ERDC/EL TR-13-7

US Army Corps
of Engineers®
Engineer Research and
Development Center

Two-dimensional (2-D) Acoustic Fish Tracking at River Mile 85, Sacramento River, California

Philip T. Sandstrom, David L. Smith, and Brian Mulvey

June 2013

Environmental Laboratory

ERDC/EL TR-13-7
June 2013

Two-dimensional (2-D) Acoustic Fish Tracking at River Mile 85, Sacramento River, California

Philip T. Sandstrom

ENVIRON
2200 Powell Street, Suite 700
Emeryville, CA 94608

David L. Smith

Environmental Laboratory
U.S. Army Engineer Research and Development Center
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Brian Mulvey

U.S. Army Engineer District, Sacramento
1325 J Street
Sacramento, CA 95814-2922

Final report

Prepared for U.S. Army Corps of Engineers
Washington, DC 20314-1000

Abstract

Fish behavior in response to levee repairs at River Mile 85.6 of the Sacramento River was monitored using 60 VR2W 180-kHz and 45 VR2W 69-kHz receivers to create a large-scale, two-dimensional (2-D) positioning system. Research teams released 250 late-fall Chinook salmon smolts from Coleman National Fish Hatchery into the river near Knights Landing, California. Smolts were implanted with VEMCO V6 180-kHz acoustic tags. Other research teams released late-fall Chinook, steelhead trout, smallmouth bass, striped bass, green sturgeon, and white sturgeon tagged with 69.0-kHz equipment. A stretch of river that was approximately 750 × 90 m in size was monitored from 13 January 2011 until 5 March 2011. More than 7,000 2-D positions were calculated for 215 late-fall Chinook salmon released near the study site. The majority (88.8%) of smolts never came within 20 m of the levee repair site, and their tracks occurred in the channel or away from the levee repair site with individuals rapidly moving through the study site. The average transit time through the study site was 14 minutes 04 seconds. No significant difference was found in the migratory rates of smolts released at different locations ($p = 0.084$). There was a strong diel component to the movement of juvenile Chinook salmon smolts at the study site ($p < 0.01$). A significant difference was observed in the survival rate of the smolts when they were grouped by size (<130 mm = small; >130 mm = large), but not by release date. The levee repair site did not appear to have a positive influence on smolt recruitment. Many of the smolts that approached the repair site subsequently moved away from the area, and smolts detected within the levee repair area were not observed to have significantly longer transit times through the site than fish that were observed in the channel or on the opposite bank ($p = 0.54$). A small number of individuals exhibited a searching or foraging behavior, and several of these individuals had a higher degree of variation in their bearings.

Contents

Figures and Tables

Figures

Tables

Preface

This project was funded by the U.S. Army Engineer District, Sacramento and the U.S. Army Engineer Research and Development Center (ERDC), Vicksburg, MS.

This report was prepared by Philip T. Sandstrom, ENVIRON; Dr. David L. Smith, Water Quality and Contaminant Modeling Branch (WQCMB), Environmental Processes and Engineering Division (EPED), Environmental Laboratory (EL), ERDC; and Brian Mulvey, U.S. Army Engineer District, Sacramento.

The authors extend special thanks to Dale Webber, VEMCO, and the U.S. Army Corps of Engineers Bryte Yard team, led by Captain Mike Guidry.

This work was conducted under the general supervision of Dr. Dorothy Tillman, Chief, WQCMB; and Warren Lorentz, Chief, EPED. At the time of publication, Dr. Beth Fleming was Director of EL. COL Kevin J. Wilson was Commander of ERDC. Dr. Jeffery P. Holland was Director.

Unit Conversion Factors

Multiply	By	To Obtain
feet	0.3048	meters
inches	0.0254	meters
pounds (mass)	0.45359237	kilograms
tons (2,000 pounds, mass)	907.1847	kilograms

1 Introduction

Historically, the Sacramento River flowed from the mountains of northern California and meandered sinuously down into the Central Valley on its way to meet with the San Joaquin River in the Delta. The river had broad riparian corridors and was free to break its banks and cover the floodplain and change channel position. This situation began to change in the mid-1800s when both Marysville and Sacramento were flooded and the government committed to constructing levees. In subsequent years levees were increased in size and extent, and the river was dammed for flood control (James and Singer 2008). Keswick Dam was constructed for flood control purposes and further augmentation of the flow regime of the Sacramento River. In the Delta, numerous small pumps for agricultural purposes came on line while the construction of two major pumping facilities in the south Delta were also being completed. These and other heavy alterations to the Sacramento Watershed are often highlighted as the cause for the decline in fish populations. However, it is difficult to find detailed explanations of how they cause this decline.

California Department of Water Resources (DWR) and the U.S. Army Corps of Engineers (USACE) have been engaged in levee repair focused on preventing levee erosion and flooding. The recent Biological Opinions (BO) from the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) required fish monitoring and assessment in relation to levee repair and constructed habitat features for at least 10 years (National Oceanic and Atmospheric Administration (NOAA) 2006, 2007; USFWS 2006, 2007). The Biological Opinions require a systematic evaluation of different types of levee features that were deemed likely to be beneficial to special status species of fish. Based on these evaluations, recent repairs have included features such as benches and the installation of large woody material in the banks to emulate more natural riverbank features.

A Standardized Assessment Methodology (SAM) was developed in order to have a standardized predictive modeling and tracking tool for systematically assessing the response patterns of threatened and endangered species to the habitat features incorporated into the levee repair sites. The SAM is a numeric predictive model used to evaluate a suite of physical, biological

and hydrological features of a repair site. It is designed to be adaptive and modifiable as information of the effects of the repair features on fish become known (USACE 2004). Levee repair and constructed habitat features included (1) protection of the toe and upper slopes of the bank with riprap and or riprap mixed with soil; (2) installation of a berm or bench to provide habitat during higher river stages in the winter and spring; (3) placement of in-stream woody material (IWM) for aquatic structures and as a hydraulic refuge; and (4) planting of living cuttings, grasses, and plants to stabilize the bank and provide riparian and shaded aquatic habitat. The objective of the required monitoring was to evaluate these features and determine if the habitat features constructed by the Sacramento River Bank Protection Project (SRBPP) were enhancing habitat values and offsetting any adverse bank protection effects.

While there is uncertainty regarding the impact of vegetation on levees, there is less confusion on its impact as fish habitat. Trees and large woody vegetation have been shown to provide essential habitat for many salmonids (Beechie et al. 2005; Lehtinen et al. 1997). Newly added instream structures have been shown to be colonized by Chinook fry at a high rate, with this rate increasing during the migratory period. Instream structure was also documented to recruit juvenile rainbow trout (Slaney et al. 1994). Woody debris also gives invertebrates substrate or habitat and serves as an important source of forage for salmon smolts (Benke and Wallace 2003).

In the 2009-2010 winter, five arrays of VR2W 69-kHz receivers were installed in the river adjacent to levee repair sites and natural areas. This initial effort at 2-D tracking indicated the need to modify the array from four receivers over a broad area to many receivers in a smaller area in order to develop tracks of fish movement during high water river conditions. Additionally, the transmission interval or the fish tags need to be shortened and the mooring system needs to be substantially more robust. The results and lessons learned are described in Appendix A.

The 2010-2011 study focused on a single levee repair site in the lower Sacramento River at River Mile (RM) 85. The objective of the project was to examine the effect of levee augmentation on juvenile Chinook behavior and survival through the use of presence/absence data and 2-D positions of smolts as they migrated through the study site. The 2-D data will be used for the Eularian-Lagrangian-Agent Method (ELAM), a hydrologic modeling approach to predicting fish behavior.

2 Methods and Materials

Locations

The movements of juvenile Chinook salmon smolts were monitored through a small stretch of the Sacramento River where a levee repair site was located on the outside of a river bend. The site was located at RM 85, just south of Knights Landing, California. The study area was approximately 1 km in length, and extended from the bend just upstream to the downstream bend beyond the repaired levee (38.766691, -121.692430). This levee repair site was selected to be monitored since a smaller scale VR2W Positioning System (VPS) was successfully run at this site during the previous year. The results of the 2009-2010 study indicated this site was preferable to other sites because all receivers were likely to be recovered rather than being lost due to sediment dunes, large woody material floating downstream, and vandalism. The RM 85 site was a relatively mature repair site that included large woody material installed into the banks and natural brush and trees along the bank just upstream and downstream of the repair.

The RM 85 site banks are covered with angular rock riprap along both sides. Typical riprap stone is on the order of 1–2 ft in diameter. The west side of the river has a slope with tree trunks inserted into the riprap-covered bank and secured with cables and chain (Figure 1). For most of the year, the large woody material is out of the water. During high storm water flows, the woody material is completely submerged. The average water surface elevation during the summer to fall months is 14.8 ft, and during the winter it is 22.3 ft. The bottom of the river is soft sediment composed of mud and fine sand. In the winter months the water is very turbid with suspended sediment consisting of clay, silt, and fine sands.

A habitat assessment was conducted on RM 85 in 1999 well before levee repairs were initiated. The site was considered “good” based on the large amount of shade and downed trees on the river bank. The California Department of Water Resources (CDWR) provided the following information on the levee repair for RM 85.6.[1] The repair work started on

[1] Personal Communication. 2011. William O’Leary, California Department of Water Resources, Sacramento, CA.

Figure 1. Levee repair site during the restoration (left) and post restoration (right).

28 June 2006 and was completed a year later on 31 July 2007. The repair section is 1,355 ft long. The bank slope is 2:1. The floodplain inundation ratio is 1.28. Plants were first established in June 2007 and plant maintenance continued from 2008–2009. The planted material was relatively high on the levee banks but was completely covered during the study period of January and February 2011.

Construction at RM 85 included adding 31,500 tons of earth fill plus 5,000 tons of agricultural soil and bedding and 22,000 tons of rock. There were 100 pieces of in-stream woody materials consisting of tree trunks and large branches. This levee repair included 50,000 tons of material, which projected into the river channel. The addition of this material narrowed the channel and created a scour feature along the toe of the repair site.

VPS array

Forty-five VR2W 69-kHz and 60 VR2W 180-kHz VEMCO® receivers were used to create a large-scale VPS system (Figure 2). Receivers were mounted approximately 1 m off the river bottom on large, rigid mooring made of 1-in. rebar weighing more than 100 lb (Figure 3). Five of the moorings were fitted with tilt sensors to determine whether the stands remained upright for the duration of the study (Figure 4). A VPS system allows positioning of fish through triangulation and requires simultaneous detection of a tag transmission at a minimum of three receivers. The accuracy of the position calculated is highly dependent on the geometry of the three receivers that detected the tag simultaneously. VEMCO 180-kHz and 69-kHz timing synchronization transmitters were installed on approximately half of the

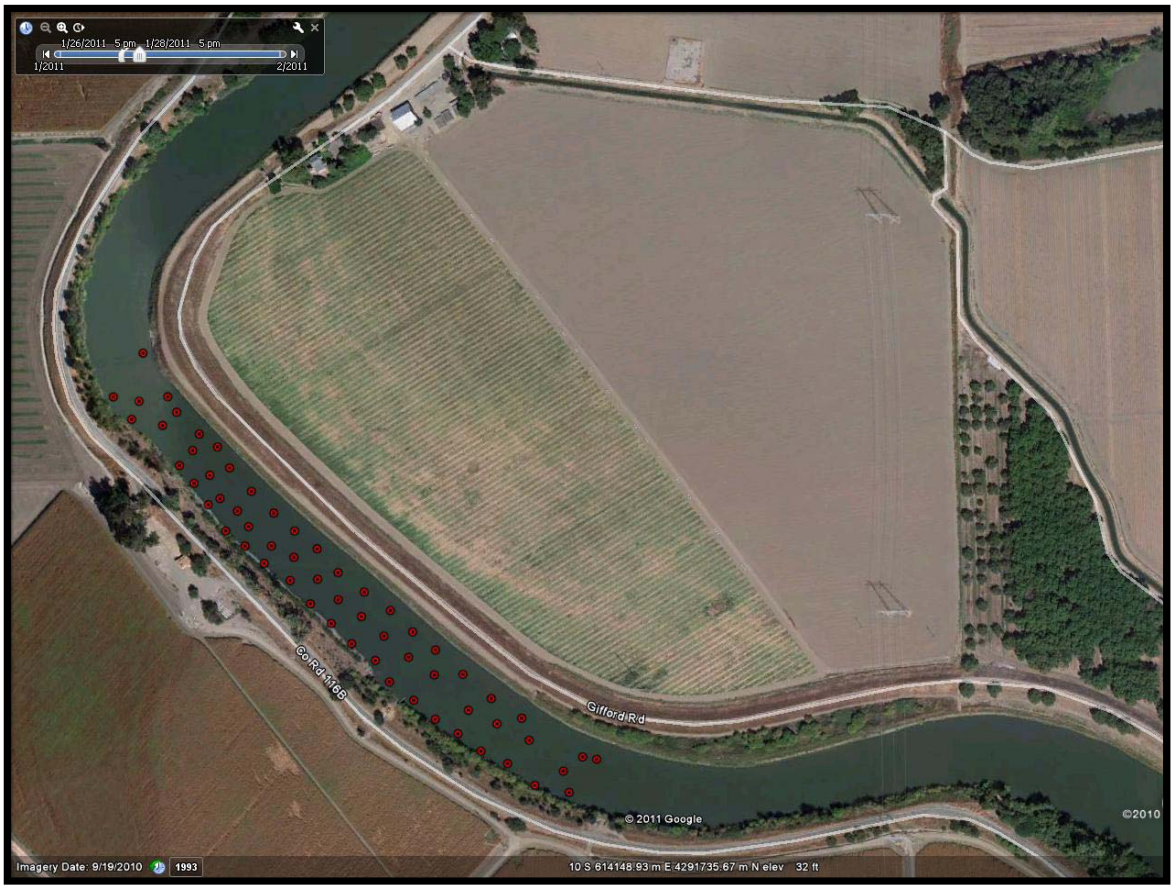

Figure 2. Receiver sites (red circles) at the levee repair site. Sixty 180-kHz receivers were deployed and forty-five 69-kHz receivers were deployed.

mooring stands to assure that the internal clocks on the receivers were precisely synchronized. The range of detection was established before the array was installed. An optimum range on the order of 30–40 m for the high flow winter conditions was established for the 180-kHz receivers.[1]

The array covered the width of the river and stretched from approximately 125 m above the levee repair site to 250 m below the levee repair site. Receivers were spaced no more than 60 m apart to maximize the number of simultaneous positions while minimizing the calculated position error. A subset of receivers were retrieved part way through the study to verify functionality of the array under the current river conditions and release strategy.

[1] Personal Communications. 2011. Matt Holland, Sales Representative, VEMCO, Halifax, Nova Scotia.

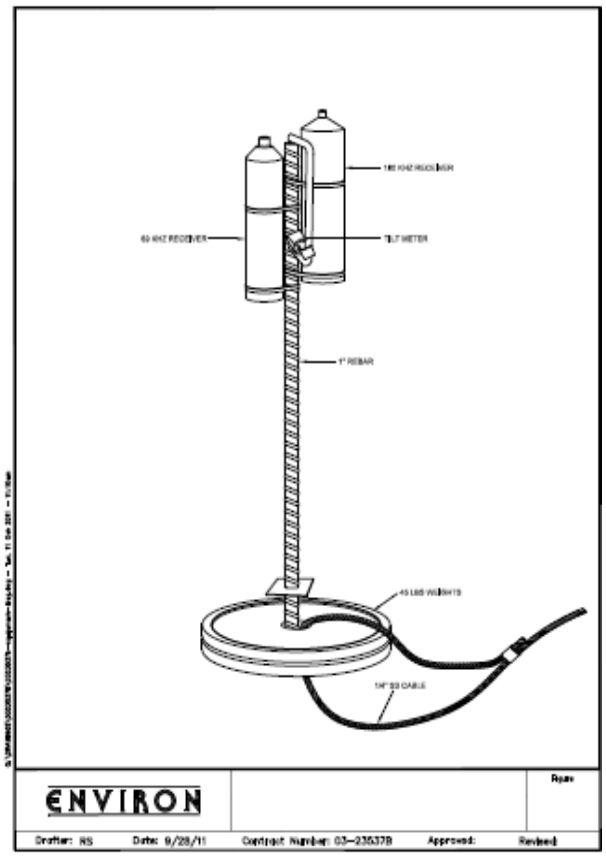

Figure 3. Mooring design.

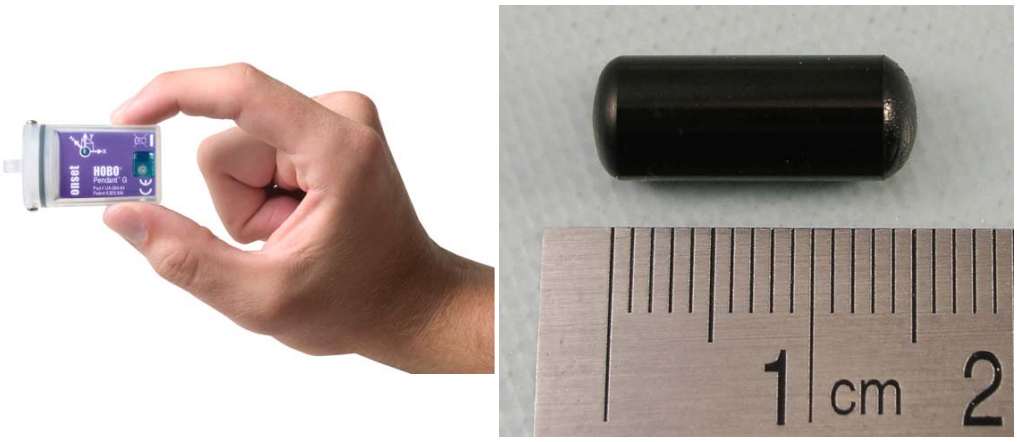

Figure 4. (Left) Pendant tilt sensor used to document the orientation of receivers throughout the study. (Right) VEMCO V6 (length: 15 mm, diameter: 6 mm, weight: 1.0 g) acoustic tag implanted into all 180-kHz smolts.

Additional acoustic monitoring

Additional receivers were deployed throughout the watershed to further monitor movement and survival rates of fish outside of the dual-frequency VPS system deployed at the RM 85 repair site. The California Fish Tracking Consortium deployed and maintained more than 300 receivers in the watershed to monitor movement and survival of various fish species implanted with 69-kHz tags (Figure 5). The majority of these other monitoring systems consisted of single receivers or curtains of receivers that detect the presence of a fish in the radius of transmission/detection for that receiver but not the position of the fish relative to the riverbanks.

A pilot small-scale, dual-frequency VPS was set up at Georgiana Slough to determine if an array could function in the area. This VPS system also acted as an acoustic gate with a high detection probability (Figure 6). This small system gave an additional downstream point of detection, which allowed calculation of average movement rates and survival between locations in addition to calculating movement rates within the levee repair site. This array also gave the study a shared end point for 69-kHz and 180-kHz tagged fish. The GPS of all 180-kHz receivers can be found in Appendices B and C.

Fish

All Chinook salmon smolts were from Coleman National Fish Hatchery. Fish ranged in size from 100–190 mm forklength (FL) (Table 1) (Appendix D). Smolts were implanted with VEMCO V6 acoustic tags, which were 16.5 mm in length, 6.3 mm in diameter, and weighed 1.0 g (Figure 4). A tag burden of 9% of a smolt's body weight was never exceeded (Figure 7). Smolts were anesthetized with a 50-mg/L dosage of MS-222. Once fish were fully anesthetized, they were removed from the knock-out concentration, weighed, measured, scored for condition (scales, fins, and eyes), and placed in a small surgical cradle made of microcell foam where a lighter concentration of MS-222, 15 mg/L, was run over their gills to keep the fish anesthetized during the surgical procedure. A small incision was made, approximately 10 mm in length just off the ventral line. Next the tag was inserted into the fish vertically and positioned horizontally once inside the peritoneal cavity. The incision was closed with two simple interrupted sutures using 19 mm (FS-2) reverse cutting, and a 3/8 circle needle with 5/0 or monofilament suture material.

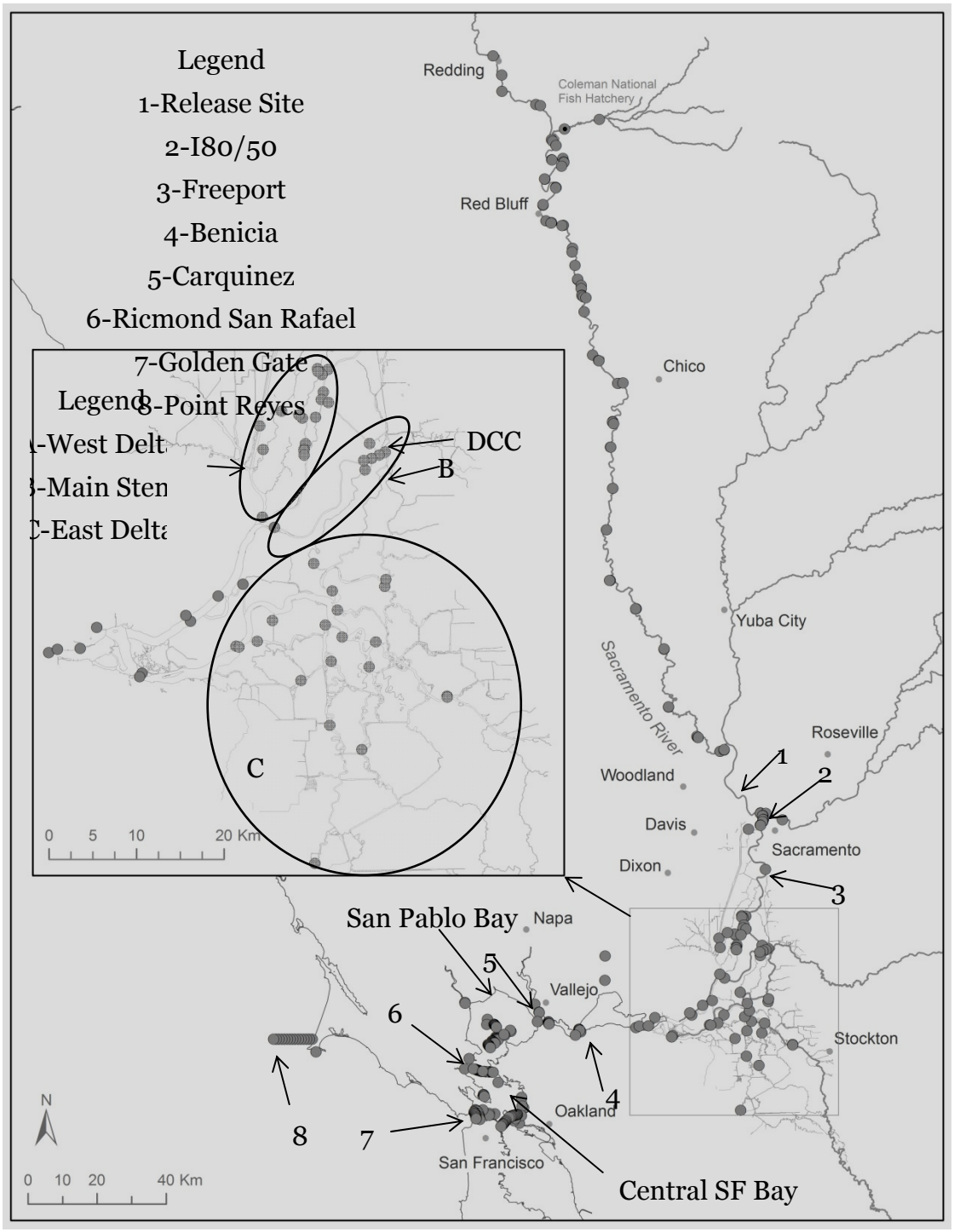

Figure 5. Map of the entire study area for 69-kHz array from Singer et al. (2011).

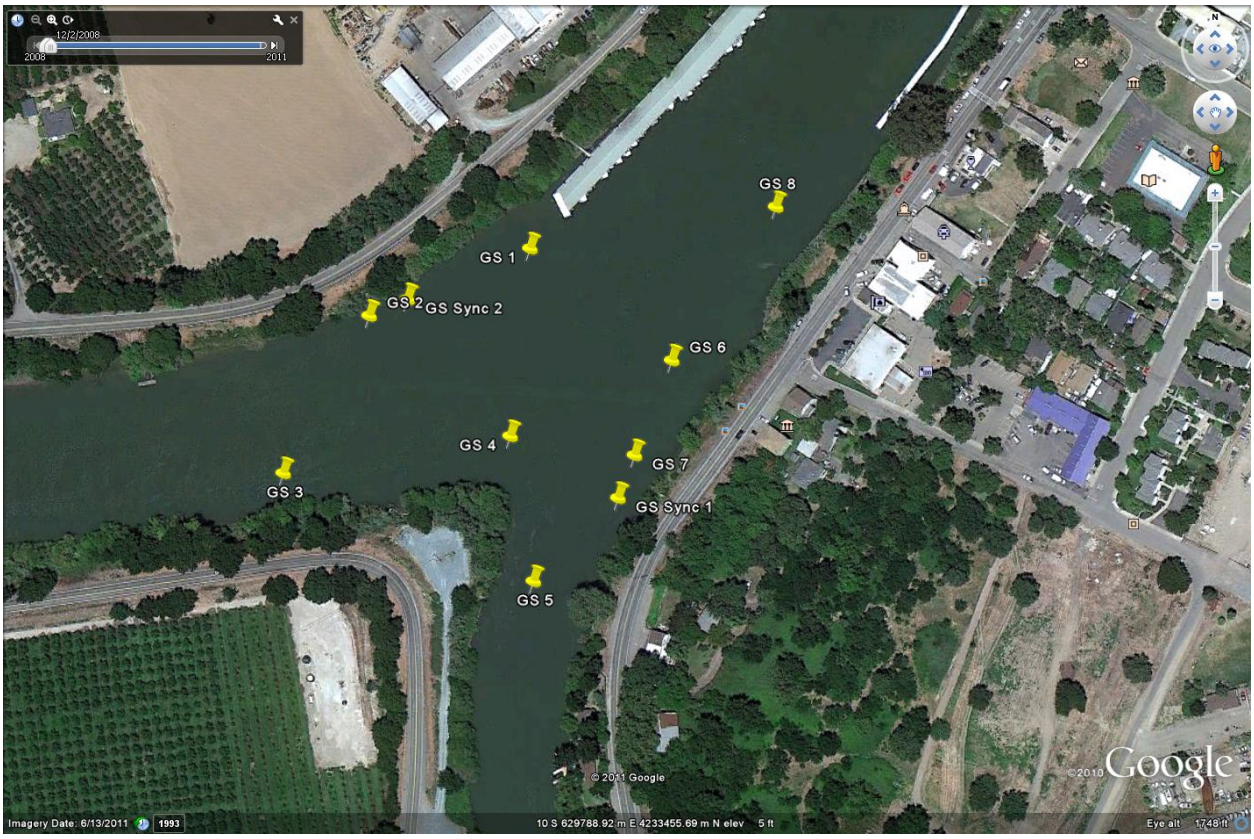

Figure 6. Map of the Georgiana Slough VPS array in its original deployment design. The yellow pins marked GS XX indicate where 180- and 69-kHz receivers were deployed in tandem. GS Sync XX mark the positions of the sync tags used for the array (GS 8 was deployed with only a 180-kHz receiver).

Table 1. Average forklength, weight, tag burden, and surgical times of tagged 180-kHz smolts by release date. Ranges of each category are reported in parentheses.

Release Group	Forklength (mm)	Weight (g)	Tag Burden (% body Weight)	Surgical Time (mm:ss)
February	125 (100-190)	23.86 (11.50-70.90)	5.0 (1.5-8.7)	03:06 (01:55-07:25)
January	148 (105-180)	34.71 (13.90-60.40)	3.8 (1.7-7.2)	02:28 (01:38-04:00)

Tags had a 41-day operational life and were programmed to transmit a pulse train that codes for a unique ID, with an average of 10 seconds between transmissions. The transmission rate interval for tags was chosen to maximize the number of positions calculated for a smolt as they passed through the VPS array while minimizing collisions of pulse trains transmitted by other tagged smolts. These tags transmitted at a frequency of 180 kHz and were not detected by the 69-kHz array.

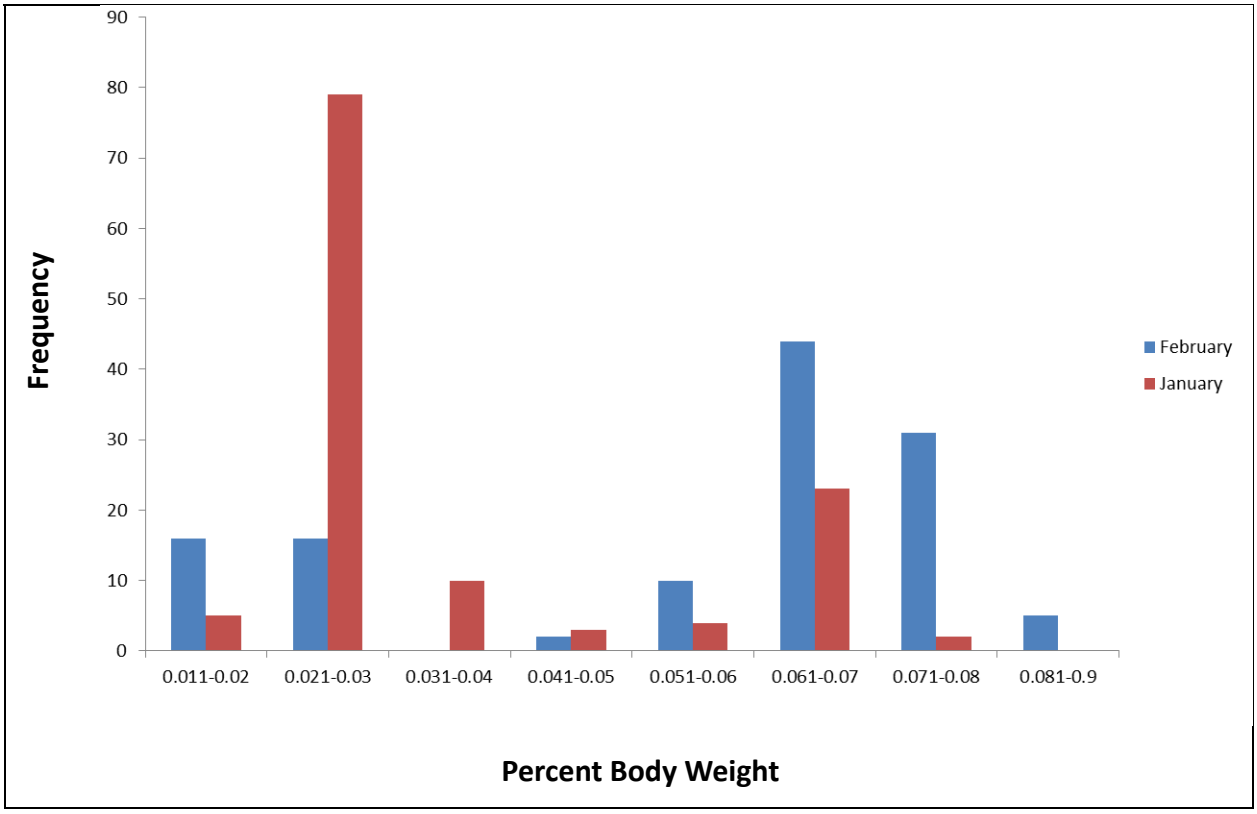

Figure 7. Frequency of the tag burden reported as percent body weight of the January and February release groups.

In addition to the smolts that were tagged with the 180-kHz gear, several other projects in the Sacramento River Basin released fish tagged with 69-kHz equipment into the system or had multi-year projects in operation. In December and January, 150 acoustically tagged juvenile steelhead were released by UC Davis to continue monitoring movement and survival in the Sacramento River.[1] Three releases of 120 acoustically tagged juvenile Chinook salmon occurred during the study period (Appendix E). In the spring preceding the VPS study, 100 striped bass were released. Since 2004 the Biotelemetry Laboratory has tagged a total of 417 green sturgeon, and a total of 165 white sturgeon have been tagged since 2010.[2] The dual-frequency VPS system allows users to gather information on multiple species. While the 69-kHz tags do not transmit as rapidly as the 180-kHz gear, it is still possible to get a smaller number of positions on individuals as well as calculating transit times through the study site.

[1] Unpublished Data. Philip T. Sandstrom et al., ENVIRON, 2200 Powell St., Suite 700, Emeryville, CA 94608.

[2] Personal Communication. 2011. Michael Thomas, Staff Scientist, University of California at Davis.

Fish release

Fish were released during two time periods to verify the functionality of the VPS array as well as monitor fish movement and behavior under different environmental conditions. The first release occurred on 13 January 2011. Smolts were released at one of three locations to see if release proximity to the study site had an effect on behavior. All smolts were released at night in small groups to reduce chances of predation and of tag transmission collision issues. Smolts were divided into three groups and released at Knights Landing, Millers Landing, and finally the uppermost site, Riverside. The second release occurred on 25 February 2011. All fish were released at the same location approximately 1 mile above the study site. Fish were released in groups of 10 smolts at a time.

Data analysis

A significance level of 0.05 was defined. Model selection was based on corrected Akaike Information Criteria (AICc) and likelihood. Smolts were separated into groups in two ways. First they were classified by size: any individual less than 130 mm in forklength (FL) was classified as "small," while all others were classified as "large." Individuals were also separated based on the date of release (Figure 8). Grouping individuals based on the date of release is essentially the same as grouping them by flow, as the majority of individuals moved through the study site shortly after release.

Survival

All survival analyses were completed in Program MARK. Four sites spaced out over approximately 95 river kilometers (RKM) were used for the mark-recapture analysis of the 180-kHz smolts. An analysis of the survival rates of late-fall Chinook salmon smolts (LFC) tagged by the California Fish Tracking Consortium (CFTC) and released in the same stretch of the mainstem Sacramento River (RKM 517) was also completed for comparison.

Movement rates

The movement rates of smolts over the 95-RKM stretch of river (in river) were calculated in addition to individual movement rates at the study site (localized). The localized movement rates were calculated between successive points in the tracks of individuals. In-river movement rates were calculated between subsequent receivers. In some instances it was not possible to calculate the movement rate of smolts between two receivers

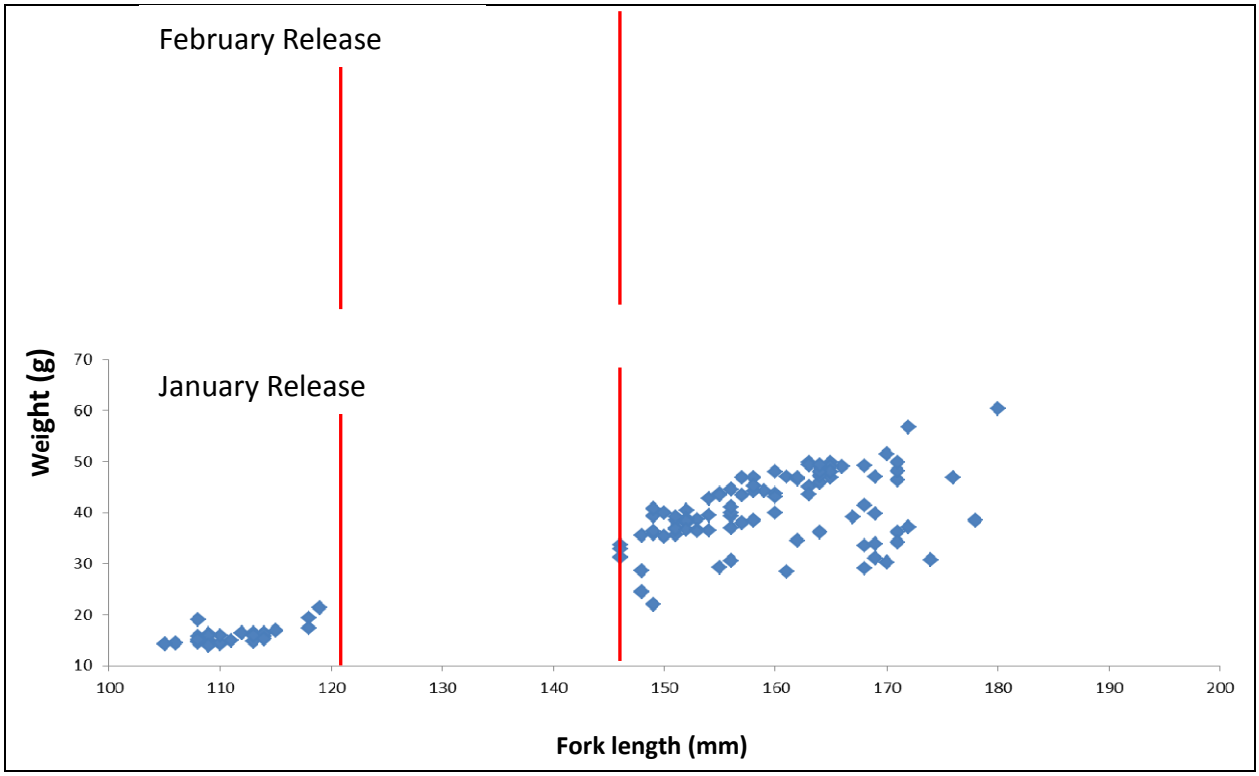

Figure 8. Weight/forklength distribution of tagged smolts for February and January. Smolts less than 130 mm FL were classified as "small," while those greater than 130 mm were classified as "large."

because they passed a location without being detected until the next downstream receiver, or they were not detected again after passing an upstream receiver. The average rate of localized movement was compared to the average in-river movement rate using a Chi-square test.

Behavior

The angle of orientation was calculated between successive points as smolts moved through the levee site. This was used as an indicator of behavioral activity. Increased variation in bearing angle would suggest greater foraging/search/meander/predator avoidance behavior. The behavior of the smolt at the levee site was also examined as an indicator of future behavior as the smolt migrated downstream. This analysis was completed by testing for a difference in the average localized movement rate to that of the in-river movement rate for each individual. A kernel density analysis was conducted for smolts observed to come into contact with the levee repair site, within 20 m, and those that do not come into contact with the levee repair site.

The movements of the smolts were also examined considering their position in the river. The study site was separated into smaller areas in two different ways: (1) the river was divided into two vertical lanes, river left and river right, while dividing the river into four approximately equal horizontal segments (above the levee repair, upper section of levee repair, lower section of levee repair, and below the levee repair site); and (2) the river was parsed into three lanes vertically, river left, center, and river right while dividing the river horizontally in the same manner as mentioned previously. Calculations included the total number of positions in each cell, the average number of positions per individual, and several other summary statistics (movement rates, bearings, time of day) for individuals passing through the cell. These data were also utilized to examine the effect of starting position on route selection through the study reach. ANOVAs were used to test for differences in counts or rates observed in each cell.

Movements within the VPS array and the river were also examined for diel patterns. The total transit time of individuals passing through the VPS was calculated for each individual and then transit times of individuals detected during the day were compared to those detected during the night. Night was defined as 17:00 to 7:00. Time of first detection was plotted against transit time.

Cross-channel distribution

The river was split into three vertical lanes divided horizontally at five locations. The number of individuals detected in each cell were counted and used to create a view of the cross-channel distribution as fish moved through the study site. The number of smolts and calculated positions were tallied for each cell. The movement rates of smolts within the cell were then averaged and the proportion of smolts detected in the cell was calculated by using the total number of smolts detected in the west bank, channel, and east bank vertical lanes. The proportion of positions in a given cell was calculated in the same manner.

Other species

Numerous other species of fish such as steelhead trout, green sturgeon, white sturgeon, striped bass, and smallmouth bass were detected and positioned by the 69-kHz array deployed in tandem with the 180-kHz

array. The movement patterns of these fish were examined in the same way as the smolts to compare the behaviors of multiple species.

3 Results

In January 2011, 103 smolts had at least one position calculated as they passed through the study site, and in February 2011, the number was 112. While approximately equal numbers of smolts were positioned during both time frames, far more positions were calculated for smolts released during February (5,553 positions) than in January (770 positions). Early retrieval of the subset of acoustic receivers verified functioning of equipment, but at a somewhat reduced capability relative to what was expected. Because of data observed on the acoustic receivers, the second release of juvenile salmon was delayed until flows subsided and a maximum flow threshold was set at 13,000 cfs, above which fish were not released (Figure 9).

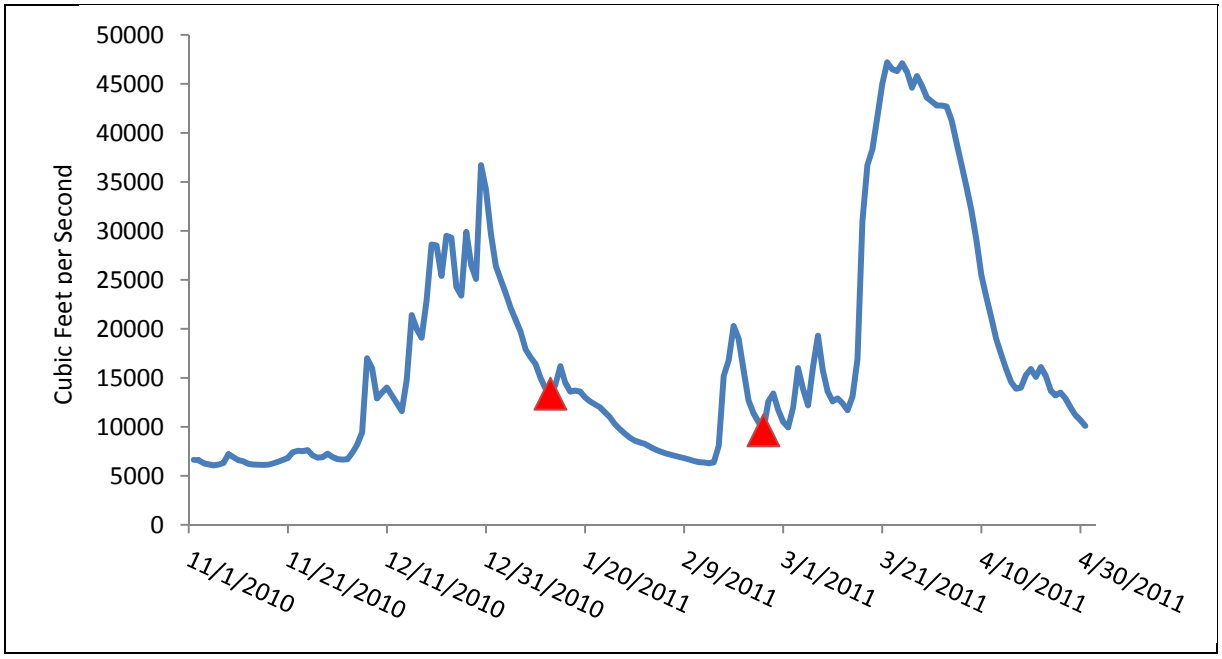

Figure 9. Flows at Colusa, CA, approximately 75 RKM upstream of the study site. The two red triangles represent the two releases of 124 and 126 smolts, respectively.

Far more positions (4,783) were calculated during the second release compared to the first release, even though similar numbers of fish were detected during both releases. The Onset pendant loggers deployed on the receiver moorings indicated that receivers were stationary and upright during the study. Stands may not have been perfectly level, but were relatively close with tilt values between 91.4 and 94.3 deg during the initial deployment (Figure 10).

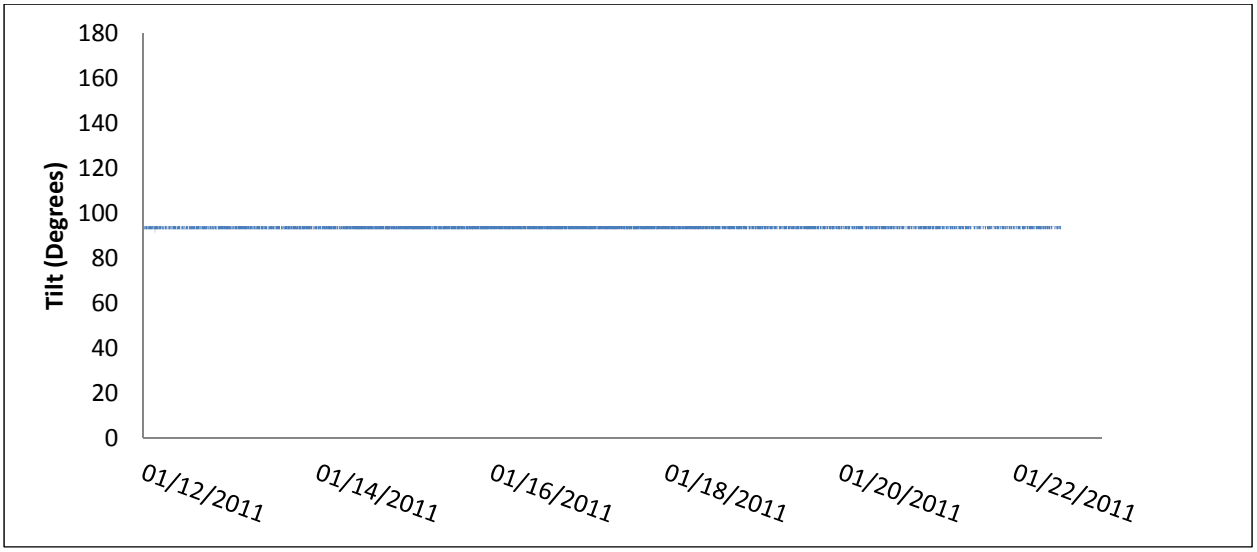

Figure 10. Onset pendant loggers were used to verify the functionality of the new mooring design. The tilt of the receiver in degrees is plotted over time during the initial portion of the study.

The release strategy adequately separated smolts, avoiding large amounts of tag transmission collisions. Releasing smolts at three locations appeared to create a greater spread in the timing of first arrival at RM 85 than the temporal spread utilized in February (Figure 11). Almost all of the smolts released in February arrived within a 7-hr time period during the night of their release, while first arrival times spanned more than two days when smolts were spread spatially and temporally (Figure 12). Furthermore, only two smolts in February had first arrival times during daytime hours.

Most smolts exhibited highly migratory behavior as they passed through the study site. Eighty-eight percent of smolts migrated directly through the study site, and they were not observed to come into contact with the levee repair site. Even smolts that contacted the levee repair site migrated through the study site in a rapid fashion with few exceptions.

Movement rates

In river

There was no statistical difference between the average movement rates of the large (31.63 km/d) and small (26.50 km/d) size classes of the tagged late-fall Chinook salmon smolts (t-test: t = -1.288, df = 85, p = 0.201) (Figure 13). There was also no statistical difference in the average movement rate of the smolts released in January (32 km/d) and those released in February (27 km/d)(t-test: t = 1.2313, df = 81, p = 0.222) (Figure 14).

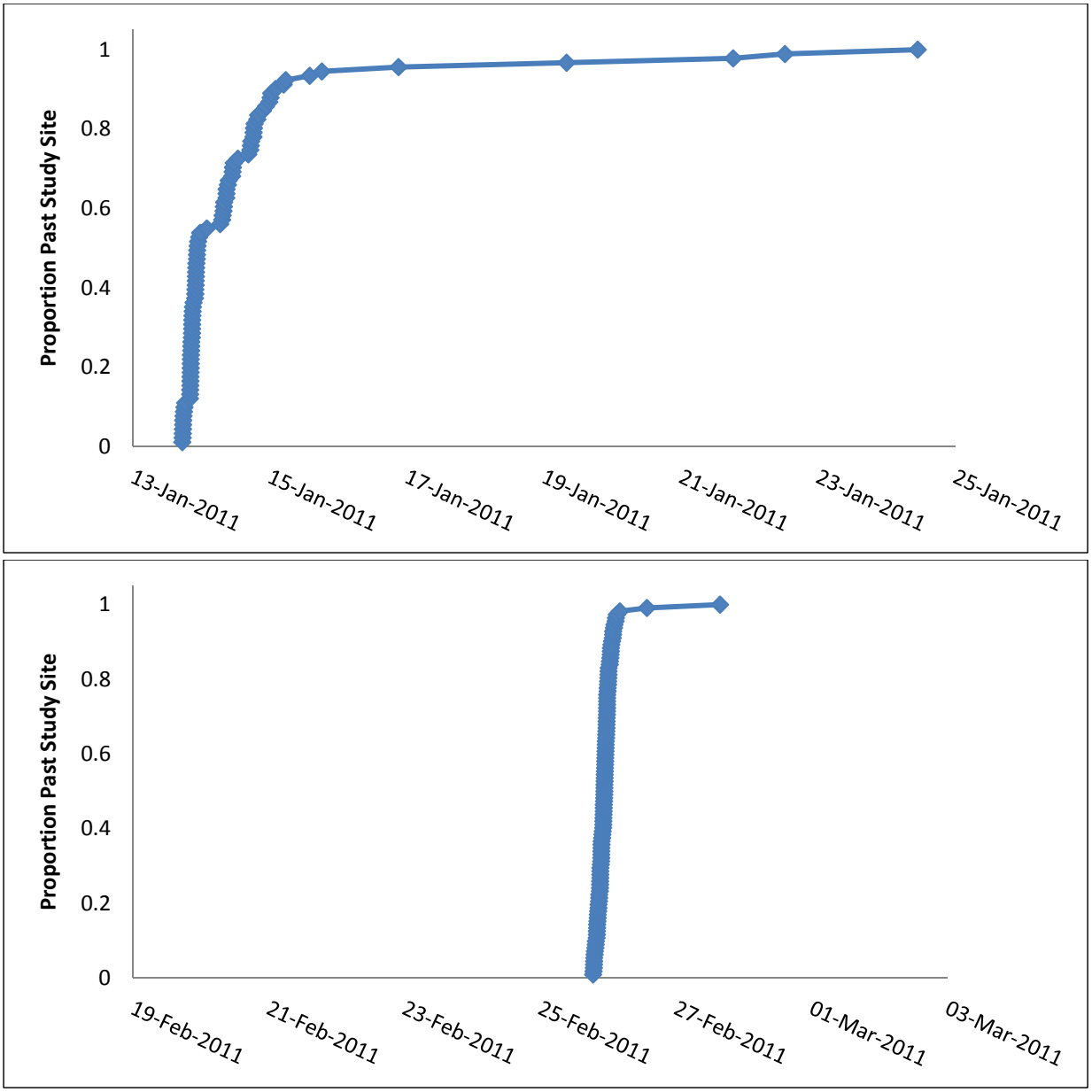

Figure 11. Proportion of smolts passing the study site by a given date.

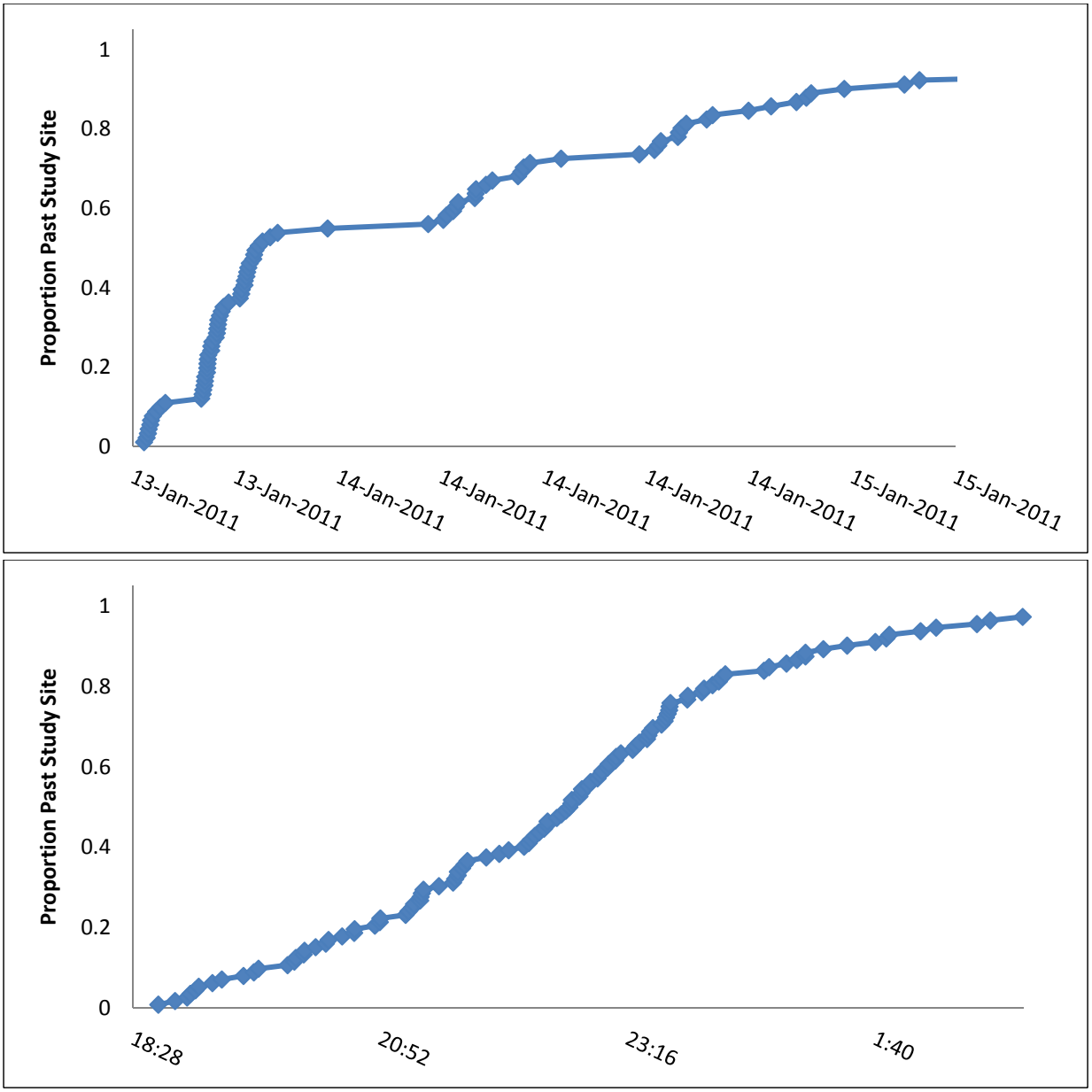

Figure 12. Proportion of smolts passing the study site by a given date and time (zoomed in from previous figure). All fish for the February group (bottom) were released from the same location. January smolts were released at one of three locations (top).

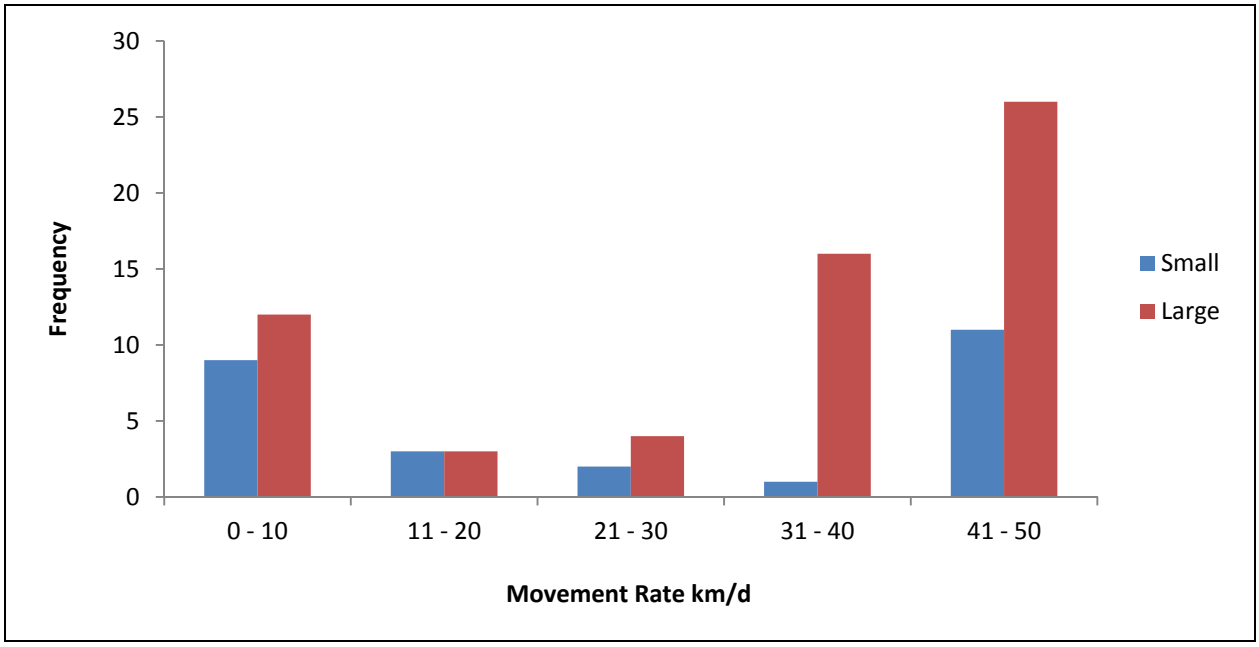

Figure 13. Frequency of smolts from a given group small (blue), large (red), exhibit an "in-river" migratory rate in km/d.

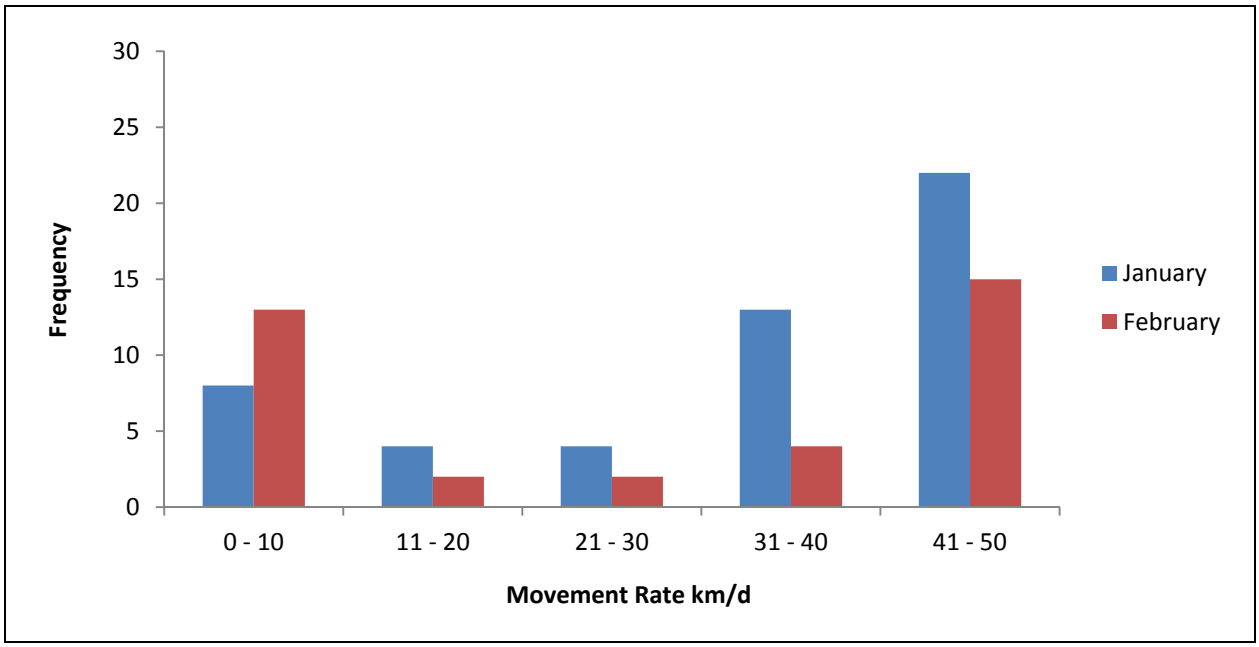

Figure 14. Frequency of "in-river" movement rates of smolts released in January (blue) and February (red).

