Fish Community Structure
In The
Lower Sevier River

2012 Sampling

For:

The Consolidated Sevier Bridge Reservoir Company
Delta, Utah

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Great Basin Environmental and Aquatics

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Table of Contents

List of Figures

List of Tables

List of Photos

Abstract

The southern leatherside chub (*Lepidomeda aliciae* formerly *Snyderichthys copei*) was historically found throughout the Sevier River Basin. Currently, the State of Utah lists the leatherside chub as a sensitive species. From the time of settlement the river has been used extensively for agricultural and municipal water. The demand for water has continued to grow throughout the west and the Sevier River basin is no exception. The demand for water, combined with the introduction of non-native species, has and will continue to impact the native fish community. This report builds upon a sampling regime that began in 1999 and continued until 2006 with the objective of determining the current status of the southern leatherside and the native fish community. The reach of interest stretches from the Sevier Bridge Dam downstream past Delta, Utah. From 1999 until 2006 the native fish numbers grew substantially with the non-native species marginally expanding numbers. The lower portion (below Delta, Utah upstream to Leamington, Utah) of the river was dominated by non-native while the upper (Leamington to Sevier Bridge Dam) was skewed towards native species during the 1999-2006 time frame. The sampling in 2012 showed a similar spatial distribution, but overall the density of native species was much lower then in 2005-06. Further, the 2012 ratio of non-native to native shows almost equality, whereas in the past ratios ranged from 1/1.7 upwards to 1/21. Southern leatherside chub were only captured at one location during 2012, indicating a reduction in distribution and numbers compared to the 2005-06 sample period. The causes of the reduction are not apparent but two possibilities can be suggested: variability in the flow regime such as high flow events or drought and ash and debris moving into the river after the Clay Spring fire of mid-summer 2012. The 2012 sampling and electroshocking does not definitively answer what factors are responsible for short-term or long term changes in the Lower Sevier river fish communities composition or population dynamics. It does provide additional basic data that could enhance future management decisions or sampling and research.

Introduction

The southern leatherside chub (*Lepidomeda aliciae* formerly *Gila copei*) was historically distributed throughout the Sevier basin, both above and below the Sevier Bridge Dam (Sigler and Sigler 1996, Wilson and Belk 1996). The leatherside is listed in the Utah Sensitive Species List (2011) as a species of special concern due to drought, the possibility of a declining population, fragmented and isolated populations, habitat alteration, and the introduction of non-native fish. The Utah Sensitive Species List (2011) defines the objective of the species of concern classification as a step towards implementing proactive management and preventing the listing of the southern leatherside as a federally threatened or endangered species. A federal listing could exacerbate the relationship between the interests of water users and the preservation, maintenance and enhancements of southern leatherside chub habitat and populations.

During the 2000s, the leatherside chub (*Gila copei*) was divided into two distinct species, a northern leatherside chub, *Lepidomeda copei,* and a southern leatherside chub species, *Lepidomeda aliciae,* (Dowling et al., 2002, Johnson et al., 2004). With the listing as a species of concern and the change in species designation, sampling was specifically directed towards the southern leatherside as well as the fish community at large. The emphasis was upon further defining the spatial distribution and the numbers of leathersides.

This report is part of an effort by the Sevier Bridge Reservoir Companies to continue building a baseline of fish community and physical attributes for the Lower Sevier River.

Methods

The electrofishing in the fall of 2012 used the following methods to collect and analyze data. Thirteen locations were sampled. We attempted to keep the methods and field work simple, yet sufficiently robust to ascertain the current state of the fish community. One should keep in mind that all field work is constrained by budget, weather, and unforeseen events (e.g. equipment failure). Data was analyzed in a manner that provided consistency with the work done previously by Utah State University.

Site Selection

The following criteria were used in site selection:

- Accessibility of the river.
- Minimize conflicts with land owners.
- The site, if possible, should closely correspond with a previously sampled location.
- The site can effectively be sampled (e.g. not hindered by depth and velocity).
- Sites are to include habitat that is representative of the greater reach (e.g. pools, riffle, runs, and the quantity of woody debris).
- The site can include areas impacted by water management practices and structures that may affect fish migration and quality of fish habitat (e.g. Central Canal Diversion structure).
- Sites should exhibit habitat that have potential for use by the southern leatherside chub. Sites with moderate water velocities, depth (Wilson and Belk 1996) and cover such as over hanging vegetation and woody debris (personal experience) were selected.

See Figure 1 for map of the site locations.

Site Locations

The Lower Sevier River for purposes of this report is defined as beginning at Conk Dam (2.0 miles downstream from Deseret, Utah) and proceeding upstream to the Sevier Bridge Dam. River miles are calculated beginning at Conk Dam (Conk Dam is 0.0 river miles). Each of the sites is assigned a river mile and a sub-reach. Table 1 has the 2012 site names, Universal Transverse Mercator (UTM) coordinates and a sub-reach designation. In Appendix A the location is also available in UTM and a polygon of each site is overlaid on NAIP 2011 imagery.

Table 1. Site locations and sub-reach.

Lower Sevier River Sampling, Fall 2012						
Count	Site Name		UTM's 12 N (NAD83) Easting	Northing	River Mile[1]	Sub Reach
1	Bunker Farm		363141.3	4360443.8	13.52	Lower
2	Flume		363392.1	4361259.4	14.90	
3	Powerline A, Below		365415.6	4361637.5	18.57	
4	Powerline B, Above		365773.8	4361441.2	18.87	
5	Rifle Range		370912.0	4362308.3	25.42	
6	Cement Plant A		396384.6	4379700.7	69.82	Upper
7	Cement Plant B		396282.9	4379936.6	69.99	
8	Central Canal Diversion		397500.6	4381283.9	71.64	
9	New Hwy 132	Backwater	400281.4	4382366.9	73.94	
		Main Channel	400284.2	4382354.5	73.95	
10	New Sevier Canyon	Main Channel	402544.5	4379185.4	78.68	
11		Side Channel	402557.2	4379219.8	78.68	
12	Mills Valley	Main Channel	409739.8	4371689.0	90.51	
13		Side Channel	409762.6	4371664.2	90.51	

[1]. River miles are calculated moving upriver from Conk Dam (354785.05E, 4349062.13N, 12N, NAD83)

General Description of the River Corridor

The river can be broken into distinct sections that correspond with riparian zone vegetation, river substrate, water usage, and land management practices or usage. We broke the Lower Sevier River into two sub-reaches.

Conk Dam to Leamington Utah

Lower Sub-Reach

From Conk Dam to Leamington, Utah, the riparian vegetation is dominated by the non-native species Russian olive (*Elaeagnus augustifolia*) and tamarisk (*Tamarix pentandra*). The upland vegetative overstory is mostly greasewood (*Sarcobatus vermiculatus*), saltbush, shadscale (*Atriplex sp.*) and sagebrush (*Artemisia sp.)* with the understory comprised of grasses, forbs, and other shrubs. Sand is the major substrate throughout this section of the river; a few areas have gravel with a limited amount of cobble. Land usage along the river corridor is mostly grazing with agricultural cropland concentrated around Delta and Lynndyl, Utah. Recreation in the form of fishing, hunting, boating, and camping is common. See Table 1 and Figure 1 for the site locations and those that are defined as being in the lower sub-reach.

Leamington, Utah to the Head of Sevier Canyon and Mills Valley

Upper Sub-reach

Moving upstream through Leamington and Sevier Canyons, tamarisk and Russian olive are reduced in extent and density and the uplands changes to a sagebrush/grassland interspersed with a pinion/juniper community in the canyon. The stands of tamarisk become reduced further up Sevier Canyon with some sections of the river having a very narrow corridor adjacent to the river. Substrates through the Leamington and Sevier Canyon reaches are comprised of gravels and cobbles with limited areas of sand. Grazing and recreation are the predominant land use in Leamington and Sevier Canyon; agricultural croplands are found at the lower through middle portions of Leamington Canyon. See

Table 1 and Figure 1 for the site locations and those that are defined as being in the upper sub-reach.

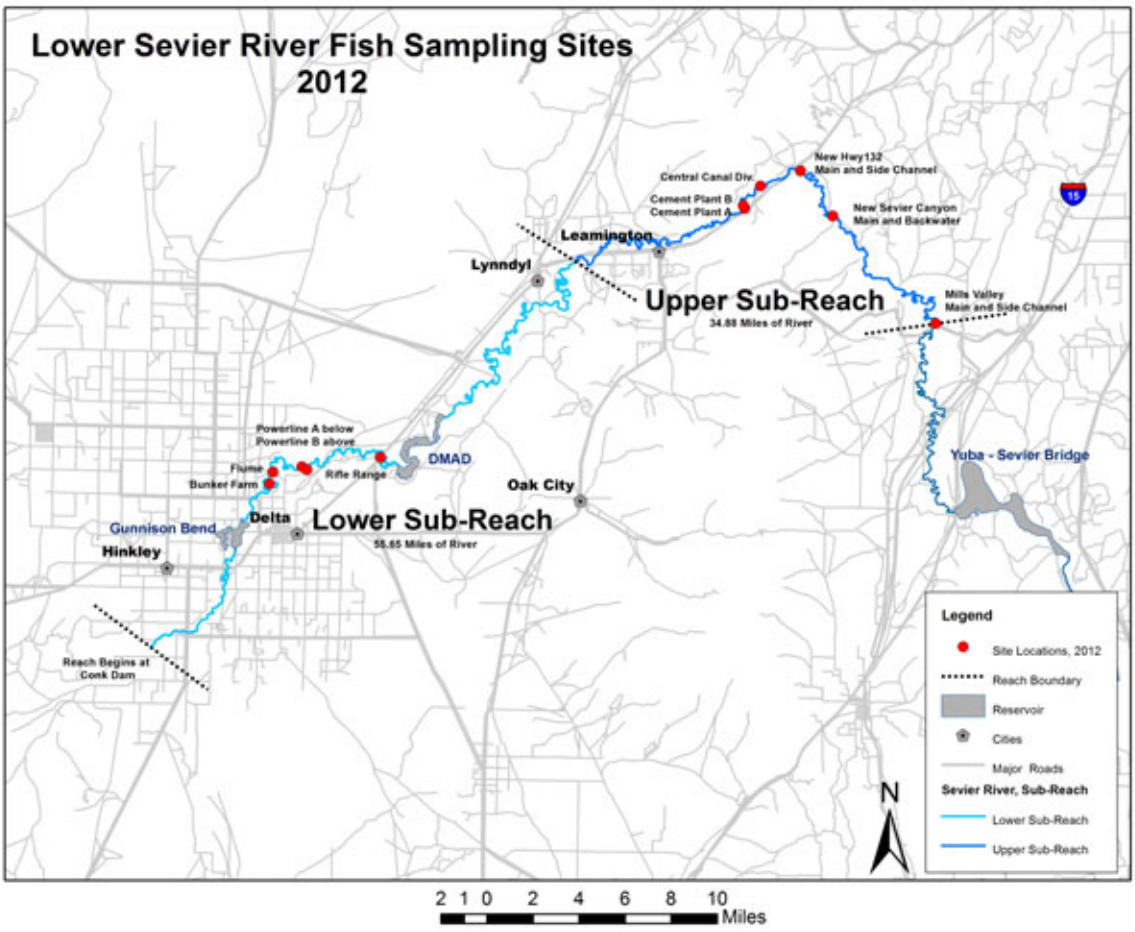


Figure 1. Map of the Lower Sevier River with sites and sub-reach boundaries.

