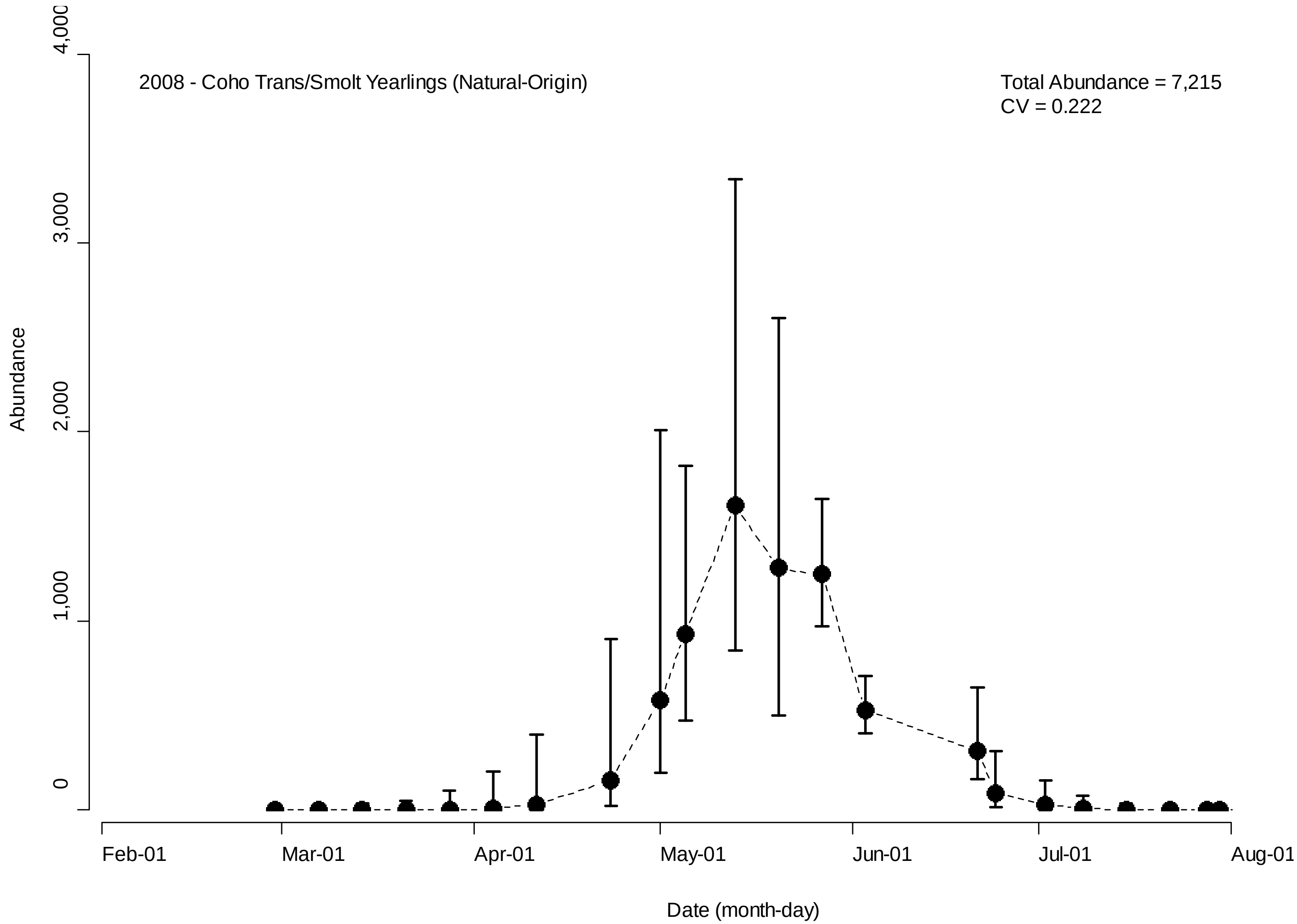

Figure E41. Estimated abundance (± 95% CI) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap in 2008.

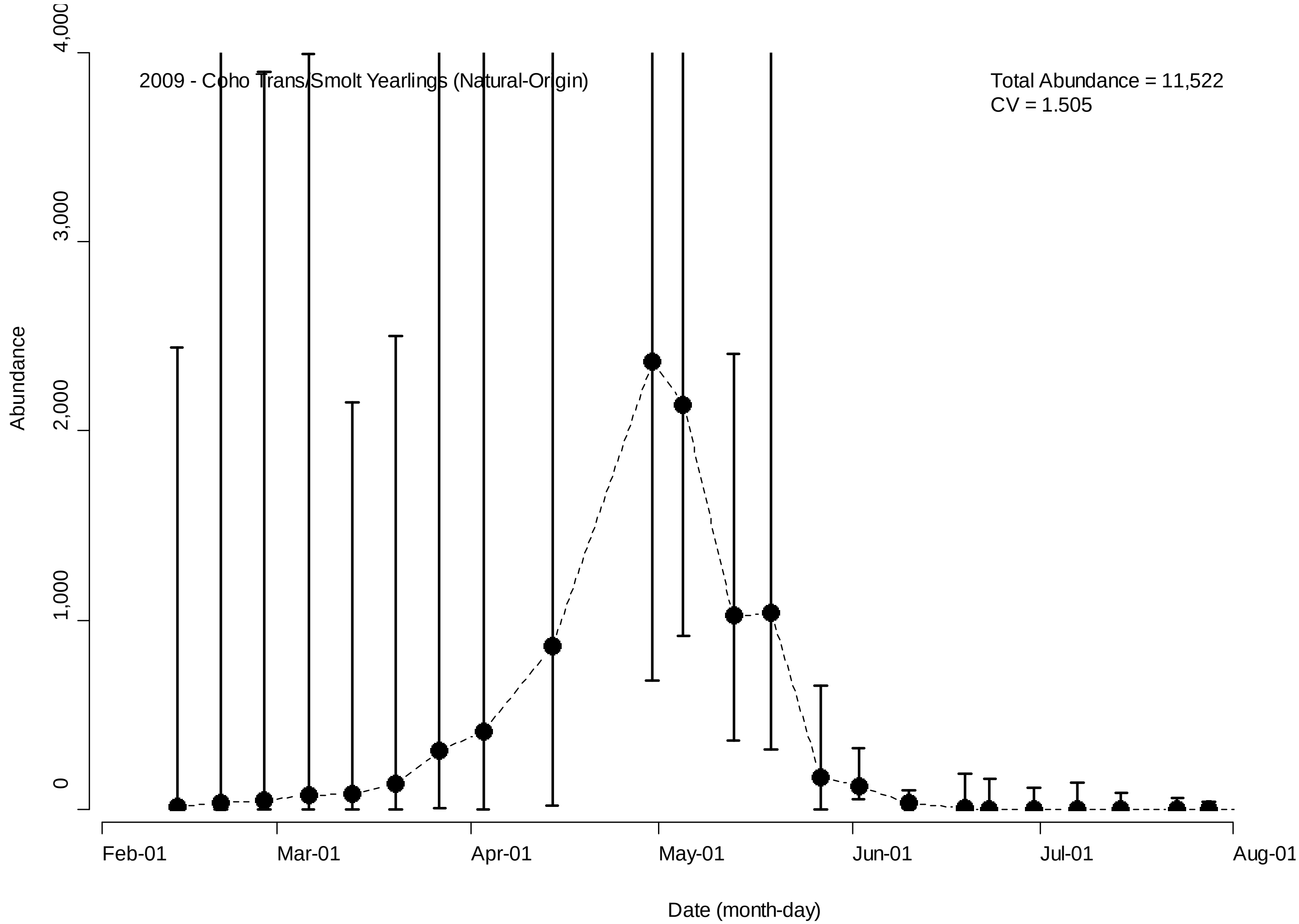

Figure E42. Estimated abundance (± 95% CI) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap in 2009.

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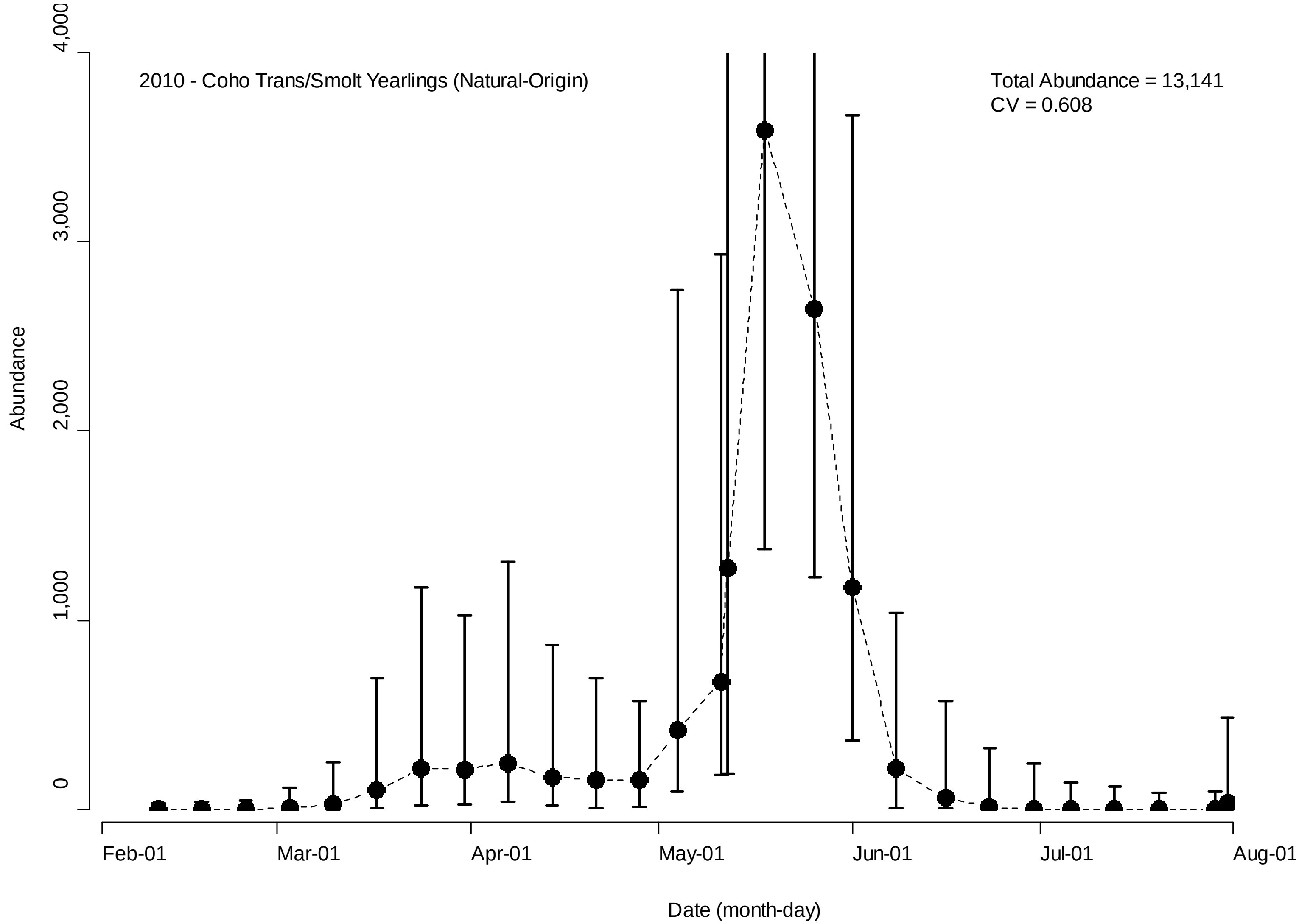

Figure E43. Estimated abundance (± 95% CI) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap in 2010.

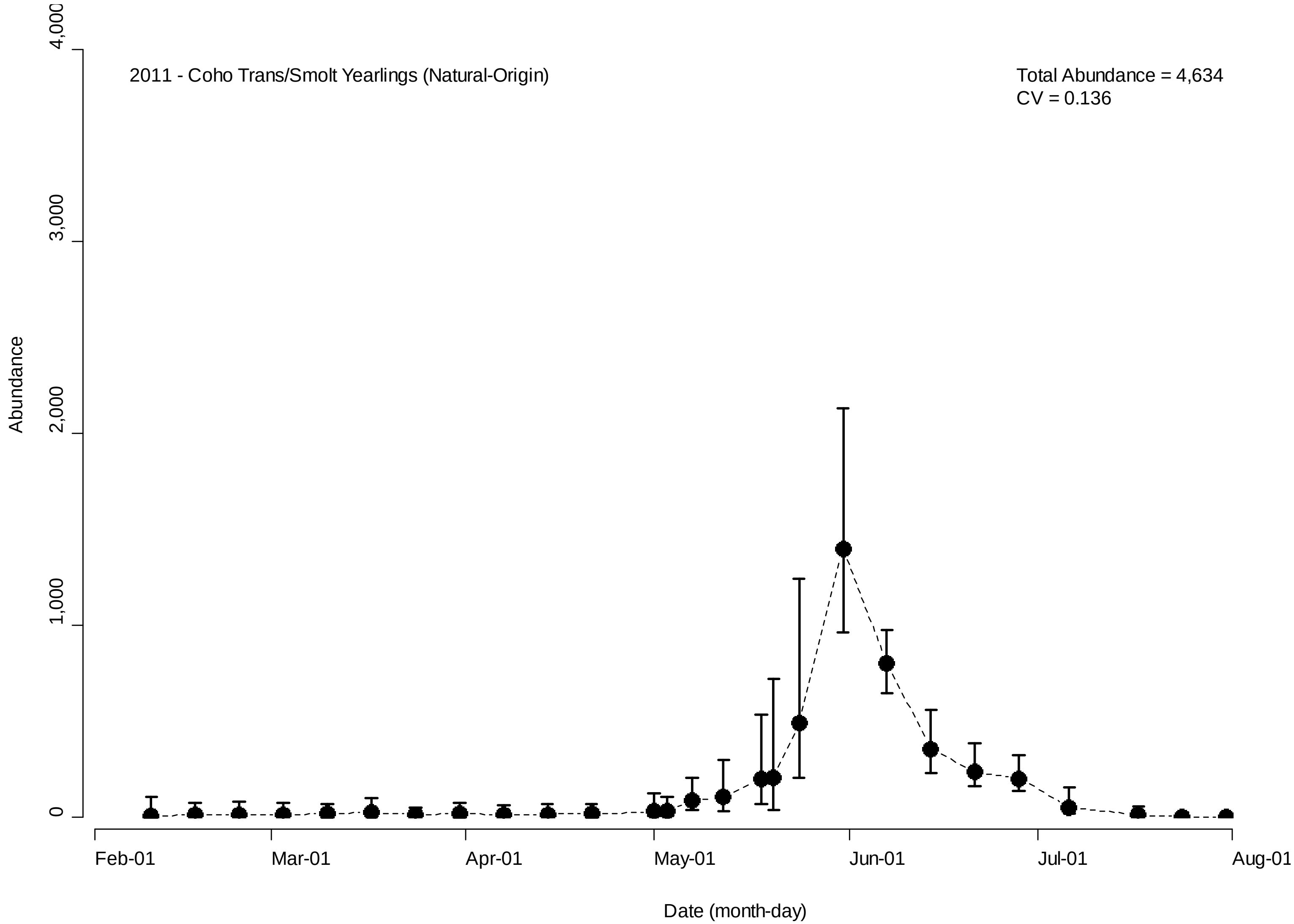

Figure E44. Estimated abundance (± 95% CI) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap in 2011.

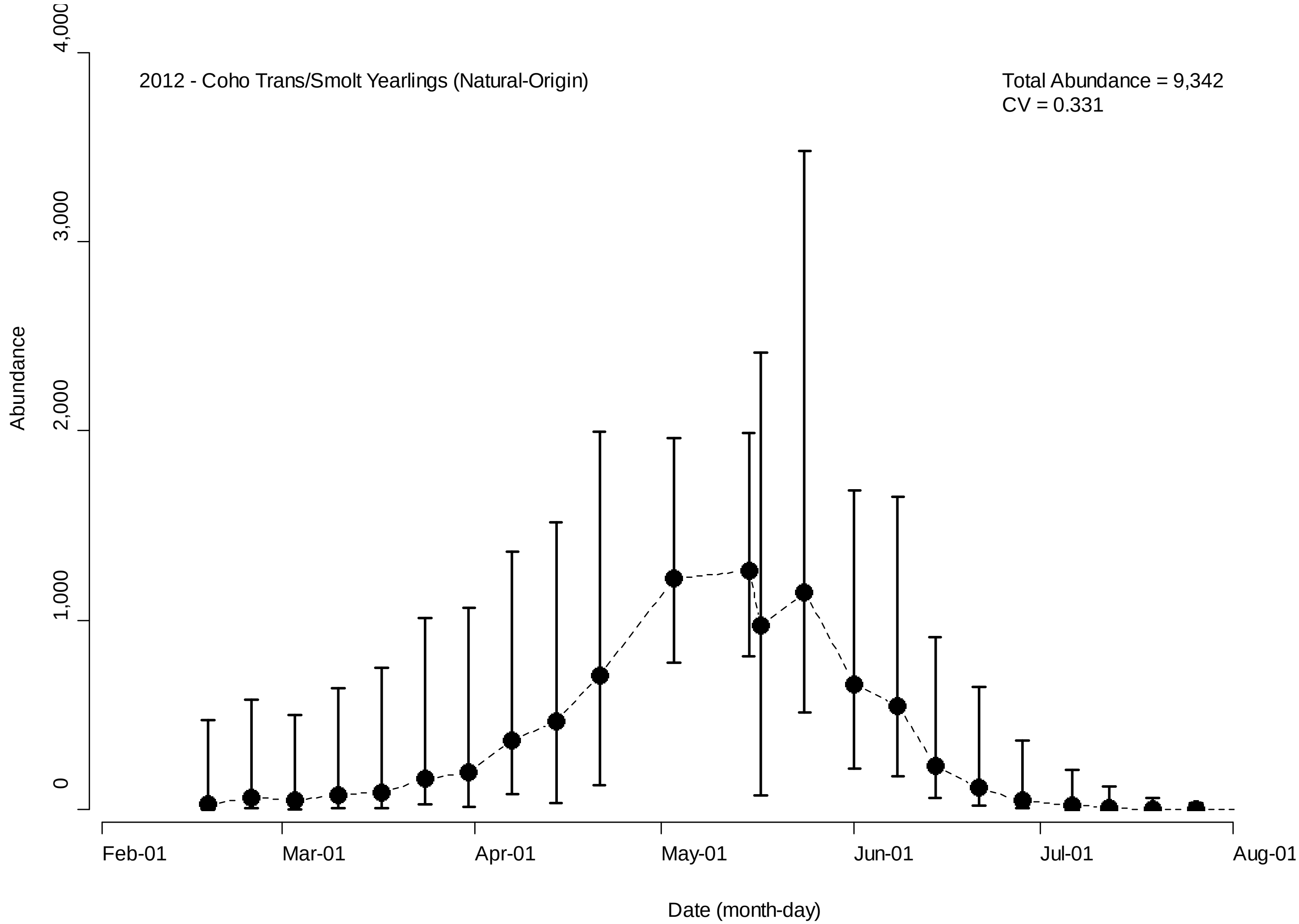

Figure E45. Estimated abundance (± 95% CI) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap in 2012.

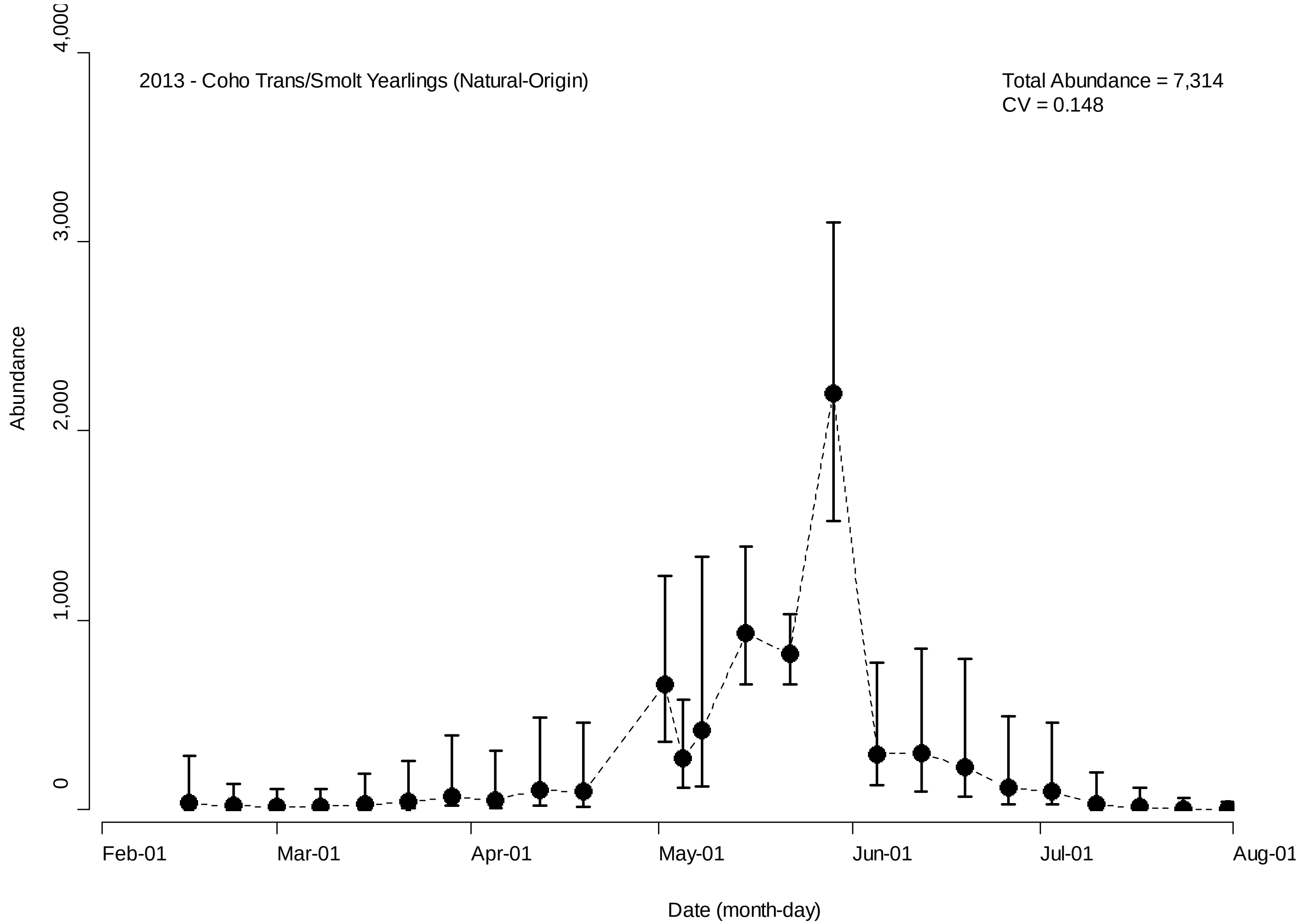

Figure E46. Estimated abundance (± 95% CI) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap in 2013.

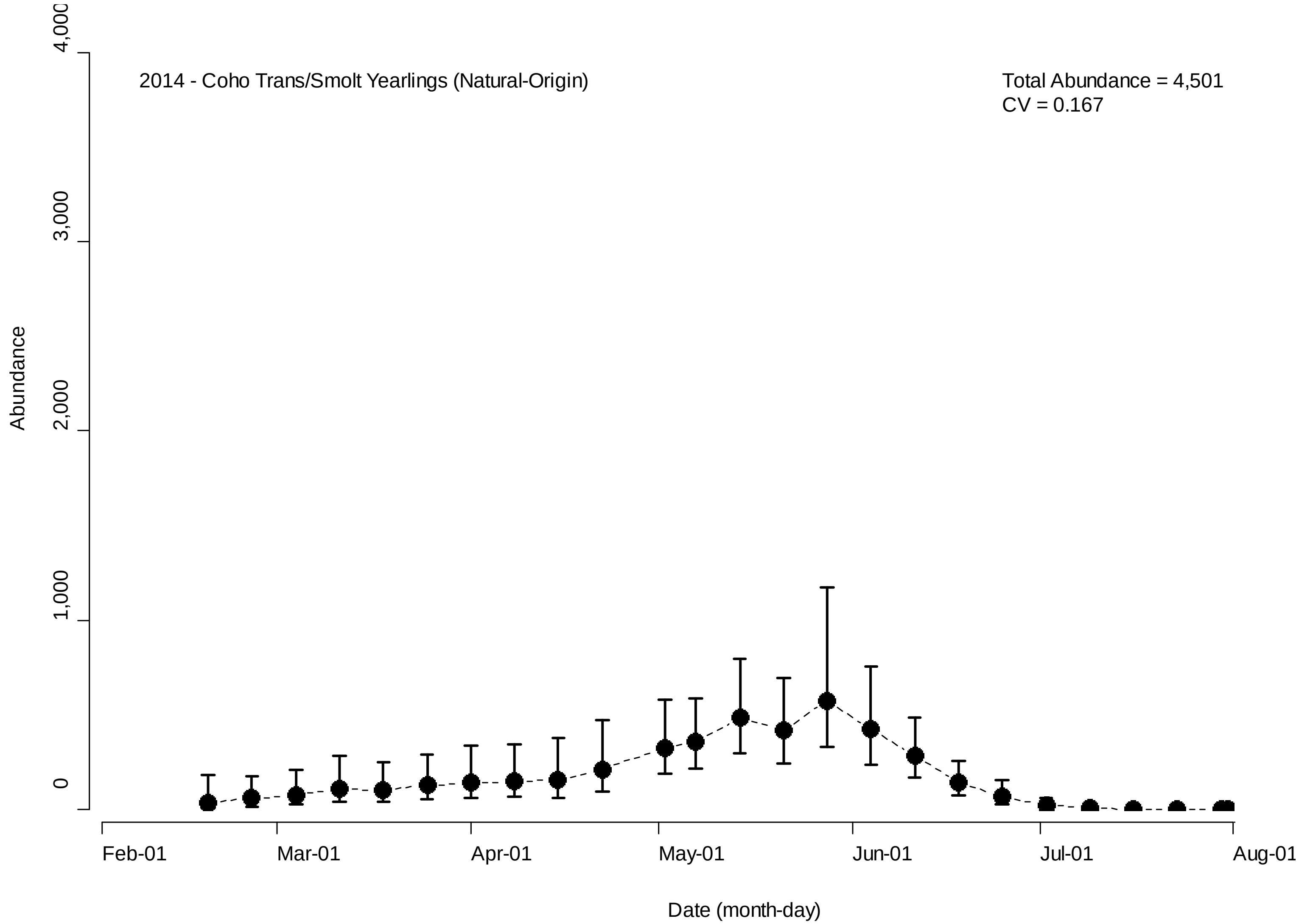

Figure E47. Estimated abundance (± 95% CI) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap in 2014.

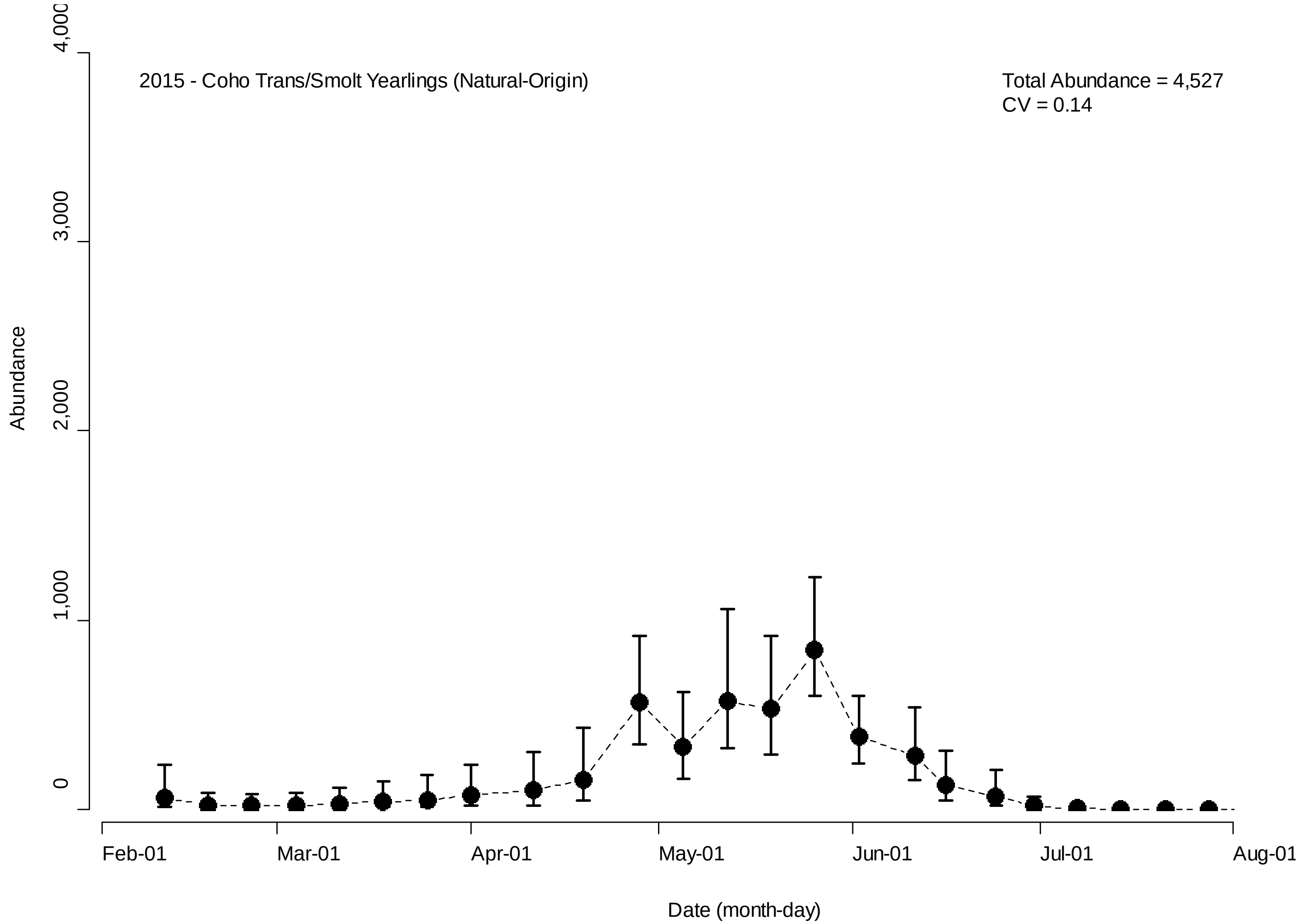

Figure E48. Estimated abundance (± 95% CI) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap in 2015.

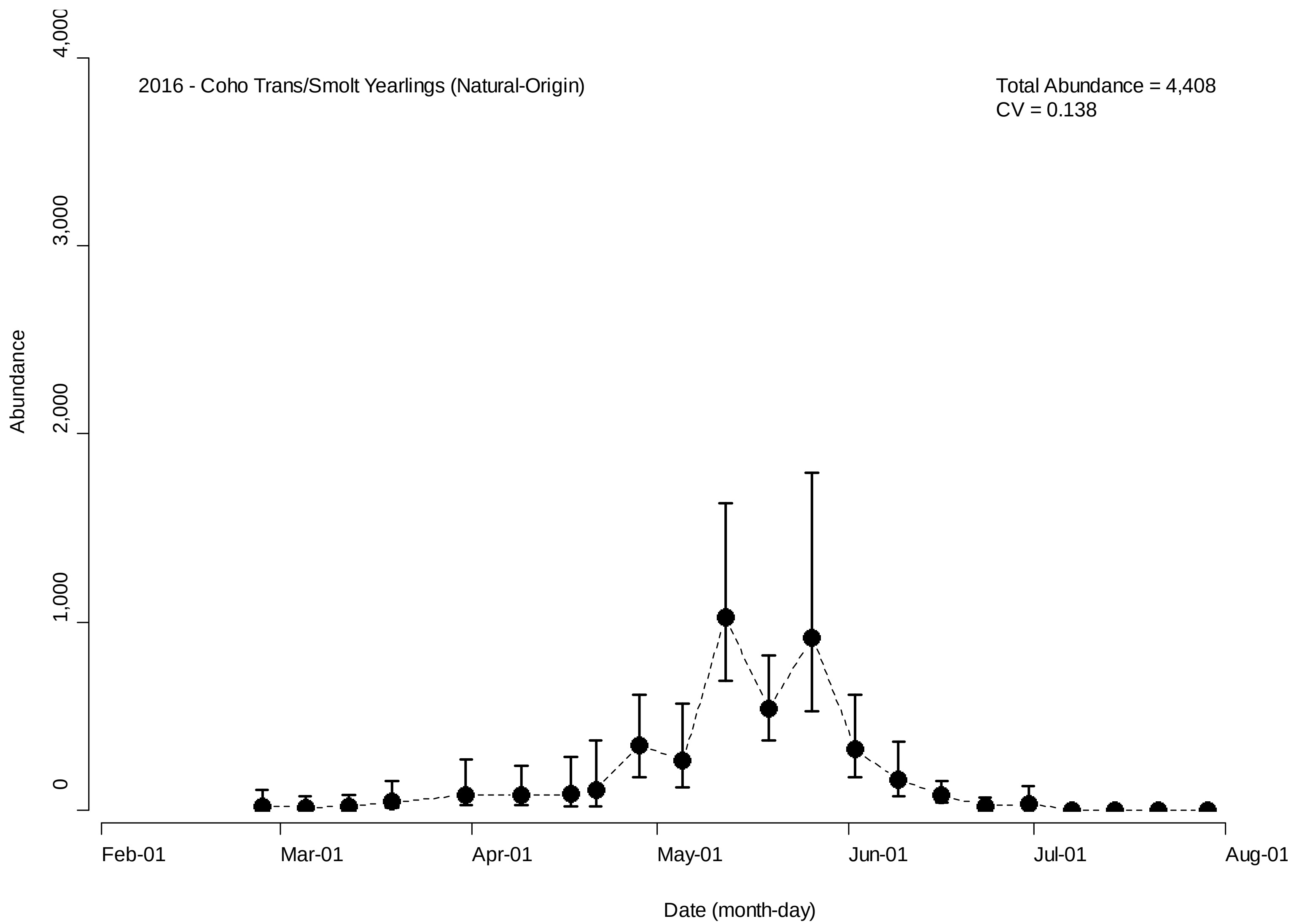

Figure E49. Estimated abundance (± 95% CI) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap in 2016.