The frequency distributions of movement rates in river appeared to be bimodal for smolts when classified by size or by release date. Movement rates tended to be relatively fast, 31–50 km/d, or slow, 0–10 km/d (Figures 13 and 14). When the in-river movement rates of February small smolts were compared to February large smolts, there was a significant difference (t-test: t = -1.68, df = 34, p = 0.05075). A difference was also observed in the in-river movement rates of small smolts by release date (t-test: t = 1.89, df = 24, p = 0.034).

Smolts were released at three separate locations in January. The average movement rates were 28.16 km/d, 27.30 km/d, and 37.63 km/d in descending order from the furthest upstream release site to the lowest, respectively. The purpose of releasing smolts at the three locations was to test for the effect of release location on behavior. No statistically significant difference was found between the movement rates of the smolts by location (ANOVA: F = 2.612, df = 2, p=0.084).

While not focused on in this report, the 69-kHz fish released from higher in the system were observed to have higher average movement rates (43 km/d (ANOVA: F = 3.72, df = 2, p = 0.0275)), and were not documented to use as much of the channel area as the 180-kHz fish released lower in the system.

Localized

The majority of movement rates calculated were <1 meter per second (m/s). While higher rates were observed, 2–3 m/s, far fewer of these rates were observed (Figure 15). The average movement rate of smolts positioned within the study site was 0.8015 m/s. There was a significant difference between the local movement rates of smolts released in January (0.844 m/s) compared to those released in February (0.732 m/s (t-test: t = 5.62, df = 6,029, p < 0.001)). However, small smolts were not observed to exhibit a significantly slower local movement rate than large smolts (t-test: t = -0.28, df = 6,091, p = 0.38). In fact, when the average movement rate of larger 69-kHz smolts (0.627 m/s) was slower than that of the 180-kHz smolts (t-test: t = 2.269, df = 6,135, p = 0.011). Travel times of the 180-kHz smolts through the study site were normally distributed with an average transit time of 14 minutes 30 seconds to navigate the reach (Figure 16). Four smolts with transit times greater than 2 hr were removed.

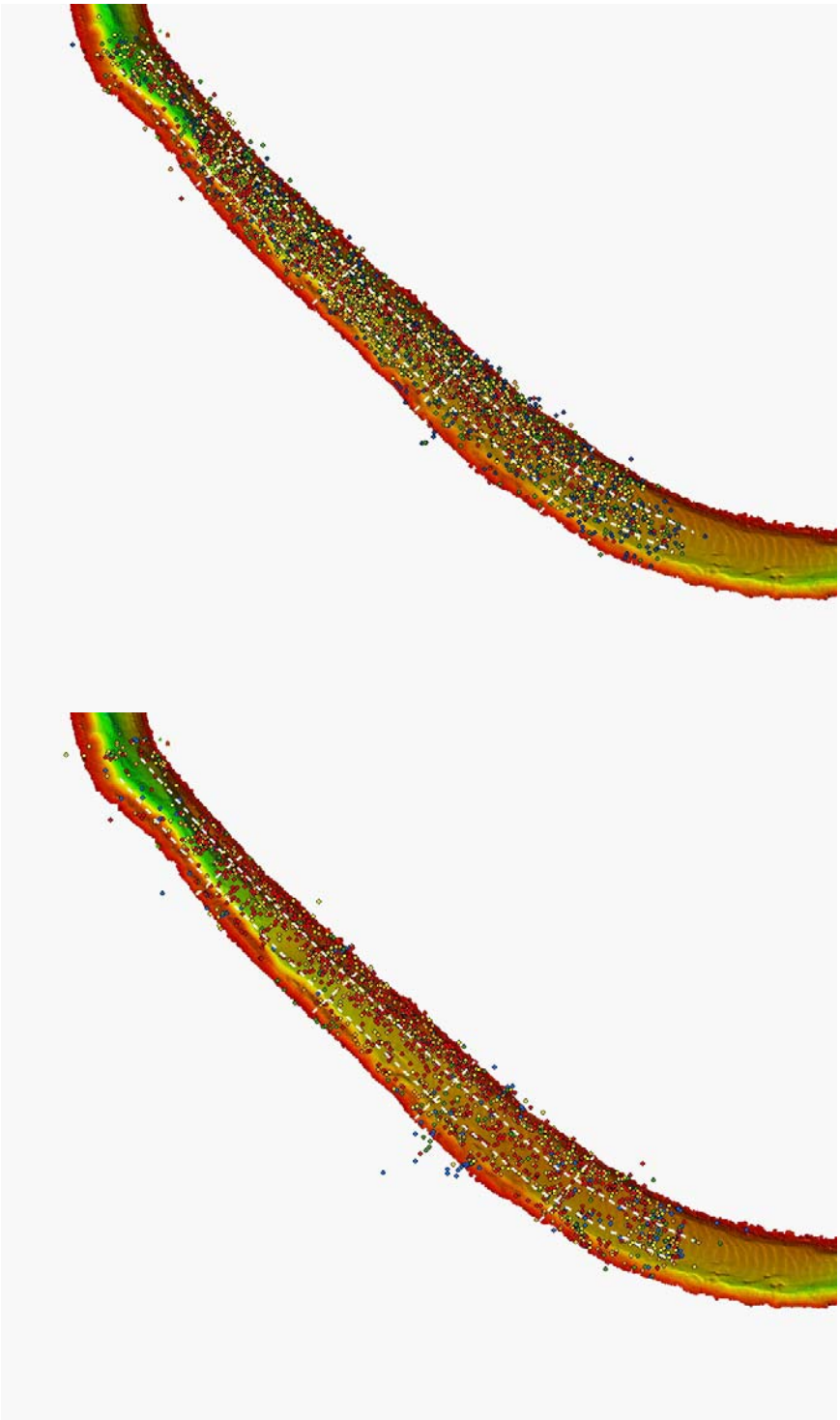

Figure 15. Movement rates <1 m/s of smolts positioned throughout the levee site. The figure on the top shows the position and corresponding movement rate (0.5 blue, 0.6 green, 0.7 yellow, 0.8 orange, and 0.9 red) while the figure on the bottom shows movement rates between 0 and 0.5 m/s (0 blue, 0.1 green, 0.2 yellow, 0.3 orange, and 0.4 red).

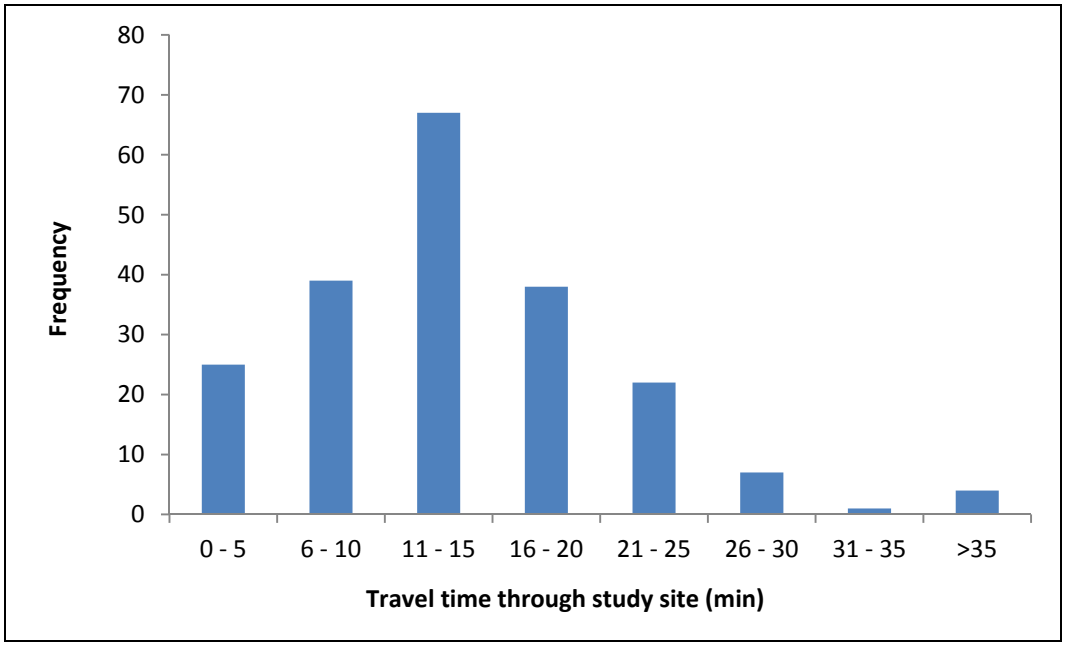

Figure 16. Frequency of travel times in minutes of all smolts through the study site. Smolts that took more than 35 minutes to pass through the study site took from 2:33:35 to 13:22:21.

Fewer smolts were detected within the levee repair site area or approaching the levee repair site than fish that passed by utilizing the main channel. Those smolts observed in close proximity (20 m) to the levee repair site at some point in their track had an average bearing of 142.87. The average movement rate of smolts within the area of the repair site was 0.795 m/s. Smolts rarely exceeded speeds of 1 m/s. Of all calculated movement rates near the levee repair site, 74% were ≤0.9 m/s. There was not a significant difference between the transit times of smolts near the levee site (0:15:25) versus non-levee site (0:14:31) fish (t-test: t = 0.61, df = 174, p = 0.27).

The average bearing of smolts that did not come into contact with the levee repair site was 139.02. Smolts utilizing the channel habitat rather than the repair site had a migratory rate (0.79 m/s) similar to the smolts positioned near the levee.

Behavior

Bearing

The majority of smolts, 68.9% of positioned individuals, exhibited high directionality. Of smolts with more than five bearings calculated, 91.4% were found to have a Rayleigh Test $p < 0.05$ (Appendix F). Even a proportion, 39.1%, of smolts positioned near the levee repair site in January

exhibited directional tracks (Rayleigh Test $p < 0.05$ considered directional). All smolts near the levee repair site in February were observed to have a directional track. While most smolts moved through the study site in a directed fashion, there were differences in the magnitude and how directed smolts were by release group (Figure 17). Smolts released in January (Average bearing: 135.65°) had higher variation in their bearings through the study site than smolts released in February (Average bearing: 131.40°), while the average bearing for small and large smolts were nearly identical (Table 2). All individual bearing data are reported in Appendix F.

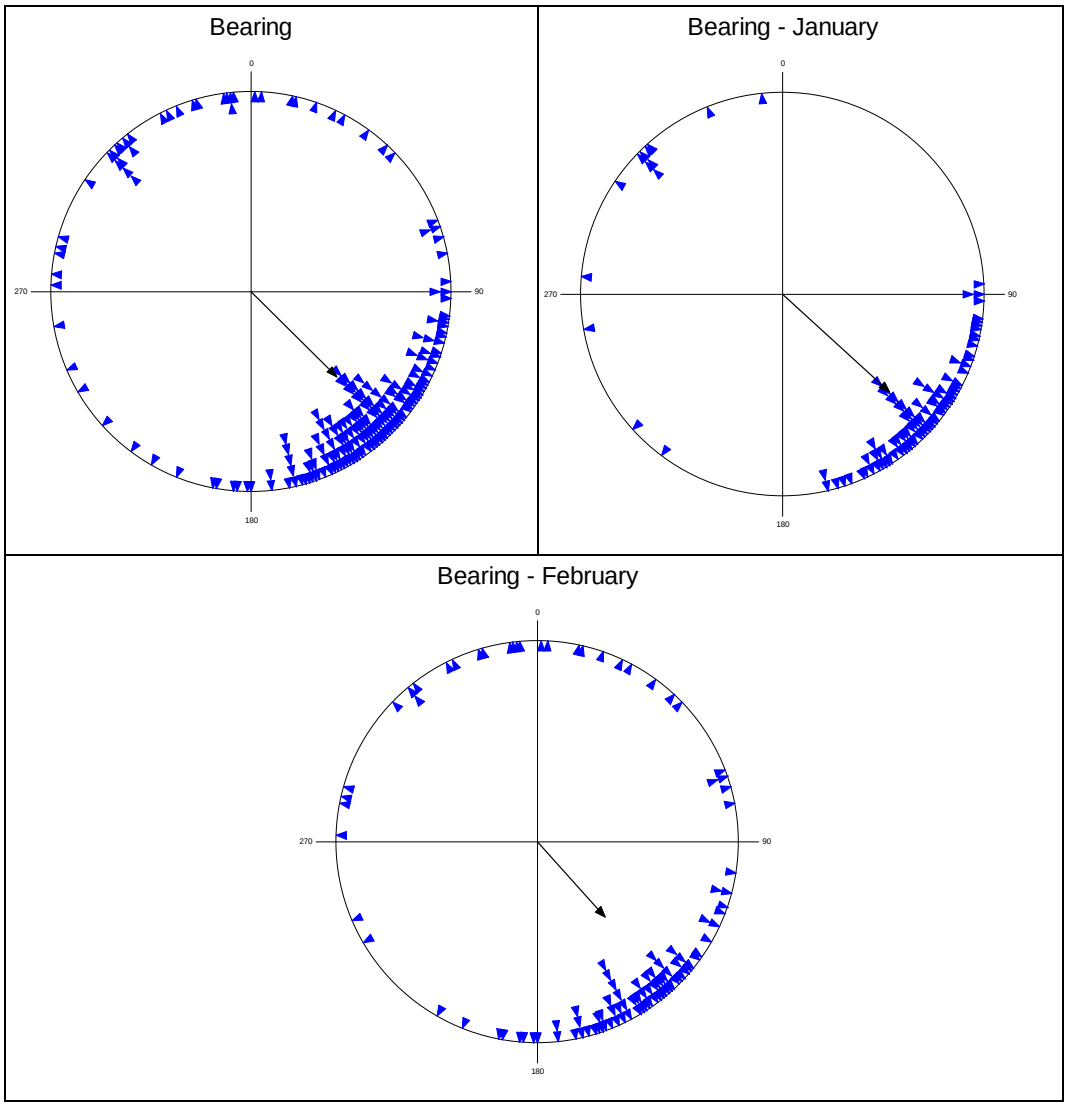

Figure 17. Bearings of smolts as they moved through the study site for all smolts, smolts released in January, and smolts released in February, respectively. The arrows represent a bearing vector for the given sample.

Table 2. Circular statistics for bearing and time by release group and size.

Population Summary Statistics	Time and Bearing							
Variable	Time	Time	Bearing	Bearing	Time	Time	Bearing	Bearing
Subgroup	Large	Small	Large	Small	January	February	January	February
Number of observations	1966	4357	1966	4356	770	5553	770	5552
Mean vector (μ)	8:28 PM	11:24 PM	132.449°	131.499°	6:27 PM	10:43 PM	135.65°	131.397°
Length of mean vector (r)	0.713	0.764	0.701	0.703	0.262	0.784	0.538	0.725
Concentration	2.091	2.487	2.01	2.027	0.544	2.685	1.278	2.174
Circular variance	0.287	0.236	0.299	0.297	0.738	0.216	0.462	0.275
Circular standard deviation	47.109°	42.011°	48.341°	48.076°	93.729°	39.931°	63.805°	45.912°
95% confidence interval (-/+) for μ	8:20 PM	11:19 PM	130.314°	130.073°	5:44 PM	10:38 PM	130.768°	130.197°
	8:37 PM	11:29 PM	134.584°	132.925°	7:10 PM	10:47 PM	140.531°	132.598°
99% confidence interval (-/+) for μ	8:17 PM	11:17 PM	129.643°	129.626°	5:31 PM	10:37 PM	129.235°	129.82°
	8:39 PM	11:30 PM	135.255°	133.372°	7:23 PM	10:48 PM	142.065°	132.975°
Rayleigh test (Z)	999.985	2545.048	964.797	2154.346	53.001	3416.54	222.797	2921.372
Rayleigh test (p)	0	0	0	0	0	0	0	0
Rao's spacing test (U)	259.758	229.938	227.384	218.816	254.471	223.441	228.422	222.493
Rao's spacing test (p)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Watson's U^2 test (Uniform, U^2)	63.761	146.67	62.508	134.147	4.876	189.977	18.167	180.11
Watson's U^2 test (p)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Kuiper's test (Uniform, V)	27.396	39.243	24.338	34.992	8.716	44.098	14.265	40.287
Kuiper's test (p)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Diel pattern

The majority (89.2%) of fish were first detected at night. Fish released in January had a larger range of first arrival times, with more individuals showing up during daytime hours than the February release group, albeit a relatively small proportion (Figure 18). Twenty-two (10.7%) smolts were detected at the study site during daytime hours (07:00–17:00). Seven of the 22 smolts observed moving through the study site during the day were positioned near the levee repair site. Five smolts were positioned near the levee in January and two smolts in February. Three of these individuals were detected for more than 2 hr (2:33:35, 3:05:12, 13:22:21). Three other individuals were positioned for less than 5 minutes (00:00:21, 00:00:34, 00:01:19). There was no significant difference in the movement rates of fish during the day (09:16) or night (14:47) within the study site (t-test: df = 172, t = -3.98, $p < 0.001$) (Table 2). Circular data for all individuals are presented in Appendix G.

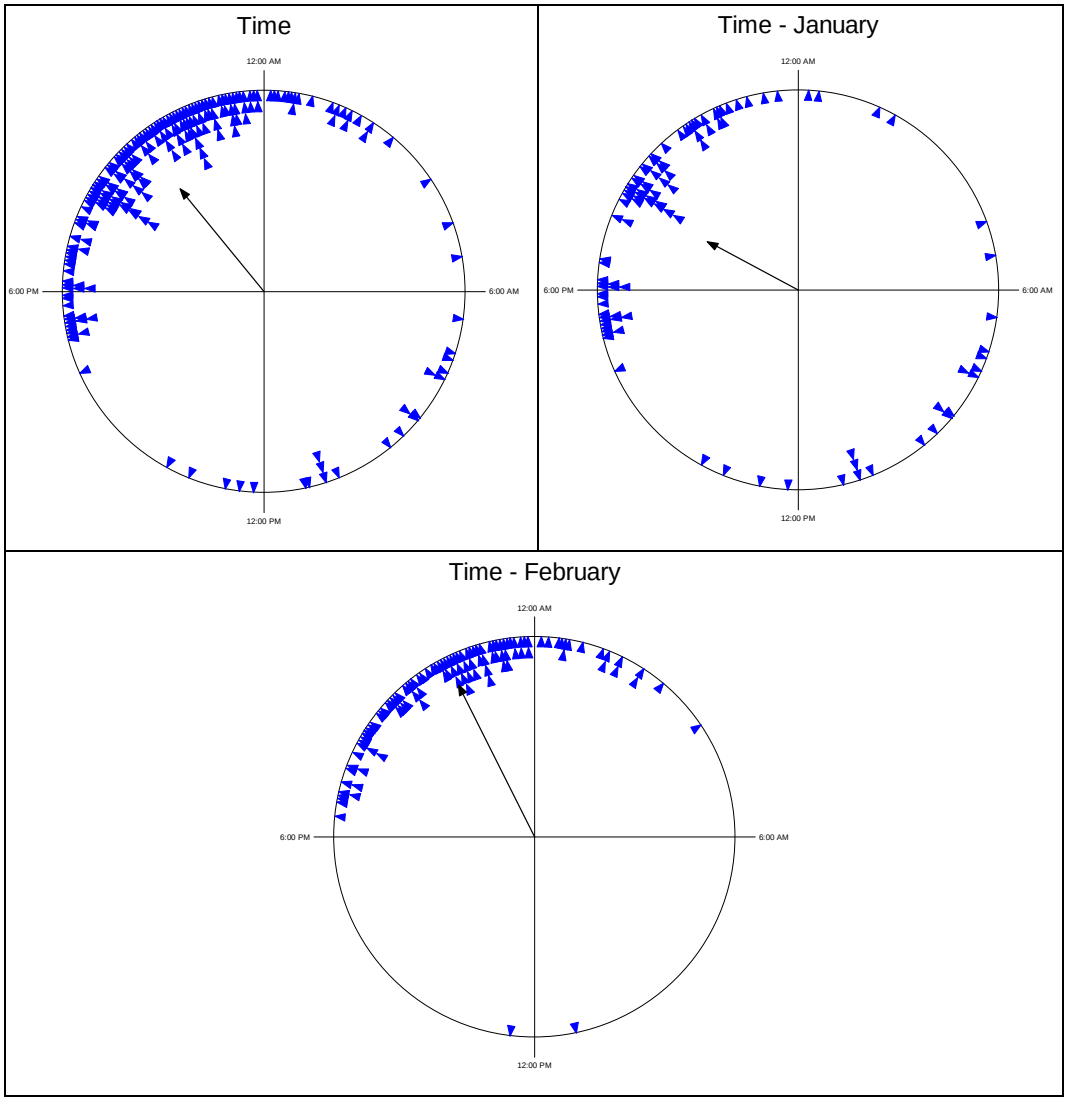

Figure 18. First arrival times at the study site for all smolts, smolts released in January, and smolts released in February, respectively. The arrows represent a time vector for the given sample.

Non-levee site

The majority of positioned smolts were not observed to utilize the levee repair site. Most were positioned in the main channel, occasionally moving closer in proximity to the eastern bank opposite of the levee repair site. The tracks of these individuals were highly directional.

Levee repair site

The fish that were observed using or near the levee repair site (14:31) moved through the site at rates similar to smolts positioned in the channel (15:25) (t-test: t = 0.61, df = 174, p = 0.54). However, the degree and

variation in the bearing of the smolts near the levee site was greater than those in the channel (t-test). One individual, T051, was observed moving back upstream after the fish had navigated through the levee repair site.

When comparing the density distribution of points plotted for fish that came within 20 m of the levee repair site to smolts that did not come into contact with the levee repair site, similar patterns were observed. However, the smolts that came into contact with the levee site had slightly smaller and more isolated areas of high density (Figure 19).

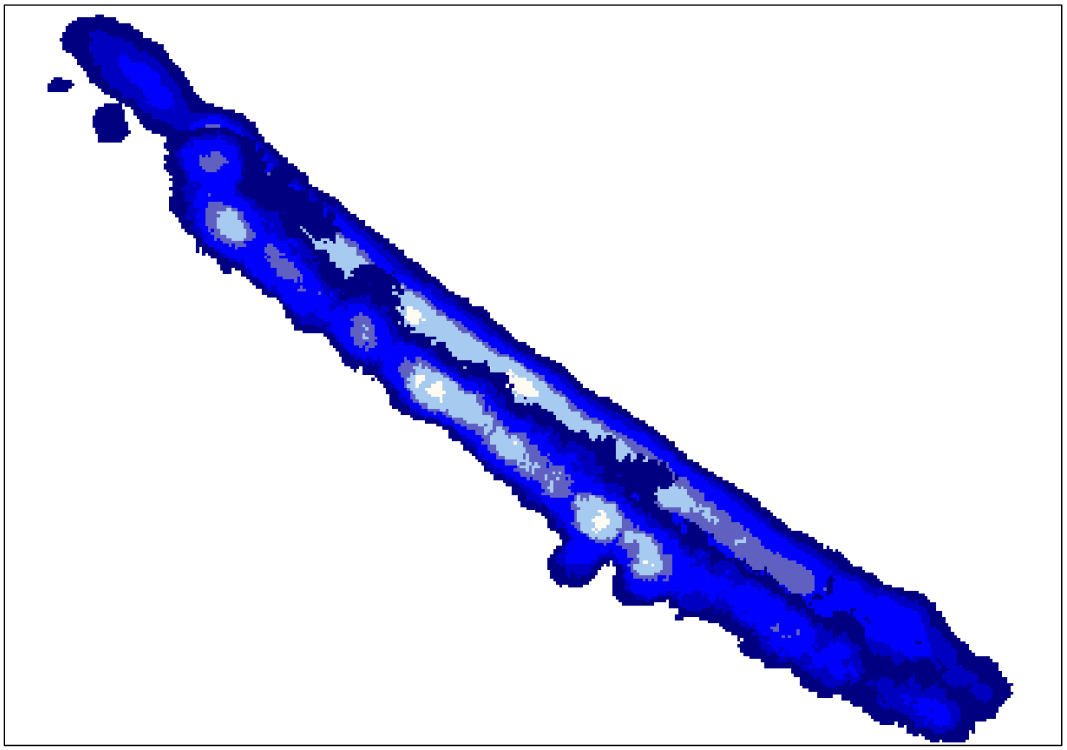

Figure 19. Density plots of smolts that were detected within the levee repair site (top) and those detected outside the levee repair site (bottom). White represents the highest density, while blue represents the lowest.

Cross-channel distribution

Throughout the study site, more individuals and positions were consistently in the center portion of the site. The outside bend section of the study site containing the levee repair site had the lowest number of individuals and positions calculated. The inside bend had more individuals detected than the repair site, but still significantly less than the channel (Table 3).

Table 3. February small smolt data for levee repair site (site was divided into 15 cells). The number of February small smolts detected, positions calculated, and average movement rates for each cell were calculated. The proportion of smolts detected and positions calculated in adjacent cells (east bank, channel, and west bank) were also calculated.

Cell	Location	Fish Count	Proportion Laterally	Positions	Proportion of Positions	Avg. Movement Rate
1	Above Study Site/River Left	9	0.084	16	0.003975	0.976
2	Above Study Site/Channel	60	0.561	196	0.048696	0.704
3	Above Study Site/River Right	38	0.355	128	0.031801	0.849
4	Upper Study Site/River Left	26	0.195	134	0.033292	0.883
5	Upper Study Site/Channel	72	0.541	608	0.151056	0.818
6	Upper Study Site/River Right	35	0.263	291	0.072298	0.639
7	Middle Study Site/River Left	17	0.133	121	0.030062	0.808
8	Middle Study Site/Channel	68	0.531	493	0.122484	0.924
9	Middle Study Site/River Right	43	0.336	356	0.088447	0.667
10	Lower Study Site/River Left	19	0.168	165	0.040994	0.670
11	Lower Study Site/Channel	53	0.469	431	0.107081	0.962
12	Lower Study Site/River Right	41	0.363	419	0.104099	0.787
13	Below Study Site/River Left	19	0.174	148	0.03677	0.625
14	Below Study Site/Channel	55	0.505	234	0.058137	0.827
15	Below Study Site/River Right	35	0.321	285	0.070807	0.777

The large smolts released in February have a pattern similar to the small fish released in February. However, as large smolts migrated down the repair site, there was a shift in the cross-channel distribution of smolts. At the upstream end of the study site, the majority of smolts were in the channel of the river, but as they moved downstream and entered the third set of cells, the proportion of smolts in the east bank cell increased and in the fourth and fifth sets of cells, the proportion of smolts in the channel and east bank cells were nearly identical. Furthermore, the proportion of calculated position in the east bank cells exceeded those calculated in the channel or west bank cells (Figure 20). This same behavior is not observed for the small smolts. While there was a slight increase in the proportion of smolts in east bank cells, as smolts moved downstream there was never a greater proportion of smolts in an east bank cell than a channel cell (Figure 21).

The average movement rates of small smolts from a given cell were slightly greater than those observed for the large smolts 60% of the time (Table 4).

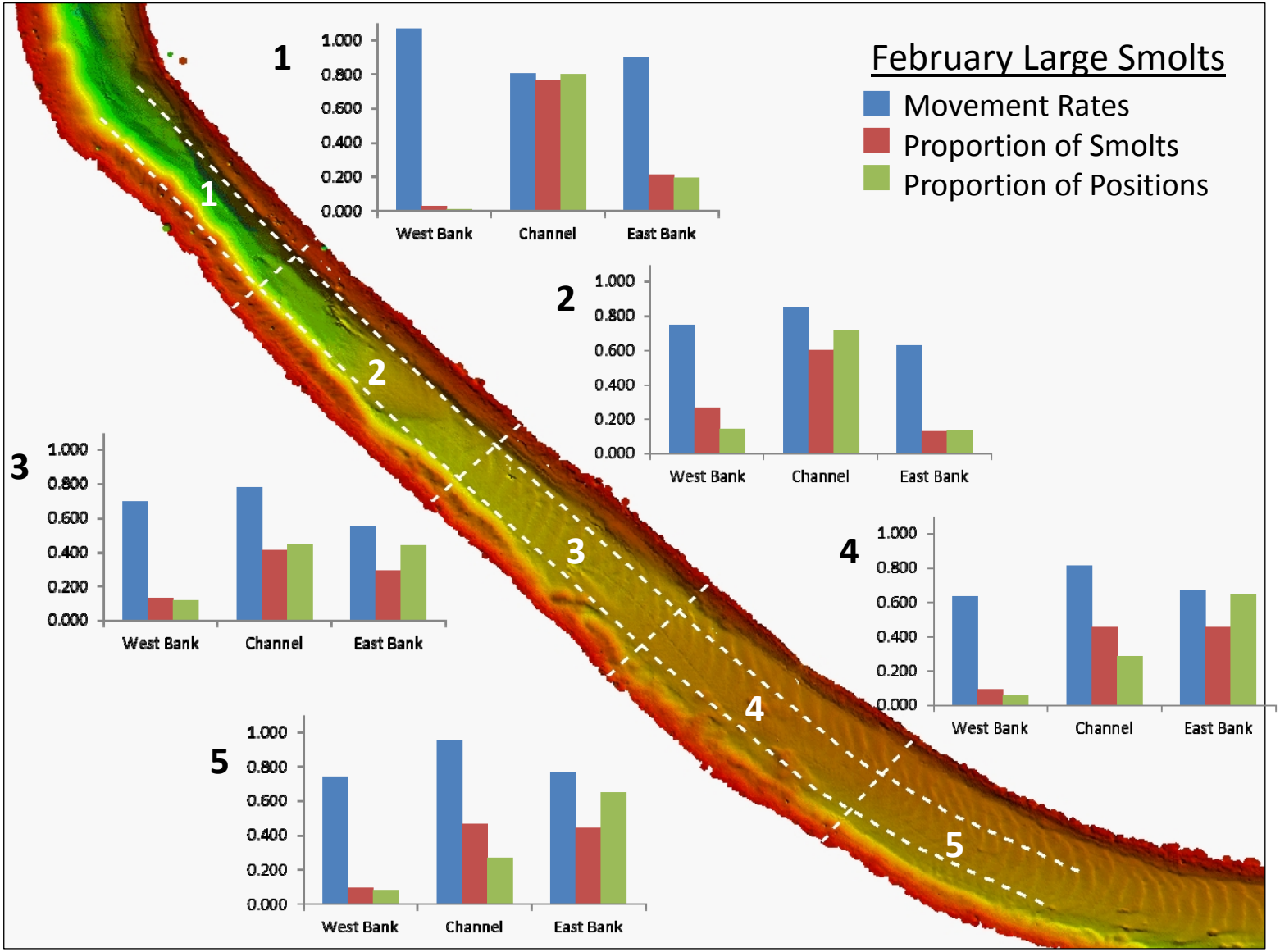

Figure 20. Movement rates (m/s), proportion of smolts, and proportion of positions of large smolts released in February. West bank, channel, and east bank denote the horizontal position while the number gives the stream position of the cell. The west bank cells contain the levee repair site.

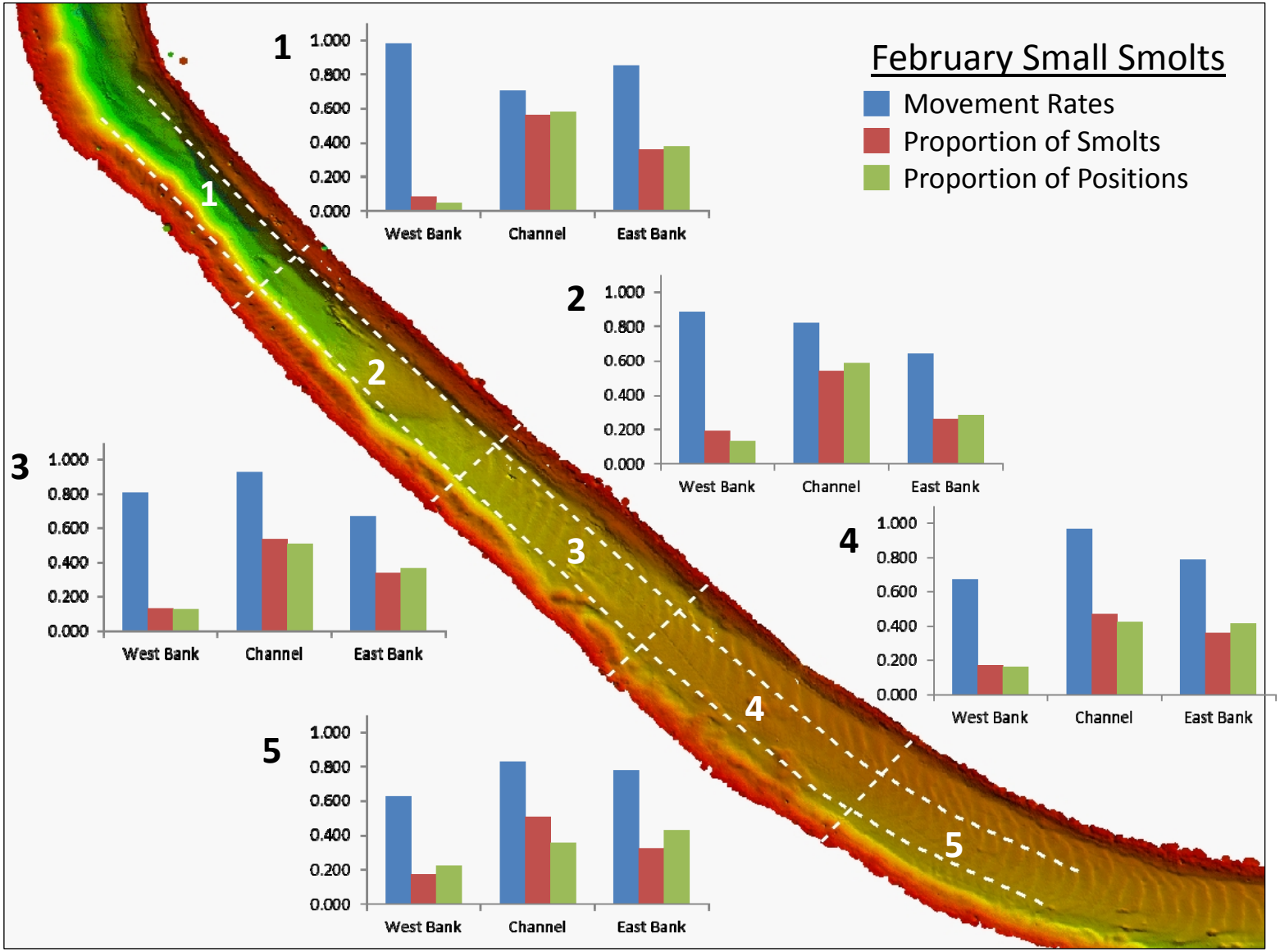

Figure 21. Movement rates (m/s), proportion of smolts, and proportion of positions of large smolts released in January. West bank, channel, and east bank denote the horizontal position while the number gives the stream position of the cell. The west bank cells contain the levee repair site.

Table 4. February large smolt data for levee repair site (site divided into 15 cells). The number of February large smolts detected, positions calculated, and average movement rates for each cell were calculated. The proportion of smolts detected and positions calculated in adjacent cells (east bank, channel, and west bank) were also calculated.

Cell	Location	Fish Count	Proportion Laterally	Positions	Proportion of Positions	Avg. Movement Rate
1	Above Study Site/River Left	1	0.026	1	0.001	1.068
2	Above Study Site/Channel	29	0.763	74	0.056	0.803
3	Above Study Site/River Right	8	0.211	18	0.014	0.901
4	Upper Study Site/River Left	12	0.267	52	0.039	0.744
5	Upper Study Site/Channel	27	0.600	260	0.197	0.845
6	Upper Study Site/River Right	6	0.133	50	0.038	0.633
7	Middle Study Site/River Left	8	0.131	45	0.034	0.694
8	Middle Study Site/Channel	25	0.410	173	0.131	0.777
9	Middle Study Site/River Right	18	0.295	172	0.130	0.549
10	Lower Study Site/River Left	4	0.098	28	0.021	0.739
11	Lower Study Site/Channel	19	0.463	93	0.070	0.951
12	Lower Study Site/River Right	18	0.439	219	0.166	0.769
13	Below Study Site/River Left	3	0.091	8	0.006	0.637
14	Below Study Site/Channel	15	0.455	39	0.030	0.810
15	Below Study Site/River Right	15	0.455	88	0.067	0.668

Other species

Multiple steelhead trout were positioned throughout the study site. Their average rates of movement within the study site ranged from 0.25 to 1.38 m/s. The number of points in fish tracks was greatly reduced, as tags only transmitted once every 60 seconds on average. Most of these fish moved similarly to the Chinook salmon smolts. However, one of these individuals was detected in the study site for more than three weeks. This 237-mm FL smolt was released into the mainstem Sacramento River at Jelly's Ferry on 17 December 2010. The individual was detected at the release site and then not again until 12 January 2011, when it was detected more than 80 RKM away from the release site. At this point, the smolt appeared to begin actively migrating and was detected at several sites as it rapidly moved downstream to Knights Landing on 17 January 2011. The fish subsequently appeared to disappear until 22 February 2011 when it actively migrated past the Carquinez Straits Bridge on 5 March 2011.

In addition to the data on the Chinook salmon, one smallmouth bass was tagged and positioned in the study site for a period of time. This predator exhibited a very different movement pattern than that of the migratory

smolt, steelhead or Chinook. The smallmouth was observed primarily near the base of the levee repair site and the distances moved were typically very small and non-directed. When the bearings between positions of the individual are plotted out, the distribution appears bimodal (Rao's Test: U = 223.9, $p < 0.01$) (Figure 22). The observed movement rates of the smallmouth bass were also significantly slower than those of the tagged Chinook salmon population (t-test: t = -42.9, df = 5,994, $p < 0.01$).

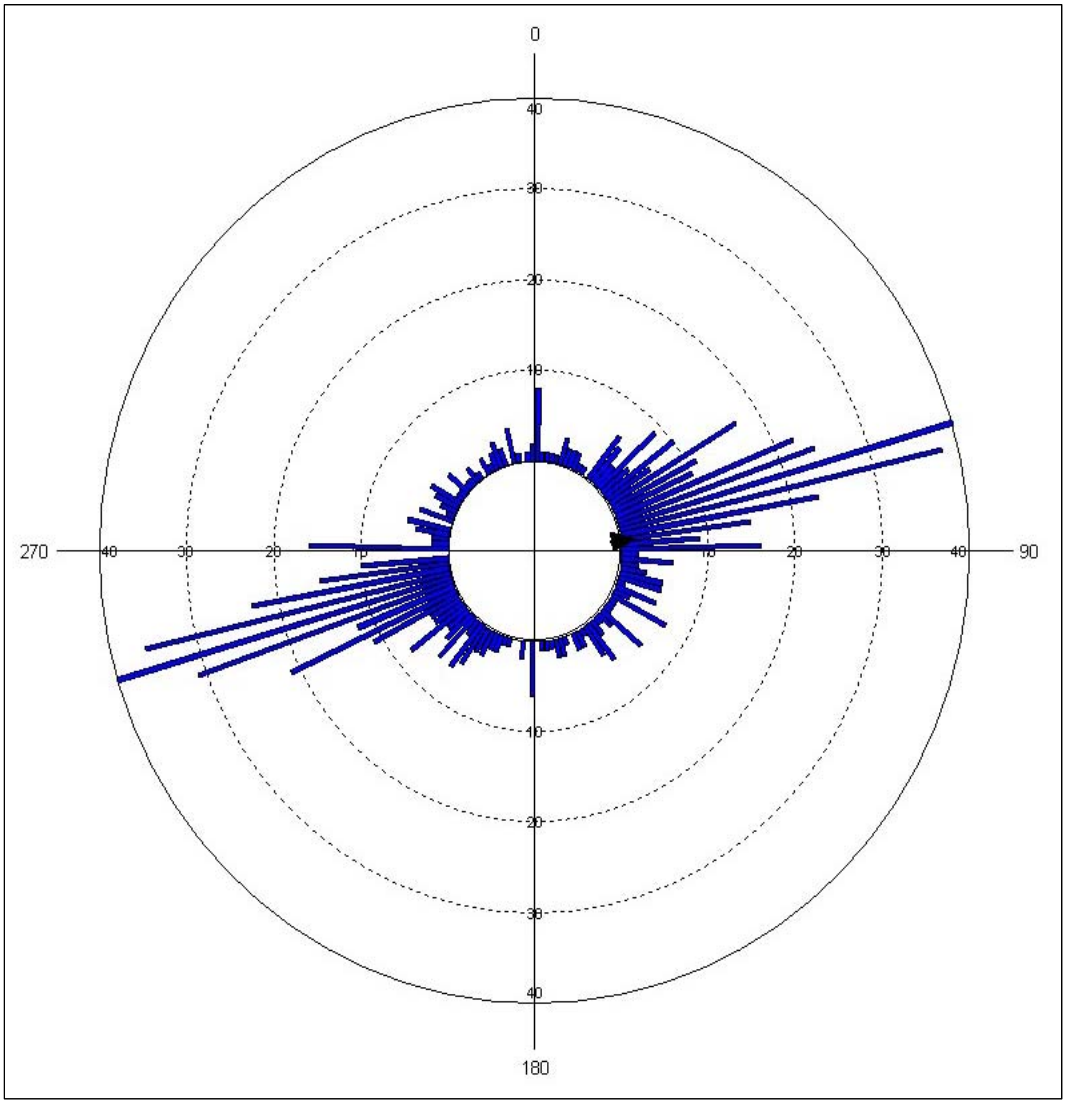

Figure 22. Bearings of the smallmouth bass positioned at RM 85. Each bar represents a 3-deg bin, while the numbered concentric circles denote the count of observations.

Survival

There was a large enough difference in the survival of the small and large smolts to utilize them as different groups. The model with the highest likelihood had only 16 parameters and separated smolts into large and small size classes. It also treated all 69-kHz tagged late-fall Chinook smolts as a different group. The next highest model likelihood was 0.347 for a model where survival varied by reach for small 180-kHz smolts, for large 180-kHz smolts released early, for large 180-kHz smolts released late, and for 69-kHz smolts while detection probability varied by location for all groups (small/early, small/late, large/early, large/late, and 69 kHz) (Table 5).

Table 5. Model and corresponding AIC, likelihood, number of parameters, and deviance in ascending order from the highest to lowest likelihood.

Model	AICc	Model Likelihood	No. Par.	Deviance
Phi G*t(size) p G*t(size)	891.916	1.000	16	15.806
Phi G*t(Small&Large_Early&Large_Late&69) p At	894.035	0.347	23	3.197
Phi G*t(Small_Late&Large_Late,LargeEarly,Small_Early&69) p At	894.408	0.288	21	7.804
Phi G*t(Small&Large_Early&Large_Late&69) p G*t(size)	894.493	0.276	20	9.999
Phi G*t(Small_Early&Large_Early,Small_Early,Small_Late&69) p At	896.400	0.106	21	9.796
Phi At p At	897.470	0.062	25	2.374

Overall, there was a minimal decrease in survival between the release site and the study site (Table 6, Figure 23). The lowest survival rate was observed in the second reach from the study site to Hood, California. Both of the 180-kHz small and large groups' survival rates declined over this stretch of river. Small smolts were observed to have the lowest rate of survival in this reach, yet they were observed to have a high detection probability of 1.00 at Hood, California (Table 7). In the third stretch, the survival estimate of the small smolts remained depressed relative to the large 180-kHz smolts and the 69-kHz smolts, but it increased from the previous reach.

Table 6. Survival estimates for fish classified as small (<130 mm), large (>130 mm), and 69-kHz late-fall Chinook smolts tagged by UC Davis/NMFS/USFWS.

Small 180-kHz LFC				
Reach	Survival Estimate	Standard Error	95% Confidence Interval	
			Lower	Upper
Release to study site	0.897	0.029	0.825	0.941
Study site to Hood	0.447	0.059	0.336	0.563
Hood to Georgiana slough	0.666	134.572	0.000	1.000
Large 180-kHz LFC				
Release to study site	0.924	0.027	0.852	0.963
Study site to Hood	0.776	0.042	0.684	0.847
Hood to Georgiana slough	0.836	168.768	0.000	1.000
69-kHz LFC				
Release to study site	0.719	0.048	0.617	0.803
Study site to Freeport	1.000	0.000	1.000	1.000
Hood to Georgiana slough	0.935	195.869	0.000	1.000

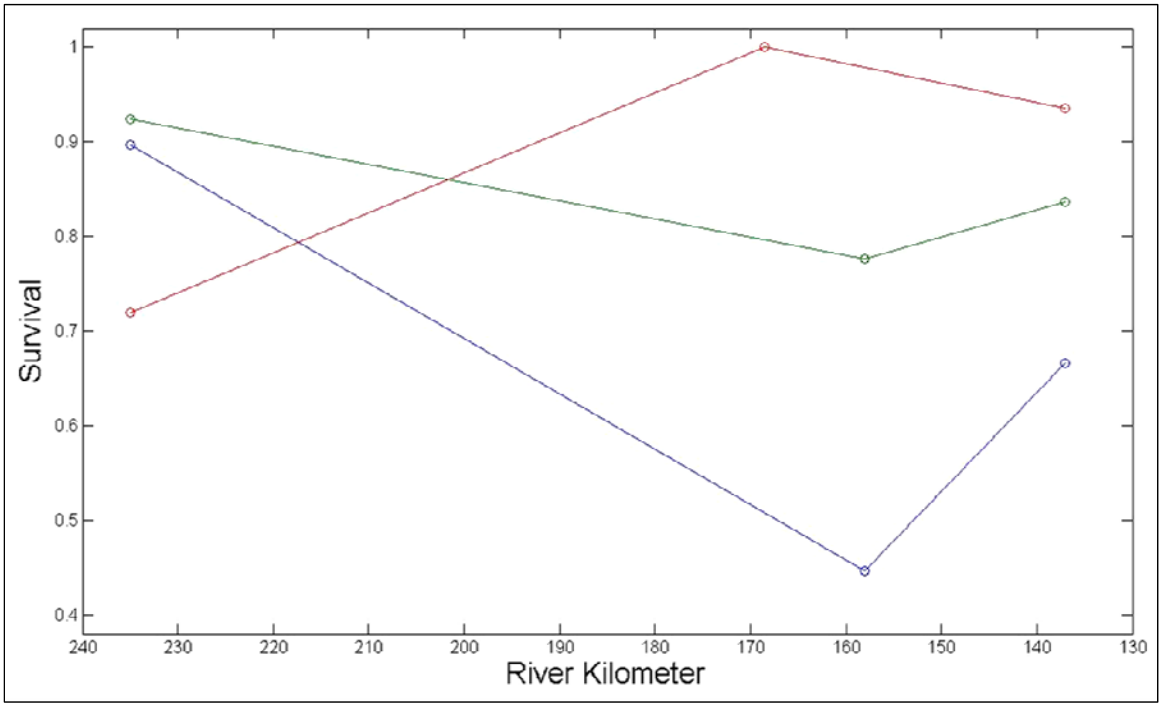

Figure 23. Survival rates of the small (blue), large (green), and 69-kHz (red) late-fall Chinook salmon at the corresponding river kilometer.

Table 7. Detection probability of small, large, and 69-kHz smolts at multiple study sites and the corresponding number of receivers throughout the Sacramento River.

Site	Number of Receivers	Detection Probability	Standard Error	95% Confidence Interval	
				Lower	Upper
Small 180-kHz LFC					
Study site	60	0.890	0.033	0.806	0.941
Hood	1	1.000	0.000	1.000	1.000
Georgiana slough	7	0.791	159.751	0.000	1.000
Large 180-kHz LFC					
Study site	60	1.000	0.000	1.000	1.000
Hood	1	0.620	0.076	0.464	0.754
Georgiana slough	7	0.803	162.194	0.000	1.000
69-kHz LFC					
Study site	45	1.000	0.000	1.000	1.000
Freeport	1	1.000	0.000	1.000	1.000
Georgiana slough	7	0.936	195.960	0.000	1.000

4 Discussion

Smolts were released at two different times and the results of the two releases were very different. The flows were higher during the first release and the detection ranges of the equipment were reduced. The number of positions calculated for each individual was greatly reduced in comparison to the second release. This reduction in the number of calculated positions for individuals is likely related to the level of flow or perhaps debris/ turbidity in the river. The increased flow may also have elevated the movement rates and reduced the number of positions calculated. A significant difference was not observed in the movement rates of large smolts released in January versus large smolts released in February and therefore it is unlikely that the decreased positions associated with individuals from the first release is due to the movement rate of individuals.

In January there were large holes in the center of the array where no fish were detected. Nothing was changed for these receivers in February other than the environmental conditions of reduced flow. In February a similar number of fish were positioned; however, individuals had far more points associated with their tracks through the study site than January fish. This finding suggests that developing a threshold of environmental conditions in which studies are conducted is crucial for collecting the most detailed data for a given site. As mentioned earlier, the decrease in number of positions is associated with river flow, but whether that decrease is most heavily influenced by the velocity, temperature, turbidity, or other debris in the water column has yet to be determined. It is likely that all of the listed variables affect the detection range of receivers and thus the number of positions that can be calculated, but it is important to understand which had the greatest impact on detection ranges, as it could be used to drive future study design. Currently it appears unwise to conduct a project at flows greater than 13,000 cfs based on the results of the two releases in 2011.

A large number of smolts were positioned in the study. The majority of smolts were positioned in the channel. Only a handful of smolts were positioned within or near the levee repair but the data gathered from these smolts was very useful for qualitative comparison purposes. These smolts generated the question of what, if any, impact did the levee repair site

have? While there were no significant differences in the rates of smolts near the levee versus smolts in the channel, a higher degree of variation in behavior was observed near the levee compared to the non-levee smolts.

Large instream woody debris has been shown to be beneficial for juvenile salmonids. The lack of high recruitment to the study site may have to do with the maturity of the repair site. The size of fish monitored may have also impacted the results. A study examining the impact of artificial woody debris structures showed increased recruitment but average weights of fish were all under 12 g (Floyd et al. 2009).

One reason for no visible difference in the movement rates of smolts detected at the levee and non-levee regions is because of the flow levels under both releases. While the second release occurred during lower flows, releases still occurred during a period of high flow in the rainy season. Fish may not have been searching for refuge habitat, or river flows may have been so great that they made habitat on the levee site unsuitable when fish were passing through the area. Also, without removing the "outliers," there may have been a significant difference in movement rates of smolts near the levee. The "outliers" that were on the high end of transit times were likely the most representative smolts for foraging behavior. Moreover, a greater number of large fish were tagged in January than in February. Larger smolts appeared to have a somewhat greater degree of control over their migratory rates, which were consistently slower than the migratory rates of the small smolts on a local level.

While no significant difference occurred in the movement rates of smolts detected on the levee site compared to smolts detected in the channel, an interesting difference was found between the average bearing of those individuals. There are several possible explanations for the observed difference. First, smolts could be foraging on the levee site. Alternatively, they could be searching for refuge habitat to hold in, or finally, they could be exhibiting predator avoidance behavior. Most smolts detected in the channel had a very narrow range of bearings, reflecting the highly migratory nature of the movement. One or two bearings were typically observed approximately 180 deg from the downstream direction of movement.

One possible explanation for the rapid migration of smolts through the study site is that they were not at the proper life stage for such habitat. Smolts may not have used the levee repair site to a heavy degree because

they were actively migrating and not searching for rearing habitat. Perhaps fish under 100 mm in FL would use the repair site to a greater degree than smolts. Work looking at the salmonid habitat use in the Grays River Watershed captured Chinook ranging in size from 25–100 mm FL, with most individuals under 60 mm and considered to be fry rather than fingerlings (Roegner et al. 2010). Previous studies of the Yolo Bypass (Sommer et al. 2001) and the Mokelumne River (Jeffres et al. 2008) have shown that fish utilizing floodplains grow larger in size than fish in the river. These studies focused on smaller fish in the 50 to 60 mm in FL range.

Another potential explanation would be that the increased flows stimulated smolt movement. The flows may have also been high enough to force smolts downstream regardless of what might be optimal for the individual. Furthermore, the increased flows may have made the new levee habitat unsuitable for smolts. The design of the benches and habitat are somewhat conflicting. Benches are only inundated when the flows are high and only remain inundated if the flows stay above a given level. Smolt movement appears to be triggered by flow. Numerous screw traps in the Central Valley have increased catches of smolts with increasing flows. While smolts may be searching for habitat to rear or rest in as they emigrate from the system, they may not do so until flows recede. At that point the benches may no longer be available. The habitat area may also need to be extensive and large in size like a floodplain. Smolts may pass by levee repair sites and not even be aware of their existence, or perhaps they need to be moving through suitable habitat for a period of time prior to holding. If that is the case, the levee repair site may simply not be long enough to recruit smolts.

A strong diel pattern of movement was detected based on the time of first arrival, but there was no difference in the movement rate of fish positioned during daylight hours versus night-time hours. Although three individuals took a significantly longer time period to move through the site during the day, most moved through at a rate similar to fish migrating at night. A possible explanation for the lack of difference in movement rates through the study site would be smolt response to turbidity levels. Some of the smolts detected during the daytime hours may have moved similarly to fish at night due to the turbidity of the water. Turbidity has been hypothesized as a possible explanation for the breakdown of diel patterns of Chinook salmon as they migrate from the upper Sacramento River into the

Delta (Chapman et al. 2012). Perhaps the storms and high flows increased the turbidity levels to a degree that caused smolts to migrate as though it were night. Alternatively, the increased flows may have simply facilitated the continued downstream movement of smolts and decreased the likelihood of smolts coming into contact with suitable holding habitat.

When considering the various groupings of "small/early, small/late, large/early, and large/late" it is helpful to look at the clusters of calculated positions. One reason for the difference in the clustering of positions may be related to the size of the individuals, suggesting that large smolts can actively select their location in the river rather than being uniformly distributed across the river.

Fish with higher variation in their bearing were observed more frequently utilizing the levee site or off-channel habitat. These fish were likely looking for rearing habitat or a holding position. Interestingly, five fish in January and two fish in February were detected approaching the levee during daylight hours. This suggests these smolts may have been searching out holding habitat for daytime hours. Unfortunately, relatively few smolts were positioned during the daytime and the sample size is far too small to make any statistically supported statements.

The survival of smaller smolts may have to do with a difference in behavior. Perhaps the smaller smolts spend a greater amount of time searching out rearing habitat, while the larger smolts are emigrating, making relatively few stops. Another possible explanation for the difference in survival rate for the smaller smolts is that these individuals cannot evade predators to as high a degree as the larger smolts. A final potential explanation for the difference in survival is related to the difference in body/tag weight ratio. The same sized tags were used in both the small and large smolts, but the tags may have had differential survival effects based on the size of the fish. Survival estimates of smolts were meant to represent a lack of tag effect on the population of interest. This appears to be the case because larger smolts' survival rates were found to be different by release date, suggesting other factors may play a more significant role in influencing survival.

The same effect was not observed in the small fish. The survival rate of the 69-kHz fish was higher than the 180-kHz smolts (Figure 22; Table 6). This difference could be due in large part to selective forces taking place further

upstream following their release into the river while that process had not yet occurred for the 180-kHz smolts. Late-fall Chinook salmon have been monitored using acoustic telemetry for the past 5 years and high initial declines following release have been documented on numerous occasions (Michel et al. 2012). Tag effect studies have suggested a low, if not non-existent, mortality level as a result of the surgical procedure when implanting tags that were as much as 5.6% of the body weight of late-fall Chinook from Coleman National Fish Hatchery (Ammann et al. 2007).

Additional predator studies

Quantifying the abundance and types of predators present in the study site would be useful to the study. This quantification could be accomplished in three ways: catch per unit of fishing effort (CPUE); dual-frequency identification sonar (DIDSON), or electro-shocking. Such data may help to explain why smolts may preferentially avoid a given area. Ideally, sampling would occur just prior to releases, as fish are passing through, and following the passage of the majority of smolts.

Release strategy

Future studies may employ more of a "trickle" release strategy than the 2011 strategy. While there did not appear to be an issue with collisions of tag transmissions, most fish did move through the site rapidly with very few individuals moving through during daytime hours. While Chinook are known to have a strong diel pattern of movement, the release timing also likely played a role in the observed behavior of smolts. Most fish were released at night in an attempt to protect them from predation. This reduced the chances of observing differences in daytime movement patterns because most of the smolts migrated through the study site within 24 hr of being released into the river.

Tag effects studies

To optimize the validity of the data collected, a tag effects study should be completed. While numerous tag effect studies have been completed with Chinook salmon smolts (Deters et al. 2010; Frost et al. 2010; Hall et al. 2009), they have not been completed with tags or fish of this size. Ammann et al. (2007) completed a tag effect study on late-fall Chinook salmon from CNFH and found no significant effect in relative growth rate among PIT, PIT+acoustic tag, and sham+PIT treatments. VEMCO V7 tags

in the study represented a tag burden of 2.6–5.6%. Fifty-four percent of the smolts tagged had tag burdens under 5.6% and no smolt had a tag burden greater than 8.7%. A tag effect study would be highly beneficial by determining whether tag burden impacts change with size. A significant difference in the survival rates of small and large smolts was observed in the study. However, since smolts were all tagged with the same size transmitter, it is difficult to determine whether this is due to tag burden or biological factors. A tag effect study could also be used to determine the optimal holding period of tagged smolts prior to release as well as the minimum-sized smolt that should be considered for tagging. Tag effect studies should include a control, sham, and multiple tag sizes. The healing of smolts should be closely monitored and the U-crit, or swimming performance, of smolts should be tested throughout the duration of the study. U-crit tests are conducted by forcing fish to swim against the current for a set time increment and then increasing the speed of the water by a set amount for the next increment until the individual can no longer continue to swim against the current.

Steelhead trout and smaller Chinook salmon

It was surprising to see how few smolts of both species utilized the levee repair site. As mentioned earlier, perhaps the study subject was not the optimal target for the repair site restorations. It would be informative to shift to smaller-sized smolts to observe whether they exhibited an increased use of the repair site.

Steelhead trout of varying size have been documented to hold for extended periods of time in the midsections of the Sacramento River from ~RKM 260 to ~RKM 168 during a 5-year study of hatchery smolts.[1] This area includes the repair study site at ~RKM 235. As mentioned earlier, one individual was detected for more than three weeks. A single 69-kHz tagged steelhead trout exhibited foraging behavior within the study site. The smolt spent more than 33 days in the study site. It was then subsequently detected in the Sacramento-San Joaquin Delta for a period of days prior to moving into San Francisco Bay Estuary, past the Carquinez Straits Bridge on 7 March 2011. This behavior of holding in a small area, or a great decrease in the migratory rate of a steelhead smolt, has been observed in previous years of study, but the 2-D positions associated with the long

[1] Unpublished Data. Philip T. Sandstrom et al., ENVIRON, 2200 Powell St., Suite 700, Emeryville, CA 94608.

absence between two receiver sites had never been documented.[1] The track of this smolt was very informative of foraging behavior and as a potential example of what behavior steelhead in previous years may have been exhibiting between locations.

Georgiana Slough

While the system at Georgiana Slough was deployed as a VPS, the data were not developed for 2-D positions. However, travel time through the much smaller study site can still be estimated, as well as having a downstream site with high detection probability away from the levee repair site. Although the study site at Georgiana Slough was much smaller than the RM 85 VPS site, smolts moved through the RM 85 study site more quickly than at the Georgiana Slough site. Smolts may exhibit slower movements in the Georgiana Slough area because of reduced water velocities, tidal influences, or possibly a behavioral response at a natural confluence area. Examining the behavior of smolts in confluence areas or lower in the system may yield more detailed track data as the movement rates of individuals potentially slow.

[1] Unpublished Data. Philip T. Sandstrom et al., ENVIRON, 2200 Powell St., Suite 700, Emeryville, CA 94608.