Fish Sampling and Analysis

A Smith-Root VVP-15B electrofishing controller was used. The VVP-15 control unit was fitted into a plastic "barge" (94”L x 42”W x 14”H). The 240 volt ac was supplied by a 3500/4000 watt generator. Photo 1 and 2 show the "barge” being prepared and ready for use.

The sampling crew consisted of 4-6 people. One person controlled the "barge" and VVP-15 while the other members of the crew operated the pole electrodes, captured the fish using dip nets, and maintained block nets.

Fish were held after capture and during processing in 5-15 gallon containers. The water was refreshed in each container periodically to reduce stress and prevent the loss of fish during processing.

Photo 1. The electrofishing "barge" ready to use.

Photo 2. The electrofishing "barge" being prepared for use at the Mills Valley site.

Qualitative Sampling

All sampling in 2012 was a single pass. The procedure for qualitative sampling is as follows:

- A single pass with the electrofishing barge and dip nets.
- The sampling is done either moving upstream or downstream with or with out a block net.
- Block net usage was determined by past sampling methods at a given site, physical size of the site (i.e. stream width), if the size of substrate prevented effective use, and if a riffle or other feature was present at the upper or lower boundary.
- If the width or depth of a site prevented effective coverage only one side of the river was sampled at a time. Sampling was also keyed to fish holding structure such as woody debris on the portion sampled.

All sites in 2012 were sampled for the full wetted width of stream.

Identification, Enumeration, and Weighing

At each site the captured fish were enumerated, identified to species, and measured for total length (TL) to the nearest millimeter. Not all enumerated and measured fish were weighed. A representative sub-sample approach was used. Some non-native species were also not weighed. After processing all fish were released.

An Ohaus Scout Pro 400 was used to weigh fish to the nearest 0.1g for fish under 200g. Larger fish were weighed using Pesola spring scales. Some difficulty with wind and balance vibration was experienced. An attempt to prevent this by shielding failed at higher wind speeds, thus at times the weighing was stopped.

Relative Fish Density

A relative density of fish was calculated for each species captured at a site. This provides the ability to compare between locations and time, sample years, based upon a standardized unit of stream dimensions (10 meters of length) and numbers of captured fish. The thalweg longitudinal length was used. The following equation was used.

$$Density = \frac{LengthofSite / FishNumbers}{10m}$$

Throughout the rest of the report we use 10m length to designate relative density. We used the length of stream, instead of a defined square area or sampling time. Throughout much of the year surface area changes quickly, this is based upon water demand and the resulting change in flows. Site length easily measured at each site and remains consistent as a site attribute. The relative density is roughly comparable to the catch per unit of effort (CPUE) concept and can be used in conjunction with previous work done by USU.

Physical Attributes and Water Quality

The length of each site was measured with a 300' fiberglass surveyor style tape measure and a hand drawn field map produced to be used in conjunction with ESRI ArcGis software. Using Google Earth and the ESRI ArcGis software, each site was also delineated with a digitized polygon (Appendix A). The length of the site down the approximate thalwag, was measured using ArcGis for the relative density calculations.

The physical attributes of water temperature (C°), pH, dissolved oxygen (mg/l and %), specific conductance (millisiemens/cm at 25°), stream width (ft), and site length (ft), were collected. Not all sites have this information available for all attributes. See Appendix A for site dimensions and Appendix D for water quality.

Discussion

The list of species captured during 2012 is in Table 2.

Table 2. Lower Sevier River Species list.

Lower Sevier River Species List Electroshocking 2012 X = captured			
	Common Name	Scientific Name	Presence Absence
Native	Chub, Southern Leatherside	*Lepidomeda aliciae*	X
	Chub, Utah	*Gila atraria*	X
	Dace, Speckled	*Rhinichthys osculus*	X
	Sculpin, Mottled	*Cottus bairdi*	X
	Shiner, Redside	*Richardsonius balteatus*	X
	Sucker, Mountain	*Catostomus platyrhynchus*	X
	Sucker, Utah	*Catostomus ardens*	X
Non-Native	Bass, Largemouth	*Micropterus salmoides*	X
	Bass, Smallmouth	*Micropterus dolomieui*	X
	Bass, White	*Morone chyrsops*	X
	Bullhead, black	*Ameriurus melas*	X
	Carp, Common	*Cyprinus carpio*	X
	Catfish, Channel	*Ictaluras punctatus*	X
	Crappie, White	*Pomoxis anularis*	X
	Mosquitofish[3]	*Gambusia sp.*	
	Northern, Pike[1]	*Esox lucius*	
	Perch, Yellow	*Perca flavecens*	X
	Sunfish, Green	*Lepomis cyanellus*	X
	Trout, Brown[2]	*Salmo trutta*	
	Trout, Rainbow[3]	*Oncorhynchus mykiss*	
	Walleye	*Stizostedion vitreum*	X
Number of Species			17
Number of Sites			13
[1]. Known to be present in the river system (Combes and Hardy, 2009).			
[2]. Brown trout have been stocked throughtout the Sevier River Basin			
[5]. Previously sampled by USU (Combes and Hardy, 2009).			

Combes and Hardy (2007) reported that during 1999-2006 the sampling, the number of species captured varied from 13 to 17 species per year. A few species were rarely seen in the samples; walleyes have been captured three years and rainbow trout have been sampled once. The 2012 sampling effort was similar in species numbers with the white crappie being added to the species list.

Presence /Absence, Spatial Distribution and Number/Density of Native and Non-Native Species

In the past Combes and Hardy (2007) reported that carp were the most common species (1999-2006) being present in 65.5% of 113 samples and the green sunfish second with 40.7%. For 2012 the green sunfish was present in 81.8% of the samples and the carp was second at 63.3%. As for natives, Combes and Hardy (2007) reported the mountain sucker occurred in 56% of the samples (1999-2006), redside shiners 48%, and the Utah chub 44%. In 2012 the Utah chub was present in 63.6% of the samples, Utah sucker in 45.5%, and the redside shiner captured in 36.4% of the samples.

Traditionally the lower portion of the system has been skewed towards non-native species with the upper portion having greater numbers of native species (Combes and Hardy, 2007). This holds true for 2012 as well. Figures 2 and 3 show this as raw numbers captured and as a percent of catch. Both charts have

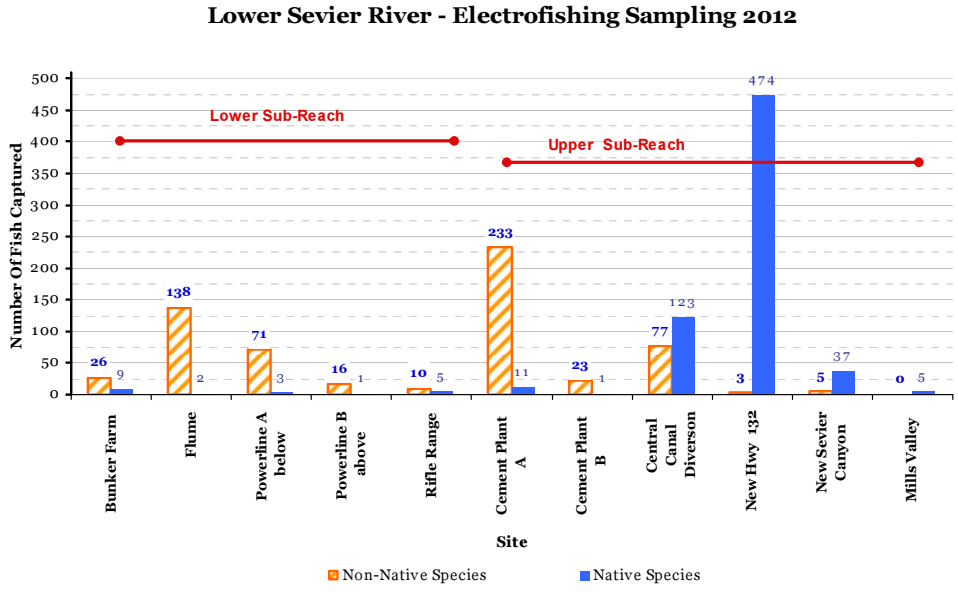


Figure 2. Numbers of native and non-native species by site and reach.

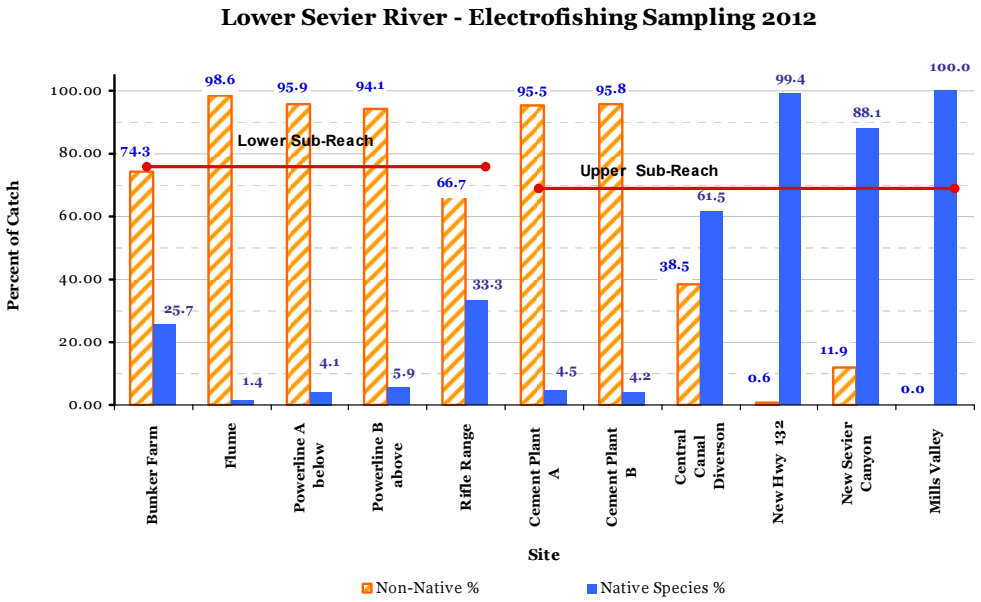


Figure 3. Percent of catch by native and non-native species.

the sites arranged with the lowest in the system on the left and the highest sites on the right.

Total numbers of fish captured in 2012 are substantially lower then what was captured in 2002, 2005, and 2006 (Combes and Hardy, 2007). Figure 4 shows that 2012 is closer to 1999, 2000, 2001, and 2004 in total numbers of fish.