Coho salmon (Hatchery-Origin, Transitional/Smolt, Sub-Yearling)

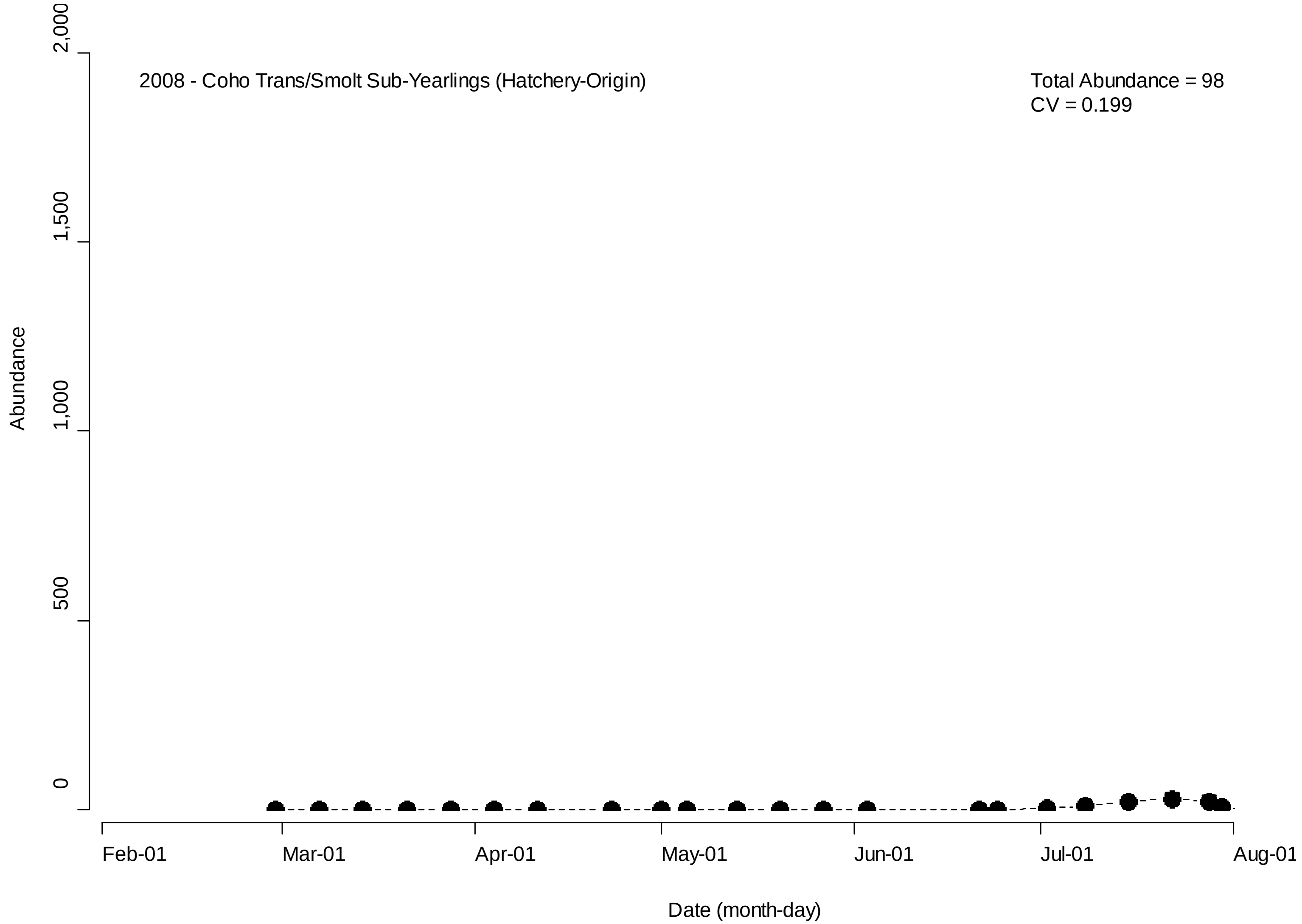

Figure E50. Estimated abundance (± 95% CI) by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2008

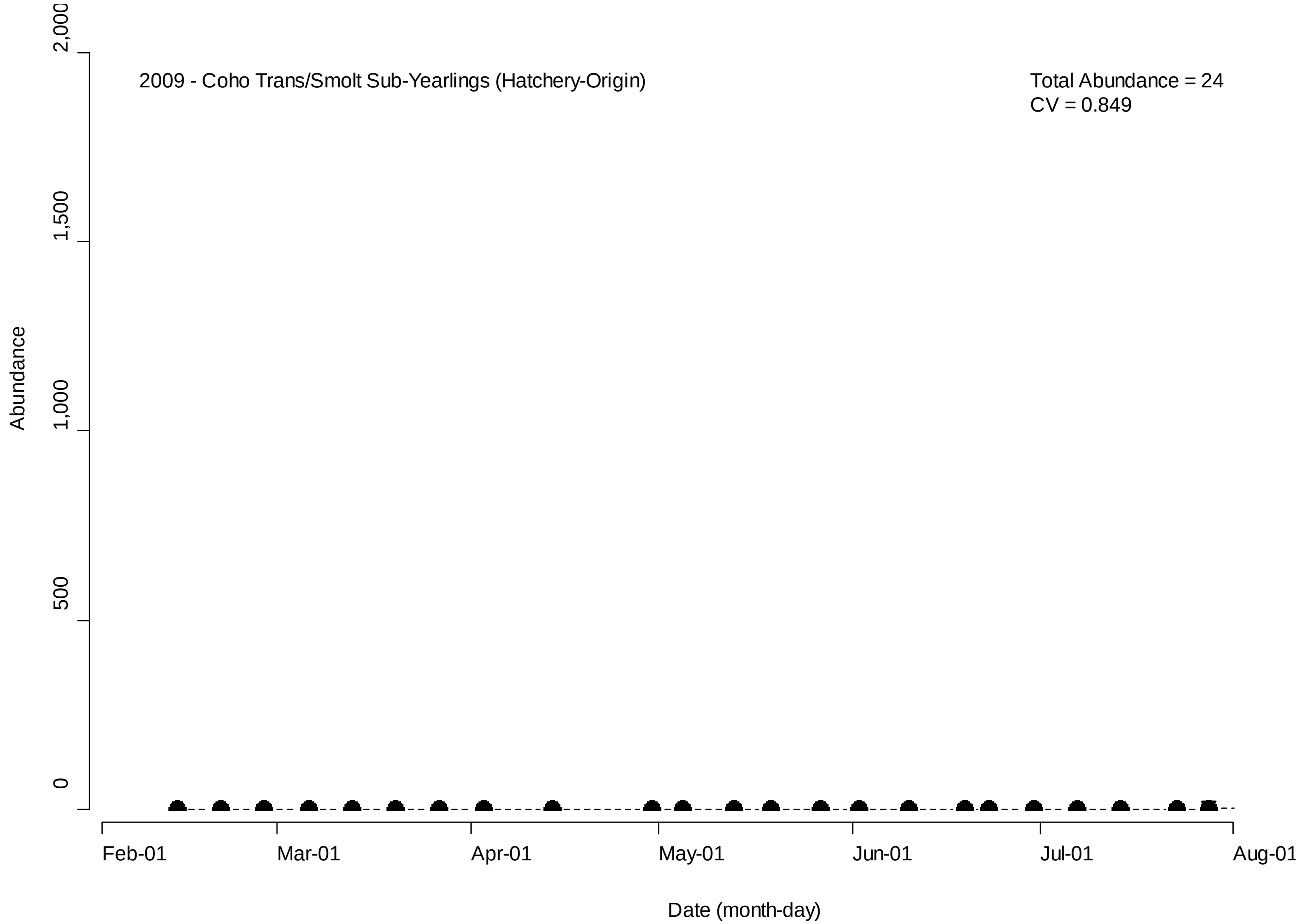

Figure E51. Estimated abundance (± 95% CI) by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2009.

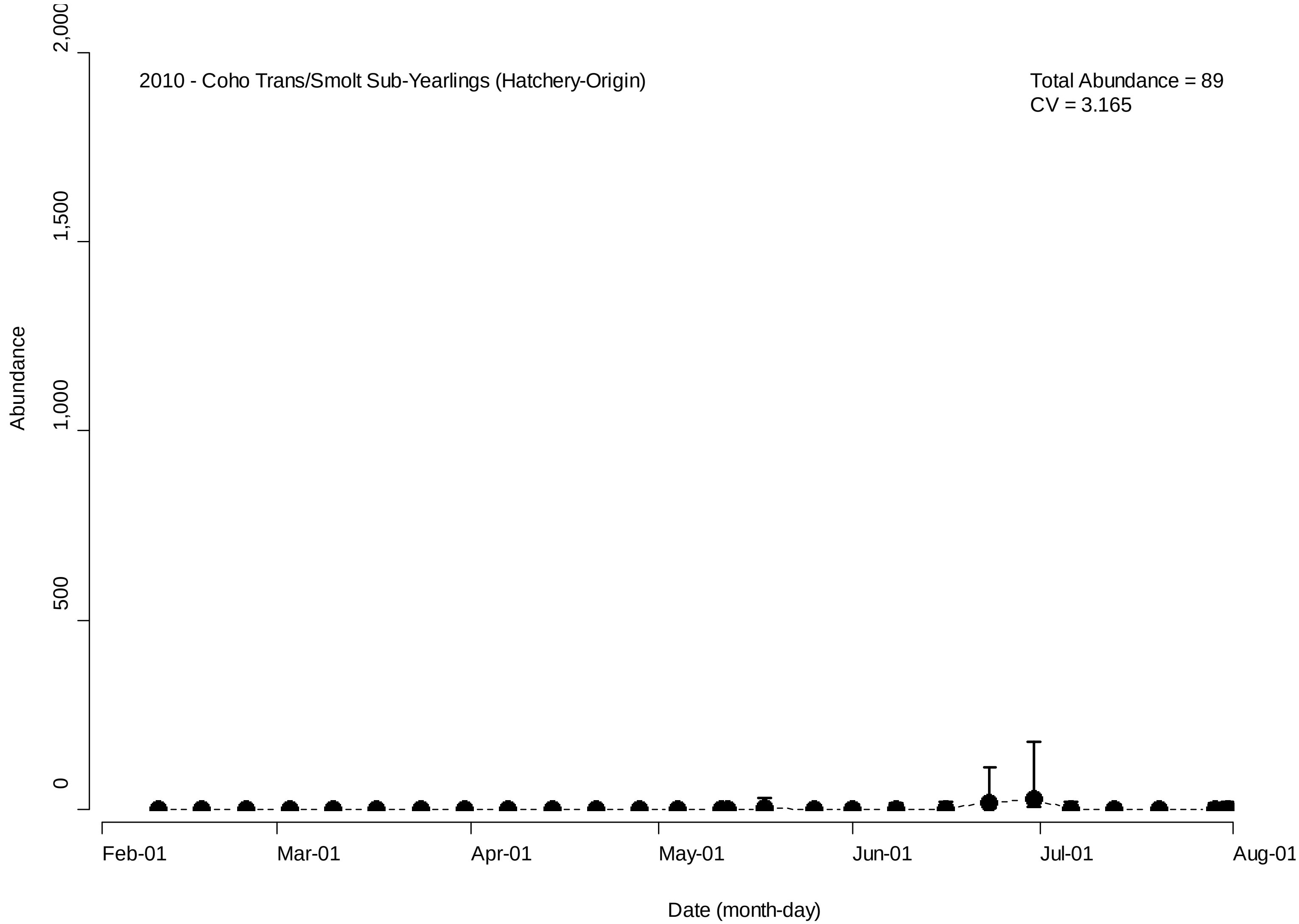

Figure E52. Estimated abundance (± 95% CI) by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2010.

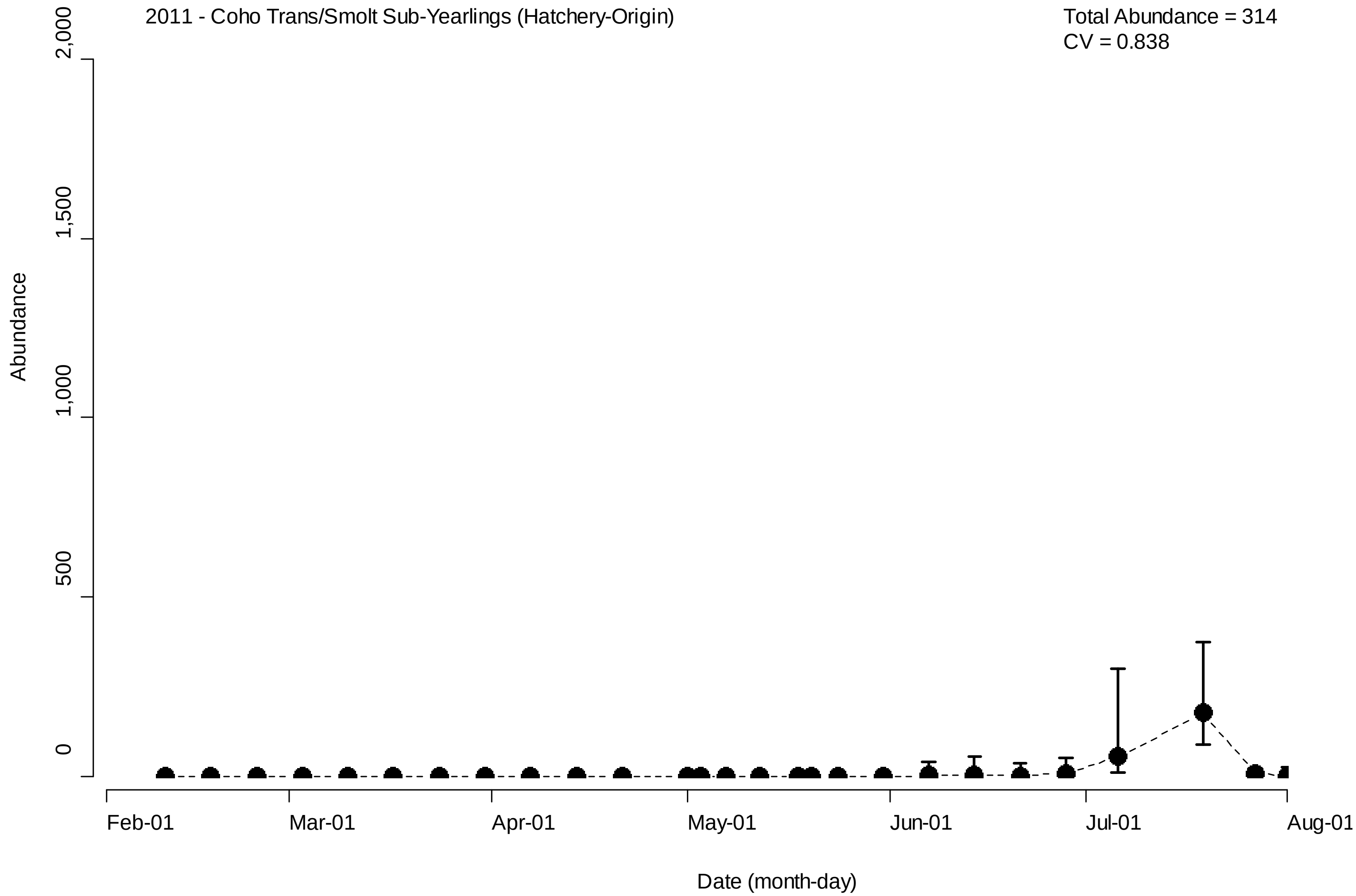

Figure E53. Estimated abundance (± 95% CI) by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2011.

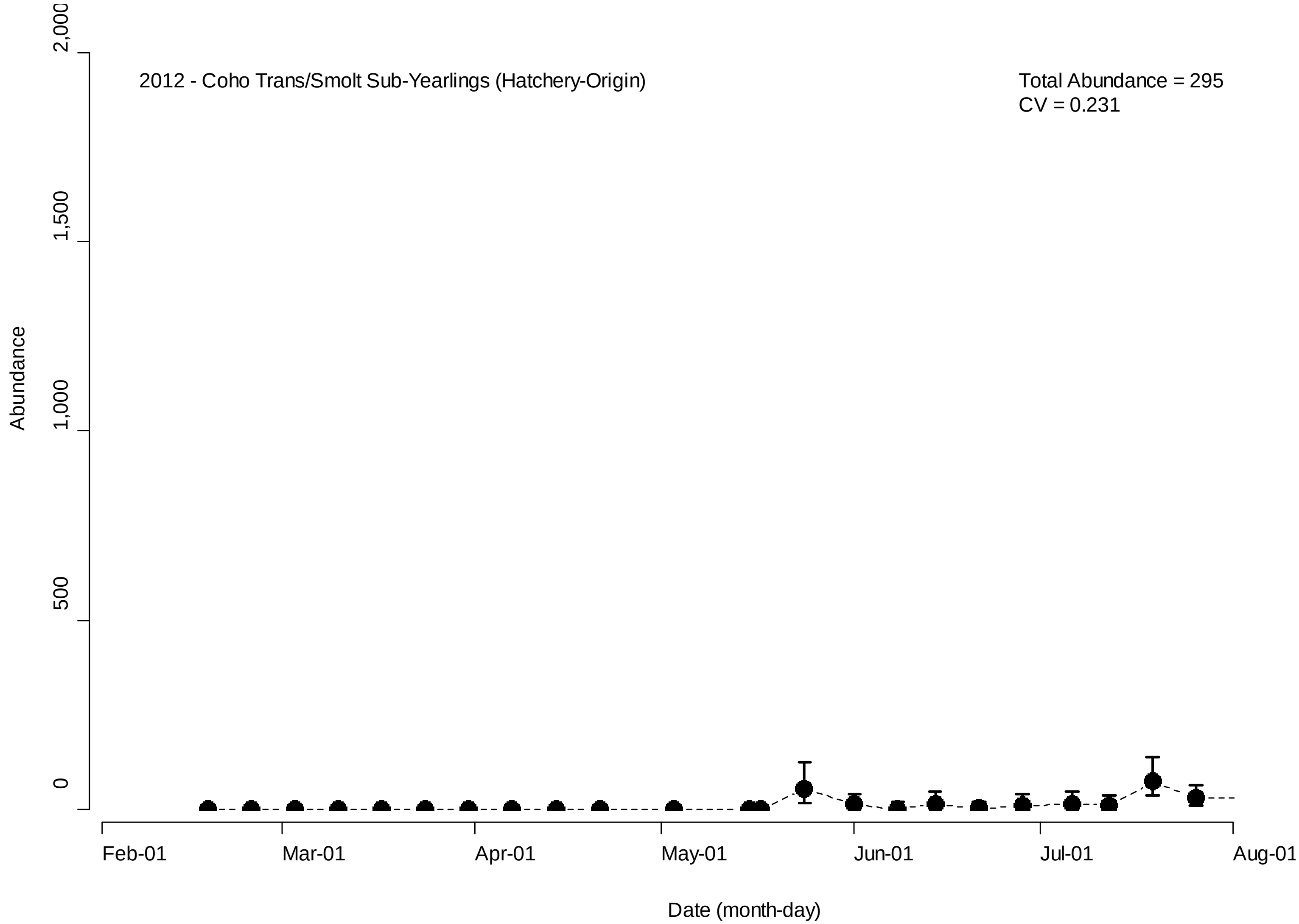

Figure E54. Estimated abundance (± 95% CI) by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2012.

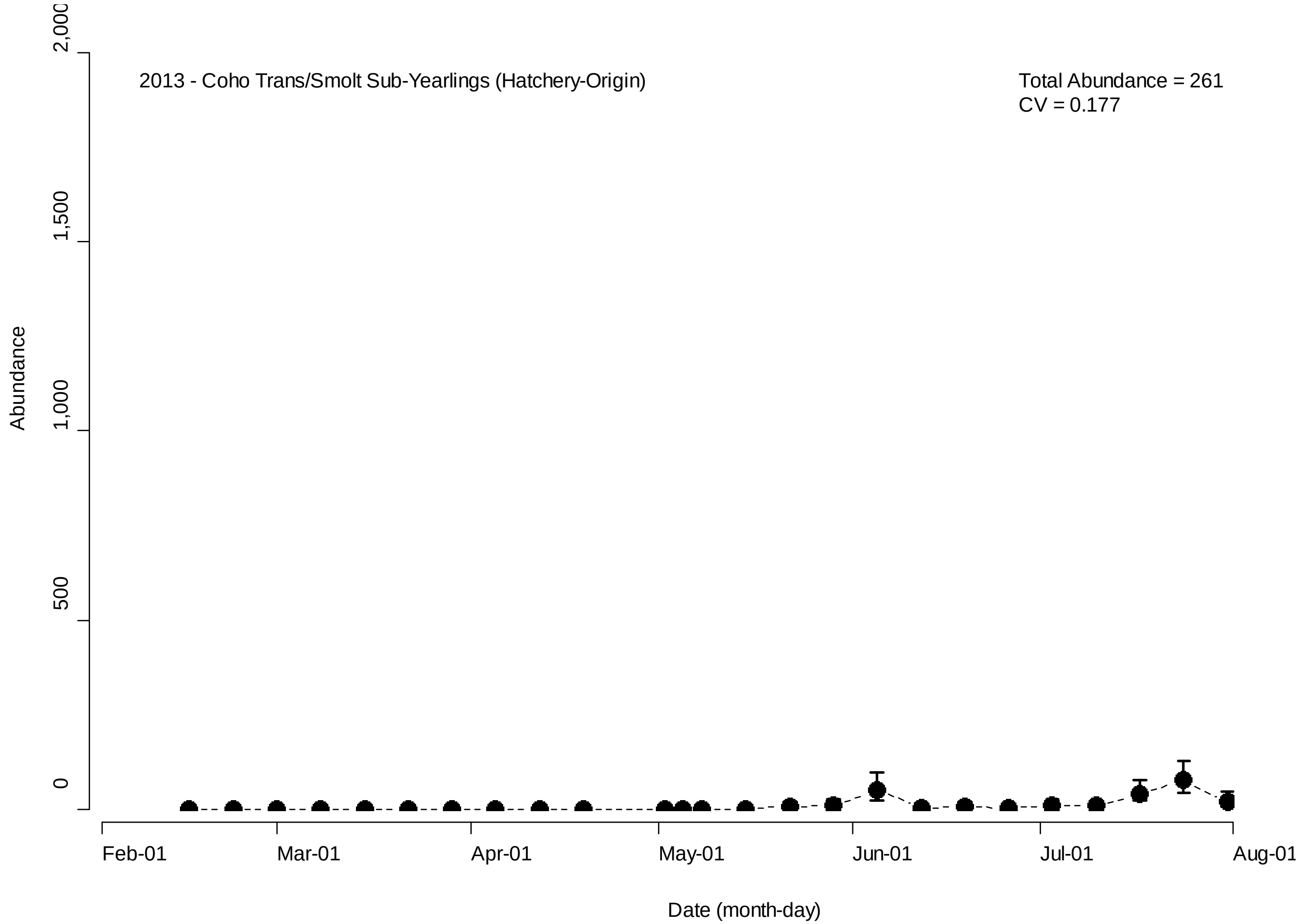

Figure E55. Estimated abundance (± 95% CI) by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2013.

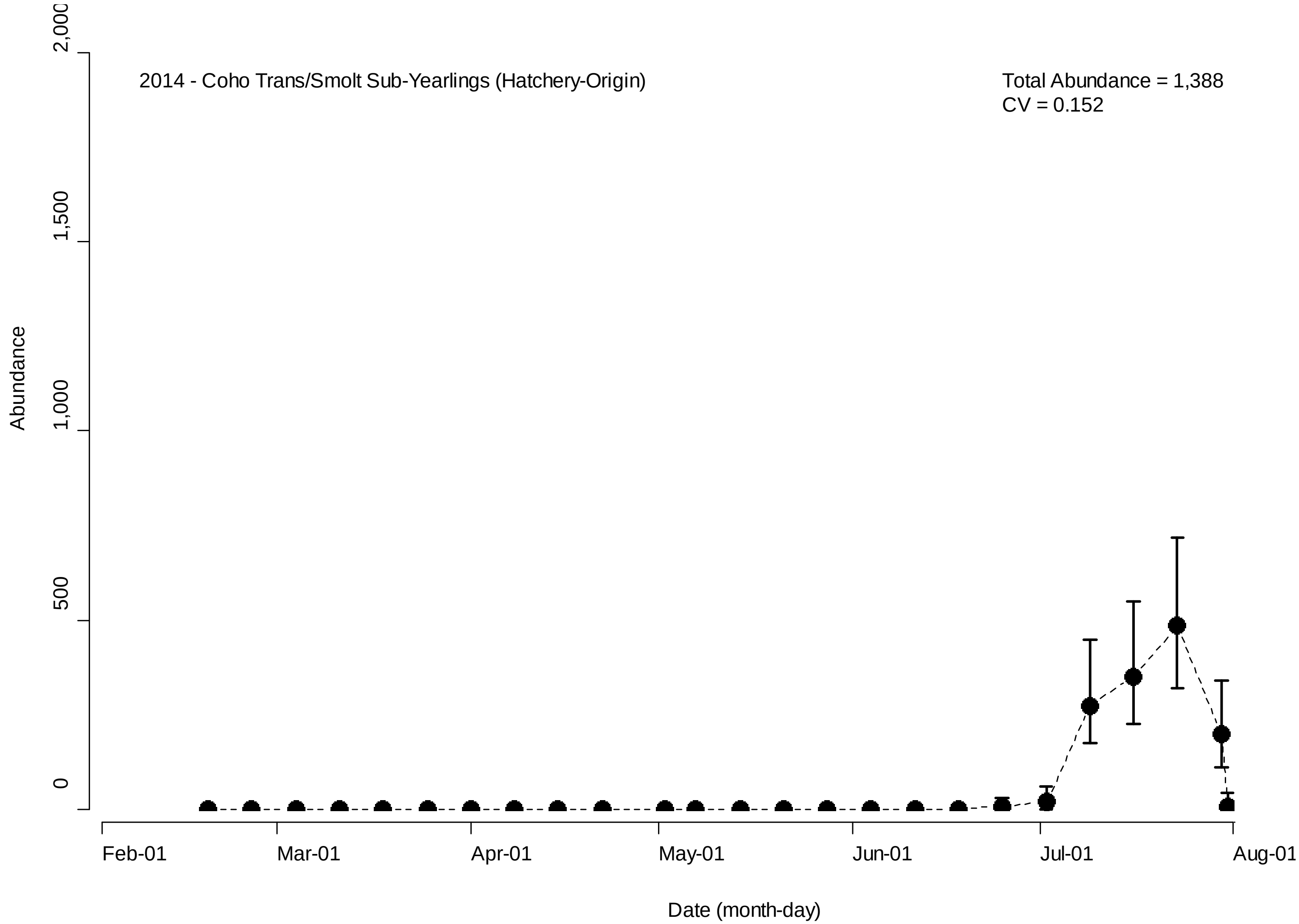

Figure E56. Estimated abundance (± 95% CI) by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2014.

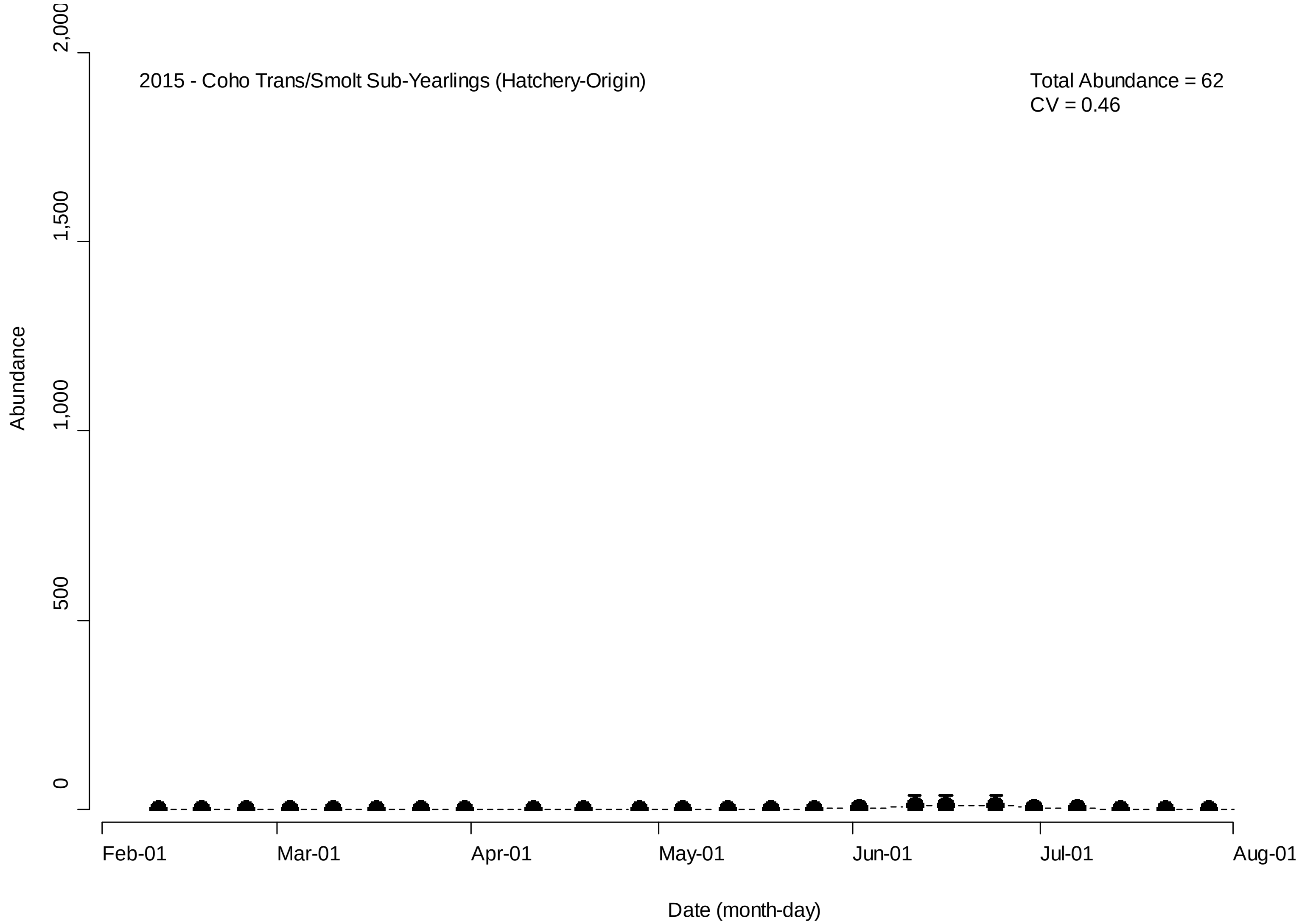

Figure E57. Estimated abundance (± 95% CI) by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2015.

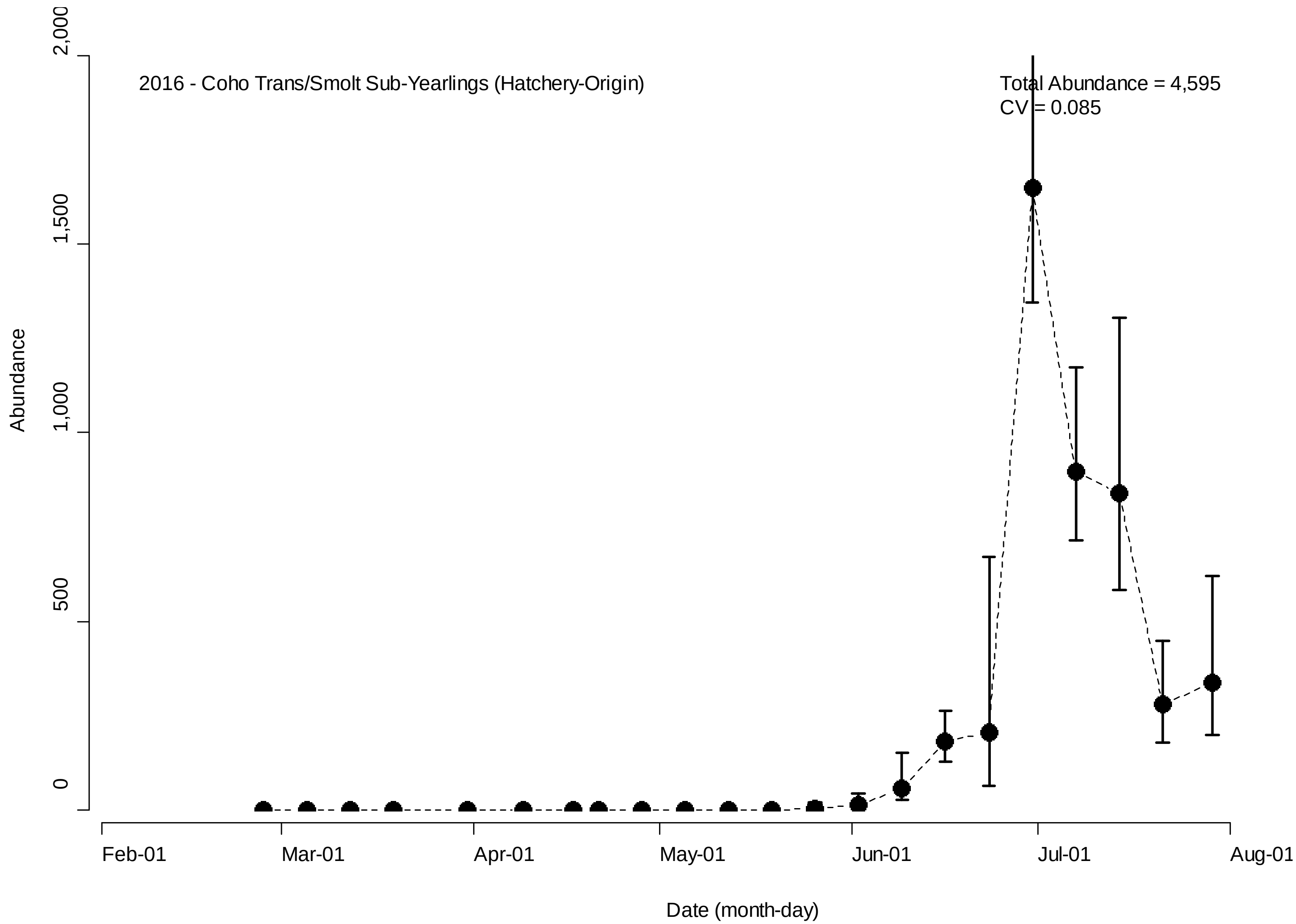

Figure E58. Estimated abundance (± 95% CI) by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = sub-yearling) produced above the mainstem Grays River screw trap in 2016.

Coho salmon (Hatchery-Origin, Transitional/Smolt, Yearling)

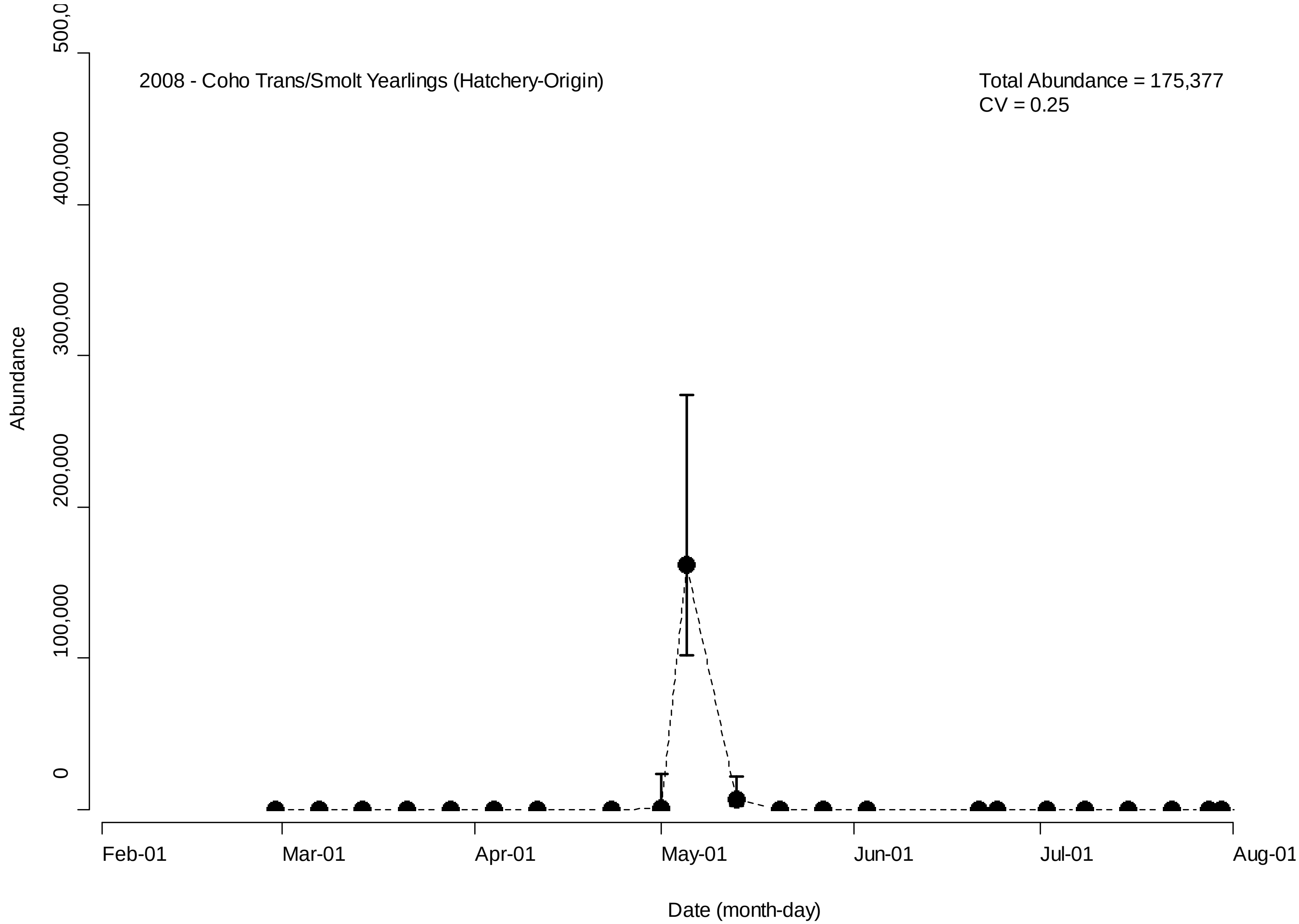

Figure E59. Estimated abundance (± 95% CI) by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap in 2008.