5 Conclusion

The results of this study suggest that under high flow conditions, the levee repair site has relatively little to no impact on the behavior of migratory smolts. Studying smaller Chinook salmon and steelhead trout with tags that ping at a higher rate than those used for the survival study in the Sacramento River survival study may prove to be highly beneficial. The steelhead holding at the study site for more than three weeks supported the theory that migratory fish will hold/forage during their emigration from the system. Movement patterns exhibited by the single smallmouth bass that was tagged at the study site suggest that it is possible to identify suspect behavior. Furthermore, the smallmouth bass was not detected on monitors elsewhere in the system, indicating that even if foraging or holding behavior of juvenile smolts appears similar to predatory behavior, subsequent downstream detections could be used to verify migratory behavior. This study illustrates the importance of assessing restoration action and monitoring the environmental variables that affect species response to those restorations.

References

Ammann, A. J., P. Sandstrom, E. Chapman, C. Michel, A. P. Klimley, S. Lindley, and R. B. MacFarlane. 2007. The performance of VEMCO V7, V9 and V16 transmitters and VR2 receivers under varying environmental conditions. Poster. Oakland, CA: *A Greener Shade of Blue: 8th Biennial State of the San Francisco Estuary Conference, October 16–18, 2007.*

Beechie, T. J., M. Liermann, E. M. Beamer, and R. Henderson. 2005. A classification of habitat types in a large river and their use by juvenile salmonids. *Transactions of the American Fisheries Society* 134:717–729.

Benke, A. C., and J. B. Wallace. 2003. Influence of wood on invertebrate communities in streams and rivers. *American Fisheries Society Symposium* 37:149–177.

Chapman, E. D., A. R. Hearn, C. J. Michel, A. J. Ammann, S. T. Lindley, M. J. Thomas, P. T. Sandstrom, G. P. Singer, M. L. Peterson, R. B. MacFarlane, and A. P. Klimley. 2012. Diel movements of out-migrating Chinook salmon (*Oncorhynchus tshawytscha*) and steelhead trout (*Oncorhynchus mykiss*) smolts in the Sacramento/San Joaquin watershed. *Environmental Biology of Fishes* (March 2012).

Department of Water Resources (DWR). 2011. Summary of bids received for emergency levee erosion repair. http://www.water.ca.gov/engineering/Contracts/06-16_Summary.pdf.

Deters, K. A., R. S. Brown, K. M. Carter, J. W. Boyd, M. B. Eppard, and A. G. Saeburg. 2010. Performance assessment of suture type, water temperature, and surgeon skill in juvenile Chinook salmon surgically implanted with acoustic transmitters. *Transactions of the American Fisheries Society* 139(3):888–899.

Floyd, T. A., C. Macinnis, and B. R. Taylor. 2009. Effects of artificial woody debris structures on Atlantic salmon habitat and populations in a Nova Scotia stream. *River Research and Application* 25(3):272–282.

Frost, D. A., R. L. McComas, and B. P. Sandford. 2010. The effects of a surgically implanted microacoustic tag on growth and survival in subyearling fall Chinook salmon. *Transactions of the American Fisheries Society* 139(4):1192–1197.

Hall, J. E., J. Chamberlin, A. N. Kagley, C. Greene, and K. L. Fresh. 2009. Effects of gastric and surgical insertions of dummy ultrasonic transmitters on juvenile Chinook salmon in seawater. *Transactions of the American Fisheries Society* 139(1):52–57.

H. T. Harvey and Associates. 2009. *Final critical erosion levee repair sites fish and habitat monitoring plan*. Davis, CA.

James, L. A., and M. B. Singer. 2008. Development of the lower Sacramento Valley flood-control system: An historical perspective. *Natural Hazard Review* 9(3):125–135.

Jeffres, C. A., J. J. Opperman, and P. B. Moyle. 2008. Ephemeral floodplain habitats provide best growth conditions for juvenile Chinook salmon in a California River. *Environmental Biology of Fishes* 83:449–458.

Lehtinen, R. M., N. D. Mundahl, and J. C. Madejczyk. 1997. Autumn use of woody snags by fishes in backwater and channel border habitats of a large river. *Environmental Biology of Fishes* 49(1):7–19.

Michel, C. J., A. J. Ammann, E. D. Chapman, P. T. Sandstrom, H. E. Fish, M. J. Thomas, G. P. Singer, S. T. Lindley, A. P. Klimley, and R. B. MacFarlane. 2012. The effects of environmental factors on the migratory movement patterns of Sacramento River yearling late-fall run Chinook salmon (*Oncorhynchus tshawytscha*). *Environmental Biology of Fishes* DOI:10.1007/s10641-012-9990-8.

National Oceanic and Atmospheric Administration (NOAA). 2006. NOAA's National Marine Fisheries Service biological opinion Sacramento River bank protection project, 14 critical levee erosion repairs, Issues: 22 December 2006. File Number 151422SWR2005SA00115.

_____. 2007. NOAA's National Marine Fisheries Service biological opinion eight Department of Water Resources critical levee erosion repairs, Issues: 7 August 2007. File Number 151422SWR2005SA00659.

Roegner, G. C., E. W. Dawley, M. Russell, A. Whiting, and D. J. Teel. 2010. Juvenile salmonid use of reconnected tidal freshwater wetlands in Grays River, lower Columbia River Basin. *Transactions of the American Fisheries Society* 139(4):1211–1232.

Singer, G. P., A. R. Hearn, E. D. Chapman, M. L. Peterson, P. E. LaCivita, W. N. Brostoff, A. Bremner and A. P. Klimley. 2012. Interannual variation of reach specific migratory success for Sacramento River hatchery yearling late-fall run Chinook salmon (Oncorhynchus tshawytscha) and steelhead trout (*Oncorhynchus mykiss*). *Environmental Biology Fishes* (May):1–17.

Slaney, P. A., B. O. Rublee, C. J. Perrin, and H. Goldberg. 1994. Debris structure placements and whole-river fertilization for salmonids in a large regulated stream in British Columbia. *Bulletin of Marine Science* 55(2-3):1160–1180.

Sommer, T. R., M. L. Nobriga, W. C. Harrell, W. Batham, and W. J. Kimmerer. 2001. Floodplain rearing of juvenile Chinook salmon: evidence of enhanced growth and survival. *Canadian Journal of Fisheries and Aquatic Sciences* 33(2):325–333.

U.S. Army Corps of Engineers (USACE). 2004. *Standard assessment methodology for the Sacramento River bank protection project*. Prepared by Stillwater Sciences, Davis, CA and Dean Ryan Consultants and Designer, Sacramento, CA for and in conjunction with USACE and the Reclamation Board, Sacramento, CA.

U.S. Fish and Wildlife Service (USFWS). 2006. U.S. Fish and Wildlife Series biological opinion 1-1-07-F-0060 issued 22 December 2006.

_____. 2007. USFWS biological opinion 1-1-07-F-0033 issued 6 April 2007.

Appendix A: 2009-2010 VPS Study

2D Tracking in the Middle Sacramento River, CA Year 1: Lessons Learned

Introduction

The U.S. Army Corps of Engineers (USACE) and the California Department of Water Resources (CDWR) have been engaged in levee repair focused on preventing levee erosion and flood prevention. The Biological Opinions (BO) from the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) required fish monitoring and assessment in relation to levee repair and constructed habitat features (National Oceanic and Atmospheric Administration (NOAA) 2006, 2007; USFWS 2006, 2007). Levee repair and constructed habitat features included: (1) protection of the toe and upper slopes of the bank with riprap and or riprap mixed with soil; (2) a berm or bench to provide habitat during higher river stages in the winter and spring; (3) placing instream woody material (IWM) for aquatic structures and as a hydraulic refuge; and (4) planting living cuttings, plants, and grasses to stabilize the bank and provide riparian and shaded aquatic habitat. The objective of the required monitoring was to evaluate these features and determine if the habitat features constructed under that Sacramento River Bank Protection Project (SRBPP) were enhancing habitat values and offsetting any adverse bank protection effects.

One aspect of the monitoring and habitat assessment program is to track the movement of salmon smolts as they migrate past constructed levee repair features so as to understand the response of the smolts to hydrologic cues set up by the levee features. The Eularian-Lagrangian-Agent Method (ELAM) is a hydrologic modeling approach to predicting fish behavior. The ELAM integrates computational fluid dynamics models and fish movement patterns to help predict fish utilization of different types of structures in the river. This report is a description of the first year of effort to collect two-dimensional movement data sets from acoustically tagged salmonid smolts, that can be used in the ELAM.

Methods and materials

Location

The natural habitat features and levee repair features of the Sacramento River from approximately the Sacramento International Airport River Mile (RM) 69 to just above Knights Landing RM 90.8 have been intensively studied (H. T. Harvey and Associates 2009). Numerous sections of the levee of this part of the river have been repaired over the years, including many sections that have been repaired within the last 10 years. Five areas of the middle Sacramento River between the Delta and Chico were selected for tracking salmonid smolt migration (Figure A1). Two study areas represented "natural" conditions where the bank was lined with tall trees, and trees that extended out from the bank to provide shade (RM 69.1 and RM 90.8). These "natural" areas had mud banks and no noticeable riprap.

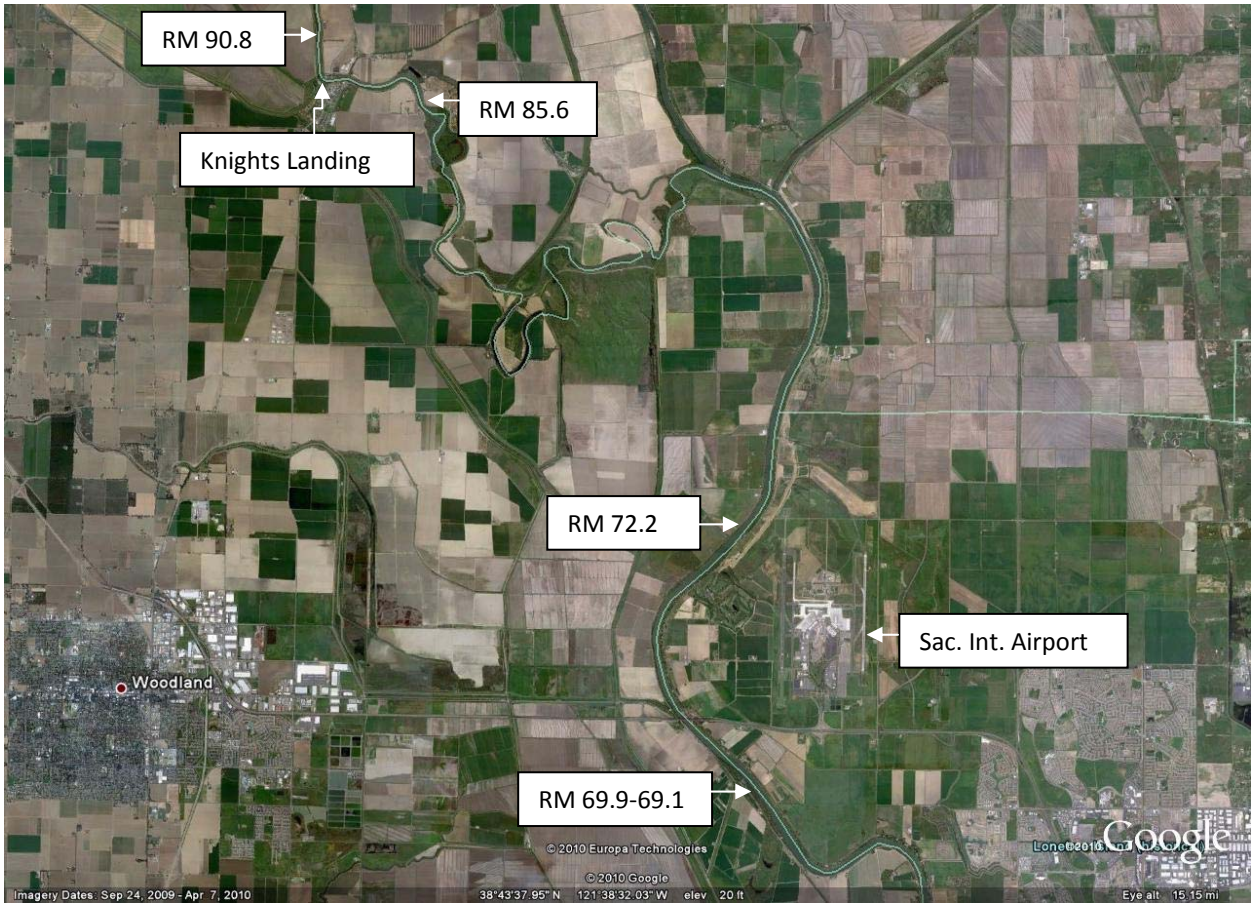

Figure A1. Study areas in the Sacramento River.

Two study areas represented a repair configuration that was termed "slope" with the installation of large IWM that would be inundated during winter and spring flows ((RM 69.9 and RM 85.6). One of the study areas was termed "bench" where the levee had a shoulder or berm that had been intensively planted with native trees and bushes (RM 72.2).

Acoustic array

Arrays of VEMCO VR2W (69 kHz) receivers and sync tags were installed at all sites on 14 and 15 December 2009. Initially the arrays at each site included four receivers in an approximate rectangle opposite the center of the study area and one sync tag. In four of the study areas, a fifth receiver was installed high on the bank where it would be submerged as the river stage increased. A review of detections from the release of acoustically tagged fish from another study indicated that additional sync tags and receivers would be required. Additional sync tags were installed in January 2009. Additional receivers and sync tags were installed between RM 69.1 and 69.9 in March 2010 to create a longer study area. (Figure A2). A total of 30 receivers and 15 sync tags were installed over the course of the study in the six study sites.

Mooring system

The mooring system employed a base of athletic weights (24–41 kg) with a receiver attached to a 3-m length of "blue steel crab line" with a crab pot float on the top (Figure A3). The mooring system was secured to tree trunks and chains on the shore with 4.76-mm (3/16-in.) galvanized cable. Each receiver/mooring system initially had a quick release line and floats so that they could be brought up and downloaded to confirm that they were communicating with the sync tags. A swim tag test was conducted the day after installation to confirm that the receivers near shore would detect the tagged fish swimming near shore and that the receivers were in fact detecting the timing sync tags in order to calculate triangulation time differential of detection at the three receivers. The river was comparatively low in late December when the systems were set up and much higher when the additional receivers and sync tags were installed in January and March (Figure A4).

Figure A2. RM 69 study area.

Fish

Chinook salmon smolts

On 27 and 28 January 2010, 200 fall-run Chinook salmon smolts from Colman Fish Hatchery were tagged. The average size was 163.7 mm (range: 150–190 mm).

Steelhead smolts

Twenty steelhead smolts from the Mokelumne Fish Hatchery were tagged on 9 March 2010. The average fork length was 206 mm (range: 174–343 mm).

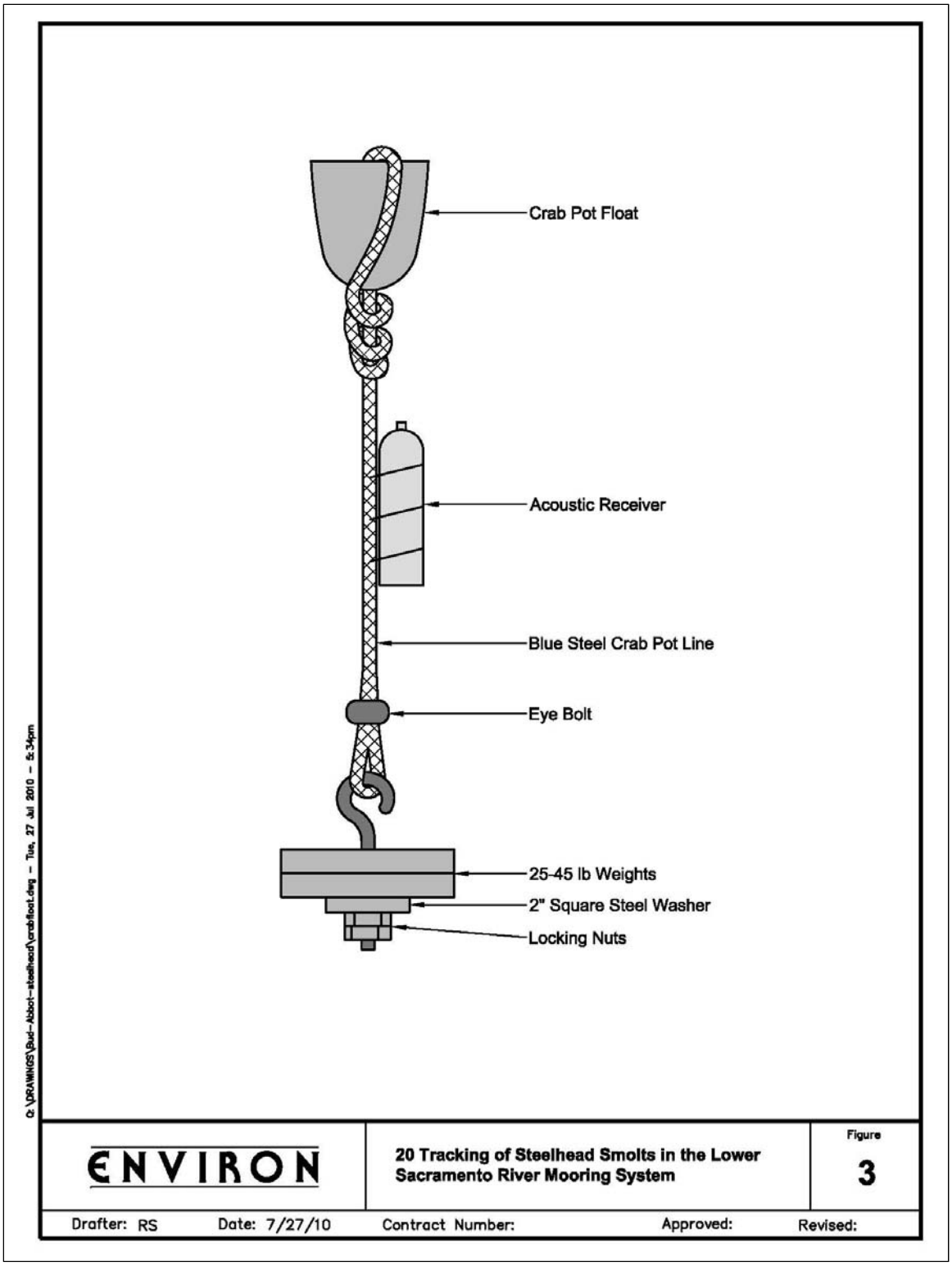

Figure A3. Mooring system diagram.

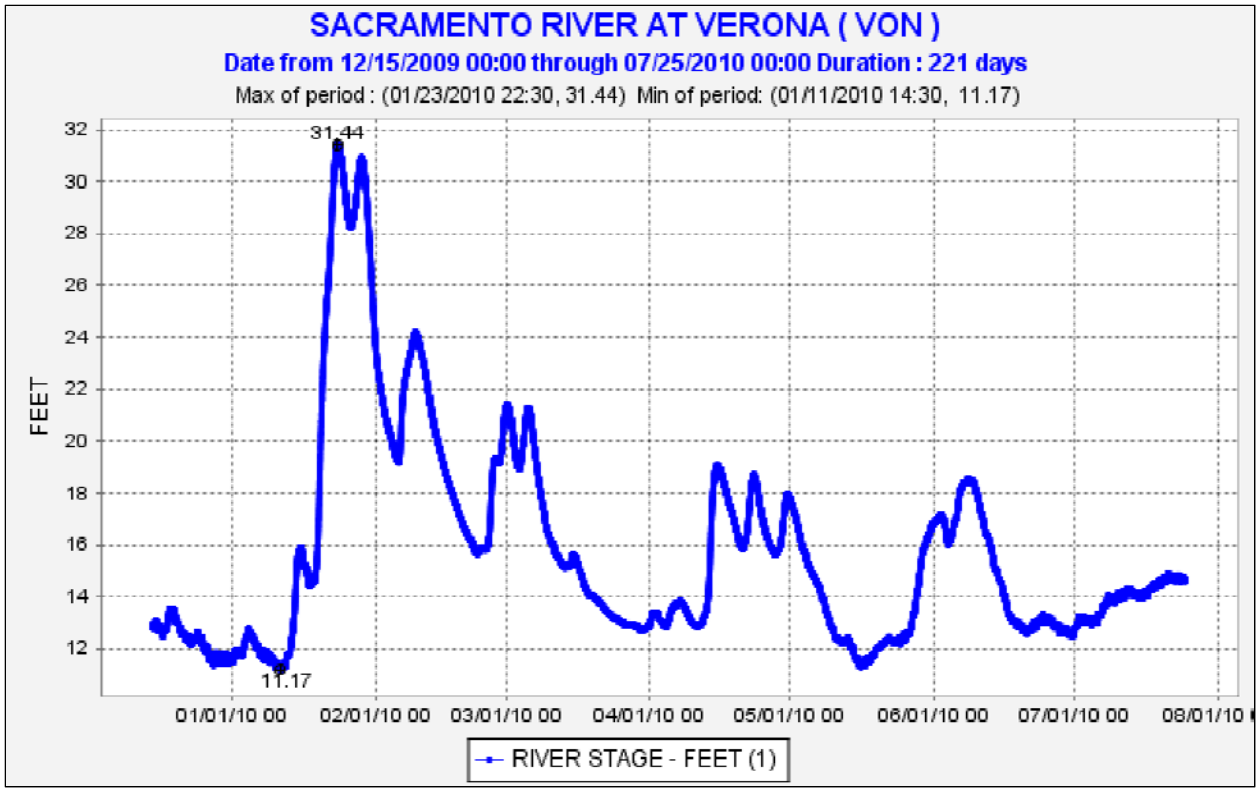

Figure A4. Sacramento River hydrograph.

Tags

Chinook salmon smolts

The Chinook smolts were tagged by a highly experienced team with a mobile tagging trailer (Cramer Fish Science). The fish were anesthetized with MS-222 until they lost equilibrium and were then placed on their dorsal side on a foam operating cradle. During the tag insertion operation, water was passed over their gills via a tube running from an anesthetic bath through a peristaltic pump. VEMCO V7 acoustic tags 7 mm in diameter and 18 mm long, weighing approximately 1.14 grams each, were inserted into the body cavity of the fish. The incision was closed with two surgical knots. The fish recovered within a minute. The fish were not held for post-operative evaluation.

Steelhead smolts

The steelhead smolts were tagged by the same team (Cramer Fish Science) at the Mokelumne Hatchery using the same operating and insertion procedure. Immediately after the fish sutured up, they were individually placed in 20-liter plastic bags containing 6 liters of hatchery water. The

bags were deflated and then filled with oxygen. The fish bags were kept in a covered bin with a layer of ice covering the top of the bags during transportation. The fish bags were re-charged with oxygen and Sacramento River water at the release site.

Fish release

Chinook salmon smolts

The tagged fish were placed in a fish transport tank with temperature control and aeration and brought to the release site the same day. There was only one Chinook smolt mortality before they were released. The Chinook salmon smolts were released in batches of five, every 5–10 minutes:

- Elverta Road, 7 km upstream of RM 69.9 on January 26
- Power lines 1 mile upstream of Knights Landing on January 27

Steelhead smolts

The steelhead smolts were released every 15 to 20 minutes beginning around 16:00 and ending around 21:30 hours. River flow was estimated at approximately 25 cm per second by the drifting stick method. Post surgery to release time ranged from 5.5 hr to 8 hr. The river temperature was 11 °C. The air temperature was 8–9 °C at the time of release. There were no pre-release mortalities.

Gear recovery

The receivers with their mooring system were recovered by freeing the cable from the anchor trees on the levee and pulling the cable on to the work boat by hand. Some systems came up easily but most required a process of slowly pulling up the cable that was buried under nearly 10 cm of sediment. Freeing the flat mooring weights was unexpectedly difficult, requiring the use of an electric power wench rated at 2,700 lb steadily pulling on the cable. It took approximately 45 minutes to recover a receiver or sync tag system.

Data management

The detection files were downloaded and sent to VEMCO for analysis, and the fish position was calculated using a triangulation algorithm. Files were

also sent to the National Marine Fisheries Service, California Fish Tracking Consortium in Santa Cruz, California.

Results

RM 90.8 (natural)

This study area was approximately 2 miles upstream from Knights Landing with dense vegetation and soft sediment along the right side of the river. The left side of the river was covered with sediment and riprap. Two-hundred and fifty acoustically tagged fish were detected in the RM 90.8 study area, including 48 fish tagged by the ENVIRON team but very few positions were detected because of the loss of one of the receivers and sporadic communication between the sync tags and the receivers. The cable and mooring for all the receivers and sync tags in RM 90.8 were buried in very deep sediment. Efforts to recover included diving where it was observed a large mound of sediment had accumulated over the mooring area of the unrecovered receiver. Duns in the river are not unusual. The mooring cable parted when an attempt was made to pull the mooring up by pulling on the mooring cable with the boat at full throttle. Although 32 positions were calculated, only five fish had multiple positions calculated and only one fish had three or more positions calculated. The very poor sync tag detection resulted in a very large error estimate on the calculated position (HPE). The average horizontal position error (HPE) for 50% of the fish was 6.0 m. The loss of one receiver and the very irregular detection of one of the sync tags by one of the receivers that was approximately 200 m from one of the sync tags resulted in very few reliably calculated positions.

RM 85.6 (slope with IWM)

This long straight reach of the Sacramento River is named “Wild Irishmen Bend.” The levees upstream of this site were comparatively clear of vegetation. The right side of the river has IWM. All the receivers and sync tags were recovered from this study area. There was also comparatively good communication between the sync tags and the receivers. There was a significant drop in sync tag detection by the receivers in late January and early February. A total of 322 fish positions were calculated for 74 fish. The HPE for 50% of the fish was <7.9 m and for 99% of the fish, it was 61.7 m. Tracks of three or more positions for a single fish were calculated for 40 fish.

RM 72.2 (bench)

The right side of the river had the bench with trees and brush that was inundated during high water. In addition IWM was installed on the riprap bank. River left was lined with private boat docks. Six receivers were recovered from the RM 72.2 study area. One receiver had been placed up on the bench and one had been placed at the December water line. One of the sync tags was lost after 20 January during a peak flow event. Despite these occurrences, the time synchronization availability of the receivers in RM 72.2 was excellent the majority of the study period. There were 798 fish positions calculated for 66 fish. The HPE for 50% of the fish was <6.3 m. Tracks of three or more positions for seven fish were calculated.

RM 69 (slope with IWM and natural)

This was initially set up as RM 69.1 (slope with IWM) and 69.9 (natural). In March additional receivers and sync tags were installed to try to make the entire reach one track. Some significant bank features including two check dams were not visible when the additional receivers were installed due to high water. RM 69 was downstream of the confluence of the Feather River and notable for the amount of heavy woody material that stacks up on the footing of the Highway 5 bridge and along the shore. Two of the receivers in the enlarged study area were never recovered. One was probably swept away by heavy woody material such as a large tree that pulled the tree that the mooring cable was attached to off the riverbank. The other may have been lost due to vandalism or floating heavy timber. There were 1,144 positions calculated for five fish. An error also occurred that was related to the movement of one of the sync tags during the study period. There were 17 tracks or three or more positions for individual fish in the RM 69 study area. Again, the limited communication between three or more receivers and a sync tag during the time frame of a fish passing through the area was the main problem.

Discussion

Distribution across the width of the river

The calculated positions of tagged fish for all six study sites were analyzed by dividing each of the study reaches into thirds: River Right, Center, River Left, without considering the type of levee repair features (Table A1).

Table A1. Distribution of calculated positions.

River Right	Middle River	River Left
62	101	65
27%	44%	29%

Most of the fish stayed in the center of the river where the current was strongest.

Migratory speed

Migratory speed down river was calculated with a lookup formula referencing each detection and location based on the receiver's locations (Figure A5).

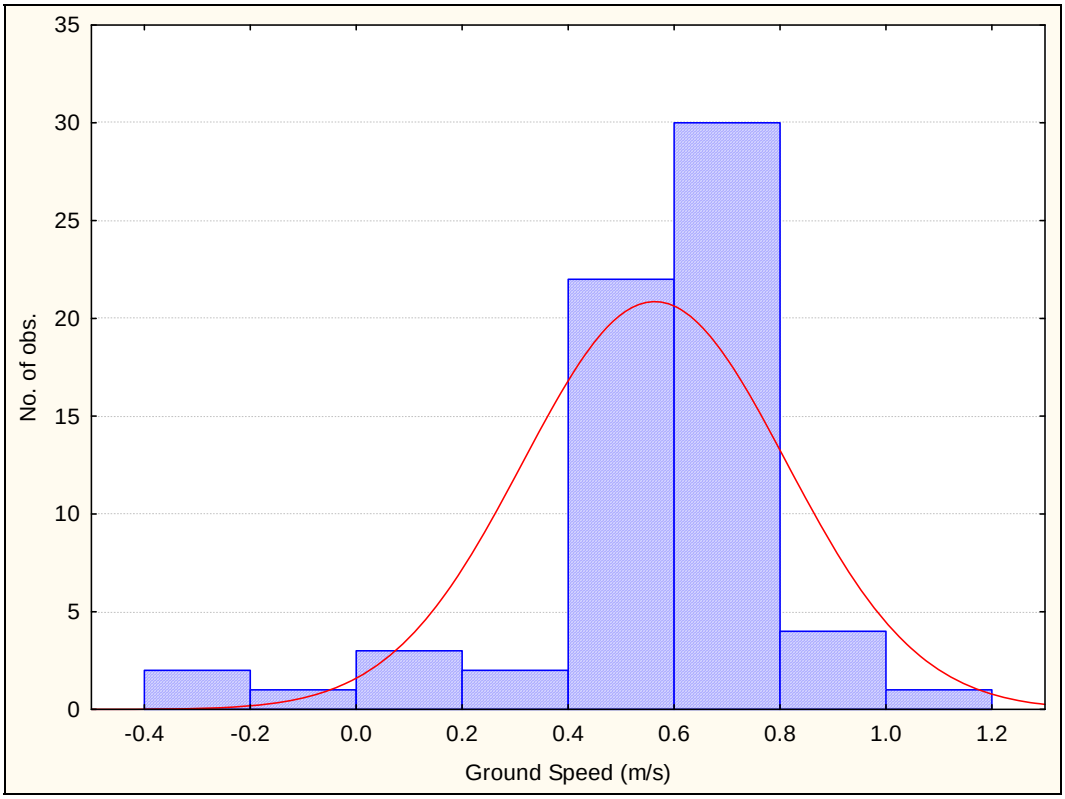

Figure A5. Ground speed calculation for all acoustically tagged fish detected at the six study site arrays.

Lessons learned

Comparatively few reliable fish movement tracks were calculated given the large number of acoustically tagged fish that were detected and the arrays of receivers at the six study sites. The main reason for the relatively low

number of calculated positions and fish tracks was directly related to the rarity of a sequence of transmissions from individual fish detected by at least three time synchronized receivers. The factors associated with the few tracks fall into three main categories:

1. Speed of fish migration: The fish used were fall-run Chinook smolts biologically programmed to immediately enter salt water for the next phase of their life cycle. They were undergoing physiological and morphological changes associated with smoltification and were not programmed to stay in the fresh water of the Sacramento River. Their rate of migration downstream was so fast that they passed through the study reach in less than a minute. For example, the effective extent of the RM 85.6 study reach was approximately 150 m long for the array of receivers and sync tags. The downstream rate of migration was on the order of 0.6 m/second.[1] The nominal pulse frequency was 30 sec (20–45 sec). Thus, there is an expectation of approximately eight transmissions per transiting fish. The data show most fish were detected just once. The use of late fall-run Chinook smolts that are typically released several months earlier, when they are still less than 100 mm long, may show a reduced rate of migration, as these smolts forage along the riverbank as they slowly migrate downstream. The rate of downstream movement by the steelhead was confounded by the number of steelhead that moved upstream after release.
2. Irregular sync tag-receiver communication: The sync tags were unreliable after the first big storm event in late January and then very irregular thereafter, with some improvement in the months just before the systems were retrieved. It was imperative that the three receivers detecting a fish were also detecting the same sync tag in order to synchronize the internal receiver clocks due to internal clock time drift. The reason for the loss of sync tag-receiver communications is largely due to the tags and receivers being pushed down towards the bottom during very high flows when debris were mobilized from the riverbanks and caught on the float lines. Some receivers were enmeshed in large tree branches. Some float lines were observed to be covered by grass when they were retrieved. The temporary loss of one receiver or the sync tag when a fish was migrating through the study reach precluded calculating a position. Two sync tags were never recovered.

[1] Personal Communication. 2011. Dr. Dale Webber, Research Biologist, VEMCO, Halifax, Nova Scotia.

3. A test conducted in the fall of 2010 compared mooring systems with a float line to those with a rigid mooring system (Figure A6). A tag on a float drifted by an array of receivers.

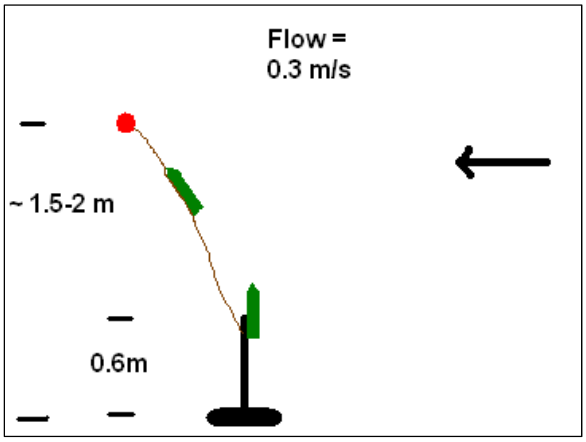

Figure A6. Gear configuration for test comparing acoustic receivers attached to a rigid post with receivers attached to a line.

4. The rigid system had a substantially longer detection range than the float line system (Figure A7) (VEMCO memo 2010). The solid stand mooring system is much less likely to be impacted by small amounts of grass and debris. Because they are closer to the bottom, they are not as likely to be affected by floating debris and thereby maintain sync tag-receiver pair communication during high flow events.
5. Distance between receivers and sync tags: Under ideal conditions, the detection range from a VEMCO V7 tag can be up to a kilometer. The Sacramento River during the winter is far from ideal conditions. The water is very turbid with a heavy burden of suspended sediment. There may be micro air bubbles in the water column from turbulence and riffles. The design of the array placed some of the receivers in comparatively shallow water in order to capture detections from fish moving close to the river bank. The VPS analysis by VEMCO showed that the optimum distance between pairs of receivers and sync tags is 70 to 80 m.
6. Loss of three receivers: It was not possible to recover one receiver in three of the study areas; RM 90.8, RM 69.5, and RM 69.5. The loss of the data from those receivers precluded calculation of the position of the detections for most of the fish detected in those three study areas. One was lost by a broken cable during recovery operations. One was lost when the tree it was attached to on shore was swept away and one may have been lost due to vandalism or a large log jam.

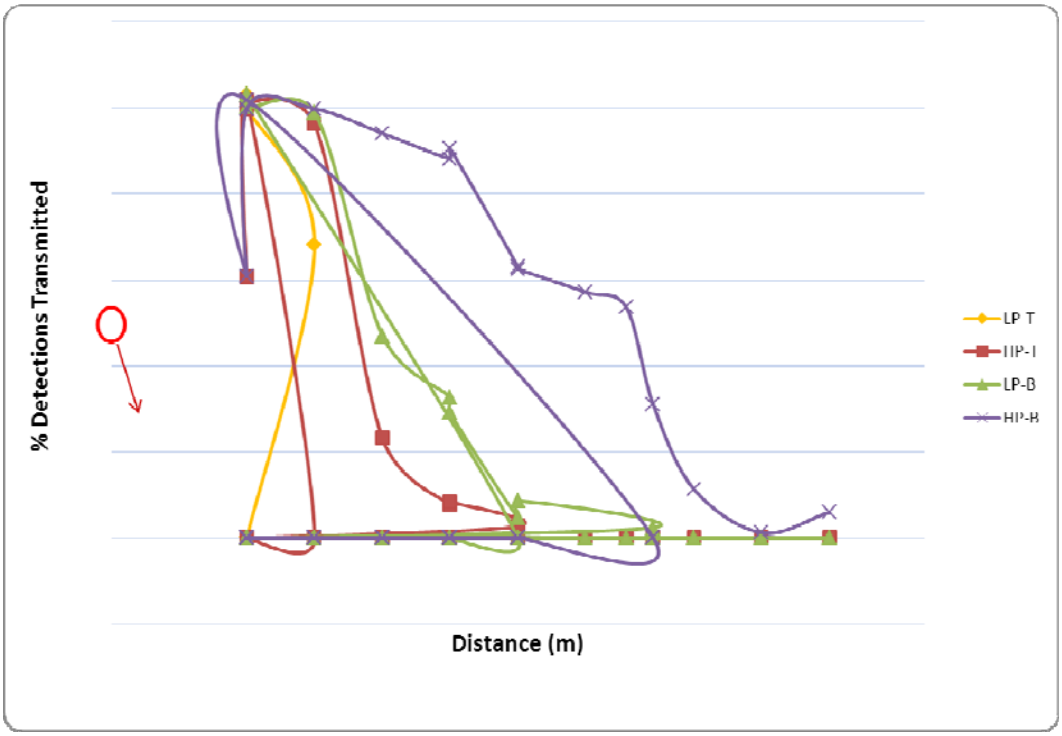

Figure A7. The 50% detection range for the high power transmitter was approximately 150 m compared to 50 m for the high power transmitter on the line.

7. Cabling: A stronger cable is needed to allow for more pressure to be applied during recovery if the receivers are impacted by drifting heavy woody material or covered by a mound of sediment. In addition, securing the cables to larger trees further up the bank would have probably prevented loss of one of the receivers. But the degree of bank erosion and mobilization of very large trees from time to time is very hard to predict. The loss of some gear due to environmental factors and vandalism is to be anticipated. The installation of extra or redundant gear needs to be considered in order to mitigate monitoring gear loss. The project lost 10% of the receivers and sync tags installed during the 2009-2010 study period. Stainless steel cable (1/4 in.) will be used in the future. Cables will be secured high on the levee banks with rebar spikes when very large trees are not available.

With a better understanding of the limitations of the acoustic detection system, the river environment, and the velocity of the fish, the experimental design for the second year was significantly changed.

Study site

RM 85 discussed above was selected for the following reasons:

- There is a long straight stretch bracketed by curves in the river above the levee repair section and below the levee repair section of the river (Figure A8).
- The study site would be approximately 1,500 m long where the river is comparatively narrow (70 m).
- Researchers were relatively successful last year in being able to recover all receivers compared to the other 2009-2010 study sites.
- This region of the river is free of check dams and comparatively free of woody debris that caused gear recovery problems last year.

Figure A8. RM 85.6 study area. The levee repair is on the left side of the image (riverright). The levee repair type is a slope with embedded woody material.

- This location is above the confluence of the Feather River, which probably contributed heavy sediment and woody debris that created adverse conditions for recovering the acoustic gear at the end of the 2009-2010 season.
  This location is several miles downstream of Knights Landing with the hydrologic confounding factors of the bridge piers, upstream natural woody banks, and the influence of large irrigation drainage structures.

Table A2 is a field event log for the study. Release data are presented in Tables A3 and A4.

Acoustic tag transmission rate

A relatively short transmission interval should allow for a large number of detections over the approximately 1-mile extent of the study area.

Acoustic receivers

The number of acoustic receivers installed at the study site had to be increased in order to develop tracks. Scientists and engineers from VEMCO organized a range test that helped determine the number of receivers that would be required.

Receiver mounting

An improved receiver stand design was needed to keep the receivers rigidly fixed above the bottom.

Receiver system calibration

Much effort will be required to make sure the receivers are detecting the adjacent sync tags.

Table A2. Field event log.

Date	Activity
12/14/09	Installation at RM 69.9
12/15/10	Installation at RM 69.1, 72.2. Noted USFS team releasing fish
12/16/09	Swim tag test at RMs 69.1, 69.9, 72.2
1/26/10	Added a sync tag to each array
1/27/10	Tag fish at Coleman Hatchery and release fish at Knights Landing
1/28/10	Tag fish at Coleman Hatchery and release fish at Elverta Rd.
3/8/10	Install additional receivers at RM 69 termed 69.5
3/9/10	Tagged 30 steelhead at Mokelumne Hatchery, released at Elkhorn Boat Landing
4/19/10	Recovered shore receivers at RM 69.9 and 72.2
5/10/10	Recovery of 4 receivers and 4 sync tags
5/17/10	Recovered additional receivers and sync tags
7/22/10	Attempted to recover missing receivers. Recovered the 3 receivers left for HT Harvey

Table A3. Chinook salmon smolt release data.

Serial No.	ID Code	Species	Race	FL	Source	Date	Time	Location	Lat	Long
1083147	64459	Chinook	Late-Fall	158	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083148	64460	Chinook	Late-Fall	159	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083149	64461	Chinook	Late-Fall	168	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083150	64462	Chinook	Late-Fall	166	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083151	64463	Chinook	Late-Fall	152	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083152	64464	Chinook	Late-Fall	172	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083153	64465	Chinook	Late-Fall	164	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083154	64466	Chinook	Late-Fall	160	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083155	64467	Chinook	Late-Fall	150	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083156	64468	Chinook	Late-Fall	168	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083157	64469	Chinook	Late-Fall	160	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083158	64470	Chinook	Late-Fall	153	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083159	64471	Chinook	Late-Fall	171	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083160	64472	Chinook	Late-Fall	160	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083161	64473	Chinook	Late-Fall	166	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083162	64474	Chinook	Late-Fall	166	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083163	64475	Chinook	Late-Fall	152	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083164	64476	Chinook	Late-Fall	178	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083165	64477	Chinook	Late-Fall	161	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083166	64478	Chinook	Late-Fall	174	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724

Serial No.	ID Code	Species	Race	FL	Source	Date	Time	Location	Lat	Long
1083167	64479	Chinook	Late-Fall	150	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083168	64480	Chinook	Late-Fall	185	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083169	64481	Chinook	Late-Fall	158	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083170	64482	Chinook	Late-Fall	168	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083171	64483	Chinook	Late-Fall	156	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083172	64484	Chinook	Late-Fall	176	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083173	64485	Chinook	Late-Fall	158	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083174	64486	Chinook	Late-Fall	166	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083175	64487	Chinook	Late-Fall	157	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083176	64488	Chinook	Late-Fall	161	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083177	64489	Chinook	Late-Fall	162	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083178	64490	Chinook	Late-Fall	174	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083179	64491	Chinook	Late-Fall	170	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083180	64492	Chinook	Late-Fall	176	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083181	64493	Chinook	Late-Fall	159	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083182	64494	Chinook	Late-Fall	166	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083183	64495	Chinook	Late-Fall	162	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083184	64496	Chinook	Late-Fall	176	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083185	64497	Chinook	Late-Fall	164	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083186	64498	Chinook	Late-Fall	161	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083187	64499	Chinook	Late-Fall	182	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083188	64500	Chinook	Late-Fall	171	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083189	64501	Chinook	Late-Fall	158	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083190	64502	Chinook	Late-Fall	154	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083191	64503	Chinook	Late-Fall	166	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083192	64504	Chinook	Late-Fall	178	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083193	64505	Chinook	Late-Fall	159	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083194	64506	Chinook	Late-Fall	156	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083195	64507	Chinook	Late-Fall	176	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083196	64508	Chinook	Late-Fall	155	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083197	64509	Chinook	Late-Fall	172	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083198	64510	Chinook	Late-Fall	168	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083199	64511	Chinook	Late-Fall	158	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083200	64512	Chinook	Late-Fall	155	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083201	64513	Chinook	Late-Fall	164	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083202	64514	Chinook	Late-Fall	154	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083203	64515	Chinook	Late-Fall	181	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083204	64516	Chinook	Late-Fall	170	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724

Serial No.	ID Code	Species	Race	FL	Source	Date	Time	Location	Lat	Long
1083205	64517	Chinook	Late-Fall	161	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083206	64518	Chinook	Late-Fall	154	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083207	64519	Chinook	Late-Fall	163	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083208	64520	Chinook	Late-Fall	158	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083209	64521	Chinook	Late-Fall	167	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083210	64522	Chinook	Late-Fall	170	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083211	64523	Chinook	Late-Fall	158	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083212	64524	Chinook	Late-Fall	168	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083213	64525	Chinook	Late-Fall	164	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083214	64526	Chinook	Late-Fall	152	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083215	64527	Chinook	Late-Fall	159	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083216	64528	Chinook	Late-Fall	160	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083217	64529	Chinook	Late-Fall	162	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083218	64530	Chinook	Late-Fall	185	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083219	64531	Chinook	Late-Fall	174	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083220	64532	Chinook	Late-Fall	151	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083221	64533	Chinook	Late-Fall	182	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083222	64534	Chinook	Late-Fall	169	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083223	64535	Chinook	Late-Fall	162	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083224	64536	Chinook	Late-Fall	160	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083225	64537	Chinook	Late-Fall	170	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083226	64538	Chinook	Late-Fall	182	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083227	64539	Chinook	Late-Fall	158	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083228	64540	Chinook	Late-Fall	160	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083229	64541	Chinook	Late-Fall	150	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083230	64542	Chinook	Late-Fall	154	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083231	64543	Chinook	Late-Fall	166	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083232	64544	Chinook	Late-Fall	152	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083233	64545	Chinook	Late-Fall	152	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083234	64546	Chinook	Late-Fall	174	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083235	64547	Chinook	Late-Fall	160	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083236	64548	Chinook	Late-Fall	169	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083237	64549	Chinook	Late-Fall	153	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083238	64550	Chinook	Late-Fall	162	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083239	64551	Chinook	Late-Fall	178	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083240	64552	Chinook	Late-Fall	153	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083241	64553	Chinook	Late-Fall	166	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083242	64554	Chinook	Late-Fall	164	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724

Serial No.	ID Code	Species	Race	FL	Source	Date	Time	Location	Lat	Long
1083243	64555	Chinook	Late-Fall	154	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083244	64556	Chinook	Late-Fall	164	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083245	64557	Chinook	Late-Fall	150	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083246	64558	Chinook	Late-Fall	160	Coleman	1/27/2010	16:00-18:00	Knights Landing	38.819	-121.724
1083247	64559	Chinook	Late-Fall	174	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083248	64560	Chinook	Late-Fall	162	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083249	64561	Chinook	Late-Fall	182	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083250	64562	Chinook	Late-Fall	158	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083251	64563	Chinook	Late-Fall	172	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083252	64564	Chinook	Late-Fall	174	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083253	64565	Chinook	Late-Fall	160	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083254	64566	Chinook	Late-Fall	180	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083255	64567	Chinook	Late-Fall	159	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083256	64568	Chinook	Late-Fall	164	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083257	64569	Chinook	Late-Fall	153	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083258	64570	Chinook	Late-Fall	160	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083259	64571	Chinook	Late-Fall	150	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083260	64572	Chinook	Late-Fall	162	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083261	64573	Chinook	Late-Fall	164	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083262	64574	Chinook	Late-Fall	174	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083263	64575	Chinook	Late-Fall	172	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083264	64576	Chinook	Late-Fall	164	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083265	64577	Chinook	Late-Fall	160	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083266	64578	Chinook	Late-Fall	154	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083267	64579	Chinook	Late-Fall	164	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083268	64580	Chinook	Late-Fall	158	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083269	64581	Chinook	Late-Fall	165	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083270	64582	Chinook	Late-Fall	157	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083271	64583	Chinook	Late-Fall	161	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083272	64584	Chinook	Late-Fall	166	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083273	64585	Chinook	Late-Fall	158	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083274	64586	Chinook	Late-Fall	163	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083275	64587	Chinook	Late-Fall	162	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083276	64588	Chinook	Late-Fall	159	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083277	64589	Chinook	Late-Fall	168	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083278	64590	Chinook	Late-Fall	154	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083279	64591	Chinook	Late-Fall	166	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240

Serial No.	ID Code	Species	Race	FL	Source	Date	Time	Location	Lat	Long
1083280	64592	Chinook	Late-Fall	155	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083281	64594	Chinook	Late-Fall	178	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083282	64595	Chinook	Late-Fall	150	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083283	64596	Chinook	Late-Fall	160	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083284	64597	Chinook	Late-Fall	156	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083285	64598	Chinook	Late-Fall	169	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083286	64599	Chinook	Late-Fall	151	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083287	64600	Chinook	Late-Fall	162	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083288	64601	Chinook	Late-Fall	150	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083289	64602	Chinook	Late-Fall	190	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083290	64603	Chinook	Late-Fall	163	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083291	64604	Chinook	Late-Fall	172	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083292	64605	Chinook	Late-Fall	164	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083293	64606	Chinook	Late-Fall	164	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083294	64607	Chinook	Late-Fall	153	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083295	64608	Chinook	Late-Fall	171	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083296	64609	Chinook	Late-Fall	151	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083297	64610	Chinook	Late-Fall	154	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083298	64611	Chinook	Late-Fall	164	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083299	64612	Chinook	Late-Fall	167	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083300	64613	Chinook	Late-Fall	159	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083301	64614	Chinook	Late-Fall	150	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083302	64615	Chinook	Late-Fall	150	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083303	64616	Chinook	Late-Fall	163	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083304	64617	Chinook	Late-Fall	158	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083305	64618	Chinook	Late-Fall	180	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083306	64619	Chinook	Late-Fall	160	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083307	64620	Chinook	Late-Fall	179	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083308	64621	Chinook	Late-Fall	171	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083309	64622	Chinook	Late-Fall	186	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083310	64623	Chinook	Late-Fall	154	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083311	64624	Chinook	Late-Fall	160	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083312	64625	Chinook	Late-Fall	162	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083313	64626	Chinook	Late-Fall	151	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083314	64627	Chinook	Late-Fall	157	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083315	64628	Chinook	Late-Fall	168	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083316	64629	Chinook	Late-Fall	162	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240

Serial No.	ID Code	Species	Race	FL	Source	Date	Time	Location	Lat	Long
1083317	64630	Chinook	Late-Fall	165	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083318	64631	Chinook	Late-Fall	150	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083319	64632	Chinook	Late-Fall	168	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083320	64633	Chinook	Late-Fall	172	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083321	64634	Chinook	Late-Fall	150	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083322	64635	Chinook	Late-Fall	166	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083323	64636	Chinook	Late-Fall	158	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083324	64637	Chinook	Late-Fall	166	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083325	64638	Chinook	Late-Fall	164	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083326	64639	Chinook	Late-Fall	164	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083327	64640	Chinook	Late-Fall	172	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083328	64641	Chinook	Late-Fall	180	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083329	64642	Chinook	Late-Fall	161	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083330	64643	Chinook	Late-Fall	170	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083331	64644	Chinook	Late-Fall	160	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083332	64645	Chinook	Late-Fall	178	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083333	64646	Chinook	Late-Fall	180	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083334	64647	Chinook	Late-Fall	161	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083335	64648	Chinook	Late-Fall	156	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083336	64649	Chinook	Late-Fall	168	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083337	64650	Chinook	Late-Fall	166	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083338	64651	Chinook	Late-Fall	165	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083339	64652	Chinook	Late-Fall	183	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083340	64653	Chinook	Late-Fall	151	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083341	64654	Chinook	Late-Fall	160	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083342	64655	Chinook	Late-Fall	172	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083343	64656	Chinook	Late-Fall	165	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083344	64657	Chinook	Late-Fall	158	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083345	64658	Chinook	Late-Fall	168	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240
1083346	64659	Chinook	Late-Fall	162	Coleman	1/28/2010	16:30-18:15	Elverta Rd.	38.287	-121.240

Table A4. Steelhead release data.