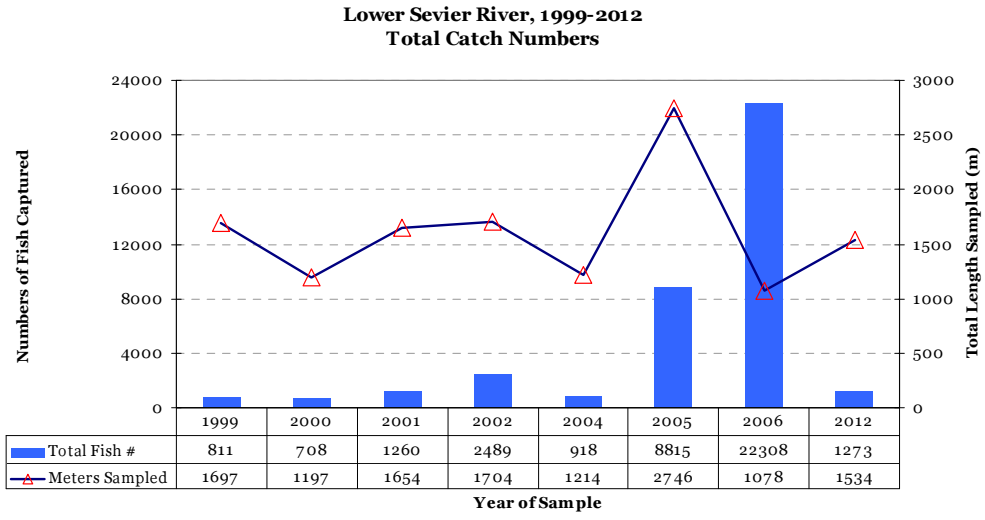


Figure 4. Total numbers of fish captured by year, both non-natives and natives combined.

Not only are total numbers of fish lower then some previously samples, the ratio of non-natives to natives is different. In past years the ratio ranged from 1/1.7 upwards to 1/21.1. In 2012 the ratio was 1/1.1, thus approaching equal (Table 3.).

Table 3. Number of native species per non-native.

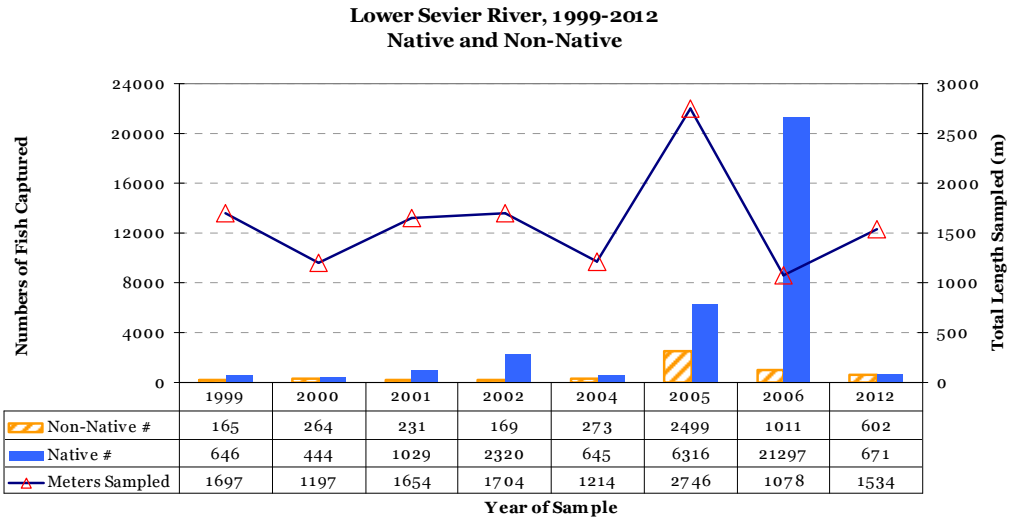
Lower Sevier River

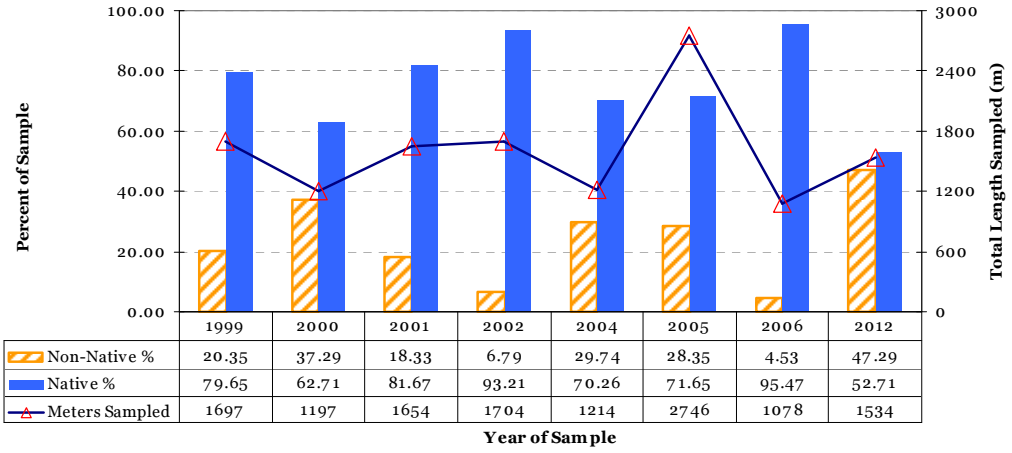
Non-natives per Native

Year	1999	2000	2001	2002	2004	2005	2006	2012
Number	1/3.9	1/1.7	1/4.5	1/13.7	1/2.4	1/2.5	1/21.1	1/1.1

One must keep in mind that these ratios and numbers are for all sites sampled. It is possible that one or two sites might skew the values due to high numbers of fish captured in comparison to other sites. This is evident in the year 2006, as at one site in the upper reach, 19406 fish were captured with 99.6 percent of those native fish. If this site is eliminated with the correspondingly high numbers of natives, the ratio drops from 1/21.1 and becomes 1/2.1, non-natives to natives. This value is in keeping with the previous years, but it is still double the ratio for 2012. The 1/1.1 ratio suggests that the composition of the fish community for the over all Lower Sevier River has changed from previous years.

Figure 5 has three charts that compare non-native to native using fish numbers, percent of catch, and relative density. While 2012's over all numbers of fish are similar to previous low years, the percent of catch and relative density suggest that overall the non-natives are increasing proportionally. The previous observation of the lower reach being skewed, as a percent of catch towards non-native, still holds.





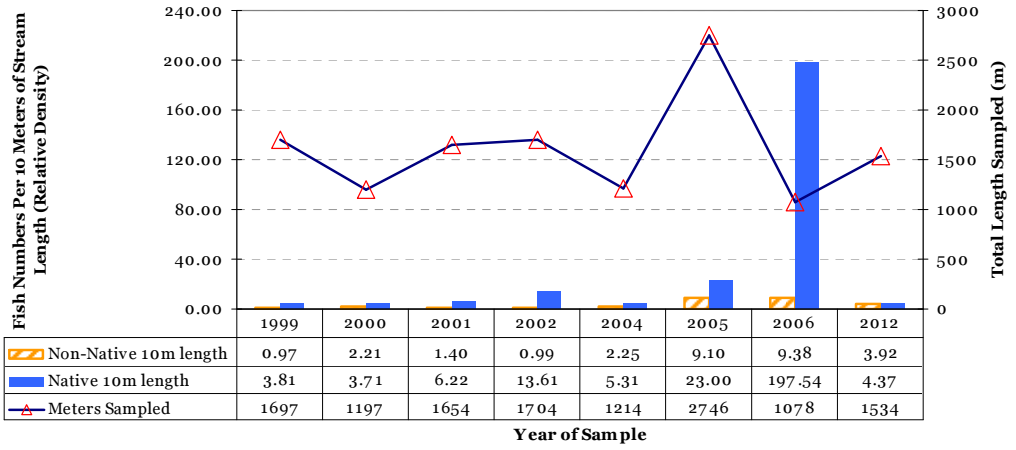
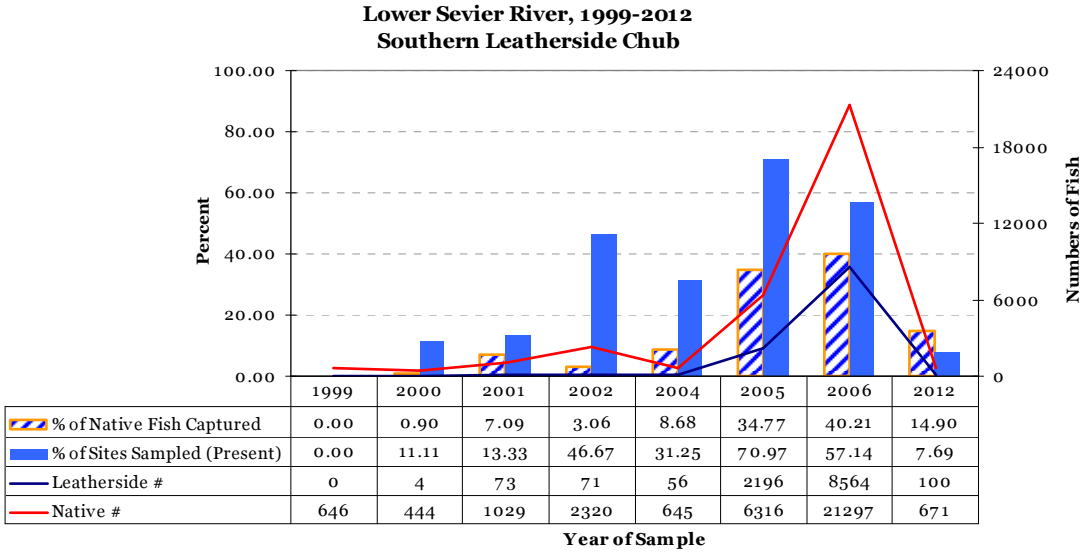


Figure 5. A comparison of non-native and native fish numbers, percent composition of catch, and relative density (10m of stream length).

Southern Leatherside Chub

During the 1999-2006 years' numbers of southern leatherside chub increased as shown in Figure 6 (Combes and Hardy 2009). By 2005 and 2006 the southern leatherside comprised 35-40 percent of the total native fish catch, and 57 to 71 percent of the sites had leathersides present.



	1999	2000	2001	2002	2004	2005	2006	2012
% of Native Fish Captured	0.00	0.90	7.09	3.06	8.68	34.77	40.21	14.90
% of Sites Sampled (Present)	0.00	11.11	13.33	46.67	31.25	70.97	57.14	7.69
Leatherside #	0	4	73	71	56	2196	8564	100
Native #	646	444	1029	2320	645	6316	21297	671

Figure 6. Southern leatherside chub numbers, percent of catch, and percent of sites.

In 2012 this trend was no longer observed with leathersides being captured at only one site and numbers closer to the previous 2005-2006 period. This suggests that the geographical distribution of southern leatherside might be reduced from previous years, thus the potentially for lower leatherside numbers through out the Lower Sevier exist. One must note that sampling of one site in the Sevier Canyon where traditionally high numbers of leatherside and natives have been observed in the past, was prevented by a rain and snow storm in 2012. If leatherside would have been present it would have raised the percent of sites value up to 15.4 percent, which is still below the 2002, 2004, 2005, and 2006 values.

The range of length for leathersides is smaller then in previous years. Figure 7 shows smaller fish and a narrower range for 2012.