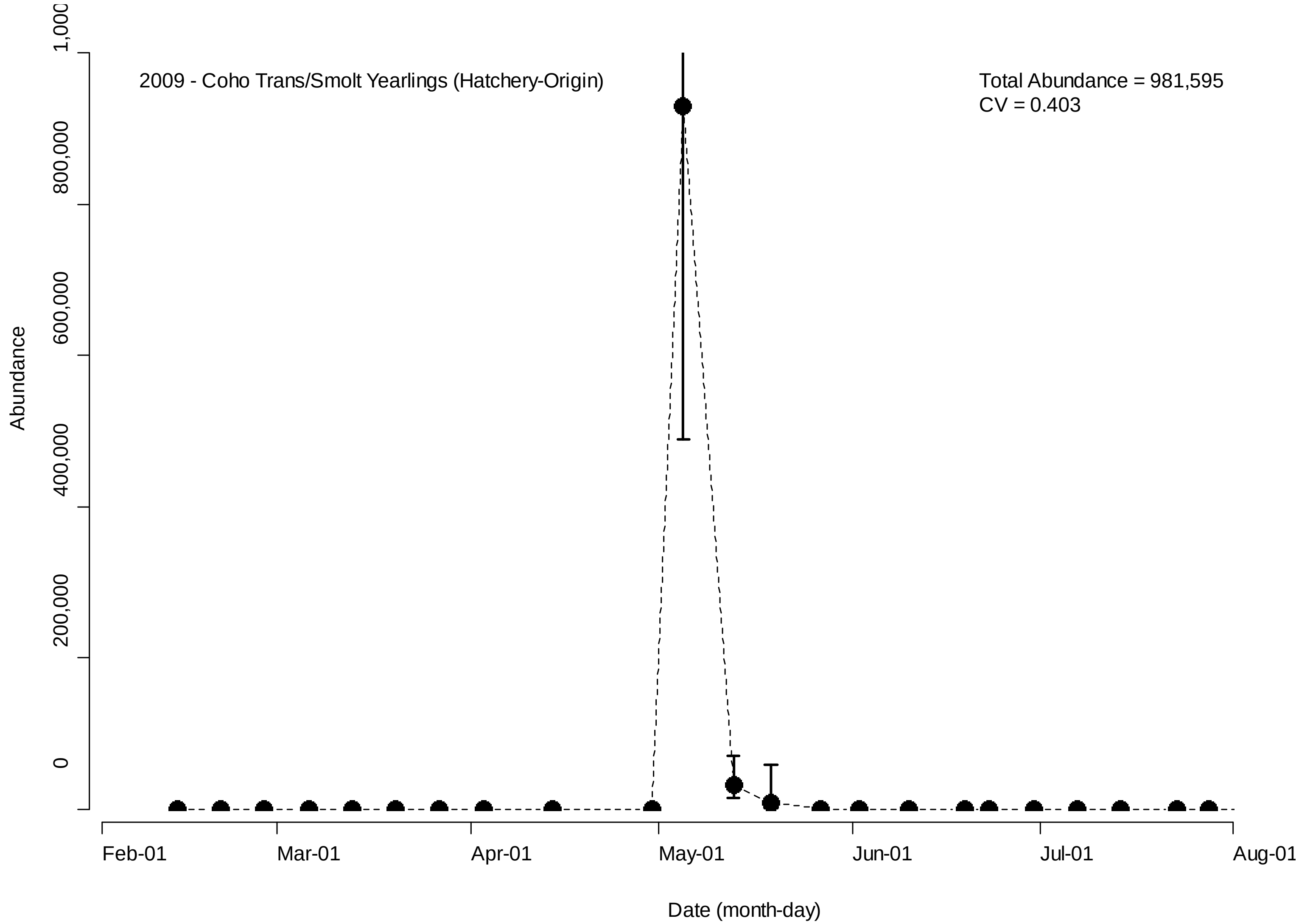

Figure E60. Estimated abundance (± 95% CI) by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap in 2009. Note change in y-axis relative to other hatchery coho plots.

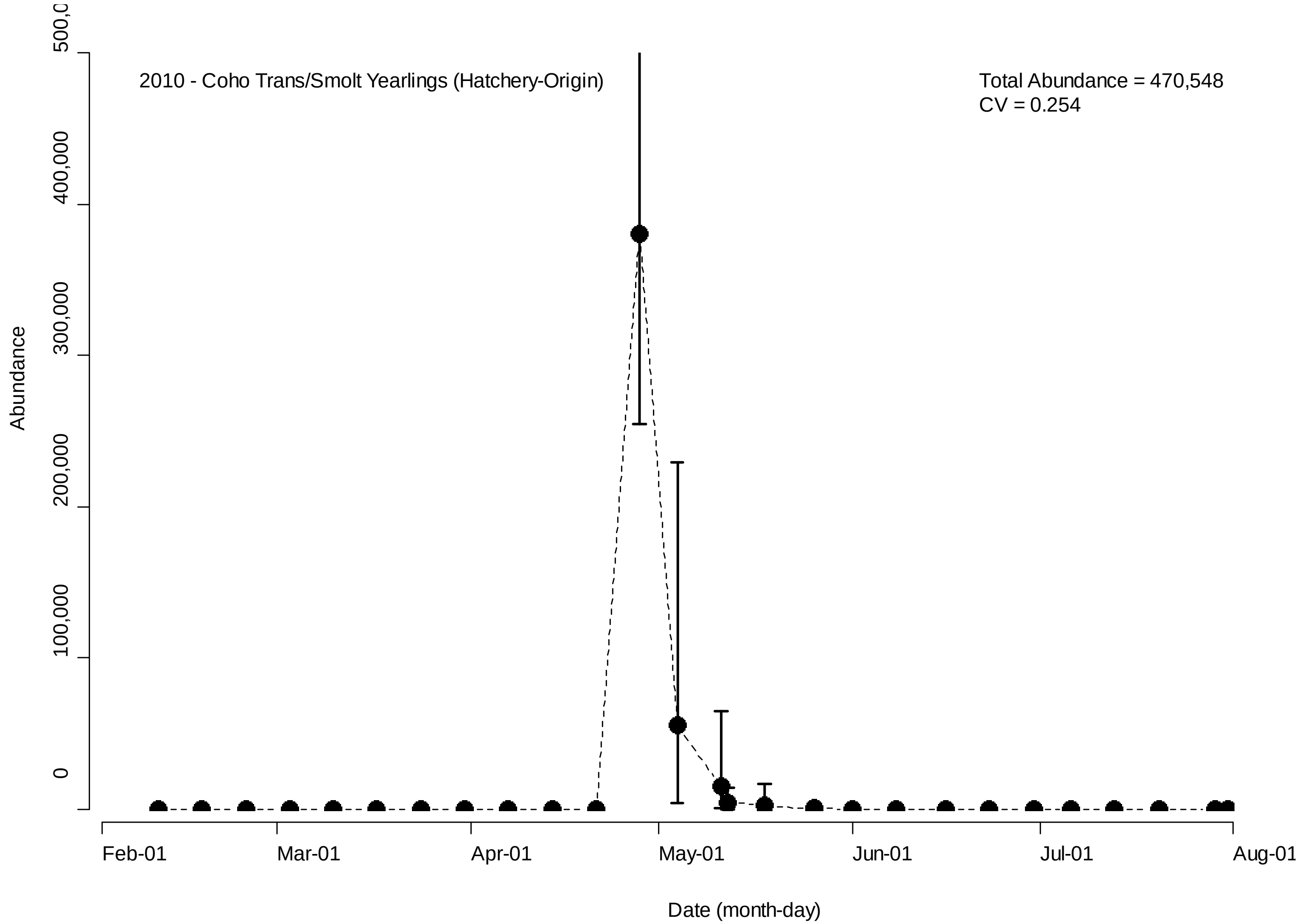

Figure E61. Estimated abundance (± 95% CI) by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap in 2010.

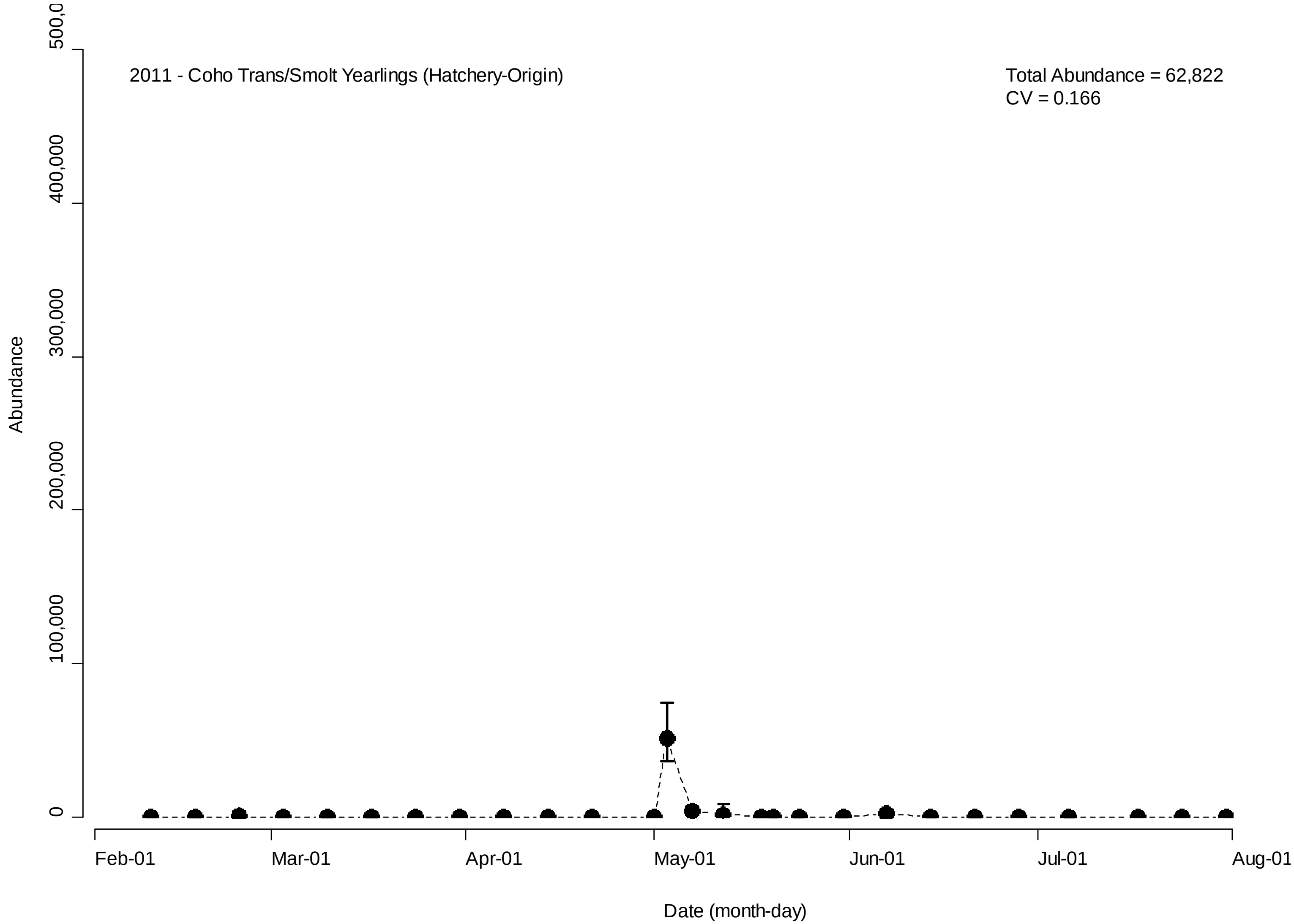

Figure E62. Estimated abundance (± 95% CI) by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap in 2011.

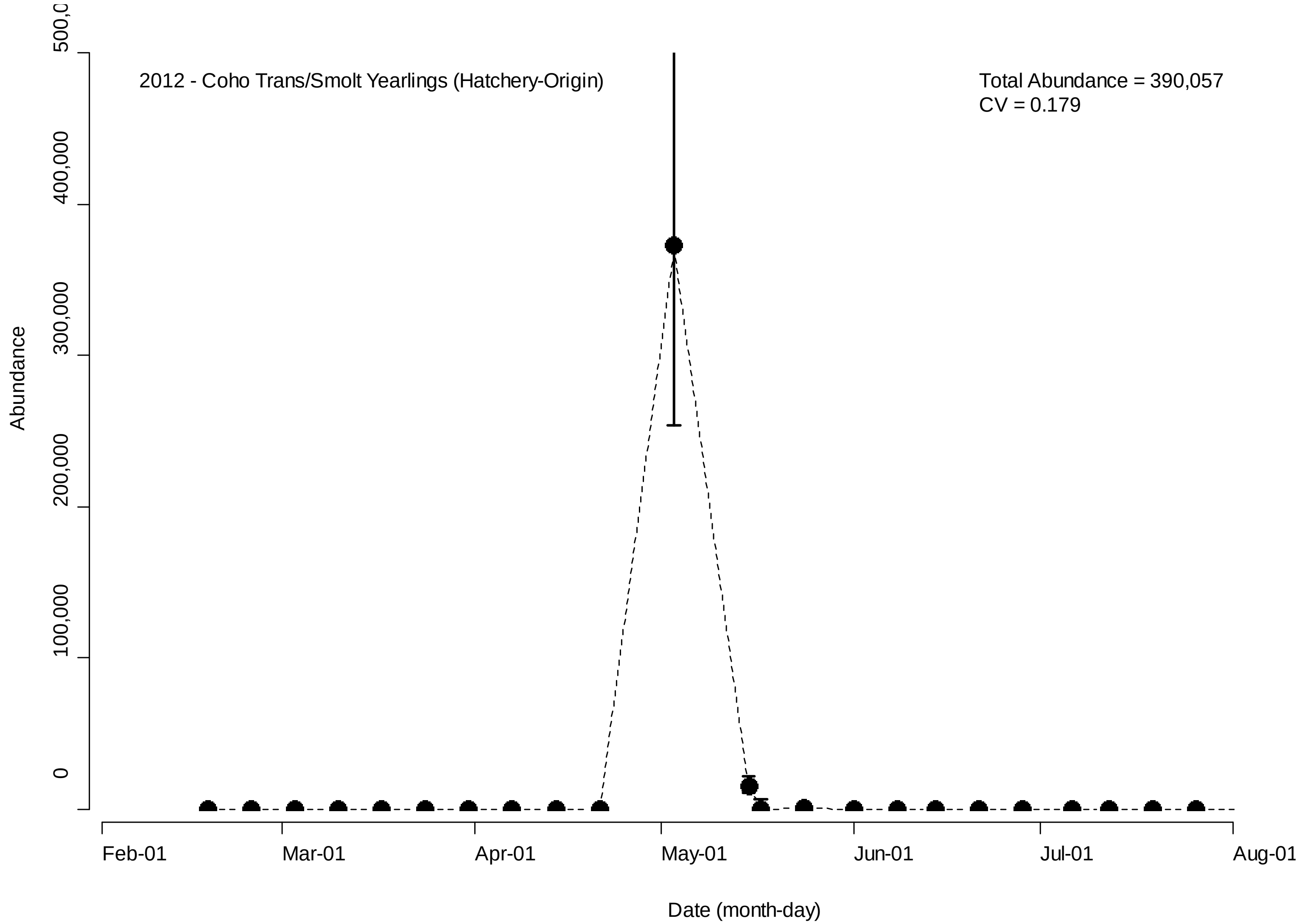

Figure E63. Estimated abundance (± 95% CI) by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap in 2012.

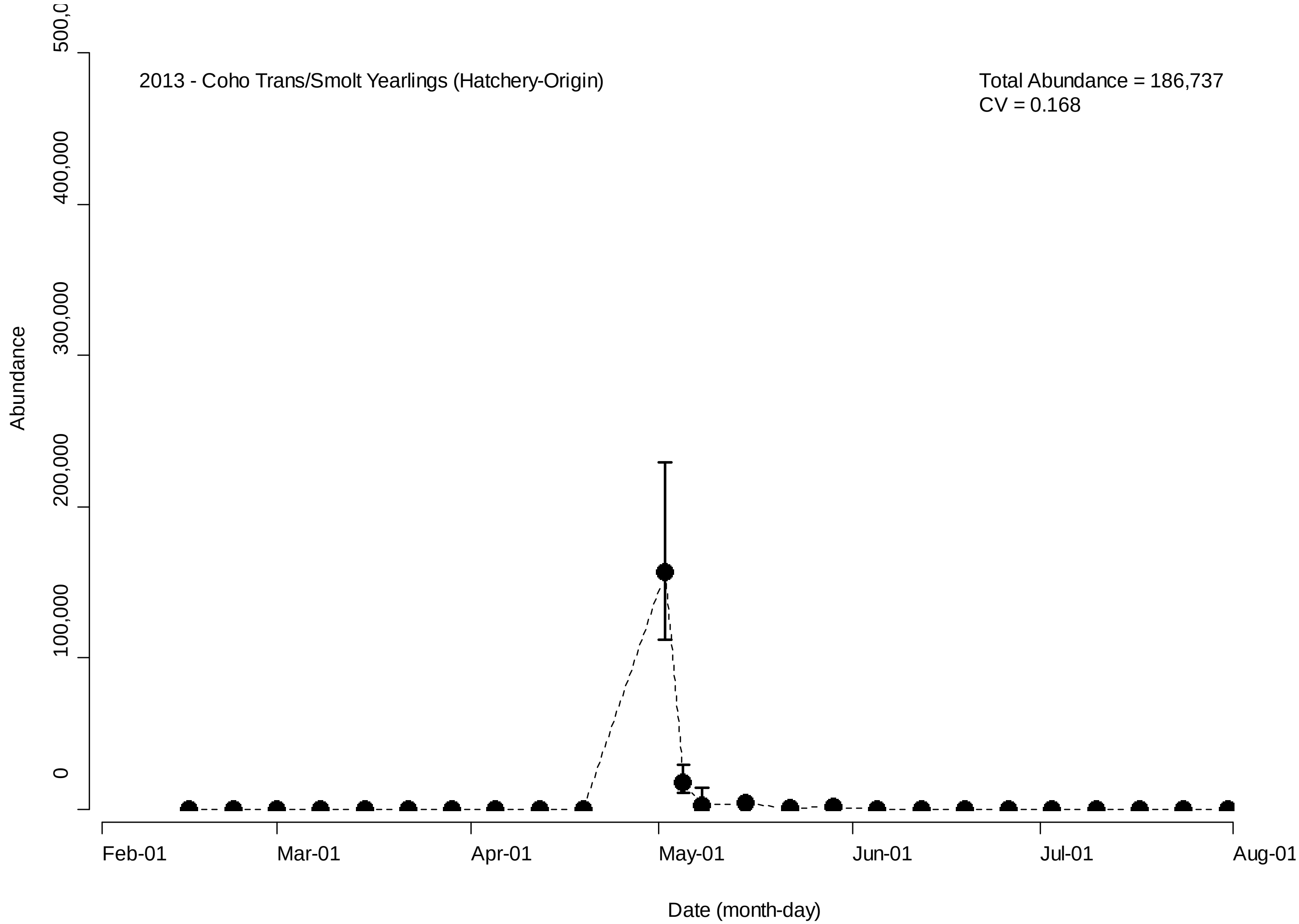

Figure E64. Estimated abundance (± 95% CI) by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap in 2013.

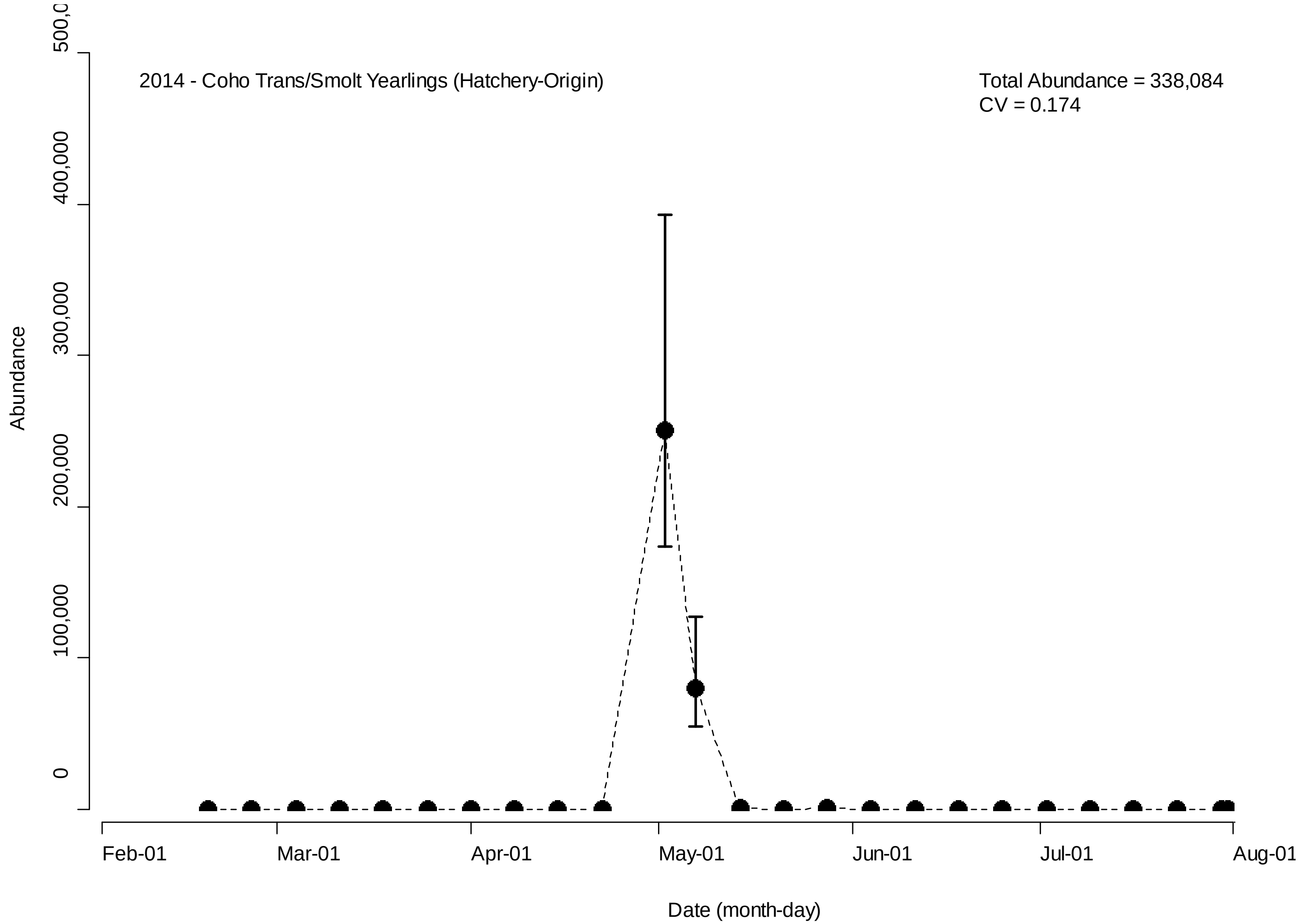

Figure E65. Estimated abundance (± 95% CI) by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap in 2014.

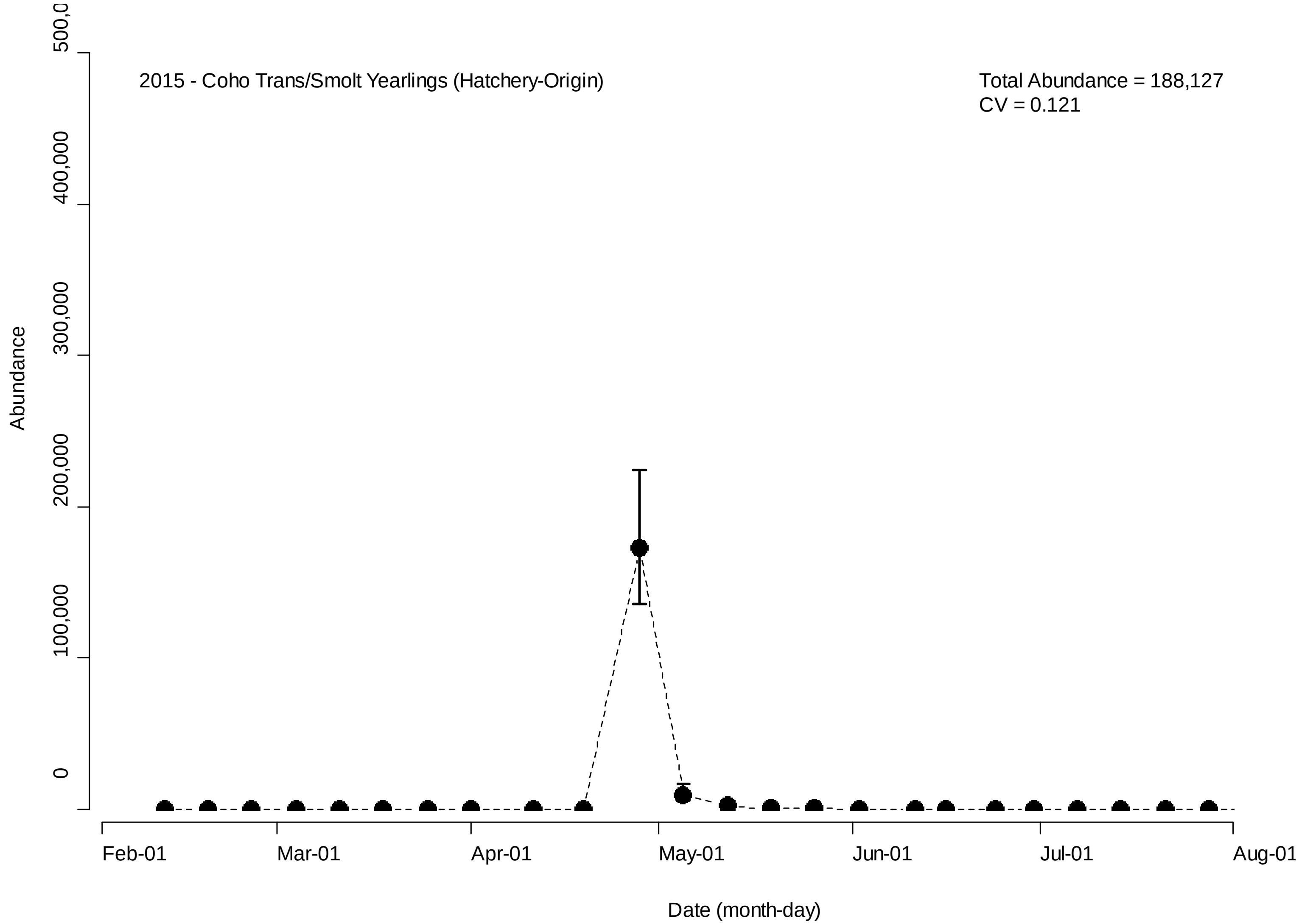

Figure E66. Estimated abundance (± 95% CI) by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap in 2015.

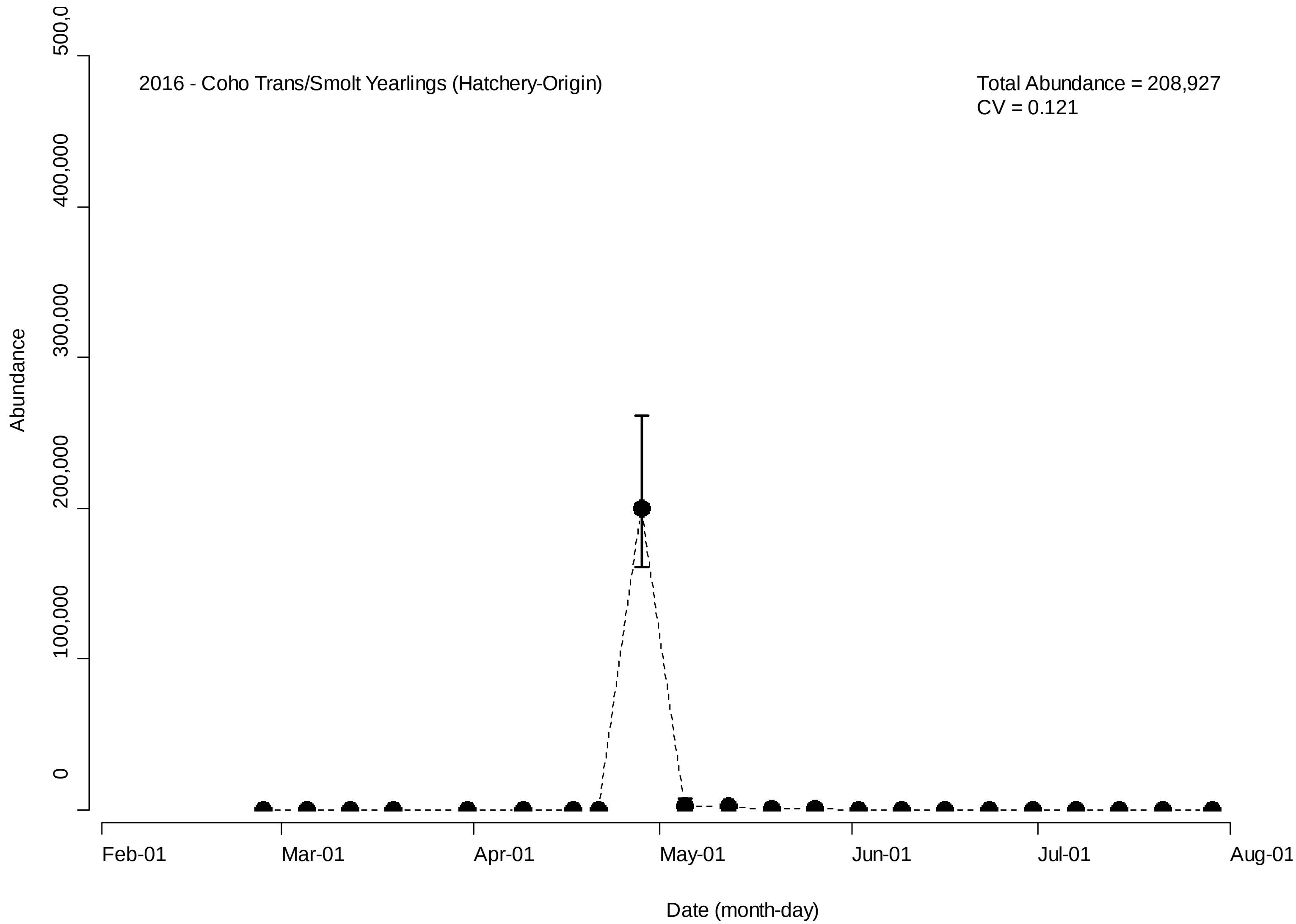

Figure E67. Estimated abundance (± 95% CI) by date for hatchery-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap in 2016.

Steelhead (Natural-Origin, Transitional/Smolt, Yearling)

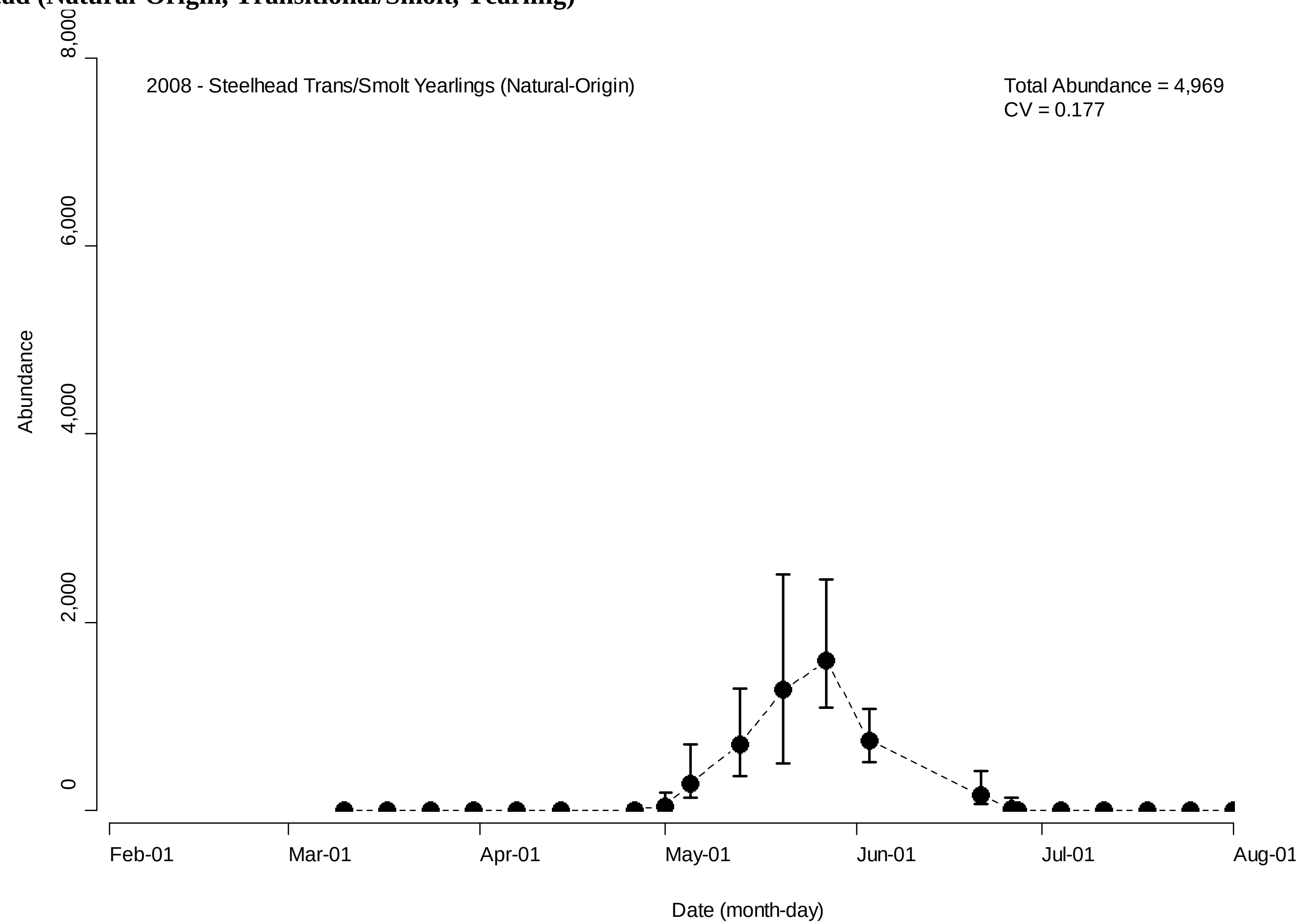

Figure E68. Estimated abundance (± 95% CI) by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap in 2008.