Serial No.	ID Code	Species	Race	FL	Source	Date	Time	Location	Lat	Long
1088557	29891	Steelhead	Mok. Riv	200	Mok. Riv	03/09/2010	4:04:00 PM	Elkhorn Landing	38.67247	-121.62494
1088558	29892	Steelhead	Mok. Riv	180	Mok. Riv	03/09/2010	4:19:00 PM	Elkhorn Landing	38.67247	-121.62494
1088559	29893	Steelhead	Mok. Riv	205	Mok. Riv	03/09/2010	4:34:00 PM	Elkhorn Landing	38.67247	-121.62494
1088560	29894	Steelhead	Mok. Riv	227	Mok. Riv	03/09/2010	4:49:00 PM	Elkhorn Landing	38.67247	-121.62494
1088561	29895	Steelhead	Mok. Riv	195	Mok. Riv	03/09/2010	5:04:00 PM	Elkhorn Landing	38.67247	-121.62494
1088562	29896	Steelhead	Mok. Riv	175	Mok. Riv	03/09/2010	5:21:00 PM	Elkhorn Landing	38.67247	-121.62494
1088563	29897	Steelhead	Mok. Riv	174	Mok. Riv	03/09/2010	5:40:00 PM	Elkhorn Landing	38.67247	-121.62494
1088564	29899	Steelhead	Mok. Riv	205	Mok. Riv	03/09/2010	5:55:00 PM	Elkhorn Landing	38.67247	-121.62494
1088565	29900	Steelhead	Mok. Riv	220	Mok. Riv	03/09/2010	6:10:00 PM	Elkhorn Landing	38.67247	-121.62494
1088566	29901	Steelhead	Mok. Riv	220	Mok. Riv	03/09/2010	6:40:00 PM	Elkhorn Landing	38.67247	-121.62494
1088567	29902	Steelhead	Mok. Riv	174	Mok. Riv	03/09/2010	6:25:00 PM	Elkhorn Landing	38.67247	-121.62494
1088568	29903	Steelhead	Mok. Riv	228	Mok. Riv	03/09/2010	6:55:00 PM	Elkhorn Landing	38.67247	-121.62494
1088569	29904	Steelhead	Mok. Riv	209	Mok. Riv	03/09/2010	7:10:00 PM	Elkhorn Landing	38.67247	-121.62494
1088570	29905	Steelhead	Mok. Riv	243	Mok. Riv	03/09/2010	7:25:00 PM	Elkhorn Landing	38.67247	-121.62494
1088571	29906	Steelhead	Mok. Riv	239	Mok. Riv	03/09/2010	7:42:00 PM	Elkhorn Landing	38.67247	-121.62494
1088572	29907	Steelhead	Mok. Riv	189	Mok. Riv	03/09/2010	8:00:00 PM	Elkhorn Landing	38.67247	-121.62494
1088573	29908	Steelhead	Mok. Riv	230	Mok. Riv	03/09/2010	8:21:00 PM	Elkhorn Landing	38.67247	-121.62494
1088574	29909	Steelhead	Mok. Riv	167	Mok. Riv	03/09/2010	8:41:00 PM	Elkhorn Landing	38.67247	-121.62494
1088575	29910	Steelhead	Mok. Riv	225	Mok. Riv	03/09/2010	9:02:00 PM	Elkhorn Landing	38.67247	-121.62494
1088576	29911	Steelhead	Mok. Riv	230	Mok. Riv	03/09/2010	9:19:00 PM	Elkhorn Landing	38.67247	-121.62494

Appendix B: Receiver Locations, River Mile 85

	Long	Lat	Point Name	180 receiver	69 receiver	180 sync	69 sync	Tilt	Depth (ft.)
1	-121.6931000	38.7676500	RR1-180-69	300686	107122	1104704-65019	1105019-44631		35
2	-121.6926100	38.7679300	RL1-180-69	300677	107070	1104698-65013	1105021-44633		N/A
3	-121.6923380	38.7676005	RL2-180	300680		1104696-65011			22
4	-121.6925155	38.7673188	RR3-RM2-180	300652		1104695-65010			35
5	-121.6928666	38.7673916	RR2-180	300681		1104689-65004			23
6	-121.6923263	38.7669372	RR4-180-69	300657	107057	1104705-65020	1088555-48637		23
7	-121.6920271	38.7672437	RL4-180-69	300683	107060	1104694-65009	1105022-44634		20
8	-121.6921335	38.7671380	RM3-180	300653		1104692-65007			45
9	-121.6922847	38.7675036	RL3-180	300644		1104697-65012			22
10	-121.6918364	38.7670868	RL5-180	300643		1104691-65006			N/A
11	-121.6921093	38.7667290	RR5-180-69	300676	107121	1104774-65044	1105015-44627		25
12	-121.6915727	38.7668941	RL6-180-69	300684	107115	1104779-65049	1105028-44625		20
13	-121.6919126	38.7665356	RR6-180	300673		1104701-65016			22
14	-121.6917201	38.7662864	RR7-180-69	300678	107058	1104700-65015	1088554-48636		20
15	-121.6914726	38.7661033	RR8-180	300687		1104771-65041			21
16	-121.6913447	38.7666350	RL7-180	300651		1104776-65046			20
17	-121.6910813	38.7664383	RL8-180-69	300685	107061	1104777-65047	1105024-44621		23
18	-121.6908115	38.7662405	RL9-180	300645		1104702-65017			20
19	-121.6905386	38.7660444	RL10-180-69	300674	107071	1104778-65048	1105023-44620		20
20	-121.6912203	38.7659251	RR9-180-69	300682	104302	1104768-65038	1105026-44623		23
21	-121.6919456	38.7668212	RM4-180-S	300635		1104766-65036			40
22	-121.6913968	38.7665519	RM6-180-0	300650		no sync			38
23	-121.6909011	38.7657403	RR10-180	300638		1104767-65037			24

	Long	Lat	Point Name	180 receiver	69 receiver	180 sync	69 sync	Tilt	Depth (ft.)
24	-121.6906418	38.7655313	RR11-180-69	300647	107119	1104703-65018	1084725-48929		24
25	-121.6904078	38.7653194	RR12-180	300648		1104755-65025			23
26	-121.6901781	38.7651069	RR13-180-69-SH-TL	300690	109063	1104757-65027	1088556-48638	482	23
27	-121.6898991	38.7649169	RR14-180-TL	300655		1104753-65023		483	21
28	-121.6911119	38.7661529	RM8-180-0	300649		no sync			32
29	-121.6902587	38.7658281	RL11-180	300646		1104759-65029			23
30	-121.6899735	38.7656200	RL12-180-69-TL	300675	107118	1104758-65028	65389	479	22
31	-121.6896762	38.7653944	RL13-180-69	300654	107069	1104770-65040	1084728-48932		22
32	-121.6894038	38.7651978	RL14-180-69	300679	107113	1104688-65003	1105020-44632		20
33	-121.6890994	38.7650103	RL15-180	300656		1104751-65021			N/A
34	-121.6887563	38.7647418	RL16-180-69-SH	300689	107117	1104756-65026	1082757-64381		22
35	-121.6883683	38.7645422	RL17-180	300634		1104754-65024			19
36	-121.6880388	38.7642784	RL18-180-69	300632	107067	1104762-65032	1082758-64382		20
37	-121.6876664	38.7641105	RL19-180	300642		1104693-65008			21
38	-121.6872499	38.7639295	RL20-180-69	300693	107063	1104761-65031	1082760-64384		20
39	-121.6908792	38.7659951	RM9-180-SY	300688		1104763-65033			31
40	-121.6905674	38.7657560	RM10-180-0	300692		no sync			28
41	-121.6896876	38.7646940	RR15-180-69-TL	300695	107066	1104769-65039	1084729-48933	484	24
42	-121.6893861	38.7644897	RR16-180-TL-SH	300694		1104760-65030		481	19
43	-121.6902894	38.7655413	RM11-180-SY-NSH	300669		1104690-65005			28
44	-121.6891133	38.7643312	RR17-180-69-NSH	300661	109061	1104765-65035	1084727-48931		18
45	-121.6888370	38.7641754	RR18-180	300671		1104764-65034			19
46	-121.6885543	38.7640057	RR19-180-69-NSH	300666	107062	1104699-65014	1105018-44630		18

	Long	Lat	Point Name	180 receiver	69 receiver	180 sync	69 sync	Tilt	Depth (ft.)
47	-121.6882303	38.7638376	RR20-180-TL	300641		1104687-65002		478	20
48	-121.6878400	38.7636791	RR21-180-NSH	300665		1104686-65001			24
49	-121.6900099	38.7653428	RM12-180-0	300668		no sync			27
50	-121.6897661	38.7651423	RM13-180-SY	300670		1104780-65050			N/A
51	-121.6894806	38.7649412	RM14-180-0	300667		no sync			23
52	-121.6891093	38.7647413	RM15-180-SY	300662		1104773-65043			22
53	-121.6886947	38.7644156	RM16-180-0	300691		no sync			22
54	-121.6883402	38.7642657	RM17-180-SY	300660		1104775-65045			20
55	-121.6879563	38.7641017	RM18-180-0	300664		no sync			21
56	-121.6875301	38.7637785	RM19-180-SY	300672		1104772-65042			23
57	-121.6874214	38.7634681	RR22-180-69SY	300663	107059	no sync	1105029-44626		20
58	-121.6927879	38.7676049	RM1-180-69SY	300658	107120	no sync	1105027-44624		45
59	-121.6913789	38.7663505	RM7-180-SY	300633		1104752-65022			32
60	-121.6917169	38.7666384	RM5-180-SY69	300659		no sync	1105017-44629		N/A

Appendix C: Receiver Locations, Georgiana Slough

	Long	Lat	Point Name	180 receiver	69 receiver	180 sync	69 sync	Tilt
1	4233531.8100	629737.4400	GS 1	300063	106679	No	No	No
2	4233497.7000	629659.0300	GS 2	300064	106680	No	No	No
3	4233420.2300	629618.0900	GS 3	300065	106681	No	No	No
4	4233440.0900	629729.1900	GS 4	300565	106682	No	No	No
5	4233369.4900	629741.7200	GS 5	300568	106683	No	No	No
6	4233478.3300	629807.9100	GS 6	300571	106684	No	No	No
7	4233431.7600	629790.3700	GS 7	300578	106685	No	No	No
8	4233554.0400	629857.7300	GS 8			No	No	No
9	4233410.7700	629782.6100	GS Sync 1	N/A	N/A	Yes	Yes	No
10	4233506.1000	629677.7100	GS Sync 2	N/A	N/A	Yes	Yes	No

Appendix D: 180-kHz Tagged Smolts

Release Area	Release Date	Release Time Start	Release Time End	Date	Tag Code	Holding Temp	Holding DO	Surgeon	Knockdown Start	Knockdown End	Surgery End	FL	Weight	Scales	Fins	Eyes
Knights Landing Bridge	13/Jan/11	5:20 PM	7:40 PM	1/12/2011	1	7.00	12.39	CW	10:43:20 AM	10:44:10 AM	10:46:35 AM	166	53.80	G	G	G
	13/Jan/11	5:20 PM	7:40 PM	1/12/2011	2	7.00	12.39	BR	10:42:05 AM	10:42:25 AM	10:45:50 AM	156	39.30	G	G	G
	13/Jan/11	5:20 PM	7:40 PM	1/12/2011	3	7.00	12.39	BR	9 :55:25 AM	9 :56:00 AM	10:00:40 AM	108	14.50	G	G	G
	13/Jan/11	5:20 PM	7:40 PM	1/12/2011	4	7.00	12.39	CW	9 :59:25 AM	10:00:20 AM	10:04:55 AM	109	14.90	G	G	G
	13/Jan/11	5:20 PM	7:40 PM	1/11/2011	5	7.00	12.39	CL	4 :53:07 PM	4 :54:25 PM	4 :59:28 PM	150	39.90	G	G	G
	13/Jan/11	5:20 PM	7:40 PM	1/11/2011	6	7.00	12.39	BB	4 :54:25 PM	4 :55:27 PM	4 :59:53 PM	151	35.70	G	G	G
	13/Jan/11	5:20 PM	7:40 PM	1/11/2011	7	7.00	12.39	CL	4 :46:45 PM	4 :47:10 PM	4 :51:20 PM	161	47.00	G	G	G
	13/Jan/11	5:20 PM	7:40 PM	1/11/2011	8	7.00	12.39	BB	4 :46:40 PM	4 :47:00 PM	4 :51:29 PM	180	60.40	G	G	G
	13/Jan/11	5:20 PM	7:40 PM	1/11/2011	9	7.00	12.39	CL	4 :36:46 PM	4 :38:09 PM	4 :42:30 PM	168	49.20	G	G	G
	13/Jan/11	5:20 PM	7:40 PM	1/11/2011	10	7.00	12.39	BR	4 :35:05 PM	4 :36:01 PM	4 :38:55 PM	159	44.30	G	G	G
	13/Jan/11	5:20 PM	7:40 PM	1/11/2011	11	7.00	12.39	BR	4 :29:30 PM	4 :30:25 PM	4 :33:39 PM	155	43.70	G	G	G
	13/Jan/11	5:20 PM	7:40 PM	1/11/2011	12	7.00	12.39	CW	4 :27:40 PM	4 :29:00 PM	4 :31:35 PM	149	35.80	G	G	G
	13/Jan/11	5:20 PM	7:40 PM	1/11/2011	13	7.00	12.39	BR	4 :24:00 PM	4 :25:05 PM	4 :28:00 PM	172	56.80	G	G	G
	13/Jan/11	5:20 PM	7:40 PM	1/11/2011	14	7.00	12.39	CW	4 :22:55 PM	4 :24:20 PM	4 :26:50 PM	171	46.40	G	G	G
	13/Jan/11	5:20 PM	7:40 PM	1/11/2011	15	7.00	12.39	BR	4 :19:00 PM	4 :20:05 PM	4 :22:55 PM	151	37.00	G	G	G
	13/Jan/11	5:20 PM	7:40 PM	1/11/2011	16	7.00	12.39	CW	3 :51:24 PM	3 :52:40 PM	3 :58:20 PM	156	44.50	G	G	G
	13/Jan/11	5:20 PM	7:40 PM	1/11/2011	17	7.00	12.39	CW	4 :17:20 PM	4 :18:30 PM	4 :21:10 PM	163	49.80	G	G	G
	13/Jan/11	5:20 PM	7:40 PM	1/11/2011	18	7.00	12.39	BR	4 :12:40 PM	4 :13:30 PM	4 :17:55 PM	162	46.60	G	G	G
	13/Jan/11	5:20 PM	7:40 PM	1/11/2011	19	7.00	12.39	CW	4 :10:30 PM	4 :11:55 PM	4 :15:15 PM	170	51.50	F	G	G
	13/Jan/11	5:20 PM	7:40 PM	1/11/2011	20	7.00	12.39	BR	4 :02:30 PM	4 :03:30 PM	4 :07:55 PM	151	36.70	G	G	G
Millers Landing	13/Jan/11	6:20 PM	7:15 PM	1/12/2011	21	7.00	12.39	BR	11:04:00 AM	11:04:45 AM	11:08:15 AM	158	46.90	G	G	G
	13/Jan/11	6:20 PM	7:15 PM	1/12/2011	22	7.00	12.39	CW	11:04:45 AM	11:06:00 AM	11:08:35 AM	166	49.00	G	G	G
	13/Jan/11	6:20 PM	7:15 PM	1/12/2011	23	7.00	12.39	BR	11:10:00 AM	11:10:40 AM	11:13:10 AM	151	37.00	G	G	G

Release Area	Release Date	Release Time Start	Release Time End	Date	Tag Code	Holding Temp	Holding DO	Surgeon	Knockdown Start	Knockdown End	Surgery End	FL	Weight	Scales	Fins	Eyes
Millers Landing (cont)	13/Jan/11	6:20 PM	7:15 PM	1/12/2011	24	7.00	12.39	CW	11:12:05 AM	11:13:05 AM	11:15:20 AM	156	36.90	G	G	G
	13/Jan/11	6:20 PM	7:15 PM	1/12/2011	25	7.00	12.39	BR	11:15:35 AM	11:16:05 AM	11:18:35 AM	149	39.30	G	G	G
	13/Jan/11	6:20 PM	7:15 PM	1/12/2011	26	7.00	12.39	CW	11:16:45 AM	11:17:35 AM	11:19:45 AM	146	33.70	G	G	G
	13/Jan/11	6:20 PM	7:15 PM	1/12/2011	27	7.00	12.39	BR	11:18:55 AM	11:19:55 AM	11:22:25 AM	154	39.40	G	G	G
	13/Jan/11	6:20 PM	7:15 PM	1/12/2011	28	7.00	12.39	CW	11:19:55 AM	11:21:05 AM	11:23:05 AM	158	44.30	G	G	G
	13/Jan/11	6:20 PM	7:15 PM	1/12/2011	29	7.00	12.39	BR	11:23:00 AM	11:23:20 AM	11:25:40 AM	160	48.00	G	G	G
	13/Jan/11	6:20 PM	7:15 PM	1/12/2011	30	7.00	12.39	CW	11:23:55 AM	11:24:45 AM	11:26:40 AM	163	45.10	G	G	G
	13/Jan/11	6:20 PM	7:15 PM	1/12/2011	31	7.00	12.39	BR	11:25:40 AM	11:25:50 AM	11:28:40 AM	156	40.00	G	G	G
	13/Jan/11	6:20 PM	7:15 PM	1/12/2011	32	7.00	12.39	BB	11:32:15 AM	11:33:05 AM	11:37:45 AM	153	38.60	G	G	G
	13/Jan/11	6:20 PM	7:15 PM	1/12/2011	33	7.00	12.39	BR	11:31:00 AM	11:31:35 AM	11:34:05 AM	154	42.70	G	G	G
	13/Jan/11	6:20 PM	7:15 PM	1/12/2011	34	7.00	12.39	BR	11:39:15 AM	11:39:50 AM	11:42:30 AM	175	0.00	G	F	G
	13/Jan/11	6:20 PM	7:15 PM	1/12/2011	35	7.00	12.39	BB	11:40:45 AM	11:41:20 AM	11:48:45 AM	169	31.00	G	G	G
	13/Jan/11	6:20 PM	7:15 PM	1/12/2011	36	7.00	12.39	BR	11:48:20 AM	11:48:45 AM	11:51:50 AM	149	22.00	G	G	G
	13/Jan/11	6:20 PM	7:15 PM	1/12/2011	37	7.00	12.39	BB	11:50:10 AM	11:51:10 AM	11:55:50 AM	156	30.50	G	G	G
	13/Jan/11	6:20 PM	7:15 PM	1/12/2011	38	7.00	12.39	CL	11:55:50 AM	11:56:52 AM	12:00:37 PM	171	48.20	G	G	G
	13/Jan/11	6:20 PM	7:15 PM	1/12/2011	39	7.00	12.39	BB	11:57:36 AM	11:58:25 AM	12:02:47 PM	155	43.40	G	G	G
	13/Jan/11	6:20 PM	7:15 PM	1/12/2011	40	7.00	12.39	CL	12:01:38 PM	12:02:02 PM	12:05:12 PM	176	46.80	G	G	G
	13/Jan/11	6:20 PM	7:15 PM	1/12/2011	41	7.00	12.39	BB	12:03:07 PM	12:03:49 PM	12:07:06 PM	163	43.60	G	G	G
Riverside	13/Jan/11	5:00 PM	8:00 PM	1/12/2011	42	7.00	12.39	CL	12:42:28 PM	12:43:15 PM	12:46:14 PM	174	30.70	G	G	G
	13/Jan/11	5:00 PM	8:00 PM	1/12/2011	43	7.00	12.39	BB	12:41:34 PM	12:41:53 PM	12:45:34 PM	170	30.30	G	G	G
	13/Jan/11	5:00 PM	8:00 PM	1/12/2011	44	7.00	12.39	BB	12:46:45 PM	12:47:09 PM	12:49:52 PM	161	28.40	G	G	G
	13/Jan/11	5:00 PM	8:00 PM	1/12/2011	45	7.00	12.39	CL	12:47:41 PM	12:48:18 PM	12:51:11 PM	169	39.80	G	G	G
	13/Jan/11	5:00 PM	8:00 PM	1/12/2011	46	7.00	12.39	BB	12:49:52 PM	12:51:04 PM	12:53:55 PM	178	38.40	G	G	G

Release Area	Release Date	Release Time Start	Release Time End	Date	Tag Code	Holding Temp	Holding DO	Surgeon	Knockdown Start	Knockdown End	Surgery End	FL	Weight	Scales	Fins	Eyes
Riverside (cont)	13/Jan/11	5:00 PM	8:00 PM	1/12/2011	47	7.00	12.39	CL	12:52:54 PM	12:53:27 PM	12:56:09 PM	168	33.60	G	G	G
	13/Jan/11	5:00 PM	8:00 PM	1/12/2011	48	7.00	12.39	BB	12:55:02 PM	12:55:28 PM	12:58:27 PM	160	39.90	G	F	G
	13/Jan/11	5:00 PM	8:00 PM	1/12/2011	49	7.00	12.39	CL	12:57:45 PM	12:58:11 PM	1 :00:48 PM	168	41.40	G	G	G
	13/Jan/11	5:00 PM	8:00 PM	1/12/2011	50	7.00	12.39	BB	12:59:41 PM	12:59:59 PM	1 :02:36 PM	171	36.20	G	G	G
	13/Jan/11	5:00 PM	8:00 PM	1/12/2011	51	7.00	12.39	CL	1 :01:54 PM	1 :02:36 PM	1 :04:59 PM	164	36.20	G	F	G
	13/Jan/11	5:00 PM	8:00 PM	1/12/2011	52	7.00	12.39	BB	1 :15:20 PM	1 :15:42 PM	1 :19:06 PM	155	29.30	G	G	G
	13/Jan/11	5:00 PM	8:00 PM	1/12/2011	53	7.00	12.39	CL	1 :14:52 PM	1 :15:42 PM	1 :18:32 PM	169	33.80	G	G	G
	13/Jan/11	5:00 PM	8:00 PM	1/12/2011	54	7.00	12.39	BB	1 :20:45 PM	1 :21:15 PM	1 :23:52 PM	168	29.00	G	G	G
	13/Jan/11	5:00 PM	8:00 PM	1/12/2011	55	7.00	12.39	CL	1 :19:57 PM	1 :20:30 PM	1 :23:35 PM	148	24.50	G	G	G
	13/Jan/11	5:00 PM	8:00 PM	1/12/2011	56	7.00	12.39	CL	1 :24:22 PM	1 :25:01 PM	1 :27:11 PM	169	47.00	G	G	G
	13/Jan/11	5:00 PM	8:00 PM	1/12/2011	57	7.00	12.39	BB	1 :24:53 PM	1 :25:26 PM	1 :28:49 PM	154	36.50	G	G	G
	13/Jan/11	5:00 PM	8:00 PM	1/12/2011	58	7.00	12.39	CL	1 :28:06 PM	1 :28:57 PM	1 :31:52 PM	172	37.20	G	G	G
	13/Jan/11	5:00 PM	8:00 PM	1/12/2011	59	7.00	12.39	BB	1 :29:37 PM	1 :30:02 PM	1 :32:52 PM	171	34.10	G	G	G
	13/Jan/11	5:00 PM	8:00 PM	1/12/2011	60	7.00	12.39	CL	1 :33:19 PM	1 :34:05 PM	1 :37:01 PM	162	34.50	G	G	G
	13/Jan/11	5:00 PM	8:00 PM	1/12/2011	61	7.00	12.39	BB	1 :34:05 PM	1 :34:32 PM	1 :37:23 PM	167	39.10	G	G	G
	13/Jan/11	5:00 PM	8:00 PM	1/12/2011	62	7.00	12.39	CL	1 :38:14 PM	1 :38:54 PM	1 :42:10 PM	148	28.50	G	G	G
Millers Landing	13/Jan/11	6:20 PM	7:15 PM	1/12/2011	63	7.00	12.39	CW	2 :14:18 PM	2 :15:30 PM	2 :18:43 PM	114	15.80	G	G	G
	13/Jan/11	6:20 PM	7:15 PM	1/12/2011	64	7.00	12.39	CW	1 :51:28 PM	1 :52:27 PM	1 :55:37 PM	110	14.30	G	G	G
	13/Jan/11	6:20 PM	7:15 PM	1/12/2011	65	7.00	12.39	BR	2 :13:17 PM	2 :13:46 PM	2 :17:52 PM	108	14.70	G	G	G
	13/Jan/11	6:20 PM	7:15 PM	1/12/2011	66	7.00	12.39	BR	2 :18:32 PM	2 :19:00 PM	2 :23:00 PM	108	19.10	G	G	G
	13/Jan/11	6:20 PM	7:15 PM	1/12/2011	67	7.00	12.39	CW	2 :20:01 PM	2 :20:41 PM	2 :25:00 PM	113	14.80	G	G	G

Release Area	Release Date	Release Time Start	Release Time End	Date	Tag Code	Holding Temp	Holding DO	Surgeon	Knockdown Start	Knockdown End	Surgery End	FL	Weight	Scales	Fins	Eyes
Knights Landing Bridge	13/Jan/11	5:20 PM	7:40 PM	1/12/2011	68	7.00	12.39	BR	3 :07:40 PM	3 :08:21 PM	3 :12:21 PM	106	14.40	G	G	G
	13/Jan/11	5:20 PM	7:40 PM	1/12/2011	69	7.00	12.39	CW	3 :08:10 PM	3 :08:43 PM	3 :12:00 PM	109	16.20	G	G	G
	13/Jan/11	5:20 PM	7:40 PM	1/12/2011	70	7.00	12.39	BR	3 :13:05 PM	3 :13:40 PM	3 :17:12 PM	118	19.30	G	G	G
Riverside	13/Jan/11	5:00 PM	8:00 PM	1/12/2011	71	7.00	12.39	CW	3 :20:23 PM	3 :21:26 PM	3 :24:57 PM	113	16.30	G	G	G
	13/Jan/11	5:00 PM	8:00 PM	1/12/2011	72	7.00	12.39	BR	3 :19:28 PM	3 :20:07 PM	3 :25:50 PM	114	16.40	G	G	G
	13/Jan/11	5:00 PM	8:00 PM	1/12/2011	73	7.00	12.39	BR	3 :27:33 PM	3 :27:56 PM	3 :30:50 PM	114	16.20	G	G	G
	13/Jan/11	5:00 PM	8:00 PM	1/12/2011	74	7.00	12.39	CW	3 :27:20 PM	3 :27:58 PM	3 :30:37 PM	109	14.20	G	G	G
	13/Jan/11	5:00 PM	8:00 PM	1/12/2011	75	7.00	12.39	CW	3 :31:26 PM	3 :32:30 PM	3 :35:22 PM	112	16.40	G	G	G
Knights Landing Bridge	13/Jan/11	5:20 PM	7:40 PM	1/12/2011	76	7.00	12.39	BR	3 :54:10 PM	3 :54:24 PM	3 :57:39 PM	109	14.40	G	G	G
	2/25/11			2/24/11	77	7.90	12.22	BR	2:46:16 PM	2:46:58 PM	2:49:07 PM	109	14.30	G	G	G
	2/25/11			2/24/11	78	7.90	12.22	BR	2:49:34 PM	2:50:10 PM	2:52:34 PM	106	13.90	G	G	G
	2/25/11			2/24/11	79	7.90	12.22	BR	2:53:30 PM	2:53:51 PM	2:55:29 PM	112	14.10	G	G	G
	2/25/11			2/24/11	80	7.90	12.22	BR	2:56:10 PM	2:56:44 PM	2:58:51 PM	111	13.80	G	G	G
	2/25/11			2/24/11	81	7.90	12.22	CW	2:59:03 PM	3:00:01 PM	3:02:48 PM	113	14.20	G	G	G
	2/25/11			2/24/11	82	7.90	12.22	BR	2:59:42 PM	3:00:46 PM	3:03:03 PM	104	13.20	G	G	G
	2/25/11			2/24/11	83	7.90	12.22	BR	3:11:57 PM	3:13:06 PM	3:15:05 PM	106	13.10	G	G	G
	2/25/11			2/24/11	84	7.90	12.22	BR	3:03:23 PM	3:04:17 PM	3:06:39 PM	109	15.10	G	G	G
	2/25/11			2/24/11	85	7.90	12.22	BR	3:08:56 PM	3:09:30 PM	3:11:36 PM	105	13.00	G	G	G
	2/25/11			2/24/11	86	7.90	12.22	CW	3:15:36 PM	3:16:31 PM	3:19:09 PM	105	13.30	G	G	G
	2/25/11			2/24/11	87	7.90	12.22	BR	3:15:28 PM	3:16:10 PM	3:18:37 PM	106	12.60	G	G	P
	2/25/11			2/24/11	88	7.90	12.22	CW	3:19:30 PM	3:20:14 PM	3:23:32 PM	112	13.40	G	G	G
	2/25/11			2/24/11	89	7.90	12.22	BR	3:18:51 PM	3:19:44 PM	3:22:04 PM	104	14.30	G	G	G
	2/25/11			2/24/11	90	7.90	12.22	BR	3:45:45 PM	3:46:13 PM	3:48:49 PM	112	16.20	G	G	G

Release Area	Release Date	Release Time Start	Release Time End	Date	Tag Code	Holding Temp	Holding DO	Surgeon	Knockdown Start	Knockdown End	Surgery End	FL	Weight	Scales	Fins	Eyes
Knights Landing Bridge (cont)	2/25/11			2/24/11	91	7.90	12.22	CW	3:46:13 PM	3:46:52 PM	3:49:27 PM	109	13.80	G	G	G
	2/25/11			2/24/11	92	7.90	12.22	BR	3:49:08 PM	3:50:00 PM	3:52:45 PM	113	14.30			
	2/25/11			2/24/11	93	7.90	12.22	CW	3:49:49 PM	3:50:47 PM	3:53:00 PM	120	17.50	G	G	G
	2/25/11			2/24/11	94	7.90	12.22	BR	3:53:00 PM	3:53:43 PM	3:55:53 PM	110	14.60	G	G	G
	2/25/11			2/24/11	95	7.90	12.22	CW	3:53:43 PM	3:54:30 PM	3:57:18 PM	105	12.60	G	G	G
	2/25/11			2/24/11	96	7.90	12.22	BR	3:56:09 PM	3:56:39 PM	3:58:51 PM	110	14.80	G	G	G
	2/25/11			2/24/11	97	7.90	12.22	CW	3:57:43 PM	3:58:32 PM	4:01:17 PM	113	17.00	G	G	G
	2/25/11			2/24/11	98	7.90	12.22	BR	3:59:05 PM	4:00:03 PM	4:02:34 PM	106	14.40	G	G	G
	2/25/11			2/24/11	99	7.90	12.22	CW	4:01:38 PM	4:02:22 PM	4:04:39 PM	117	17.90	G	G	G
	2/25/11			2/24/11	100	7.90	12.22	BR	4:03:18 PM	4:03:57 PM	4:06:02 PM	110	14.90	G	G	G
	2/25/11			2/24/11	101	7.90	12.22	CW	4:04:58 PM	4:05:41 PM	4:08:05 PM	110	13.30	G	G	G
	2/25/11			2/24/11	102	7.90	12.22	BR	4:06:27 PM	4:07:06 PM	4:09:24 PM	110	15.20	G	G	G
	2/25/11			2/24/11	103	7.90	12.22	CW	4:08:26 PM	4:09:16 PM	4:12:01 PM	118	14.70	G	G	G
	2/25/11			2/24/11	104	7.90	12.22	BR	4:09:53 PM	4:11:18 PM	4:13:36 PM	106	12.60	G	G	G
	2/25/11			2/24/11	105	7.90	12.22	CW	4:12:28 PM	4:13:30 PM	4:16:35 PM	107	13.90	G	G	G
	2/25/11			2/24/11	106	7.90	12.22	BR	4:13:55 PM	4:15:08 PM	4:17:32 PM	106	12.10	G	G	G
	2/25/11			2/24/11	107	7.90	12.22	CW	4:17:38 PM	4:18:42 PM	4:21:12 PM	111	15.20	G	G	G
	2/25/11			2/24/11	108	7.90	12.22	BR	4:18:33 PM	4:19:26 PM	4:21:45 PM	110	14.60	G	G	G
	2/25/11			2/24/11	109	7.90	12.22	CW	4:21:31 PM	4:22:19 PM	4:25:37 PM	106	13.80	G	G	G
	2/25/11			2/24/11	110	7.90	12.22	BR	4:22:10 PM	4:22:53 PM	4:25:26 PM	108	15.20	G	G	G
	2/25/11			2/24/11	111	7.90	12.22	BR	4:26:13 PM	4:26:49 PM	4:28:58 PM	103	12.60	G	G	G
	2/25/11			2/24/11	112	7.90	12.22	CW	4:26:51 PM	4:27:48 PM	4:30:26 PM	107	12.30	G	G	G
	2/25/11			2/25/11	113	7.20	12.42	BR	9:34:15 AM	9:34:58 AM	9:37:23 AM	173	60.50	G	G	G

Release Area	Release Date	Release Time Start	Release Time End	Date	Tag Code	Holding Temp	Holding DO	Surgeon	Knockdown Start	Knockdown End	Surgery End	FL	Weight	Scales	Fins	Eyes
Knights Landing Bridge (cont)	2/25/11			2/25/11	114	7.20	12.42	BB	9:44:45 AM	9:45:15 AM	9:48:30 AM	171	39.70	G	F	G
	2/25/11			2/25/11	115	7.20	12.42	BR	9:37:40 AM	9:38:15 AM	9:40:45 AM	162	42.80	G	G	G
	2/25/11			2/25/11	116	7.20	12.42	BB	9:48:55 AM	9:49:25 AM	9:53:15 AM	170	49.60	G	F	G
	2/25/11			2/25/11	117	7.20	12.42	BR	9:40:45 AM	9:41:00 AM	9:44:00 AM	155	36.40	G	F	G
	2/25/11			2/25/11	118	7.20	12.42	BR	9:45:00 AM	9:45:50 AM	9:48:25 AM	170	49.80	G	G	G
	2/25/11			2/25/11	119	7.20	12.42	BR	9:49:55 AM	9:50:35 AM	9:52:35 AM	156	40.60	G	G	G
	2/25/11			2/25/11	120	7.20	12.42	BB	9:54:55 AM	9:55:35 AM	9:58:25 AM	181	63.10	G	G	G
	2/25/11			2/25/11	121	7.20	12.42	BR	9:52:50 AM	9:53:40 AM	9:55:45 AM	163	45.30	F	G	G
	2/25/11			2/25/11	122	7.20	12.42	BR	9:56:00 AM	9:56:55 AM	9:59:00 AM	176	64.90	G	G	G
	2/25/11			2/25/11	123	7.20	12.42	BB	9:59:30 AM	10:00:00 AM	10:03:20 AM	180	59.80	G	G	G
	2/25/11			2/25/11	124	7.20	12.42	BR	10:00:00 AM	10:00:30 AM	10:02:22 AM	190	70.90	F	G	G
	2/25/11			2/25/11	125	7.20	12.42	BB	10:02:25 AM	10:02:50 AM	10:06:50 AM	158	37.40	G	F	G
	2/25/11			2/25/11	126	7.20	12.42	BR	10:03:30 AM	10:04:00 AM	10:05:50 AM	150		G	F	G
	2/25/11			2/25/11	127	7.20	12.42	BR	10:10:15 AM	10:10:55 AM	10:12:45 AM	172	52.30	F	G	G
	2/25/11			2/25/11	128	7.20	12.42	BB	10:09:40 AM	10:10:20 AM	10:13:20 AM	152	35.00	G	G	G
	2/25/11			2/25/11	129	7.20	12.42	BR	10:12:55 AM	10:13:40 AM	10:15:45 AM	164	42.50	F	F	G
	2/25/11			2/25/11	130	7.20	12.42	BB	10:14:10 AM	10:14:50 AM	10:17:25 AM	172	55.80	G	G	G
	2/25/11			2/25/11	131	7.20	12.42	BR	10:15:50 AM	10:16:40 AM	10:18:40 AM	158	38.30	F	F	G
	2/25/11			2/25/11	132	7.20	12.42	BB	10:18:30 AM	10:19:05 AM	10:21:25 AM	179	60.30	G	G	G
	13/Jan/11	5:20 PM	7:40 PM	1 /12/2011	133	7.00	12.39	CW	3 :54:43 PM	3 :55:45 PM	3 :58:18 PM	110	14.40	G	G	G
	13/Jan/11	5:20 PM	7:40 PM	1 /12/2011	134	7.00	12.39	BR	3 :58:45 PM	3 :58:56 PM	4 :01:46 PM	118	17.40	G	G	G

Release Area	Release Date	Release Time Start	Release Time End	Date	Tag Code	Holding Temp	Holding DO	Surgeon	Knockdown Start	Knockdown End	Surgery End	FL	Weight	Scales	Fins	Eyes
Millers Landing	13/Jan/11	6:20 PM	7:15 PM	1 /12/2011	135	7.00	12.39	CW	4 :01:15 PM	4 :01:47 PM	4 :04:16 PM	112	16.40	G	G	G
	13/Jan/11	6:20 PM	7:15 PM	1 /12/2011	136	7.00	12.39	BR	4 :02:45 PM	4 :02:46 PM	4 :06:40 PM	110	15.90	G	G	G
	13/Jan/11	6:20 PM	7:15 PM	1 /12/2011	137	7.00	12.39	CW	4 :05:35 PM	4 :06:20 PM	4 :09:16 PM	108	15.80	G	G	G
Riverside	13/Jan/11	5:00 PM	8:00 PM	1 /12/2011	138	7.00	12.39	BR	4 :07:43 PM	4 :07:49 PM	4 :11:32 PM	108	15.00	G	G	G
	13/Jan/11	5:00 PM	8:00 PM	1 /12/2011	139	7.00	12.39	CW	4 :09:49 PM	4 :11:12 PM	4 :14:26 PM	119	21.40	G	G	G
	13/Jan/11	5:00 PM	8:00 PM	1 /12/2011	140	7.00	12.39	BR	4 :12:00 PM	4 :12:50 PM	4 :15:20 PM	114	15.20	G	G	G
Knights Landing Bridge	13/Jan/11	5:20 PM	7:40 PM	1 /12/2011	141	7.00	12.39	BR	4 :26:19 PM	4 :26:42 PM	4 :30:01 PM	105	14.30	G	G	G
	13/Jan/11	5:20 PM	7:40 PM	1 /12/2011	142	7.00	12.39	CW	4 :27:39 PM	4 :28:27 PM	4 :32:11 PM	115	16.80	G	G	G
Millers Landing	13/Jan/11	6:20 PM	7:15 PM	1 /12/2011	143	7.00	12.39	BR	4 :31:26 PM	4 :31:55 PM	4 :34:16 PM	113	15.90	G	G	G
	13/Jan/11	6:20 PM	7:15 PM	1 /12/2011	144	7.00	12.39	CW	4 :33:17 PM	4 :34:16 PM	4 :37:20 PM	109	15.90	G	G	G
Riverside	13/Jan/11	5:00 PM	8:00 PM	1 /12/2011	145	7.00	12.39	BR	4 :34:53 PM	4 :35:37 PM	4 :38:11 PM	109	13.90	G	G	G
	13/Jan/11	5:00 PM	8:00 PM	1 /12/2011	146	7.00	12.39	CW	4 :38:11 PM	4 :38:55 PM	4 :41:56 PM	111	14.90	G	G	G
Knights Landing Bridge	13/Jan/11	5:20 PM	7:40 PM	1 /13/2011	147	7.00	12.39	CW	9 :19:12 AM	9 :19:54 AM	9 :22:21 AM	164	45.90	G	G	G
	13/Jan/11	5:20 PM	7:40 PM	1 /13/2011	148	7.00	12.39	BR	9 :17:50 AM	9 :18:10 AM	9 :20:33 AM	165	46.80	G	G	G
	13/Jan/11	5:20 PM	7:40 PM	1 /13/2011	149	7.00	12.39	BR	9 :21:45 AM	9 :22:50 AM	9 :25:07 AM	148	35.50	G	G	G
	13/Jan/11	5:20 PM	7:40 PM	1 /13/2011	150	7.00	12.39	CW	9 :21:58 AM	9 :22:45 AM	9 :26:09 AM	152	40.40	G	G	G
	13/Jan/11	5:20 PM	7:40 PM	1 /13/2011	151	7.00	12.39	BR	9 :25:16 AM	9 :26:00 AM	9 :28:19 AM	152	37.90	G	G	G
	13/Jan/11	5:20 PM	7:40 PM	1 /13/2011	152	7.00	12.39	CW	9 :26:09 AM	9 :26:59 AM	9 :29:14 AM	149	36.40	G	G	G
	13/Jan/11	5:20 PM	7:40 PM	1 /13/2011	153	7.00	12.39	BR	9 :28:33 AM	9 :29:23 AM	9 :32:06 AM	160	43.70	G	G	G
	13/Jan/11	5:20 PM	7:40 PM	1 /13/2011	154	7.00	12.39	CW	9 :29:14 AM	9 :30:05 AM	9 :32:05 AM	150	35.40	G	G	G
	13/Jan/11	5:20 PM	7:40 PM	1 /13/2011	155	7.00	12.39	BR	9 :32:18 AM	9 :32:47 AM	9 :34:46 AM	156	41.10	G	G	G
	13/Jan/11	5:20 PM	7:40 PM	1 /13/2011	156	7.00	12.39	CW	9 :32:37 AM	9 :33:21 AM	9 :35:18 AM	165	49.90	G	G	G
	13/Jan/11	5:20 PM	7:40 PM	1 /13/2011	157	7.00	12.39	BR	9 :34:53 AM	9 :35:19 AM	9 :38:34 AM	151	38.50	G	G	G

Release Area	Release Date	Release Time Start	Release Time End	Date	Tag Code	Holding Temp	Holding DO	Surgeon	Knockdown Start	Knockdown End	Surgery End	FL	Weight	Scales	Fins	Eyes
Millers Landing	13/Jan/11	6:20 PM	7:15 PM	1 /13/2011	158	7.00	12.39	CL	9 :50:30 AM	9 :50:45 AM	9 :53:25 AM	146	31.20	G	G	G
	13/Jan/11	6:20 PM	7:15 PM	1 /13/2011	159	7.00	12.39	CW	9 :51:03 AM	9 :51:43 AM	9 :53:49 AM	151	36.80	F	G	G
	13/Jan/11	6:20 PM	7:15 PM	1 /13/2011	160	7.00	12.39	CL	9 :53:23 AM	9 :54:25 AM	9 :56:46 AM	146	32.90	G	G	G
	13/Jan/11	6:20 PM	7:15 PM	1 /13/2011	161	7.00	12.39	CW	9 :53:55 AM	9 :54:37 AM	9 :56:46 AM	149	40.80	G	G	G
	13/Jan/11	6:20 PM	7:15 PM	1 /13/2011	162	7.00	12.39	CL	10:04:08 AM	10:04:38 AM	10:07:47 AM	157	37.90	G	G	G
	13/Jan/11	6:20 PM	7:15 PM	1 /13/2011	163	7.00	12.39	CW	9 :56:18 AM	9 :59:35 AM	10:02:15 AM	152	38.80	G	G	G
	13/Jan/11	6:20 PM	7:15 PM	1 /13/2011	164	7.00	12.39	BB	10:05:13 AM	10:05:42 AM	10:08:58 AM	157	43.40	G	G	G
	13/Jan/11	6:20 PM	7:15 PM	1 /13/2011	165	7.00	12.39	CL	10:08:45 AM	10:09:24 AM	10:11:46 AM	152	38.30	G	G	G
	13/Jan/11	6:20 PM	7:15 PM	1 /13/2011	166	7.00	12.39	BB	10:09:43 AM	10:10:31 AM	10:13:02 AM	151	39.20	G	G	G
	13/Jan/11	6:20 PM	7:15 PM	1 /13/2011	167	7.00	12.39	CL	10:12:25 AM	10:13:07 AM	10:15:29 AM	152	36.70	G	G	G
	13/Jan/11	6:20 PM	7:15 PM	1 /13/2011	168	7.00	12.39	BB	10:13:37 AM	10:14:28 AM	10:18:00 AM	165	49.00	G	G	G
Riverside	13/Jan/11	5:00 PM	8:00 PM	1 /12/2011	169	7.00	12.39	CL	10:29:54 AM	10:30:33 AM	10:33:20 AM	153	36.70	G	G	G
	13/Jan/11	5:00 PM	8:00 PM	1 /12/2011	170	7.00	12.39	BB	10:33:37 AM	10:34:28 AM	10:37:47 AM	165	48.00	G	G	G
	13/Jan/11	5:00 PM	8:00 PM	1 /12/2011	171	7.00	12.39	CL	10:34:03 AM	10:34:43 AM	10:37:24 AM	164	47.20	G	G	G
	13/Jan/11	5:00 PM	8:00 PM	1 /12/2011	172	7.00	12.39	BB	10:40:55 AM	10:41:20 AM	10:44:12 AM	171	49.90	G	G	G
	13/Jan/11	5:00 PM	8:00 PM	1 /12/2011	173	7.00	12.39	CL	10:38:03 AM	10:38:46 AM	10:41:15 AM	164	49.00	G	G	G
	13/Jan/11	5:00 PM	8:00 PM	1 /12/2011	174	7.00	12.39	CL	10:43:16 AM	10:44:22 AM	10:46:35 AM	163	49.40	G	G	G
	13/Jan/11	5:00 PM	8:00 PM	1 /12/2011	175	7.00	12.39	BB	10:46:52 AM	10:48:05 AM	10:51:14 AM	157	46.80	G	G	G
	13/Jan/11	5:00 PM	8:00 PM	1 /12/2011	176	7.00	12.39	CL	10:47:39 AM	10:48:31 AM	10:51:16 AM	160	43.00	G	G	G
	13/Jan/11	5:00 PM	8:00 PM	1 /12/2011	177	7.00	12.39	BB	10:51:27 AM	10:52:34 AM	10:55:24 AM	158	45.30	G	G	G
	13/Jan/11	5:00 PM	8:00 PM	1 /12/2011	178	7.00	12.39	CL	10:52:07 AM	10:52:57 AM	10:55:45 AM	164	48.00	G	G	G
	13/Jan/11	5:00 PM	8:00 PM	1 /12/2011	179	7.00	12.39	BB	10:55:24 AM	10:56:51 AM	10:59:19 AM	164	49.30	G	G	G

Release Area	Release Date	Release Time Start	Release Time End	Date	Tag Code	Holding Temp	Holding DO	Surgeon	Knockdown Start	Knockdown End	Surgery End	FL	Weight	Scales	Fins	Eyes
Knights Landing Bridge	2/25/11			2/25/11	180	7.20	12.42	BB	10:25:05 AM	10:25:50 AM	10:27:55 AM	177	62.80	G	G	G
	2/25/11			2/25/11	181	7.20	12.42	BR	10:25:45 AM	10:26:25 AM	10:28:15 AM	187	68.60	F	G	G
	2/25/11			2/25/11	182	7.20	12.42	BB	10:28:00 AM	10:28:50 AM	10:31:10 AM	178	52.50	G	G	G
	2/25/11			2/25/11	183	7.20	12.42	BR	10:28:40 AM	10:29:30 AM	10:31:10 AM	189	68.60	G	F	G
	2/25/11			2/25/11	184	7.20	12.42	BB	10:36:50 AM	10:37:15 AM	10:40:20 AM	176	59.30	G	G	G
	2/25/11			2/25/11	185	7.20	12.42	BR	10:48:00 AM	10:49:20 AM	10:52:00 AM	164	43.80	G	G	G
	2/25/11			2/25/11	186	7.20	12.42	BB	10:41:10 AM	10:41:50 AM	10:43:45 AM	173	56.70	G	G	G
	2/25/11			2/25/11	187	7.20	12.42	BB	10:44:20 AM	10:45:00 AM	10:47:10 AM	155	37.20	G	G	G
	2/25/11			2/25/11	188	7.20	12.42	BB	10:47:50 AM	10:48:15 AM	10:50:25 AM	153	34.10	G	F	G
	2/25/11			2/24/11	189	7.90	12.22	BR	12:05:43 PM	12:05:55 PM	12:09:09 PM	127	21.10	G	G	G
	2/25/11			2/24/11	190	7.90	12.22	CW	12:06:46 PM	12:07:27 PM	12:10:17 PM	109	12.30	G	G	G
	2/25/11			2/24/11	191	7.90	12.22	BR	12:12:48 PM	12:13:16 PM	12:15:49 PM	116	16.50	G	G	G
	2/25/11			2/24/11	192	7.90	12.22	CW	12:10:39 PM	12:11:32 PM	12:14:40 PM	107	15.20	G	G	G
	2/25/11			2/24/11	193	7.90	12.22	CW	12:21:25 PM	12:22:07 PM	12:25:28 PM	115	16.10	G	G	G
	2/25/11			2/24/11	194	7.90	12.22	BR	12:21:02 PM	12:21:34 PM	12:24:02 PM	112	15.80	G	G	G
	2/25/11			2/24/11	195	7.90	12.22	CW	12:30:52 PM	12:32:38 PM	12:35:00 PM	105	12.80	G	G	G
	2/25/11			2/24/11	196	7.90	12.22	BR	12:24:14 PM	12:25:10 PM	12:27:16 PM	120	18.20	G	G	G
	2/25/11			2/24/11	197	7.90	12.22	BR	12:28:06 PM	12:28:46 PM	12:30:52 PM	110	15.50	G	G	G
	2/25/11			2/24/11	198	7.90	12.22	BR	12:32:49 PM	12:33:15 PM	12:35:41 PM	112	17.50	G	G	G
	2/25/11			2/24/11	199	7.90	12.22	CW	12:49:48 PM	12:50:42 PM	12:53:06 PM	118	18.70	G	G	G
	2/25/11			2/24/11	200	7.90	12.22	BR	12:36:10 PM	12:36:37 PM	12:38:44 PM	110	14.70	G	G	G
	2/25/11			2/24/11	201	7.90	12.22	BR	12:44:55 PM	12:45:32 PM	12:47:54 PM	102	11.90	G	G	G
	2/25/11			2/24/11	202	7.90	12.22	BR	12:48:38 PM	12:49:15 PM	12:51:32 PM	100	11.50	G	G	G

Release Area	Release Date	Release Time Start	Release Time End	Date	Tag Code	Holding Temp	Holding DO	Surgeon	Knockdown Start	Knockdown End	Surgery End	FL	Weight	Scales	Fins	Eyes
Knights Landing Bridge (cont)	2/25/11			2/24/11	203	7.90	12.22	BR	12:51:50 PM	12:52:20 PM	12:54:47 PM	108	14.40	G	G	G
	2/25/11			2/24/11	204	7.90	12.22	CW	12:53:30 PM	12:54:36 PM	12:56:43 PM	114	15.20	G	G	G
	2/25/11			2/24/11	205	7.90	12.22	BR	12:55:02 PM	12:55:35 PM	12:57:51 PM	109	14.80	G	G	G
	2/25/11			2/24/11	206	7.90	12.22	CW	12:57:17 PM	12:58:16 PM	1:01:06 PM	114	16.40	G	G	G
	2/25/11			2/24/11	207	7.90	12.22	BR	1:00:25 PM	1:01:20 PM	1:03:25 PM	110	13.70	G	G	G
	2/25/11			2/24/11	208	7.90	12.22	CW	1:01:30 PM	1:02:14 PM	1:04:42 PM	108	13.50	G	G	G
	2/25/11			2/24/11	209	7.90	12.22	BR	1:03:48 PM	1:04:29 PM	1:06:36 PM	110	14.30	G	G	G
	2/25/11			2/24/11	210	7.90	12.22	CW	1:05:19 PM	1:06:22 PM	1:09:38 PM	106	14.50	G	G	G
	2/25/11			2/24/11	211	7.90	12.22	BR	1:06:57 PM	1:07:39 PM	1:09:43 PM	106	14.90	G	G	G
	2/25/11			2/24/11	212	7.90	12.22	CW	1:13:53 PM	1:14:43 PM	1:17:19 PM	110	15.40	G	G	G
	2/25/11			2/24/11	213	7.90	12.22	BR	1:10:14 PM	1:10:52 PM	1:13:43 PM	106	17.10	G	G	G
	2/25/11			2/24/11	214	7.90	12.22	BR	1:14:24 PM	1:15:16 PM	1:17:00 PM	108	14.50	G	G	G
	2/25/11			2/24/11	215	7.90	12.22	CW	1:17:38 PM	1:18:26 PM	1:20:59 PM	109	13.70	G	G	G
	2/25/11			2/24/11	216	7.90	12.22	BR	1:24:20 PM	1:25:25 PM	1:27:31 PM	102	13.50	G	G	G
	2/25/11			2/24/11	217	7.90	12.22	CW	1:24:00 PM	1:24:40 PM	1:27:22 PM	105	13.30	G	G	G
	2/25/11			2/24/11	218	7.90	12.22	BR	1:27:45 PM	1:28:26 PM	1:30:36 PM	105	13.00	G	G	G
	2/25/11			2/24/11	219	7.90	12.22	CW	1:28:00 PM	1:28:53 PM	1:31:11 PM	110	14.60	G	G	G
	2/25/11			2/24/11	220	7.90	12.22	BR	1:44:50 PM	1:45:41 PM	1:48:00 PM	113	15.30	G	G	G
	2/25/11			2/24/11	221	7.90	12.22	CW	1:48:17 PM	1:48:59 PM	1:52:41 PM	112	14.60	G	G	G
	2/25/11			2/24/11	222	7.90	12.22	BR	1:48:59 PM	1:49:40 PM	1:51:45 PM	106	14.20	G	G	G
	2/25/11			2/24/11	223	7.90	12.22	CW	1:53:12 PM	1:54:03 PM	1:56:05 PM	110	14.40	G	G	G
	2/25/11			2/24/11	224	7.90	12.22	BR	1:52:08 PM	1:52:43 PM	1:54:55 PM	123	22.00	G	G	G
	2/25/11			2/24/11	225	7.90	12.22	BR	1:55:08 PM	1:55:44 PM	1:58:05 PM	110	15.10	G	G	G

Release Area	Release Date	Release Time Start	Release Time End	Date	Tag Code	Holding Temp	Holding DO	Surgeon	Knockdown Start	Knockdown End	Surgery End	FL	Weight	Scales	Fins	Eyes
Knights Landing Bridge (cont)	2/25/11			2/24/11	226	7.90	12.22	CW	1:56:25 PM	1:57:07 PM	1:59:49 PM	110	13.90	G	G	G
	2/25/11			2/24/11	227	7.90	12.22	BR	1:59:34 PM	2:00:03 PM	2:02:33 PM	110	14.80	G	G	G
	2/25/11			2/24/11	228	7.90	12.22	CW	2:00:54 PM	2:01:42 PM	2:04:16 PM	115	16.10	G	G	G
	2/25/11			2/24/11	229	7.90	12.22	BR	2:03:01 PM	2:03:52 PM	2:05:54 PM	118	17.30	G	G	G
	2/25/11			2/24/11	230	7.90	12.22	CW	2:04:37 PM	2:05:39 PM	2:08:32 PM	113	15.30	G	G	G
	2/25/11			2/24/11	231	7.90	12.22	BR	2:06:18 PM	2:06:59 PM	2:09:22 PM	116	18.40	G	G	G
	2/25/11			2/24/11	232	7.90	12.22	CW	2:08:51 PM	2:09:34 PM	2:13:00 PM	108	12.70	G	G	G
	2/25/11			2/24/11	233	7.90	12.22	BR	2:09:42 PM	2:10:32 PM	2:12:48 PM	109	14.60	G	G	G
	2/25/11			2/24/11	234	7.90	12.22	CW	2:15:10 PM	2:16:04 PM	2:18:53 PM	113	17.90	G	G	G
	2/25/11			2/24/11	235	7.90	12.22	BR	2:13:36 PM	2:14:08 PM	2:16:45 PM	107	15.80	G	G	G
	2/25/11			2/24/11	236	7.90	12.22	BR	2:17:10 PM	2:17:35 PM	2:19:40 PM	109	14.80	G	G	G
	2/25/11			2/24/11	237	7.90	12.22	CW	2:20:01 PM	2:20:46 PM	2:23:10 PM	111	14.50	G	G	G
	2/25/11			2/24/11	238	7.90	12.22	BR	2:20:40 PM	2:21:20 PM	2:23:24 PM	113	15.90	G	G	G
	2/25/11			2/24/11	239	7.90	12.22	CW	2:23:34 PM	2:24:32 PM	2:27:05 PM	114	15.80	G	G	G
	2/25/11			2/24/11	240	7.90	12.22	BR	2:24:05 PM	2:24:41 PM	2:27:56 PM	111	13.80	G	G	G
	2/25/11			2/24/11	241	7.90	12.22	CW	2:27:34 PM	2:29:26 PM	2:31:55 PM	117	12.60	G	G	G
	2/25/11			2/24/11	242	7.90	12.22	BR	2:29:56 PM	2:30:27 PM	2:32:54 PM	110	16.10	G	G	G
	2/25/11			2/24/11	243	7.90	12.22	CW	2:32:22 PM	2:33:10 PM	2:35:41 PM	108	13.90	G	G	G
	2/25/11			2/24/11	244	7.90	12.22	BR	2:33:19 PM	2:34:03 PM	2:36:06 PM	107	13.90	G	G	G
	2/25/11			2/25/11	245	7.20	12.42	BR	10:22:15 AM	10:23:05 AM	10:25:00 AM	156	34.20	F	F	G
	2/25/11			2/25/11	246	7.20	12.42	BB	10:21:50 AM	10:22:35 AM	10:24:50 AM	167	51.10	G	G	G
	2/25/11			2/25/11	247	7.20	12.42	BR	10:19:05 AM	10:19:50 AM	10:22:00 AM	180	60.90	G	G	G
	13/Jan/11	5:20 PM	7:40 PM	1 /12/2011	248	7.00	12.39	BR	10:52:05 AM	10:52:45 AM	10:55:25 AM	158	38.50	G	G	G

Release Area	Release Date	Release Time Start	Release Time End	Date	Tag Code	Holding Temp	Holding DO	Surgeon	Knockdown Start	Knockdown End	Surgery End	FL	Weight	Scales	Fins	Eyes
Knights Landing Bridge (cont)	13/Jan/11	5:20 PM	7:40 PM	1 /12/2011	249	7.00	12.39	CW	10:48:00 AM	10:48:55 AM	10:51:35 AM	153	36.40	G	G	G
	13/Jan/11	5:20 PM	7:40 PM	1 /12/2011	250	7.00	12.39	BR	10:47:10 AM	10:47:45 AM	10:50:40 AM	162	46.80	G	G	G

Appendix E: 69-kHz Late-Fall Chinook Salmon and Steelhead Smolts

Date Tagged	TagID	Days Starved	Weight	Length	Surgeon Name	In Drugs	Out Drugs	Out surgery	Recovered	Scales	Fins	Eyes	Incision	Suturing	Bleeding	Bath_Temp	Bath_DO	Tag_Weight
08-Dec-10	20853	2	36	147	KN	14:12:15	14:14:10	14:20:04	14:27:22	F	F	G	G	G	0	11.3	9	1.6
08-Dec-10	20854	2	34.3	149	KN	14:16:27	14:20:51	14:25:54	14:31:46	F	F	G	G	G	0	11.3	9	1.6
08-Dec-10	20855	2	63.9	178	KN	14:26:51	14:29:05	14:33:06	14:35:56	F	F	G	G	G	0	11.3	9	1.6
08-Dec-10	20856	2	64	178	KN	14:36:45	14:38:45	14:42:26	14:45:55	F	F	G	G	G	0	11.3	9	1.6
08-Dec-10	20857	2	37.7	154	KN	14:41:47	14:42:53	14:48:02	14:50:49	F	F	G	G	G	0	11.3	9	1.5
08-Dec-10	20858	2	43.7	161	KN	14:46:28	14:48:39	14:53:14	14:59:15	F	F	G	G	G	1	11.6	9.6	1.6
08-Dec-10	20859	2	43.6	158	KN	14:56:02	14:58:52	15:02:17	15:07:26	F	F	G	G	G	0	11.6	9.6	1.6
08-Dec-10	20860	2	61	172	KN	15:01:30	15:03:58	15:07:50	15:11:15	F	F	G	G	G	1	11.6	9.6	1.5
08-Dec-10	20861	2	39.5	154	KN	15:05:26	15:07:46	15:11:31	15:13:33	F	F	G	G	G	0	11.6	9.6	1.6
08-Dec-10	20862	2	39.6	154	KN	15:14:00	15:16:09	15:20:02	15:22:52	F	F	G	G	G	0	11.6	9.6	1.6
08-Dec-10	20863	2	34	145	KN	15:17:57	15:20:29	15:24:33	15:28:53	F	F	G	G	G	0	11.6	9.6	1.6
08-Dec-10	20864	2	38.4	152	KN	15:21:27	15:25:11	15:28:57	15:32:43	F	F	G	G	G	0	11.6	9.6	1.6
08-Dec-10	20865	2	41.4	160	KN	15:41:33	15:44:59	15:48:51	15:50:37	F	F	G	G	G	0	11.6	9.6	1.5
08-Dec-10	20866	2	58.6	180	KN	15:45:33	15:49:17	15:52:44	15:54:27	F	F	G	G	G	0	11.7	9.27	1.5
08-Dec-10	20867	2	53.9	171	KN	15:49:38	15:52:52	15:56:14	15:58:42	F	F	G	G	G	0	11.7	9.27	1.5
08-Dec-10	20868	2	57.7	171	KN	15:56:53	16:01:30	16:05:44	16:07:01	F	F	G	G	G	0	11.7	9.27	1.6
08-Dec-10	20869	2	52.1	171	KN	16:02:00	16:06:04	16:09:43	16:12:22	F	F	G	G	G	0	11.7	9.27	1.6
08-Dec-10	20870	2	42.9	161	KN	16:06:34	16:10:00	16:13:18	16:16:07	F	F	G	G	G	0	11.7	9.27	1.6
08-Dec-10	20871	2	38.5	150	KN	16:14:06	16:18:31	16:22:12	16:24:32	F	F	G	G	G	0	11.9	9.07	1.6
08-Dec-10	20872	2	48.7	166	KN	16:19:00	16:22:51	16:26:48	16:27:59	F	F	G	G	G	0	11.9	9.07	1.6
08-Dec-10	20873	2	60.1	173	KN	16:23:14	16:27:09	16:31:09	16:32:41	F	F	G	G	G	2	11.9	9.07	1.6
08-Dec-10	20874	2	49.1	164	KN	16:31:59	16:35:26	16:38:43	16:41:03	F	F	G	G	G	1	11.9	9.07	1.6
08-Dec-10	20875	2	50.7	169	KN	16:35:49	16:39:00	16:43:03	16:45:32	F	F	G	G	G	0	11.9	9.07	1.5
08-Dec-10	20876	2	37.5	155	KN	16:39:43	16:43:35	16:47:30	16:52:41	F	F	G	G	G	0	11.9	9.07	1.6
08-Dec-10	20877	2	55.5	173	KN	16:55:09	16:56:14	17:00:01	17:02:43	F	F	G	G	G	0	11.9	9.07	1.6
08-Dec-10	20878	2	57	170	KN	16:58:46	17:00:24	17:03:23	17:05:02	F	F	G	G	G	0	11.9	9.15	1.6

Date Tagged	TagID	Days Starved	Weight	Length	Surgeon Name	In Drugs	Out Drugs	Out surgery	Recovered	Scales	Fins	Eyes	Incision	Suturing	Bleeding	Bath_Temp	Bath_DO	Tag_Weight
08-Dec-10	20879	2	51.5	167	KN	17:00:58	17:03:41	17:07:14	17:08:40	F	F	G	G	G	0	11.9	9.15	1.6
08-Dec-10	20880	2	44.7	164	KN	17:08:05	17:11:48	17:16:19	17:20:50	F	F	G	G	G	0	11.9	9.15	1.6
08-Dec-10	20881	2	52.3	168	KN	17:12:08	17:16:23	17:19:38	17:23:18	F	F	G	G	G	0	11.9	9.15	1.6
08-Dec-10	20882	2	56.8	172	KN	17:16:47	17:20:21	17:23:54	17:26:25	F	F	G	G	G	0	11.9	9.15	1.6
08-Dec-10	20883	2	43.1	160	KN	17:25:23	17:28:16	17:31:55	17:35:07	F	F	G	G	G	1	11.9	9.15	1.6
08-Dec-10	20884	2	56.3	170	KN	17:28:49	17:32:18	17:37:12	17:38:23	F	F	G	G	G	0	11.9	9.15	1.6
08-Dec-10	20885	2	38.5	151	KN	17:32:58	17:37:38	17:42:11	17:44:12	F	F	G	G	G	0	11.9	9.15	1.6
08-Dec-10	20886	2	36.7	155	KN	17:43:00	17:46:03	17:49:42	17:53:11	F	F	G	G	G	0	11.9	9.15	1.6
08-Dec-10	20887	2	40.4	157	KN	17:46:34	17:50:16	17:54:44	17:57:03	F	F	G	G	G	1	11.9	9.15	1.6
08-Dec-10	20888	2	38.3	154	KN	17:50:41	17:55:10	17:58:50	18:00:14	F	F	G	G	G	0	12.1	8.47	1.6
08-Dec-10	20889	2	61.6	178	KN	17:56:40	17:59:31	18:03:30	18:06:12	F	F	G	G	G	0	12.1	8.47	1.6
08-Dec-10	20890	2	57.1	173	KN	18:00:02	18:04:26	18:09:20	18:12:49	F	F	G	G	G	0	10.7	8.74	1.5
08-Dec-10	20891	2	69.9	180	KN	18:04:58	18:10:21	18:13:55	18:16:27	F	F	G	G	G	0	10.7	8.74	1.6
08-Dec-10	20892	2	68.2	182	KN	18:16:16	18:20:21	18:23:44	18:28:36	F	F	G	G	G	0	10.7	8.74	1.6
08-Dec-10	20893	2	47	161	KN	18:20:53	18:24:21	18:27:32	18:29:13	F	F	G	G	G	0	10.7	8.74	1.6
08-Dec-10	20894	2	52.2	167	KN	18:24:47	18:28:13	18:31:24	18:34:09	F	F	G	G	G	0	10.7	8.74	1.6
08-Dec-10	20895	2	62.8	171	KN	18:32:18	18:36:09	18:39:30	18:42:30	F	F	G	G	G	0	10.7	8.74	1.5
08-Dec-10	20896	2	55.4	172	KN	18:36:26	18:40:17	18:43:43	18:47:22	F	F	G	G	G	2	10.9	9.28	1.5
08-Dec-10	20897	2	44.9	162	KN	18:40:54	18:44:56	18:49:09	18:50:27	F	F	G	G	G	0	10.9	9.28	1.6
08-Dec-10	20898	2	48.1	165	KN	18:49:56	18:54:44	18:57:48	19:00:23	F	F	G	G	G	2	10.9	9.28	1.6
08-Dec-10	20899	2	38.7	160	KN	18:55:04	18:58:27	19:02:02	19:05:48	F	F	G	G	G	0	10.9	9.28	1.6
08-Dec-10	20900	2	35.7	148	KN	18:58:48	19:02:11	19:05:45	19:09:47	F	F	G	G	G	0	10.9	9.28	1.6
08-Dec-10	20901	2	37.5	151	KN	19:07:19	19:11:53	19:14:46	19:19:13	F	F	G	G	G	0	10.9	9.28	1.5
08-Dec-10	20902	2	40.4	159	KN	19:12:14	19:15:57	19:19:22	19:23:34	F	F	G	G	G	0	10.9	9.28	1.6
08-Dec-10	20903	2	55.4	167	KN	19:18:46	19:20:27	19:24:18	19:26:30	F	F	G	G	G	0	10.9	9.28	1.6
08-Dec-10	20904	2	63.4	170	KN	19:21:19	19:24:39	19:28:20	19:30:07	F	F	G	G	G	0	10.9	9.28	1.6