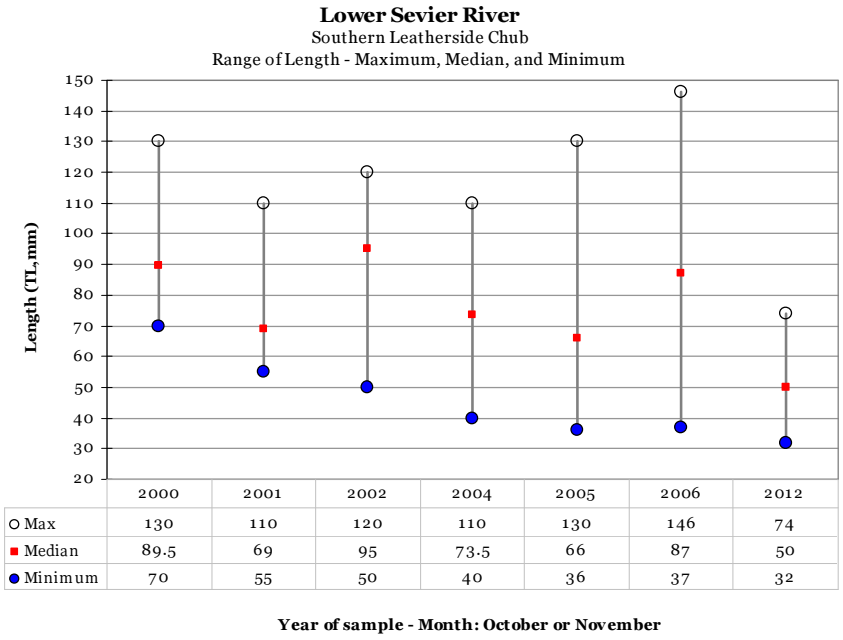


Figure 7. Southern leatherside chub length (TL,mm) range and median.

The ratio of young of year, juvenile, and sexually mature adults has also changed from previous samples. Table 4 gives the length breaks that were used for young of year (YOY), juvenile (age 1), and sexually mature adults (age 2+).

Billman et al. (2011) found that leatherside growth is influenced by habitat quality and the presence or absence of predatory fish. Water temperature can also influence growth. For example, Addley et al. (2005) investigated the growth of the woundfin minnow (*Plagopterus argentissimus*), a native from the Colorado River system, under different temperature regimes and found optimal ranges for growth. For leathersides, Belk et al. (2005), found that southern leatherside chubs had higher intrinsic growth rates at higher temperatures, while northern leathersides (*Lepidomeda copei*) had higher growth rates at lower temperatures.

We do not have detailed growth rates, water temperature regimes, habitat quality indices, and detailed predator/prey relationships for the lower Sevier, thus, Table 4 was derived from research on other drainages and fish community assemblages. The lengths are based upon personal communication with Mark Belk (2013), and research by Johnson et al (1995), and Billman et al. (2011).

Table 4. Length breaks for age class designations.

Lower Sevier River Southern Leatherside Chub	
Lifestage	Length (TL,mm)
Young of Year (YOY)	< 50mm
Juvenile - age 1	50-78mm
Sexually Mature Adult - age 2+	> 78 mm

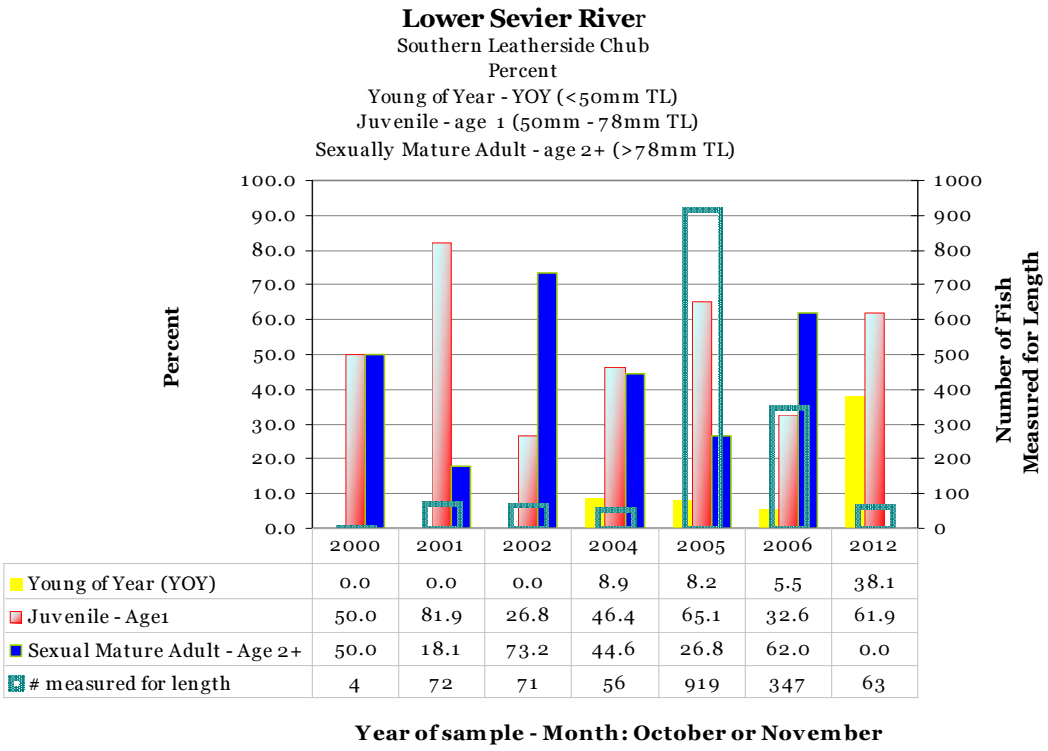


Figure 8. Percentages of age class for years 2000-2012.

In 2012 the adult age class (2+) was absent and the young of the year (YOY) surpassed all other years at 38% of the measured leathersides (Figure 8.). For the 1999-2006 years, the YOY portion of the measured sample, ranged from 0% through 8.9%. The ratio of YOY/Juvenile/2+ for 2012, is substantial different from previous years.

Factors That Might Be Limiting

Given that over all numbers of native species and the southern leatherside chub appear to be lower, plus a reduced geographical distribution of the leatherside, combined with ratio of 1 non-native/1.1 native, the fish community is different from previous sampling efforts by USU. It should be kept in mind that the lower reach is still skewed towards non-natives and the upper, natives. One might ask, what are the causes or factors driving the apparent change? Two possibilities will be briefly presented here.

The first possible factor is wildfire, and the resulting ash and debris flows during and following storm events. Fires impact may occur during the fire as a direct effect, or afterwards as an indirect effect (Neary et al, 2005). Ash and debris flows are classified as an indirect effect. Rinne and Carter (2008) reported the short-term effects of fire in several southwest streams and found that the impact of fire was highly variable. A few of the sites that Rinne and Carter (2008) sampled showed limited or no reductions in fish abundance, while other sites had 70-100% mortality. The long-term effects of fire on the persistence of a fish population is also highly variable. The variables range from the fire intensity, species of fish, hydrology of the drainage, geology of the drainage and vegetation (Gresswell, 1999). This list of variables is only a portion of list those mentioned in Gresswells, 1999 work.

In 2012 the Clay Springs fire burned 107,847 acres between June 27 and July 20. It burned almost to the Sevier River in portions of the the Sevier Canyon. Figure 9 is a map of the areas that burned during 2012 and is in close proximity to the

sample locations. The severity of the burn varies. On the Fillmore Ranger District, Fishlake National Forest, in the Canyon Mountains east of Oak City Utah, the burned areas have been classified as ranging from unburned to high severity. Table 5 has the number of acres as classified in each category. The acres classified as high and medium burn severity comprise over 54% of the area (USFS).

Table 5. Burn severity.

Burn Severity 2012 Canyon Mountains - Fishlake National Forest, Fillmore Ranger District		
Classification	Acres	Percent
High	18223.2	22.5
Medium	25830.6	31.9
Low	29510.6	36.4
Unburned	7517.3	9.3
Total	81081.7	100.0

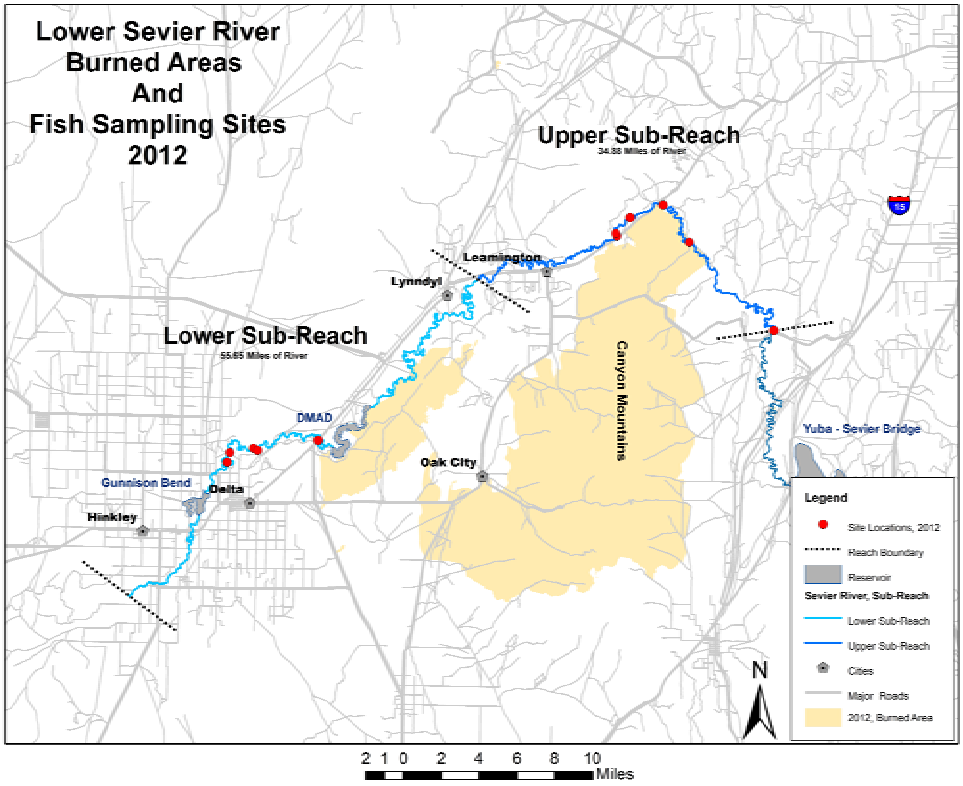


Figure 9. Burned areas in 2012 (burn GIS data source, BLM and USFS).

Photos taken during September 2012, show debris that moved into the river caused by a storm and flood event in the burned area (Photo 3). Photo 4 is a pair of aerial images that show the same alluvial fan/delta as in Photo 3. The lower image is from 2011 and the upper 2014. The vegetation and drainage show changes that could be directly related to the fires of 2012. Appendix E has photos from two other locations on the Sevier River that show similar changes. Photos taken at the Central Canal Diversion structure in September 2012. also show highly turbid water (Photo 5.). During the sampling in November, 2012 several sites had poor visibility in the vicinity of the fire. While it might not be possible to definitely say that sediment flows and poor water quality reduced the fish population, the possibility exists.

Photo 3. Clay Spring fire impact and resulting debris flow.