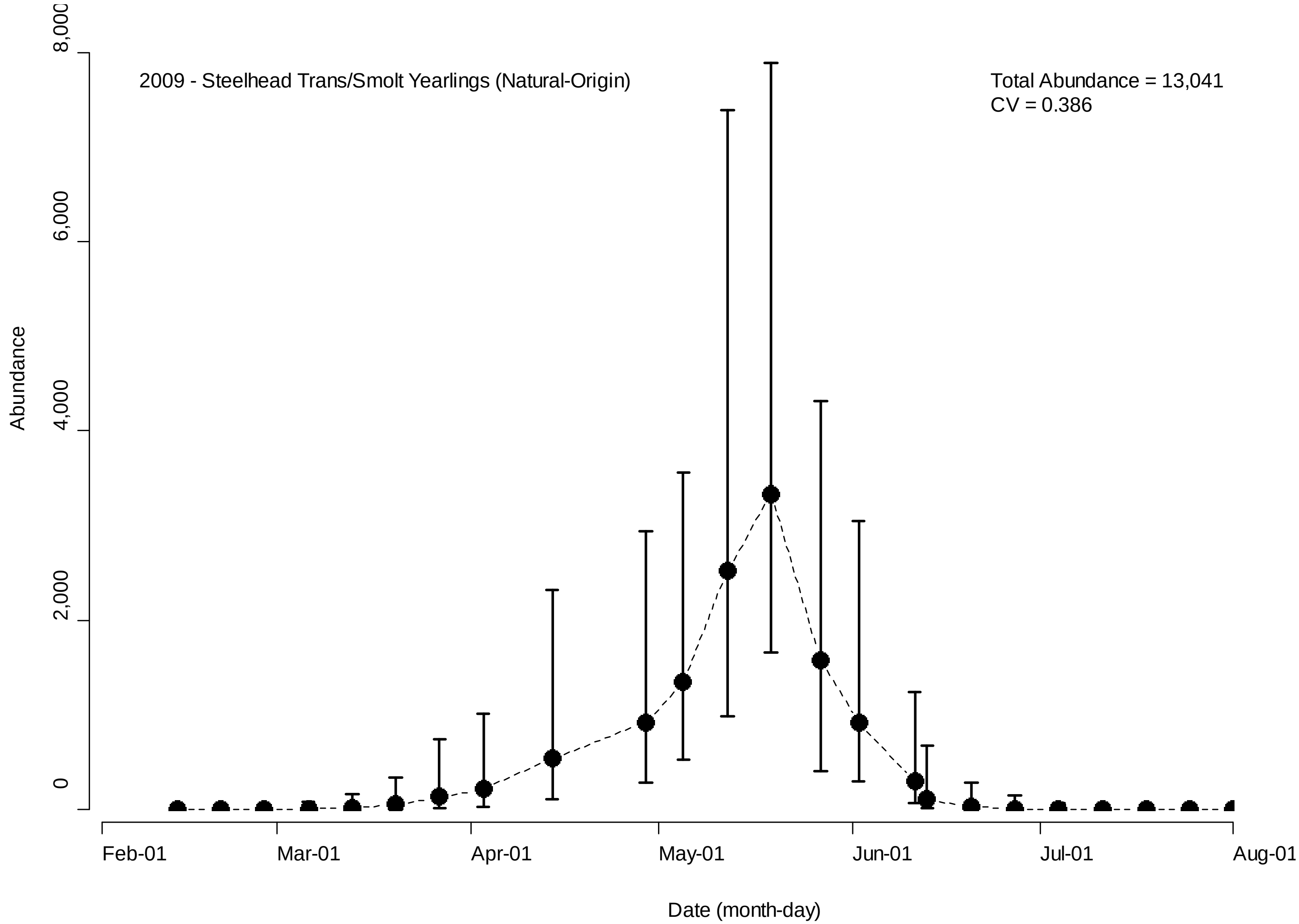

Figure E69. Estimated abundance (± 95% CI) by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap in 2009.

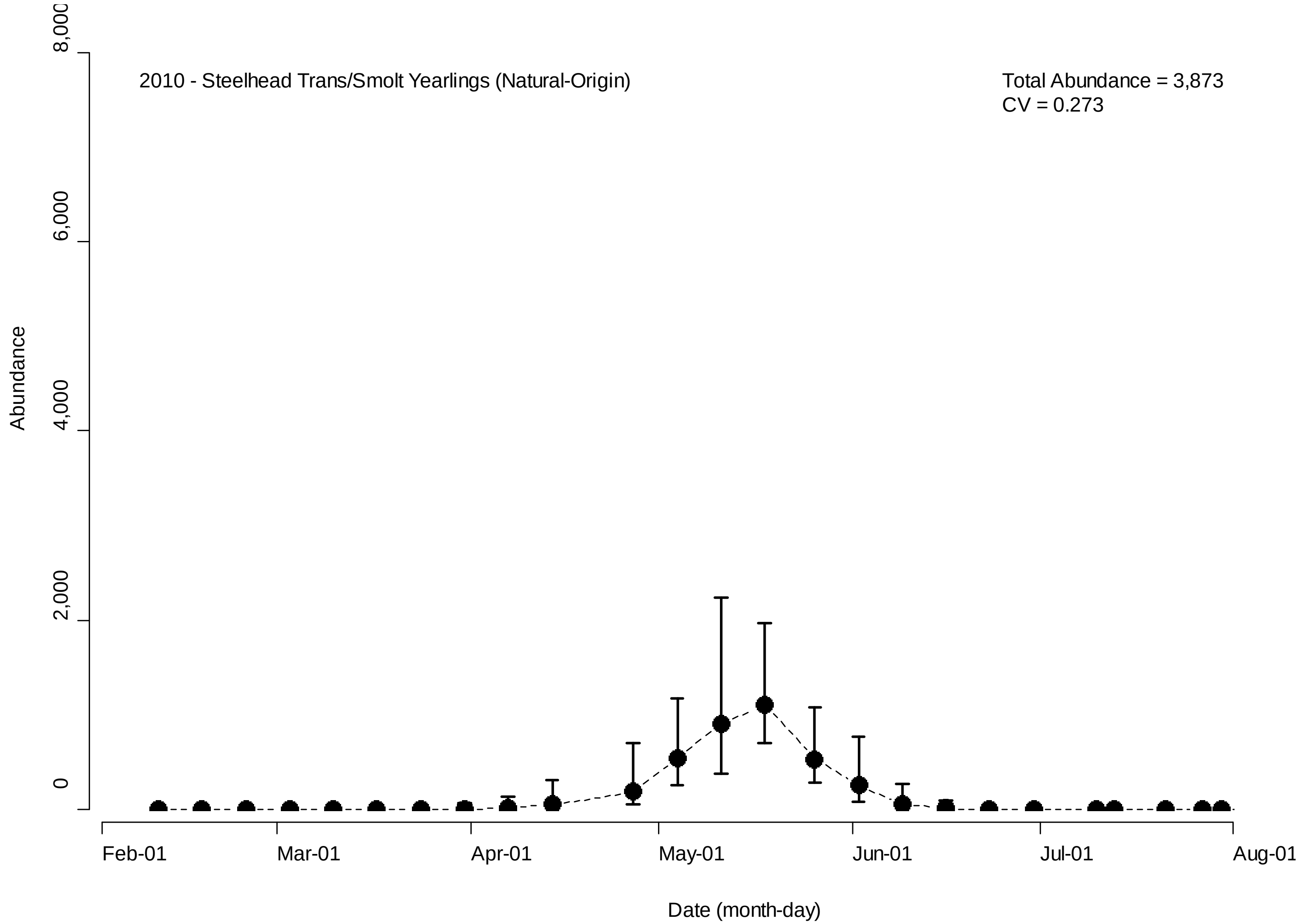

Figure E70. Estimated abundance (± 95% CI) by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap in 2010.

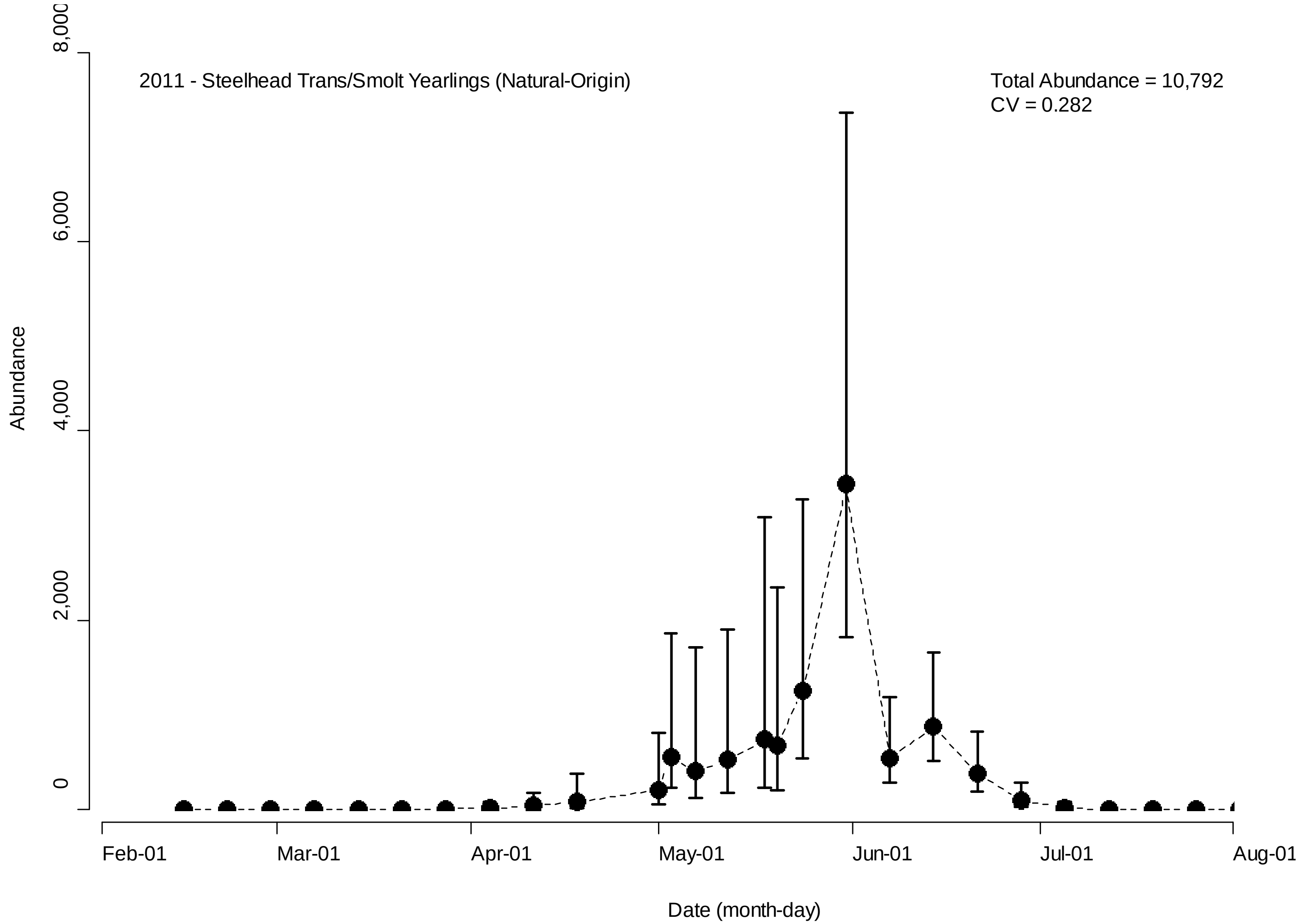

Figure E71. Estimated abundance (± 95% CI) by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap in 2011.

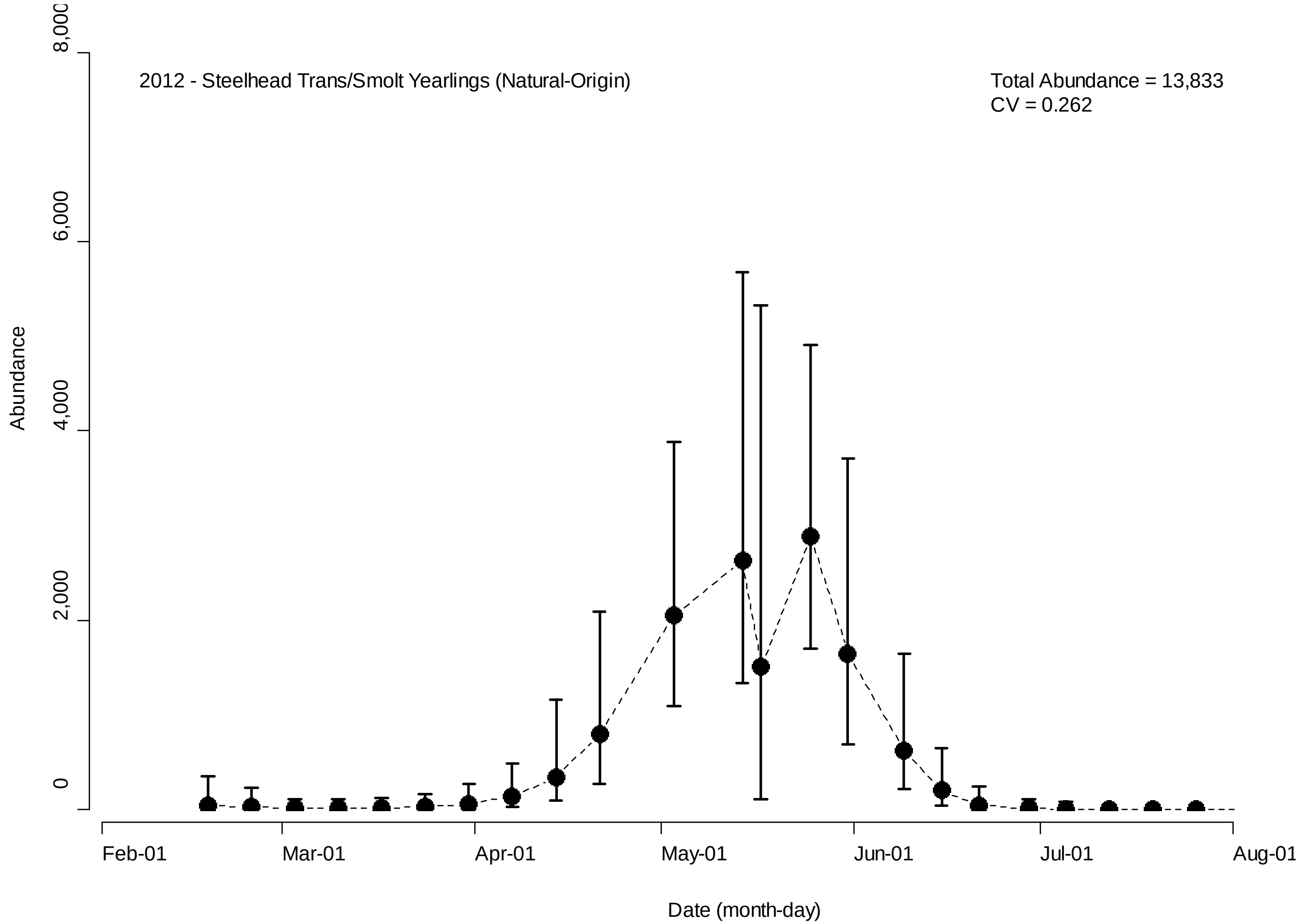

Figure E72. Estimated abundance (± 95% CI) by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap in 2012.

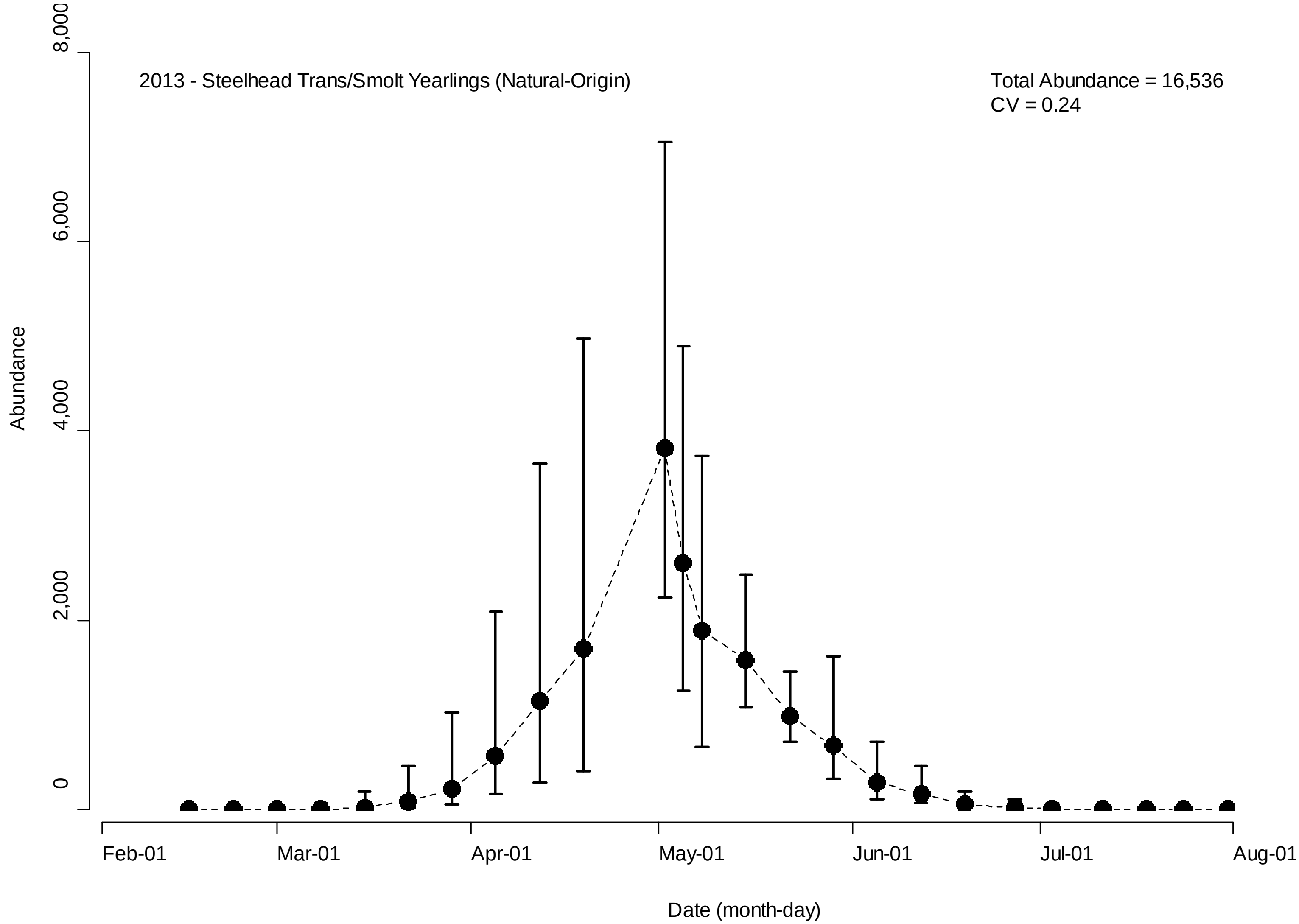

Figure E73. Estimated abundance (± 95% CI) by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap in 2013.

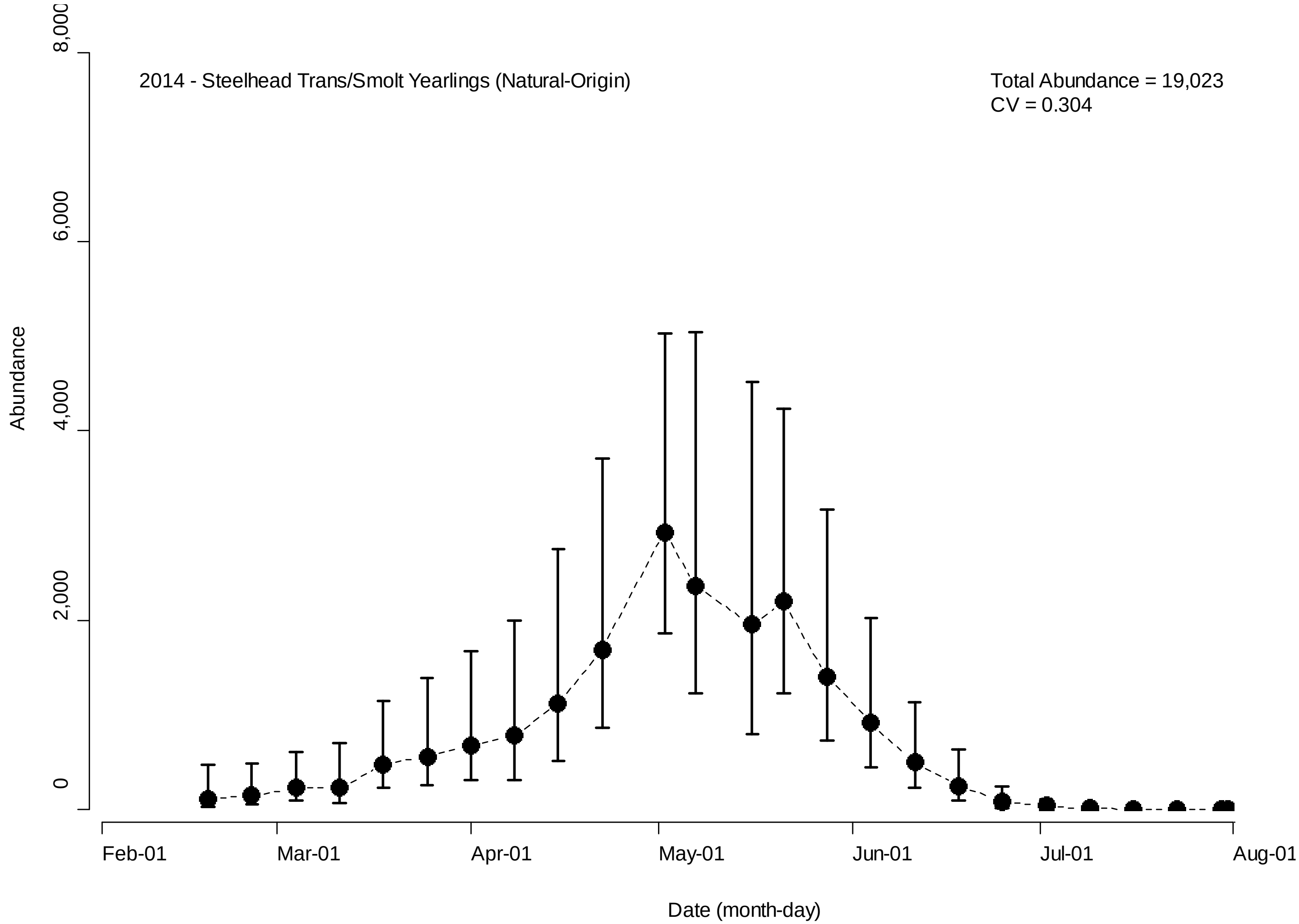

Figure E74. Estimated abundance (± 95% CI) by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap in 2014.

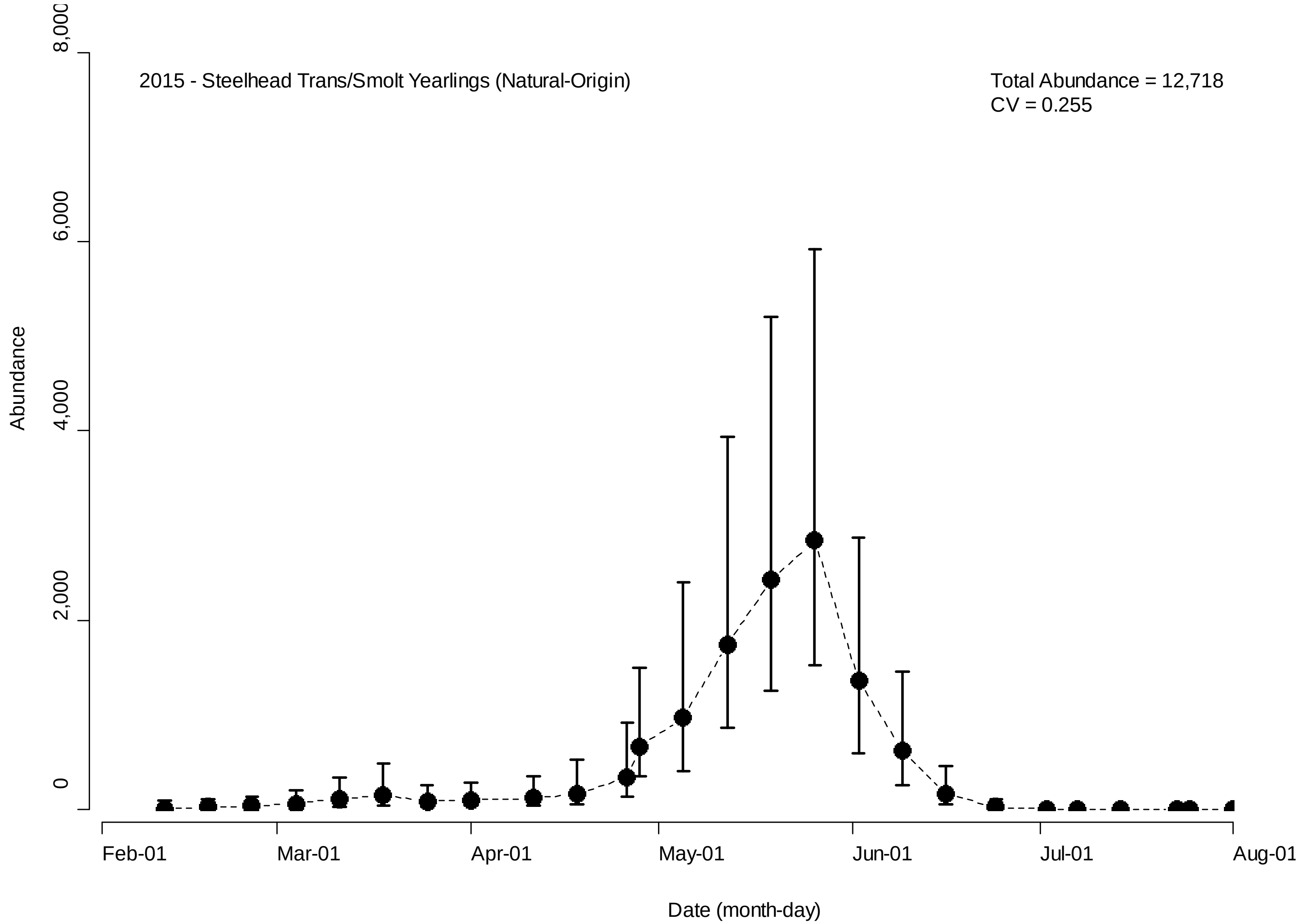

Figure E75. Estimated abundance (± 95% CI) by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap in 2015.

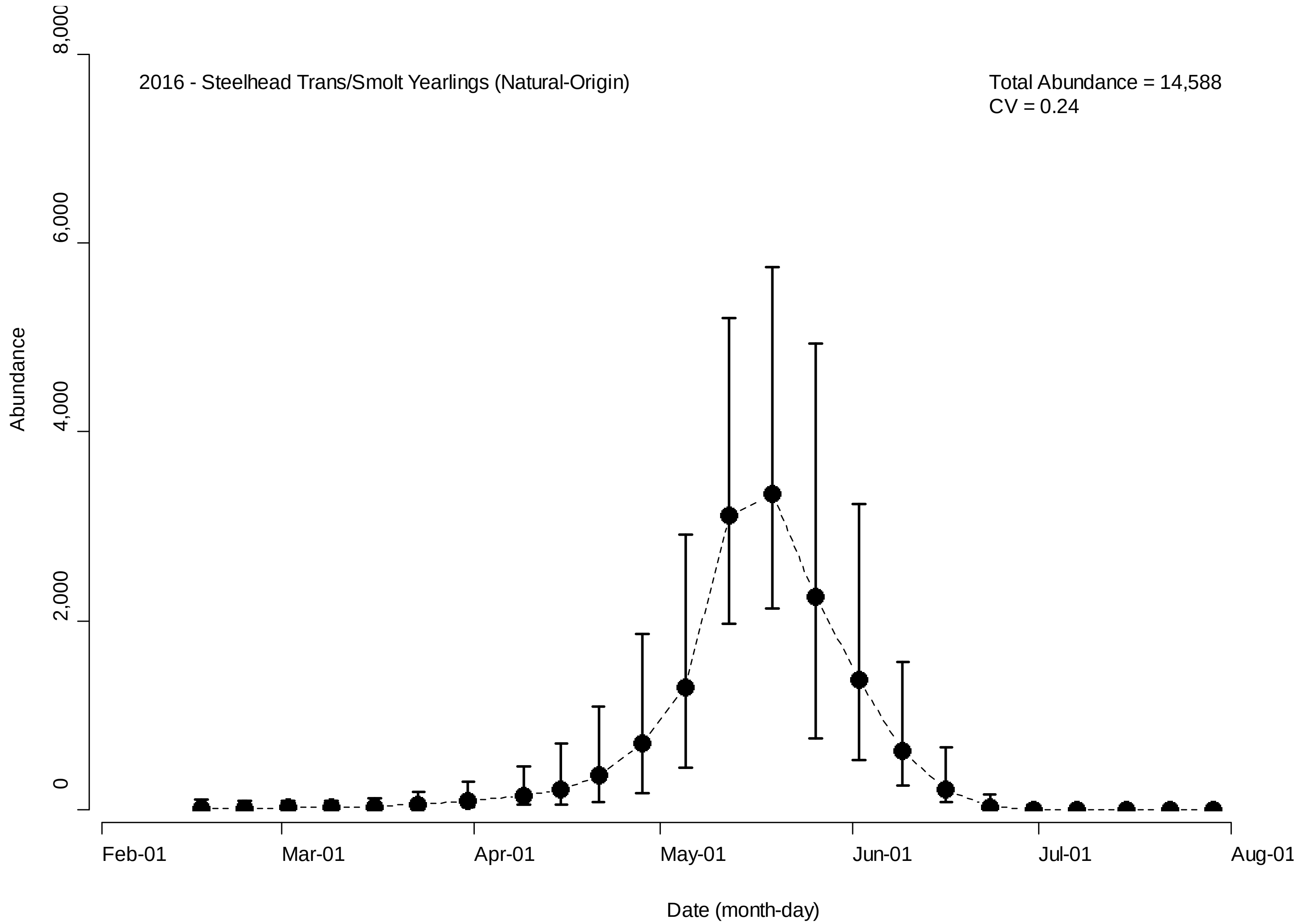

Figure E76. Estimated abundance (± 95% CI) by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap in 2016.

Steelhead (Hatchery-Origin, Transitional/Smolt, Yearling)

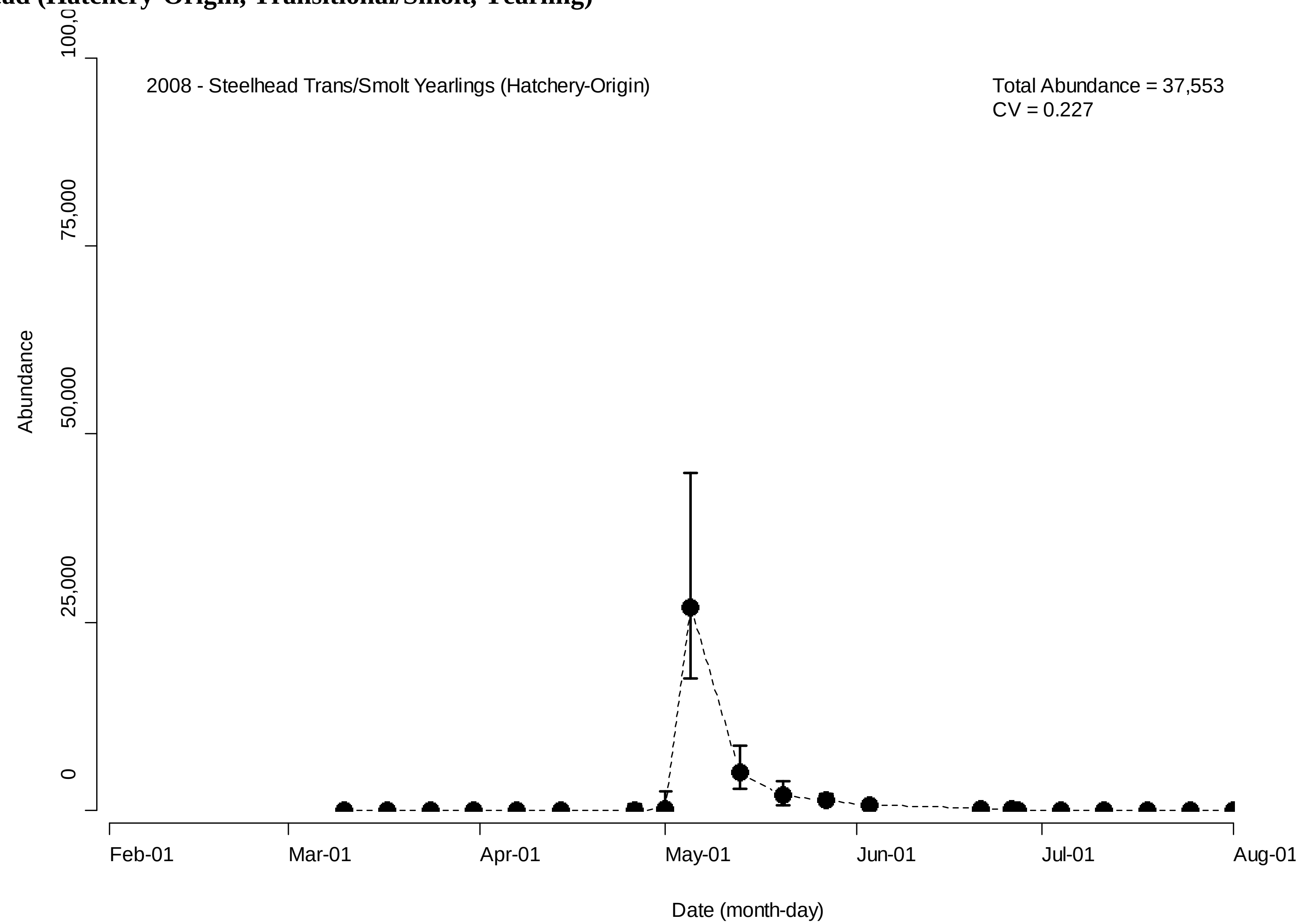

Figure E77. Estimated abundance (± 95% CI) by date for hatchery-origin steelhead (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap in 2008.

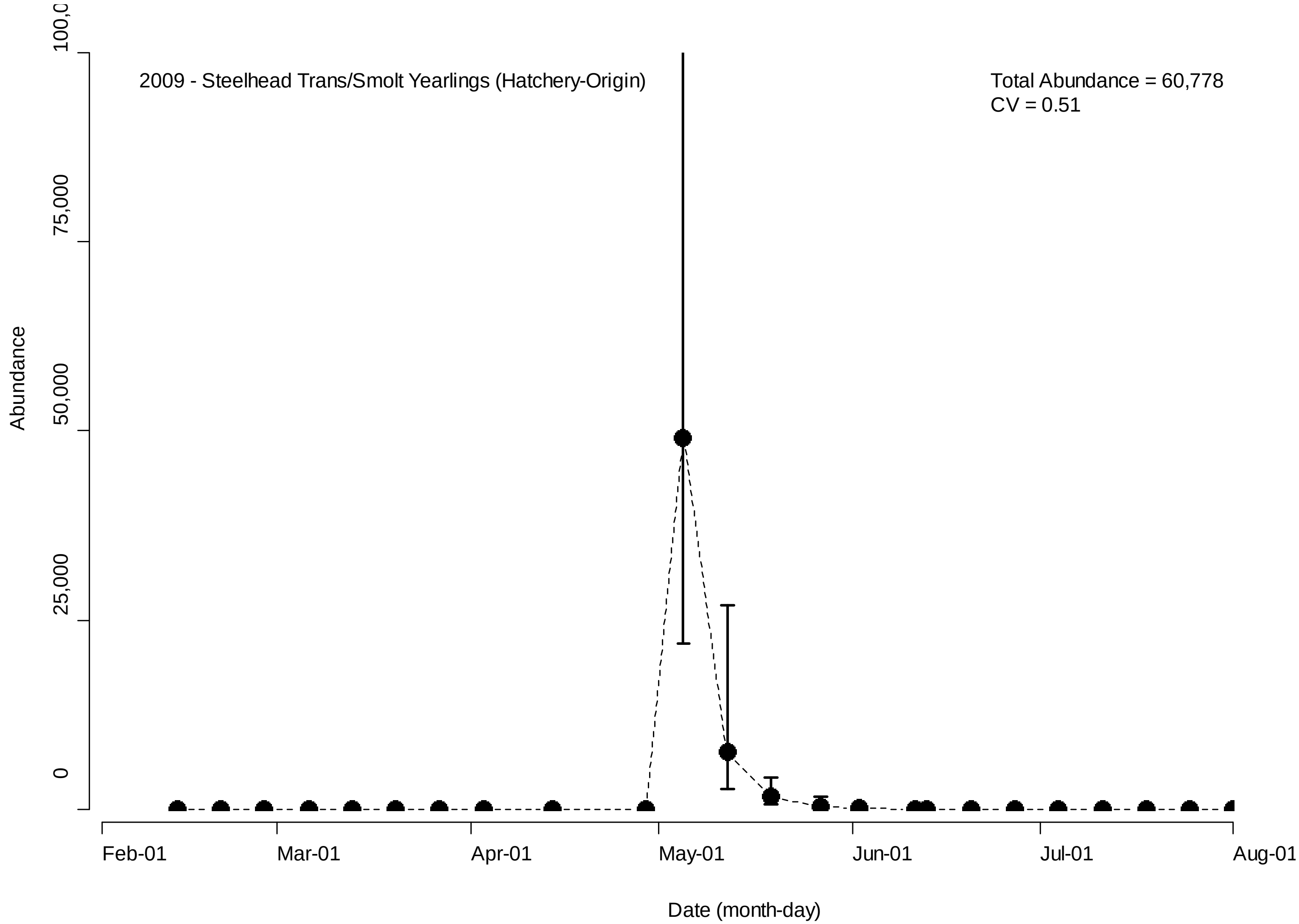

Figure E78. Estimated abundance (± 95% CI) by date for hatchery-origin steelhead (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap in 2009.