Date Tagged	TagID	Days Starved	Weight	Length	Surgeon Name	In Drugs	Out Drugs	Out surgery	Recovered	Scales	Fins	Eyes	Incision	Suturing	Bleeding	Bath_Temp	Bath_DO	Tag_Weight
08-Dec-10	20905	2	46.9	162	KN	19:25:09	19:28:37	19:32:30	19:34:07	F	F	G	G	G	2	10.9	9.28	1.5
08-Dec-10	20906	2	39.8	154	KN	19:27:10	19:32:40	19:35:51	19:40:31	F	F	G	G	G	0	10.9	9.28	1.6
08-Dec-10	20907	2	49.7	168	KN	19:36:52	19:39:37	19:42:53	19:44:25	F	F	G	G	G	2	10.9	9.28	1.5
08-Dec-10	20908	2	62	180	KN	19:42:21	19:43:23	19:46:39	19:48:21	F	F	G	G	G	2	10.9	9.28	1.6
08-Dec-10	20909	2	43.6	167	KN	19:44:46	19:46:48	19:49:50	19:54:02	F	F	G	G	G	0	10.9	9.28	1.6
08-Dec-10	20910	2	35.3	145	KN	19:49:33	19:53:23	19:56:36	20:00:54	F	F	G	G	G	2	10.9	9.28	1.6
08-Dec-10	20911	2	41.2	152	KN	19:53:46	19:56:45	19:59:41	20:03:16	F	F	G	G	G	0	10.9	9.28	1.6
08-Dec-10	20912	2	39	163	KN	19:57:02	19:59:47	20:02:25	20:04:09	F	F	G	G	G	0	10.9	9.28	1.6
08-Dec-10	20913	2	33.9	146	BN	14:11:30	14:14:38	14:18:05	14:26:56	F	F	G	G	G	0	11.1	10.1	1.57
08-Dec-10	20914	2	48.7	167	BN	14:16:29	14:20:12	14:23:33	14:35:58	F	F	G	G	G	0	11.1	10.1	1.55
08-Dec-10	20915	2	55.7	172	BN	14:21:44	14:24:36	14:27:51	14:39:50	F	F	G	G	G	0	11.1	10.1	1.56
08-Dec-10	20916	2	49.9	163	BN	14:29:56	14:35:31	14:39:57	14:48:10	F	F	G	G	G	0	11.1	10.1	1.55
08-Dec-10	20917	2	66.8	178	BN	14:36:19	14:40:26	14:43:21	14:50:40	F	F	G	G	G	0	11.1	10.1	1.58
08-Dec-10	20918	2	52.8	167	BN	14:41:22	14:44:25	14:47:15	14:58:22	F	F	G	G	G	0	11.1	10.1	1.57
08-Dec-10	20919	2	45.6	161	BN	14:49:19	14:53:03	14:56:40	15:09:44	F	F	G	G	G	0	11.1	10.1	1.56
08-Dec-10	20920	2	56.1	167	BN	14:53:25	14:57:26	15:00:14	15:08:24	F	F	G	G	G	0	11.1	10.1	1.55
08-Dec-10	20921	2	48.8	163	BN	14:58:07	15:01:47	15:04:38	15:11:54	F	F	G	G	G	0	11.3	9.6	1.55
08-Dec-10	20922	2	29.9	141	BN	15:05:48	15:08:41	15:11:10	15:19:27	F	F	G	G	G	0	11.3	9.6	1.54
08-Dec-10	20923	2	44.2	158	BN	15:09:26	15:12:44	15:15:22	15:22:50	F	F	G	G	G	0	11.3	9.6	1.53
08-Dec-10	20924	2	32.8	144	BN	15:13:03	15:15:44	15:20:47	15:26:26	F	F	G	G	G	0	11.3	9.6	1.57
08-Dec-10	20925	2	38.1	148	BN	15:29:59	15:30:47	15:33:12	15:42:27	F	F	G	G	G	0	11.3	9.6	1.57
08-Dec-10	20926	2	37.7	153	BN	15:31:33	15:33:24	15:36:00	15:42:19	F	F	G	G	G	0	11.3	9.6	1.54
08-Dec-10	20927	2	53	168	BN	15:41:20	15:44:39	15:47:20	15:53:01	F	F	G	G	G	0	11.3	9.6	1.55
08-Dec-10	20928	2	49	166	BN	15:46:20	15:50:56	15:53:41	16:05:01	F	F	G	G	G	0	11.3	9.6	1.56
08-Dec-10	20929	2	45.8	157	BN	15:48:45	15:53:49	15:56:18	16:02:40	F	F	G	G	G	1	11.3	9.6	1.55
08-Dec-10	20930	2	46.7	161	BN	15:52:06	15:56:48	15:59:19	16:13:47	F	F	G	G	G	1	11.3	9.6	1.56

Date Tagged	TagID	Days Starved	Weight	Length	Surgeon Name	In Drugs	Out Drugs	Out surgery	Recovered	Scales	Fins	Eyes	Incision	Suturing	Bleeding	Bath_Temp	Bath_DO	Tag_Weight
08-Dec-10	20931	2	45.2	162	BN	15:57:51	16:03:36	16:06:05	16:11:07	F	F	G	G	G	1	11.3	9.6	1.55
08-Dec-10	20932	2	36.8	151	BN	16:00:30	16:06:32	16:09:56	16:17:40	F	F	G	G	G	0	11.3	9.6	1.54
08-Dec-10	20933	2	45	159	BN	16:05:33	16:10:17	16:12:48	16:16:26	F	F	G	G	G	0	11.3	9.6	1.55
08-Dec-10	20934	2	43.3	157	BN	16:11:53	16:15:52	16:18:20	16:31:40	F	F	G	G	G	1	10.4	9.4	1.54
08-Dec-10	20935	2	35.1	151	BN	16:14:30	16:18:33	16:21:10	16:25:58	F	F	G	G	G	0	10.4	9.4	1.54
08-Dec-10	20936	2	49.9	166	BN	16:17:26	16:21:20	16:23:58	16:26:40	F	F	G	G	G	0	10.4	9.4	1.56
08-Dec-10	20937	2	36.5	152	BN	16:28:52	16:32:48	16:35:26	16:40:31	F	F	G	G	G	1	10.4	9.4	1.55
08-Dec-10	20938	2	44.6	162	BN	16:30:54	16:35:49	16:38:15	16:56:44	F	F	G	G	G	0	10.4	9.4	1.55
08-Dec-10	20939	2	33.7	145	BN	16:34:22	16:38:43	16:41:02	16:44:01	F	F	G	G	G	1	10.4	9.4	1.53
08-Dec-10	20940	2	47.3	163	BN	16:41:18	16:45:13	16:47:40	17:01:04	F	F	G	G	G	1	10.4	9.4	1.52
08-Dec-10	20941	2	41.9	155	BN	16:44:31	16:48:05	16:51:03	16:52:44	F	F	G	G	G	0	10.4	9.4	1.54
08-Dec-10	20942	2	49.7	166	BN	16:47:01	16:51:12	16:53:48	17:04:18	F	F	G	G	G	0	10.4	9.4	1.56
08-Dec-10	20943	2	51.5	168	BN	16:53:04	16:57:20	16:59:48	17:05:51	F	F	G	G	G	1	10.9	9.5	1.55
08-Dec-10	20944	2	45.7	155	BN	16:56:00	16:59:58	17:02:06	17:06:57	F	F	G	G	G	0	10.9	9.5	1.55
08-Dec-10	20945	2	53.2	168	BN	16:59:00	17:02:19	17:05:01	17:10:42	F	F	G	G	G	0	10.9	9.5	1.58
08-Dec-10	20946	2	44.4	160	BN	17:03:45	17:08:47	17:12:09	17:22:41	F	F	G	G	G	0	10.9	9.5	1.55
08-Dec-10	20947	2	46	165	BN	17:07:11	17:12:55	17:15:42	17:19:32	F	F	G	G	G	0	10.9	9.5	1.55
08-Dec-10	20948	2	52.4	169	BN	17:16:01	17:19:56	17:22:39	17:26:18	F	F	G	G	G	0	10.9	9.5	1.56
08-Dec-10	20949	2	55.5	168	BN	19:17:37	19:24:10	19:28:04	19:33:35	F	F	G	G	G	0	10.9	9.5	1.56
08-Dec-10	20950	2	40.2	153	BN	17:24:47	17:30:29	17:33:02	17:35:18	F	F	G	G	G	0	10.9	9.5	1.55
08-Dec-10	20951	2	39.9	154	BN	17:28:57	17:33:42	17:36:30	17:40:59	F	F	G	G	G	0	11.2	9.2	1.55
08-Dec-10	20952	2	45.3	160	BN	17:35:50	17:40:00	17:42:23	17:47:27	F	F	G	G	G	1	11.2	9.2	1.54
08-Dec-10	20953	2	38.1	152	BN	17:38:11	17:43:05	17:45:21	18:03:32	F	F	G	G	G	0	11.2	9.2	1.55
08-Dec-10	20954	2	37.3	150	BN	17:41:23	17:46:01	17:48:36	17:52:20	F	F	G	G	G	0	11.2	9.2	1.54
08-Dec-10	20955	2	31.9	145	BN	17:47:47	17:53:39	17:56:37	18:02:31	F	F	G	G	G	0	11.2	9.2	1.55
08-Dec-10	20956	2	55.9	169	BN	17:57:21	18:01:30	18:03:48	18:08:43	F	F	G	G	G	0	11.2	9.2	1.55

Date Tagged	TagID	Days Starved	Weight	Length	Surgeon Name	In Drugs	Out Drugs	Out surgery	Recovered	Scales	Fins	Eyes	Incision	Suturing	Bleeding	Bath_Temp	Bath_DO	Tag_Weight
08-Dec-10	20957	2	43.6	157	BN	18:02:57	18:05:29	18:07:27	18:13:58	F	F	G	G	G	0	11.2	9.2	1.55
08-Dec-10	20958	2	58.3	172	BN	18:06:44	18:11:48	18:14:19	18:22:45	F	F	G	G	G	0	11.2	9.2	1.55
08-Dec-10	20959	2	55.2	173	BN	18:09:59	18:14:56	18:17:41	18:19:18	F	F	G	G	G	0	11.2	9.2	1.56
08-Dec-10	20960	2	46	159	BN	18:12:53	18:18:04	18:20:37	18:33:17	F	F	G	G	G	0	11.2	9.2	1.56
08-Dec-10	20961	2	45.5	152	BN	18:16:14	18:21:14	18:24:57	18:30:20	F	F	G	G	G	0	11.2	9.2	1.56
08-Dec-10	20962	2	32.9	148	BN	18:19:41	18:25:33	18:28:50	18:37:47	F	F	G	G	G	0	11.2	9.2	1.55
08-Dec-10	20963	2	44.8	161	BN	18:23:26	18:29:12	18:31:39	18:39:40	F	F	G	G	G	0	11.2	9.2	1.56
08-Dec-10	20964	2	41.3	155	BN	18:27:28	18:32:56	18:35:30	18:43:52	F	F	G	G	G	0	11.2	9.2	1.56
08-Dec-10	20965	2	40.9	155	BN	18:30:55	18:35:52	18:38:18	18:48:45	F	F	G	G	G	0	11.2	9.2	1.58
08-Dec-10	20966	2	39.2	151	BN	18:34:36	18:38:54	18:41:50	18:46:16	F	F	G	G	G	0	10.3	8.6	1.56
08-Dec-10	20967	2	37.4	152	BN	18:44:35	18:48:13	18:50:54	18:53:15	F	F	G	G	G	0	10.3	8.6	1.6
08-Dec-10	20968	2	42.9	155	BN	18:49:22	18:53:13	18:54:40	19:01:23	F	F	G	G	G	0	10.3	8.6	1.6
08-Dec-10	20969	2	42.2	156	BN	18:53:49	19:00:20	19:02:43	19:13:14	F	F	G	G	G	0	10.3	8.6	1.6
08-Dec-10	20970	2	36	151	BN	19:02:01	19:07:22	19:10:22	19:18:19	F	F	G	G	G	0	10.3	8.6	1.5
08-Dec-10	20971	2	54.7	166	BN	19:08:31	19:12:38	19:15:39	19:22:55	F	F	G	G	G	0	10.3	8.6	1.6
06-Jan-11	40854	2	113.1	214	GS	18:10:36	18:13:48	18:16:25	18:20:06	G	F	G	G	G	1	7.6	9.2	1.81
06-Jan-11	41130	2	76.3	188	GS	18:03:25	18:07:07	18:09:38	18:10:41	G	F	G	G	G	0	7.4	8.81	1.8
06-Jan-11	41055	2	48.9	163	CM	18:01:58	18:04:43	18:06:47	18:07:47	G	F	G	G	G	1	7.6	9.2	1.78
06-Jan-11	41129	2	88.8	208	GS	18:00:01	18:03:30	18:06:22	18:08:47	G	F	G	G	G	2	7.4	8.81	1.8
06-Jan-11	41054	2	113.2	220	CM	17:59:20	18:02:00	18:04:06	18:05:07	G	F	G	G	G	1	7.4	8.78	1.81
06-Jan-11	41053	2	119	218	CM	17:56:33	17:59:25	18:01:25	18:02:56	G	F	G	G	G	1	7.4	8.78	1.8
06-Jan-11	41128	2	77.8	190	GS	17:56:21	18:00:03	18:02:57	18:05:09	G	F	G	G	G	1	7.4	8.81	1.79
06-Jan-11	41052	2	96	199	CM	17:54:00	17:56:36	17:58:39	18:01:01	G	F	G	G	G	0	7.4	8.78	1.78
06-Jan-11	41127	2	152.4	239	GS	17:52:45	17:56:25	17:59:29	18:01:38	G	F	G	G	F	1	7.4	8.81	1.81
06-Jan-11	41051	2	110.3	207	CM	17:50:39	17:54:01	17:56:01	17:57:43	G	F	G	G	G	0	7.4	8.78	1.8
06-Jan-11	41126	2	72.4	189	GS	17:48:38	17:52:47	17:55:51	17:57:44	G	F	G	G	G	1	7.4	8.81	1.81

Date Tagged	TagID	Days Starved	Weight	Length	Surgeon Name	In Drugs	Out Drugs	Out surgery	Recovered	Scales	Fins	Eyes	Incision	Suturing	Bleeding	Bath_Temp	Bath_DO	Tag_Weight
06-Jan-11	41050	2	93.7	195	CM	17:47:16	17:50:41	17:53:25	17:55:12	G	F	G	G	G	0	7.4	8.78	1.79
06-Jan-11	41125	2	56.6	173	GS	17:45:05	17:48:42	17:52:19	17:53:33	G	F	G	G	G	1	7.4	8.81	1.82
06-Jan-11	41049	2	143	230	CM	17:43:44	17:47:18	17:50:13	17:52:58	G	F	G	G	G	0	7.4	8.78	1.81
06-Jan-11	41124	2	125	221	GS	17:42:12	17:45:12	17:47:45	17:49:22	G	F	G	G	G	1	7.4	8.81	1.79
06-Jan-11	41048	2	51.5	169	CM	17:39:41	17:43:46	17:46:28	17:49:04	G	F	G	G	G	0	7.4	8.78	1.82
06-Jan-11	41047	2	140.3	234	CM	17:36:35	17:39:44	17:41:55	17:43:01	G	F	G	G	G	0	7.4	8.78	1.79
06-Jan-11	41123	2	125.5	227	GS	17:36:04	17:39:57	17:42:19	17:44:51	G	F	G	G	G	1	7.4	8.81	1.8
06-Jan-11	41046	2	148.2	234	CM	17:34:17	17:36:38	17:39:02	17:41:17	G	F	G	G	G	2	7.4	8.78	1.8
06-Jan-11	41122	2	99.9	208	GS	17:32:35	17:36:05	17:39:09	17:40:28	G	F	G	G	G	0	7.4	8.81	1.8
06-Jan-11	41045	2	70.7	184	CM	17:31:34	17:34:18	17:36:13	17:37:29	G	F	G	G	G	0	7.5	8.04	1.81
06-Jan-11	41121	2	98.5	210	GS	17:29:17	17:32:40	17:35:26	17:37:31	G	F	G	G	G	0	7.4	8.81	1.78
06-Jan-11	41044	2	109.3	213	CM	17:27:24	17:31:36	17:33:55	17:35:43	G	F	G	G	G	1	7.5	8.04	1.78
06-Jan-11	41120	2	133	232	GS	17:25:42	17:29:53	17:32:18	17:34:22	G	F	G	G	G	0	7.5	8.04	1.77
06-Jan-11	41043	2	77.3	185	CM	17:22:25	17:24:54	17:26:49	17:28:25	G	F	G	G	G	1	7.5	8.04	1.79
06-Jan-11	41119	2	151.2	237	GS	17:22:23	17:25:46	17:28:43	17:32:06	G	F	G	G	G	1	7.5	8.04	1.81
06-Jan-11	41042	2	89.6	200	CM	17:19:54	17:22:28	17:24:20	17:26:24	G	F	G	G	G	1	7.5	8.04	1.78
06-Jan-11	41118	2	82.2	198	GS	17:19:23	17:22:29	17:25:05	17:26:26	G	F	G	G	G	0	7.5	8.04	1.81
06-Jan-11	41041	2	71.8	189	CM	17:16:58	17:19:58	17:21:57	17:23:55	G	F	G	G	G	0	7.5	8.04	1.77
06-Jan-11	41117	2	92.8	201	GS	17:15:59	17:19:27	17:22:08	17:24:27	G	F	G	G	G	0	7.5	8.04	1.8
06-Jan-11	41040	2	136.3	230	CM	17:14:20	17:17:02	17:19:10	17:21:28	G	F	G	G	G	2	7.5	8.04	1.79
06-Jan-11	41116	2	129.8	226	GS	17:12:44	17:16:01	17:18:40	17:21:39	G	F	G	G	G	0	7.5	8.04	1.81
06-Jan-11	41039	2	107.6	210	CM	17:11:17	17:14:22	17:16:24	17:18:29	G	F	G	G	G	1	7.5	8.04	1.79
06-Jan-11	41115	2	145.9	240	GS	17:09:06	17:12:48	17:15:37	17:17:49	G	F	G	G	G	1	7.5	8.04	1.79
06-Jan-11	41038	2	88.8	196	CM	17:08:03	17:11:18	17:13:37	17:16:07	G	F	G	G	G	0	7.5	8.04	1.8
06-Jan-11	41114	2	72.9	193	GS	17:05:48	17:09:10	17:12:26	17:14:45	G	F	G	G	G	1	7.5	8.04	1.8
06-Jan-11	41113	2	102.9	210	GS	17:03:22	17:05:46	17:08:49	17:11:09	G	F	G	G	G	1	7.5	8.04	1.79

Date Tagged	TagID	Days Starved	Weight	Length	Surgeon Name	In Drugs	Out Drugs	Out surgery	Recovered	Scales	Fins	Eyes	Incision	Suturing	Bleeding	Bath_Temp	Bath_DO	Tag_Weight
06-Jan-11	41037	2	102.4	206	AA	16:50:23	16:53:32	16:55:51	16:56:51	G	F	G	G	G	0	8.5	9.3	1.78
06-Jan-11	41036	2	105.5	210	AA	16:47:16	16:50:33	16:53:00	16:54:43	G	F	G	G	G	0	8.5	9.3	1.75
06-Jan-11	41035	2	105.1	210	AA	16:43:49	16:47:19	16:49:36	16:51:00	G	F	G	G	G	1	8.5	9.3	1.83
06-Jan-11	41034	2	110.2	211	AA	16:39:52	16:43:58	16:46:27	16:48:30	G	F	G	G	G	1	8.5	9.3	1.81
06-Jan-11	41033	2	105.5	214	AA	16:36:48	16:40:01	16:42:30	16:43:57	G	F	G	G	G	1	8.5	9.3	1.8
06-Jan-11	41112	2	123	230	GS	16:32:24	16:36:15	16:38:39	16:40:05	G	F	G	G	G	1	8.5	9.3	1.75
06-Jan-11	41032	2	78.8	189	AA	16:31:07	16:34:02	16:36:23	16:38:23	G	F	G	G	G	1	8	11.3	1.79
06-Jan-11	41111	2	94.4	196	PS	16:29:22	16:32:24	16:35:01	16:36:58	G	F	G	G	G	1	8	11.3	1.82
06-Jan-11	41031	2	110.4	213	AA	16:27:45	16:31:08	16:33:26	16:34:37	G	F	G	G	G	0	8	11.3	1.81
06-Jan-11	41110	2	130.7	226	PS	16:24:55	16:29:31	16:31:53	16:32:57	G	F	G	G	G	1	8	11.3	1.82
06-Jan-11	41030	2	93.4	213	AA	16:23:20	16:27:48	16:30:21	16:32:31	G	F	G	G	G	0	8	11.3	1.79
06-Jan-11	41109	2	103.8	209	PS	16:21:47	16:24:56	16:27:47	16:31:28	G	F	G	G	F	0	8	11.3	1.8
06-Jan-11	41029	2	57.4	170	AA	16:19:44	16:23:21	16:26:16	16:27:41	G	F	G	G	G	0	8	11.3	1.79
06-Jan-11	41108	2	51.5	167	PS	16:19:32	16:21:49	16:24:21	16:25:42	G	F	G	G	G	0	8	11.3	1.79
06-Jan-11	41107	2	97.6	205	PS	16:17:01	16:19:34	16:21:28	16:22:46	G	F	G	G	G	1	8	11.3	1.84
06-Jan-11	41028	2	68.1	178	AA	16:16:28	16:19:46	16:22:28	16:23:46	G	F	G	G	G	0	8	11.3	1.76
06-Jan-11	41106	2	128.6	228	PS	16:14:20	16:17:03	16:19:11	16:20:59	F	F	G	G	G	1	8	11.3	1.82
06-Jan-11	41027	2	100.1	213	AA	16:12:56	16:16:30	16:19:07	16:20:59	G	F	G	G	G	0	8	11.3	1.79
06-Jan-11	41105	2	87.2	204	PS	16:10:50	16:14:21	16:16:23	16:18:29	G	F	G	G	G	0	8	11.3	1.79
06-Jan-11	41026	2	110.7	212	AA	16:08:29	16:13:02	16:15:45	16:17:07	G	F	G	G	G	0	8	11.3	1.78
06-Jan-11	41104	2	150.2	240	PS	16:08:20	16:10:53	16:13:28	16:15:29	G	F	G	G	G	1	8	11.3	1.81
06-Jan-11	41025	2	94.6	206	AA	16:06:48	16:08:56	16:11:55	16:13:00	G	F	G	G	G	0	8	11.3	1.81
06-Jan-11	41103	2	129.5	230	PS	16:05:19	16:08:21	16:10:23	16:11:38	G	F	G	G	G	1	8	11.3	1.81
06-Jan-11	41102	2	131.1	222	PS	16:02:28	16:05:21	16:07:35	16:08:50	G	F	G	G	G	1	8	11.3	1.81
06-Jan-11	41101	2	96.3	206	PS	15:59:23	16:02:32	16:05:06	16:07:26	G	F	G	F	G	1	8	11.3	1.8
06-Jan-11	41100	2	103.7	215	PS	15:56:39	15:59:26	16:01:52	16:02:59	G	F	G	G	G	1	8.3	11.1	1.82

Date Tagged	TagID	Days Starved	Weight	Length	Surgeon Name	In Drugs	Out Drugs	Out surgery	Recovered	Scales	Fins	Eyes	Incision	Suturing	Bleeding	Bath_Temp	Bath_DO	Tag_Weight
06-Jan-11	41024	2	141.1	236	AA	15:55:36	16:00:54	16:03:44	16:04:57	G	F	G	G	G	0	8.3	11.1	1.81
06-Jan-11	41099	2	114.6	218	PS	15:53:38	15:56:37	15:59:10	16:00:59	G	F	G	G	G	0	8.3	11.1	1.79
06-Jan-11	41023	2	116.9	220	AA	15:51:24	15:55:39	15:58:55	16:00:00	G	F	G	G	G	0	8.3	11.1	1.81
06-Jan-11	41098	2	115.7	216	PS	15:50:38	15:53:39	15:56:05	15:57:25	G	F	G	G	G	0	8.3	11.1	1.8
06-Jan-11	41022	2	87.2	201	AA	15:47:54	15:51:27	15:54:24	15:55:20	G	F	G	G	G	1	8.3	11.1	1.79
06-Jan-11	41097	2	114.1	220	PS	15:47:49	15:50:42	15:53:12	15:54:38	G	F	G	G	G	1	8.3	11.1	1.8
06-Jan-11	41096	2	80.1	196	PS	15:44:48	15:47:51	15:49:53	15:51:47	G	F	G	G	G	1	8.3	11.1	1.8
06-Jan-11	41021	2	120.7	226	AA	15:44:17	15:47:56	15:50:36	15:51:32	G	F	G	F	G	1	8.3	11.1	1.8
06-Jan-11	41095	2	65.1	177	PS	15:42:41	15:45:29	15:47:20	15:49:06	G	F	G	G	G	1	8.3	11.1	1.81
06-Jan-11	41020	2	90.9	203	AA	15:40:19	15:44:23	15:46:30	15:47:22	G	F	G	G	G	0	8.3	11.1	1.82
06-Jan-11	41094	2	121.8	220	PS	15:40:14	15:42:46	15:44:54	15:45:26	G	F	G	G	G	1	8.3	11.1	1.82
06-Jan-11	41019	2	122.9	218	AA	15:37:41	15:40:21	15:43:04	15:44:21	G	F	G	G	G	0	8.3	11.1	1.8
06-Jan-11	41093	2	93.8	202	GS	14:52:34	14:56:45	14:59:07	15:01:08	G	F	G	G	G	1	8.3	11.1	1.8
06-Jan-11	41092	2	51.6	163	GS	14:48:54	14:52:37	14:55:58	14:57:24	G	F	G	G	G	1	8.3	11.1	1.79
06-Jan-11	41091	2	66	186	GS	14:44:06	14:48:57	14:52:00	14:53:05	G	F	G	G	G	0	8.3	11.1	1.79
06-Jan-11	41018	2	125	220	CM	14:44:06	14:48:55	14:50:55	14:53:10	F	F	G	G	G	0	8.3	11.1	1.8
06-Jan-11	41017	2	51.7	168	CM	14:43:15	14:46:14	14:48:18	14:49:14	G	F	G	G	G	1	8.3	11.1	1.79
06-Jan-11	41090	2	85.7	195	GS	14:41:12	14:44:08	14:47:44	14:49:25	G	F	G	G	F	1	8.3	11.1	1.79
06-Jan-11	41016	2	128	226	CM	14:37:51	14:40:27	14:42:34	14:43:16	G	F	G	G	G	2	8.3	11.1	1.79
06-Jan-11	41089	2	84.8	186	GS	14:37:18	14:41:14	14:43:30	14:45:58	G	F	G	G	G	1	8.3	11.1	1.81
06-Jan-11	41088	2	93.1	201	GS	14:33:43	14:37:19	14:40:25	14:44:00	G	F	G	G	G	0	8.3	11.1	1.82
06-Jan-11	41015	2	110.6	213	CM	14:33:41	14:37:58	14:39:53	14:41:37	G	F	G	G	G	0	8.3	11.1	1.79
06-Jan-11	41014	2	121.8	225	CM	14:32:04	14:34:59	14:37:15	14:37:59	G	F	G	G	G	0	8.3	11.1	1.8
06-Jan-11	41087	2	144.3	236	GS	14:29:54	14:34:01	14:37:01	14:39:37	G	F	G	G	G	1	8.3	11.1	1.82
06-Jan-11	41013	2	131.1	230	CM	14:26:15	14:29:14	14:31:26	14:32:43	F	F	G	G	G	0	7.9	10.9	1.8
06-Jan-11	41086	2	106.8	212	GS	14:25:41	14:29:52	14:32:59	14:34:06	G	F	G	G	G	1	8.3	11.1	1.81

Date Tagged	TagID	Days Starved	Weight	Length	Surgeon Name	In Drugs	Out Drugs	Out surgery	Recovered	Scales	Fins	Eyes	Incision	Suturing	Bleeding	Bath_Temp	Bath_DO	Tag_Weight
06-Jan-11	41012	2	122.2	222	CM	14:23:28	14:26:17	14:28:34	14:29:46	G	F	G	G	G	0	7.9	10.9	1.81
06-Jan-11	41085	2	58.4	170	GS	14:23:00	14:25:52	14:29:40	14:30:58	G	F	G	G	G	1	7.9	10.9	1.82
06-Jan-11	41011	2	107.3	215	CM	14:20:42	14:23:29	14:25:29	14:27:03	G	F	G	G	G	1	7.9	10.9	1.82
06-Jan-11	41084	2	82.1	198	GS	14:19:09	14:23:02	14:25:16	14:27:24	G	F	G	G	G	1	7.9	10.9	1.8
06-Jan-11	41010	2	88.4	200	CM	14:17:30	14:20:45	14:22:48	14:24:48	G	F	G	G	G	1	7.9	10.9	1.8
06-Jan-11	41083	2	78.8	195	GS	14:15:57	14:19:06	14:23:00	14:23:37	G	F	G	G	G	0	7.9	10.9	1.81
06-Jan-11	41009	2	111.5	216	CM	14:14:00	14:17:31	14:19:46	14:22:25	G	F	G	G	G	0	7.9	10.9	1.8
06-Jan-11	41082	2	120.7	221	GS	14:12:17	14:16:00	14:18:39	14:20:39	G	F	G	G	G	1	7.9	10.9	1.78
06-Jan-11	41008	2	134	223	CM	14:10:42	14:14:02	14:16:28	14:18:10	G	F	G	G	G	1	7.2	11.1	1.81
06-Jan-11	41081	2	69.1	182	GS	14:09:07	14:12:19	14:15:08	14:16:20	G	F	G	G	G	1	7.2	11.1	1.79
06-Jan-11	41080	2	120.3	221	GS	14:06:18	14:09:09	14:11:39	14:13:22	G	F	G	G	G	0	7.2	11.1	1.78
06-Jan-11	41007	2	81.6	195	CM	14:06:15	14:10:47	14:13:14	14:14:12	G	F	G	G	G	0	7.2	11.1	1.78
06-Jan-11	41079	2	142.1	232	GS	14:02:26	14:06:21	14:08:43	14:09:41	G	F	G	G	G	1	7.2	11.1	1.8
06-Jan-11	41006	2	106.7	212	CM	14:01:47	14:06:21	14:09:37	14:10:31	G	F	G	G	G	1	7.2	11.1	1.81
06-Jan-11	41078	2	54.9	170	GS	14:00:31	14:03:24	14:06:09	14:08:55	G	F	G	G	G	1	7.2	11.1	1.8
06-Jan-11	41005	2	120.8	222	CM	13:59:15	14:01:54	14:04:19	14:05:57	G	F	G	G	G	0	7.2	11.1	1.82
06-Jan-11	41004	2	96.9	205	CM	13:56:33	13:59:20	14:01:20	14:02:31	G	F	G	G	G	1	7.2	11.1	1.8
06-Jan-11	41003	2	93	201	CM	13:54:10	13:56:35	13:58:25	13:59:23	G	F	G	G	G	1	7.2	11.1	1.82
06-Jan-11	41077	2	101.2	209	GS	13:51:56	13:55:03	13:57:15	13:59:54	G	F	G	G	G	1	7.2	11.1	1.8
06-Jan-11	41002	2	60.6	175	CM	13:51:22	13:54:11	13:56:06	13:56:39	G	F	G	G	G	1	7.2	11.1	1.81
06-Jan-11	41076	2	150.4	237	GS	13:48:36	13:51:59	13:54:40	13:55:34	G	F	G	G	G	0	7.2	11.1	1.82
06-Jan-11	41001	2	68.9	179	CM	13:48:13	13:51:23	13:53:39	13:54:26	G	F	G	G	G	0	7.2	11.1	1.82
06-Jan-11	41075	2	67.1	181	GS	13:46:33	13:48:43	13:51:43	13:54:42	G	F	G	G	G	0	8.1	11.4	1.81
06-Jan-11	41000	2	77.7	198	CM	13:45:03	13:48:15	13:50:31	13:51:26	G	F	G	G	G	0	7.2	11.1	1.82
06-Jan-11	40999	2	72.5	183	AA	13:23:26	13:26:08	13:28:13	13:30:12	G	F	G	G	G	0	8.1	11.4	1.8
06-Jan-11	40998	2	117.5	213	AA	13:20:07	13:23:29	13:25:40	13:26:57	G	F	G	G	G	0	8.1	11.4	1.8

Date Tagged	TagID	Days Starved	Weight	Length	Surgeon Name	In Drugs	Out Drugs	Out surgery	Recovered	Scales	Fins	Eyes	Incision	Suturing	Bleeding	Bath_Temp	Bath_DO	Tag_Weight
06-Jan-11	41074	2	120.7	212	PS	13:18:48	13:21:14	13:22:46	13:23:35	G	F	G	G	G	1	8.1	11.4	1.77
06-Jan-11	40997	2	136.6	236	AA	13:17:51	13:20:15	13:22:52	13:24:27	G	F	G	G	G	1	8.1	11.4	1.82
06-Jan-11	41073	2	96	207	PS	13:14:59	13:18:53	13:20:50	13:22:48	G	F	G	G	G	0	7.1	10.5	1.8
06-Jan-11	41072	2	103.3	211	PS	13:12:16	13:15:00	13:17:01	13:17:44	G	F	G	G	G	1	7.1	10.5	1.79
06-Jan-11	40996	2	119	225	AA	13:11:27	13:14:41	13:17:03	13:19:17	G	F	G	G	G	1	7.1	10.8	1.8
06-Jan-11	41071	2	85.9	193	PS	13:09:58	13:12:23	13:14:32	13:16:12	G	F	G	G	G	1	7.1	10.5	1.8
06-Jan-11	40995	2	94.4	208	AA	13:08:32	13:11:30	13:13:51	13:14:39	G	F	G	G	G	0	7.1	10.8	1.79
06-Jan-11	41070	2	109.2	216	PS	13:07:21	13:10:02	13:11:59	13:14:38	G	F	G	G	G	1	7.1	10.5	1.79
06-Jan-11	40994	2	111.1	215	AA	13:05:22	13:08:33	13:10:35	13:12:56	G	F	G	G	G	0	7.1	10.8	1.78
06-Jan-11	40993	2	84.5	192	AA	13:01:47	13:05:24	13:07:40	13:08:54	G	F	G	G	G	0	7.1	10.8	1.8
06-Jan-11	41069	2	87.8	201	PS	13:01:23	13:05:12	13:07:07	13:11:16	G	F	G	G	G	1	7.1	10.5	1.79
06-Jan-11	41068	2	73.5	192	PS	12:59:56	13:02:20	13:04:19	13:06:21	G	F	G	G	G	1	7.1	10.5	1.8
06-Jan-11	40992	2	142.2	236	AA	12:58:26	13:01:49	13:04:53	13:05:56	G	F	G	G	G	1	7.1	10.8	1.79
06-Jan-11	40991	2	96.3	202	AA	12:55:38	12:58:34	13:00:54	13:01:54	G	F	G	G	G	0	7.1	10.8	1.8
06-Jan-11	40990	2	76.2	190	AA	12:54:16	12:55:41	12:57:18	12:58:06	G	F	G	G	G	0	7.1	10.8	1.79
06-Jan-11	41067	2	141.1	225	PS	12:53:45	12:57:07	12:59:21	13:00:35	G	F	G	G	G	1	7.1	10.5	1.8
06-Jan-11	41066	2	92.9	200	PS	12:50:48	12:53:59	12:56:12	12:59:00	G	F	G	G	G	1	7.1	10.5	1.81
06-Jan-11	40989	2	92.5	208	AA	12:48:49	12:51:51	12:53:41	12:55:33	G	F	G	G	G	0	7.1	10.8	1.81
06-Jan-11	41065	2	141.6	236	PS	12:47:23	12:50:53	12:53:03	12:53:54	G	F	G	G	G	1	7.1	10.5	1.79
06-Jan-11	40988	2	76.4	192	AA	12:46:08	12:48:51	12:51:09	12:51:59	G	F	G	G	G	1	7.1	10.8	1.79
06-Jan-11	41064	2	106	212	PS	12:44:38	12:47:28	12:49:41	12:51:11	G	F	G	G	G	0	7.1	10.5	1.8
06-Jan-11	40987	2	115.7	216	AA	12:43:47	12:46:10	12:48:10	12:49:24	G	F	G	G	G	0	7.1	10.8	1.8
06-Jan-11	41063	2	122.6	214	PS	12:43:17	12:45:10	12:47:01	12:49:45	G	F	G	G	G	0	7.1	10.5	1.79
06-Jan-11	40986	2	99.6	206	AA	12:40:59	12:43:48	12:45:32	12:46:20	G	F	G	G	G	0	7.1	10.8	1.81
06-Jan-11	41062	2	75.1	187	PS	12:37:42	12:40:44	12:42:58	12:44:09	G	F	G	G	G	1	7.1	10.5	1.79
06-Jan-11	40985	2	93	195	AA	12:37:32	12:41:00	12:43:08	12:44:52	G	F	G	G	G	0	7.1	10.8	1.78

Date Tagged	TagID	Days Starved	Weight	Length	Surgeon Name	In Drugs	Out Drugs	Out surgery	Recovered	Scales	Fins	Eyes	Incision	Suturing	Bleeding	Bath_Temp	Bath_DO	Tag_Weight
06-Jan-11	41061	2	97.8	200	PS	12:35:39	12:37:47	12:39:55	12:40:36	G	F	G	G	G	0	7.1	10.5	1.81
06-Jan-11	40984	2	100.8	208	AA	12:34:42	12:37:34	12:39:50	12:40:52	G	F	G	G	G	0	7.1	10.8	1.79
06-Jan-11	41060	2	117.4	216	PS	12:33:08	12:35:40	12:37:27	12:38:54	G	F	G	G	G	0	7.1	10.5	1.8
06-Jan-11	40983	2	79.5	192	AA	12:31:48	12:34:45	12:37:11	12:38:33	G	G	G	G	G	0	7.1	10.8	1.78
06-Jan-11	41059	2	72.2	185	PS	12:30:51	12:33:11	12:35:24	12:36:17	G	F	G	G	G	1	7.1	10.5	1.82
06-Jan-11	40982	2	57.7	177	AA	12:28:51	12:31:50	12:34:06	12:35:21	G	G	G	G	G	0	7.1	10.8	1.8
06-Jan-11	41058	2	126.6	227	PS	12:28:31	12:30:56	12:33:01	12:34:37	G	F	G	G	G	0	7.1	10.5	1.8
06-Jan-11	41057	2	143.4	237	PS	12:26:14	12:28:34	12:30:39	12:32:20	G	F	G	G	G	1	7.1	10.5	1.81
06-Jan-11	40981	2	98.7	209	AA	12:26:12	12:28:56	12:31:23	12:33:20	G	G	G	G	G	1	7.1	10.8	1.8
06-Jan-11	41056	2	130.3	237	PS	12:24:11	12:26:15	12:28:28	12:29:55	G	F	G	G	G	1	7.1	10.5	1.77
08-Dec-10	20972	2	44.5	158	BN	19:11:47	19:16:10	19:19:10	19:36:34	F	F	G	G	G	1	10.3	8.6	1.6
16-Dec-10	21707	2	54.9	170	PS	10:13:29	10:16:52	10:19:03	10:21:48	G	G	G	G	G	1	4.8	9.2	1.6
16-Dec-10	21708	2	62.3	175	PS	10:19:33	10:22:43	10:24:44	10:31:09	F	F	G	G	G	1	4.8	9.2	1.63
16-Dec-10	21709	2	41.8	154	PS	10:21:59	10:25:42	10:27:44	10:35:13	F	F	G	G	G	0	4.8	9.2	1.63
16-Dec-10	21710	2	50.1	167	PS	10:25:37	10:28:51	10:31:04	10:35:55	F	F	G	G	G	0	4.8	9.2	1.6
16-Dec-10	21711	2	51.8	168	PS	10:28:38	10:31:54	10:34:29	10:38:13	F	F	G	G	G	1	4.8	9.2	1.56
16-Dec-10	21712	2	54.2	168	PS	10:31:48	10:35:29	10:37:31	10:44:34	F	F	G	G	G	0	4.8	9.2	1.59
16-Dec-10	21713	2	47.4	164	PS	10:34:39	10:39:02	10:40:55	10:46:06	F	F	G	G	G	1	4.8	9.2	1.59
16-Dec-10	21714	2	44.3	158	PS	10:39:00	10:41:58	10:44:25	10:48:16	F	F	G	G	G	2	4.8	9.2	1.57
16-Dec-10	21715	2	39.5	156	PS	10:41:47	10:45:32	10:48:09	10:54:26	F	F	G	G	G	0	4.8	9.2	1.55
16-Dec-10	21717	2	37.9	153	PS	10:48:20	10:53:04	10:55:45	10:59:27	F	F	G	G	G	1	4.8	9.2	1.57
16-Dec-10	21718	2	42.7	160	PS	10:45:22	10:48:54	10:51:09	10:56:00	F	F	G	G	G	1	4.8	9.2	1.55
16-Dec-10	21719	2	45.5	159	PS	10:52:00	10:56:33	10:59:12	11:06:20	F	F	G	G	G	1	4.8	9.2	1.5
16-Dec-10	21720	2	34.2	147	PS	10:59:32	11:03:47	11:06:12	11:13:13	F	F	G	G	G	0	4.8	9.2	1.58
16-Dec-10	21721	2	35.5	149	PS	11:02:53	11:07:32	11:10:03	11:16:18	F	F	G	G	G	1	5.3	10.9	1.57
16-Dec-10	21722	2	42.1	155	PS	11:10:34	11:13:47	11:15:35	11:22:15	F	F	G	G	G	2	5.3	10.9	1.54

Date Tagged	TagID	Days Starved	Weight	Length	Surgeon Name	In Drugs	Out Drugs	Out surgery	Recovered	Scales	Fins	Eyes	Incision	Suturing	Bleeding	Bath_Temp	Bath_DO	Tag_Weight
16-Dec-10	21723	2	39.4	156	PS	11:12:49	11:16:40	11:18:57	11:25:03	F	F	G	G	G	1	5.3	10.9	1.57
16-Dec-10	21724	2	53.9	168	PS	11:16:28	11:19:57	11:22:08	11:28:48	F	F	G	G	G	0	5.3	10.9	1.57
16-Dec-10	21725	2	43.2	159	PS	11:19:53	11:23:16	11:25:29	11:32:27	F	F	G	F	G	1	5.3	10.9	1.55
16-Dec-10	21726	2	43.7	163	PS	11:22:23	11:26:44	11:29:14	11:38:13	F	F	G	G	G	1	5.3	10.9	1.55
16-Dec-10	21727	2	40.7	154	PS	11:25:49	11:30:10	11:32:18	11:38:14	F	F	G	G	G	0	5.7	11	1.57
16-Dec-10	21729	2	50.6	166	PS	11:29:31	11:33:50	11:36:21	11:40:15	F	F	G	G	G	1	5.7	11	1.56
16-Dec-10	21730	2	35.5	150	PS	11:32:55	11:37:24	11:39:43	11:50:40	F	F	G	G	G	1	5.7	11	1.55
16-Dec-10	21731	2	29.8	140	PS	11:39:53	11:43:11	11:46:05	11:54:25	F	F	G	G	G	1	5.7	11	1.54
16-Dec-10	21732	2	40.5	155	PS	11:42:01	11:46:22	11:48:47	11:55:42	F	F	G	G	G	1	5.7	11	1.56
16-Dec-10	21733	2	41.6	161	PS	11:43:09	11:50:12	11:52:47	12:01:29	F	F	G	G	G	1	5.7	11	1.57
16-Dec-10	21734	2	51.7	171	PS	11:48:58	11:53:09	11:55:36	12:01:19	F	F	G	G	G	1	5.7	11	1.58
16-Dec-10	21735	2	42.9	160	PS	11:53:05	11:56:04	11:58:27	12:00:52	F	F	G	G	G	0	5.7	11	1.57
16-Dec-10	21736	2	53.5	168	PS	11:55:53	11:59:57	12:03:12	12:11:02	F	F	G	P	G	1	6.2	11.4	1.59
16-Dec-10	21737	2	55.8	173	PS	11:58:54	12:03:48	12:05:56	12:11:50	F	F	G	G	G	1	6.2	11.4	1.61
16-Dec-10	21738	2	31.6	144	PS	12:15:06	12:18:03	12:20:44	12:21:23	F	F	G	G	G	1	6.2	11.4	1.56
16-Dec-10	21739	2	38.1	156	GS	14:02:00	14:04:47	14:07:38	14:10:29	F	P	G	G	G	1	8.5	11.4	1.6
16-Dec-10	21740	2	38.7	154	GS	14:04:45	14:08:14	14:11:43	14:16:45	F	F	G	G	G	1	8.5	11.4	1.59
16-Dec-10	21742	2	55.1	172	GS	14:08:16	14:12:22	14:15:23	14:22:24	F	F	G	G	G	1	8.5	11.4	1.58
16-Dec-10	21743	2	49.3	162	GS	14:12:20	14:16:08	14:18:56	14:24:23	F	F	G	G	G	1	8.5	11.4	1.57
16-Dec-10	21744	2	44.8	163	GS	14:16:07	14:19:30	14:22:14	14:24:25	F	F	G	G	G	2	8.5	11.4	1.57
16-Dec-10	21745	2	40.3	158	GS	14:19:28	14:22:39	14:25:52	14:33:05	F	P	G	G	G	2	8.5	11.4	1.57
16-Dec-10	21746	2	54.1	173	GS	14:22:38	14:26:29	14:30:09	14:34:56	F	F	G	G	G	2	9.1	10.6	1.6
16-Dec-10	21747	2	41.5	161	GS	14:26:27	14:31:00	14:33:48	14:41:33	F	F	G	G	G	1	9.1	10.6	1.59
16-Dec-10	21748	2	40.8	156	GS	14:30:45	14:34:22	14:37:11	14:41:35	F	F	G	G	G	1	9.1	10.6	1.62
16-Dec-10	21749	2	35	151	GS	14:34:25	14:44:03	14:46:35	14:50:36	F	F	G	G	G	1	9.1	10.6	1.57
16-Dec-10	21750	2	30.6	143	GS	14:48:03	14:51:47	14:54:06	15:01:00	F	P	G	G	G	1	9.1	10.6	1.59

Date Tagged	TagID	Days Starved	Weight	Length	Surgeon Name	In Drugs	Out Drugs	Out surgery	Recovered	Scales	Fins	Eyes	Incision	Suturing	Bleeding	Bath_Temp	Bath_DO	Tag_Weight
16-Dec-10	21752	2	42.8	159	GS	14:51:19	14:55:00	14:57:48	15:04:37	F	F	G	G	G	1	9.1	10.6	1.6
16-Dec-10	21753	2	55.5	172	GS	14:54:49	14:59:48	15:02:37	15:04:39	F	F	G	G	G	1	9.1	10.6	1.57
16-Dec-10	21754	2	45.2	159	GS	14:59:45	15:04:14	15:05:56	15:10:01	F	P	G	G	G	1	9.1	10.6	1.59
16-Dec-10	21755	2	31.8	145	GS	15:03:43	15:07:05	15:10:09	15:12:23	F	P	G	G	G	1	9.1	10.6	1.57
16-Dec-10	21756	2	61.8	175	GS	15:06:52	15:11:42	15:14:27	15:19:14	F	F	G	G	G	1	9.1	10.6	1.6
16-Dec-10	21757	2	32.1	143	GS	16:36:01	16:41:53	16:44:20	16:53:22	F	F	G	G	G	1	9.1	10.6	1.58
16-Dec-10	21758	2	40.4	157	GS	15:11:39	15:15:03	15:18:27	15:19:20	F	F	G	G	G	2	9.1	10.6	1.57
16-Dec-10	21759	2	35.7	153	GS	15:46:49	15:52:03	15:54:28	15:59:32	F	F	G	G	G	2	9.1	10.6	1.57
16-Dec-10	21760	2	45.9	165	GS	15:49:43	15:55:14	15:57:31	16:04:45	F	F	G	G	G	1	9.1	10.6	1.59
16-Dec-10	21761	2	38.6	154	GS	15:54:44	15:58:28	16:01:18	16:04:46	F	F	G	G	G	1	9.1	10.6	1.58
16-Dec-10	21762	2	43.8	159	GS	16:00:00	16:03:00	16:06:00	16:12:00	F	F	G	G	G	0	9.1	10.6	1.57
16-Dec-10	21763	2	31	144	GS	15:57:58	16:03:49	16:07:04	16:13:57	F	F	G	G	G	1	10	10.9	1.55
16-Dec-10	21764	2	44.8	165	GS	16:06:42	16:11:55	16:14:37	16:25:01	F	F	G	G	G	2	10	10.9	1.59
16-Dec-10	21765	2	37.4	152	GS	16:10:35	16:16:13	16:19:00	16:25:10	F	P	G	G	G	1	10	10.9	1.55
16-Dec-10	21766	2	46.8	172	GS	16:15:23	16:20:43	16:22:45	16:28:44	F	P	G	G	G	1	10	10.9	1.57
16-Dec-10	21767	2	49.6	165	GS	16:19:32	16:24:04	16:26:55	16:29:52	F	F	G	G	G	1	10	10.9	1.55
16-Dec-10	21768	2	51.7	172	GS	16:23:14	16:27:59	16:30:14	16:38:10	F	P	G	G	G	1	10	10.9	1.58
16-Dec-10	21769	2	47.7	165	GS	16:27:43	16:33:12	16:35:52	16:45:19	F	P	G	F	G	2	10	10.9	1.56
16-Dec-10	21770	2	43.6	164	GS	16:30:50	16:37:58	16:40:35	16:48:24	F	P	G	G	G	2	10	10.9	1.57
16-Dec-10	21771	2	41.5	157	CM	10:30:02	10:33:15	10:36:17	10:39:47	G	F	G	G	G	1	5.3	10.9	1.56
16-Dec-10	21772	2	33.7	145	CM	10:33:18	10:36:59	10:39:35	10:44:39	F	F	G	G	G	1	5.3	10.9	1.6
16-Dec-10	21773	2	47.7	167	CM	10:37:01	10:40:50	10:43:21	10:47:40	F	F	G	G	G	1	5.3	10.9	1.58
16-Dec-10	21774	2	36.5	155	CM	10:40:52	10:45:03	10:47:55	10:51:31	F	F	G	G	G	1	5.3	10.9	1.57
16-Dec-10	21776	2	47	167	CM	10:45:05	10:49:09	10:51:36	10:58:56	F	F	G	G	G	1	5.3	10.9	1.57
16-Dec-10	21777	2	38.7	151	CM	10:49:07	10:53:23	10:55:37	10:59:08	G	F	G	G	G	1	5.3	10.9	1.56
16-Dec-10	21778	2	33	147	CM	10:53:25	10:56:43	10:58:43	11:01:37	F	F	G	G	G	1	5.3	10.9	1.56

Date Tagged	TagID	Days Starved	Weight	Length	Surgeon Name	In Drugs	Out Drugs	Out surgery	Recovered	Scales	Fins	Eyes	Incision	Suturing	Bleeding	Bath_Temp	Bath_DO	Tag_Weight
16-Dec-10	21779	2	39.1	154	CM	10:56:42	11:00:26	11:03:01	11:05:46	F	F	G	G	G	1	5.3	10.9	1.55
16-Dec-10	21780	2	43.1	159	CM	11:00:28	11:05:08	11:07:21	11:09:01	F	F	G	G	G	1	5.3	10.9	1.56
16-Dec-10	21781	2	36.9	156	CM	11:03:43	11:09:03	11:11:22	11:13:15	F	F	G	G	G	1	5.3	10.9	1.57
16-Dec-10	21782	2	51.3	166	CM	11:08:01	11:12:48	11:15:03	11:21:03	F	F	G	G	G	1	5.3	10.9	1.57
16-Dec-10	21783	2	44.1	160	CM	11:12:21	11:18:39	11:21:42	11:25:40	G	F	G	G	G	1	5.7	11	1.58
16-Dec-10	21785	2	53.6	165	CM	11:18:40	11:22:55	11:25:49	11:29:56	F	F	G	G	G	1	5.7	11	1.54
16-Dec-10	21786	2	36.3	147	CM	11:22:54	11:28:05	11:30:41	11:38:12	G	F	G	G	G	1	5.7	11	1.58
16-Dec-10	21787	2	37.7	156	CM	11:26:42	11:31:38	11:34:43	11:38:51	G	F	G	G	G	0	5.7	11	1.58
16-Dec-10	21788	2	37.8	153	CM	11:28:08	11:36:13	11:39:07	11:44:53	F	F	G	G	G	1	5.7	11	1.54
16-Dec-10	21789	2	28.8	139	CM	11:31:40	11:40:02	11:42:32	11:47:07	F	F	G	G	G	1	6.2	11.4	1.57
16-Dec-10	21790	2	37.8	155	CM	11:36:15	11:43:27	11:45:56	11:50:09	F	F	G	G	G	1	6.2	11.4	1.57
16-Dec-10	21791	2	41.9	157	CM	11:40:04	11:47:10	11:49:56	11:54:51	F	F	G	G	G	1	6.2	11.4	1.59
16-Dec-10	21792	2	39.3	157	CM	11:43:29	11:51:13	11:53:16	11:59:42	F	F	G	G	G	1	6.2	11.4	1.55
16-Dec-10	21793	2	41.6	159	CM	11:47:12	11:54:13	11:56:53	12:01:32	F	F	G	G	G	1	6.2	11.4	1.57
16-Dec-10	21794	2	32.4	148	CM	11:51:15	11:57:23	11:59:55	12:05:02	F	F	G	G	G	0	6.2	11.4	1.55
16-Dec-10	21795	2	45.2	160	CM	11:54:15	12:00:53	12:03:07	12:06:23	F	F	G	G	G	1	6.2	11.4	1.58
16-Dec-10	21796	2	49.2	166	CM	11:57:25	12:03:57	12:06:17	12:08:41	F	F	G	G	G	1	6.2	11.4	1.58
16-Dec-10	21797	2	50.7	165	CM	12:00:51	12:06:48	12:09:01	12:14:17	F	F	G	G	G	1	6.2	11.4	1.56
16-Dec-10	21798	2	41.2	153	CM	12:18:36	12:22:35	12:24:39	12:26:39	F	F	G	G	G	1	6.2	11.4	1.59
16-Dec-10	21799	2	40.9	157	CM	12:18:41	12:25:22	12:27:30	12:30:13	F	F	G	G	G	1	9.1	10.6	1.57
16-Dec-10	21800	2	30.5	142	CM	12:22:37	12:28:03	12:30:04	12:33:24	F	F	G	G	G	1	9.1	10.6	1.55
16-Dec-10	21802	2	45.1	163	CM	12:25:24	12:30:57	12:33:11	12:38:44	F	F	G	G	G	2	9.1	10.6	1.57
16-Dec-10	21803	2	55.1	169	CM	12:28:05	12:33:47	12:35:27	12:39:58	F	F	G	G	G	2	9.1	10.6	1.57
16-Dec-10	21804	2	36	153	AA	14:02:36	14:07:25	14:09:45	14:12:33	F	F	G	G	G	1	9.1	10.6	1.57
16-Dec-10	21805	2	42.1	158	AA	14:06:45	14:10:44	14:12:45	14:18:43	F	F	G	G	G	0	9.1	10.6	1.56
16-Dec-10	21806	2	37.3	158	AA	14:09:56	14:13:52	14:16:24	14:20:15	F	F	G	G	G	2	9.1	10.6	1.56

Date Tagged	TagID	Days Starved	Weight	Length	Surgeon Name	In Drugs	Out Drugs	Out surgery	Recovered	Scales	Fins	Eyes	Incision	Suturing	Bleeding	Bath_Temp	Bath_DO	Tag_Weight
16-Dec-10	21807	2	39.5	157	AA	14:13:03	14:17:38	14:20:05	14:23:29	F	F	G	G	G	1	9.1	10.6	1.55
16-Dec-10	21808	2	34.7	151	AA	14:16:33	14:21:05	14:23:18	14:25:03	F	F	G	G	G	1	9.1	10.6	1.56
16-Dec-10	21810	2	37.6	151	AA	14:20:22	14:24:17	14:26:17	14:28:05	F	F	G	G	G	2	9.1	10.6	1.57
16-Dec-10	21811	2	42.8	158	AA	14:23:43	14:27:42	14:29:47	14:33:11	F	F	G	G	G	1	9.1	10.6	1.57
16-Dec-10	21814	2	55	167	AA	14:26:37	14:31:01	14:33:04	14:37:06	F	F	G	G	G	0	9.1	10.6	1.54
16-Dec-10	21815	2	42	160	AA	14:30:30	14:34:12	14:36:47	14:40:33	F	F	G	F	G	2	9.1	10.6	1.56
16-Dec-10	21816	2	39.7	156	AA	14:33:17	14:38:55	14:42:00	14:45:09	F	F	G	G	G	1	9.1	10.6	1.55
16-Dec-10	21817	2	36.7	152	AA	14:37:55	14:42:44	14:49:31	14:53:30	F	F	G	G	G	1	8.7	10.8	1.55
16-Dec-10	21818	2	34.3	145	AA	14:42:33	14:49:38	14:51:56	14:58:43	F	F	G	G	G	1	8.7	10.8	1.56
16-Dec-10	21819	2	32.3	147	AA	14:45:35	14:52:14	14:54:49	15:01:53	F	F	G	G	G	1	8.7	10.8	1.56
16-Dec-10	21820	2	40.7	155	AA	14:52:12	14:55:13	14:57:59	15:03:38	F	F	G	G	G	1	8.7	10.8	1.53
16-Dec-10	21821	2	41.2	156	AA	15:04:52	15:08:32	15:10:27	15:12:58	F	F	G	G	G	1	8.7	10.8	1.57
16-Dec-10	21823	2	38.3	154	AA	15:07:30	15:11:46	15:14:20	15:16:52	F	F	G	G	G	2	9.6	10.4	1.58
16-Dec-10	21824	2	33.1	147	AA	15:11:12	15:14:59	15:17:47	15:19:21	F	F	G	G	G	1	9.6	10.4	1.56
16-Dec-10	21825	2	26.9	137	AA	15:14:48	15:18:20	15:20:31	15:21:52	F	F	G	G	G	1	9.6	10.4	1.57
16-Dec-10	21826	2	33.3	148	AA	15:18:16	15:22:11	15:24:24	15:29:21	F	F	G	F	G	1	9.6	10.4	1.58
16-Dec-10	21827	2	48.3	167	AA	15:22:05	15:25:52	15:28:57	15:30:06	F	F	G	G	G	2	9.6	10.4	1.56
16-Dec-10	21828	2	37.3	153	AA	15:25:44	15:30:21	15:33:09	15:35:04	F	F	G	G	G	1	9.6	10.4	1.56
16-Dec-10	21829	2	44.1	160	AA	15:30:20	15:33:59	15:36:49	15:40:14	F	P	G	G	G	1	9.6	10.4	1.56
16-Dec-10	21830	2	37.8	158	AA	15:37:17	15:42:02	15:44:08	15:45:26	F	P	G	G	G	0	9.6	10.4	1.56
16-Dec-10	21831	2	39.8	156	AA	15:46:45	15:51:03	15:53:23	15:54:32	F	F	G	G	G	2	10	10.9	1.56
16-Dec-10	21832	2	45.9	162	AA	15:50:55	15:54:45	15:57:28	15:58:46	F	F	G	G	G	1	10	10.9	1.58
16-Dec-10	21833	2	40.1	159	AA	15:54:35	15:58:40	16:00:34	16:01:56	F	F	G	G	G	1	10	10.9	1.55
16-Dec-10	21834	2	38.3	158	AA	15:57:33	16:01:47	16:03:47	16:05:04	F	F	G	G	G	1	10	10.9	1.6
16-Dec-10	21835	2	39.1	155	AA	16:00:50	16:04:35	16:06:36	16:07:35	F	F	G	G	G	1	10	10.9	1.57
16-Dec-10	21836	2	35.6	150	AA	16:06:48	16:11:14	16:13:20	16:16:45	F	F	G	G	G	1	10	10.9	1.58