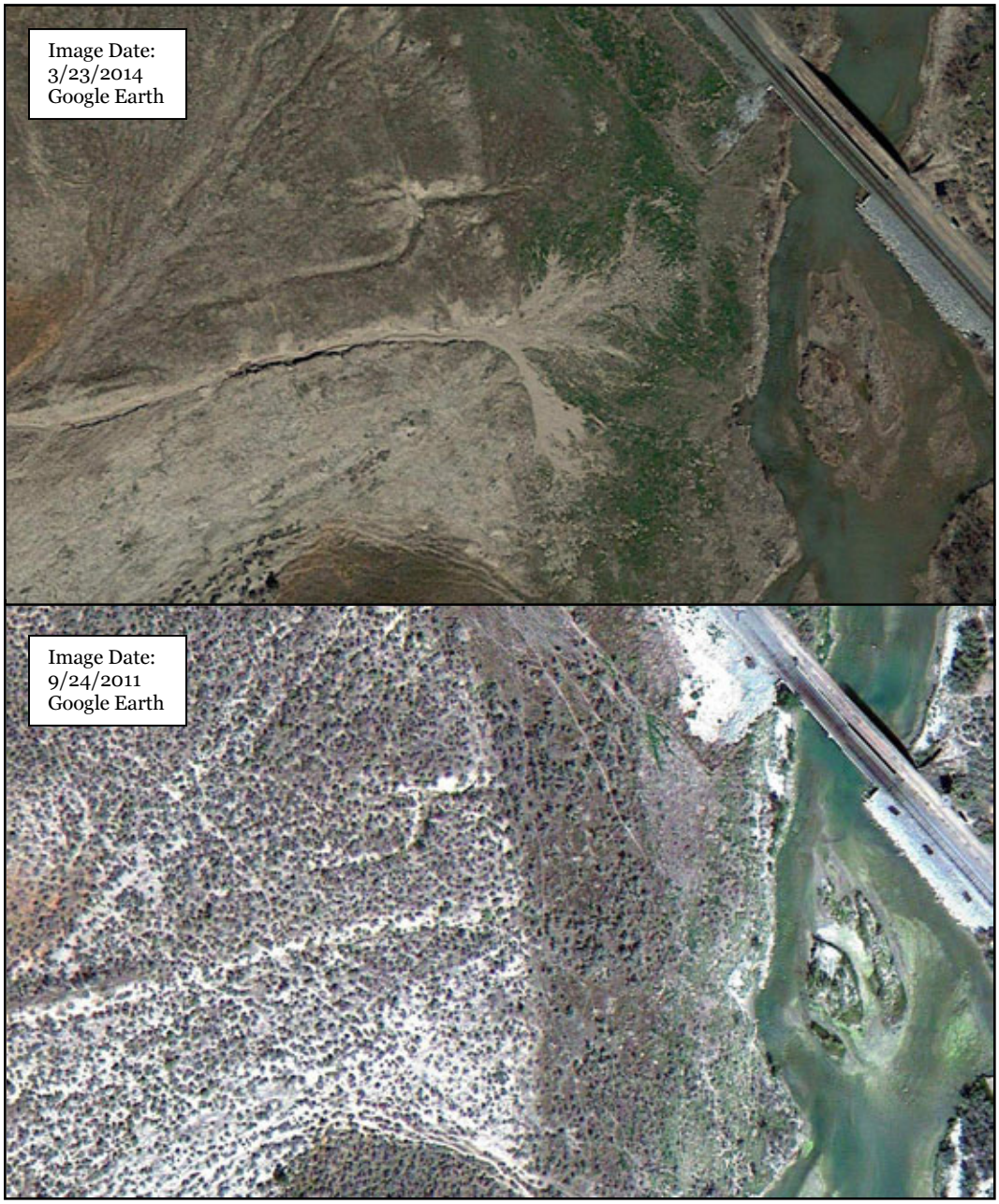


Photo 4. Aerial images that show the change from 2011 to 2014 (Google Earth images).

Photo 5. Turbid water at the Central Canal Diversion during September 2012.

Water flow regimes of drought or extreme high water events can enhance or deplete a fishery. During the five years leading up to the November 2012 sampling one year had substantially higher flows (2012 included). June of 2011 had flows exceeding 2700 cfs at the Lynndyl USGS gage for the mean daily flow (Figure 9).

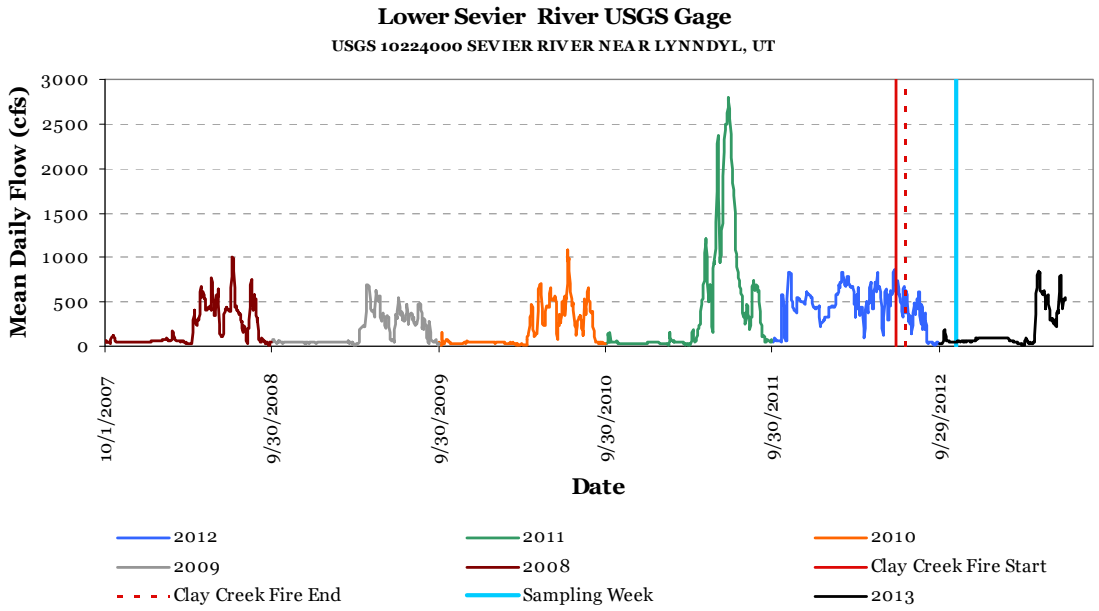


Figure 10. Water years 2008-2012 mean daily flow (cfs) at the USGS Lynndyl gage.

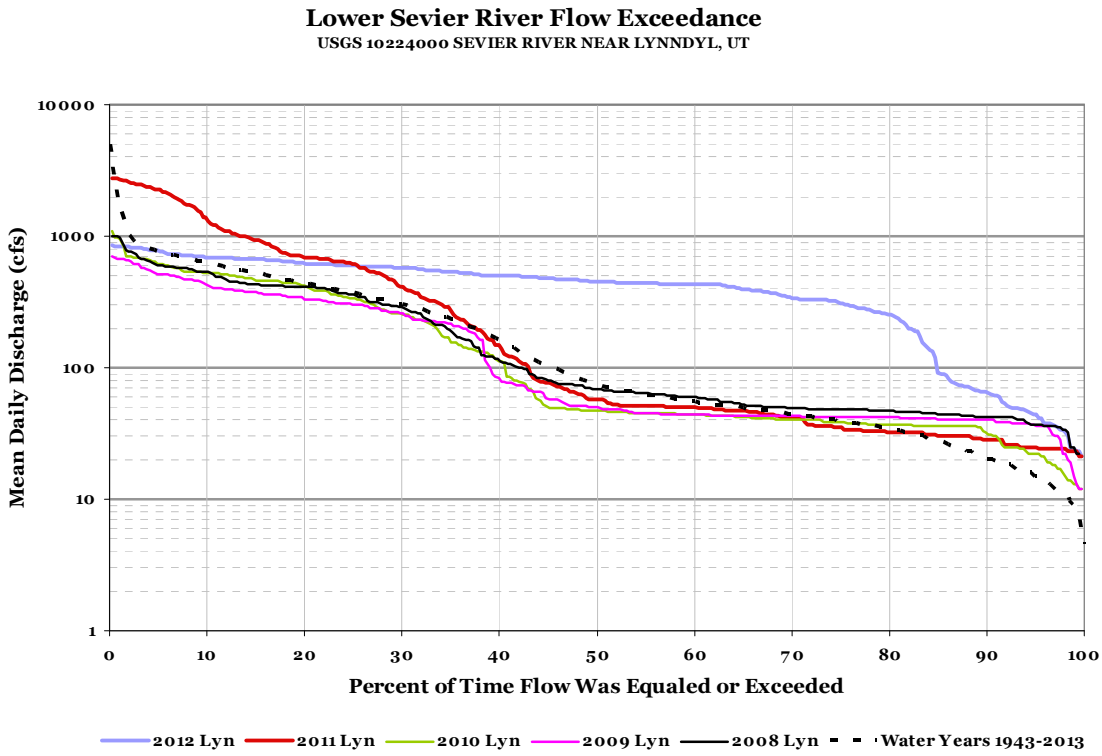


Figure 11. Exceedance for water years 2008-2012 at the USGS Lynndyl gage, #10224000.

Not only were the flows high during June of 2011 and into July, 1000cfs was exceeded almost continually from late May until July 15. Further, the water year 2012 is also unusual when compared to the previous years as flows exceeded 450 cfs for almost 50% of the year (Figure 10). In many years 450 cfs is in the 20% exceeedance range.

Flows exceeding 2000 cfs for any period of time have only occurred in three water years since 1943 (70 years of records). The three years are 1983, 1984 and 2011. Water years 2011 and 2012 are anomalies.

It is possible that flows of the right intensity and duration that occur during spawning or other life stages, could adversely or positively impact reproduction and recruitment (Rinne, personal communication, 2013). Without having a consistent and yearly regime of fish sampling, to combine with multiple years of high and low flow data, it is extremely difficult to empirically derive a correlation.

Conclusion

Given the apparent change in the ratio of non-natives to native, along with a substantial reduction in numbers of fish from the 2005-2006 period, the reduction in the geographical distribution of the southern leatherside chub, combined with no definitive understanding of the causes or potential limiting factors, point to further monitoring and sampling being warranted. The question of what form the cycles of change in the fish community population and species composition in the Lower Sevier River, is not answered. Further, the management of flows for agricultural uses and power production and what it bears upon the fish community is not known. With the classification of the southern leatherside chub as a species of concern, and the stated objective of preventing the species from being federally classified as threatened or endangered, it behooves a high degree of vigilance in monitoring the Lower Sevier River fish community.

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Appendix A
Lower Sevier River Electrofishing Sampling Site Description, Charts, and Data
2012

Table of Contents - Appendix A

List of Tables - Appendix A

List of Aerial Photos - Appendix A

Bunker Farm

The Bunker Farm site was moved upstream from previous USU sampling due to a change in channel topography and low flows preventing effective sampling. Sampling began at the bottom of the site and proceeded upstream. No block nets were used and one pass was made for a qualitative sample. Meso-habitat is a long run (lateral pool tail out) with a shallow riffle at the bottom. Substrates are sand, silts, and some clay. Fish were generally associated with over hanging vegetation or woody debris. The fish captured were dominated by non-natives with largemouth bass and green sun fish the most numerous. A single white crappie was captured; this species has never been captured in the previous sampling by USU.