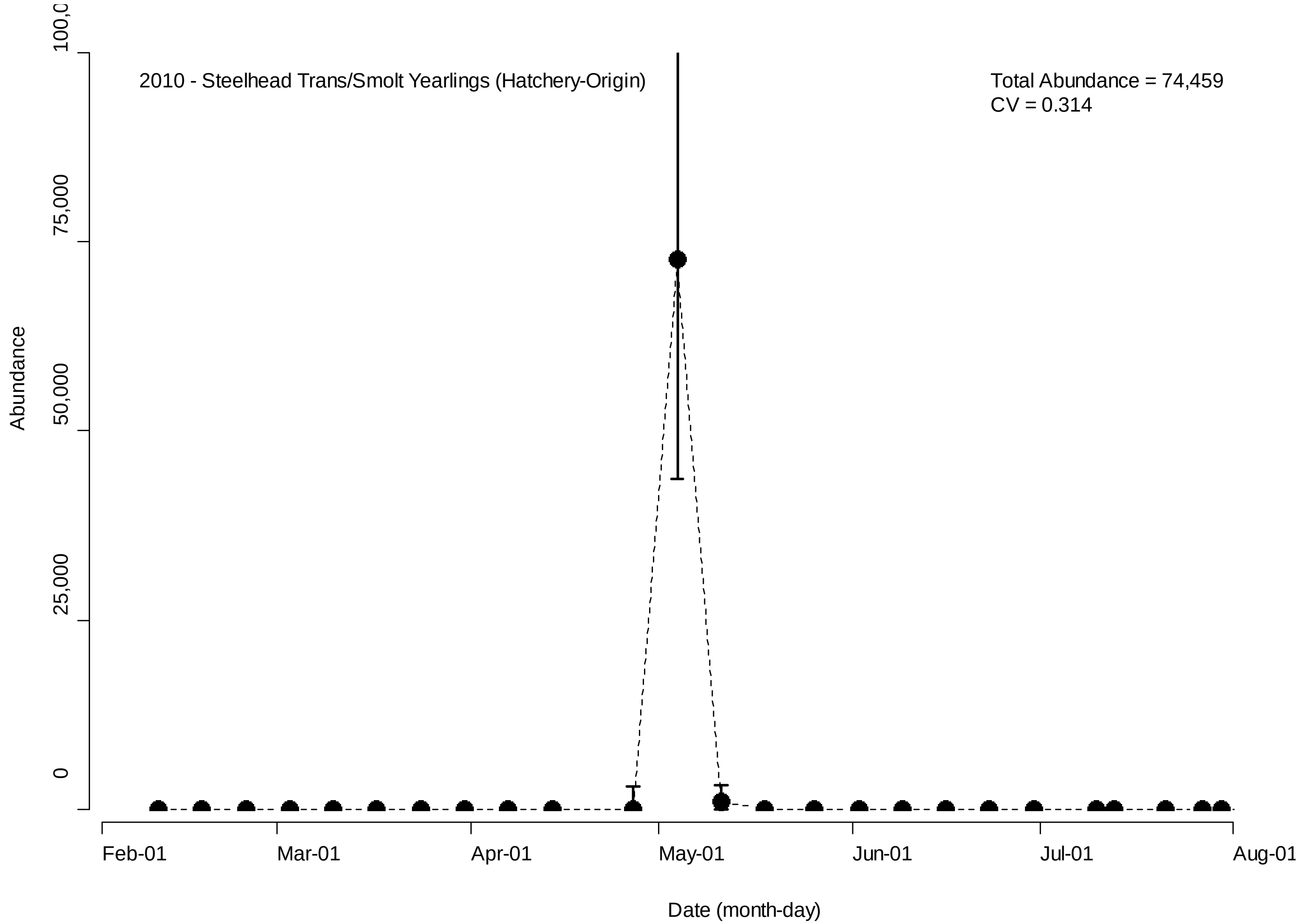

Figure E79. Estimated abundance (± 95% CI) efficiency by date for hatchery-origin steelhead (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap in 2010.

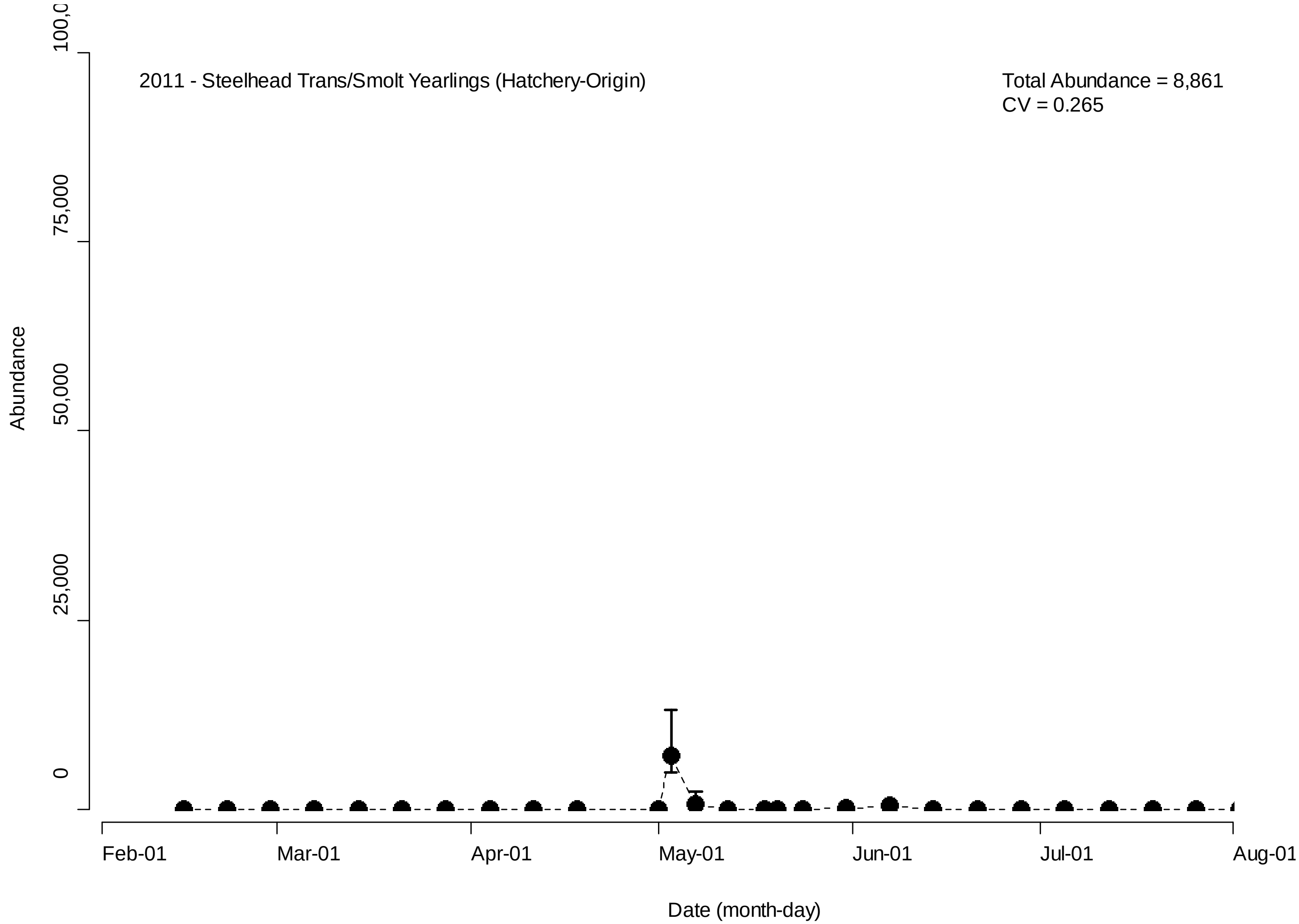

Figure E80. Estimated abundance (± 95% CI) by date for hatchery-origin steelhead (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap in 2011.

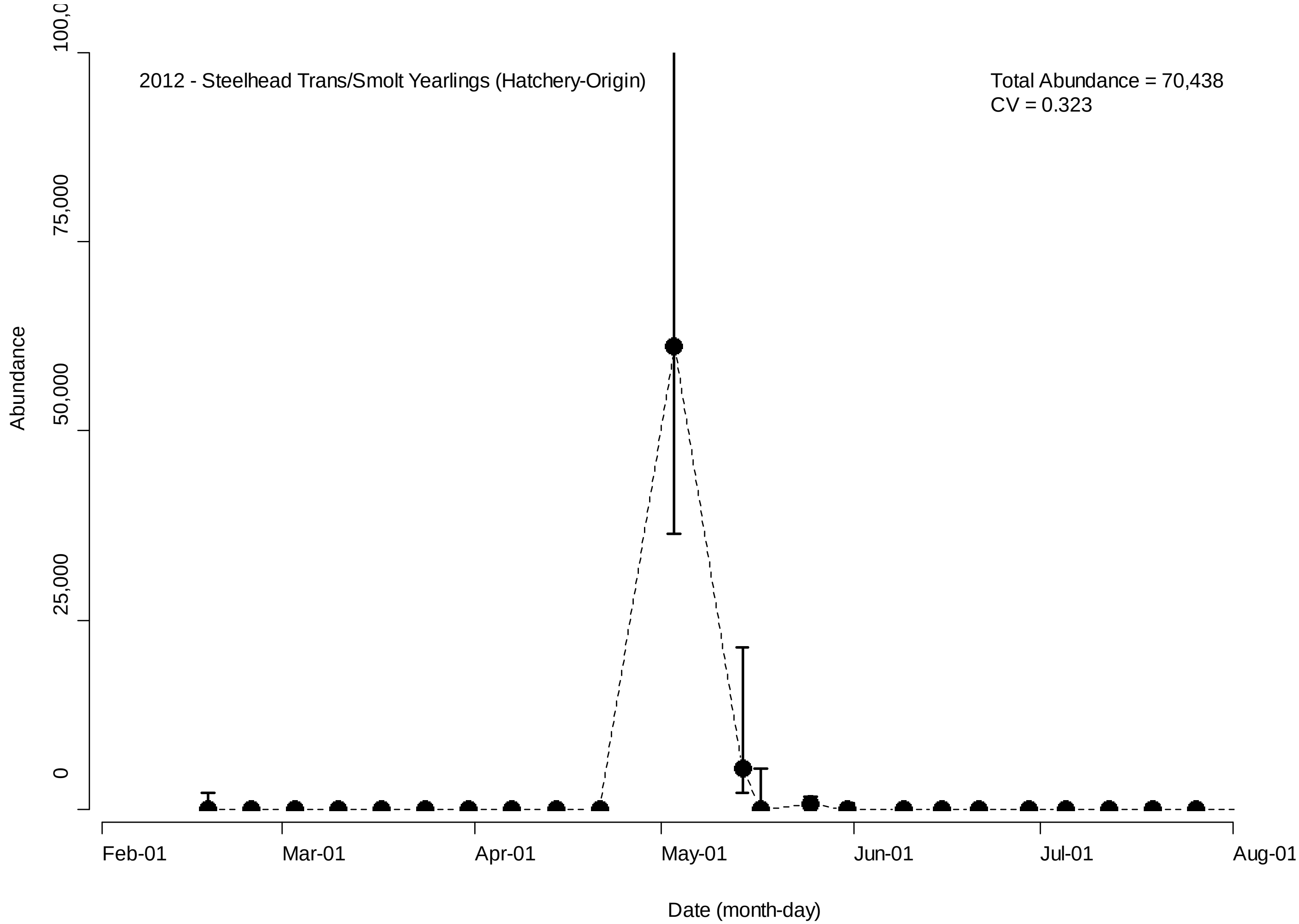

Figure E81. Estimated abundance (± 95% CI) by date for hatchery-origin steelhead (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap in 2012.

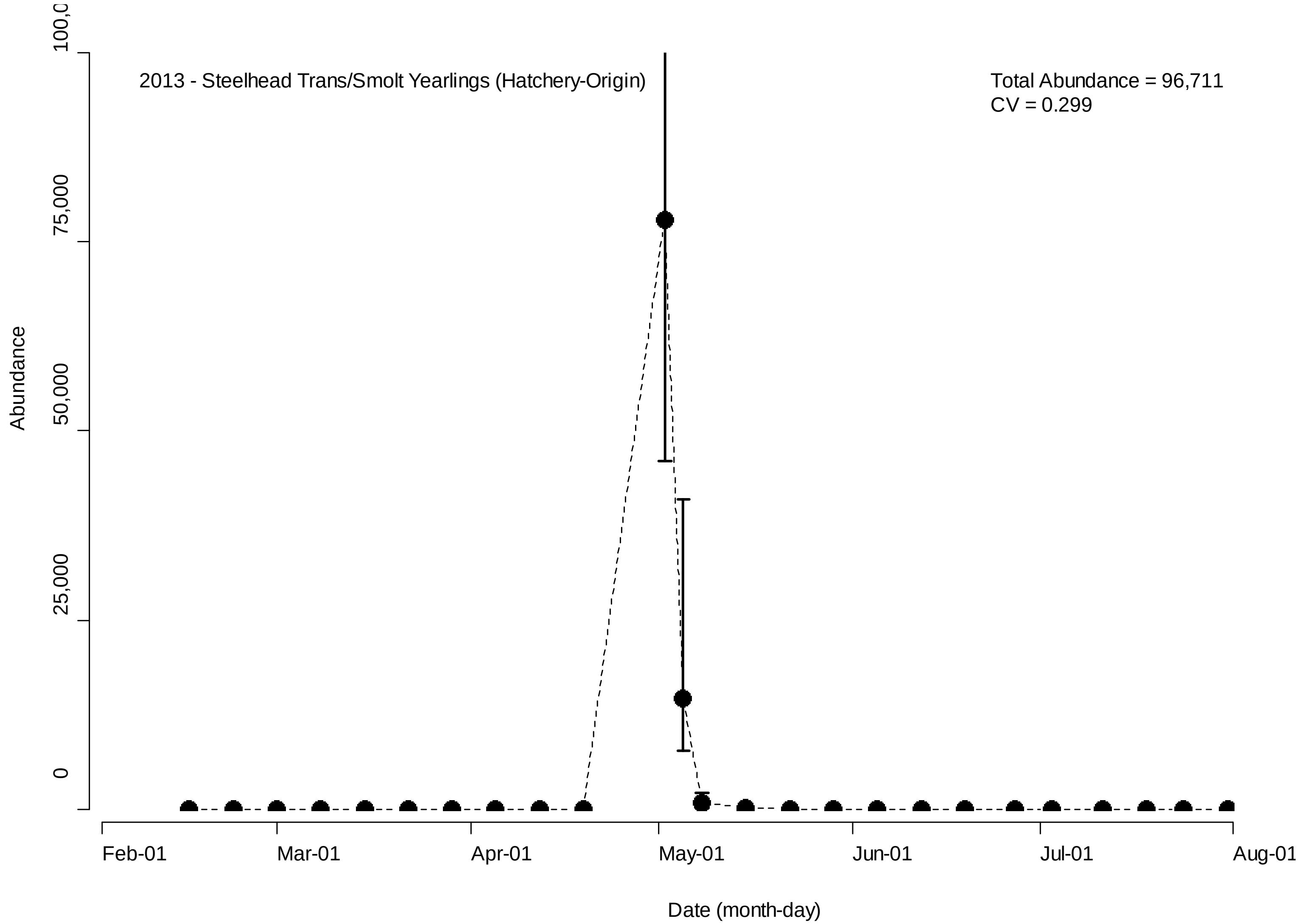

Figure E82. Estimated abundance (± 95% CI) by date for hatchery-origin steelhead (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap in 2013.

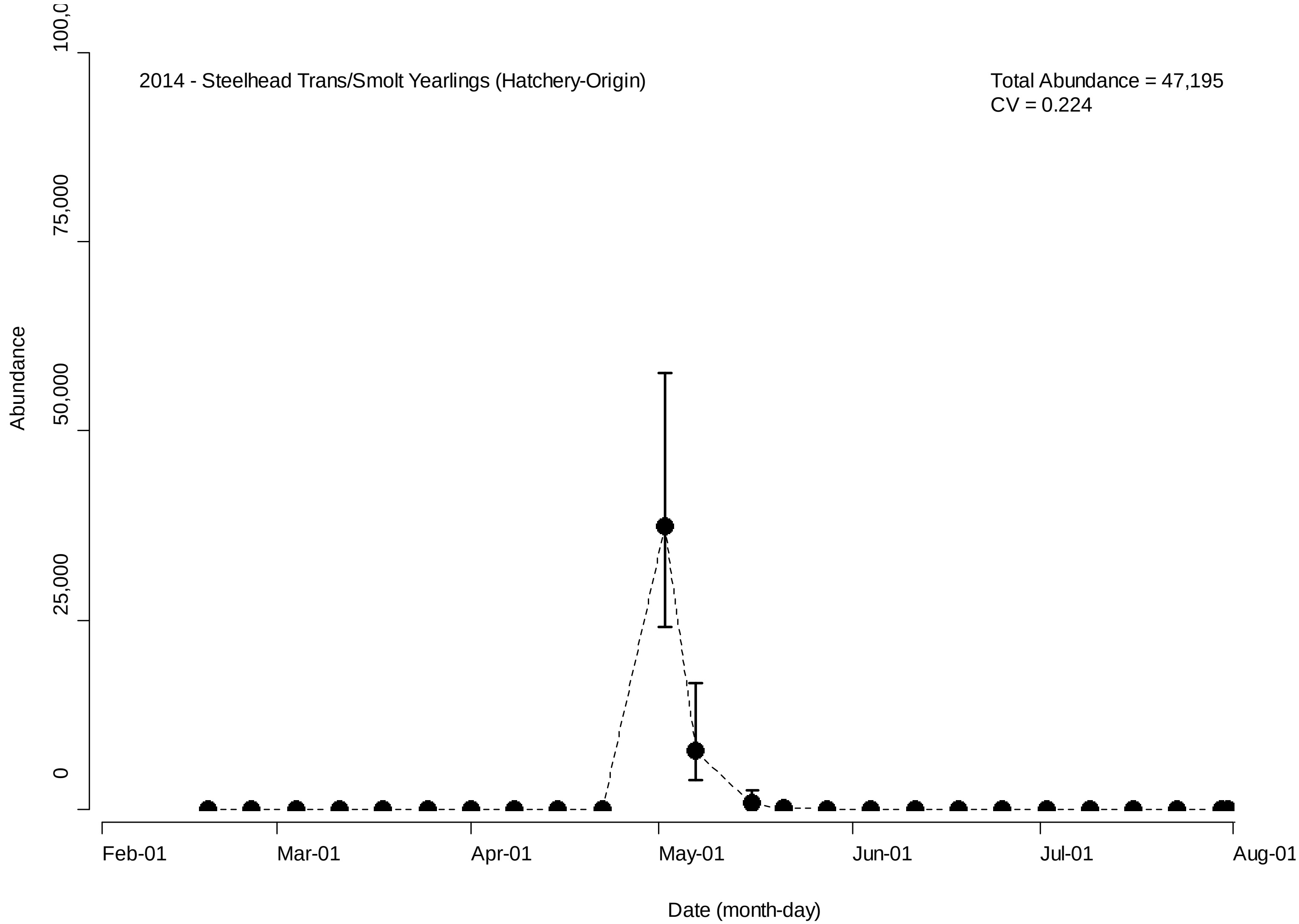

Figure E83. Estimated abundance (± 95% CI) by date for hatchery-origin steelhead (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap in 2014.

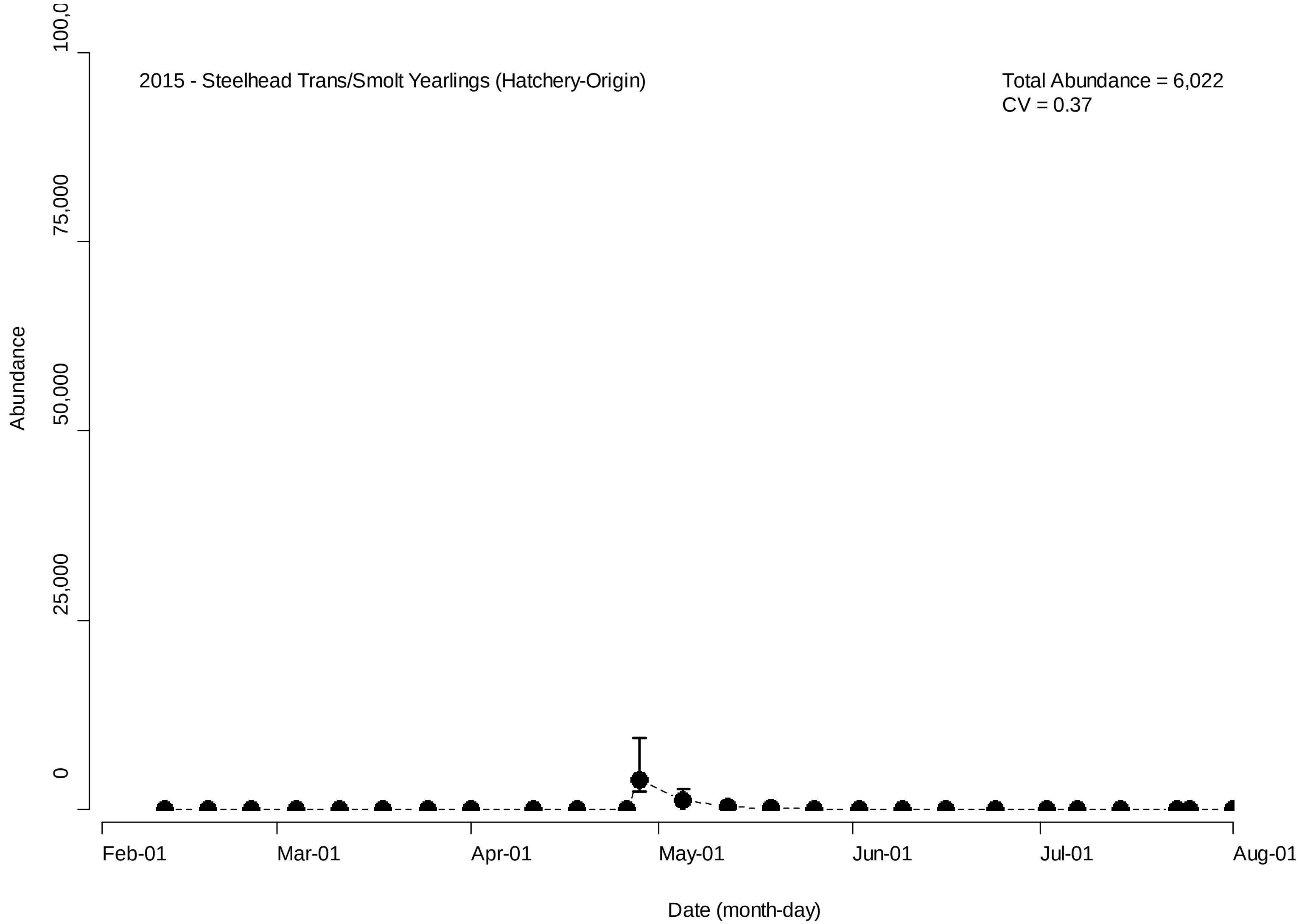

Figure E84. Estimated abundance (± 95% CI) by date for hatchery-origin steelhead (life-stage = transitional/smolt; age-class = yearling) produced above the mainstem Grays River screw trap in 2015.

Crazy Johnson

Chum salmon (Natural-Origin, Fry)

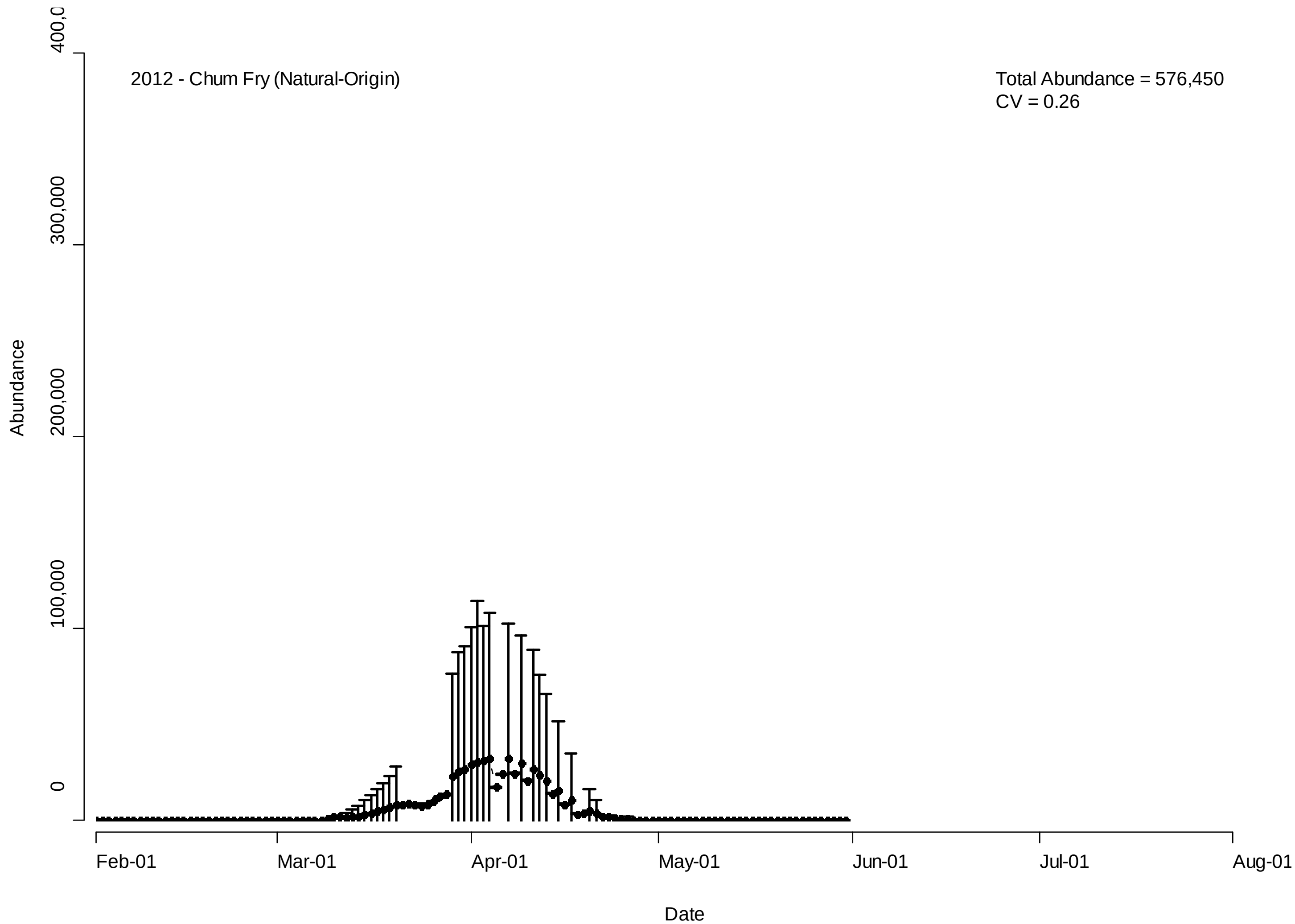

Figure E85. Estimated abundance (± 95% CI) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) produced above the Crazy Johnson Creek weir trap in 2012.

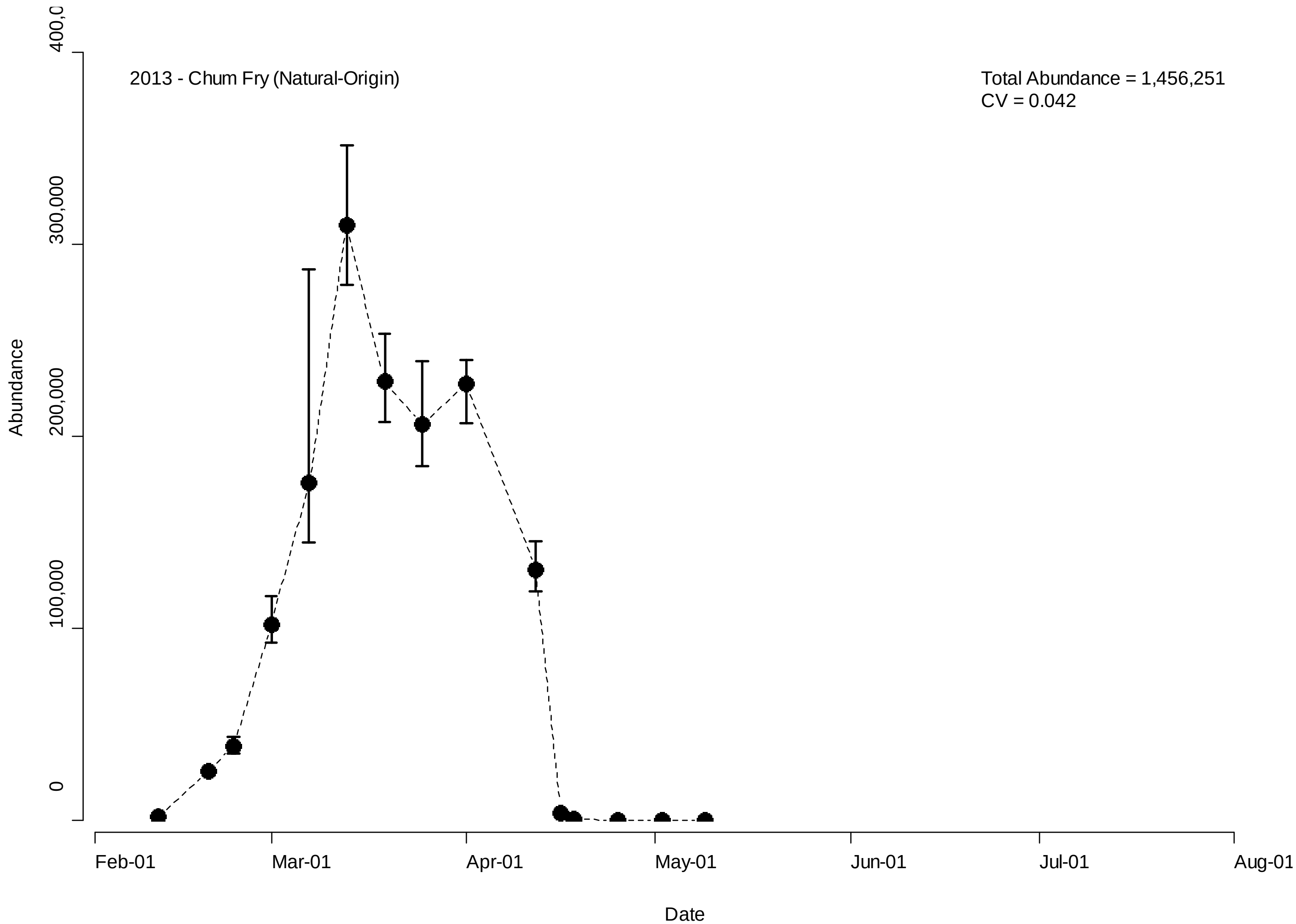

Figure E86. Estimated abundance (± 95% CI) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) produced above the Crazy Johnson Creek screw trap in 2013.

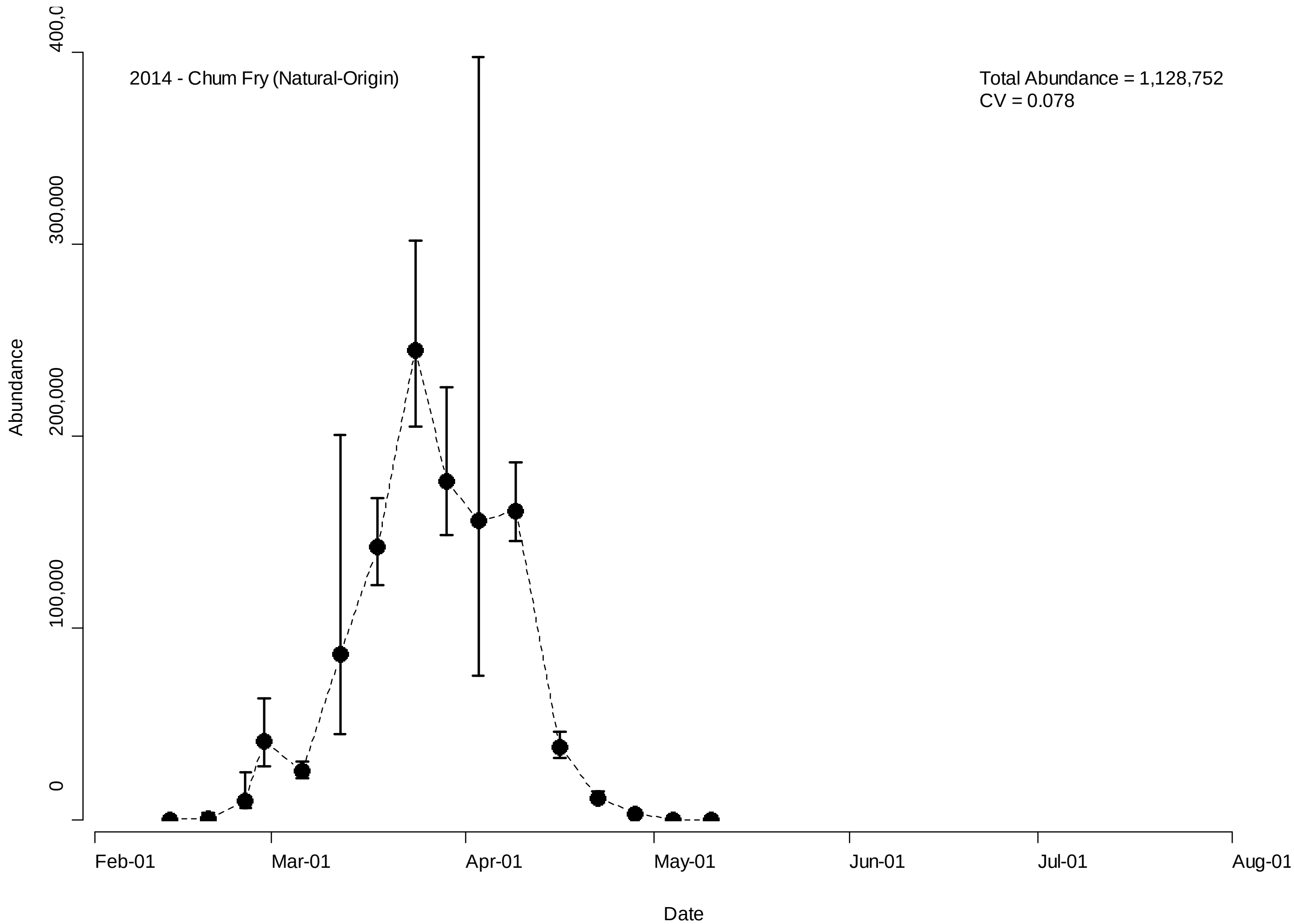

Figure E87. Estimated abundance (± 95% CI) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) produced above the Crazy Johnson Creek screw trap in 2014.