Date Tagged	TagID	Days Starved	Weight	Length	Surgeon Name	In Drugs	Out Drugs	Out surgery	Recovered	Scales	Fins	Eyes	Incision	Suturing	Bleeding	Bath_Temp	Bath_DO	Tag_Weight
17-Dec-10	40804	2	82.7	194	CM	16:31:09	16:34:03	16:35:47	16:38:04	G	F	G	G	G	0	6.2	11.11	1.82
17-Dec-10	40879	2	69.2	178	GS	16:29:04	16:32:35	16:35:24	16:38:22	G	F	G	G	G	1	6.2	11.1	1.79
17-Dec-10	40803	2	66	183	CM	16:26:50	16:31:23	16:33:15	16:35:08	G	F	G	G	G	0	6.2	11.11	1.79
17-Dec-10	40878	2	127.8	228	GS	16:25:23	16:29:07	16:31:52	16:34:12	G	F	G	G	G	0	6.2	11.1	1.8
17-Dec-10	40802	2	138.4	230	CM	16:23:31	16:26:55	16:30:17	16:32:58	G	F	G	G	G	0	6.2	11.11	1.79
17-Dec-10	40877	2	110	218	GS	16:20:46	16:25:25	16:28:23	16:31:25	G	F	G	G	G	1	6.2	11.1	1.8
17-Dec-10	40801	2	51.5	167	CM	16:20:09	16:23:32	16:25:54	16:28:14	G	F	G	G	G	1	6.2	11.11	1.79
17-Dec-10	40876	2	104.3	217	GS	16:17:20	16:20:47	16:23:37	16:26:10	G	F	G	G	G	0	6.2	11.1	1.81
17-Dec-10	40800	2	58	172	CM	16:16:29	16:20:10	16:22:28	16:24:02	G	F	G	G	G	1	6.2	11.11	1.82
17-Dec-10	40875	2	113.9	215	GS	16:14:02	16:17:43	16:20:08	16:21:26	G	F	G	G	G	0	6.2	11.1	1.76
17-Dec-10	40799	2	114.1	217	CM	16:12:51	16:16:33	16:18:49	16:20:42	G	F	G	G	G	0	6.2	11.11	1.8
17-Dec-10	40874	2	118.3	218	GS	16:10:10	16:14:04	16:16:30	16:18:26	G	F	G	G	G	1	6.2	11.1	1.79
17-Dec-10	40798	2	140.7	228	CM	16:09:18	16:12:53	16:15:35	16:18:20	G	F	G	G	G	1	6.2	11.11	1.81
17-Dec-10	40873	2	89.6	206	GS	16:06:54	16:10:11	16:12:56	16:15:31	G	F	G	G	G	1	6.2	11.1	1.77
17-Dec-10	40797	2	139.3	234	CM	16:06:03	16:09:19	16:12:09	16:14:21	G	F	G	G	G	1	6.2	11.11	1.79
17-Dec-10	40872	2	61	176	GS	16:03:23	16:06:56	16:09:31	16:10:42	G	F	G	G	G	0	6	11.5	1.79
17-Dec-10	40796	2	74.6	184	CM	16:02:02	16:06:05	16:08:23	16:10:45	G	F	G	G	G	1	6.2	11.11	1.8
17-Dec-10	40871	2	118.4	219	GS	16:00:50	16:03:25	16:06:04	16:07:15	G	F	G	G	G	0	6	11.5	1.82
17-Dec-10	40795	2	71.4	182	CM	15:59:09	16:02:18	16:05:13	16:06:48	G	F	G	G	G	1	6	11.53	1.8
17-Dec-10	40870	2	141.5	233	GS	15:55:20	15:59:05	16:02:24	16:05:27	G	F	G	G	G	1	6	11.5	1.8
17-Dec-10	40869	2	87.5	199	GS	15:52:47	15:55:19	15:58:20	16:00:07	G	F	G	G	G	0	6	11.5	1.77
17-Dec-10	40794	2	73.6	185	CM	15:51:05	15:54:07	15:56:34	15:58:43	G	F	G	G	G	1	6	11.53	1.8
17-Dec-10	40793	2	76.5	188	CM	15:47:51	15:51:08	15:53:26	15:54:50	G	F	G	G	G	1	6	11.53	1.8
17-Dec-10	40792	2	71.9	186	CM	15:44:36	15:47:53	15:50:14	15:52:34	G	F	G	G	G	1	6	11.53	1.81
17-Dec-10	40868	2	78.2	194	GS	15:44:17	15:48:28	15:51:57	15:54:45	G	F	G	G	G	1	6	11.5	1.79
17-Dec-10	40791	2	43.9	158	CM	15:41:29	15:44:38	15:47:37	15:49:04	G	F	G	G	G	1	6	11.53	1.77

Date Tagged	TagID	Days Starved	Weight	Length	Surgeon Name	In Drugs	Out Drugs	Out surgery	Recovered	Scales	Fins	Eyes	Incision	Suturing	Bleeding	Bath_Temp	Bath_DO	Tag_Weight
17-Dec-10	40867	2	99.6	209	GS	15:40:41	15:44:19	15:47:35	15:51:39	G	F	G	G	G	1	6	11.5	1.79
17-Dec-10	40790	2	70.1	183	CM	15:39:33	15:41:51	15:44:00	15:45:18	G	F	G	G	G	1	6	11.53	1.81
17-Dec-10	40866	2	87.6	202	GS	15:37:04	15:40:44	15:43:24	15:46:18	G	F	G	G	G	1	6	11.5	1.79
17-Dec-10	40865	2	48.8	167	GS	15:33:52	15:37:06	15:40:02	15:40:48	G	F	G	G	G	1	6	11.5	1.79
17-Dec-10	40789	2	120.2	218	CM	15:33:35	15:36:45	15:39:00	15:41:05	G	F	G	G	G	1	6	11.53	1.78
17-Dec-10	40864	2	118.9	214	GS	15:30:30	15:33:58	15:36:35	15:39:22	G	F	G	G	G	1	6	11.5	1.79
17-Dec-10	40788	2	133.2	231	CM	15:29:07	15:33:37	15:36:17	15:38:16	G	F	G	G	G	0	6	11.53	1.8
17-Dec-10	40863	2	73.6	190	GS	15:26:44	15:30:28	15:33:14	15:36:11	G	F	G	G	G	0	6	11.5	1.81
17-Dec-10	40787	2	116.1	217	CM	15:25:48	15:29:09	15:32:50	15:34:09	G	F	G	G	G	0	6	11.53	1.81
17-Dec-10	40862	2	135.6	230	GS	15:24:41	15:26:47	15:30:07	15:32:39	G	F	G	G	G	1	6	11.5	1.79
17-Dec-10	40786	2	83.1	196	AA	15:01:51	15:05:12	15:07:40	15:09:11	G	F	G	G	G	0	6.4	11.3	1.79
17-Dec-10	40785	2	95.7	208	AA	14:58:19	15:01:56	15:04:37	15:07:26	G	F	G	G	G	1	6.4	11.3	1.81
17-Dec-10	40784	2	108.9	210	AA	14:54:52	14:58:21	15:01:03	15:02:46	G	F	G	G	G	0	6.3	11.1	1.79
17-Dec-10	40861	2	66.1	183	PS	14:54:35	14:58:35	15:01:51	15:03:01	G	F	G	G	G	0	6.4	11.3	1.78
17-Dec-10	40783	2	56.9	174	AA	14:51:15	14:54:54	14:57:32	15:00:42	G	F	G	G	G	0	6.3	11.1	1.81
17-Dec-10	40860	2	139.3	226	PS	14:50:05	14:54:41	14:57:48	14:59:01	G	F	G	G	G	1	6.3	11.1	1.8
17-Dec-10	40859	2	116.9	222	PS	14:47:38	14:50:11	14:53:55	14:56:20	G	F	G	G	G	1	6.3	11.1	1.81
17-Dec-10	40782	2	101.8	203	AA	14:47:21	14:51:17	14:53:46	14:56:54	G	F	G	G	G	0	6.3	11.1	1.8
17-Dec-10	40781	2	169.9	238	AA	14:43:56	14:47:28	14:50:20	14:52:34	G	F	G	G	G	0	6.3	11.1	1.81
17-Dec-10	40858	2	99.3	208	PS	14:43:55	14:47:40	14:49:45	14:50:42	G	F	G	F	G	1	6.1	11.4	1.8
17-Dec-10	40857	2	144.1	231	PS	14:41:36	14:43:59	14:46:40	14:47:25	G	F	G	G	G	0	6.1	11.4	1.81
17-Dec-10	40780	2	64.7	183	AA	14:40:23	14:44:05	14:46:27	14:48:56	G	F	G	G	G	1	6.3	11.1	1.8
17-Dec-10	40779	2	64.5	181	AA	14:37:25	14:40:26	14:43:11	14:44:50	G	F	G	G	G	0	6.1	11.4	1.78
17-Dec-10	40856	2	99.7	203	PS	14:35:11	14:38:19	14:40:39	14:42:22	G	F	G	G	G	0	6.1	11.4	1.79
17-Dec-10	40778	2	134	224	AA	14:34:32	14:37:28	14:39:45	14:43:26	G	F	G	G	G	0	6.1	11.4	1.8
17-Dec-10	40855	2	60.3	175	PS	14:32:13	14:35:20	14:37:44	14:40:38	G	F	G	G	G	1	6.1	11.4	1.8

Date Tagged	TagID	Days Starved	Weight	Length	Surgeon Name	In Drugs	Out Drugs	Out surgery	Recovered	Scales	Fins	Eyes	Incision	Suturing	Bleeding	Bath_Temp	Bath_DO	Tag_Weight
17-Dec-10	40777	2	81.5	195	AA	14:31:48	14:34:35	14:36:47	14:39:12	G	F	G	G	G	0	6.1	11.4	1.8
17-Dec-10	40776	2	81.6	198	AA	14:28:25	14:31:50	14:34:12	14:35:14	G	F	G	G	G	0	6.1	11.4	1.8
17-Dec-10	40853	2	126.6	217	PS	14:26:00	14:29:23	14:31:56	14:33:53	G	F	G	G	G	1	6.1	11.4	1.81
17-Dec-10	40775	2	93.7	203	AA	14:25:38	14:28:38	14:31:05	14:33:29	G	F	G	G	G	0	6.1	11.4	1.81
17-Dec-10	40852	2	115.5	216	PS	14:22:44	14:26:06	14:28:45	14:32:21	G	F	G	G	G	1	6	11.5	1.81
17-Dec-10	40851	2	87.4	197	PS	14:19:48	14:22:48	14:25:07	14:26:36	G	F	G	G	G	0	6	11.5	1.8
17-Dec-10	40774	2	158	239	AA	14:18:35	14:22:01	14:24:58	14:27:33	G	F	G	G	G	1	6.1	11.4	1.81
17-Dec-10	40850	2	104.8	209	PS	14:16:55	14:19:53	14:22:19	14:25:06	G	F	G	G	G	0	6	11.5	1.81
17-Dec-10	40773	2	93.6	195	AA	14:15:25	14:18:37	14:21:28	14:23:03	G	F	G	G	G	0	6	11.5	1.77
17-Dec-10	40849	2	97.4	199	PS	14:14:10	14:16:58	14:19:29	14:20:19	G	F	G	G	G	0	6	11.5	1.82
17-Dec-10	40772	2	143.5	230	AA	14:11:22	14:15:32	14:18:18	14:20:53	G	F	G	G	G	1	6	11.5	1.81
17-Dec-10	40848	2	78.6	194	PS	14:10:51	14:14:13	14:16:33	14:18:34	G	F	G	G	G	1	6	11.5	1.81
17-Dec-10	40771	2	69.9	189	AA	14:07:55	14:11:26	14:15:07	14:17:27	G	F	G	G	G	0	6	11.5	1.8
17-Dec-10	40847	2	69.9	183	PS	14:07:21	14:10:55	14:13:30	14:15:46	G	F	G	G	G	0	6	11.5	1.8
17-Dec-10	40846	2	127	227	PS	14:04:07	14:07:25	14:09:56	14:12:42	G	F	G	G	G	1	6	11.5	1.8
17-Dec-10	40770	2	70.8	184	AA	14:04:01	14:07:59	14:11:04	14:13:27	G	F	G	G	G	0	6	11.5	1.78
17-Dec-10	40845	2	122.7	218	PS	14:01:14	14:04:14	14:06:35	14:08:00	G	F	G	G	G	1	6	11.5	1.83
17-Dec-10	40769	2	49.8	166	AA	14:00:07	14:04:04	14:07:17	14:08:26	G	F	G	G	G	0	6	11.5	1.78
17-Dec-10	40844	2	143.4	230	PS	13:58:44	14:01:24	14:03:34	14:05:33	G	F	G	G	G	0	6	11.5	1.8
17-Dec-10	40768	2	67	185	AA	13:57:49	14:00:10	14:03:30	14:05:51	G	F	G	G	G	1	5.8	11.16	1.79
17-Dec-10	40843	2	122	217	PS	13:56:27	13:58:49	14:00:50	14:03:12	G	F	G	G	G	0	6	11.5	1.79
17-Dec-10	40767	2	112.9	217	CM	12:36:24	12:40:47	12:43:03	12:49:15	G	F	G	G	G	1	5.8	11.16	1.79
17-Dec-10	40766	2	98.4	203	CM	12:34:27	12:37:38	12:39:59	12:43:31	G	F	G	G	G	0	5.8	11.16	1.8
17-Dec-10	40842	2	78.3	184	GS	12:32:53	12:35:48	12:40:14	12:41:11	F	F	G	G	G	1	5.9	11.3	1.82
17-Dec-10	40841	2	89	203	GS	12:29:44	12:32:55	12:35:18	12:36:58	G	F	G	G	G	1	5.8	11.2	1.82
17-Dec-10	40765	2	74.7	189	CM	12:28:13	12:31:25	12:33:53	12:36:19	G	F	G	G	G	0	5.8	11.16	1.78

Date Tagged	TagID	Days Starved	Weight	Length	Surgeon Name	In Drugs	Out Drugs	Out surgery	Recovered	Scales	Fins	Eyes	Incision	Suturing	Bleeding	Bath_Temp	Bath_DO	Tag_Weight
17-Dec-10	40840	2	88	201	GS	12:26:07	12:29:42	12:32:17	12:34:38	G	F	G	G	G	1	5.8	11.2	1.82
17-Dec-10	40764	2	99.6	206	CM	12:24:32	12:28:15	12:30:31	12:31:31	G	F	G	G	G	0	5.8	11.16	1.77
17-Dec-10	40839	2	131	227	GS	12:22:27	12:26:05	12:29:02	12:31:46	G	F	G	G	G	1	5.8	11.2	1.8
17-Dec-10	40763	2	86.9	196	CM	12:19:38	12:24:33	12:27:33	12:28:20	G	F	G	G	G	1	5.8	11.16	1.81
17-Dec-10	40838	2	71.6	184	GS	12:19:09	12:22:33	12:25:28	12:27:25	G	F	G	G	G	1	5.8	11.2	1.79
17-Dec-10	40837	2	72.5	190	GS	12:15:56	12:19:11	12:21:33	12:23:26	G	F	G	G	G	0	5.8	11.2	1.8
17-Dec-10	40836	2	67.9	180	GS	12:13:11	12:15:58	12:18:28	12:19:40	G	F	G	G	G	1	5.8	11.2	1.78
17-Dec-10	40762	2	106.3	216	CM	12:11:17	12:16:29	12:18:47	12:21:29	G	F	G	G	G	1	5.8	11.16	1.8
17-Dec-10	40761	2	73.4	185	CM	12:07:58	12:12:18	12:15:21	12:16:33	G	F	G	G	G	1	5.8	11.16	1.79
17-Dec-10	40835	2	107.1	209	GS	12:05:52	12:09:20	12:12:10	12:13:48	G	F	G	G	G	0	5.8	11.2	1.83
17-Dec-10	40760	2	65.9	176	CM	12:04:02	12:08:11	12:10:23	12:11:06	G	F	G	G	G	0	5.8	11.16	1.8
17-Dec-10	40834	2	79.9	200	GS	12:01:44	12:05:54	12:08:44	12:11:23	G	F	G	G	G	1	5.7	11.4	1.81
17-Dec-10	40759	2	142.4	237	CM	12:00:41	12:04:04	12:06:50	12:09:56	G	F	G	G	G	0	5.7	11.4	1.76
17-Dec-10	40758	2	76.3	191	CM	11:58:31	12:00:47	12:03:20	12:06:23	G	F	G	G	G	1	5.7	11.4	1.79
17-Dec-10	40833	2	64.3	176	GS	11:56:49	12:01:46	12:05:11	12:06:38	G	F	G	G	F	1	5.7	11.4	1.81
17-Dec-10	40832	2	85.9	199	GS	11:53:54	11:56:47	11:59:12	12:02:16	G	F	G	G	G	1	5.7	11.4	1.79
17-Dec-10	40757	2	57.8	166	CM	11:52:02	11:55:08	11:57:24	11:58:29	G	F	G	G	G	1	5.7	11.4	1.79
17-Dec-10	40831	2	93.3	205	GS	11:50:30	11:53:52	11:56:20	11:58:54	G	F	G	G	G	0	5.8	10.4	1.8
17-Dec-10	40830	2	77	194	GS	11:46:36	11:50:28	11:53:23	11:56:31	F	F	G	G	G	0	5.8	10.4	1.8
17-Dec-10	40756	2	56.4	168	CM	11:45:16	11:48:57	11:51:30	11:52:00	G	F	G	G	G	0	5.7	11.4	1.79
17-Dec-10	40829	2	98.8	212	GS	11:44:01	11:46:38	11:49:54	11:51:09	G	F	G	G	G	1	5.8	10.4	1.77
17-Dec-10	40755	2	112.4	215	CM	11:42:19	11:45:18	11:48:08	11:49:09	G	F	G	G	G	0	5.7	11.4	1.8
17-Dec-10	40754	2	94.6	200	CM	11:39:24	11:42:21	11:44:47	11:46:06	G	F	G	G	G	0	5.7	11.4	1.77
17-Dec-10	40828	2	61.4	175	GS	11:37:11	11:40:04	11:43:28	11:47:14	G	F	G	G	G	0	5.8	10.4	1.8
17-Dec-10	40753	2	110.1	210	CM	11:36:24	11:39:29	11:41:35	11:43:16	G	F	G	G	G	1	5.7	11.4	1.77
17-Dec-10	40827	2	58.9	178	GS	11:33:32	11:37:08	11:39:25	11:42:52	G	F	G	G	G	1	5.8	10.4	1.79

Date Tagged	TagID	Days Starved	Weight	Length	Surgeon Name	In Drugs	Out Drugs	Out surgery	Recovered	Scales	Fins	Eyes	Incision	Suturing	Bleeding	Bath_Temp	Bath_DO	Tag_Weight
17-Dec-10	40752	2	131.5	221	CM	11:33:16	11:36:30	11:38:51	11:39:35	G	F	G	G	G	0	5.8	10.4	1.75
17-Dec-10	40826	2	103.7	204	GS	11:29:54	11:33:35	11:36:38	11:38:29	G	F	G	G	G	1	5.8	10.4	1.78
17-Dec-10	40751	2	97.1	202	CM	11:29:50	11:33:18	11:35:51	11:36:57	G	F	G	G	G	1	5.8	10.4	1.77
17-Dec-10	40750	2	97.8	211	CM	11:26:16	11:30:02	11:32:47	11:35:49	G	F	G	G	G	0	5.8	10.4	1.78
17-Dec-10	40825	2	79.2	193	GS	11:26:16	11:29:56	11:33:27	11:36:10	G	F	G	G	G	1	5.8	10.4	1.77
17-Dec-10	40824	2	86.8	202	GS	11:23:48	11:26:19	11:29:14	11:33:25	G	F	G	G	G	1	5.8	10.4	1.79
17-Dec-10	40749	2	90.6	199	CM	11:23:24	11:26:19	11:29:08	11:31:10	G	F	G	G	G	1	5.8	10.4	1.79
17-Dec-10	40748	2	77.9	185	AA	11:02:05	11:06:08	11:08:32	11:11:40	G	F	G	G	G	0	5.8	10.4	1.78
17-Dec-10	40747	2	65.2	184	AA	10:57:55	11:02:18	11:05:24	11:07:42	G	F	G	G	G	0	5.8	10.4	1.75
17-Dec-10	40746	2	78.2	193	AA	10:51:31	10:54:48	10:57:36	11:02:02	G	F	G	G	G	0	5.8	10.4	1.79
17-Dec-10	40823	2	85.7	195	PS	10:49:59	10:53:25	10:55:48	10:56:27	G	F	G	G	G	0	5.5	11.4	1.78
17-Dec-10	40745	2	109.5	217	AA	10:48:33	10:51:37	10:54:27	10:56:47	G	F	G	G	G	0	5.8	10.4	1.74
17-Dec-10	40822	2	131	222	PS	10:47:01	10:50:02	10:52:25	10:53:18	G	F	G	G	G	0	5.5	11.4	1.8
17-Dec-10	40744	2	92.3	199	AA	10:45:33	10:48:36	10:50:46	10:54:55	G	F	G	G	G	1	5.8	10.4	1.75
17-Dec-10	40821	2	90.5	202	PS	10:44:36	10:47:04	10:49:16	10:49:53	G	F	G	G	G	1	5.5	11.4	1.79
17-Dec-10	40743	2	80.8	192	AA	10:42:42	10:45:39	10:48:01	10:49:18	G	F	G	G	G	0	5.8	10.4	1.75
17-Dec-10	40820	2	105	207	PS	10:42:26	10:44:42	10:46:37	10:47:46	G	F	G	G	G	1	5.5	11.4	1.77
17-Dec-10	40742	2	79.5	194	AA	10:40:18	10:42:44	10:45:11	10:46:41	G	F	G	G	G	0	5.8	10.4	1.76
17-Dec-10	40819	2	87.5	207	PS	10:39:49	10:42:30	10:44:27	10:44:51	G	F	G	G	G	0	5.5	11.4	1.8
17-Dec-10	40741	2	74.7	185	AA	10:37:20	10:40:21	10:42:20	10:43:44	G	F	G	G	G	0	5.8	10.4	1.75
17-Dec-10	40818	2	102.6	208	PS	10:36:03	10:39:55	10:41:36	10:42:20	G	F	G	G	G	0	5.5	11.4	1.79
17-Dec-10	40817	2	59.7	172	PS	10:33:31	10:36:04	10:38:33	10:39:04	G	F	G	G	G	0	5.5	11.4	1.8
17-Dec-10	40740	2	88	204	AA	10:32:53	10:37:22	10:39:47	10:41:25	G	F	G	G	G	0	5.8	10.4	1.8
17-Dec-10	40739	2	43.5	156	AA	10:29:42	10:32:57	10:35:29	10:36:56	G	F	G	G	G	1	5.8	10.4	1.75
17-Dec-10	40816	2	86.3	200	PS	10:28:08	10:31:03	10:33:12	10:36:01	G	F	G	G	G	0	5.5	11.4	1.8
17-Dec-10	40738	2	69	189	AA	10:26:54	10:29:51	10:32:12	10:34:44	G	F	G	G	G	1	5.8	10.4	1.78

Date Tagged	TagID	Days Starved	Weight	Length	Surgeon Name	In Drugs	Out Drugs	Out surgery	Recovered	Scales	Fins	Eyes	Incision	Suturing	Bleeding	Bath_Temp	Bath_DO	Tag_Weight
17-Dec-10	40815	2	91.1	203	PS	10:25:37	10:28:13	10:30:39	10:31:48	G	F	G	F	G	0	5.5	11.4	1.83
17-Dec-10	40737	2	136	224	AA	10:23:39	10:26:56	10:29:01	10:30:26	G	F	G	G	G	0	5.8	10.4	1.74
17-Dec-10	40814	2	117.8	218	PS	10:22:44	10:25:38	10:27:35	10:28:49	G	F	G	G	G	0	5.5	11.4	1.8
17-Dec-10	40736	2	132.1	227	AA	10:20:06	10:23:41	10:26:11	10:28:47	G	F	G	G	G	0	5.8	10.4	1.74
17-Dec-10	40813	2	79.3	185	PS	10:19:29	10:22:57	10:25:08	10:26:49	G	F	G	G	G	1	5.5	11.4	1.81
17-Dec-10	40735	2	63.4	176	AA	10:17:14	10:20:08	10:22:41	10:24:14	G	F	G	G	G	0	5.8	10.4	1.75
17-Dec-10	40812	2	87.4	203	PS	10:16:58	10:19:31	10:22:28	10:22:49	G	F	G	P	G	1	5.5	11.4	1.8
17-Dec-10	40811	2	110.5	214	PS	10:14:23	10:17:00	10:19:12	10:20:19	G	F	G	G	G	0	5.5	11.4	1.78
17-Dec-10	40734	2	91.9	205	AA	10:14:19	10:17:16	10:19:42	10:21:42	G	F	G	G	G	0	5.8	10.4	1.76
17-Dec-10	40810	2	86.9	206	PS	10:11:39	10:14:32	10:16:39	10:19:15	G	F	G	G	G	0	5.5	11.4	1.8
17-Dec-10	40733	2	125	223	AA	10:11:26	10:14:23	10:16:39	10:17:35	G	F	G	G	G	0	5.8	10.4	1.78
17-Dec-10	40732	2	128	225	AA	10:09:08	10:11:29	10:13:42	10:16:21	G	F	G	G	G	0	5.8	10.4	1.77
17-Dec-10	40809	2	56.4	167	PS	10:08:38	10:11:46	10:14:09	10:16:43	G	F	G	G	G	1	5.5	11.4	1.81
17-Dec-10	40808	2	63.9	176	PS	10:05:39	10:08:45	10:11:06	10:12:52	G	F	G	G	G	1	5.5	11.4	1.8
17-Dec-10	40807	2	102.9	207	PS	10:03:46	10:05:44	10:07:58	10:08:53	G	F	G	G	G	0	6.2	11.11	1.77
17-Dec-10	40731	2	91.4	203	AA	10:00:35	10:04:18	10:06:24	10:09:04	G	F	G	G	G	0	5.8	10.4	1.77
17-Dec-10	40806	2	115.8	213	PS	9:59:09	10:01:47	10:03:52	10:05:01	G	F	G	G	G	0	6.2	11.11	1.81
17-Dec-10	40730	2	69.5	187	AA	9:58:02	10:01:51	10:03:40	10:06:28	G	F	G	G	G	0	5.5	11.4	1.79
17-Dec-10	40805	2	93.7	205	PS	9:56:58	9:59:13	10:01:15	10:02:50	G	F	G	G	G	0	6.2	11.11	1.81
16-Dec-10	21837	2	44.3	161	AA	16:09:21	16:14:09	16:16:21	16:17:49	F	F	G	G	G	2	10	10.9	1.56
04-Jan-11	21838	2	43.4	159	PS	10:50:55	10:54:29	10:57:13	11:01:29	F	F	G	G	G	2	6.8	10.9	1.59
04-Jan-11	21839	2	46.2	162	PS	10:56:20	10:59:37	11:02:11	11:05:13	F	F	G	G	G	1	6.8	10.9	1.55
04-Jan-11	21840	2	60.1	173	PS	10:58:16	11:02:24	11:04:35	11:11:44	F	F	G	G	G	1	6.8	10.9	1.55
04-Jan-11	21841	2	51.1	164	PS	10:59:35	11:05:10	11:07:23	11:14:52	F	F	G	G	G	1	6.8	10.9	1.58
04-Jan-11	21842	2	45.8	159	PS	11:04:11	11:07:31	11:09:26	11:17:01	F	F	G	G	G	1	6.8	10.9	1.58
04-Jan-11	21843	2	36.9	148	PS	11:05:08	11:09:56	11:12:09	11:22:03	F	F	G	G	G	1	6.8	10.9	1.57

Date Tagged	TagID	Days Starved	Weight	Length	Surgeon Name	In Drugs	Out Drugs	Out surgery	Recovered	Scales	Fins	Eyes	Incision	Suturing	Bleeding	Bath_Temp	Bath_DO	Tag_Weight
04-Jan-11	21844	2	48.7	166	PS	11:07:26	11:12:36	11:14:44	11:22:04	F	F	G	G	G	1	6.8	10.9	1.58
04-Jan-11	21845	2	49.7	166	PS	11:09:54	11:14:57	11:17:03	11:22:08	F	F	G	G	G	1	6.8	10.9	1.57
04-Jan-11	21846	2	50.7	167	PS	11:12:30	11:17:20	11:19:16	11:24:36	F	F	G	G	G	1	6.8	10.9	1.57
04-Jan-11	21847	2	47.4	162	PS	11:14:55	11:19:30	11:21:58	11:24:41	F	F	G	G	G	1	6.8	10.9	1.58
04-Jan-11	21848	2	41.9	153	PS	11:17:14	11:22:13	11:24:21	11:28:16	F	F	G	G	G	1	6.8	10.9	1.58
04-Jan-11	21849	2	41.8	161	PS	11:19:28	11:25:00	11:27:15	11:32:26	F	F	G	G	G	1	6.8	10.9	1.55
04-Jan-11	21850	2	49.3	173	PS	11:22:11	11:27:30	11:29:39	11:34:52	F	F	G	G	G	2	6.8	10.9	1.58
04-Jan-11	21851	2	51.3	167	PS	11:24:53	11:29:58	11:32:21	11:36:13	F	F	G	G	G	`1	6.8	10.9	1.55
04-Jan-11	21852	2	37.1	152	PS	11:27:27	11:32:37	11:34:45	11:39:20	F	F	G	G	G	1	6.8	10.9	1.57
04-Jan-11	21853	2	49.1	167	PS	11:29:53	11:35:32	11:37:24	11:44:21	F	F	G	G	G	1	6.8	10.9	1.57
04-Jan-11	21854	2	49.2	165	PS	11:32:31	11:37:49	11:39:58	11:43:45	F	F	G	G	G	1	6.8	10.9	1.57
04-Jan-11	21855	2	56.1	169	PS	11:35:31	11:40:10	11:42:19	11:46:30	F	F	G	F	G	1	6.8	10.9	1.58
04-Jan-11	21856	2	42.6	163	PS	11:43:57	11:49:31	11:52:14	11:57:39	F	F	G	G	G	1	6.8	10.9	1.57
04-Jan-11	21857	2	46.4	158	PS	11:48:10	11:52:49	11:55:19	11:58:19	F	F	G	F	G	1	6.8	10.9	1.6
04-Jan-11	21858	2	51.4	168	PS	11:49:29	11:56:31	11:58:47	12:08:00	F	F	G	G	G	2	6.8	10.9	1.57
04-Jan-11	21859	2	49.5	167	PS	12:02:48	12:06:59	12:09:32	12:14:27	F	F	G	G	G	1	7.1	10.9	1.58
04-Jan-11	21861	2	43.6	162	PS	12:03:55	12:10:10	12:12:41	12:18:04	F	F	G	G	G	1	7.1	10.9	1.56
04-Jan-11	21862	2	34.3	148	PS	12:06:57	12:12:56	12:15:11	12:20:34	F	F	G	G	G	2	7.1	10.9	1.58
04-Jan-11	21863	2	49.5	167	PS	12:10:06	12:15:59	12:18:00	12:21:44	F	F	G	G	G	1	7.1	10.9	1.58
04-Jan-11	21864	2	43	158	PS	12:12:52	12:18:17	12:20:29	12:26:14	F	F	G	G	G	1	7.1	10.9	1.56
04-Jan-11	21865	2	44.8	162	PS	12:15:55	12:21:00	12:23:41	12:26:15	F	F	G	G	G	2	7.1	10.9	1.57
04-Jan-11	21867	2	32.5	145	PS	12:18:13	12:24:04	12:26:13	12:31:02	F	F	G	G	G	1	7.1	10.9	1.56
04-Jan-11	21868	2	50.7	167	PS	12:20:49	12:26:38	12:29:07	12:36:06	F	F	G	G	G	0	7.1	10.9	1.56
04-Jan-11	21869	2	52.1	167	PS	12:24:02	12:29:31	12:31:31	12:39:00	F	F	G	G	G	1	7.4	10.5	1.56
13-Jan-11	39242	2	33.8	152	BN	9:17:18	9:20:50	9:24:06	9:30:04	F	F	G	G	G	1	8.3	9.65	1.56
13-Jan-11	39243	2	36.6	162	BN	9:20:47	9:26:47	9:29:28	9:34:56	F	F	G	G	G	1	8.3	9.65	1.55

Date Tagged	TagID	Days Starved	Weight	Length	Surgeon Name	In Drugs	Out Drugs	Out surgery	Recovered	Scales	Fins	Eyes	Incision	Suturing	Bleeding	Bath_Temp	Bath_DO	Tag_Weight
13-Jan-11	39244	2	37.7	156	BN	9:24:40	9:30:00	9:32:34	9:39:22	F	F	G	G	G	2	8.3	9.65	1.59
13-Jan-11	39245	2	33.6	147	BN	9:30:25	9:36:56	9:39:46	9:42:40	F	F	G	G	G	1	8.3	9.65	1.57
13-Jan-11	39246	2	50.9	168	BN	9:33:44	9:39:53	9:42:48	9:48:52	F	F	G	G	G	1	8.3	9.65	1.59
13-Jan-11	39247	2	38.1	154	BN	9:38:35	9:43:10	9:45:42	9:56:07	F	F	G	G	G	1	8.3	9.65	1.58
13-Jan-11	39248	2	52	170	BN	9:48:42	9:51:38	9:54:29	9:57:48	F	F	G	G	G	1	8.3	9.65	1.56
13-Jan-11	39249	2	32.5	156	BN	9:49:05	9:55:09	9:58:46	10:07:35	F	F	G	G	G	1	8.3	9.65	1.54
13-Jan-11	39250	2	51.4	167	BN	9:53:44	9:58:59	10:02:07	10:06:15	F	F	G	G	G	1	8.3	9.65	1.55
13-Jan-11	39251	2	42.5	157	BN	9:59:19	10:05:58	10:08:54	10:15:57	F	F	G	G	G	1	8.3	9.65	1.58
13-Jan-11	39252	2	43.5	163	BN	10:03:13	10:10:05	10:13:09	10:21:12	F	F	G	G	G	1	8.3	9.65	1.57
13-Jan-11	39253	2	40.8	158	BN	10:06:18	10:13:20	10:15:43	10:21:51	F	F	G	G	G	1	8.3	9.65	1.56
13-Jan-11	39254	2	48.8	167	BN	10:13:35	10:20:50	10:23:53	10:32:06	F	F	G	G	G	1	8.3	9.65	1.58
13-Jan-11	39255	2	46	160	BN	10:16:57	10:24:39	10:27:30	10:33:36	F	F	G	G	G	1	8.3	9.65	1.56
13-Jan-11	39256	2	45.7	163	BN	10:21:41	10:27:43	10:30:53	10:35:26	F	F	G	G	G	1	8.3	9.65	1.55
13-Jan-11	39257	2	39.3	153	BN	11:01:13	11:05:00	11:07:36	11:09:32	F	F	G	G	G	1	8.3	9.65	1.57
13-Jan-11	39258	2	47.5	165	BN	11:03:11	11:07:44	11:10:13	11:16:17	F	F	G	G	G	1	8.3	9.65	1.56
13-Jan-11	39259	2	31.6	142	BN	11:07:30	11:10:17	11:13:01	11:20:53	F	F	G	G	G	1	8.3	9.65	1.55
13-Jan-11	39260	2	53.3	172	BN	11:11:26	11:18:17	11:20:41	11:25:23	F	F	G	G	G	1	8.3	9.65	1.55
13-Jan-11	39261	2	40.4	158	BN	11:16:44	11:20:49	11:23:35	11:29:02	F	F	G	G	G	1	8.6	9.7	1.57
13-Jan-11	39262	2	50.6	170	BN	11:19:18	11:25:24	11:27:56	11:34:58	F	F	G	G	G	1	8.6	9.7	1.58
13-Jan-11	39263	2	41.7	158	BN	11:25:54	11:31:05	11:33:57	11:37:58	F	F	G	G	G	1	8.6	9.7	1.56
13-Jan-11	39264	2	48.8	161	BN	11:28:31	11:34:05	11:37:01	11:44:32	F	F	G	G	G	1	8.6	9.7	1.54
13-Jan-11	39265	2	42.3	162	BN	11:33:02	11:37:05	11:40:05	11:44:49	F	F	G	G	G	2	8.6	9.7	1.56
13-Jan-11	39266	2	51.2	170	BN	11:38:21	11:43:14	11:46:18	11:54:24	F	F	G	G	G	1	8.6	9.7	1.55
13-Jan-11	39267	2	37.6	153	BN	11:40:58	11:46:35	11:49:26	11:57:55	F	F	G	G	G	1	8.8	9.6	1.56
13-Jan-11	39268	2	37.5	152	BN	11:51:20	11:54:27	11:56:58	12:02:22	F	F	G	G	G	1	8.8	9.6	1.56
13-Jan-11	39269	2	52.2	168	BN	11:55:44	12:00:50	12:03:47	12:07:37	F	F	G	G	G	1	8.8	9.6	1.56

Date Tagged	TagID	Days Starved	Weight	Length	Surgeon Name	In Drugs	Out Drugs	Out surgery	Recovered	Scales	Fins	Eyes	Incision	Suturing	Bleeding	Bath_Temp	Bath_DO	Tag_Weight
13-Jan-11	39270	2	36.3	152	BN	11:58:24	12:04:03	12:06:53	12:16:43	F	F	G	G	G	1	8.8	9.6	1.58
13-Jan-11	39271	2	37.8	155	BN	12:01:32	12:07:09	12:10:44	12:16:14	F	F	G	G	G	1	8.8	9.6	1.57
13-Jan-11	39272	2	31.9	143	KN	13:30:57	13:37:02	13:42:53	13:46:19	F	F	G	G	G	2	8.8	9.6	1.58
13-Jan-11	39273	2	41.2	154	KN	13:35:58	13:43:10	13:46:14	13:47:33	F	F	G	G	G	1	8.8	9.6	1.57
13-Jan-11	39275	2	42.5	157	KN	13:46:42	13:50:57	13:55:30	13:59:32	F	F	G	G	G	1	8.8	9.6	1.56
13-Jan-11	39276	2	43.8	158	KN	13:58:51	14:01:43	14:04:49	14:12:30	F	F	G	G	G	1	8.8	9.6	1.56
13-Jan-11	39277	2	35.9	147	KN	14:02:30	14:05:03	14:07:52	14:14:01	F	F	G	G	G	1	8.8	9.6	1.59
13-Jan-11	39278	2	45.5	160	KN	14:07:15	14:12:05	14:15:41	14:20:41	F	F	G	G	G	1	8.8	9.65	1.56
13-Jan-11	39279	2	48.6	165	KN	14:17:27	14:19:40	14:22:06	14:24:40	F	F	G	G	G	2	8.8	9.65	1.59
13-Jan-11	39280	2	44	160	KN	14:19:08	14:22:30	14:25:02	14:31:17	F	F	G	G	G	1	8.8	9.65	1.55
13-Jan-11	39281	2	42.3	156	KN	14:25:14	14:30:26	14:32:57	14:36:52	F	F	G	G	G	1	8.8	9.65	1.58
13-Jan-11	39282	2	48.8	163	KN	14:28:21	14:33:15	14:35:49	14:44:55	F	F	G	G	G	1	8.8	9.65	1.57
13-Jan-11	39283	2	40	155	KN	14:31:14	14:36:24	14:40:22	14:46:48	F	F	G	G	G	1	8.9	9.57	1.56
13-Jan-11	39284	2	42.3	156	KN	14:38:28	14:45:09	14:47:42	15:02:27	F	F	G	G	G	1	8.9	9.57	1.57
13-Jan-11	39285	2	37.2	155	KN	14:41:45	14:47:57	14:51:37	14:57:40	F	F	G	G	G	1	8.9	9.57	1.54
13-Jan-11	39286	2	50.6	168	KN	14:46:23	14:52:23	14:54:56	15:08:35	F	F	G	G	G	1	8.9	9.57	1.56
13-Jan-11	39287	2	33.3	145	KN	15:13:24	15:18:03	15:20:42	15:26:44	F	F	G	G	G	1	8.9	9.57	1.57
13-Jan-11	39288	2	35.9	150	KN	15:16:40	15:21:25	15:24:18	15:37:50	F	F	G	G	G	1	8.9	9.57	1.55
13-Jan-11	39289	2	33.3	147	KN	15:18:19	15:24:40	15:28:26	15:34:49	F	F	G	G	G	1	8.9	9.57	1.58
13-Jan-11	39290	2	49.8	167	KN	15:26:35	15:32:58	15:35:50	15:44:37	F	F	G	G	G	1	8.9	9.57	1.58
13-Jan-11	39291	2	45	159	KN	15:33:11	15:36:06	15:39:25	15:46:47	F	F	G	G	G	1	8.7	9.83	1.55
13-Jan-11	39292	2	49.6	161	KN	15:36:19	15:39:38	15:43:12	15:47:51	F	F	G	G	G	1	8.7	9.83	1.53
13-Jan-11	39293	2	51	169	KN	15:41:22	15:46:44	15:49:13	15:57:14	F	F	G	G	G	1	8.8	9.5	1.55
13-Jan-11	39294	2	53.3	168	KN	15:45:19	15:49:44	15:52:51	15:58:59	F	F	G	G	G	1	8.8	9.5	1.55
13-Jan-11	39295	2	45.5	163	KN	15:48:50	15:53:16	15:55:19	16:03:30	F	F	G	G	G	1	8.9	9.5	1.53
13-Jan-11	39296	2	48.2	166	KN	15:54:58	16:00:46	16:04:14	16:10:46	F	F	G	G	G	1	8.9	9.5	1.56

Date Tagged	TagID	Days Starved	Weight	Length	Surgeon Name	In Drugs	Out Drugs	Out surgery	Recovered	Scales	Fins	Eyes	Incision	Suturing	Bleeding	Bath_Temp	Bath_DO	Tag_Weight
13-Jan-11	39297	2	44.2	162	KN	15:58:19	16:04:44	16:07:43	16:14:39	F	F	G	G	G	1	8.9	9.5	1.57
13-Jan-11	39298	2	41.7	159	KN	16:01:56	16:08:09	16:10:44	16:15:16	F	F	G	G	G	1	9	9.58	1.57
13-Jan-11	39299	2	39.9	155	KN	16:10:39	16:15:36	16:18:13	16:27:02	F	F	G	G	G	2	9	9.58	1.58
13-Jan-11	39300	2	36.2	150	KN	16:13:31	16:18:28	16:20:54	16:26:59	F	F	G	G	G	1	9	9.58	1.58
13-Jan-11	39301	2	40.4	158	KN	16:15:20	16:21:17	16:24:23	16:29:58	F	F	G	G	G	1	9	9.58	1.55
04-Jan-11	39380	2	39.9	146	GS	13:00:37	13:04:35	13:07:26	13:13:16	F	F	G	F	G	1	7.4	10.5	1.55
04-Jan-11	39381	2	42.5	157	GS	13:04:32	13:09:46	13:13:14	13:16:20	F	F	G	G	G	1	7	11.2	1.58
04-Jan-11	39382	2	39.5	154	GS	13:09:42	13:14:04	13:17:08	13:19:12	F	F	G	G	G	2	7	11.2	1.59
04-Jan-11	39383	2	49	167	GS	13:14:02	13:17:41	13:21:17	13:26:01	F	F	G	G	G	1	7	11.2	1.59
04-Jan-11	39384	2	40.4	155	GS	13:17:38	13:23:12	13:26:03	13:27:54	F	F	G	G	G	1	7	11.2	1.58
04-Jan-11	39385	2	48.7	167	GS	13:23:09	13:27:12	13:30:15	13:36:42	F	F	G	G	G	1	7	11.2	1.62
04-Jan-11	39386	2	44.6	163	GS	13:26:35	13:31:47	13:34:18	13:42:08	F	F	G	G	G	2	7	11.2	1.57
04-Jan-11	39388	2	46.8	161	GS	13:31:02	13:35:01	13:37:34	13:42:32	F	F	G	G	G	1	7	11.2	1.56
04-Jan-11	39389	2	39.7	160	GS	13:34:50	13:38:07	13:40:48	13:42:20	F	F	G	G	G	1	7	11.2	1.55
04-Jan-11	39391	2	43.2	158	GS	13:38:01	13:41:16	13:44:00	13:55:11	F	F	G	F	G	1	7	11.2	1.56
04-Jan-11	39392	2	43	157	GS	13:44:34	13:49:11	13:51:36	13:57:17	F	F	G	G	G	1	7	11.2	1.6
04-Jan-11	39393	2	29.9	143	GS	13:49:08	13:52:01	13:55:02	14:02:08	F	F	G	G	F	1	7	11.2	1.62
04-Jan-11	39394	2	47	163	GS	13:51:56	13:55:32	13:58:01	14:02:43	F	F	G	G	G	1	7	11.2	1.58
04-Jan-11	39395	2	57.5	173	GS	13:55:21	14:01:28	14:03:01	14:09:29	P	F	G	G	G	1	7	11.2	1.58
04-Jan-11	39396	2	57.1	173	GS	13:58:21	14:03:17	14:05:49	14:11:43	F	F	G	G	G	2	7	11.2	1.6
04-Jan-11	39397	2	28.9	141	GS	14:08:35	14:10:15	14:13:39	14:17:10	P	F	G	G	G	1	7	11.2	1.59
04-Jan-11	39398	2	36.5	148	GS	14:10:10	14:14:06	14:17:06	14:17:57	F	F	G	G	G	1	7	11.2	1.6
04-Jan-11	39399	2	38	150	GS	14:14:00	14:17:30	14:20:22	14:22:41	F	F	G	G	G	1	7	11.2	1.58
04-Jan-11	39400	2	37.6	154	GS	14:17:22	14:21:30	14:24:15	14:26:45	F	F	G	G	G	0	7	11.2	1.58
04-Jan-11	39401	2	45.7	163	GS	14:21:22	14:24:47	14:27:58	14:31:04	F	F	G	G	G	2	8.9	11.2	1.59
04-Jan-11	39402	2	36.3	153	GS	14:24:44	14:28:15	14:30:37	14:37:33	F	F	G	G	G	1	8.9	11.2	1.58

Date Tagged	TagID	Days Starved	Weight	Length	Surgeon Name	In Drugs	Out Drugs	Out surgery	Recovered	Scales	Fins	Eyes	Incision	Suturing	Bleeding	Bath_Temp	Bath_DO	Tag_Weight
04-Jan-11	39404	2	33.4	147	GS	14:34:07	14:36:46	14:39:28	14:46:00	F	F	G	G	G	1	8.9	11.2	1.56
04-Jan-11	39405	2	50.8	166	GS	14:36:28	14:39:58	14:42:27	14:48:10	F	F	G	G	G	1	8.9	11.2	1.56
04-Jan-11	39406	2	49.5	165	GS	14:39:53	14:42:46	14:45:37	14:50:17	F	F	G	G	G	1	8.9	11.2	1.56
04-Jan-11	39407	2	41.4	152	GS	14:42:37	14:46:11	14:49:29	14:50:22	F	F	G	G	G	1	8.9	11.2	1.58
04-Jan-11	39408	2	37	150	GS	14:45:52	14:48:45	14:51:27	14:55:19	F	F	G	G	G	1	8.9	11.2	1.59
04-Jan-11	39409	2	41.9	157	GS	14:48:43	14:51:57	14:54:09	14:59:54	F	F	G	G	G	1	8.9	11.2	1.58
04-Jan-11	39410	2	50.5	166	GS	14:52:00	14:54:43	14:57:27	15:03:50	F	F	G	G	G	2	8.9	11.2	1.6
04-Jan-11	39411	2	43.1	158	GS	14:54:37	14:59:14	15:01:44	15:07:01	F	F	G	G	G	1	8	11.4	1.57
04-Jan-11	39412	2	44.4	160	GS	14:59:12	15:04:50	15:07:22	15:13:42	F	F	G	G	G	0	8	11.4	1.6
04-Jan-11	39413	2	49.7	164	CM	10:51:48	10:55:43	10:58:20	11:02:41	F	F	G	G	G	1	6.8	10.9	1.55
04-Jan-11	39414	2	37.9	153	CM	10:58:40	11:02:09	11:04:47	11:08:53	G	F	G	G	G	1	6.8	10.9	1.58
04-Jan-11	39415	2	42.6	158	CM	11:01:22	11:05:46	11:07:52	11:09:50	F	F	G	G	G	1	6.8	10.9	1.59
04-Jan-11	39416	2	38.3	150	CM	11:05:44	11:08:29	11:10:53	11:17:18	F	F	G	G	G	2	6.8	10.9	1.58
04-Jan-11	39417	2	49.5	163	CM	11:08:27	11:11:41	11:13:48	11:20:04	F	F	G	G	G	1	6.8	10.9	1.55
04-Jan-11	39418	2	39.2	152	CM	11:10:24	11:14:37	11:16:57	11:23:31	G	F	G	G	G	1	6.8	10.9	1.58
04-Jan-11	39419	2	57.2	169	CM	11:12:01	11:18:21	11:20:33	11:26:45	F	F	G	G	G	1	6.8	10.9	1.59
04-Jan-11	39420	2	37.7	149	CM	11:15:36	11:21:33	11:23:40	11:29:05	F	F	G	G	G	1	6.8	10.9	1.58
04-Jan-11	39421	2	45.1	158	CM	11:18:10	11:24:58	11:27:19	11:33:00	F	F	G	G	G	1	6.8	10.9	1.58
04-Jan-11	39423	2	59.9	172	CM	11:21:32	11:28:15	11:30:50	11:35:09	F	F	G	G	F	1	6.8	10.9	1.58
04-Jan-11	39424	2	48.8	167	CM	11:24:55	11:31:49	11:34:28	11:41:00	F	F	G	G	G	1	6.8	10.9	1.57
04-Jan-11	39425	2	39.8	151	CM	11:28:14	11:35:14	11:38:00	11:43:00	F	F	G	G	G	2	6.8	10.9	1.54
04-Jan-11	39428	2	49.7	168	CM	11:31:44	11:42:00	11:45:00	11:49:00	F	F	G	G	G	0	6.8	10.9	1.57
04-Jan-11	39429	2	42.8	155	CM	11:35:12	11:46:00	11:48:00	11:51:00	F	F	G	G	G	0	7.1	10.9	1.59
04-Jan-11	39430	2	41.5	155	CM	12:04:25	12:09:00	12:11:10	12:18:05	G	F	G	G	G	1	7.1	10.9	1.57
04-Jan-11	39431	2	52.2	166	CM	12:04:42	12:11:45	12:14:13	12:18:25	F	F	G	G	G	1	7.1	10.9	1.56
04-Jan-11	39432	2	42.8	159	CM	12:19:57	12:25:39	12:27:45	12:31:02	F	F	G	G	G	1	7.1	10.9	1.59

Date Tagged	TagID	Days Starved	Weight	Length	Surgeon Name	In Drugs	Out Drugs	Out surgery	Recovered	Scales	Fins	Eyes	Incision	Suturing	Bleeding	Bath_Temp	Bath_DO	Tag_Weight
04-Jan-11	39434	2	40	150	CM	12:23:21	12:28:48	12:30:48	12:36:02	F	F	G	G	G	0	7.1	10.9	1.57
04-Jan-11	39435	2	42.8	157	CM	12:25:33	12:31:30	12:33:19	12:36:47	F	F	G	G	G	1	7.4	10.5	1.64
04-Jan-11	39436	2	40.6	156	CM	12:29:09	12:34:00	12:35:52	12:39:13	F	F	G	G	G	1	7.4	10.5	1.62
04-Jan-11	39437	2	38.5	154	CM	12:31:27	12:36:24	12:38:31	12:43:56	F	F	G	G	F	1	7.4	10.5	1.57
04-Jan-11	39438	2	34.4	148	CM	12:33:57	12:39:09	12:40:55	12:47:02	F	F	G	G	G	1	7.4	10.5	1.57
04-Jan-11	39439	2	46.5	164	CM	12:36:21	12:41:36	12:43:13	12:48:57	F	F	G	G	G	1	7.4	10.5	1.59
04-Jan-11	39440	2	52.6	168	CM	12:41:35	12:46:22	12:49:31	12:52:56	G	F	G	G	G	1	7.4	10.5	1.57
04-Jan-11	39441	2	46.3	163	CM	12:44:18	12:50:35	12:52:44	12:55:13	F	F	G	G	G	1	7.4	10.5	1.53
04-Jan-11	39442	2	38.8	153	CM	12:46:19	12:53:25	12:55:35	13:00:04	F	F	G	G	G	1	7.4	10.5	1.55
04-Jan-11	39443	2	51.9	167	CM	12:50:30	12:56:26	12:58:56	13:05:09	F	F	G	G	G	1	7.4	10.5	1.56
04-Jan-11	39444	2	37.5	152	CM	12:53:21	12:59:43	13:02:25	13:06:24	F	F	G	G	G	2	7.4	10.5	1.6
04-Jan-11	39445	2	45	158	CM	12:56:25	13:03:00	13:05:31	13:09:24	F	F	G	G	G	1	7.4	10.5	1.61
04-Jan-11	39446	2	45.4	159	CM	12:59:40	13:05:57	13:07:52	13:11:08	G	F	G	G	G	1	7.9	10.9	1.58
04-Jan-11	39447	2	40	154	AA	14:09:37	14:14:42	14:17:56	14:25:05	F	F	G	G	G	1	7.9	10.9	1.57
04-Jan-11	39448	2	35.9	149	AA	14:18:51	14:22:00	14:24:54	14:30:23	F	F	G	G	G	1	7.9	10.9	1.57
04-Jan-11	39449	2	40.5	151	AA	14:19:41	14:25:53	14:28:37	14:35:08	F	F	G	G	G	1	7.8	11.4	1.61
04-Jan-11	39450	2	45.8	160	AA	14:28:58	14:34:26	14:36:53	14:40:42	F	F	G	G	G	1	7.8	11.4	1.58
04-Jan-11	39451	2	37	147	AA	14:31:29	14:37:18	14:40:26	14:45:16	F	F	G	G	G	0	7.8	11.4	1.54
04-Jan-11	39452	2	46.5	163	AA	14:34:20	14:41:00	14:43:33	14:48:58	F	F	G	G	G	1	7.8	11.4	1.61
04-Jan-11	39453	2	35	148	AA	14:37:14	14:44:14	14:47:03	14:53:35	F	F	G	G	G	2	7.8	11.4	1.56
04-Jan-11	39454	2	41.1	159	AA	14:40:56	14:48:13	14:50:34	14:55:58	F	F	G	G	G	0	7.8	11.4	1.54
04-Jan-11	39455	2	43.9	155	AA	14:44:12	14:51:15	14:53:30	14:57:36	F	F	G	G	G	0	7.8	11.4	1.57
04-Jan-11	39456	2	40.5	152	AA	14:48:10	14:54:11	14:56:14	15:03:38	F	F	G	G	G	1	7.8	11.4	1.57
04-Jan-11	39457	2	43.5	158	AA	14:51:13	14:56:57	14:59:34	15:07:54	F	F	G	G	G	2	7.8	11.4	1.6
04-Jan-11	39458	2	48.4	165	AA	14:54:06	15:00:09	15:02:26	15:08:28	F	F	G	G	G	1	8.7	11.2	1.59
04-Jan-11	39459	2	45.9	164	AA	14:56:55	15:02:52	15:05:11	15:10:19	F	F	G	G	G	1	8.7	11.2	1.61

Date Tagged	TagID	Days Starved	Weight	Length	Surgeon Name	In Drugs	Out Drugs	Out surgery	Recovered	Scales	Fins	Eyes	Incision	Suturing	Bleeding	Bath_Temp	Bath_DO	Tag_Weight
04-Jan-11	39460	2	35.9	149	AA	15:00:01	15:05:56	15:08:21	15:14:26	F	F	G	G	G	2	8.7	11.2	1.61
04-Jan-11	39461	2	44	155	AA	15:05:54	15:10:59	15:13:47	15:20:04	F	F	G	G	G	1	8.7	11.2	1.61
04-Jan-11	39462	2	38.5	153	AA	15:10:55	15:14:47	15:17:50	15:21:47	F	F	G	G	G	1	8.7	11.2	1.58
04-Jan-11	39463	2	35	151	AA	15:14:45	15:18:33	15:21:39	15:28:10	F	F	G	G	G	1	8.7	11.2	1.58
04-Jan-11	39464	2	50.7	165	AA	15:16:29	15:23:30	15:25:51	15:30:20	F	F	G	G	G	0	8.7	11.2	1.58
04-Jan-11	39465	2	41.6	158	AA	15:18:31	15:26:54	15:29:05	15:32:31	P	F	G	G	G	1	8.7	11.2	1.59
04-Jan-11	39466	2	37.4	150	AA	15:23:26	15:29:52	15:32:23	15:40:40	F	F	G	G	G	1	8.7	11.2	1.58
04-Jan-11	39467	2	43.5	155	AA	15:26:52	15:33:02	15:35:06	15:40:51	F	F	G	G	G	2	8.7	11.2	1.58
04-Jan-11	39468	2	37.3	158	AA	15:29:50	15:35:40	15:38:02	15:42:23	F	F	G	G	G	1	8	11.4	1.57
04-Jan-11	39470	2	42.6	158	AA	15:33:00	15:40:34	15:42:44	15:45:42	F	F	G	G	G	1	8	11.4	1.58
04-Jan-11	39472	2	35.5	152	AA	15:35:38	15:43:15	15:46:02	15:50:59	F	F	G	G	G	1	8	11.4	1.58
04-Jan-11	39473	2	40.2	153	AA	15:38:50	15:46:52	15:49:28	15:54:50	F	F	G	G	G	2	8	11.4	1.56
04-Jan-11	39474	2	44	160	AA	15:43:13	15:50:53	15:53:59	16:02:22	F	F	G	G	G	0	8	11.4	1.57
04-Jan-11	39475	2	39.6	154	AA	15:46:51	15:54:26	15:57:35	16:02:43	F	F	G	G	G	2	8	11.4	1.56
04-Jan-11	39476	2	36	151	AA	15:50:51	15:58:34	16:01:00	16:03:36	F	F	G	G	G	2	8.5	11.2	1.56
04-Jan-11	39477	2	44.2	164	AA	15:54:24	16:02:16	16:04:56	16:12:08	F	F	G	G	G	1	8.5	11.2	1.58
04-Jan-11	39478	2	39.9	154	AA	15:58:28	16:05:42	16:08:16	16:13:38	F	F	G	G	G	2	8.5	11.2	1.58
13-Jan-11	39479	2	45.8	163	AA	9:15:35	9:20:09	9:22:45	9:29:46	F	F	G	G	G	1	8.3	9.65	1.56
13-Jan-11	39480	2	46.1	161	AA	9:20:15	9:24:08	9:26:33	9:30:52	F	F	G	G	G	1	8.3	9.65	1.59
13-Jan-11	39481	2	51.4	172	AA	9:24:06	9:27:00	9:29:22	9:37:18	F	F	G	G	G	1	8.3	9.65	1.61
13-Jan-11	39482	2	41.8	160	AA	9:31:00	9:34:17	9:36:36	9:40:02	F	F	G	G	G	1	8.3	9.65	1.58
13-Jan-11	39483	2	47.4	164	AA	9:34:21	9:38:18	9:40:20	9:48:50	F	F	G	G	G	1	8.3	9.65	1.59
13-Jan-11	39485	2	43.9	163	AA	9:38:20	9:42:25	9:44:37	9:52:46	F	F	G	G	G	1	8.3	9.65	1.59
13-Jan-11	39486	2	37.6	152	AA	9:46:32	9:49:05	9:52:19	9:57:38	F	F	G	G	G	2	8.3	9.65	1.6
13-Jan-11	39487	2	52.7	170	AA	9:50:16	9:54:39	9:57:12	10:06:12	F	F	G	G	G	2	8.3	9.65	1.57
13-Jan-11	39488	2	51.8	167	AA	9:54:38	9:58:08	10:00:29	10:06:14	F	F	G	G	G	0	8.3	9.65	1.59