Aerial Photo A1. Bunker Farm location (blue polygon).

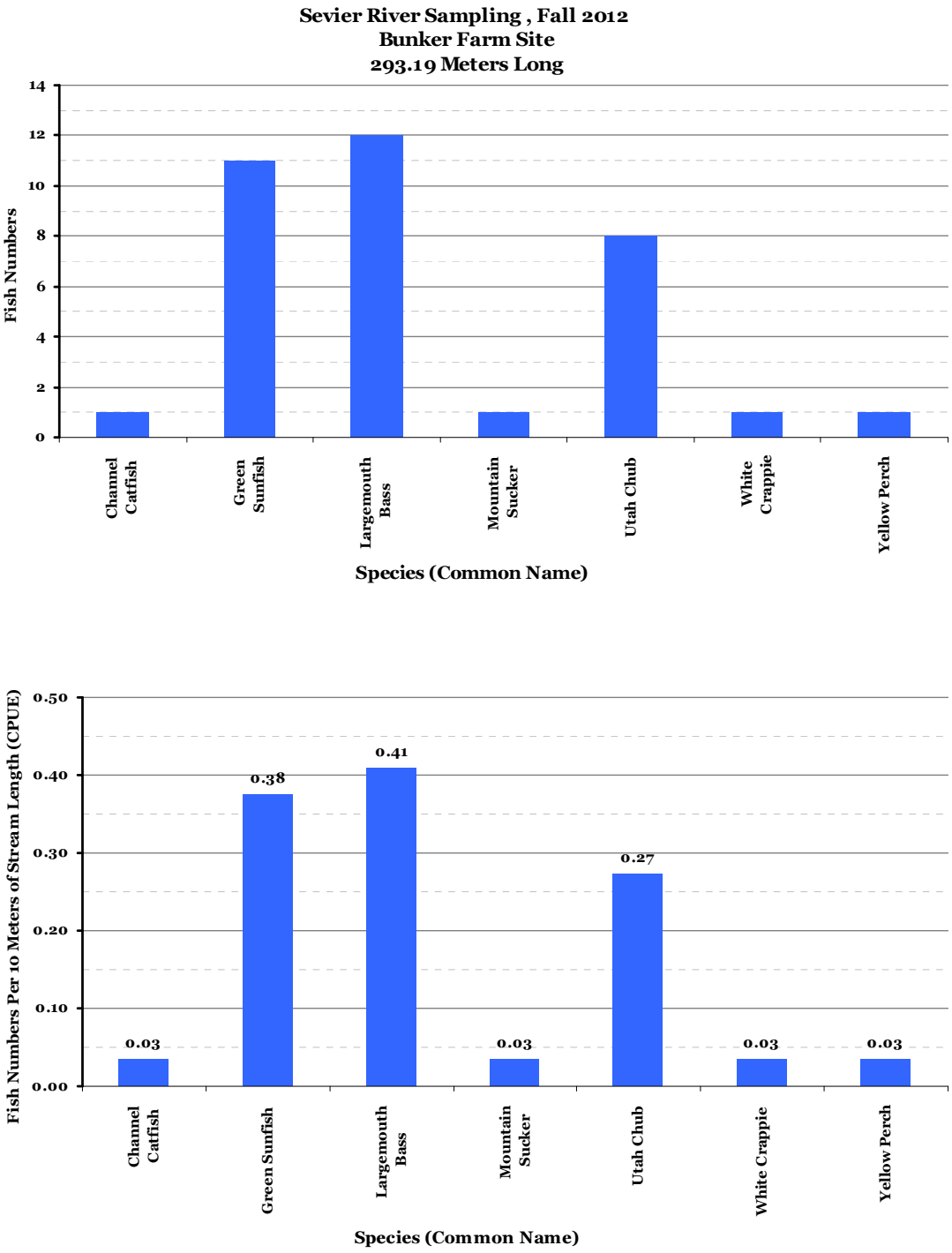


Figure A1. The Bunker Farm site, captured fish numbers and relative density (10 m of stream length or CPUE) by species.

Table A1. Bunker Farm basic data.

Bunker Farm

Date of Sampling: Monday, November 05, 2012

Location	UTM, 12N, NAD 83	
Sub Reach	Easting	Northing
Lower	363141.3	4360443.8

River Mile[2]	13.52

Length of Site (m)	293.19
Area (m^2)	4068.42

Native Species				
Common Name	Scientific Name	Number Captured	10m length[1]	100 m^2
Mountain Sucker	*Catostomus platyrhynchus*	1	0.03	2.458E-02
Utah Chub	*Gila atraria*	8	0.27	1.966E-01

Non-Native Species				
Common Name	Scientific Name	Number Captured	10m length[1]	100 m^2
Channel Catfish	*Ictalurus punctatus*	1	0.03	2.458E-02
Green Sunfish	*Lepomis cyanellus*	11	0.38	2.704E-01
Largemouth Bass	*Micropterus salmoides*	12	0.41	2.950E-01
White Crappie	*Pomoxis anularis*	1	0.03	2.458E-02
Yellow Perch	*Perca flavescens*	1	0.03	2.458E-02

Native Species. Sub-Total	9
Non-Native Species Sub-Total	26
Total Number of Fish Captured	35

Native Species Percent	25.71
Non-Native Species Percent	74.29

Native Species - 10m length[1]	0.31
Non-Native Species - 10m length[1]	0.89
All Fish 10m - length[1]	1.19

[1] Estimated numbers of fish captured per 10 meters of stream length similar to a catch per unit of effort (CPUE).
[2] River miles are calculated moving upriver from Conk Dam (354785.05E, 4349062.13N, 12N, NAD83)
Note: 100 m^2 is defined as estimated numbers of fish per a 10 x 10 meter square.

Flume

The Flume site was previously sampled by USU in 1999. Sampling began at the bottom of the site and proceeded upstream. No block nets were used and one pass was made for a qualitative sample. Meso-habitat is a long run (lateral pool tail out) a pool under the flume trestle, and a lateral pool with over hanging tamarisk. Substrates are sand, silts, and some clay with old concrete trestle pilings, woody debris and overhanging vegetation for cover. The fish captured were 100% non-natives with carp and green sun fish the most numerous. The majority of the fish captured were associated with the lateral pool and the tamarisk.

Aerial Photo A2. Flume location (blue polygon).

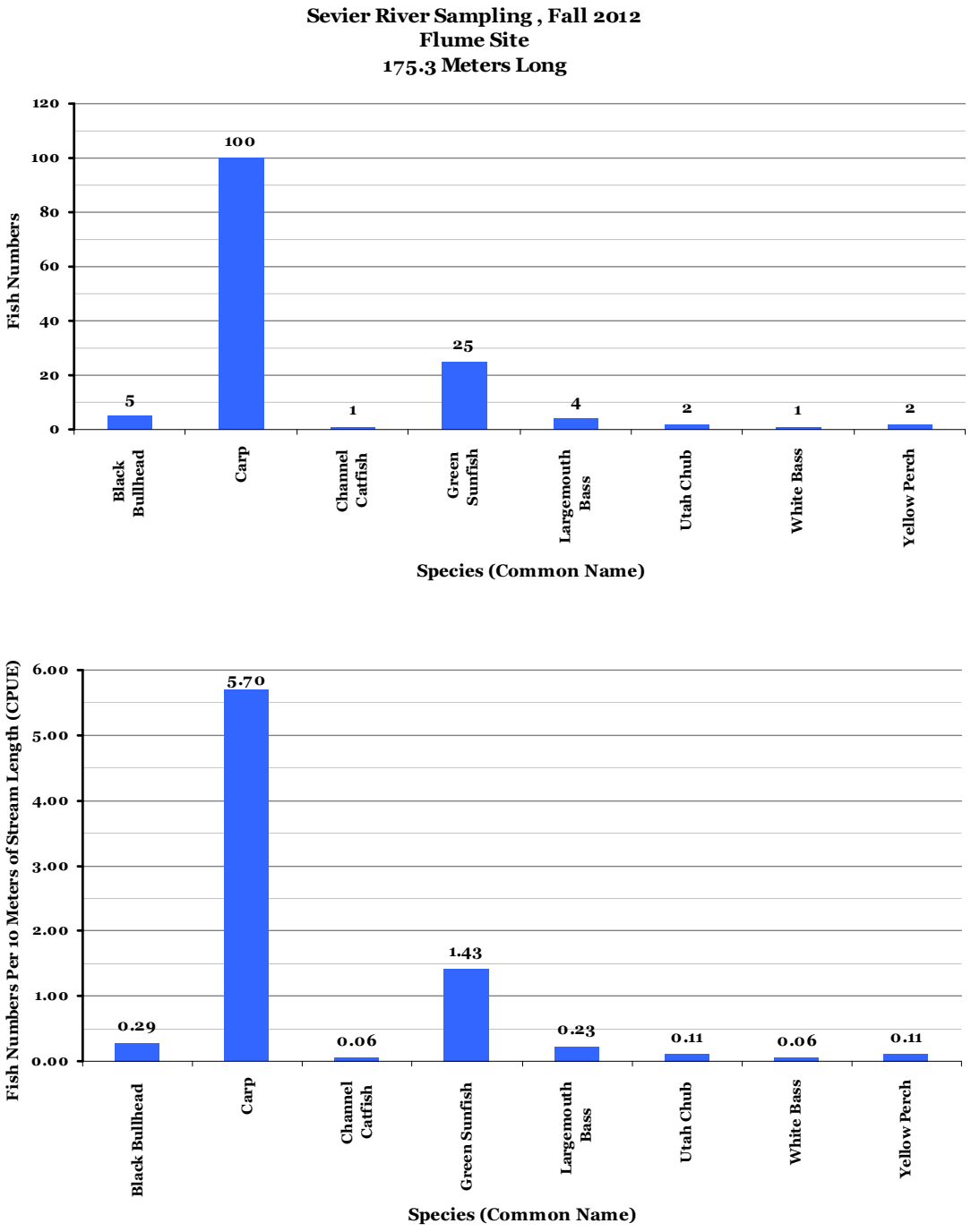


Figure A2. The Flume site, captured fish numbers and relative density (10 m of stream length or CPUE) by species.

Table A2. Flume basic data.

Flume

Date of Sampling: Monday, November 05, 2012

Location	UTM, 12N, NAD 83	
Sub Reach	Easting	Northing
Lower	363392.1	4361259.4

River Mile[2]	14.90

Length of Site (m)	175.30
Area (m^2)	2542.69

Native Species				
Common Name	Scientific Name	Number Captured	10m length[1]	100 m^2
Utah Chub	*Gila atraria*	2	0.114	7.866E-02

Non-Native Species				
Common Name	Scientific Name	Number Captured	10m length[1]	100 m^2
Black Bullhead	*Ameiurus melas*	5	0.29	1.966E-01
Carp	*Cyprinus carpio*	100	5.70	3.933E+00
Channel Catfish	*Ictalurus punctatus*	1	0.06	3.933E-02
Green Sunfish	*Lepomis cyanellus*	25	1.43	9.832E-01
Largemouth Bass	*Micropterus salmoides*	4	0.23	1.573E-01
White Bass	*Morone chrysops*	1	0.06	3.933E-02
Yellow Perch	*Perca flavescens*	2	0.11	7.866E-02

Native Species. Sub-Total	2
Non-Native Species Sub-Total	138
Total Number of Fish Captured	140

Native Species Percent	1.43
Non-Native Species Percent	98.57

Native Species - 10m length[1]	0.11
Non-Native Species - 10m lengtl	7.87
All Fish 10m - length[1]	7.99

[1] Estimated numbers of fish captured per 10 meters of stream length similar to a catch per unit of effort (CPUE).