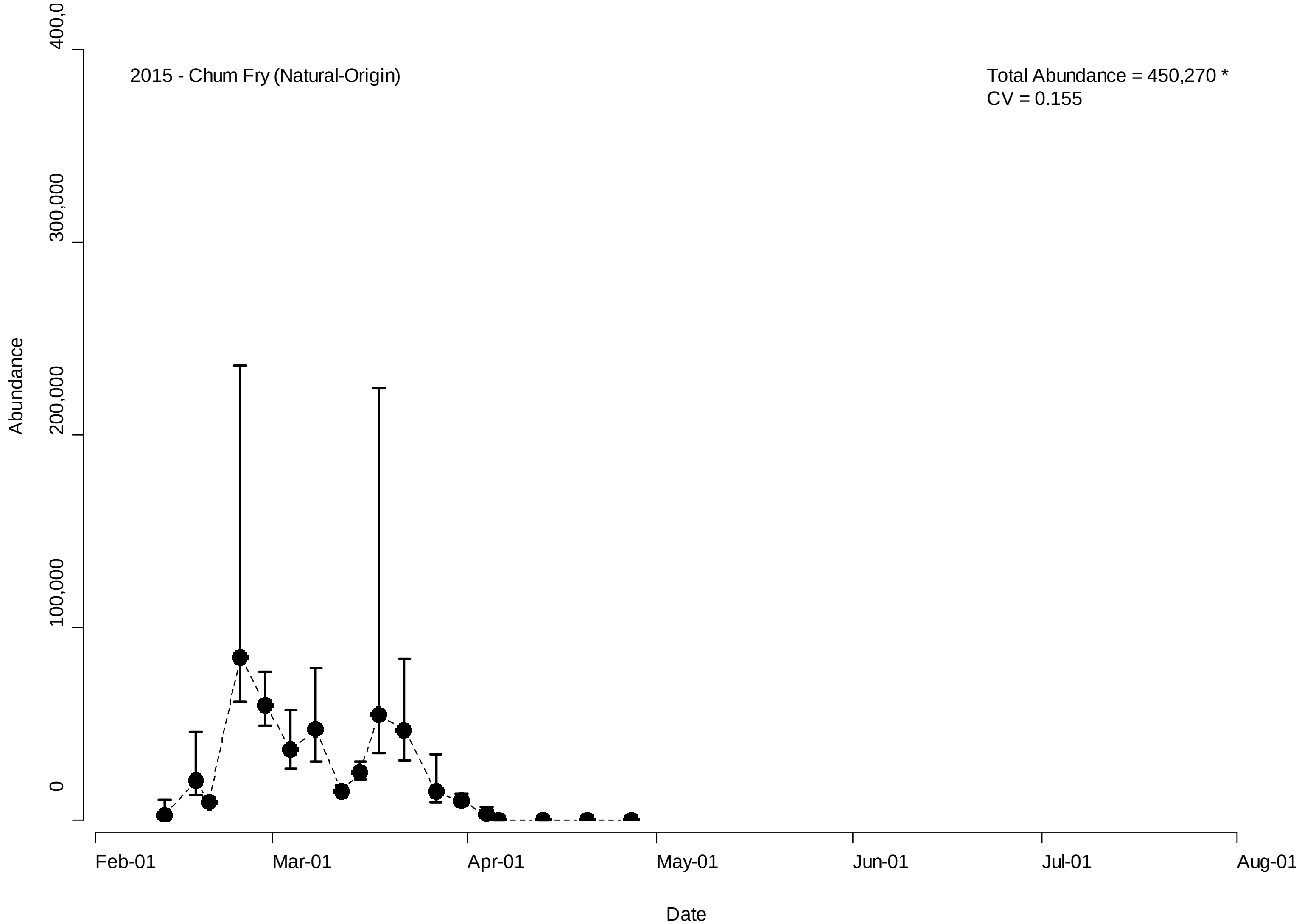

Figure E88. Estimated abundance (± 95% CI) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) produced above the Crazy Johnson Creek screw trap in 2015.

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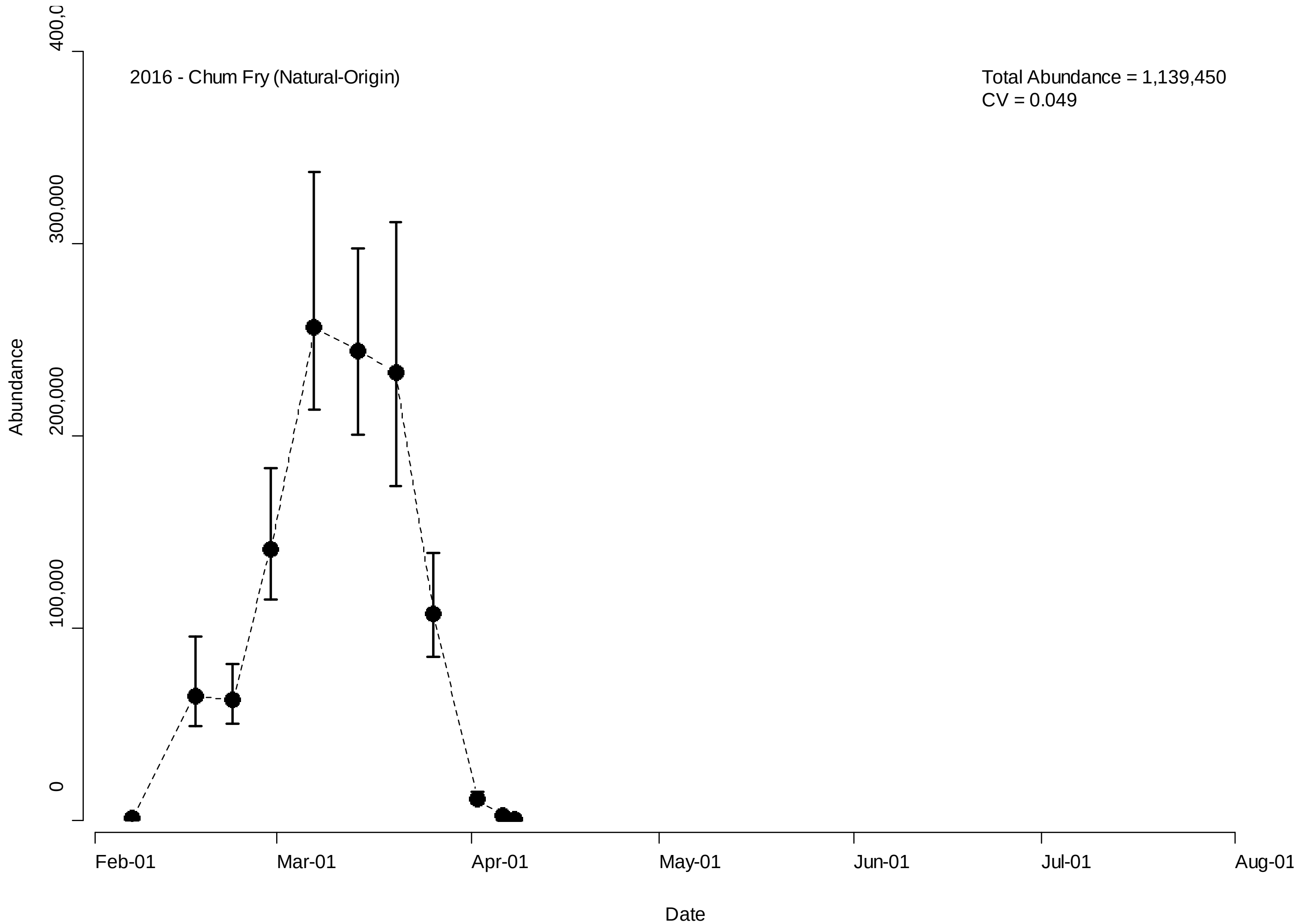

Figure E89. Estimated abundance (± 95% CI) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) produced above the Crazy Johnson Creek screw trap in 2016.

Duncan Channels
Chum salmon (Natural-Origin, Fry)

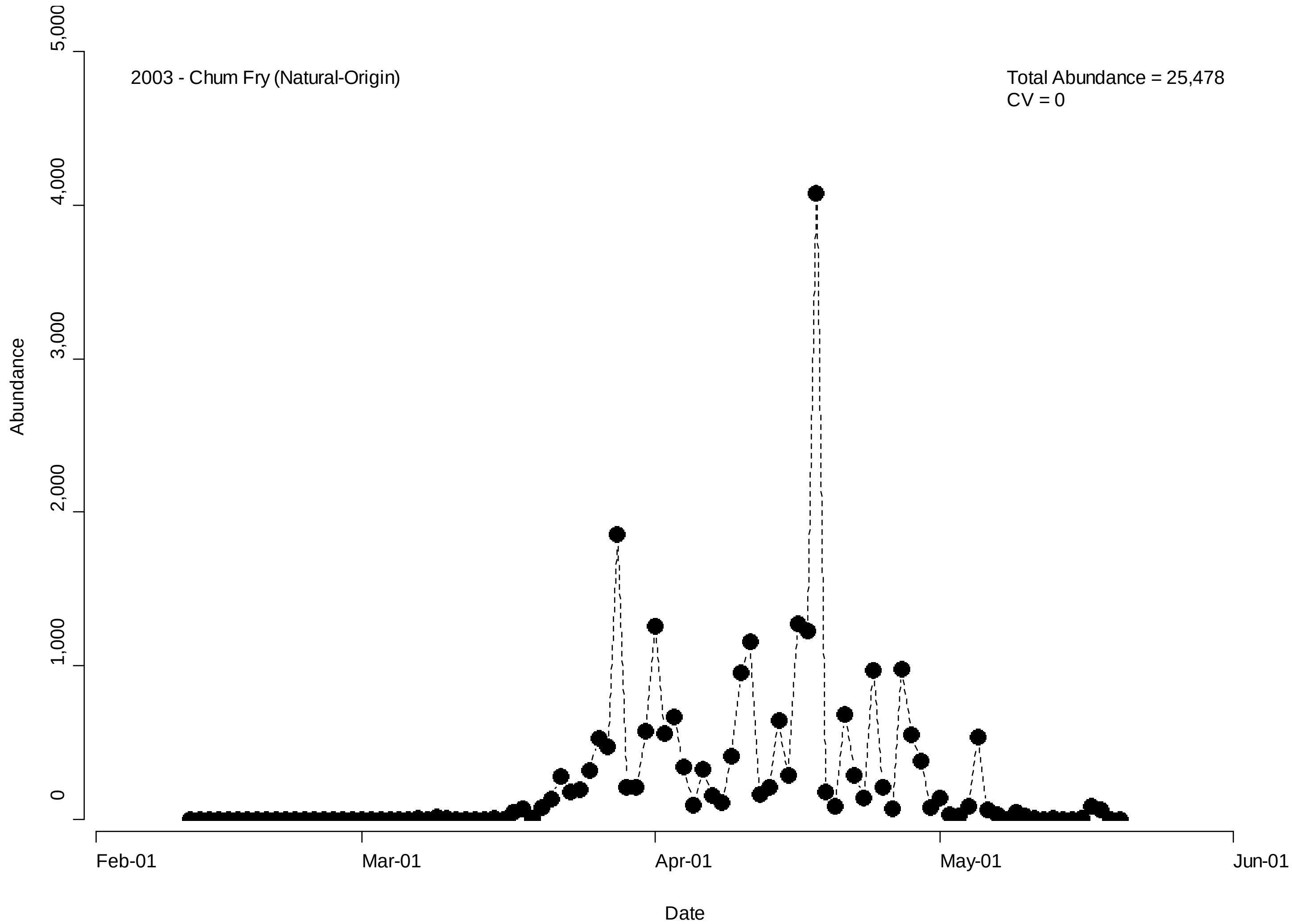

Figure E90. Abundance by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) produced above the Duncan Creek spawning channel weirs in 2003.

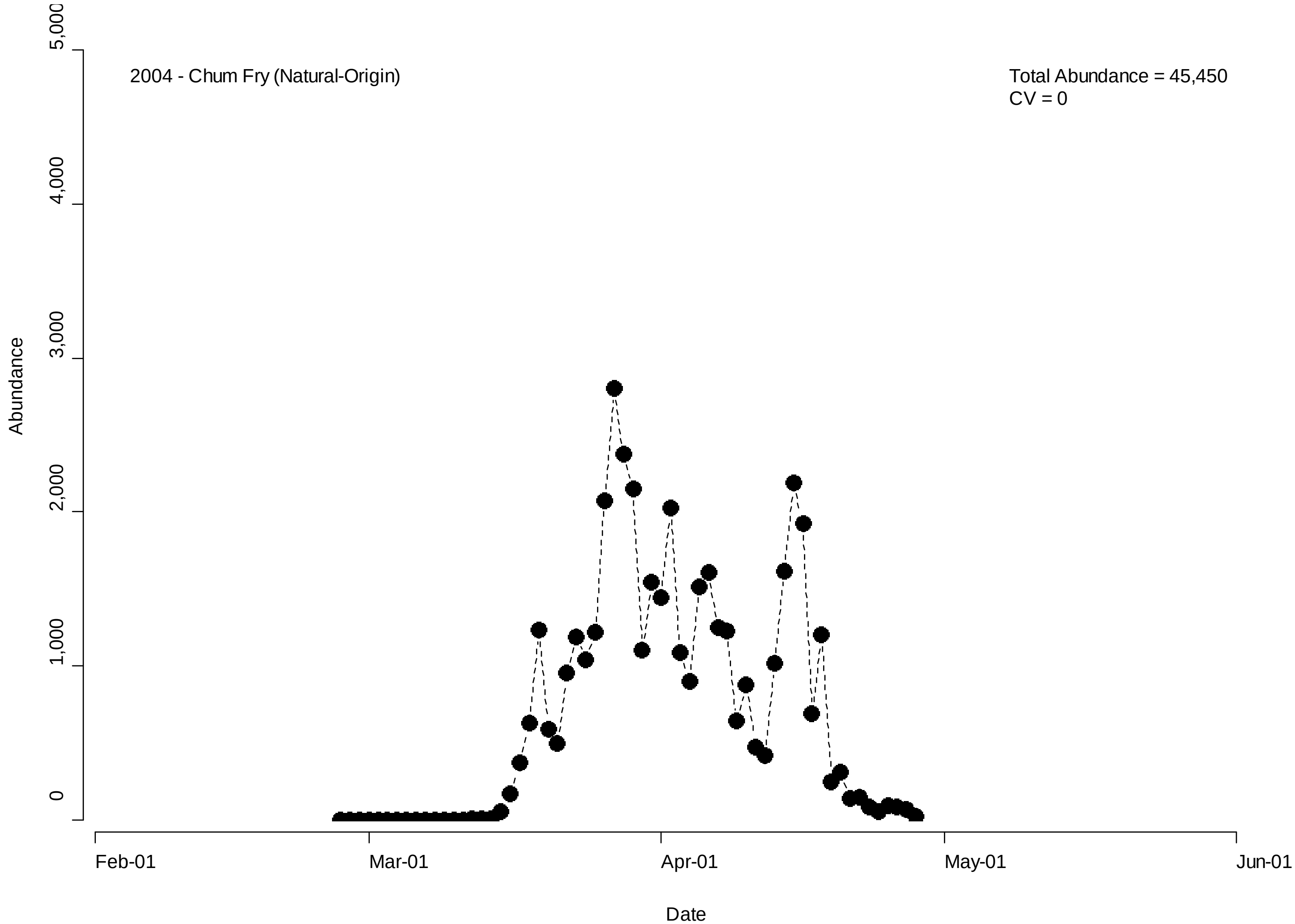

Figure E91. Abundance by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) produced above the Duncan Creek spawning channel weirs in 2004.

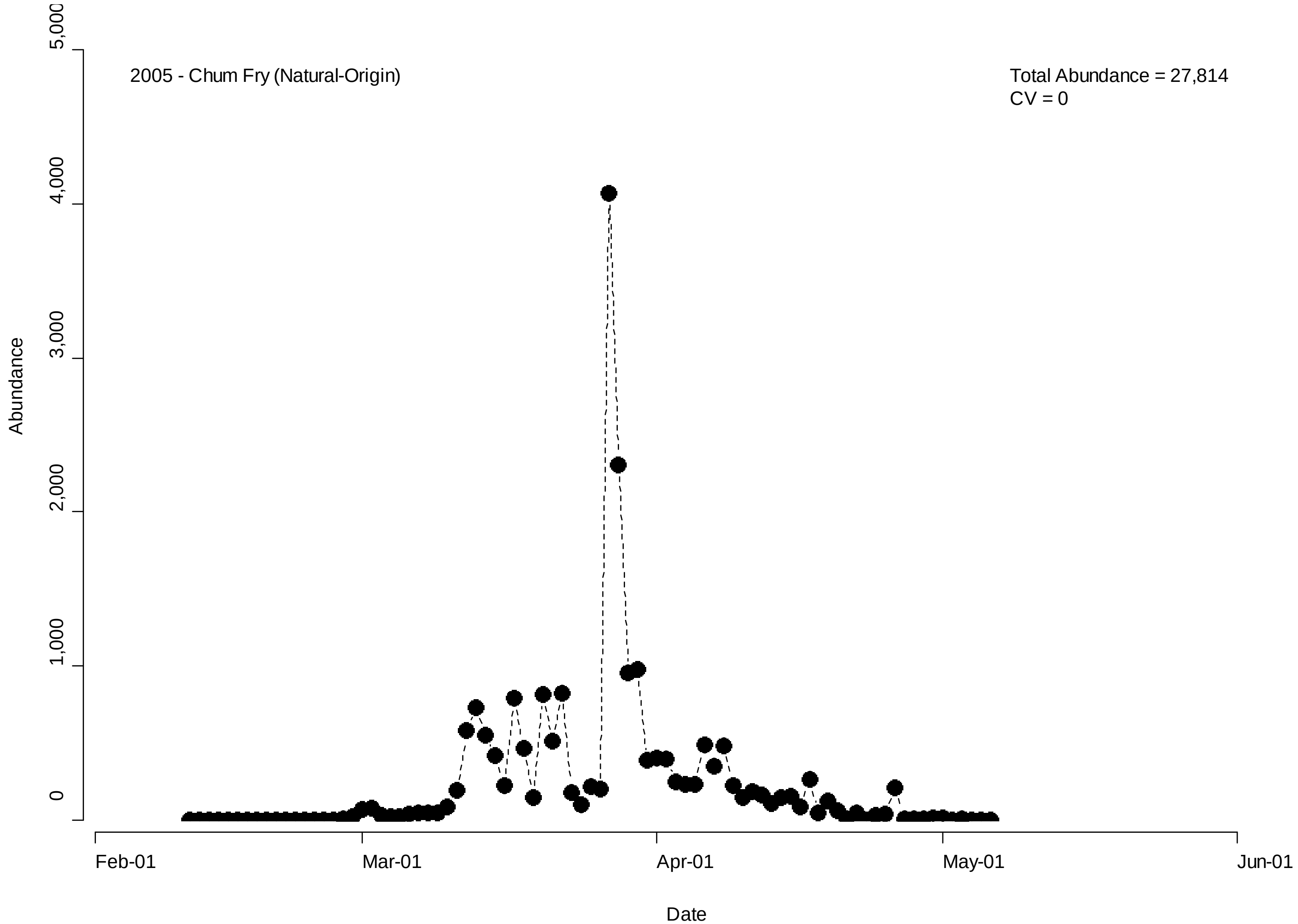

Figure E92. Abundance by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) produced above the Duncan Creek spawning channel weirs in 2005.

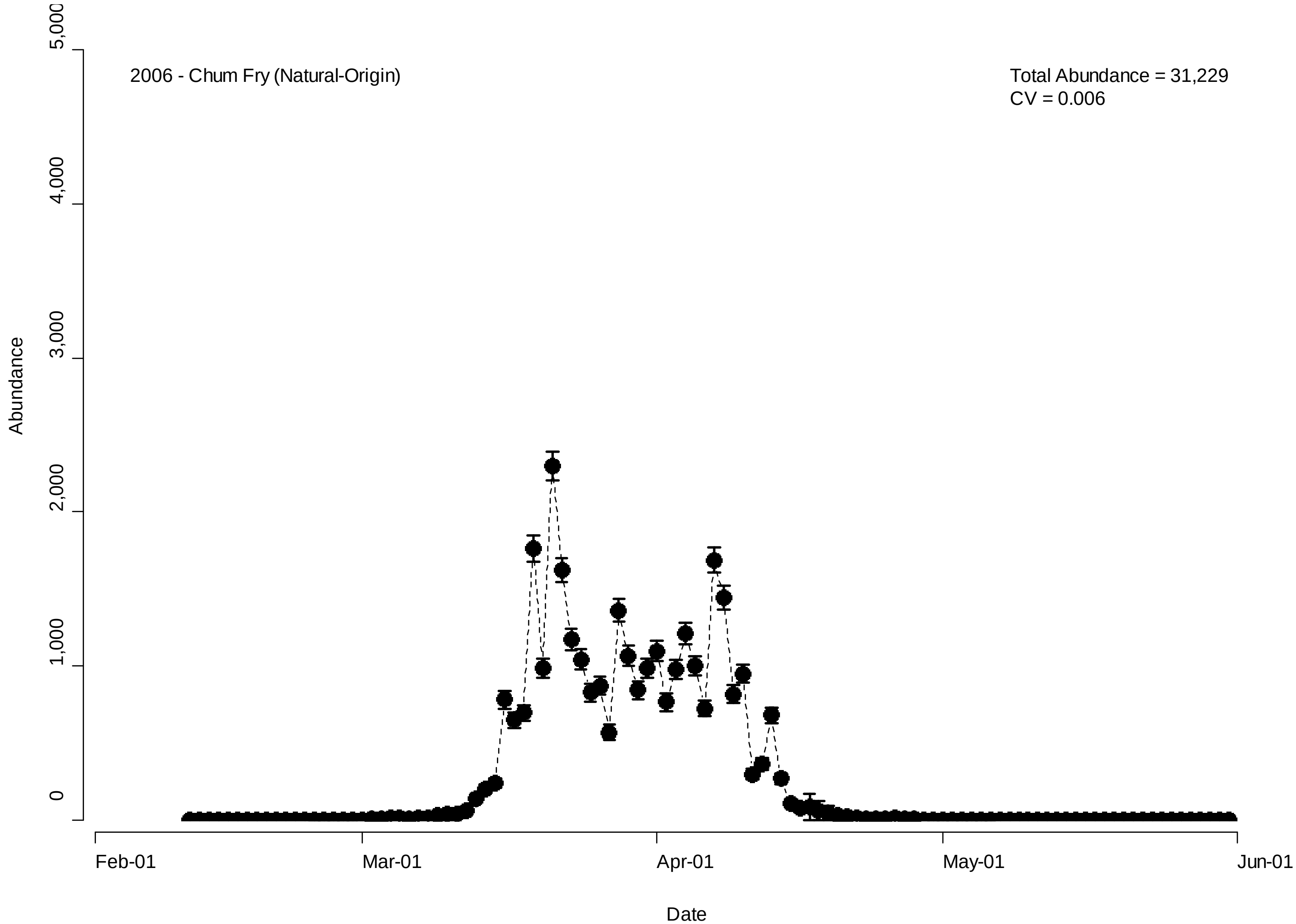

Figure E93. Estimated abundance (± 95% CI) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) produced above the Duncan Creek spawning channel weirs in 2006.

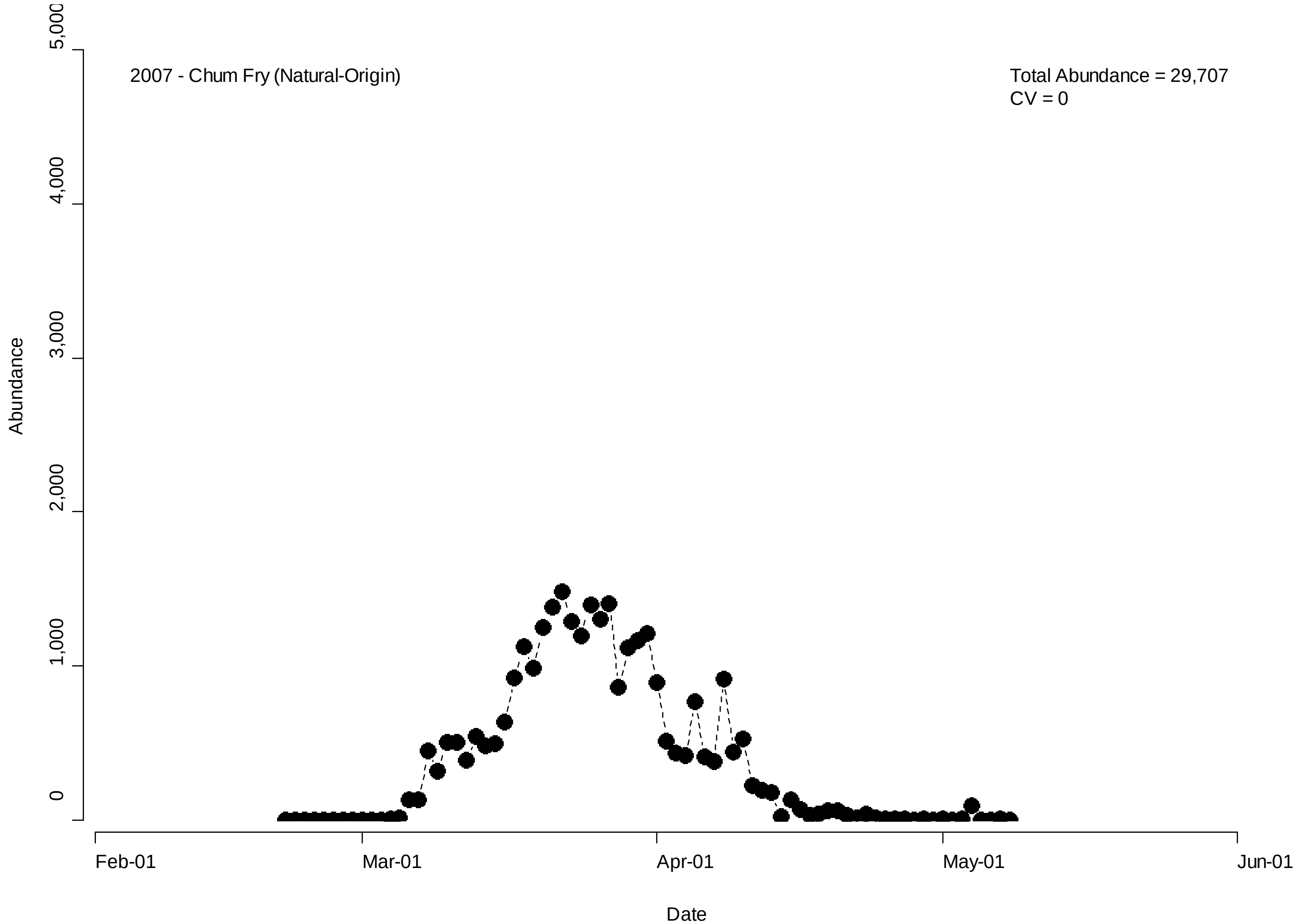

Figure E94. Abundance by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) produced above the Duncan Creek spawning channel weirs in 2007.

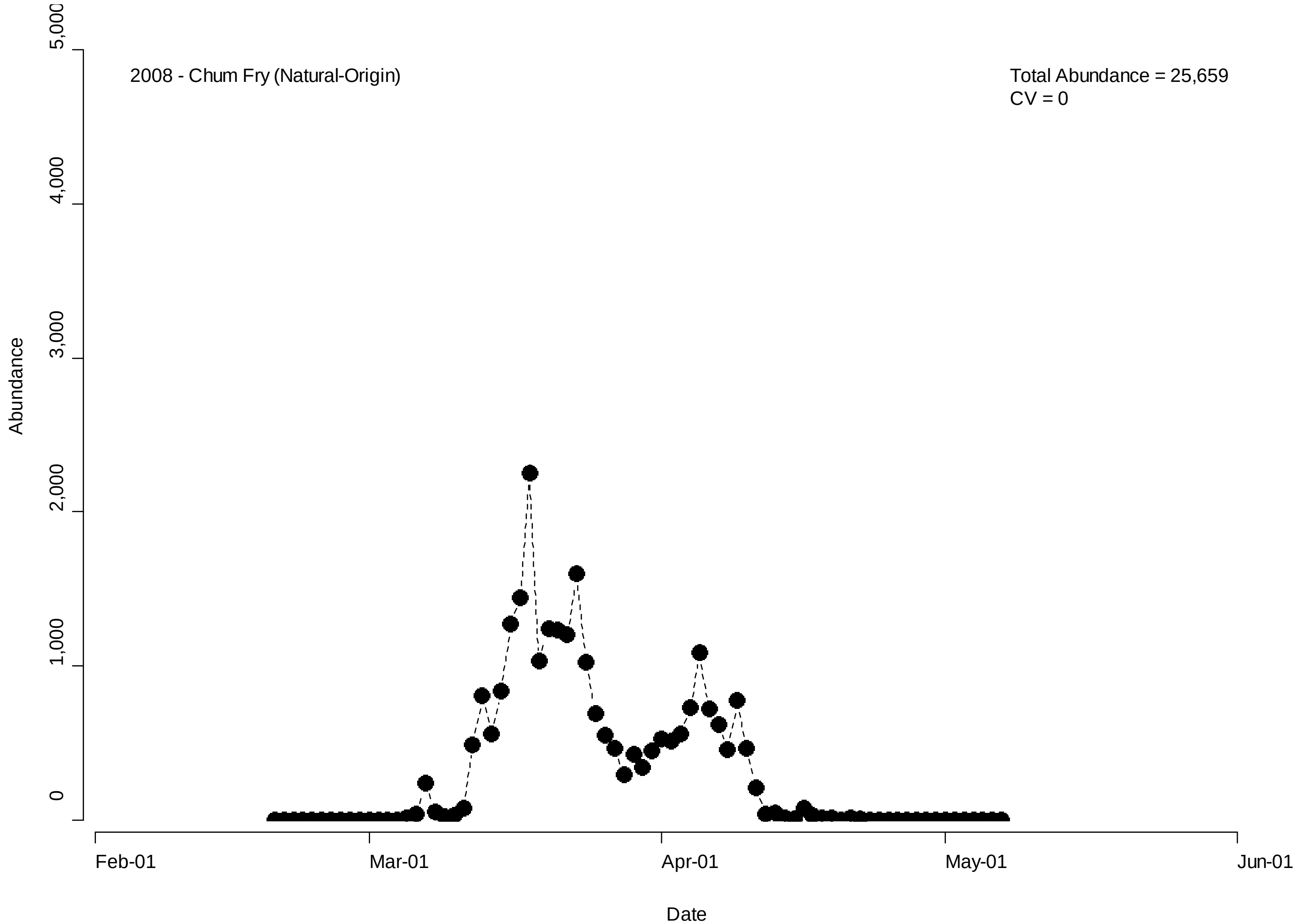

Figure E95. Abundance by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) produced above the Duncan Creek spawning channel weirs in 2008.

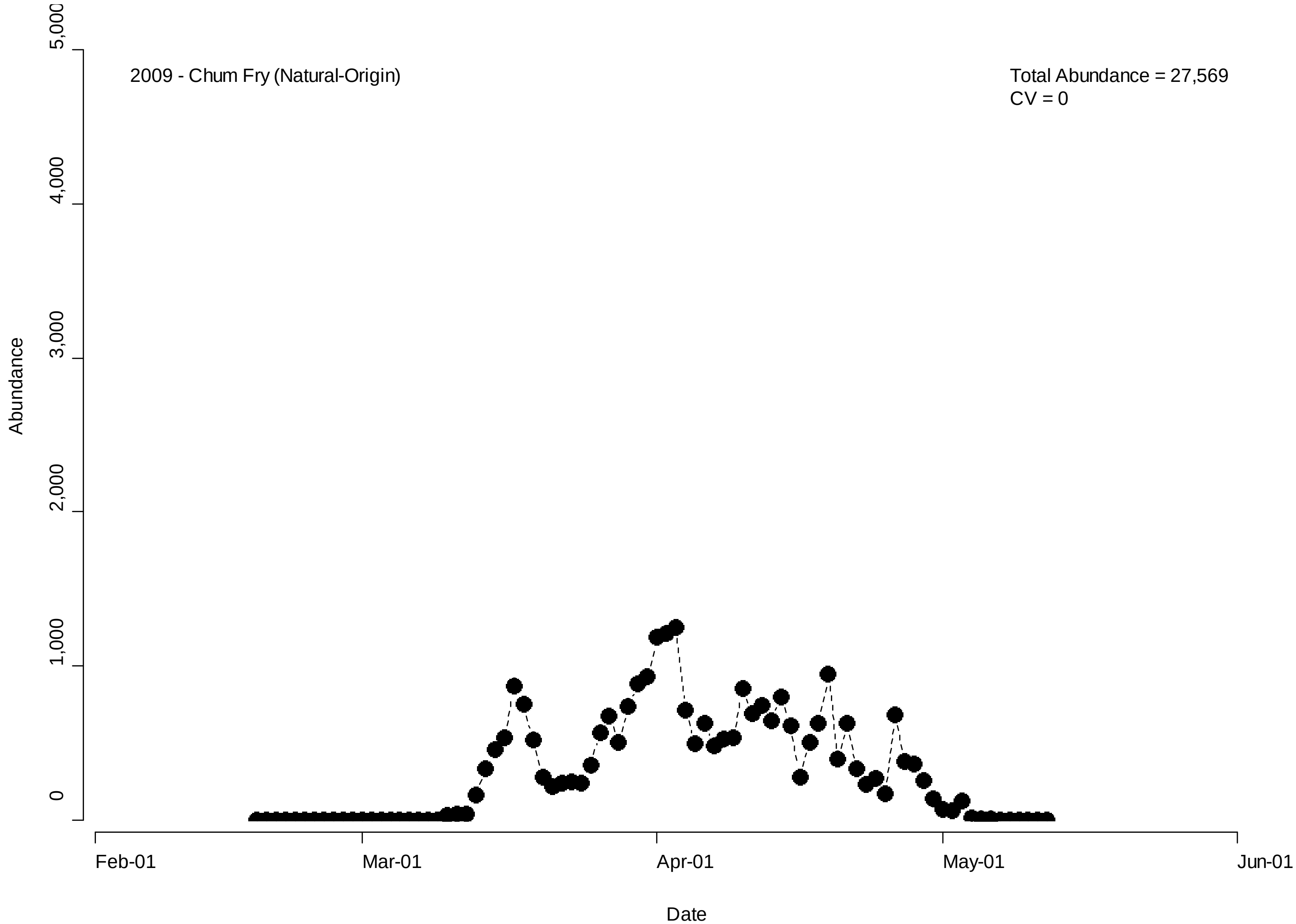

Figure E96. Abundance by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) produced above the Duncan Creek spawning channel weirs in 2009.