Date Tagged	TagID	Days Starved	Weight	Length	Surgeon Name	In Drugs	Out Drugs	Out surgery	Recovered	Scales	Fins	Eyes	Incision	Suturing	Bleeding	Bath_Temp	Bath_DO	Tag_Weight
13-Jan-11	39489	2	55.8	172	AA	10:01:36	10:05:04	10:07:40	10:15:56	F	F	G	G	G	2	8.3	9.65	1.58
13-Jan-11	39490	2	39	152	AA	10:05:07	10:10:36	10:13:00	10:21:08	F	F	G	G	G	1	8.3	9.65	1.59
13-Jan-11	39491	2	36.9	152	AA	10:10:34	10:13:42	10:16:28	10:22:14	F	F	G	G	G	2	8.5	9.37	1.57
13-Jan-11	39492	2	48.5	161	AA	10:16:59	10:21:49	10:23:56	10:31:39	F	F	G	G	G	2	8.5	9.37	1.58
13-Jan-11	39493	2	48.3	165	AA	10:18:47	10:25:01	10:27:47	10:33:33	F	F	G	G	G	1	8.5	9.37	1.57
13-Jan-11	39494	2	36.4	152	AA	10:21:21	10:28:26	10:30:36	10:35:36	F	F	G	G	G	1	8.6	9.5	1.59
13-Jan-11	39495	2	49.1	162	AA	11:01:34	11:07:55	11:09:56	11:14:25	F	F	G	G	G	1	8.4	9.5	1.56
13-Jan-11	39496	2	37.2	153	AA	11:04:14	11:10:21	11:12:20	11:18:07	F	F	G	G	G	1	8.4	9.5	1.59
13-Jan-11	39497	2	38.1	158	AA	11:07:59	11:13:28	11:15:44	11:20:51	F	F	G	G	G	2	8.4	9.5	1.56
13-Jan-11	39498	2	52.6	170	AA	11:13:34	11:19:16	11:21:21	11:25:26	F	F	G	G	G	2	8.4	9.5	1.57
13-Jan-11	39499	2	53.3	173	AA	11:16:29	11:22:17	11:24:04	11:29:42	F	F	G	G	G	1	8.6	9.7	1.57
13-Jan-11	39500	2	55.2	172	AA	11:19:17	11:25:09	11:27:15	11:34:57	F	F	G	G	G	1	8.6	9.7	1.58
13-Jan-11	39501	2	43.9	160	AA	11:25:11	11:32:23	11:34:47	11:38:39	F	F	G	G	G	1	8.6	9.7	1.57
13-Jan-11	39502	2	55.4	173	AA	11:32:28	11:36:22	11:39:02	11:44:34	F	F	G	G	G	1	8.6	9.7	1.57
13-Jan-11	39503	2	37.5	155	AA	11:39:52	11:45:19	11:47:59	11:53:46	F	F	G	G	G	1	8.6	9.7	1.61
13-Jan-11	39504	2	35.1	152	AA	11:45:14	11:51:41	11:53:53	11:59:49	F	F	G	G	G	1	8.8	9.52	1.58
13-Jan-11	39505	2	46	162	AA	11:48:35	11:54:15	11:56:35	12:05:23	F	F	G	G	G	2	8.8	9.52	1.61
13-Jan-11	39506	2	48.8	165	AA	11:51:27	11:57:12	11:59:28	12:05:55	F	F	G	G	G	1	8.8	9.52	1.59
13-Jan-11	39507	2	49.3	165	AA	11:57:15	12:03:10	12:05:21	12:10:28	F	F	G	G	G	1	8.8	9.52	1.59
13-Jan-11	39508	2	40.9	157	AA	12:00:35	12:06:03	12:08:22	12:14:48	F	F	G	G	G	0	8.8	9.52	1.6
13-Jan-11	39510	2	34.6	150	AA	12:03:09	12:08:59	12:12:09	12:16:35	F	F	G	G	G	0	8.8	9.52	1.6
13-Jan-11	39511	2	52	172	CM	13:29:34	13:36:16	13:38:05	13:41:33	F	F	G	G	G	1	8.5	9.7	1.6
13-Jan-11	39512	2	36.1	149	CM	13:34:15	13:38:38	13:40:48	13:47:37	F	G	G	G	G	1	8.5	9.7	1.59
13-Jan-11	39513	2	46.8	162	CM	13:36:18	13:42:29	13:45:00	13:50:10	F	F	G	G	G	2	8.5	9.7	1.6
13-Jan-11	39515	2	48.1	163	CM	13:42:43	13:49:37	13:51:49	13:54:24	G	F	G	G	G	0	8.5	9.7	1.59
13-Jan-11	39516	2	45.9	161	CM	13:45:27	13:53:51	13:55:53	14:03:36	F	F	G	G	G	1	8.5	9.7	1.57

Date Tagged	TagID	Days Starved	Weight	Length	Surgeon Name	In Drugs	Out Drugs	Out surgery	Recovered	Scales	Fins	Eyes	Incision	Suturing	Bleeding	Bath_Temp	Bath_DO	Tag_Weight
13-Jan-11	39517	2	32	143	CM	13:49:41	13:57:30	14:00:20	14:03:37	F	F	G	G	G	1	8.5	9.7	1.57
13-Jan-11	39518	2	49.4	163	CM	14:05:09	14:10:45	14:12:49	14:19:45	F	F	G	G	G	0	8.7	9.5	1.6
13-Jan-11	39519	2	41.5	163	CM	14:06:01	14:14:49	14:16:57	14:23:13	G	F	G	G	G	1	8.7	9.5	1.58
13-Jan-11	39520	2	40.4	159	CM	14:10:47	14:18:15	14:20:31	14:28:02	F	F	G	G	G	1	8.7	9.5	1.59
13-Jan-11	39521	2	34.6	149	CM	14:18:12	14:25:29	14:27:37	14:33:10	F	F	G	G	G	1	8.9	9.68	1.59
13-Jan-11	39522	2	45.8	162	CM	14:22:00	14:29:56	14:32:09	14:34:37	F	F	G	G	G	1	8.9	9.68	1.59
13-Jan-11	39523	2	46.5	161	CM	14:25:22	14:33:23	14:36:00	14:44:12	F	F	G	G	G	1	8.9	9.68	1.59
13-Jan-11	39524	2	48.6	165	CM	14:33:21	14:42:14	14:45:03	14:52:48	F	F	G	G	G	2	9	9.63	1.59
13-Jan-11	39525	2	54.3	169	CM	14:38:20	14:46:02	14:48:34	14:51:20	F	F	G	G	G	0	9	9.63	1.57
13-Jan-11	39526	2	33.9	150	CM	14:42:12	14:49:05	14:51:24	14:57:02	F	F	G	G	G	2	9	9.63	1.58
13-Jan-11	39527	2	39.4	154	CM	15:10:47	15:16:57	15:19:12	15:24:12	F	F	G	G	G	0	8.5	8.79	1.57
13-Jan-11	39528	2	36.9	150	CM	15:14:12	15:19:51	15:21:54	15:28:56	F	F	G	G	G	1	8.5	8.79	1.58
13-Jan-11	39529	2	44.9	163	CM	15:16:55	15:24:40	15:26:55	15:28:54	F	F	G	G	G	2	8.5	8.79	1.58
13-Jan-11	39530	2	44.9	163	CM	15:24:39	15:32:15	15:34:47	15:40:08	F	F	G	G	G	2	8.5	8.79	1.57
13-Jan-11	39531	2	38.3	152	CM	15:28:40	15:35:47	15:38:00	15:43:44	F	F	G	G	G	0	8.7	9.8	1.58
13-Jan-11	39532	2	52.3	172	CM	15:36:30	15:41:06	15:43:07	15:46:51	F	F	G	G	G	1	8.7	9.8	1.58
13-Jan-11	39533	2	42.9	157	CM	15:41:04	15:47:16	15:49:23	15:56:07	F	F	G	G	G	2	8.7	9.8	1.57
13-Jan-11	39534	2	42.4	162	CM	15:43:40	15:50:06	15:53:11	15:57:15	G	F	G	G	G	1	8.8	9.5	1.57
13-Jan-11	39535	2	33.9	148	CM	15:47:14	15:53:45	15:55:56	16:01:09	F	F	G	G	G	0	8.8	9.5	1.58
13-Jan-11	39536	2	49.4	166	CM	15:53:43	15:59:24	16:01:34	16:06:12	F	F	G	G	G	0	8.8	9.5	1.58
13-Jan-11	39537	2	41.9	159	CM	15:56:37	16:03:20	16:05:40	16:10:46	F	F	G	G	G	1	8.8	9.5	1.6
13-Jan-11	39538	2	38	150	CM	15:59:22	16:06:22	16:08:28	16:14:38	F	F	G	G	G	1	9	9.7	1.58
13-Jan-11	39539	2	39.4	154	CM	16:09:32	16:15:42	16:17:41	16:23:09	F	F	G	G	G	2	9	9.7	1.59
13-Jan-11	39540	2	37.3	152	CM	16:12:49	16:18:15	16:20:24	16:26:54	F	F	G	G	G	1	9	9.7	1.58
13-Jan-11	39541	2	36.6	149	CM	16:15:40	16:21:11	16:23:00	16:29:44	F	F	G	G	G	1	9	9.7	1.57

Appendix F: Individual Smolt Bearing Summary Statistics

Subgroup	T001	T003	T006	T007	T008	T009	T010
Number of Observations	5	6	12	4	4	14	3
Mean Vector (μ)	135.411°	150.182°	135.845°	136.819°	136.594°	136.822°	126.297°
Length of Mean Vector (r)	0.547	0.61	0.541	0.492	0.451	0.694	0.342
Concentration	1.004	1.335	1.158	0.682	0.516	1.894	0
Circular Variance	0.453	0.39	0.459	0.508	0.549	0.306	0.658
Circular Standard Deviation	62.933°	56.979°	63.556°	68.27°	72.265°	49.021°	83.946°
95% Confidence Interval (-/+) for μ	67.642°	99.362°	94.855°	39.855°	20.176°	110.63°	*****
	203.181°	201.002°	176.834°	233.783°	253.013°	163.013°	*****
99% Confidence Interval (-/+) for μ	46.354°	83.398°	81.979°	9.397°	343.607°	102.403°	*****
	224.469°	216.966°	189.71°	264.241°	289.582°	171.241°	*****
Rayleigh Test (Z)	1.496	2.232	3.506	0.967	0.815	6.733	0.351
Rayleigh Test (p)	0.234	0.105	0.026	0.407	0.472	5.37E-04	0.739
Rao's Spacing Test (U)	157.281	179.893	217.228	159.359	128.932	251.011	*****
Rao's Spacing Test (p)	0.50 > p > 0.10	0.10 > p > 0.05	< 0.01	0.50 > p > 0.10	0.50 > p > 0.10	< 0.01	*****
Watson's U^2 Test (Uniform, U^2)	*****	*****	0.332	*****	*****	0.571	*****
Watson's U^2 Test (p)	*****	*****	< 0.005	*****	*****	< 0.005	*****
Kuiper's Test (Uniform, V)	1.591	1.801	2.238	1.576	1.384	2.892	1.342
Kuiper's Test (p)	0.15 > p > 0.10	< 0.05	< 0.01	0.15 > p > 0.10	> 0.15	< 0.01	> 0.15

Subgroup	T011	T012	T014	T015	T017	T018	T019
Number of Observations	8	4	9	3	2	1	6
Mean Vector (μ)	140.978°	120.027°	135.37°	138.764°	80.342°	338.874°	154.773°
Length of Mean Vector (r)	0.722	0.454	0.733	0.334	0.387	1	0.623
Concentration	1.417	0.528	1.544	0	0	*****	1.397
Circular Variance	0.278	0.546	0.267	0.666	0.613	*****	0.377
Circular Standard Deviation	46.268°	71.972°	45.205°	84.805°	78.926°	*****	55.782°
95% Confidence Interval (-/+) for μ	101.715°	5.321°	100.168°	*****	*****	*****	105.6°
	180.241°	234.733°	170.572°	*****	*****	*****	203.946°
99% Confidence Interval (-/+) for μ	89.381°	329.29°	89.11°	*****	*****	*****	90.154°
	192.575°	270.764°	181.629°	*****	*****	*****	219.392°
Rayleigh Test (Z)	4.168	0.826	4.83	0.335	0.3	1	2.325
Rayleigh Test (p)	0.011	0.468	0.005	0.749	0.79	0.512	0.094
Rao's Spacing Test (U)	222.842	127.938	215.257	*****	*****	*****	187.662
Rao's Spacing Test (p)	< 0.01	0.50 > p > 0.10	< 0.01	*****	*****	*****	< 0.05
Watson's U^2 Test (Uniform, U^2)	*****	*****	*****	*****	*****	*****	*****
Watson's U^2 Test (p)	*****	*****	*****	*****	*****	*****	*****
Kuiper's Test (Uniform, V)	2.283	1.377	2.294	1.304	1.09	1.395	1.859
Kuiper's Test (p)	< 0.01	> 0.15	< 0.01	> 0.15	> 0.15	> 0.15	< 0.05

Subgroup	T020	T021	T022	T023	T024	T025	T026
Number of Observations	6	8	10	29	5	52	16
Mean Vector (μ)	146.114°	148.839°	122.484°	136.064°	140.553°	135.543°	139.483°
Length of Mean Vector (r)	0.643	0.687	0.653	0.48	0.599	0.691	0.824
Concentration	1.502	1.797	1.632	1.093	1.238	1.95	3.183
Circular Variance	0.357	0.313	0.347	0.52	0.401	0.309	0.176
Circular Standard Deviation	53.848°	49.686°	52.902°	69.39°	58.024°	49.303°	35.692°
95% Confidence Interval (-/+) for μ	99.451°	113.084°	88.076°	107.272°	82.219°	122.118°	122.141°
	192.777°	184.594°	156.892°	164.856°	198.888°	148.967°	156.826°
99% Confidence Interval (-/+) for μ	84.794°	101.853°	77.268°	98.228°	63.895°	117.902°	116.693°
	207.435°	195.825°	167.7°	173.9°	217.212°	153.184°	162.274°
Rayleigh Test (Z)	2.481	3.771	4.263	6.69	1.793	24.799	10.854
Rayleigh Test (p)	0.079	0.018	0.01	9.12E-04	0.17	1.70E-11	1.58E-06
Rao's Spacing Test (U)	197.07	197.779	234.062	149.138	204.162	221.988	234.324
Rao's Spacing Test (p)	< 0.05	< 0.05	< 0.01	0.50 > p > 0.10	< 0.05	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	*****	*****	0.343	0.418	*****	1.636	0.767
Watson's U^2 Test (p)	*****	*****	< 0.005	< 0.005	*****	< 0.005	< 0.005
Kuiper's Test (Uniform, V)	1.93	2.069	2.212	2.42	1.917	4.223	3.007
Kuiper's Test (p)	< 0.025	< 0.01	< 0.01	< 0.01	< 0.025	< 0.01	< 0.01

Subgroup	T027	T028	T029	T032	T035	T036	T037
Number of Observations	5	10	11	7	8	13	5
Mean Vector (μ)	130.072°	135.878°	134.647°	122.134°	134.916°	137.025°	135.46°
Length of Mean Vector (r)	0.486	0.764	0.7	0.704	0.647	0.832	0.187
Concentration	0.747	1.793	1.495	1.255	1.57	2.592	0
Circular Variance	0.514	0.236	0.3	0.296	0.353	0.168	0.813
Circular Standard Deviation	68.876°	42.036°	48.398°	47.98°	53.495°	34.757°	104.876°
95% Confidence Interval (-/+) for μ	46.658°	105.532°	101.537°	76.968°	95.51°	115.811°	*****
	213.486°	166.223°	167.758°	167.301°	174.323°	158.239°	*****
99% Confidence Interval (-/+) for μ	20.456°	96°	91.137°	62.78°	83.131°	109.147°	*****
	239.688°	175.756°	178.158°	181.488°	186.701°	164.903°	*****
Rayleigh Test (Z)	1.179	5.838	5.389	3.472	3.346	8.998	0.175
Rayleigh Test (p)	0.325	0.001	0.003	0.025	0.03	9.75E-06	0.853
Rao's Spacing Test (U)	131.394	224.93	226.764	228.715	178.714	269.558	157.85
Rao's Spacing Test (p)	0.50 > p > 0.10	< 0.01	< 0.01	< 0.01	< 0.05	< 0.01	0.50 > p > 0.10
Watson's U^2 Test (Uniform, U^2)	*****	0.46	0.43	*****	*****	0.727	*****
Watson's U^2 Test (p)	*****	< 0.005	< 0.005	*****	*****	< 0.005	*****
Kuiper's Test (Uniform, V)	1.412	2.459	2.555	2.25	1.907	3.16	1.266
Kuiper's Test (p)	> 0.15	< 0.01	< 0.01	< 0.01	< 0.025	< 0.01	> 0.15

Subgroup	T038	T040	T041	T042	T043	T045	T046
Number of Observations	8	4	4	7	4	1	4
Mean Vector (μ)	130.015°	122.74°	139.516°	133.6°	72.269°	87.182°	133.481°
Length of Mean Vector (r)	0.745	0.514	0.498	0.427	0.022	1	0.49
Concentration	1.531	0.776	0.71	0.641	0	*****	0.676
Circular Variance	0.255	0.486	0.502	0.573	0.978	*****	0.51
Circular Standard Deviation	43.968°	66.083°	67.627°	74.734°	158.393°	*****	68.414°
95% Confidence Interval (-/+) for μ	92.833°	33.815°	45.066°	52.488°	*****	*****	35.938°
	167.198°	211.665°	233.966°	214.712°	*****	*****	231.024°
99% Confidence Interval (-/+) for μ	81.153°	5.882°	15.397°	27.009°	*****	*****	5.298°
	178.878°	239.598°	263.635°	240.191°	*****	*****	261.665°
Rayleigh Test (Z)	4.44	1.058	0.993	1.277	0.002	1	0.961
Rayleigh Test (p)	0.007	0.372	0.397	0.289	0.998	0.512	0.409
Rao's Spacing Test (U)	248.958	150.243	168.072	221.061	136.198	*****	155.739
Rao's Spacing Test (p)	< 0.01	0.50 > p > 0.10	0.10 > p > 0.05	< 0.01	0.50 > p > 0.10	*****	0.50 > p > 0.10
Watson's U^2 Test (Uniform, U^2)	*****	*****	*****	*****	*****	*****	*****
Watson's U^2 Test (p)	*****	*****	*****	*****	*****	*****	*****
Kuiper's Test (Uniform, V)	2.505	1.518	1.631	1.913	1.028	1.395	1.553
Kuiper's Test (p)	< 0.01	> 0.15	0.10 > p > 0.05	< 0.025	> 0.15	> 0.15	0.15 > p > 0.10

Subgroup	T047	T048	T049	T050	T051	T052	T053
Number of Observations	1	3	8	11	54	2	1
Mean Vector (μ)	317.63°	140.146°	126.14°	138.495°	302.333°	137.178°	315.698°
Length of Mean Vector (r)	1	0.333	0.726	0.621	0.289	0.994	1
Concentration	*****	0	1.436	1.486	0.603	8.184	*****
Circular Variance	*****	0.667	0.274	0.379	0.711	0.006	*****
Circular Standard Deviation	*****	84.924°	45.877°	55.897°	90.297°	6.353°	*****
95% Confidence Interval (-/+) for μ	*****	*****	87.236°	103.245°	265.722°	109.329°	*****
	*****	*****	165.044°	173.746°	338.944°	165.027°	*****
99% Confidence Interval (-/+) for μ	*****	*****	75.016°	92.172°	254.222°	100.581°	*****
	*****	*****	177.264°	184.819°	350.444°	173.775°	*****
Rayleigh Test (Z)	1	0.333	4.214	4.247	4.505	1.976	1
Rayleigh Test (p)	0.512	0.751	0.01	0.011	0.011	0.142	0.512
Rao's Spacing Test (U)	*****	*****	225.995	241.7	169.932	*****	*****
Rao's Spacing Test (p)	*****	*****	< 0.01	< 0.01	< 0.01	*****	*****
Watson's U^2 Test (Uniform, U^2)	*****	*****	*****	0.407	0.388	*****	*****
Watson's U^2 Test (p)	*****	*****	*****	< 0.005	< 0.005	*****	*****
Kuiper's Test (Uniform, V)	1.395	1.332	2.31	2.51	2.665	1.678	1.395
Kuiper's Test (p)	> 0.15	> 0.15	< 0.01	< 0.01	< 0.01	0.10 > p > 0.05	> 0.15

Subgroup	T054	T055	T056	T057	T058	T059	T060
Number of Observations	6	3	5	3	7	6	7
Mean Vector (μ)	136.644°	119.186°	141.972°	149.873°	121.674°	170.717°	132.815°
Length of Mean Vector (r)	0.662	0.33	0.595	0.325	0.617	0.495	0.713
Concentration	1.608	0	1.219	0	1.399	0.844	1.289
Circular Variance	0.338	0.67	0.405	0.675	0.383	0.505	0.287
Circular Standard Deviation	52.022°	85.367°	58.397°	85.859°	56.311°	67.9°	47.144°
95% Confidence Interval (-/+) for μ	92.199°	*****	82.995°	*****	75.983°	99.828°	88.521°
	181.089°	*****	200.949°	*****	167.364°	241.606°	177.11°
99% Confidence Interval (-/+) for μ	78.238°	*****	64.469°	*****	61.63°	77.56°	74.607°
	195.05°	*****	219.475°	*****	181.717°	263.874°	191.023°
Rayleigh Test (Z)	2.631	0.326	1.769	0.318	2.664	1.473	3.557
Rayleigh Test (p)	0.066	0.756	0.175	0.761	0.065	0.238	0.022
Rao's Spacing Test (U)	223.282	*****	198.419	*****	176.76	149.643	248.408
Rao's Spacing Test (p)	< 0.01	*****	< 0.05	*****	0.10 > p > 0.05	0.50 > p > 0.10	< 0.01
Watson's U^2 Test (Uniform, U^2)	*****	*****	*****	*****	*****	*****	*****
Watson's U^2 Test (p)	*****	*****	*****	*****	*****	*****	*****
Kuiper's Test (Uniform, V)	2.127	1.251	1.877	1.236	1.833	1.574	2.408
Kuiper's Test (p)	< 0.01	> 0.15	< 0.025	> 0.15	< 0.05	0.15 > p > 0.10	< 0.01

Subgroup	T062	T063	T064	T065	T066	T067	T068
Number of Observations	3	12	7	11	9	6	6
Mean Vector (μ)	143.73°	137.674°	135.414°	136.392°	132.147°	120.998°	154.864°
Length of Mean Vector (r)	0.331	0.808	0.709	0.795	0.723	0.627	0.707
Concentration	0	2.263	1.273	2.091	1.498	1.419	1.154
Circular Variance	0.669	0.192	0.291	0.205	0.277	0.373	0.293
Circular Standard Deviation	85.188°	37.448°	47.532°	38.776°	46.121°	55.361°	47.719°
95% Confidence Interval (-/+) for μ	*****	113.691°	90.717°	110.131°	96.176°	72.386°	104.099°
	*****	161.657°	180.112°	162.652°	168.118°	169.61°	205.629°
99% Confidence Interval (-/+) for μ	*****	106.157°	76.677°	101.882°	84.877°	57.116°	88.152°
	*****	169.19°	194.152°	170.901°	179.417°	184.88°	221.575°
Rayleigh Test (Z)	0.329	7.828	3.517	6.958	4.708	2.359	2.998
Rayleigh Test (p)	0.754	7.01E-05	0.023	2.52E-04	0.006	0.091	0.043
Rao's Spacing Test (U)	*****	242.275	236.959	247.625	221.438	174.088	206.136
Rao's Spacing Test (p)	*****	< 0.01	< 0.01	< 0.01	< 0.01	0.10 > p > 0.05	< 0.05
Watson's U^2 Test (Uniform, U^2)	*****	0.617	*****	0.556	*****	*****	*****
Watson's U^2 Test (p)	*****	< 0.005	*****	< 0.005	*****	*****	*****
Kuiper's Test (Uniform, V)	1.266	2.79	2.316	2.76	2.349	1.757	1.998
Kuiper's Test (p)	> 0.15	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05	< 0.025

Subgroup	T069	T070	T071	T072	T073	T074	T075
Number of Observations	4	14	1	4	16	7	5
Mean Vector (μ)	127.376°	141.822°	318.032°	125.363°	130.923°	121.982°	131.432°
Length of Mean Vector (r)	0.499	0.648	1	0.469	0.651	0.303	0.598
Concentration	0.711	1.638	*****	0.588	1.739	0.185	1.236
Circular Variance	0.501	0.352	*****	0.531	0.349	0.697	0.402
Circular Standard Deviation	67.587°	53.394°	*****	70.519°	53.042°	88.598°	58.06°
95% Confidence Interval (-/+) for μ	33.078°	112.681°	*****	18.391°	104.543°	302.453°	73.037°
	221.675°	170.964°	*****	232.336°	157.302°	301.511°	189.828°
99% Confidence Interval (-/+) for μ	3.457°	103.527°	*****	344.789°	96.257°	246.059°	54.694°
	251.296°	180.118°	*****	265.938°	165.589°	357.905°	208.171°
Rayleigh Test (Z)	0.995	5.874	1	0.879	6.791	0.641	1.791
Rayleigh Test (p)	0.396	0.002	0.512	0.444	5.72E-04	0.544	0.171
Rao's Spacing Test (U)	169.903	223.178	*****	135.52	225.183	140.799	205.623
Rao's Spacing Test (p)	0.10 > p > 0.05	< 0.01	*****	0.50 > p > 0.10	< 0.01	0.50 > p > 0.10	< 0.05
Watson's U^2 Test (Uniform, U^2)	*****	0.494	*****	*****	0.491	*****	*****
Watson's U^2 Test (p)	*****	< 0.005	*****	*****	< 0.005	*****	*****
Kuiper's Test (Uniform, V)	1.642	2.699	1.395	1.425	2.662	1.544	1.927
Kuiper's Test (p)	0.10 > p > 0.05	< 0.01	> 0.15	> 0.15	< 0.01	0.15 > p > 0.10	< 0.025

Subgroup	T077	T078	T079	T080	T081	T082	T083
Number of Observations	53	79	35	41	65	66	33
Mean Vector (μ)	123.755°	126.465°	130.602°	135.686°	126.49°	132.854°	132.415°
Length of Mean Vector (r)	0.619	0.563	0.837	0.869	0.684	0.643	0.868
Concentration	1.59	1.367	3.402	4.124	1.909	1.699	4.099
Circular Variance	0.381	0.437	0.163	0.131	0.316	0.357	0.132
Circular Standard Deviation	56.103°	61.409°	34.179°	30.353°	49.972°	53.826°	30.463°
95% Confidence Interval (-/+) for μ	108.204°	112.06°	119.35°	126.42°	114.296°	119.63°	122.05°
	139.307°	140.871°	141.854°	144.951°	138.684°	146.079°	142.779°
99% Confidence Interval (-/+) for μ	103.319°	107.535°	115.815°	123.51°	110.466°	115.475°	118.795°
	144.192°	145.396°	145.388°	147.861°	142.515°	150.233°	146.035°
Rayleigh Test (Z)	20.318	25.046	24.52	30.967	30.378	27.306	24.874
Rayleigh Test (p)	1.50E-09	1.33E-11	7.46E-11	0	0	1.38E-12	6.62E-11
Rao's Spacing Test (U)	207.463	191.924	231.48	253.155	210.193	203.523	253.134
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	1.393	1.637	1.595	1.981	2.034	1.694	1.649
Watson's U^2 Test (p)	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Kuiper's Test (Uniform, V)	4.036	4.5	4.009	4.701	4.555	4.496	4.324
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Subgroup	T084	T085	T086	T087	T088	T089	T090
Number of Observations	55	28	31	29	35	38	64
Mean Vector (μ)	132.9°	138.471°	135.439°	124.171°	129.341°	126.246°	126.691°
Length of Mean Vector (r)	0.841	0.709	0.837	0.587	0.855	0.906	0.585
Concentration	3.482	2.061	3.406	1.457	3.766	5.598	1.448
Circular Variance	0.159	0.291	0.163	0.413	0.145	0.094	0.415
Circular Standard Deviation	33.661°	47.554°	34.151°	59.134°	32.041°	25.482°	59.357°
95% Confidence Interval (-/+) for μ	124.053°	120.905°	123.493°	101.622°	118.763°	118.154°	111.433°
	141.747°	156.036°	147.386°	146.72°	139.92°	134.337°	141.948°
99% Confidence Interval (-/+) for μ	121.273°	115.387°	119.74°	94.538°	115.44°	115.612°	106.641°
	144.527°	161.554°	151.139°	153.804°	143.243°	136.879°	146.741°
Rayleigh Test (Z)	38.946	14.06	21.731	9.995	25.601	31.18	21.882
Rayleigh Test (p)	0	1.74E-07	8.03E-10	1.93E-05	3.25E-11	0	3.14E-10
Rao's Spacing Test (U)	254.312	237.944	241.989	186.846	249.797	262.668	201.252
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	2.57	1.085	1.464	0.718	1.699	2.169	1.462
Watson's U^2 Test (p)	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Kuiper's Test (Uniform, V)	5.41	3.746	3.901	2.968	4.345	4.807	4.07
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Subgroup	T091	T092	T094	T095	T096	T097	T099
Number of Observations	40	49	39	40	33	53	84
Mean Vector (μ)	136.97°	131.227°	130.683°	137.282°	128.36°	141.242°	131.321°
Length of Mean Vector (r)	0.701	0.814	0.78	0.718	0.767	0.701	0.67
Concentration	2.013	3.042	2.637	2.126	2.511	2.012	1.834
Circular Variance	0.299	0.186	0.22	0.282	0.233	0.299	0.33
Circular Standard Deviation	48.286°	36.77°	40.409°	46.59°	41.743°	48.307°	51.287°
95% Confidence Interval (-/+) for μ	122.021°	121.028°	118.14°	122.913°	114.269°	128.249°	120.264°
	151.92°	141.425°	143.226°	151.651°	142.451°	154.235°	142.379°
99% Confidence Interval (-/+) for μ	117.325°	117.825°	114.2°	118.399°	109.843°	124.167°	116.791°
	156.615°	144.628°	147.166°	156.165°	146.877°	158.317°	145.852°
Rayleigh Test (Z)	19.661	32.458	23.716	20.649	19.409	26.035	37.696
Rayleigh Test (p)	1.75E-09	0	1.03E-10	8.76E-10	3.34E-09	4.93E-12	0
Rao's Spacing Test (U)	209.874	237.085	240.308	231.432	246.487	216.485	191.889
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	1.294	2.129	1.54	1.467	1.32	1.634	2.263
Watson's U^2 Test (p)	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Kuiper's Test (Uniform, V)	3.689	4.878	4.328	4.353	3.977	4.165	4.836
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Subgroup	T100	T101	T103	T104	T105	T106	T107
Number of Observations	55	35	27	69	37	16	32
Mean Vector (μ)	133.15°	132.153°	128.187°	131.283°	133.847°	132.067°	134.609°
Length of Mean Vector (r)	0.886	0.812	0.543	0.713	0.75	0.841	0.649
Concentration	4.669	3.022	1.295	2.086	2.364	3.482	1.725
Circular Variance	0.114	0.188	0.457	0.287	0.25	0.159	0.351
Circular Standard Deviation	28.24°	36.929°	63.348°	47.175°	43.447°	33.666°	53.317°
95% Confidence Interval (-/+) for μ	125.701°	120.036°	102.398°	120.192°	119.979°	115.661°	115.838°
	140.598°	144.27°	153.976°	142.374°	147.715°	148.472°	153.381°
99% Confidence Interval (-/+) for μ	123.362°	116.23°	94.297°	116.708°	115.623°	110.508°	109.941°
	142.938°	148.076°	162.077°	145.858°	152.071°	153.626°	159.277°
Rayleigh Test (Z)	43.138	23.102	7.952	35.029	20.82	11.329	13.461
Rayleigh Test (p)	0	2.16E-10	2.08E-04	0	9.49E-10	1.04E-06	3.54E-07
Rao's Spacing Test (U)	270.253	232.575	232.453	198.887	225.087	241.496	228.944
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	3.03	1.545	0.789	2.014	1.367	0.862	0.991
Watson's U^2 Test (p)	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Kuiper's Test (Uniform, V)	5.673	4.099	3.262	4.568	3.891	3.091	3.65
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Subgroup	T108	T109	T110	T111	T112	T113	T114
Number of Observations	24	30	22	64	34	93	40
Mean Vector (μ)	130.985°	132.532°	130.828°	130.5°	138.056°	128.559°	133.994°
Length of Mean Vector (r)	0.809	0.725	0.869	0.704	0.707	0.604	0.754
Concentration	2.972	2.168	4.132	2.03	2.047	1.525	2.394
Circular Variance	0.191	0.275	0.131	0.296	0.293	0.396	0.246
Circular Standard Deviation	37.334°	45.999°	30.321°	48.025°	47.756°	57.54°	43.086°
95% Confidence Interval (-/+) for μ	116.197°	116.169°	118.192°	118.753°	122.04°	116.423°	120.772°
	145.773°	148.895°	143.463°	142.247°	154.072°	140.695°	147.217°
99% Confidence Interval (-/+) for μ	111.551°	111.029°	114.223°	115.063°	117.009°	112.611°	116.618°
	150.419°	154.035°	147.432°	145.937°	159.103°	144.507°	151.37°
Rayleigh Test (Z)	15.697	15.747	16.626	31.7	16.973	33.922	22.723
Rayleigh Test (p)	7.25E-08	4.51E-08	5.55E-08	0	1.58E-08	0	2.00E-10
Rao's Spacing Test (U)	269.872	229.701	265.883	227.914	199.38	192.281	215.005
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	1.19	1.105	1.198	2.156	1.04	1.782	1.431
Watson's U^2 Test (p)	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Kuiper's Test (Uniform, V)	3.971	3.64	3.835	4.994	3.301	4.274	3.809
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Subgroup	T116	T117	T118	T119	T120	T121	T122
Number of Observations	43	52	58	58	80	23	62
Mean Vector (μ)	133.647°	130.32°	130.51°	132.254°	130.652°	130.731°	126.17°
Length of Mean Vector (r)	0.747	0.856	0.818	0.893	0.775	0.846	0.83
Concentration	2.339	3.773	3.106	4.972	2.584	3.569	3.286
Circular Variance	0.253	0.144	0.182	0.107	0.225	0.154	0.17
Circular Standard Deviation	43.75°	32.007°	36.271°	27.242°	40.951°	33.129°	34.956°
95% Confidence Interval (-/+) for μ	120.689°	121.65°	121.259°	125.256°	121.777°	117.254°	117.533°
	146.605°	138.99°	139.761°	139.253°	139.528°	144.209°	134.807°
99% Confidence Interval (-/+) for μ	116.619°	118.927°	118.353°	123.057°	118.988°	113.02°	114.82°
	150.675°	141.713°	142.667°	141.451°	142.316°	148.442°	137.52°
Rayleigh Test (Z)	24.002	38.061	38.849	46.265	48	16.464	42.731
Rayleigh Test (p)	6.43E-11	0	0	0	0	5.36E-08	0
Rao's Spacing Test (U)	230.828	266.258	229.878	255.56	228.354	246.668	231.067
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	1.478	2.621	2.391	3.022	2.888	1.089	2.547
Watson's U^2 Test (p)	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Kuiper's Test (Uniform, V)	4.298	5.433	5.003	5.63	5.415	3.644	5.175
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Subgroup	T123	T124	T125	T126	T127	T129	T130
Number of Observations	54	18	25	13	23	58	41
Mean Vector (μ)	128.667°	138.29°	130.29°	137.901°	133.723°	131.957°	131.519°
Length of Mean Vector (r)	0.748	0.734	0.797	0.789	0.895	0.834	0.779
Concentration	2.348	2.238	2.827	2.137	5.06	3.348	2.633
Circular Variance	0.252	0.266	0.203	0.211	0.105	0.166	0.221
Circular Standard Deviation	43.64°	45.05°	38.593°	39.457°	26.974°	34.533°	40.452°
95% Confidence Interval (-/+) for μ	117.134°	117.633°	115.323°	113.91°	122.718°	123.13°	119.272°
	140.199°	158.946°	145.257°	161.892°	144.729°	140.783°	143.765°
99% Confidence Interval (-/+) for μ	113.512°	111.144°	110.622°	106.374°	119.261°	120.357°	115.426°
	143.822°	165.435°	149.958°	169.428°	148.186°	143.556°	147.612°
Rayleigh Test (Z)	30.231	9.7	15.882	8.091	18.428	40.333	24.906
Rayleigh Test (p)	0	1.25E-05	5.93E-08	5.86E-05	1.68E-08	0	3.69E-11
Rao's Spacing Test (U)	232.854	217.413	224.659	233.323	291.415	244.534	223.212
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	1.993	0.672	1.042	0.581	1.37	2.544	1.496
Watson's U^2 Test (p)	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Kuiper's Test (Uniform, V)	4.741	2.937	3.455	2.775	4.266	5.278	4.186
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Subgroup	T131	T132	T133	T134	T135	T137	T138
Number of Observations	30	41	12	2	8	6	1
Mean Vector (μ)	133.506°	131.418°	143.981°	219.747°	131.189°	155.629°	135.792°
Length of Mean Vector (r)	0.705	0.765	0.766	0.017	0.749	0.6	1
Concentration	2.04	2.492	1.916	0	1.554	1.289	*****
Circular Variance	0.295	0.235	0.234	0.983	0.251	0.4	*****
Circular Standard Deviation	47.872°	41.946°	41.813°	163.168°	43.532°	57.897°	*****
95% Confidence Interval (-/+) for μ	116.41°	118.713°	117.217°	*****	94.392°	103.492°	*****
	150.603°	144.122°	170.744°	*****	167.986°	207.766°	*****
99% Confidence Interval (-/+) for μ	111.039°	114.722°	108.81°	*****	82.834°	87.114°	*****
	155.973°	148.113°	179.151°	*****	179.544°	224.144°	*****
Rayleigh Test (Z)	14.926	23.989	7.045	6.01E-04	4.491	2.161	1
Rayleigh Test (p)	8.32E-08	7.36E-11	2.68E-04	1	0.007	0.113	0.512
Rao's Spacing Test (U)	215.326	230.782	216.24	*****	263.513	167.252	*****
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	*****	< 0.01	0.10 > p > 0.05	*****
Watson's U^2 Test (Uniform, U^2)	0.965	1.636	0.508	*****	*****	*****	*****
Watson's U^2 Test (p)	< 0.005	< 0.005	< 0.005	*****	*****	*****	*****
Kuiper's Test (Uniform, V)	3.154	4.363	2.523	0.879	2.629	1.706	1.395
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	> 0.15	< 0.01	0.10 > p > 0.05	> 0.15

Subgroup	T139	T140	T142	T143	T144	T146	T147
Number of Observations	1	7	2	27	8	1	5
Mean Vector (μ)	315.808°	128.989°	230.615°	136.861°	138.192°	275.489°	130.87°
Length of Mean Vector (r)	1	0.428	0.158	0.825	0.715	1	0.603
Concentration	*****	0.644	0	3.2	1.385	*****	1.259
Circular Variance	*****	0.572	0.842	0.175	0.285	*****	0.397
Circular Standard Deviation	*****	74.665°	110.076°	35.569°	46.972°	*****	57.608°
95% Confidence Interval (-/+) for μ	*****	48.09°	*****	123.554°	98.275°	*****	73.24°
	*****	209.888°	*****	150.168°	178.108°	*****	188.5°
99% Confidence Interval (-/+) for μ	*****	22.678°	*****	119.375°	85.736°	*****	55.137°
	*****	235.301°	*****	154.348°	190.647°	*****	206.603°
Rayleigh Test (Z)	1	1.281	0.05	18.365	4.085	1	1.819
Rayleigh Test (p)	0.512	0.288	0.962	1.12E-08	0.012	0.512	0.166
Rao's Spacing Test (U)	*****	228.807	*****	248.918	212.65	*****	199.796
Rao's Spacing Test (p)	*****	< 0.01	*****	< 0.01	< 0.01	*****	< 0.05
Watson's U^2 Test (Uniform, U^2)	*****	*****	*****	1.298	*****	*****	*****
Watson's U^2 Test (p)	*****	*****	*****	< 0.005	*****	*****	*****
Kuiper's Test (Uniform, V)	1.395	1.949	0.957	3.932	2.196	1.395	1.886
Kuiper's Test (p)	> 0.15	< 0.025	> 0.15	< 0.01	< 0.01	> 0.15	< 0.025

Subgroup	T148	T149	T150	T151	T152	T153	T154
Number of Observations	1	3	3	8	6	15	2
Mean Vector (μ)	314.085°	118.36°	115.667°	138.333°	126.996°	131.492°	49.83°
Length of Mean Vector (r)	1	0.301	0.336	0.728	0.665	0.764	0.024
Concentration	*****	0	0	1.446	1.623	2.009	0
Circular Variance	*****	0.699	0.664	0.272	0.335	0.236	0.976
Circular Standard Deviation	*****	88.815°	84.621°	45.664°	51.763°	42.06°	156.267°
95% Confidence Interval (-/+) for μ	*****	*****	*****	99.624°	82.856°	108.081°	*****
	*****	*****	*****	177.043°	171.137°	154.902°	*****
99% Confidence Interval (-/+) for μ	*****	*****	*****	87.464°	68.991°	100.727°	*****
	*****	*****	*****	189.202°	185.002°	162.256°	*****
Rayleigh Test (Z)	1	0.271	0.339	4.239	2.653	8.751	0.001
Rayleigh Test (p)	0.512	0.793	0.747	0.01	0.065	3.11E-05	0.999
Rao's Spacing Test (U)	*****	*****	*****	223.083	228.167	236.678	*****
Rao's Spacing Test (p)	*****	*****	*****	< 0.01	< 0.01	< 0.01	*****
Watson's U^2 Test (Uniform, U^2)	*****	*****	*****	*****	*****	0.643	*****
Watson's U^2 Test (p)	*****	*****	*****	*****	*****	< 0.005	*****
Kuiper's Test (Uniform, V)	1.395	1.146	1.252	2.285	2.163	2.962	0.883
Kuiper's Test (p)	> 0.15	> 0.15	> 0.15	< 0.01	< 0.01	< 0.01	> 0.15

Subgroup	T155	T156	T157	T158	T159	T160	T161
Number of Observations	4	17	4	7	27	2	4
Mean Vector (μ)	116.402°	146.545°	135.317°	128.593°	134.061°	127.585°	123.675°
Length of Mean Vector (r)	0.5	0.655	0.5	0.68	0.839	0.995	0.496
Concentration	0.715	1.755	0.716	1.736	3.442	10.139	0.699
Circular Variance	0.5	0.345	0.5	0.32	0.161	0.005	0.504
Circular Standard Deviation	67.499°	52.733°	67.472°	50.342°	33.915°	5.704°	67.885°
95% Confidence Interval (-/+) for μ	22.437°	121.134°	41.455°	89.516°	121.344°	102.58°	28.235°
	210.368°	171.956°	229.18°	167.671°	146.778°	152.59°	219.115°
99% Confidence Interval (-/+) for μ	352.921°	113.152°	11.971°	77.241°	117.349°	94.726°	358.255°
	239.884°	179.938°	258.664°	179.946°	150.773°	160.445°	249.094°
Rayleigh Test (Z)	0.998	7.287	1	3.235	19.019	1.98	0.983
Rayleigh Test (p)	0.395	3.20E-04	0.394	0.033	7.40E-09	0.141	0.401
Rao's Spacing Test (U)	150.821	194.298	175.586	203.22	242.863	*****	160.885
Rao's Spacing Test (p)	0.50 > p > 0.10	< 0.01	0.10 > p > 0.05	< 0.01	< 0.01	*****	0.50 > p > 0.10
Watson's U^2 Test (Uniform, U^2)	*****	0.516	*****	*****	1.237	*****	*****
Watson's U^2 Test (p)	*****	< 0.005	*****	*****	< 0.005	*****	*****
Kuiper's Test (Uniform, V)	1.522	2.595	1.678	2.045	3.841	1.684	1.585
Kuiper's Test (p)	> 0.15	< 0.01	0.10 > p > 0.05	< 0.01	< 0.01	0.10 > p > 0.05	0.15 > p > 0.10

Subgroup	T162	T163	T164	T167	T168	T169	T170
Number of Observations	4	7	2	7	15	1	13
Mean Vector (μ)	145.173°	128.993°	38.826°	133.291°	127.234°	314.452°	96.679°
Length of Mean Vector (r)	0.48	0.557	0.052	0.708	0.429	1	0.374
Concentration	0.633	1.133	0	1.269	0.808	*****	0.615
Circular Variance	0.52	0.443	0.948	0.292	0.571	*****	0.626
Circular Standard Deviation	69.43°	61.972°	139.113°	47.63°	74.553°	*****	80.371°
95% Confidence Interval (-/+) for μ	43.307°	75.558°	*****	88.491°	77.975°	*****	31.724°
	247.039°	182.428°	*****	178.09°	176.492°	*****	161.633°
99% Confidence Interval (-/+) for μ	11.309°	58.773°	*****	74.418°	62.502°	*****	11.321°
	279.037°	199.213°	*****	192.163°	191.965°	*****	182.036°
Rayleigh Test (Z)	0.921	2.173	0.006	3.507	2.759	1	1.817
Rayleigh Test (p)	0.426	0.112	0.996	0.024	0.061	0.512	0.164
Rao's Spacing Test (U)	147.551	149.122	*****	235.54	161.712	*****	121.948
Rao's Spacing Test (p)	0.50 > p > 0.10	0.50 > p > 0.10	*****	< 0.01	0.10 > p > 0.05	*****	0.90 > p > 0.50
Watson's U^2 Test (Uniform, U^2)	*****	*****	*****	*****	0.234	*****	0.122
Watson's U^2 Test (p)	*****	*****	*****	*****	< 0.025	*****	0.25 > p > 0.15
Kuiper's Test (Uniform, V)	1.501	1.611	0.899	2.305	1.884	1.395	1.459
Kuiper's Test (p)	> 0.15	0.15 > p > 0.10	> 0.15	< 0.01	< 0.025	> 0.15	> 0.15

Subgroup	T171	T174	T175	T176	T179	T180	T181
Number of Observations	2	4	1	2	1	32	64
Mean Vector (μ)	223.007°	138.074°	133.205°	22.393°	126.876°	133.667°	131.387°
Length of Mean Vector (r)	0.004	0.493	1	0.346	1	0.722	0.801
Concentration	0	0.688	*****	0	*****	2.149	2.868
Circular Variance	0.996	0.507	*****	0.654	*****	0.278	0.199
Circular Standard Deviation	189.074°	68.123°	*****	83.464°	*****	46.27°	38.222°
95% Confidence Interval (-/+) for μ	*****	41.696°	*****	*****	*****	117.722°	122.121°
	*****	234.451°	*****	*****	*****	149.612°	140.653°
99% Confidence Interval (-/+) for μ	*****	11.422°	*****	*****	*****	112.714°	119.21°
	*****	264.725°	*****	*****	*****	154.621°	143.564°
Rayleigh Test (Z)	3.73E-05	0.973	1	0.24	1	16.669	41.012
Rayleigh Test (p)	1	0.405	0.512	0.829	0.512	2.16E-08	0
Rao's Spacing Test (U)	*****	162.215	*****	*****	*****	213.593	228.425
Rao's Spacing Test (p)	*****	0.50 > p > 0.10	*****	*****	*****	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	*****	*****	*****	*****	*****	1.101	2.557
Watson's U^2 Test (p)	*****	*****	*****	*****	*****	< 0.005	< 0.005
Kuiper's Test (Uniform, V)	0.872	1.594	1.395	1.065	1.395	3.656	5.03
Kuiper's Test (p)	> 0.15	0.15 > p > 0.10	> 0.15	> 0.15	> 0.15	< 0.01	< 0.01

Subgroup	T182	T183	T184	T185	T186	T187	T188
Number of Observations	41	57	27	40	65	38	69
Mean Vector (μ)	130.196°	130.657°	132.67°	137.812°	131.304°	135.108°	132.138°
Length of Mean Vector (r)	0.846	0.898	0.904	0.701	0.874	0.879	0.66
Concentration	3.573	5.197	5.49	2.014	4.262	4.426	1.781
Circular Variance	0.154	0.102	0.096	0.299	0.126	0.121	0.34
Circular Standard Deviation	33.106°	26.568°	25.762°	48.27°	29.774°	29.127°	52.243°
95% Confidence Interval (-/+) for μ	120.108°	123.77°	122.966°	122.868°	124.084°	125.869°	119.666°
	140.283°	137.543°	142.374°	152.755°	138.524°	144.347°	144.61°
99% Confidence Interval (-/+) for μ	116.939°	121.607°	119.917°	118.174°	121.816°	122.966°	115.749°
	143.452°	139.706°	145.422°	157.449°	140.792°	147.25°	148.527°
Rayleigh Test (Z)	29.362	45.972	22.058	19.671	49.617	29.346	30.045
Rayleigh Test (p)	1.09E-12	0	9.14E-10	1.74E-09	0	1.34E-12	0
Rao's Spacing Test (U)	241.171	259.01	284.053	206.176	246.703	259.434	202.088
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	1.936	2.984	1.602	1.325	3.054	1.956	1.806
Watson's U^2 Test (p)	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Kuiper's Test (Uniform, V)	4.512	5.598	4.459	3.831	5.502	4.665	4.48
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Subgroup	T189	T190	T191	T193	T195	T196	T197
Number of Observations	27	97	36	29	69	36	45
Mean Vector (μ)	125.67°	126.761°	134.643°	135.677°	130.262°	133.032°	134.339°
Length of Mean Vector (r)	0.704	0.703	0.817	0.833	0.74	0.684	0.816
Concentration	2.033	2.025	3.092	3.326	2.282	1.909	3.067
Circular Variance	0.296	0.297	0.183	0.167	0.26	0.316	0.184
Circular Standard Deviation	47.979°	48.105°	36.379°	34.682°	44.464°	49.979°	36.567°
95% Confidence Interval (-/+) for μ	107.604°	117.202°	122.867°	123.143°	119.857°	116.644°	123.754°
	143.736°	136.321°	146.419°	148.211°	140.667°	149.42°	144.924°
99% Confidence Interval (-/+) for μ	101.929°	114.199°	119.168°	119.206°	116.589°	111.496°	120.429°
	149.411°	139.324°	150.118°	152.148°	143.936°	154.568°	148.249°
Rayleigh Test (Z)	13.392	47.933	24.056	20.103	37.783	16.821	29.944
Rayleigh Test (p)	3.18E-07	0	9.85E-11	2.97E-09	0	1.63E-08	0
Rao's Spacing Test (U)	237.803	220.053	231.464	232.427	211.11	219.066	254.65
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	1.004	3.059	1.576	1.289	2.11	1.201	2.019
Watson's U^2 Test (p)	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Kuiper's Test (Uniform, V)	3.686	5.597	3.976	3.698	4.632	3.786	4.98
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Subgroup	T199	T200	T201	T204	T205	T206	T207
Number of Observations	117	60	75	85	95	55	57
Mean Vector (μ)	129.476°	125.979°	143.623°	130.866°	128.088°	130.266°	129.824°
Length of Mean Vector (r)	0.552	0.699	0.403	0.701	0.688	0.761	0.678
Concentration	1.328	1.998	0.881	2.012	1.937	2.453	1.879
Circular Variance	0.448	0.301	0.597	0.299	0.312	0.239	0.322
Circular Standard Deviation	62.427°	48.52°	77.212°	48.307°	49.517°	42.393°	50.495°
95% Confidence Interval (-/+) for μ	117.352°	113.707°	121.866°	120.606°	118.107°	119.177°	116.643°
	141.599°	138.251°	165.379°	141.126°	138.069°	141.354°	143.004°
99% Confidence Interval (-/+) for μ	113.544°	109.852°	115.032°	117.384°	114.971°	115.693°	112.503°
	145.407°	142.106°	172.213°	144.349°	141.205°	144.838°	147.144°
Rayleigh Test (Z)	35.695	29.289	12.2	41.755	45.013	31.813	26.215
Rayleigh Test (p)	0	0	5.03E-06	0	0	0	4.12E-12
Rao's Spacing Test (U)	174.375	188.921	155.099	198.722	203.731	232.631	216.387
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.05	< 0.01	< 0.01	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	2.189	1.744	0.671	2.424	2.666	2.073	1.713
Watson's U^2 Test (p)	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Kuiper's Test (Uniform, V)	4.608	4.085	2.532	4.828	5.204	4.998	4.429
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Subgroup	T208	T209	T210	T211	T212	T213	T214
Number of Observations	61	27	42	32	34	48	30
Mean Vector (μ)	129.366°	134.214°	126.361°	135.247°	132.156°	134.732°	130.987°
Length of Mean Vector (r)	0.651	0.813	0.729	0.708	0.76	0.824	0.887
Concentration	1.737	3.031	2.199	2.055	2.448	3.194	4.733
Circular Variance	0.349	0.187	0.271	0.292	0.24	0.176	0.113
Circular Standard Deviation	53.095°	36.852°	45.565°	47.645°	42.443°	35.613°	28.019°
95% Confidence Interval (-/+) for μ	115.839°	120.445°	112.672°	118.781°	118.036°	124.741°	120.981°
	142.892°	147.982°	140.05°	151.713°	146.277°	144.724°	140.993°
99% Confidence Interval (-/+) for μ	111.59°	116.121°	108.372°	113.608°	113.6°	121.602°	117.837°
	147.141°	152.307°	144.35°	156.886°	150.713°	147.863°	144.137°
Rayleigh Test (Z)	25.846	17.852	22.315	16.026	19.641	32.618	23.619
Rayleigh Test (p)	5.96E-12	1.54E-08	2.36E-10	3.40E-08	2.65E-09	0	2.19E-10
Rao's Spacing Test (U)	191.854	227.287	229.124	216.731	215.262	250.592	256.063
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	1.459	1.138	1.541	1.051	1.254	2.054	1.625
Watson's U^2 Test (p)	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Kuiper's Test (Uniform, V)	3.843	3.41	4.137	3.53	3.709	4.828	4.215
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Subgroup	T215	T218	T219	T220	T221	T222	T223
Number of Observations	49	71	53	56	28	110	122
Mean Vector (μ)	130.097°	132.715°	132.731°	133.286°	128.722°	137.069°	128.454°
Length of Mean Vector (r)	0.792	0.827	0.594	0.856	0.725	0.467	0.578
Concentration	2.763	3.24	1.483	3.784	2.172	1.054	1.423
Circular Variance	0.208	0.173	0.406	0.144	0.275	0.533	0.422
Circular Standard Deviation	39.177°	35.283°	58.51°	31.949°	45.947°	70.728°	59.965°
95% Confidence Interval (-/+) for μ	119.247°	124.572°	116.29°	124.946°	111.805°	121.798°	117.246°
	140.947°	140.858°	149.171°	141.625°	145.639°	152.34°	139.662°
99% Confidence Interval (-/+) for μ	115.838°	122.014°	111.126°	122.327°	106.491°	117.001°	113.725°
	144.355°	143.415°	154.336°	144.245°	150.953°	157.136°	143.183°
Rayleigh Test (Z)	30.701	48.592	18.68	41.035	14.719	23.966	40.799
Rayleigh Test (p)	0	0	7.72E-09	0	1.02E-07	3.90E-11	0
Rao's Spacing Test (U)	232.864	250.694	197.728	242.312	210.578	164.987	177.439
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	2.049	3.221	1.224	2.647	0.969	1.404	2.396
Watson's U^2 Test (p)	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Kuiper's Test (Uniform, V)	4.797	6.01	3.995	5.3	3.265	4.03	4.83
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Subgroup	T224	T225	T226	T227	T228	T229	T230
Number of Observations	20	88	107	33	63	98	40
Mean Vector (μ)	128.845°	129.866°	131.622°	136.722°	131.169°	130.408°	133.338°
Length of Mean Vector (r)	0.772	0.725	0.688	0.765	0.681	0.705	0.641
Concentration	2.557	2.172	1.936	2.497	1.893	2.035	1.69
Circular Variance	0.228	0.275	0.312	0.235	0.319	0.295	0.359
Circular Standard Deviation	41.237°	45.939°	49.525°	41.9°	50.258°	47.949°	54.016°
95% Confidence Interval (-/+) for μ	110.968°	120.326°	122.215°	122.577°	118.701°	120.932°	116.277°
	146.722°	139.407°	141.028°	150.866°	143.637°	139.884°	150.4°
99% Confidence Interval (-/+) for μ	105.352°	117.329°	119.26°	118.133°	114.784°	117.956°	110.917°
	152.337°	142.404°	143.983°	155.31°	147.554°	142.861°	155.759°
Rayleigh Test (Z)	11.914	46.27	50.687	19.331	29.187	48.649	16.446
Rayleigh Test (p)	9.51E-07	0	0	3.52E-09	0	0	2.07E-08
Rao's Spacing Test (U)	232.608	209.036	201.213	214.749	223.303	213.924	189.026
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	0.823	2.717	2.948	1.183	2.005	2.926	1.008
Watson's U^2 Test (p)	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Kuiper's Test (Uniform, V)	3.258	5.408	5.498	3.652	4.728	5.478	3.329
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Subgroup	T231	T232	T233	T234	T235	T236	T237
Number of Observations	21	35	67	40	39	16	20
Mean Vector (μ)	127.651°	130.767°	134.3°	132.156°	127.284°	134.409°	131.53°
Length of Mean Vector (r)	0.84	0.854	0.643	0.739	0.799	0.847	0.781
Concentration	3.451	3.729	1.698	2.274	2.854	3.578	2.648
Circular Variance	0.16	0.146	0.357	0.261	0.201	0.153	0.219
Circular Standard Deviation	33.863°	32.234°	53.844°	44.576°	38.348°	33.075°	40.295°
95% Confidence Interval (-/+) for μ	113.252°	120.126°	121.169°	118.454°	115.375°	118.275°	114.064°
	142.051°	141.409°	147.431°	145.858°	139.192°	150.543°	148.996°
99% Confidence Interval (-/+) for μ	108.729°	116.783°	117.044°	114.15°	111.634°	113.206°	108.578°
	146.574°	144.751°	151.555°	150.162°	142.933°	155.611°	154.482°
Rayleigh Test (Z)	14.809	25.504	27.703	21.837	24.918	11.465	12.196
Rayleigh Test (p)	1.60E-07	3.51E-11	0	3.78E-10	4.16E-11	9.62E-07	7.33E-07
Rao's Spacing Test (U)	234.574	256.836	194.964	222.16	220.525	267.516	253.09
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	1.029	1.73	1.726	1.338	1.469	0.908	0.928
Watson's U^2 Test (p)	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Kuiper's Test (Uniform, V)	3.349	4.535	4.191	3.965	3.946	3.327	3.525
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Subgroup	T238	T239	T240	T241	T242	T243	T244
Number of Observations	60	48	103	36	40	30	88
Mean Vector (μ)	128.784°	129.536°	132.421°	127.471°	132.359°	132.624°	129.393°
Length of Mean Vector (r)	0.777	0.931	0.507	0.819	0.73	0.794	0.704
Concentration	2.604	7.53	1.174	3.116	2.206	2.786	2.03
Circular Variance	0.223	0.069	0.493	0.181	0.27	0.206	0.296
Circular Standard Deviation	40.741°	21.657°	66.735°	36.191°	45.472°	38.959°	48.03°
95% Confidence Interval (-/+) for μ	118.588°	123.413°	118.08°	115.754°	118.363°	118.833°	119.374°
	138.98°	135.659°	146.761°	139.188°	146.355°	146.414°	139.412°
99% Confidence Interval (-/+) for μ	115.386°	121.489°	113.576°	112.073°	113.966°	114.501°	116.227°
	142.183°	137.582°	151.266°	142.869°	150.752°	150.746°	142.56°
Rayleigh Test (Z)	36.188	41.61	26.526	24.156	21.306	18.894	43.581
Rayleigh Test (p)	0	0	3.02E-12	9.13E-11	5.51E-10	6.03E-09	0
Rao's Spacing Test (U)	226.631	287.682	182.094	222.071	211.674	248.301	197.503
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	2.353	2.875	1.545	1.574	1.26	1.293	2.379
Watson's U^2 Test (p)	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Kuiper's Test (Uniform, V)	4.89	5.836	4.019	3.964	3.889	4.104	4.505
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Subgroup	T245	T246	T247	T248	T249	T250	
Number of Observations	30	55	49	5	2	1	
Mean Vector (μ)	127.673°	136.905°	135.871°	138.76°	221.565°	228.684°	
Length of Mean Vector (r)	0.837	0.782	0.668	0.899	0.029	1	
Concentration	3.4	2.663	1.824	2.592	0	*****	
Circular Variance	0.163	0.218	0.332	0.101	0.971	*****	
Circular Standard Deviation	34.188°	40.15°	51.466°	26.374°	152.818°	*****	
95% Confidence Interval (-/+) for μ	115.517°	126.41°	121.334°	105.861°	*****	*****	
	139.83°	147.399°	150.408°	171.658°	*****	*****	
99% Confidence Interval (-/+) for μ	111.698°	123.114°	116.767°	95.527°	*****	*****	
	143.648°	150.696°	154.974°	181.992°	*****	*****	
Rayleigh Test (Z)	21.013	33.659	21.867	4.045	0.002	1	
Rayleigh Test (p)	1.45E-09	0	2.23E-10	0.009	0.999	0.512	
Rao's Spacing Test (U)	259.439	232.385	181.92	205.722	*****	*****	
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	< 0.05	*****	*****	
Watson's U^2 Test (Uniform, U^2)	1.506	2.128	1.208	*****	*****	*****	
Watson's U^2 Test (p)	< 0.005	< 0.005	< 0.005	*****	*****	*****	
Kuiper's Test (Uniform, V)	4.28	4.724	3.717	1.927	0.885	1.395	
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.025	> 0.15	> 0.15	