[2] River miles are calculated moving upriver from Conk Dam (354785.05E, 4349062.13N, 12N, NAD83)

Note: 100 m^2 is defined as estimated numbers of fish per a 10 x 10 meter square.

Powerline A, Downstream

The Powerline A, Downstream site has not previously been sampled. Sampling began at the bottom of the site and proceeded upstream. No block nets were used and one pass was made for a qualitative sample. Meso-habitat is a lateral pool with over hanging tamarisk and Russian olive trees. Substrates are sand, silts, and some clay, with woody debris and overhanging vegetation for cover. The fish captured were dominated by non-natives, mostly carp. Two white crappies were captured, a species previously not sampled during the USU efforts. The majority of the fish captured were associated with the tamarisk and Russian olive woody debris.

Aerial Photo A3. Powerline A Downstream location (blue polygon).

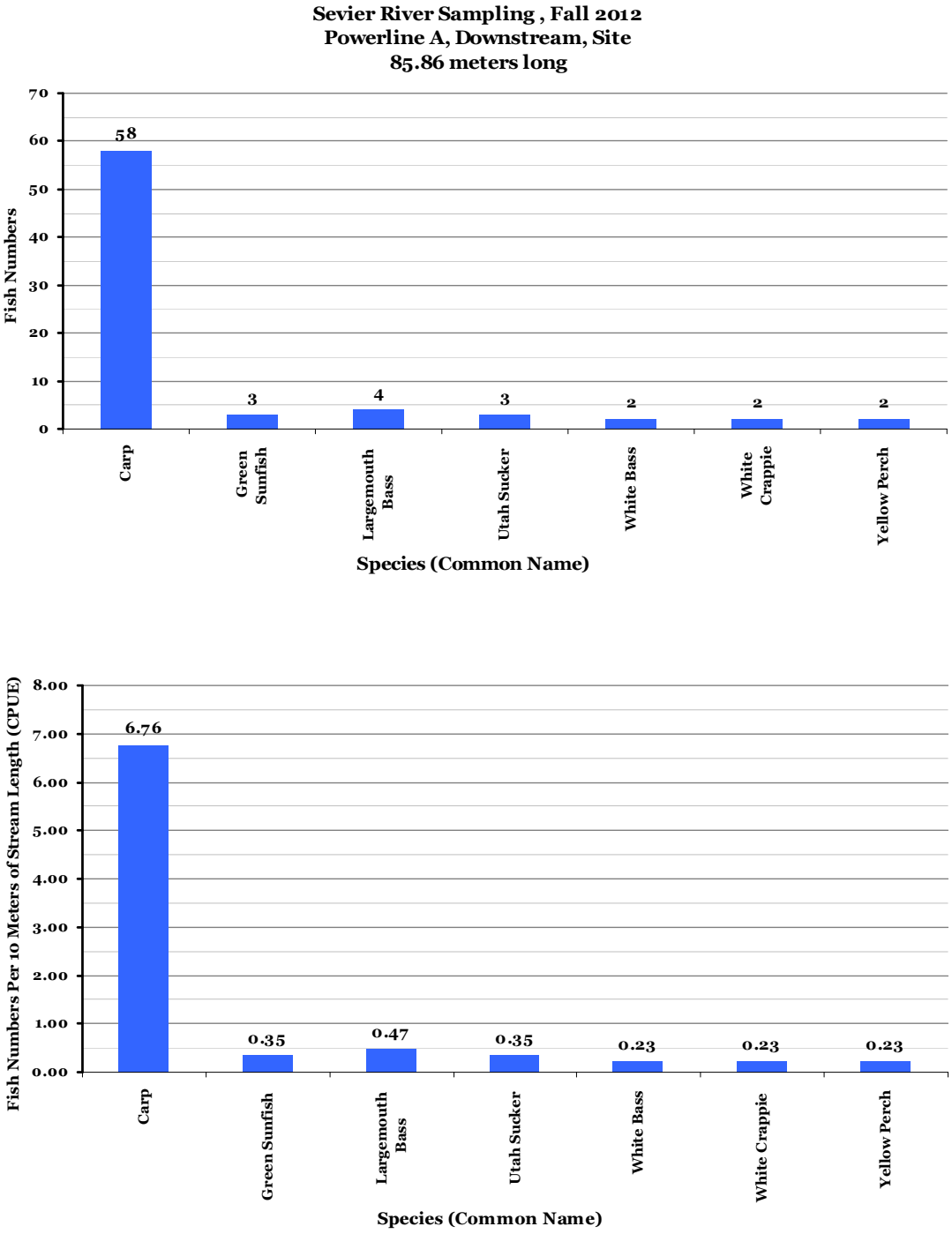


Figure A3. The Powerline A Downstream site, captured fish numbers and relative density (10 m of stream length, OR CPUE) by species.

Table A3. Powerline A Downstream basic data.

Powerline A, Downstream

Date of Sampling: Wednesday, November 07, 2012

Location	UTM, 12N, NAD 83	
Sub Reach	Easting	Northing
Lower	365415.6	4361637.5

River Mile[2]	18.57

Length of Site (m)	85.86
Area (m^2)	1371.62

Native Species				
Common Name	Scientific Name	Number Captured	10m length[1]	100 m^2
Utah Sucker	*Catostomus ardens*	3	0.35	2.187E-01

Non-Native Species				
Common Name	Scientific Name	Number Captured	10m length[1]	100 m^2
Carp	*Cyprinus carpio*	58	6.76	4.229E+00
Green Sunfish	*Lepomis cyanellus*	2	0.23	1.458E-01
Largemouth Bass	*Micropterus salmoides*	3	0.35	2.187E-01
White Bass	*Morone chrysops*	4	0.47	2.916E-01
White Crappie	*Pomoxis anularis*	2	0.23	1.458E-01
Yellow Perch	*Perca flavescens*	2	0.23	1.458E-01

Native Species. Sub-Total	3
Non-Native Species Sub-Total	71
Total Number of Fish Captured	74

Native Species Percent	4.05
Non-Native Species Percent	95.95

Native Species - 10m length[1]	0.35
Non-Native Species - 10m length[1]	8.27
All Fish 10m - length[1]	8.62

[1] Estimated numbers of fish captured per 10 meters of stream length - similar to a catch per unit of effort (CPUE).
[2] River miles are calculated moving upriver from Conk Dam (354785.05E, 4349062.13N, 12N, NAD83)
Note: 100 m^2 is defined as estimated numbers of fish per a 10 x 10 meter square.

Powerline B. Upstream

The Powerline B, Upstream site has not previously been sampled. Sampling began at the bottom of the site and proceeded upstream. No block nets were used and one pass was made for a qualitative sample. Meso-habitat is a long run with small pools along the side and over hanging tamarisk and Russian olive trees. Substrates are sand, silts, and some clay. The fish captured were dominated by non-natives with the largest number being largemouth bass. The majority of the fish captured were associated with the small pools and the tamarisk - Russian olive woody debris.

Aerial Photo A4. Powerline B Upstream location (blue polygon).

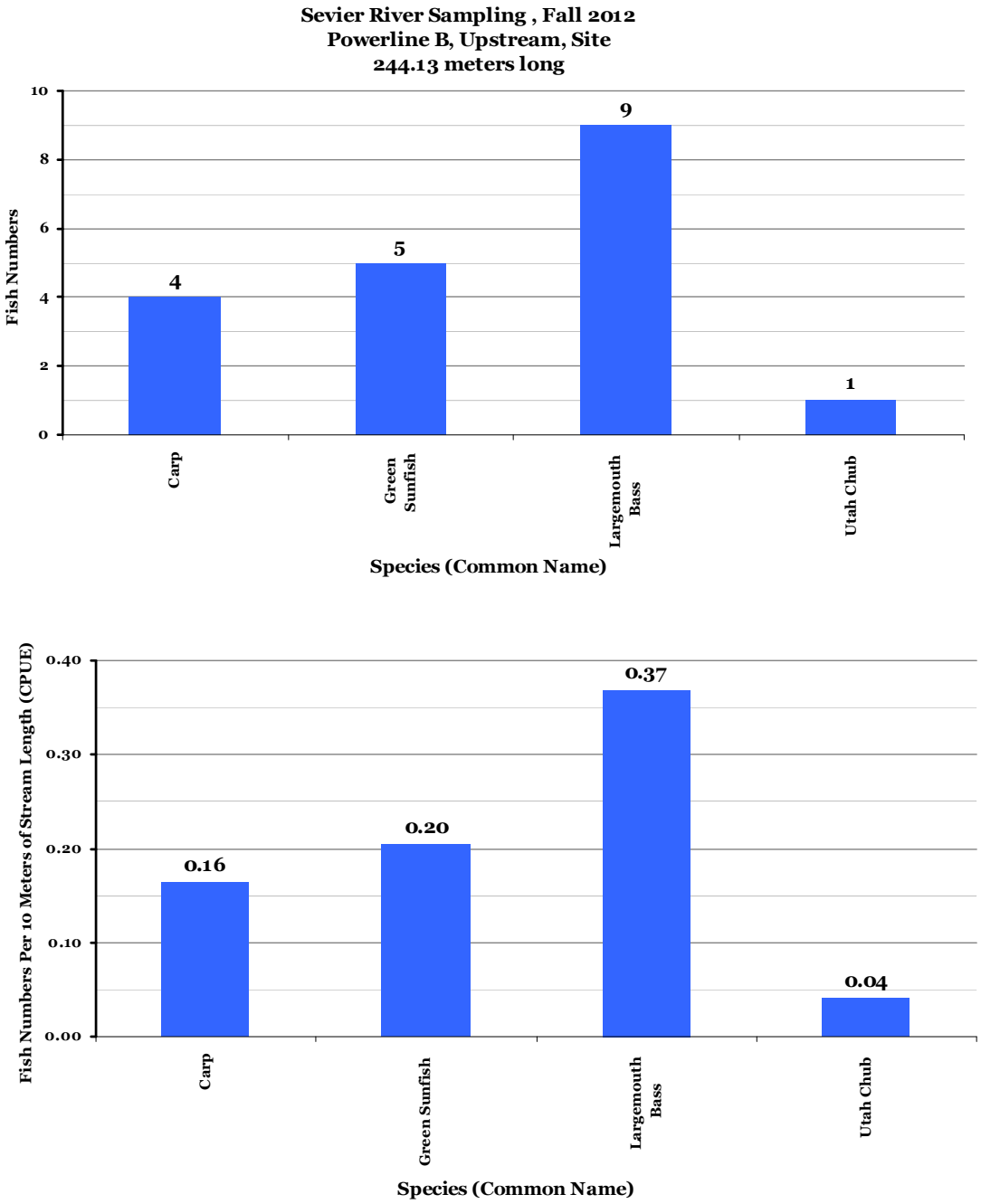


Figure A4. The Powerline B Upstream site, captured fish numbers and relative density (10 m of stream length, OR CPUE) by species.