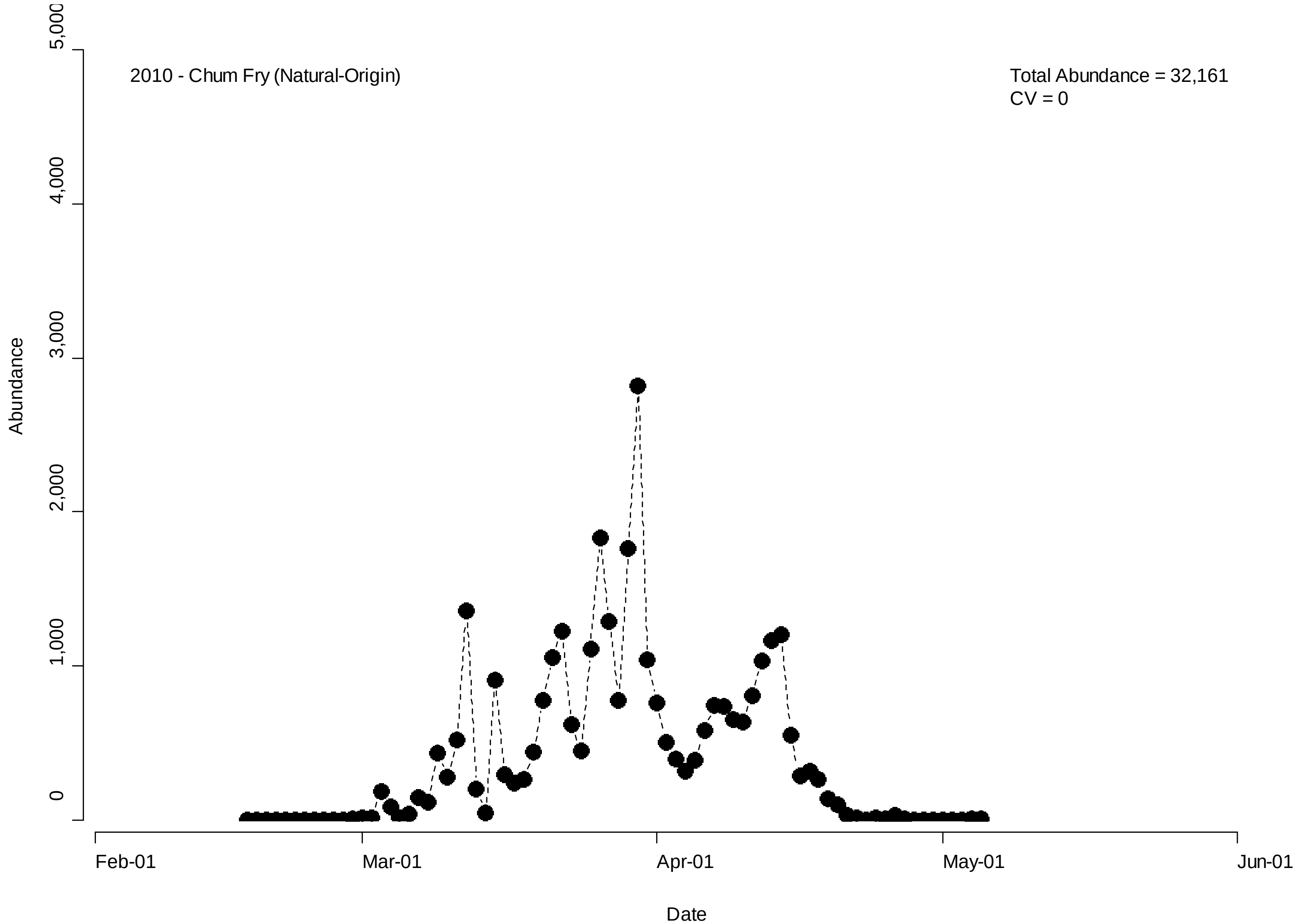

Figure E97. Abundance by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) produced above the Duncan Creek spawning channel weirs in 2010.

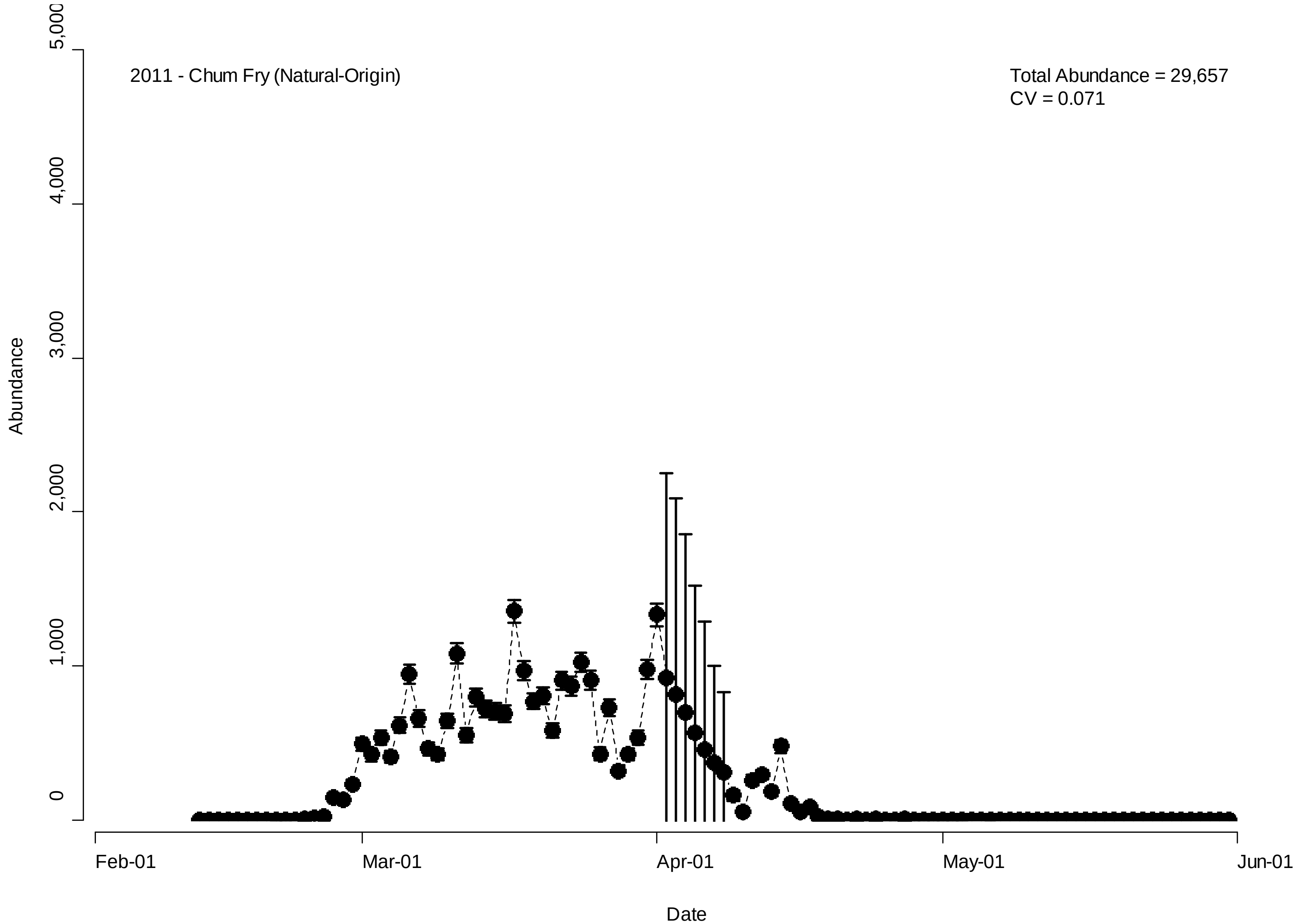

Figure E98. Estimated abundance (± 95% CI) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) produced above the Duncan Creek spawning channel weirs in 2011.

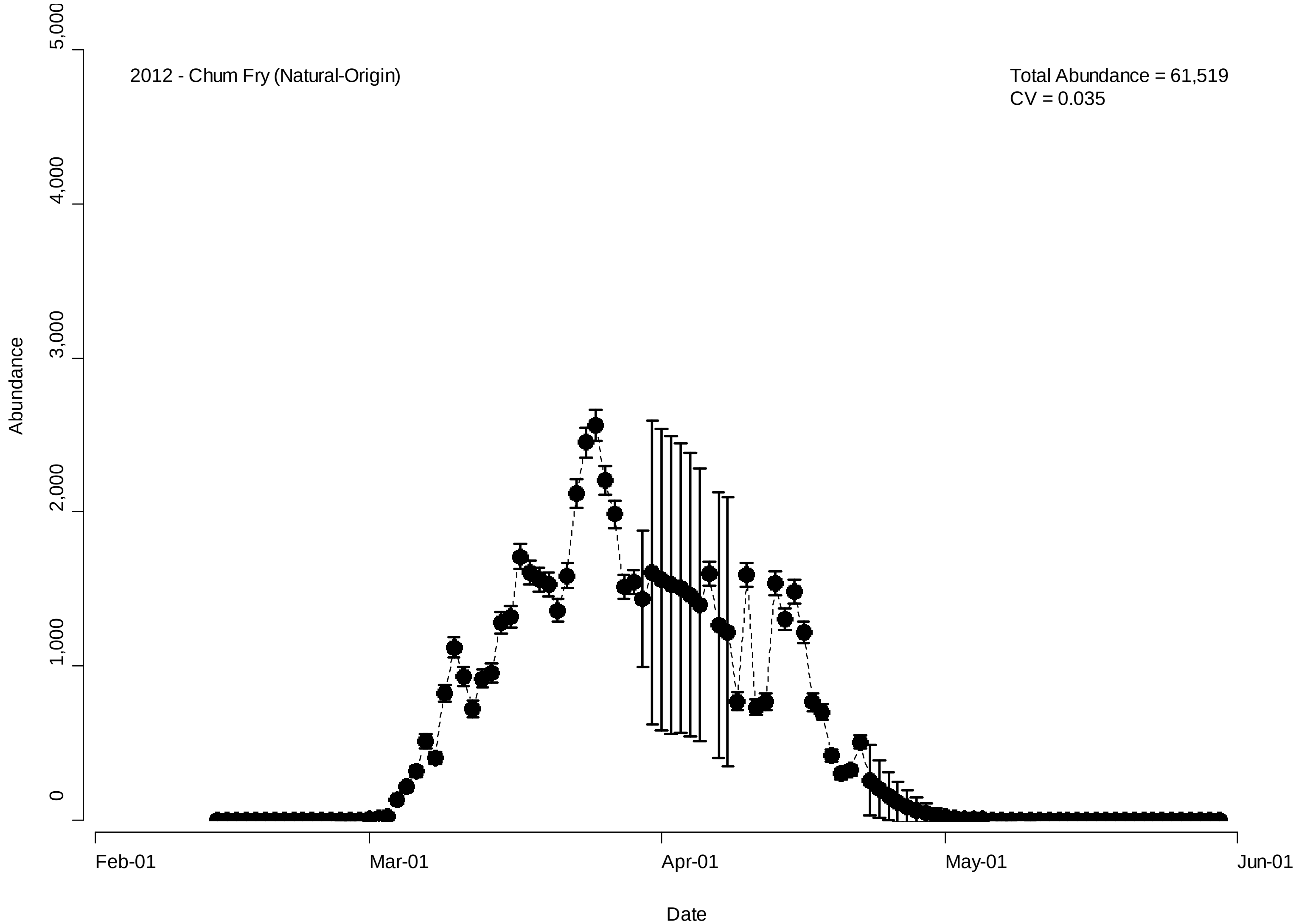

Figure E99. Estimated abundance (± 95% CI) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) produced above the Duncan Creek spawning channel weirs in 2012.

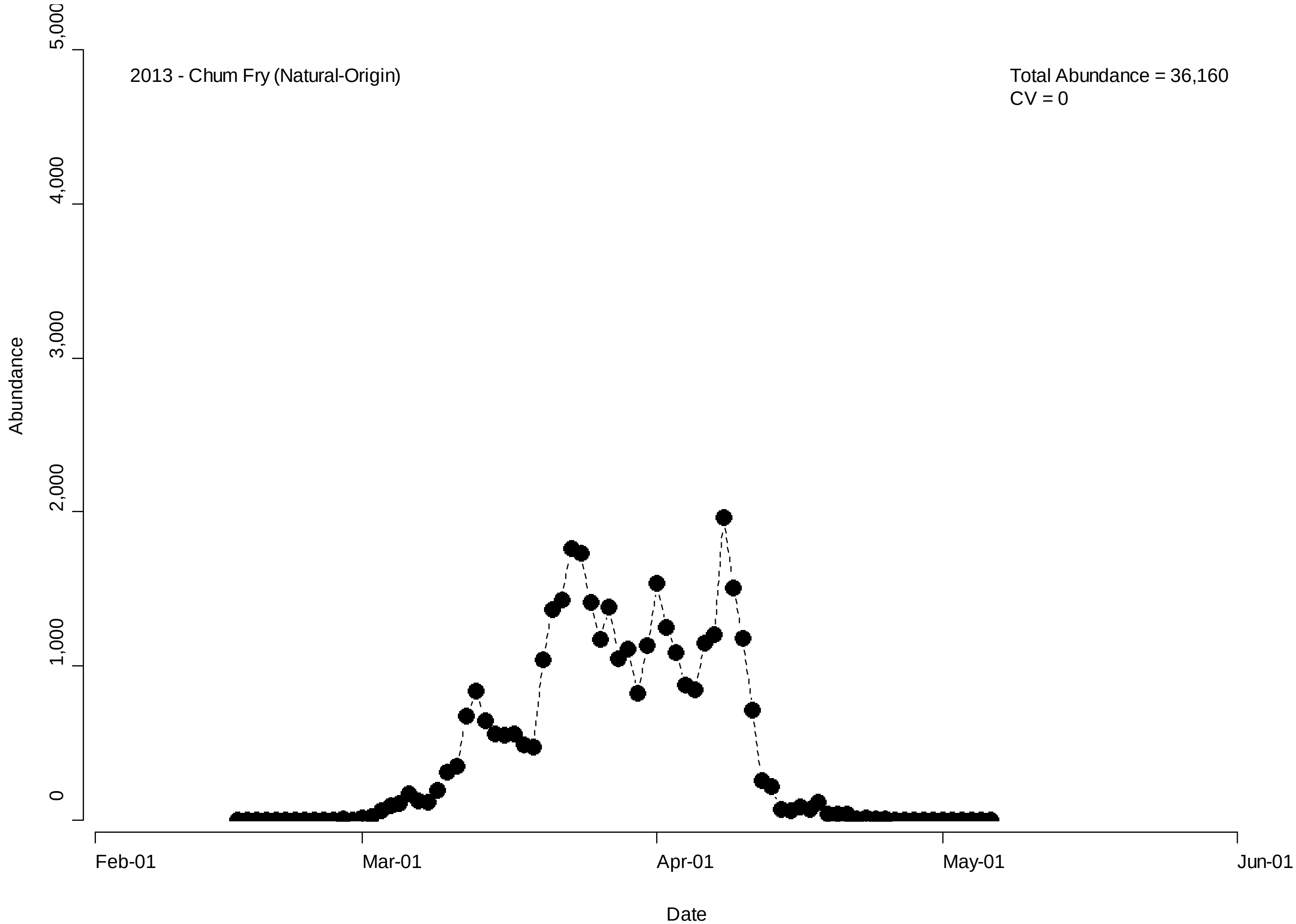

Figure E100. Abundance by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) produced above the Duncan Creek spawning channel weirs in 2013.

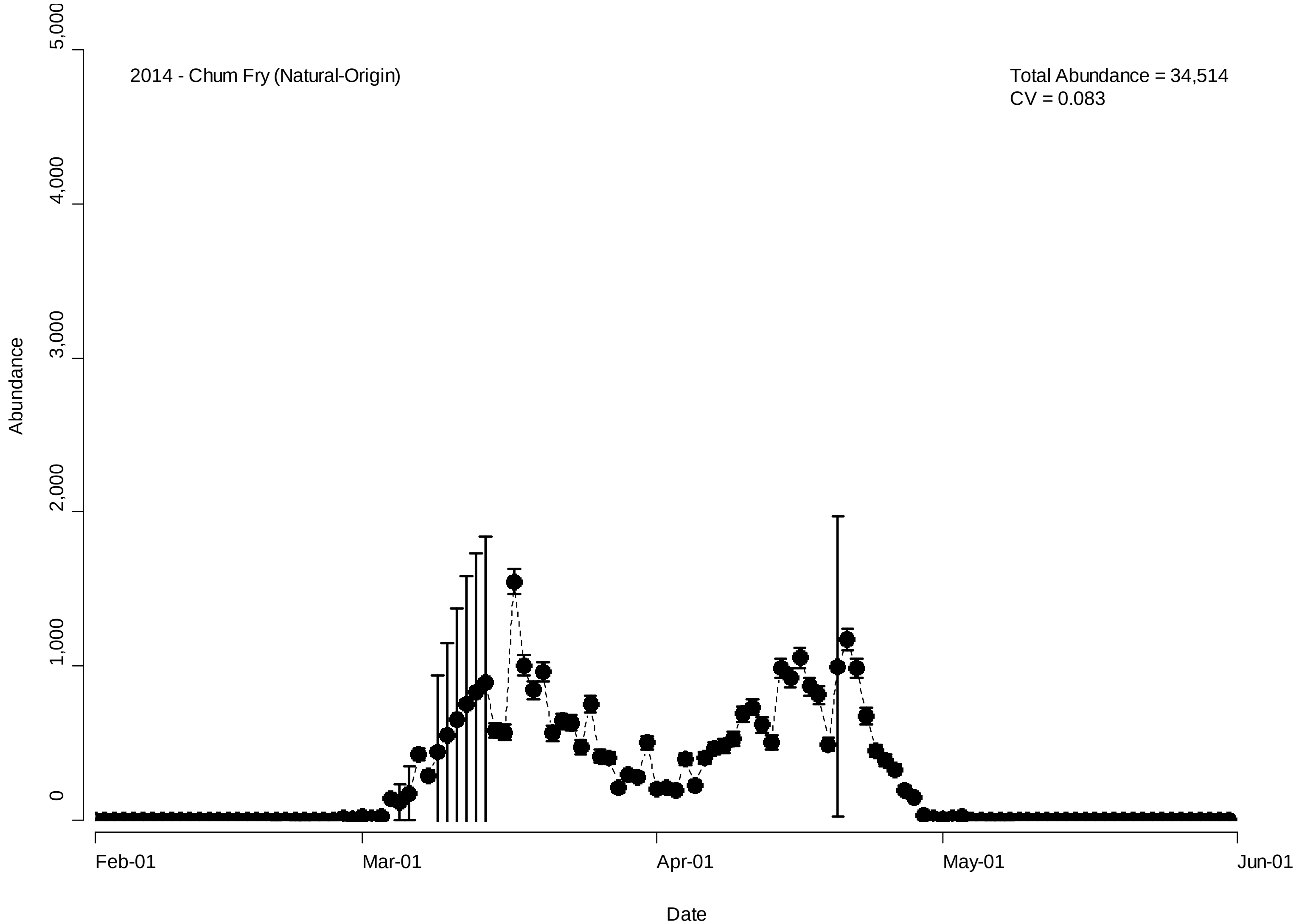

Figure E101. Estimated abundance (± 95% CI) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) produced above the Duncan Creek spawning channel weirs in 2014.

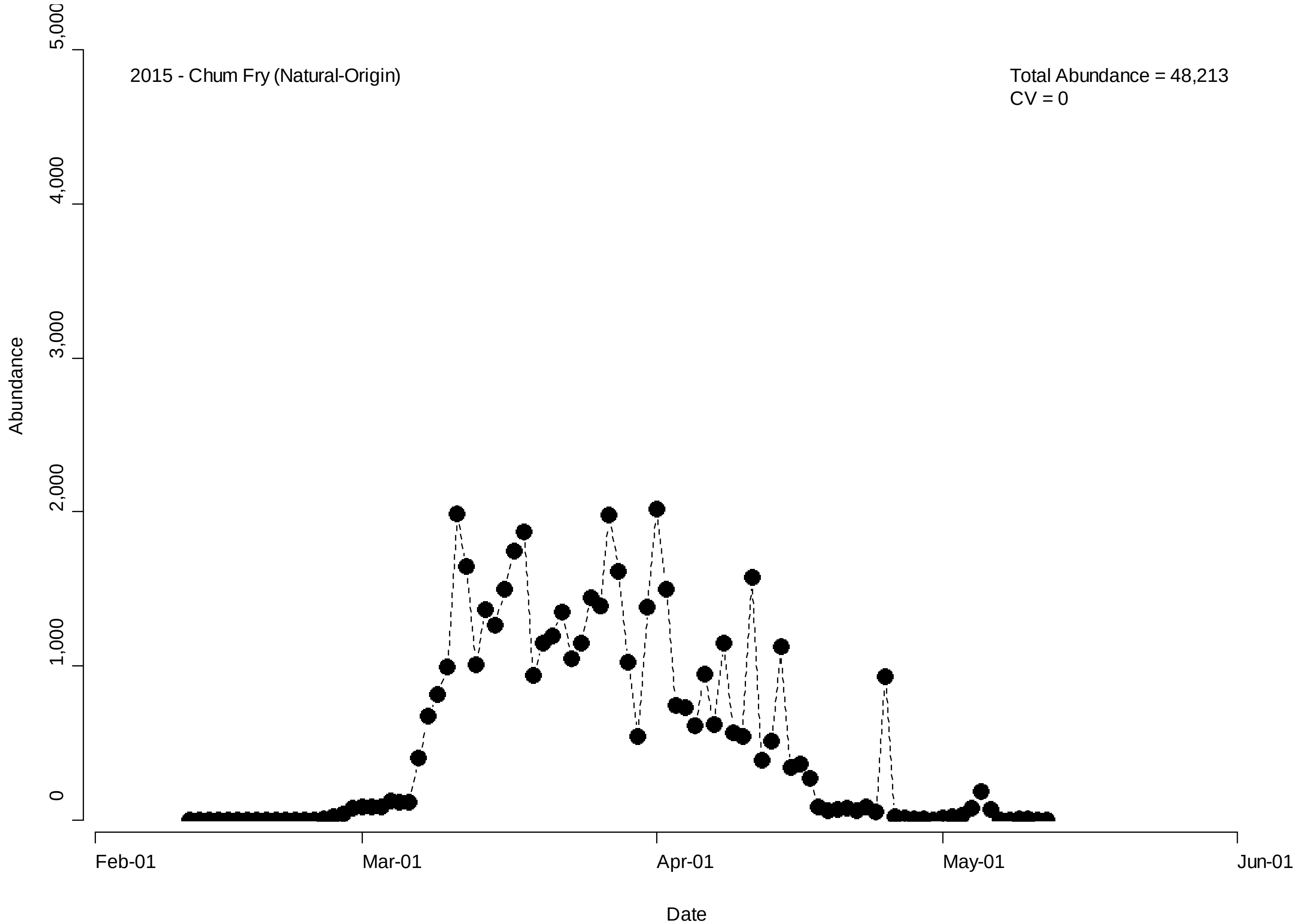

Figure E102. Abundance by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) produced above the Duncan Creek spawning channel weirs in 2015.

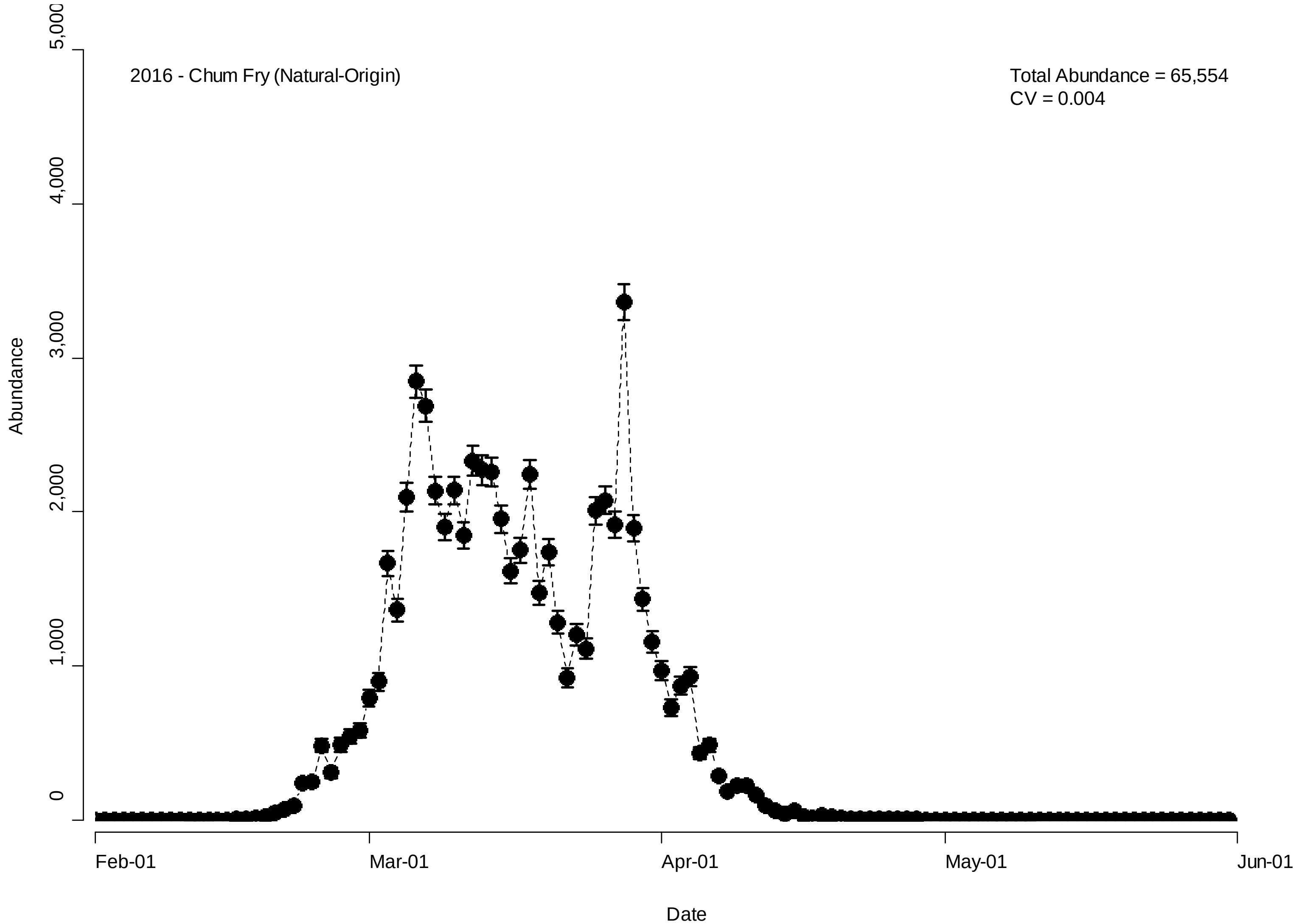

Figure E103. Estimated abundance (± 95% CI) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) produced above the Duncan Creek spawning channel weirs in 2016.

Hamilton Creek

Coho salmon (Natural-Origin, Transitional/Smolt, Yearling)

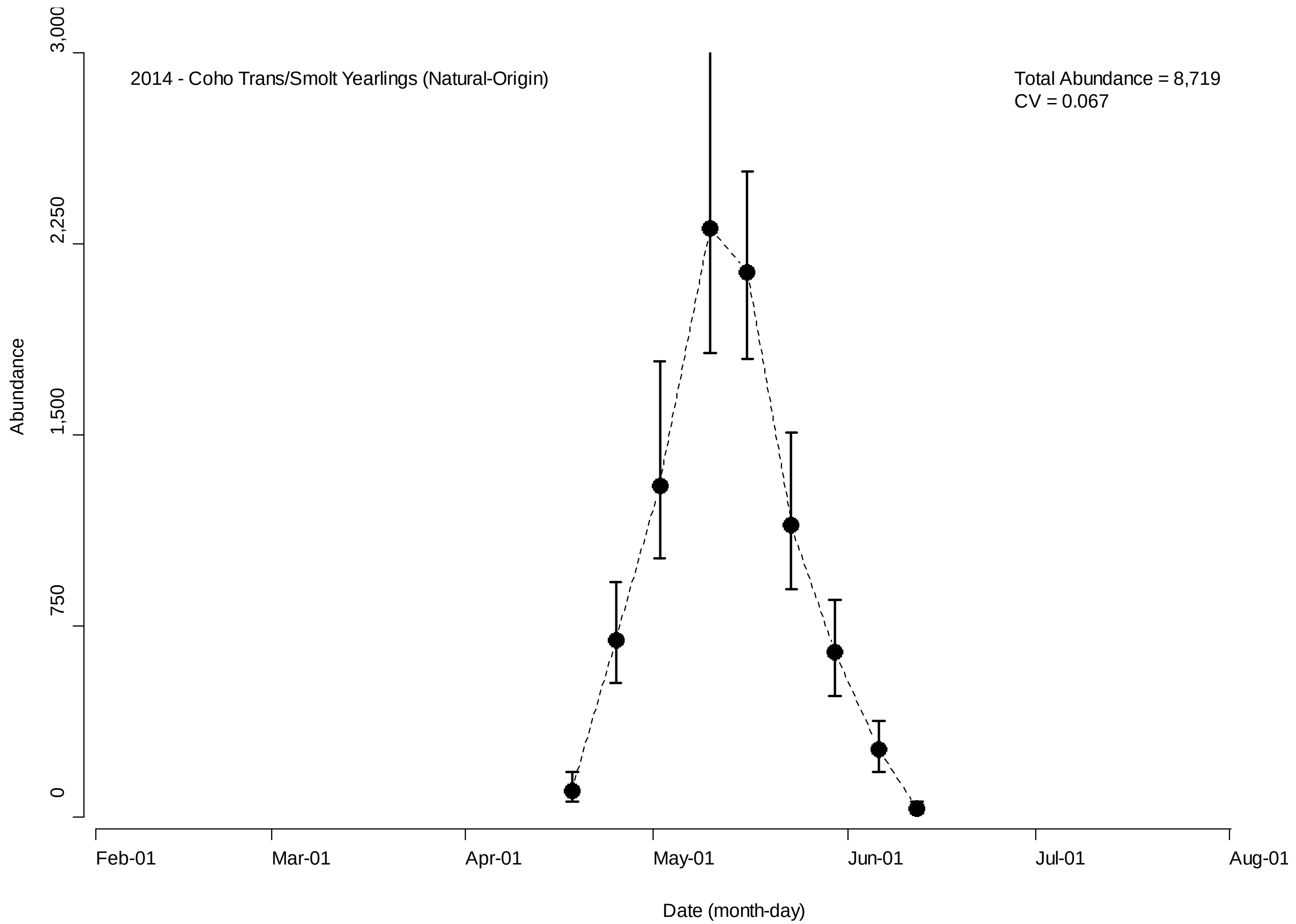

Figure E104. Estimated abundance (± 95% CI) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) produced above the Hamilton Creek screw trap in 2014.

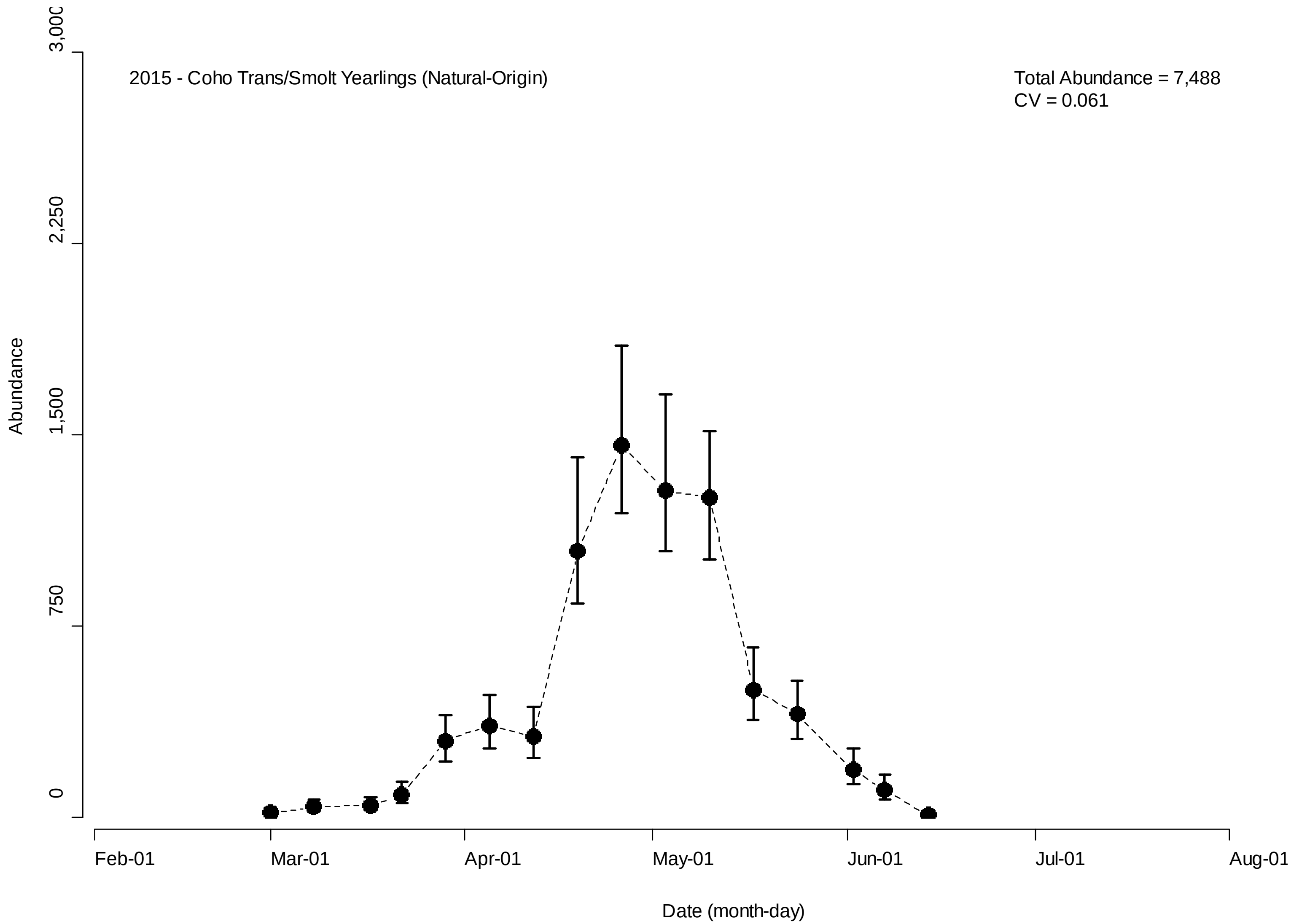

Figure E105. Estimated abundance (± 95% CI) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) produced above the Hamilton Creek screw trap in 2015.

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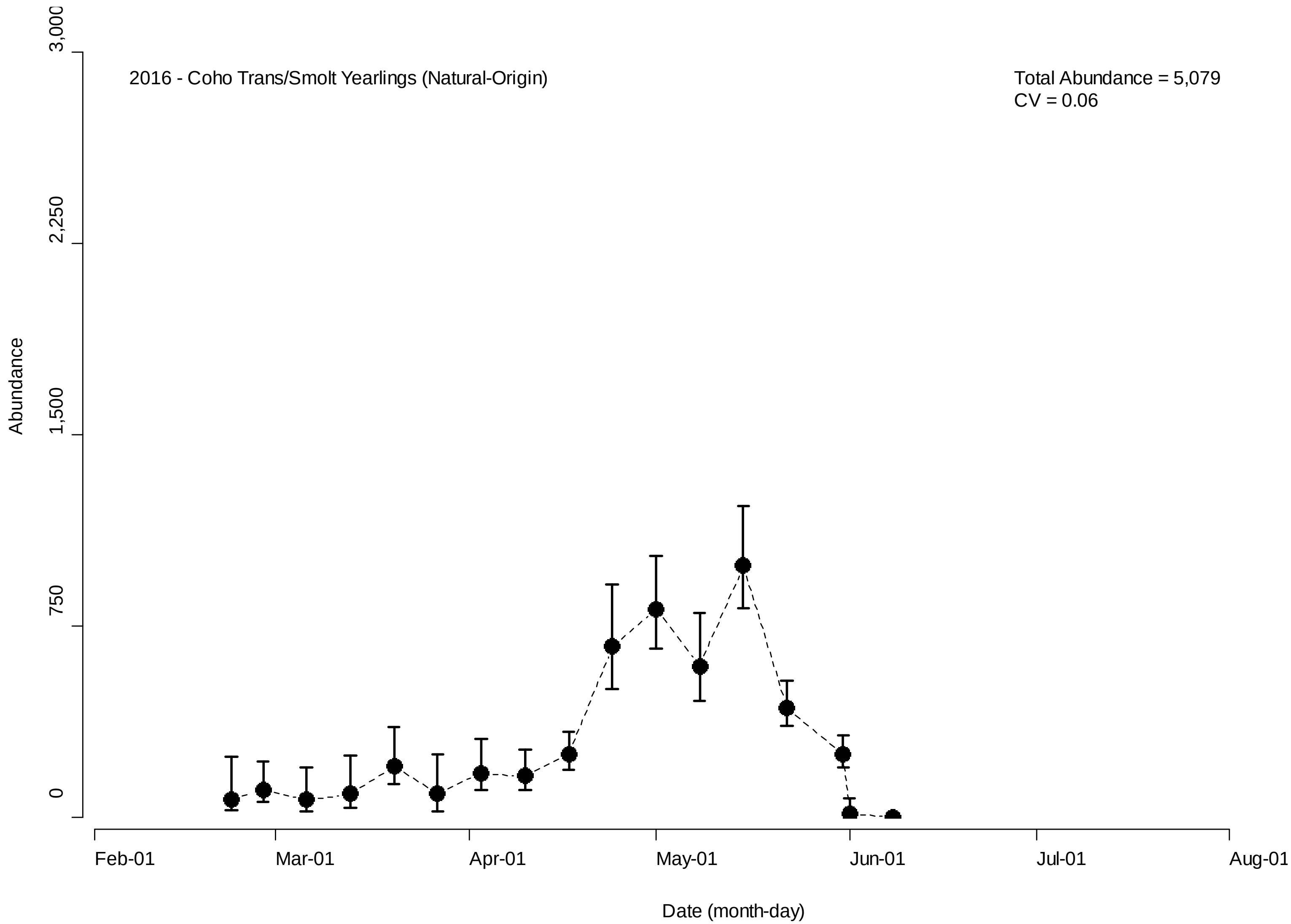

Figure E106. Estimated abundance (± 95% CI) by date for natural-origin coho salmon (life-stage = transitional/smolt; age-class = yearling) produced above the Hamilton Creek screw trap in 2016.