Appendix G: Individual Time Summary Statistics

Subgroup	T001	T003	T006	T007	T008	T009	T010
Number of Observations	5	6	12	4	4	14	3
Mean Vector (μ)	10:27 PM	5:11 PM	10:32 PM	10:08 PM	9:53 PM	11:05 PM	9:51 PM
Length of Mean Vector (r)	1	1	1	1	1	1	1
Concentration	*****	2201.787	6262.709	*****	922.818	2024.483	*****
Circular Variance	*****	1.28E-04	6.11E-05	*****	2.15E-04	1.97E-04	*****
Circular Standard Deviation	*****	0.916°	0.633°	*****	1.189°	1.137°	*****
95% Confidence Interval (-/+) for μ	*****	5:07 PM	10:30 PM	*****	9:46 PM	11:02 PM	*****
	*****	5:15 PM	10:34 PM	*****	10:00 PM	11:07 PM	*****
99% Confidence Interval (-/+) for μ	*****	5:06 PM	10:30 PM	*****	9:43 PM	11:01 PM	*****
	*****	5:16 PM	10:34 PM	*****	10:03 PM	11:08 PM	*****
Rayleigh Test (Z)	5	5.998	11.999	4	3.998	13.994	3
Rayleigh Test (p)	0.001	0	1.75E-06	0.007	0.007	7.36E-07	0.033
Rao's Spacing Test (U)	287.8	297.346	327.521	269.817	267.154	331.415	*****
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	*****
Watson's U^2 Test (Uniform, U^2)	*****	*****	1.05	*****	*****	1.204	*****
Watson's U^2 Test (p)	*****	*****	< 0.005	*****	*****	< 0.005	*****
Kuiper's Test (Uniform, V)	2.497	2.683	3.663	2.274	2.257	3.929	2.024
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Subgroup	T011	T012	T014	T015	T017	T018	T019
Number of Observations	8	4	9	3	2	1	6
Mean Vector (μ)	10:08 PM	10:24 PM	9:53 PM	8:56 PM	6:34 AM	8:51 PM	8:51 PM
Length of Mean Vector (r)	1	1	1	1	1	1	1
Concentration	4478.652	*****	1466.744	*****	9337.794	*****	*****
Circular Variance	7.36E-05	*****	2.37E-04	*****	5.35E-06	*****	*****
Circular Standard Deviation	0.695°	*****	1.246°	*****	0.188°	*****	*****
95% Confidence Interval (-/+) for μ	10:06 PM	*****	9:49 PM	*****	6:31 AM	*****	*****
	10:10 PM	*****	9:57 PM	*****	6:38 AM	*****	*****
99% Confidence Interval (-/+) for μ	10:05 PM	*****	9:48 PM	*****	6:30 AM	*****	*****
	10:11 PM	*****	9:58 PM	*****	6:39 AM	*****	*****
Rayleigh Test (Z)	7.999	4	8.996	3	2	1	6
Rayleigh Test (p)	0	0.007	0	0.033	0.137	0.512	0
Rao's Spacing Test (U)	312.629	269.546	316.804	*****	*****	*****	299.629
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	*****	*****	*****	< 0.01
Watson's U^2 Test (Uniform, U^2)	*****	*****	*****	*****	*****	*****	*****
Watson's U^2 Test (p)	*****	*****	*****	*****	*****	*****	*****
Kuiper's Test (Uniform, V)	3.048	2.272	3.206	2.023	1.737	1.395	2.7
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	0.10 > p > 0.05	> 0.15	< 0.01

Subgroup	T020	T021	T022	T023	T024	T025	T026
Number of Observations	6	8	10	29	5	52	16
Mean Vector (μ)	8:23 PM	6:09 PM	5:25 AM	10:53 AM	8:43 AM	10:56 AM	6:18 PM
Length of Mean Vector (r)	1	1	1	1	1	1	1
Concentration	2968.159	2155.526	1764.608	1988.78	2500.02	2992.974	3345.774
Circular Variance	9.49E-05	1.53E-04	2.05E-04	2.51E-04	9.85E-05	1.67E-04	1.49E-04
Circular Standard Deviation	0.789°	1.002°	1.159°	1.285°	0.804°	1.047°	0.991°
95% Confidence Interval (-/+) for μ	8:20 PM	6:05 PM	5:22 AM	10:51 AM	8:39 AM	10:55 AM	6:16 PM
	8:27 PM	6:12 PM	5:28 AM	10:55 AM	8:47 AM	10:57 AM	6:20 PM
99% Confidence Interval (-/+) for μ	8:19 PM	6:04 PM	5:20 AM	10:51 AM	8:37 AM	10:54 AM	6:15 PM
	8:28 PM	6:13 PM	5:29 AM	10:56 AM	8:48 AM	10:57 AM	6:20 PM
Rayleigh Test (Z)	5.999	7.998	9.996	28.985	4.999	51.983	15.995
Rayleigh Test (p)	0	0	0	3.43E-12	0.001	0	1.95E-07
Rao's Spacing Test (U)	297.779	312.083	321.229	343.836	285.888	349.306	334.671
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	*****	*****	0.872	2.425	*****	4.31	1.369
Watson's U^2 Test (p)	*****	*****	< 0.005	< 0.005	*****	< 0.005	< 0.005
Kuiper's Test (Uniform, V)	2.686	3.043	3.367	5.527	2.484	7.322	4.182
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Subgroup	T027	T028	T029	T032	T035	T036	T037
Number of Observations	5	10	11	7	8	13	5
Mean Vector (μ)	12:14 AM	10:30 PM	5:15 PM	8:45 AM	11:12 AM	6:10 PM	9:32 PM
Length of Mean Vector (r)	1	1	1	1	1	1	1
Concentration	*****	2112.197	1679.475	3408.516	3258.596	4550.964	*****
Circular Variance	*****	1.71E-04	2.22E-04	9.05E-05	1.01E-04	8.59E-05	*****
Circular Standard Deviation	*****	1.059°	1.207°	0.771°	0.815°	0.751°	*****
95% Confidence Interval (-/+) for μ	*****	10:27 PM	5:12 PM	8:42 AM	11:09 AM	6:08 PM	*****
	*****	10:33 PM	5:18 PM	8:48 AM	11:15 AM	6:12 PM	*****
99% Confidence Interval (-/+) for μ	*****	10:26 PM	5:11 PM	8:41 AM	11:08 AM	6:08 PM	*****
	*****	10:34 PM	5:20 PM	8:49 AM	11:16 AM	6:13 PM	*****
Rayleigh Test (Z)	5	9.997	10.995	6.999	7.998	12.998	5
Rayleigh Test (p)	0.001	0	1.31E-06	0	0	1.25E-06	0.001
Rao's Spacing Test (U)	287.704	321.283	324.352	306.726	312.379	330.174	287.775
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	*****	0.873	0.953	*****	*****	1.127	*****
Watson's U^2 Test (p)	*****	< 0.005	< 0.005	*****	*****	< 0.005	*****
Kuiper's Test (Uniform, V)	2.496	3.368	3.515	2.877	3.046	3.804	2.497
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Subgroup	T038	T040	T041	T042	T043	T045	T046
Number of Observations	8	4	4	7	4	1	4
Mean Vector (μ)	7:40 AM	1:56 PM	7:48 AM	5:59 PM	8:05 PM	8:20 PM	6:13 PM
Length of Mean Vector (r)	1	1	1	1	1	1	1
Concentration	3291.402	*****	1453.515	1109.414	1930.013	*****	1106.584
Circular Variance	1.00E-04	*****	1.37E-04	2.78E-04	1.03E-04	*****	1.79E-04
Circular Standard Deviation	0.811°	*****	0.947°	1.352°	0.822°	*****	1.085°
95% Confidence Interval (-/+) for μ	7:37 AM	*****	7:42 AM	5:54 PM	7:59 PM	*****	6:07 PM
	7:43 AM	*****	7:54 AM	6:04 PM	8:10 PM	*****	6:20 PM
99% Confidence Interval (-/+) for μ	7:36 AM	*****	7:40 AM	5:52 PM	7:58 PM	*****	6:05 PM
	7:44 AM	*****	7:56 AM	6:06 PM	8:11 PM	*****	6:22 PM
Rayleigh Test (Z)	7.998	4	3.999	6.996	3.999	1	3.999
Rayleigh Test (p)	0	0.007	0.007	0	0.007	0.512	0.007
Rao's Spacing Test (U)	312.917	269.858	267.867	305.009	268.042	*****	267.604
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	*****	< 0.01
Watson's U^2 Test (Uniform, U^2)	*****	*****	*****	*****	*****	*****	*****
Watson's U^2 Test (p)	*****	*****	*****	*****	*****	*****	*****
Kuiper's Test (Uniform, V)	3.051	2.274	2.262	2.863	2.263	1.395	2.26
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	> 0.15	< 0.01

Subgroup	T047	T048	T049	T050	T051	T052	T053
Number of Observations	1	3	8	11	54	2	1
Mean Vector (μ)	8:06 PM	7:14 AM	5:32 PM	5:49 PM	9:09 AM	5:32 PM	8:10 PM
Length of Mean Vector (r)	1	1	1	1	0.691	1	1
Concentration	*****	2013.352	1807.893	3814.295	1.95	*****	*****
Circular Variance	*****	6.62E-05	1.82E-04	9.77E-05	0.309	*****	*****
Circular Standard Deviation	*****	0.659°	1.095°	0.801°	49.291°	*****	*****
95% Confidence Interval (-/+) for μ	*****	7:08 AM	5:28 PM	5:47 PM	8:16 AM	*****	*****
	*****	7:19 AM	5:36 PM	5:51 PM	10:01 AM	*****	*****
99% Confidence Interval (-/+) for μ	*****	7:06 AM	5:27 PM	5:46 PM	7:59 AM	*****	*****
	*****	7:21 AM	5:37 PM	5:52 PM	10:18 AM	*****	*****
Rayleigh Test (Z)	1	3	7.997	10.998	25.762	2	1
Rayleigh Test (p)	0.512	0.033	0	1.32E-06	6.48E-12	0.137	0.512
Rao's Spacing Test (U)	*****	*****	312.262	325.089	326.121	*****	*****
Rao's Spacing Test (p)	*****	*****	< 0.01	< 0.01	< 0.01	*****	*****
Watson's U^2 Test (Uniform, U^2)	*****	*****	*****	0.96	2.447	*****	*****
Watson's U^2 Test (p)	*****	*****	*****	< 0.005	< 0.005	*****	*****
Kuiper's Test (Uniform, V)	1.395	2.017	3.045	3.522	5.935	1.738	1.395
Kuiper's Test (p)	> 0.15	< 0.01	< 0.01	< 0.01	< 0.01	0.10 > p > 0.05	> 0.15

Subgroup	T054	T055	T056	T057	T058	T059	T060
Number of Observations	6	3	5	3	7	6	7
Mean Vector (μ)	8:41 PM	8:11 PM	8:00 PM	5:26 PM	7:59 PM	7:23 AM	5:22 PM
Length of Mean Vector (r)	1	1	1	1	1	1	1
Concentration	2155.313	631.878	3563.824	2209.285	2493.584	8203.61	1666.558
Circular Variance	1.31E-04	2.11E-04	6.91E-05	6.04E-05	1.24E-04	3.43E-05	1.85E-04
Circular Standard Deviation	0.926°	1.177°	0.673°	0.629°	0.901°	0.475°	1.103°
95% Confidence Interval (-/+) for μ	8:37 PM	8:01 PM	7:56 PM	5:21 PM	7:56 PM	7:21 AM	5:18 PM
	8:45 PM	8:21 PM	8:03 PM	5:32 PM	8:03 PM	7:25 AM	5:26 PM
99% Confidence Interval (-/+) for μ	8:36 PM	7:58 PM	7:55 PM	5:19 PM	7:55 PM	7:20 AM	5:17 PM
	8:46 PM	8:25 PM	8:04 PM	5:33 PM	8:04 PM	7:25 AM	5:28 PM
Rayleigh Test (Z)	5.998	2.999	4.999	3	6.998	6	6.997
Rayleigh Test (p)	0	0.033	0.001	0.033	0	0	0
Rao's Spacing Test (U)	297.592	*****	286.496	*****	305.855	298.654	305.776
Rao's Spacing Test (p)	< 0.01	*****	< 0.01	*****	< 0.01	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	*****	*****	*****	*****	*****	*****	*****
Watson's U^2 Test (p)	*****	*****	*****	*****	*****	*****	*****
Kuiper's Test (Uniform, V)	2.684	2.01	2.488	2.018	2.87	2.692	2.869
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Subgroup	T062	T063	T064	T065	T066	T067	T068
Number of Observations	3	12	7	11	9	6	6
Mean Vector (μ)	8:10 PM	8:57 PM	7:53 AM	8:40 AM	11:39 PM	5:08 PM	9:46 PM
Length of Mean Vector (r)	1	1	1	1	1	1	1
Concentration	616.507	2820.731	989.829	3441.089	4687.122	*****	*****
Circular Variance	2.16E-04	1.36E-04	3.12E-04	1.08E-04	7.40E-05	*****	*****
Circular Standard Deviation	1.192°	0.944°	1.431°	0.843°	0.697°	*****	*****
95% Confidence Interval (-/+) for μ	7:59 PM	8:55 PM	7:47 AM	8:37 AM	11:37 PM	*****	*****
	8:20 PM	9:00 PM	7:58 AM	8:42 AM	11:41 PM	*****	*****
99% Confidence Interval (-/+) for μ	7:56 PM	8:54 PM	7:45 AM	8:37 AM	11:36 PM	*****	*****
	8:24 PM	9:00 PM	8:00 AM	8:43 AM	11:42 PM	*****	*****
Rayleigh Test (Z)	2.999	11.997	6.996	10.998	8.999	6	6
Rayleigh Test (p)	0.033	1.75E-06	0	1.32E-06	0	0	0
Rao's Spacing Test (U)	*****	327.392	305.171	325.044	317.567	299.625	299.454
Rao's Spacing Test (p)	*****	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	*****	1.042	*****	0.96	*****	*****	*****
Watson's U^2 Test (p)	*****	< 0.005	*****	< 0.005	*****	*****	*****
Kuiper's Test (Uniform, V)	2.011	3.662	2.864	3.522	3.213	2.7	2.698
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Subgroup	T069	T070	T071	T072	T073	T074	T075
Number of Observations	4	14	1	4	16	7	5
Mean Vector (μ)	10:02 PM	9:48 PM	5:56 PM	6:11 PM	7:40 PM	5:38 PM	8:23 PM
Length of Mean Vector (r)	1	1	1	1	0.999	1	1
Concentration	1735.371	1939.163	*****	*****	757.739	951.291	1621.848
Circular Variance	1.14E-04	2.05E-04	*****	*****	6.60E-04	3.24E-04	1.52E-04
Circular Standard Deviation	0.867°	1.161°	*****	*****	2.082°	1.46°	0.998°
95% Confidence Interval (-/+) for μ	9:57 PM	9:45 PM	*****	*****	7:36 PM	5:32 PM	8:18 PM
	10:07 PM	9:50 PM	*****	*****	7:44 PM	5:43 PM	8:28 PM
99% Confidence Interval (-/+) for μ	9:55 PM	9:44 PM	*****	*****	7:34 PM	5:30 PM	8:16 PM
	10:09 PM	9:51 PM	*****	*****	7:45 PM	5:45 PM	8:29 PM
Rayleigh Test (Z)	3.999	13.994	1	4	15.979	6.995	4.998
Rayleigh Test (p)	0.007	7.36E-07	0.512	0.007	1.97E-07	0	0.001
Rao's Spacing Test (U)	268.125	331.177	*****	269.638	331.579	305.134	285.617
Rao's Spacing Test (p)	< 0.01	< 0.01	*****	< 0.01	< 0.01	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	*****	1.201	*****	*****	1.342	*****	*****
Watson's U^2 Test (p)	*****	< 0.005	*****	*****	< 0.005	*****	*****
Kuiper's Test (Uniform, V)	2.263	3.927	1.395	2.273	4.146	2.864	2.482
Kuiper's Test (p)	< 0.01	< 0.01	> 0.15	< 0.01	< 0.01	< 0.01	< 0.01

Subgroup	T077	T078	T079	T080	T081	T082	T083
Number of Observations	53	79	35	41	65	66	33
Mean Vector (μ)	12:02 AM	2:27 AM	10:49 PM	10:26 PM	10:08 PM	11:59 PM	8:45 PM
Length of Mean Vector (r)	1	1	1	1	1	1	1
Concentration	1524.544	1134.166	5200.928	2559.843	2744.548	1170.61	4578.896
Circular Variance	3.28E-04	4.41E-04	9.61E-05	1.95E-04	1.82E-04	4.27E-04	1.09E-04
Circular Standard Deviation	1.468°	1.702°	0.795°	1.133°	1.094°	1.675°	0.847°
95% Confidence Interval (-/+) for μ	12:01 AM	2:25 AM	10:48 PM	10:25 PM	10:07 PM	11:57 PM	8:44 PM
	12:04 AM	2:28 AM	10:50 PM	10:27 PM	10:09 PM	12:00 AM	8:46 PM
99% Confidence Interval (-/+) for μ	12:00 AM	2:25 AM	10:48 PM	10:24 PM	10:07 PM	11:57 PM	8:43 PM
	12:04 AM	2:29 AM	10:51 PM	10:28 PM	10:09 PM	12:01 AM	8:46 PM
Rayleigh Test (Z)	52.965	78.93	34.993	40.984	64.976	65.944	32.993
Rayleigh Test (p)	0	0	0	0	0	0	0
Rao's Spacing Test (U)	348.012	348.785	346.739	347.17	350.199	348.504	346.112
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	4.357	6.433	2.935	3.406	5.367	5.387	2.769
Watson's U^2 Test (p)	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Kuiper's Test (Uniform, V)	7.36	8.902	6.061	6.521	8.149	8.169	5.892
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Subgroup	T084	T085	T086	T087	T088	T089	T090
Number of Observations	55	28	31	29	35	38	64
Mean Vector (μ)	8:41 PM	9:08 PM	10:18 PM	10:41 PM	10:51 PM	8:08 PM	12:48 AM
Length of Mean Vector (r)	1	1	1	1	1	1	1
Concentration	3016.561	3502.153	5418.411	2247.078	3946.709	5602.685	1831.996
Circular Variance	1.66E-04	1.43E-04	9.23E-05	2.23E-04	1.27E-04	8.92E-05	2.73E-04
Circular Standard Deviation	1.043°	0.968°	0.778°	1.209°	0.912°	0.765°	1.339°
95% Confidence Interval (-/+) for μ	8:40 PM	9:07 PM	10:17 PM	10:40 PM	10:50 PM	8:07 PM	12:47 AM
	8:42 PM	9:10 PM	10:19 PM	10:43 PM	10:52 PM	8:09 PM	12:49 AM
99% Confidence Interval (-/+) for μ	8:40 PM	9:06 PM	10:16 PM	10:39 PM	10:49 PM	8:06 PM	12:46 AM
	8:42 PM	9:10 PM	10:19 PM	10:44 PM	10:53 PM	8:09 PM	12:50 AM
Rayleigh Test (Z)	54.982	27.992	30.994	28.987	34.991	37.993	63.965
Rayleigh Test (p)	0	8.40E-12	0	3.43E-12	0	0	0
Rao's Spacing Test (U)	349.692	343.701	345.57	343.736	346.06	347.618	349.183
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	4.556	2.352	2.608	2.423	2.929	3.184	5.263
Watson's U^2 Test (p)	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Kuiper's Test (Uniform, V)	7.524	5.439	5.721	5.525	6.05	6.307	8.067
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Subgroup	T091	T092	T094	T095	T096	T097	T099
Number of Observations	40	49	39	40	33	53	84
Mean Vector (μ)	11:55 PM	11:20 PM	9:35 PM	8:00 PM	11:03 PM	12:50 AM	1:54 AM
Length of Mean Vector (r)	1	1	1	1	1	1	1
Concentration	1830.46	2510.94	2802.924	3091.788	3460.233	1662.509	1640.598
Circular Variance	2.73E-04	1.99E-04	1.78E-04	1.62E-04	1.45E-04	3.01E-04	3.05E-04
Circular Standard Deviation	1.339°	1.144°	1.082°	1.031°	0.974°	1.405°	1.415°
95% Confidence Interval (-/+) for μ	11:53 PM	11:18 PM	9:33 PM	7:59 PM	11:02 PM	12:48 AM	1:53 AM
	11:56 PM	11:21 PM	9:36 PM	8:02 PM	11:05 PM	12:51 AM	1:55 AM
99% Confidence Interval (-/+) for μ	11:53 PM	11:18 PM	9:33 PM	7:59 PM	11:02 PM	12:48 AM	1:53 AM
	11:57 PM	11:21 PM	9:36 PM	8:02 PM	11:05 PM	12:52 AM	1:56 AM
Rayleigh Test (Z)	39.978	48.98	38.986	39.987	32.99	52.968	83.949
Rayleigh Test (p)	0	0	0	0	0	0	0
Rao's Spacing Test (U)	345.821	348.603	347.436	347.579	345.783	348.066	349.948
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	3.312	4.058	3.246	3.331	2.762	4.362	6.876
Watson's U^2 Test (p)	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Kuiper's Test (Uniform, V)	6.424	7.108	6.379	6.456	5.887	7.361	9.197
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Subgroup	T100	T101	T103	T104	T105	T106	T107
Number of Observations	55	35	27	69	37	16	32
Mean Vector (μ)	8:22 PM	10:13 PM	10:24 PM	12:43 AM	10:11 PM	9:08 PM	11:30 PM
Length of Mean Vector (r)	1	1	1	1	1	1	1
Concentration	3584.026	3225.377	4563.525	1833.281	2357.778	6048.297	2992.983
Circular Variance	1.40E-04	1.55E-04	1.10E-04	2.73E-04	2.12E-04	8.27E-05	1.67E-04
Circular Standard Deviation	0.957°	1.009°	0.848°	1.338°	1.18°	0.737°	1.047°
95% Confidence Interval (-/+) for μ	8:21 PM	10:12 PM	10:22 PM	12:42 AM	10:09 PM	9:07 PM	11:29 PM
	8:23 PM	10:14 PM	10:25 PM	12:45 AM	10:12 PM	9:10 PM	11:32 PM
99% Confidence Interval (-/+) for μ	8:21 PM	10:11 PM	10:22 PM	12:42 AM	10:09 PM	9:06 PM	11:28 PM
	8:24 PM	10:15 PM	10:25 PM	12:45 AM	10:13 PM	9:10 PM	11:32 PM
Rayleigh Test (Z)	54.985	34.989	26.994	68.962	36.984	15.997	31.989
Rayleigh Test (p)	0	0	2.05E-11	0	0	1.95E-07	0
Rao's Spacing Test (U)	349.909	346.173	343.821	349.512	346.366	335.046	344.787
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	4.563	2.923	2.276	5.667	3.076	1.375	2.676
Watson's U^2 Test (p)	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Kuiper's Test (Uniform, V)	7.529	6.052	5.355	8.366	6.209	4.186	5.79
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Subgroup	T108	T109	T110	T111	T112	T113	T114
Number of Observations	24	30	22	64	34	93	40
Mean Vector (μ)	11:21 PM	11:33 PM	11:31 PM	11:41 PM	10:36 PM	8:27 PM	7:57 PM
Length of Mean Vector (r)	1	1	1	1	1	1	1
Concentration	5055.111	3217.827	5590.566	3157.012	1296.248	1230.078	5243.051
Circular Variance	9.89E-05	1.55E-04	8.94E-05	1.58E-04	3.86E-04	4.07E-04	9.54E-05
Circular Standard Deviation	0.806°	1.01°	0.766°	1.02°	1.592°	1.634°	0.791°
95% Confidence Interval (-/+) for μ	11:20 PM	11:31 PM	11:29 PM	11:40 PM	10:34 PM	8:25 PM	7:56 PM
	11:23 PM	11:34 PM	11:32 PM	11:42 PM	10:38 PM	8:28 PM	7:58 PM
99% Confidence Interval (-/+) for μ	11:20 PM	11:31 PM	11:29 PM	11:39 PM	10:33 PM	8:25 PM	7:56 PM
	11:23 PM	11:35 PM	11:32 PM	11:42 PM	10:39 PM	8:28 PM	7:58 PM
Rayleigh Test (Z)	23.995	29.991	21.996	63.98	33.974	92.924	39.992
Rayleigh Test (p)	2.89E-10	1.38E-12	1.62E-09	0	0	0	0
Rao's Spacing Test (U)	342.287	343.842	340.87	349.512	343.362	350.371	348.433
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	2.031	2.515	1.868	5.294	2.81	7.573	3.346
Watson's U^2 Test (p)	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Kuiper's Test (Uniform, V)	5.065	5.61	4.859	8.074	5.926	9.666	6.471
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Subgroup	T116	T117	T118	T119	T120	T121	T122
Number of Observations	43	52	58	58	80	23	62
Mean Vector (μ)	10:52 PM	8:29 PM	8:12 PM	7:13 PM	9:16 PM	10:33 PM	8:56 PM
Length of Mean Vector (r)	1	1	1	1	1	1	1
Concentration	2394.158	2701.721	2639.775	4449.295	1265.812	3345.548	1922.667
Circular Variance	2.09E-04	1.85E-04	1.89E-04	1.12E-04	3.95E-04	1.49E-04	2.60E-04
Circular Standard Deviation	1.171°	1.102°	1.115°	0.859°	1.611°	0.991°	1.307°
95% Confidence Interval (-/+) for μ	10:50 PM	8:28 PM	8:11 PM	7:12 PM	9:15 PM	10:31 PM	8:55 PM
	10:53 PM	8:30 PM	8:13 PM	7:14 PM	9:17 PM	10:34 PM	8:58 PM
99% Confidence Interval (-/+) for μ	10:50 PM	8:27 PM	8:11 PM	7:12 PM	9:14 PM	10:30 PM	8:55 PM
	10:54 PM	8:31 PM	8:14 PM	7:14 PM	9:18 PM	10:35 PM	8:58 PM
Rayleigh Test (Z)	42.982	51.981	57.978	57.987	79.937	22.993	61.968
Rayleigh Test (p)	0	0	0	0	0	6.88E-10	0
Rao's Spacing Test (U)	347.053	349.273	349.71	350.385	349.929	340.748	348.644
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	3.567	4.305	4.794	4.818	6.526	1.942	5.105
Watson's U^2 Test (p)	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Kuiper's Test (Uniform, V)	6.663	7.321	7.714	7.728	8.985	4.951	7.935
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Subgroup	T123	T124	T125	T126	T127	T129	T130
Number of Observations	54	18	25	13	23	58	41
Mean Vector (μ)	6:34 PM	7:58 PM	6:54 PM	10:37 PM	6:59 PM	6:54 PM	9:31 PM
Length of Mean Vector (r)	1	1	1	1	1	1	1
Concentration	2514.953	8273.177	4813.104	4660.157	6853.662	3133.296	2277.352
Circular Variance	1.99E-04	6.04E-05	1.04E-04	8.39E-05	7.30E-05	1.60E-04	2.20E-04
Circular Standard Deviation	1.143°	0.63°	0.826°	0.742°	0.692°	1.024°	1.201°
95% Confidence Interval (-/+) for μ	6:33 PM	7:57 PM	6:53 PM	10:35 PM	6:58 PM	6:53 PM	9:30 PM
	6:36 PM	8:00 PM	6:56 PM	10:39 PM	7:01 PM	6:55 PM	9:33 PM
99% Confidence Interval (-/+) for μ	6:33 PM	7:57 PM	6:53 PM	10:35 PM	6:58 PM	6:53 PM	9:29 PM
	6:36 PM	8:00 PM	6:56 PM	10:39 PM	7:01 PM	6:55 PM	9:33 PM
Rayleigh Test (Z)	53.979	17.998	24.995	12.998	22.997	57.981	40.982
Rayleigh Test (p)	0	4.31E-08	1.20E-10	1.25E-06	6.86E-10	0	0
Rao's Spacing Test (U)	349.204	337.817	342.954	329.908	341.794	350.056	347.274
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	4.465	1.543	2.112	1.126	1.953	4.803	3.402
Watson's U^2 Test (p)	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Kuiper's Test (Uniform, V)	7.45	4.427	5.165	3.802	4.965	7.721	6.523
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Subgroup	T131	T132	T133	T134	T135	T137	T138
Number of Observations	30	41	12	2	8	6	1
Mean Vector (μ)	10:23 PM	8:58 PM	7:53 PM	8:40 PM	10:53 AM	6:37 PM	8:06 PM
Length of Mean Vector (r)	1	1	1	1	1	1	1
Concentration	2831.077	3986.291	3447.521	240.36	4345.792	*****	*****
Circular Variance	1.77E-04	1.25E-04	1.11E-04	2.08E-04	7.59E-05	*****	*****
Circular Standard Deviation	1.077°	0.908°	0.854°	1.169°	0.706°	*****	*****
95% Confidence Interval (-/+) for μ	10:22 PM	8:57 PM	7:51 PM	8:19 PM	10:50 AM	*****	*****
	10:25 PM	9:00 PM	7:55 PM	9:00 PM	10:55 AM	*****	*****
99% Confidence Interval (-/+) for μ	10:21 PM	8:57 PM	7:50 PM	8:13 PM	10:50 AM	*****	*****
	10:25 PM	9:00 PM	7:56 PM	9:07 PM	10:56 AM	*****	*****
Rayleigh Test (Z)	29.989	40.99	11.997	1.999	7.999	6	1
Rayleigh Test (p)	1.38E-12	0	1.75E-06	0.137	0	0	0.512
Rao's Spacing Test (U)	344.538	347.511	327.658	*****	313.092	299.475	*****
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	*****	< 0.01	< 0.01	*****
Watson's U^2 Test (Uniform, U^2)	2.511	3.421	1.044	*****	*****	*****	*****
Watson's U^2 Test (p)	< 0.005	< 0.005	< 0.005	*****	*****	*****	*****
Kuiper's Test (Uniform, V)	5.621	6.528	3.664	1.728	3.052	2.699	1.395
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	0.10 > p > 0.05	< 0.01	< 0.01	> 0.15

Subgroup	T139	T140	T142	T143	T144	T146	T147
Number of Observations	1	7	2	27	8	1	5
Mean Vector (μ)	5:19 PM	5:35 PM	8:19 PM	12:16 PM	4:46 AM	5:21 PM	8:59 PM
Length of Mean Vector (r)	1	1	1	1	1	1	1
Concentration	*****	4630.392	*****	7297.291	6337.036	*****	1267.732
Circular Variance	*****	6.66E-05	*****	6.85E-05	5.20E-05	*****	1.94E-04
Circular Standard Deviation	*****	0.661°	*****	0.671°	0.585°	*****	1.129°
95% Confidence Interval (-/+) for μ	*****	5:33 PM	*****	12:15 PM	4:44 AM	*****	8:54 PM
	*****	5:38 PM	*****	12:17 PM	4:48 AM	*****	9:05 PM
99% Confidence Interval (-/+) for μ	*****	5:32 PM	*****	12:15 PM	4:43 AM	*****	8:52 PM
	*****	5:39 PM	*****	12:18 PM	4:48 AM	*****	9:07 PM
Rayleigh Test (Z)	1	6.999	2	26.996	7.999	1	4.998
Rayleigh Test (p)	0.512	0	0.137	2.05E-11	0	0.512	0.001
Rao's Spacing Test (U)	*****	306.351	*****	344.112	313.362	*****	284.667
Rao's Spacing Test (p)	*****	< 0.01	*****	< 0.01	< 0.01	*****	< 0.01
Watson's U^2 Test (Uniform, U^2)	*****	*****	*****	2.284	*****	*****	*****
Watson's U^2 Test (p)	*****	*****	*****	< 0.005	*****	*****	*****
Kuiper's Test (Uniform, V)	1.395	2.874	1.738	5.359	3.054	1.395	2.475
Kuiper's Test (p)	> 0.15	< 0.01	0.10 > p > 0.05	< 0.01	< 0.01	> 0.15	< 0.01

Subgroup	T148	T149	T150	T151	T152	T153	T154
Number of Observations	1	3	3	8	6	15	2
Mean Vector (μ)	9:53 PM	8:09 PM	9:12 PM	8:12 PM	8:43 PM	11:28 PM	10:50 PM
Length of Mean Vector (r)	1	1	1	1	1	1	1
Concentration	*****	*****	1897.114	4050.644	1996.6	1564.743	*****
Circular Variance	*****	*****	7.03E-05	8.14E-05	1.41E-04	2.59E-04	*****
Circular Standard Deviation	*****	*****	0.679°	0.731°	0.962°	1.303°	*****
95% Confidence Interval (-/+) for μ	*****	*****	9:06 PM	8:10 PM	8:39 PM	11:25 PM	*****
	*****	*****	9:18 PM	8:15 PM	8:47 PM	11:31 PM	*****
99% Confidence Interval (-/+) for μ	*****	*****	9:04 PM	8:09 PM	8:38 PM	11:24 PM	*****
	*****	*****	9:20 PM	8:16 PM	8:49 PM	11:32 PM	*****
Rayleigh Test (Z)	1	3	3	7.999	5.998	14.992	2
Rayleigh Test (p)	0.512	0.033	0.033	0	0	3.92E-07	0.137
Rao's Spacing Test (U)	*****	*****	*****	312.992	297.529	332.875	*****
Rao's Spacing Test (p)	*****	*****	*****	< 0.01	< 0.01	< 0.01	*****
Watson's U^2 Test (Uniform, U^2)	*****	*****	*****	*****	*****	1.28	*****
Watson's U^2 Test (p)	*****	*****	*****	*****	*****	< 0.005	*****
Kuiper's Test (Uniform, V)	1.395	2.025	2.017	3.051	2.684	4.054	1.737
Kuiper's Test (p)	> 0.15	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.10 > p > 0.05

Subgroup	T155	T156	T157	T158	T159	T160	T161
Number of Observations	4	17	4	7	27	2	4
Mean Vector (μ)	10:26 PM	1:44 AM	8:22 PM	9:29 AM	6:09 PM	4:26 PM	12:27 AM
Length of Mean Vector (r)	1	1	1	1	1	1	1
Concentration	2252.947	1961.258	1974.01	2731.83	5249.648	*****	*****
Circular Variance	8.81E-05	2.55E-04	1.01E-04	1.13E-04	9.52E-05	*****	*****
Circular Standard Deviation	0.761°	1.294°	0.813°	0.861°	0.791°	*****	*****
95% Confidence Interval (-/+) for μ	10:21 PM	1:42 AM	8:16 PM	9:26 AM	6:08 PM	*****	*****
	10:31 PM	1:47 AM	8:27 PM	9:32 AM	6:11 PM	*****	*****
99% Confidence Interval (-/+) for μ	10:20 PM	1:41 AM	8:15 PM	9:25 AM	6:08 PM	*****	*****
	10:32 PM	1:48 AM	8:28 PM	9:33 AM	6:11 PM	*****	*****
Rayleigh Test (Z)	3.999	16.991	3.999	6.998	26.995	2	4
Rayleigh Test (p)	0.007	9.36E-08	0.007	0	2.05E-11	0.137	0.007
Rao's Spacing Test (U)	268.079	335.136	268.004	306.384	344.1	*****	269.288
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	*****	< 0.01
Watson's U^2 Test (Uniform, U^2)	*****	1.443	*****	*****	2.279	*****	*****
Watson's U^2 Test (p)	*****	< 0.005	*****	*****	< 0.005	*****	*****
Kuiper's Test (Uniform, V)	2.263	4.292	2.262	2.874	5.359	1.737	2.27
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.10 > p > 0.05	< 0.01

Subgroup	T162	T163	T164	T167	T168	T169	T170
Number of Observations	4	7	2	7	15	1	13
Mean Vector (μ)	10:38 AM	2:00 AM	12:47 PM	7:30 PM	1:49 PM	8:06 PM	9:13 AM
Length of Mean Vector (r)	1	1	1	1	0.97	1	1
Concentration	871.704	*****	*****	5440.942	13.87	*****	2702.274
Circular Variance	2.28E-04	*****	*****	5.67E-05	0.03	*****	1.45E-04
Circular Standard Deviation	1.223°	*****	*****	0.61°	14.053°	*****	0.975°
95% Confidence Interval (-/+) for μ	10:31 AM	*****	*****	7:28 PM	1:17 PM	*****	9:10 AM
	10:46 AM	*****	*****	7:33 PM	2:20 PM	*****	9:15 AM
99% Confidence Interval (-/+) for μ	10:28 AM	*****	*****	7:27 PM	1:07 PM	*****	9:10 AM
	10:48 AM	*****	*****	7:33 PM	2:30 PM	*****	9:16 AM
Rayleigh Test (Z)	3.998	7	2	6.999	14.124	1	12.996
Rayleigh Test (p)	0.007	0	0.137	0	5.65E-07	0.512	1.25E-06
Rao's Spacing Test (U)	267.054	308.192	*****	306.721	309.804	*****	329.112
Rao's Spacing Test (p)	< 0.01	< 0.01	*****	< 0.01	< 0.01	*****	< 0.01
Watson's U^2 Test (Uniform, U^2)	*****	*****	*****	*****	1.162	*****	1.123
Watson's U^2 Test (p)	*****	*****	*****	*****	< 0.005	*****	< 0.005
Kuiper's Test (Uniform, V)	2.256	2.888	1.738	2.877	3.792	1.395	3.793
Kuiper's Test (p)	< 0.01	< 0.01	0.10 > p > 0.05	< 0.01	< 0.01	> 0.15	< 0.01

Subgroup	T171	T174	T175	T176	T179	T180	T181
Number of Observations	2	4	1	2	1	32	64
Mean Vector (μ)	8:11 PM	8:04 PM	8:07 PM	8:40 PM	5:24 PM	6:45 PM	8:43 PM
Length of Mean Vector (r)	1	1	1	1	1	1	1
Concentration	388.945	*****	*****	*****	*****	3183.528	2183.337
Circular Variance	1.29E-04	*****	*****	*****	*****	1.57E-04	2.29E-04
Circular Standard Deviation	0.919°	*****	*****	*****	*****	1.016°	1.226°
95% Confidence Interval (-/+) for μ	7:55 PM	*****	*****	*****	*****	6:44 PM	8:42 PM
	8:28 PM	*****	*****	*****	*****	6:47 PM	8:44 PM
99% Confidence Interval (-/+) for μ	7:50 PM	*****	*****	*****	*****	6:43 PM	8:42 PM
	8:33 PM	*****	*****	*****	*****	6:47 PM	8:45 PM
Rayleigh Test (Z)	1.999	4	1	2	1	31.99	63.971
Rayleigh Test (p)	0.137	0.007	0.512	0.137	0.512	0	0
Rao's Spacing Test (U)	*****	269.133	*****	*****	*****	345.579	350.292
Rao's Spacing Test (p)	*****	< 0.01	*****	*****	*****	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	*****	*****	*****	*****	*****	2.68	5.273
Watson's U^2 Test (p)	*****	*****	*****	*****	*****	< 0.005	< 0.005
Kuiper's Test (Uniform, V)	1.73	2.27	1.395	1.739	1.395	5.803	8.092
Kuiper's Test (p)	0.10 > p > 0.05	< 0.01	> 0.15	0.10 > p > 0.05	> 0.15	< 0.01	< 0.01

Subgroup	T182	T183	T184	T185	T186	T187	T188
Number of Observations	41	57	27	40	65	38	69
Mean Vector (μ)	7:09 PM	8:15 PM	11:13 PM	7:01 PM	9:45 PM	7:26 PM	11:20 PM
Length of Mean Vector (r)	1	1	1	1	1	1	1
Concentration	5990.66	3421.578	5954.223	4011.535	2456.817	5188.189	1409.349
Circular Variance	8.35E-05	1.46E-04	8.40E-05	1.25E-04	2.04E-04	9.64E-05	3.55E-04
Circular Standard Deviation	0.74°	0.98°	0.743°	0.905°	1.156°	0.795°	1.526°
95% Confidence Interval (-/+) for μ	7:08 PM	8:14 PM	11:12 PM	6:59 PM	9:44 PM	7:25 PM	11:18 PM
	7:10 PM	8:16 PM	11:15 PM	7:02 PM	9:46 PM	7:27 PM	11:21 PM
99% Confidence Interval (-/+) for μ	7:07 PM	8:14 PM	11:12 PM	6:59 PM	9:43 PM	7:25 PM	11:18 PM
	7:10 PM	8:16 PM	11:15 PM	7:02 PM	9:46 PM	7:28 PM	11:21 PM
Rayleigh Test (Z)	40.993	56.983	26.995	39.99	64.974	37.993	68.951
Rayleigh Test (p)	0	0	2.05E-11	0	0	0	0
Rao's Spacing Test (U)	348.461	350.113	343.558	348.046	350.149	347.614	349.383
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	3.432	4.725	2.281	3.339	5.361	3.182	5.647
Watson's U^2 Test (p)	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Kuiper's Test (Uniform, V)	6.545	7.66	5.351	6.464	8.148	6.307	8.363
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Subgroup	T189	T190	T191	T193	T195	T196	T197
Number of Observations	27	97	36	29	69	36	45
Mean Vector (μ)	10:52 PM	2:53 AM	10:43 PM	11:34 PM	11:49 PM	11:55 PM	10:14 PM
Length of Mean Vector (r)	1	1	1	1	1	1	1
Concentration	2050.57	1471.651	2847.117	4482.018	1735.966	3380.994	2130.977
Circular Variance	2.44E-04	3.40E-04	1.76E-04	1.12E-04	2.88E-04	1.48E-04	2.35E-04
Circular Standard Deviation	1.265°	1.494°	1.074°	0.856°	1.375°	0.985°	1.241°
95% Confidence Interval (-/+) for μ	10:50 PM	2:52 AM	10:41 PM	11:33 PM	11:47 PM	11:53 PM	10:13 PM
	10:54 PM	2:54 AM	10:44 PM	11:35 PM	11:50 PM	11:56 PM	10:15 PM
99% Confidence Interval (-/+) for μ	10:49 PM	2:51 AM	10:41 PM	11:32 PM	11:47 PM	11:53 PM	10:12 PM
	10:54 PM	2:54 AM	10:44 PM	11:36 PM	11:50 PM	11:56 PM	10:16 PM
Rayleigh Test (Z)	26.987	96.934	35.987	28.994	68.96	35.989	44.979
Rayleigh Test (p)	2.06E-11	0	0	3.41E-12	0	0	0
Rao's Spacing Test (U)	342.417	350.034	345.962	344.453	349.666	346.713	347.688
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	2.257	7.918	3.001	2.439	5.663	3.007	3.724
Watson's U^2 Test (p)	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Kuiper's Test (Uniform, V)	5.334	9.854	6.126	5.536	8.37	6.138	6.816
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Subgroup	T199	T200	T201	T204	T205	T206	T207
Number of Observations	117	60	76	85	95	55	57
Mean Vector (μ)	2:02 AM	11:09 PM	1:05 PM	9:52 PM	1:30 AM	1:39 AM	12:40 AM
Length of Mean Vector (r)	0.999	1	0.98	1	1	1	1
Concentration	890.475	1332.798	25.191	2348.95	1503.578	2420.312	2652.024
Circular Variance	5.62E-04	3.75E-04	0.02	2.13E-04	3.33E-04	2.07E-04	1.89E-04
Circular Standard Deviation	1.921°	1.57°	11.533°	1.182°	1.478°	1.165°	1.113°
95% Confidence Interval (-/+) for μ	2:01 AM	11:08 PM	12:54 PM	9:51 PM	1:29 AM	1:38 AM	12:39 AM
	2:04 AM	11:11 PM	1:15 PM	9:53 PM	1:32 AM	1:40 AM	12:41 AM
99% Confidence Interval (-/+) for μ	2:00 AM	11:07 PM	12:51 PM	9:50 PM	1:29 AM	1:38 AM	12:39 AM
	2:04 AM	11:11 PM	1:18 PM	9:53 PM	1:32 AM	1:41 AM	12:42 AM
Rayleigh Test (Z)	116.869	59.955	72.982	84.964	94.937	54.977	56.979
Rayleigh Test (p)	0	0	0	0	0	0	0
Rao's Spacing Test (U)	349.723	347.354	312.622	350.969	351.011	348.78	349.213
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	9.457	4.914	5.323	6.988	7.757	4.545	4.713
Watson's U^2 Test (p)	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Kuiper's Test (Uniform, V)	10.774	7.786	7.756	9.275	9.783	7.505	7.641
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Subgroup	T208	T209	T210	T211	T212	T213	T214
Number of Observations	61	27	42	32	34	48	30
Mean Vector (μ)	11:08 PM	9:28 PM	12:00 AM	10:34 PM	9:30 PM	9:01 PM	9:29 PM
Length of Mean Vector (r)	1	1	1	1	1	1	1
Concentration	1960.522	2703.497	3295.431	1915.582	2464.636	4115.338	3460.209
Circular Variance	2.55E-04	1.85E-04	1.52E-04	2.61E-04	2.03E-04	1.22E-04	1.45E-04
Circular Standard Deviation	1.294°	1.102°	0.998°	1.309°	1.154°	0.893°	0.974°
95% Confidence Interval (-/+) for μ	11:07 PM	9:26 PM	11:59 PM	10:32 PM	9:28 PM	9:00 PM	9:27 PM
	11:09 PM	9:30 PM	12:02 AM	10:35 PM	9:31 PM	9:02 PM	9:30 PM
99% Confidence Interval (-/+) for μ	11:06 PM	9:26 PM	11:59 PM	10:31 PM	9:28 PM	9:00 PM	9:27 PM
	11:10 PM	9:30 PM	12:02 AM	10:36 PM	9:32 PM	9:02 PM	9:31 PM
Rayleigh Test (Z)	60.969	26.99	41.987	31.983	33.986	47.988	29.991
Rayleigh Test (p)	0	2.06E-11	0	0	0	0	1.38E-12
Rao's Spacing Test (U)	349.011	342.867	347.099	343.671	345.074	348.992	344.787
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	5.022	2.264	3.497	2.663	2.834	3.996	2.516
Watson's U^2 Test (p)	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Kuiper's Test (Uniform, V)	7.883	5.34	6.593	5.772	5.954	7.048	5.625
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Subgroup	T215	T218	T219	T220	T221	T222	T223
Number of Observations	49	71	53	56	28	110	122
Mean Vector (μ)	10:18 PM	7:50 PM	11:02 PM	7:33 PM	10:32 PM	3:58 AM	2:32 AM
Length of Mean Vector (r)	1	1	1	1	1	1	0.999
Concentration	2562.319	2935.538	1868.074	3048.753	3036.749	1087.904	698.871
Circular Variance	1.95E-04	1.70E-04	2.68E-04	1.64E-04	1.65E-04	4.60E-04	7.16E-04
Circular Standard Deviation	1.132°	1.058°	1.326°	1.038°	1.04°	1.738°	2.168°
95% Confidence Interval (-/+) for μ	10:17 PM	7:49 PM	11:01 PM	7:32 PM	10:30 PM	3:57 AM	2:30 AM
	10:20 PM	7:50 PM	11:04 PM	7:34 PM	10:33 PM	4:00 AM	2:33 AM
99% Confidence Interval (-/+) for μ	10:17 PM	7:48 PM	11:00 PM	7:32 PM	10:30 PM	3:57 AM	2:30 AM
	10:20 PM	7:51 PM	11:04 PM	7:35 PM	10:34 PM	4:00 AM	2:34 AM
Rayleigh Test (Z)	48.981	70.976	52.972	55.982	27.991	109.899	121.825
Rayleigh Test (p)	0	0	0	0	8.41E-12	0	0
Rao's Spacing Test (U)	348.486	351.109	348.491	349.651	343.647	350.686	348.303
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	4.059	5.862	4.368	4.638	2.349	8.927	9.813
Watson's U^2 Test (p)	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Kuiper's Test (Uniform, V)	7.106	8.518	7.37	7.587	5.439	10.487	10.949
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Subgroup	T224	T225	T226	T227	T228	T229	T230
Number of Observations	20	88	107	33	63	98	40
Mean Vector (μ)	11:30 PM	9:58 PM	12:55 AM	9:08 PM	12:26 AM	1:10 AM	11:00 PM
Length of Mean Vector (r)	1	1	0.999	1	1	1	1
Concentration	1732.572	1946.561	980.252	2091.628	2228.97	1186.761	1620.517
Circular Variance	2.89E-04	2.57E-04	5.10E-04	2.39E-04	2.24E-04	4.21E-04	3.09E-04
Circular Standard Deviation	1.377°	1.299°	1.83°	1.253°	1.214°	1.664°	1.424°
95% Confidence Interval (-/+) for μ	11:28 PM	9:56 PM	12:54 AM	9:07 PM	12:24 AM	1:09 AM	10:59 PM
	11:32 PM	9:59 PM	12:57 AM	9:10 PM	12:27 AM	1:11 AM	11:02 PM
99% Confidence Interval (-/+) for μ	11:27 PM	9:56 PM	12:53 AM	9:06 PM	12:24 AM	1:08 AM	10:58 PM
	11:33 PM	9:59 PM	12:57 AM	9:10 PM	12:27 AM	1:12 AM	11:03 PM
Rayleigh Test (Z)	19.988	87.955	106.891	32.984	62.972	97.917	39.975
Rayleigh Test (p)	8.68E-09	0	0	0	0	0	0
Rao's Spacing Test (U)	337.488	351.409	349.661	344.558	349.698	349.868	345.904
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	1.684	7.215	8.67	2.747	5.192	7.972	3.305
Watson's U^2 Test (p)	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Kuiper's Test (Uniform, V)	4.622	9.442	10.318	5.867	8.019	9.898	6.425
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Subgroup	T231	T232	T233	T234	T235	T236	T237
Number of Observations	21	35	67	40	39	16	20
Mean Vector (μ)	11:01 PM	9:35 PM	1:38 AM	11:19 PM	10:32 PM	11:31 PM	9:10 PM
Length of Mean Vector (r)	1	1	1	1	1	1	1
Concentration	7123.796	4077.415	1592.358	2311.401	1222.783	3095.983	5214.753
Circular Variance	7.02E-05	1.23E-04	3.14E-04	2.16E-04	4.09E-04	1.62E-04	9.59E-05
Circular Standard Deviation	0.679°	0.897°	1.436°	1.192°	1.639°	1.03°	0.793°
95% Confidence Interval (-/+) for μ	11:00 PM	9:34 PM	1:36 AM	11:18 PM	10:30 PM	11:29 PM	9:09 PM
	11:02 PM	9:37 PM	1:39 AM	11:21 PM	10:34 PM	11:33 PM	9:11 PM
99% Confidence Interval (-/+) for μ	10:59 PM	9:34 PM	1:36 AM	11:17 PM	10:29 PM	11:28 PM	9:08 PM
	11:02 PM	9:37 PM	1:40 AM	11:21 PM	10:34 PM	11:33 PM	9:12 PM
Rayleigh Test (Z)	20.997	34.991	66.958	39.983	38.968	15.995	19.996
Rayleigh Test (p)	3.76E-09	0	0	0	0	1.95E-07	8.63E-09
Rao's Spacing Test (U)	340.615	346.16	349.506	346.958	345.378	334.204	339.425
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	1.788	2.93	5.494	3.321	3.211	1.367	1.702
Watson's U^2 Test (p)	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Kuiper's Test (Uniform, V)	4.76	6.051	8.251	6.444	6.342	4.176	4.647
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Subgroup	T238	T239	T240	T241	T242	T243	T244
Number of Observations	60	48	103	36	40	30	88
Mean Vector (μ)	11:44 PM	7:33 PM	11:50 AM	10:57 PM	9:26 PM	11:29 PM	12:22 AM
Length of Mean Vector (r)	1	1	0.975	1	1	1	1
Concentration	3029.968	4277.1	20.349	4135.459	1760.272	2712.077	1023.791
Circular Variance	1.65E-04	1.17E-04	0.025	1.21E-04	2.84E-04	1.84E-04	4.89E-04
Circular Standard Deviation	1.041°	0.876°	12.864°	0.891°	1.366°	1.1°	1.791°
95% Confidence Interval (-/+) for μ	11:43 PM	7:32 PM	11:40 AM	10:56 PM	9:25 PM	11:27 PM	12:21 AM
	11:45 PM	7:34 PM	12:00 PM	10:58 PM	9:28 PM	11:30 PM	12:24 AM
99% Confidence Interval (-/+) for μ	11:42 PM	7:32 PM	11:37 AM	10:56 PM	9:24 PM	11:27 PM	12:20 AM
	11:45 PM	7:34 PM	12:03 PM	10:59 PM	9:29 PM	11:31 PM	12:24 AM
Rayleigh Test (Z)	59.98	47.989	97.937	35.991	39.977	29.989	87.914
Rayleigh Test (p)	0	0	0	0	0	1.38E-12	0
Rao's Spacing Test (U)	350.046	349.538	324.152	346.729	346.188	343.692	348.913
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Watson's U^2 Test (Uniform, U^2)	4.964	3.996	7.049	3.012	3.31	2.512	7.147
Watson's U^2 Test (p)	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Kuiper's Test (Uniform, V)	7.845	7.059	9.226	6.139	6.43	5.608	9.376
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Subgroup	T245	T246	T247	T248	T249	T250	
Number of Observations	30	55	49	5	2	1	
Mean Vector (μ)	8:02 PM	9:06 PM	10:41 PM	10:10 PM	8:39 PM	10:39 PM	
Length of Mean Vector (r)	1	1	1	1	1	1	
Concentration	4865.764	1890.288	1676.716	*****	447.792	*****	
Circular Variance	1.03E-04	2.65E-04	2.98E-04	*****	1.12E-04	*****	
Circular Standard Deviation	0.821°	1.318°	1.399°	*****	0.856°	*****	
95% Confidence Interval (-/+) for μ	8:01 PM	9:05 PM	10:39 PM	*****	8:24 PM	*****	
	8:03 PM	9:08 PM	10:43 PM	*****	8:55 PM	*****	
99% Confidence Interval (-/+) for μ	8:01 PM	9:05 PM	10:39 PM	*****	8:20 PM	*****	
	8:04 PM	9:08 PM	10:43 PM	*****	8:59 PM	*****	
Rayleigh Test (Z)	29.994	54.971	48.971	5	2	1	
Rayleigh Test (p)	1.38E-12	0	0	0.001	0.137	0.512	
Rao's Spacing Test (U)	344.925	348.596	347.02	287.717	*****	*****	
Rao's Spacing Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	*****	*****	
Watson's U^2 Test (Uniform, U^2)	2.524	4.531	4.038	*****	*****	*****	
Watson's U^2 Test (p)	< 0.005	< 0.005	< 0.005	*****	*****	*****	
Kuiper's Test (Uniform, V)	5.628	7.501	7.077	2.496	1.731	1.395	
Kuiper's Test (p)	< 0.01	< 0.01	< 0.01	< 0.01	0.10 > p > 0.05	> 0.15	

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
June 2013	Final report	

4. TITLE AND SUBTITLE

Two-Dimensional (2-D) Acoustic Fish Tracking at River Mile 85, Sacramento River, California

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

Philip T. Sandstrom, David L. Smith, and Brian Mulvey

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

See reverse.

8. PERFORMING ORGANIZATION REPORT NUMBER

ERDC/EL TR-13-7

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

U.S. Army Corps of Engineers
Washington, DC 20314-1000

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT

Fish behavior in response to levee repairs at River Mile 85.6 of the Sacramento River was monitored using 60 VR2W 180-kHz and 45 VR2W 69-kHz receivers to create a large scale, two-dimensional (2-D) positioning system. Research teams released 250 late-fall Chinook salmon smolts from Coleman National Fish Hatchery were released into the river near Knights Landing, California. Smolts were implanted with VEMCO V6 180-kHz acoustic tags. Other research teams released late-fall Chinook, steelhead trout, smallmouth bass, striped bass, green sturgeon, and white sturgeon tagged with 69.0-kHz equipment. A stretch of river that was approximately 750 × 90 m in size was monitored from January 13, 2011 until March 5, 2011. More than 7,000 2-D positions were calculated for 215 late-fall Chinook salmon released near the study site. The majority (88.8%) of smolts never came within 20 m of the levee repair site, and their tracks occurred in the channel or away from the levee repair site with individuals rapidly moving through the study site. The average transit time through the study site was 14 min 04 sec. No significant difference in the migratory rates of smolts released at different locations ($p = 0.084$). There was a strong diel component to the movement of juvenile Chinook salmon smolts at the study site ($p < 0.01$). A significant difference was observed in the survival rate of the smolts when they were grouped by size (<130 mm = small; >130 mm = large), but not by release date. The levee repair site did not appear to have a positive influence on smolt recruitment.

(Continued)

15. SUBJECT TERMS

Acoustic telemetry
Behavior
Chinook salmon
Levee repair
Sacramento River
Two-dimensional (2-D) tracks

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			19b. TELEPHONE NUMBER *(include area code)*
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED		189	

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) (Concluded).

ENVIRON
2200 Powell Street, Suite 700
Emeryville, CA 94608;
U.S. Army Engineer Research and Development Center
Environmental Laboratory
3909 Halls Ferry Road
Vicksburg, MS 39180-6199;
U.S. Army Engineer District, Sacramento
1325 J Street, Sacramento, CA 95814-2922

14. ABSTRACT (Concluded).

Many of the smolts that approached the repair site subsequently moved away from the area, and smolts detected within the levee repair area were not observed to have significantly longer transit times through the sit than fish that were observed in the channel or on the opposite bank ($p = 0.54$). A small number of individuals exhibited a searching or foraging behavior, and several of these individuals had a higher degree of variation in their bearings.