Steelhead (Natural-Origin, Transitional/Smolt, Yearling)

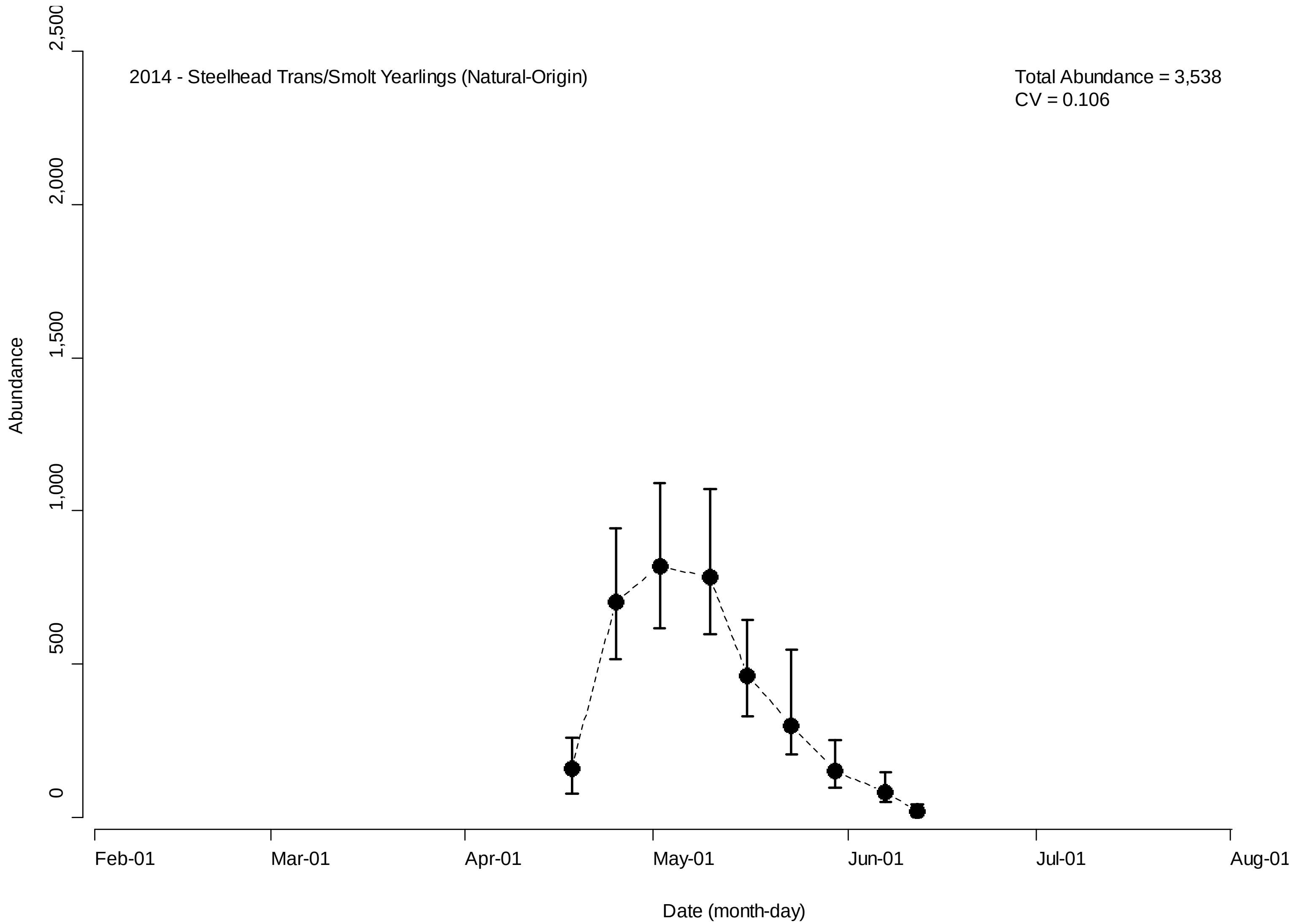

Figure E107. Estimated abundance (± 95% CI) by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) produced above the Hamilton Creek screw trap in 2014.

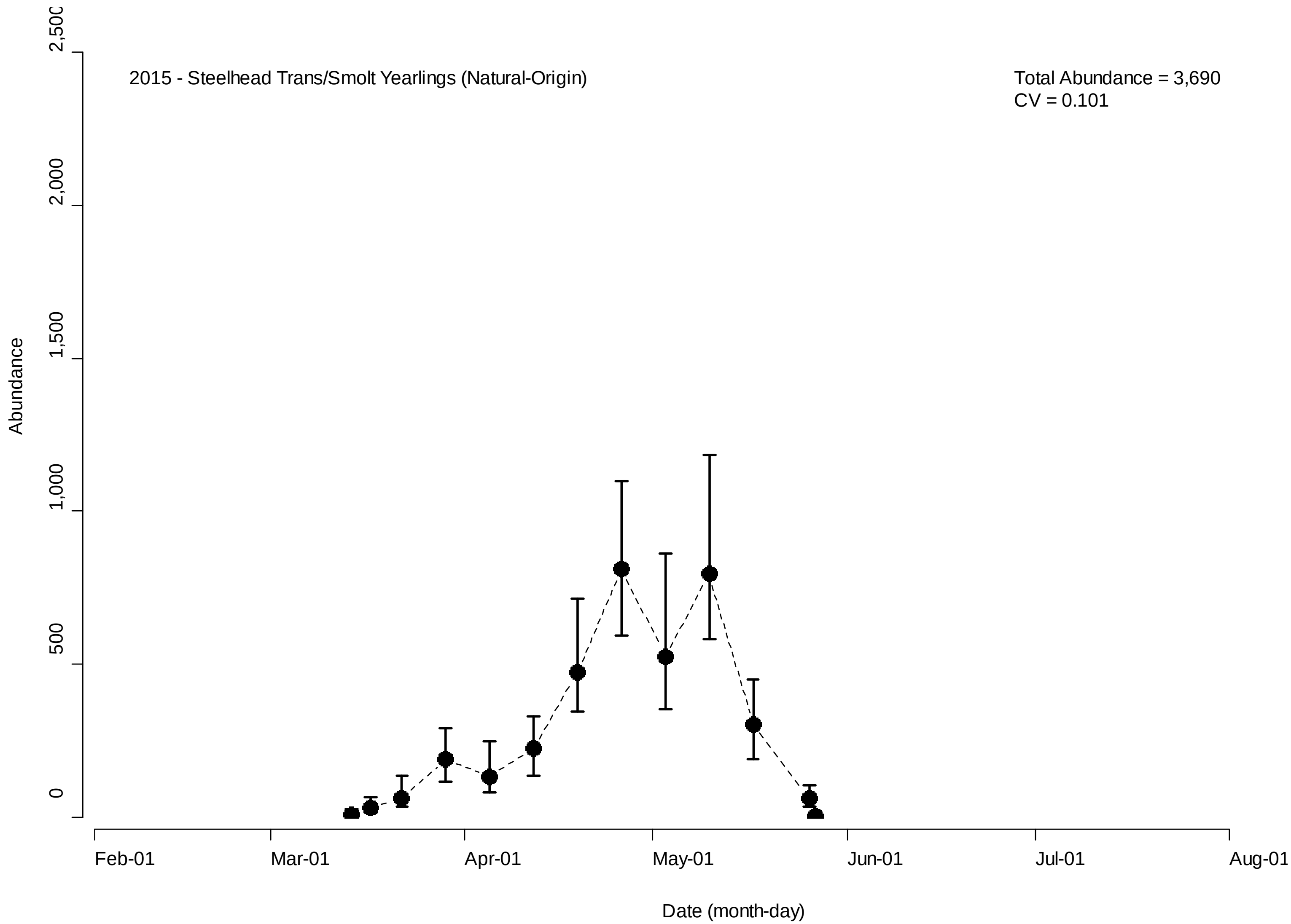

Figure E108. Estimated abundance (± 95% CI) by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) produced above the Hamilton Creek screw trap in 2015.

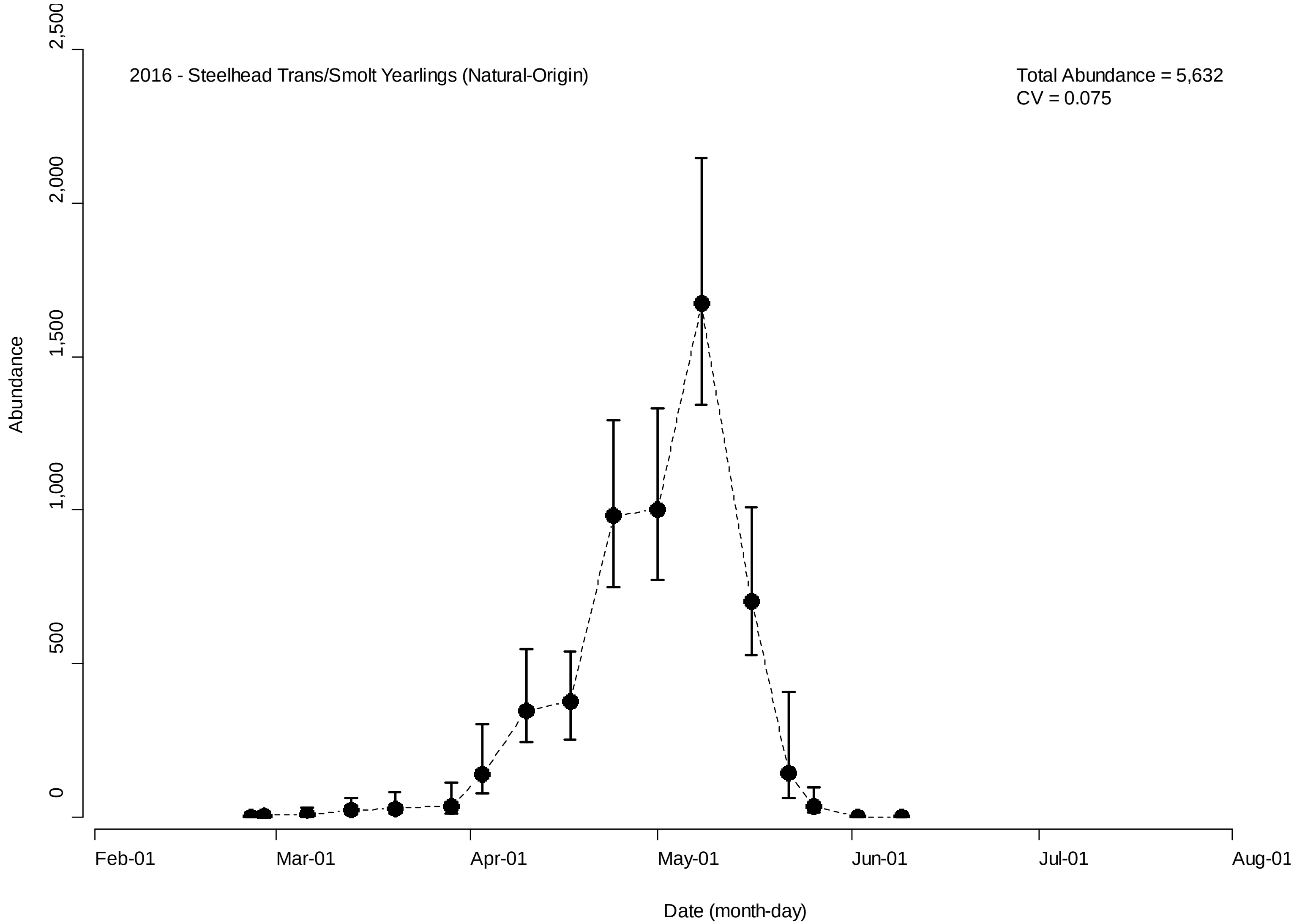

Figure E109. Estimated abundance (± 95% CI) by date for natural-origin steelhead (life-stage = transitional/smolt; age-class = yearling) produced above the Hamilton Creek screw trap in 2016.

Hamilton Springs

Chum salmon (Natural-Origin, Fry)

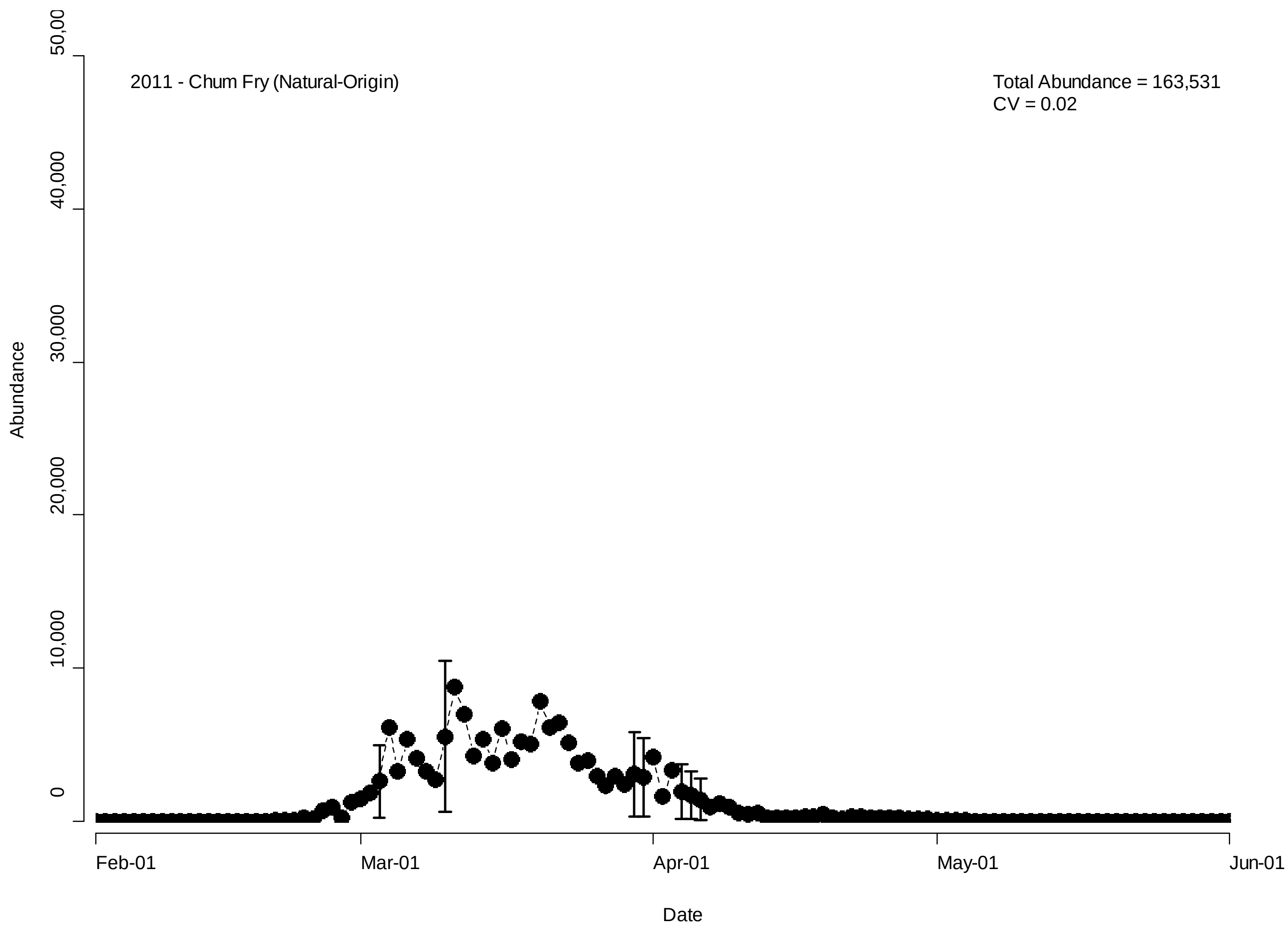

Figure E110. Estimated abundance (± 95% CI) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) produced above the Hamilton Springs spawning channel weir in 2011.

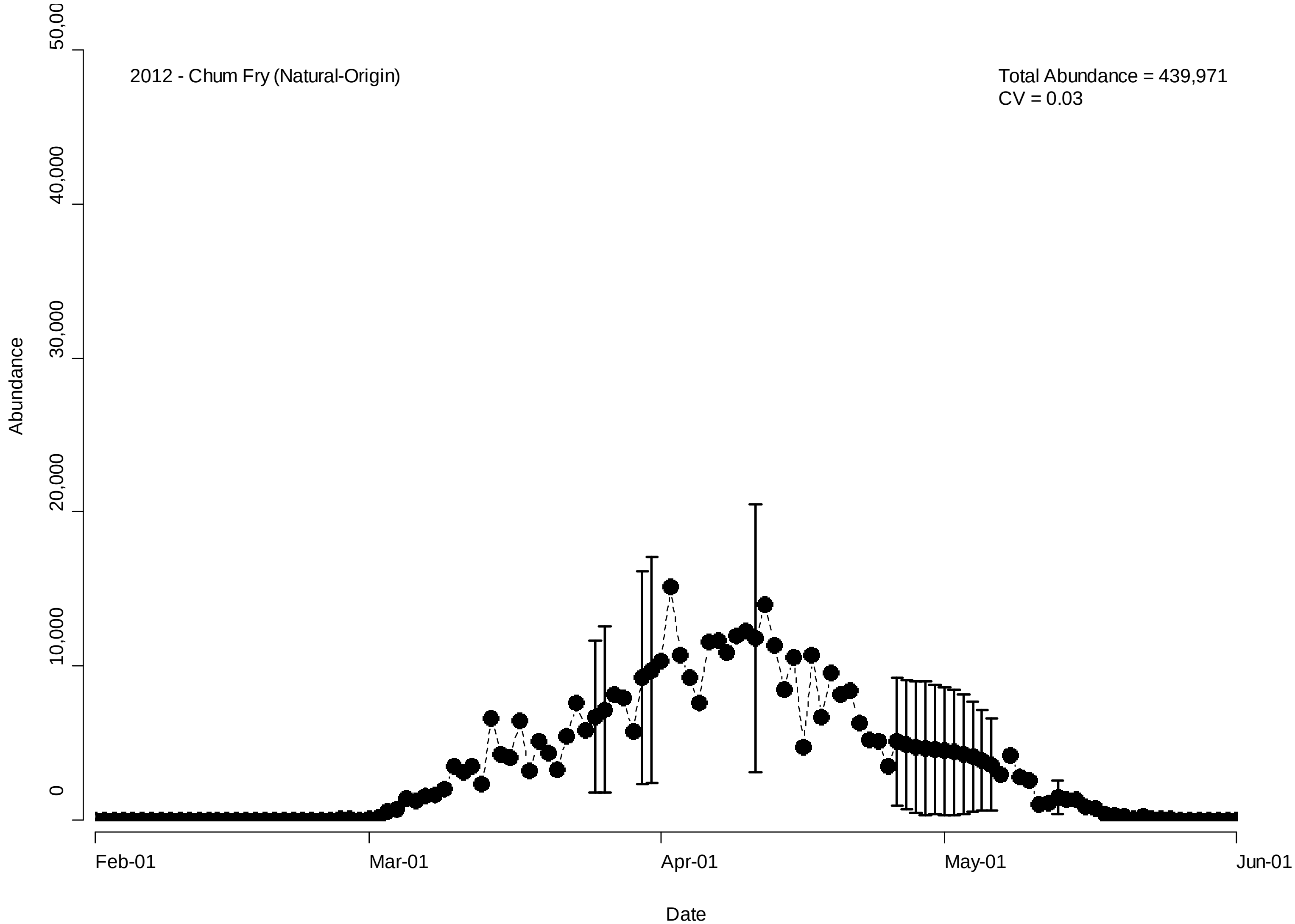

Figure E111. Estimated abundance (± 95% CI) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) produced above the Hamilton Springs spawning channel weir in 2012.

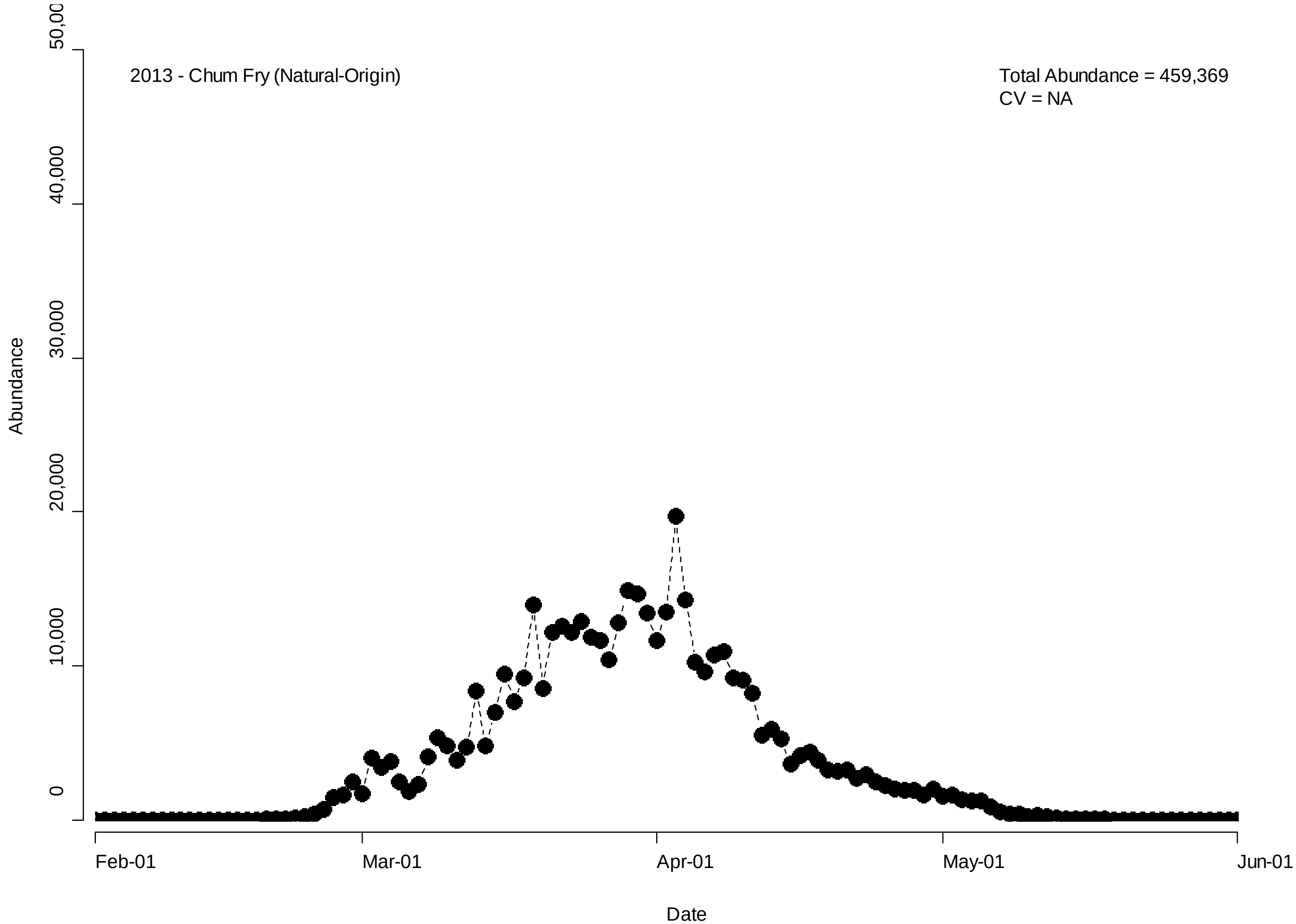

Figure E112. Estimated abundance by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) produced above the Hamilton Springs spawning channel weir in 2013.

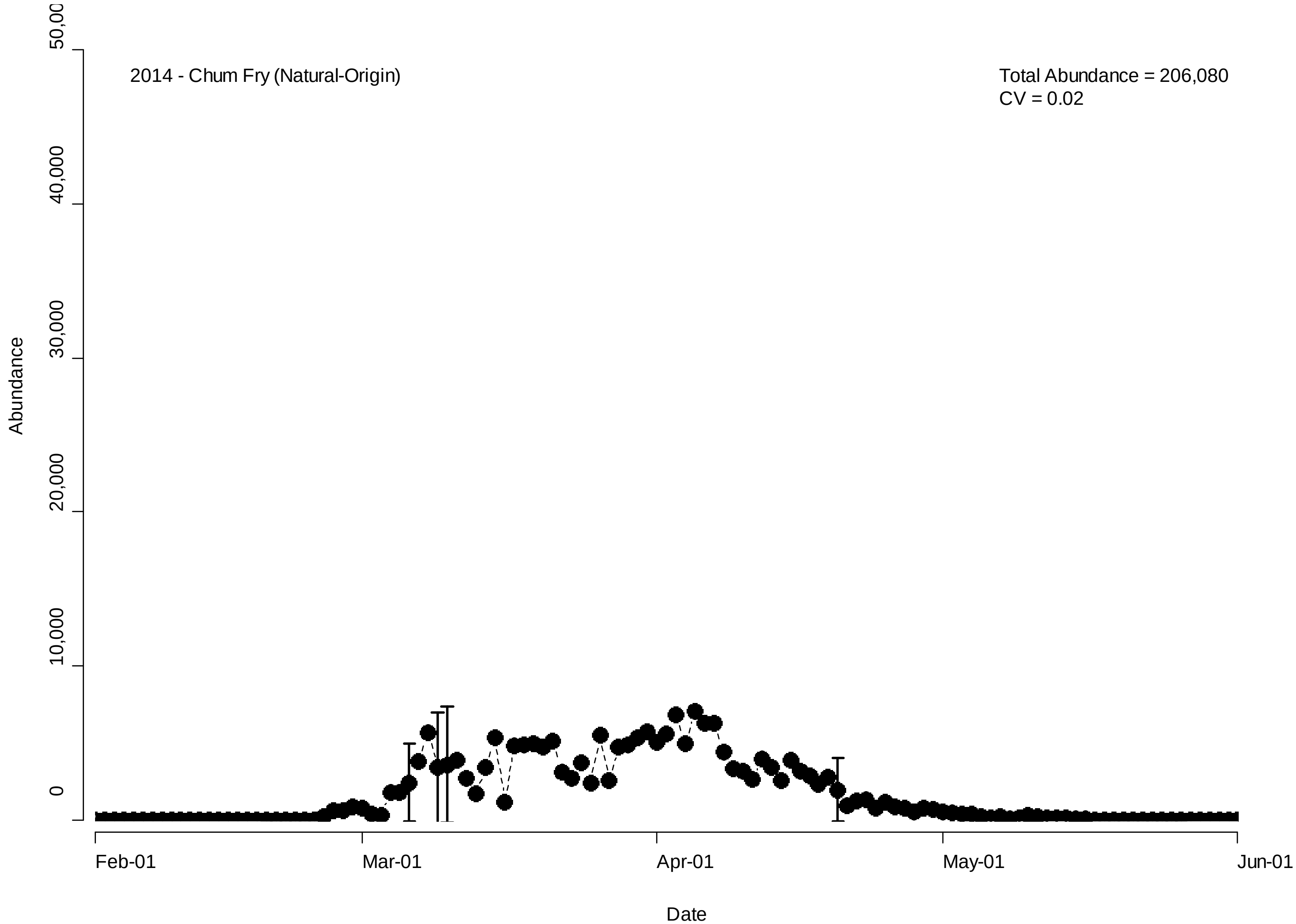

Figure E113. Estimated abundance (± 95% CI) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) produced above the Hamilton Springs spawning channel weir in 2014.

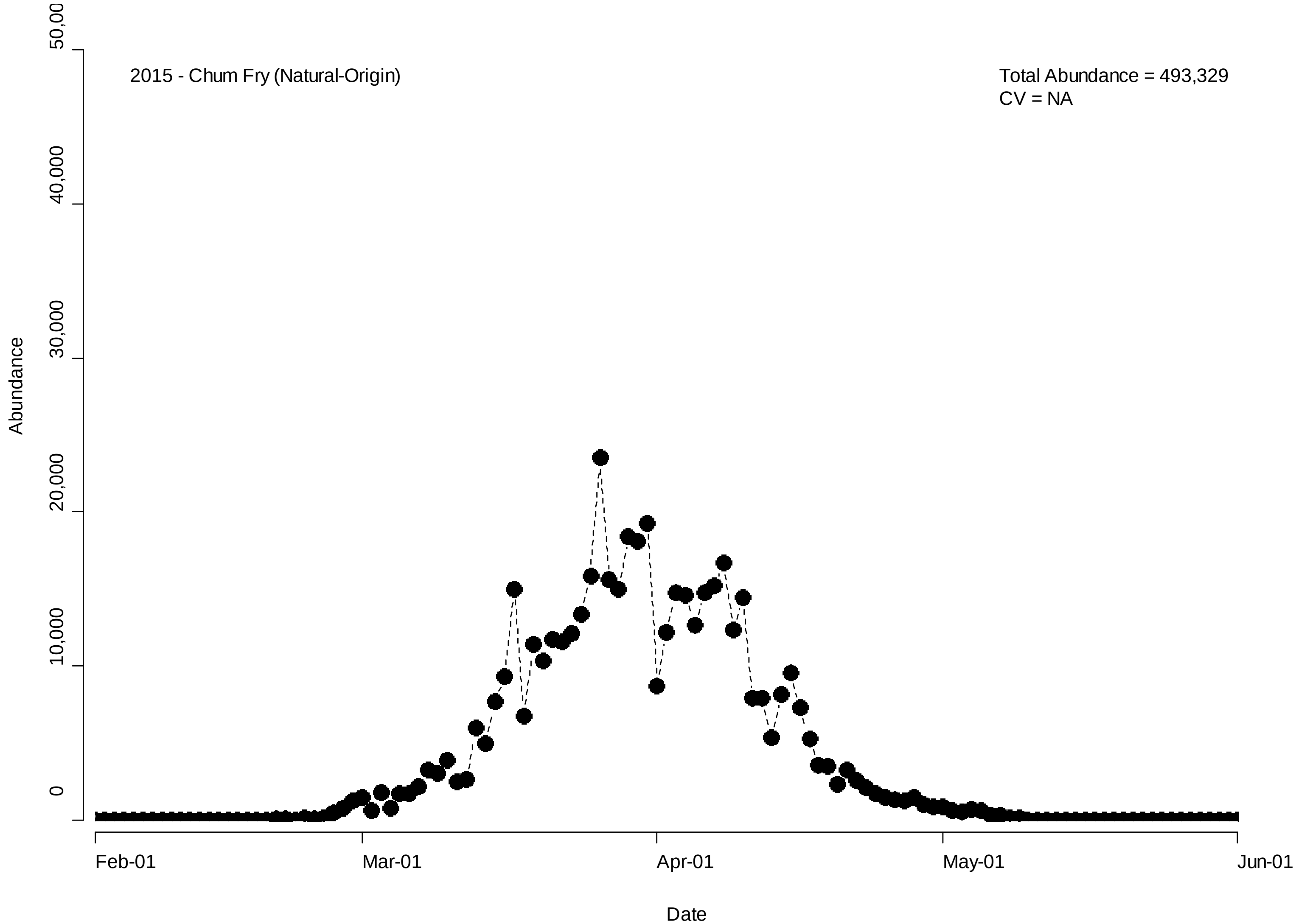

Figure E114. Estimated abundance by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) produced above the Hamilton Springs spawning channel weir in 2015.

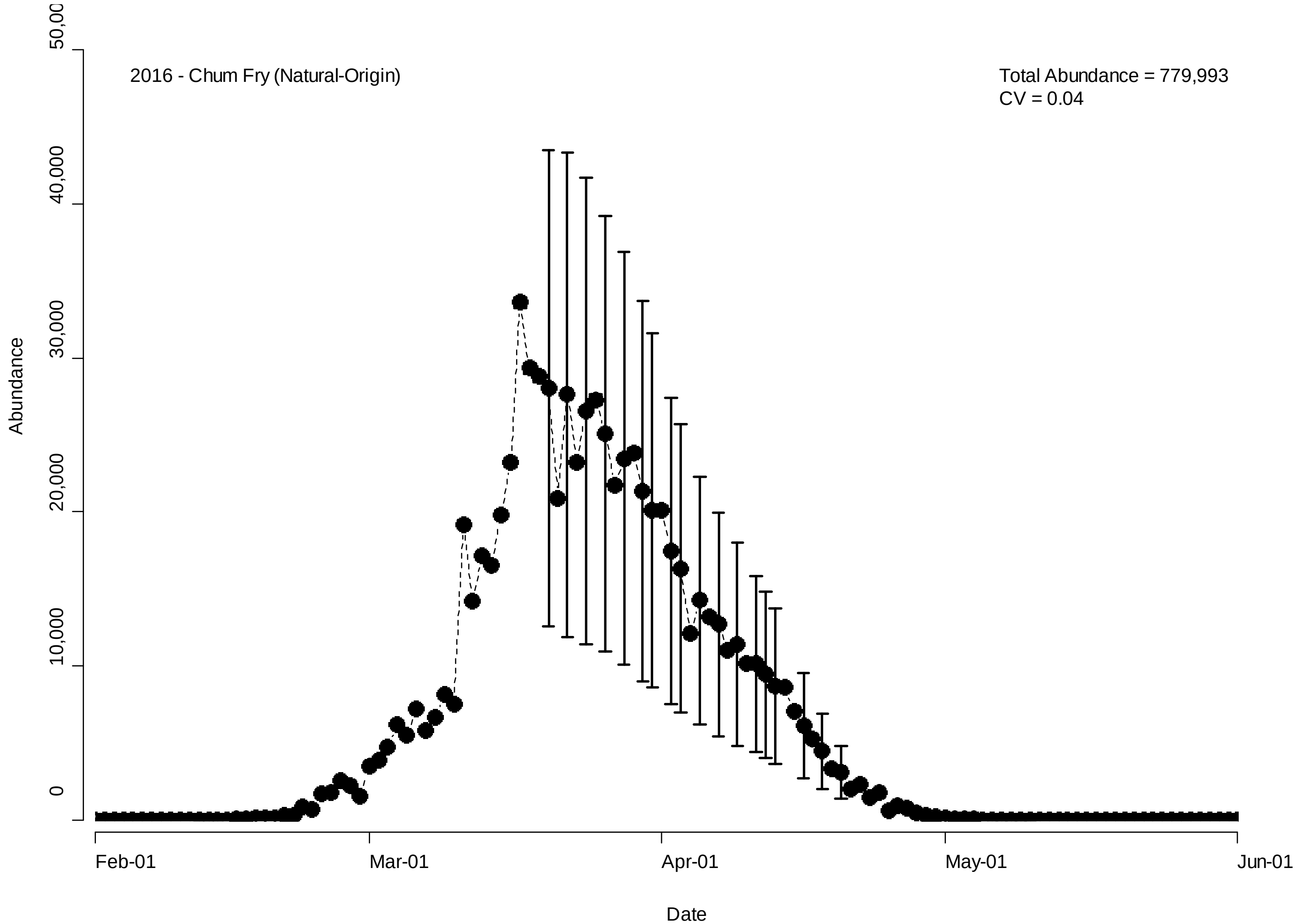

Figure E115. Estimated abundance (± 95% CI) by date for natural-origin chum salmon (life-stage = fry; age-class = sub-yearling) produced above the Hamilton Springs spawning channel weir in 2016. Note: all missed days in March and April were intentional under an alternate-day trapping schedule.