Table A4. Powerline B Upstream basic data

Powerline B, Upstream

Date of Sampling: Wednesday, November 07, 2012

Location	UTM, 12N, NAD 83	
Sub Reach	Easting	Northing
Lower	365773.8	4361441.2

River Mile[2]	18.87

Length of Site (m)	244.13
Area (m^2)	4622.17

Native Species				
Common Name	Scientific Name	Number Captured	10m length[1]	100 m^2
Utah Chub	*Gila atraria*	1	0.04	2.163E-02

Non-Native Species				
Common Name	Scientific Name	Number Captured	10m length[1]	100 m^2
Carp	*Cyprinus carpio*	4	0.16	8.654E-02
Green Sunfish	*Lepomis cyanellus*	3	0.12	6.490E-02
Largemouth Bass	*Micropterus salmoides*	9	0.37	1.947E-01

Native Species. Sub-Total	1
Non-Native Species Sub-Total	16
Total Number of Fish Captured	17

Native Species Percent	5.88
Non-Native Species Percent	94.12

Native Species - 10m length[1]	0.04
Non-Native Species - 10m length[1]	0.66
All Fish 10m - length[1]	0.70

[1] Estimated numbers of fish captured per 10 meters of stream length - similar to a catch per unit of effort (CPUE).

[2] River miles are calculated moving upriver from Conk Dam (354785.05E, 4349062.13N, 12N, NAD83)

Note: 100 m^2 is defined as estimated numbers of fish per a 10 x 10 meter square.

Rifle Range

The Rifle Range site has been previously sampled by USU. Sampling began at the top of the site and proceeded downstream. A downstream block nets was used and one pass was made for a qualitative sample. Meso-habitat begins as a long run at the top of the site moving through a riffle and into a pool at the downstream. The block net was placed in the pool tail out. Substrates are sand, silts, and some cobbles in the run, gravels and small cobbles in the riffle, and smaller gravel in the pool. The fish captured were split by 67% non-natives and 33% natives.

Aerial Photo A5. Rifle Range location (blue polygon).

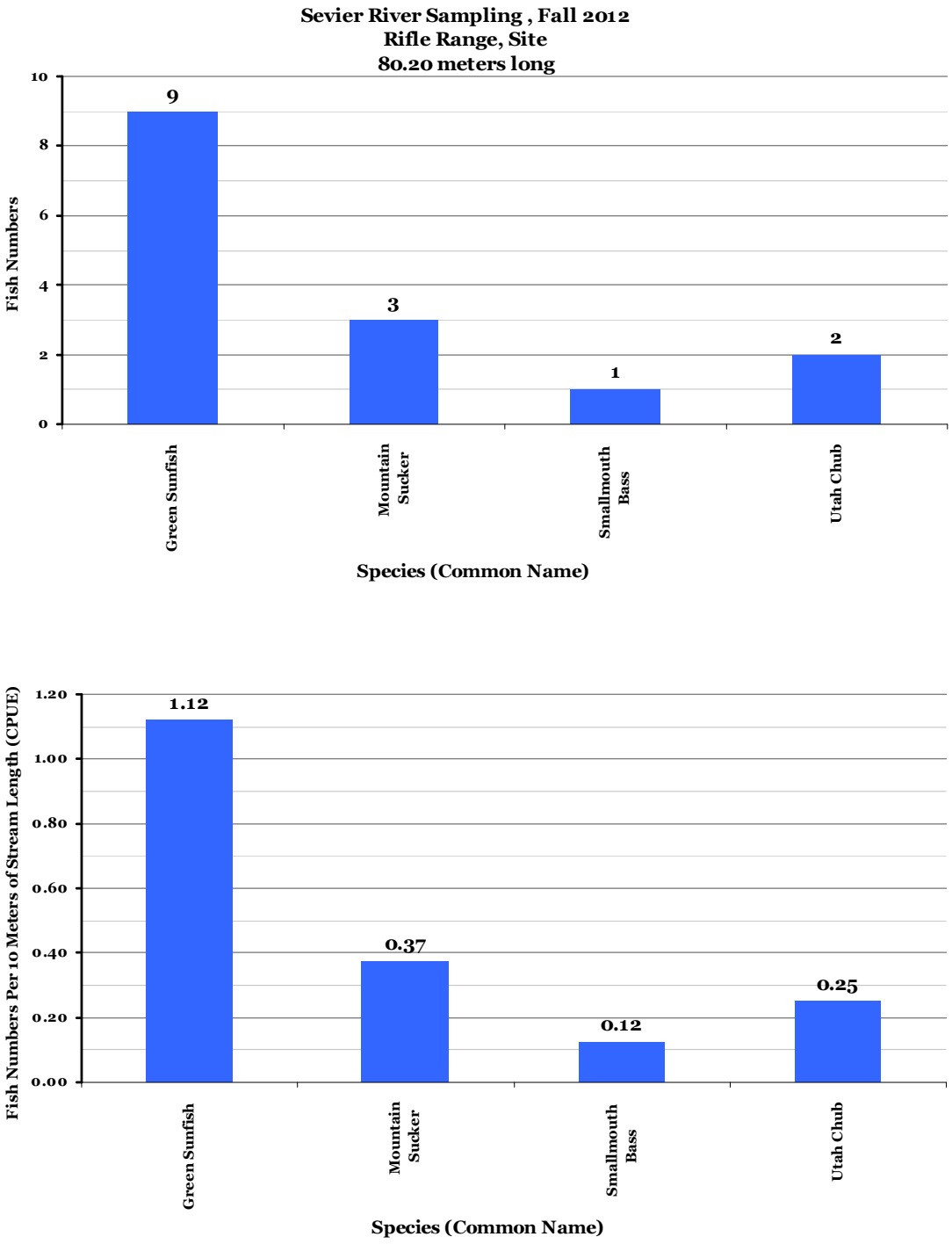


Figure A5. The Rifle Range site, captured fish numbers and relative density (10 m of stream length, OR CPUE) by species.

Table A5. Rifle Range basic data.

Rifle Range

Date of Sampling: Monday, November 05, 2012

Location	UTM, 12N, NAD 83	
Sub Reach	Easting	Northing
Lower	370912.0	4362308.3

River Mile[2]	25.42

Length of Site (m)	80.20
Area (m^2)	915.47

Native Species				
Common Name	Scientific Name	Number Captured	10m length[1]	100 m^2
Mountain Sucker	*Catostomus platyrhynchus*	3	0.37	3.277E-01
Utah Chub	*Gila atraria*	2	0.25	2.185E-01

Non-Native Species				
Common Name	Scientific Name	Number Captured	10m length[1]	100 m^2
Green Sunfish	*Lepomis cyanellus*	9	1.12	9.831E-01
Smallmouth Bass	*Micropterus dolomieu*	1	0.12	1.092E-01

Native Species. Sub-Total	5
Non-Native Species Sub-Total	10
Total Number of Fish Captured	15

Native Species Percent	33.33
Non-Native Species Percent	66.67

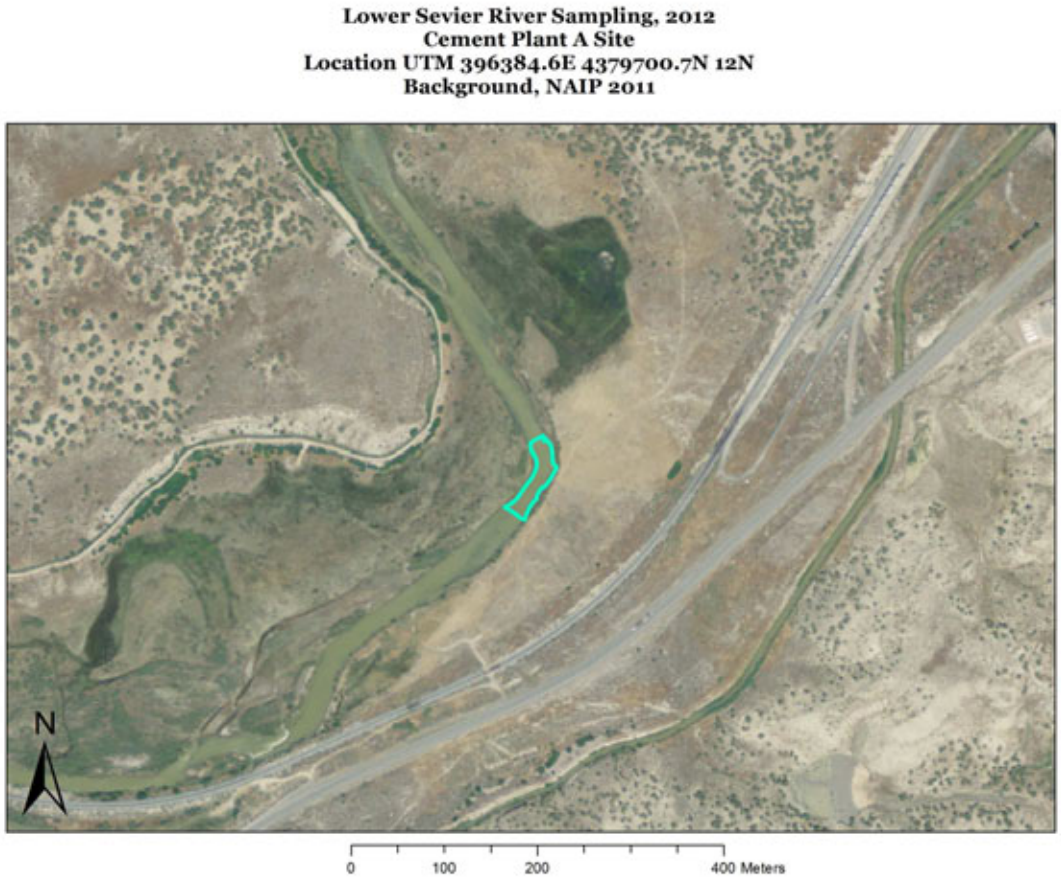
Native Species - 10m length[1]	0.62
Non-Native Species - 10m length[1]	1.25
All Fish 10m - length[1]	1.87

[1] Estimated numbers of fish captured per 10 meters of stream length - similar to a catch per unit of effort (CPUE).
[2] River miles are calculated moving upriver from Conk Dam (354785.05E, 4349062.13N, 12N, NAD83)
Note: 100 m^2 is defined as estimated numbers of fish per a 10 x 10 meter square.

Cement Plant A

The Cement Plant A site has been previously sampled by USU. Sampling began at the top of the site and proceeded downstream. A downstream block net was used and one pass was made for a qualitative sample. Meso-habitat begins at a riffle at the upstream boundary and moves into a long thigh deep pool. run combination. The block net was placed in the tail out. Substrates are limited sand and silt, and are dominated by gravel, cobbles and some boulders. The fish captured were dominated by non-natives with carp the most numerous. Several large Utah suckers were captured with a range of 324-457 mm in total length.

The block net collapsed partially, shortly before electroshocking was finished. Several large carp and channel cats were observed escaping, thus caution is due in using the Cement Plant A 2012 data.



Aerial Photo A6. Cement Plant A location (blue polygon).

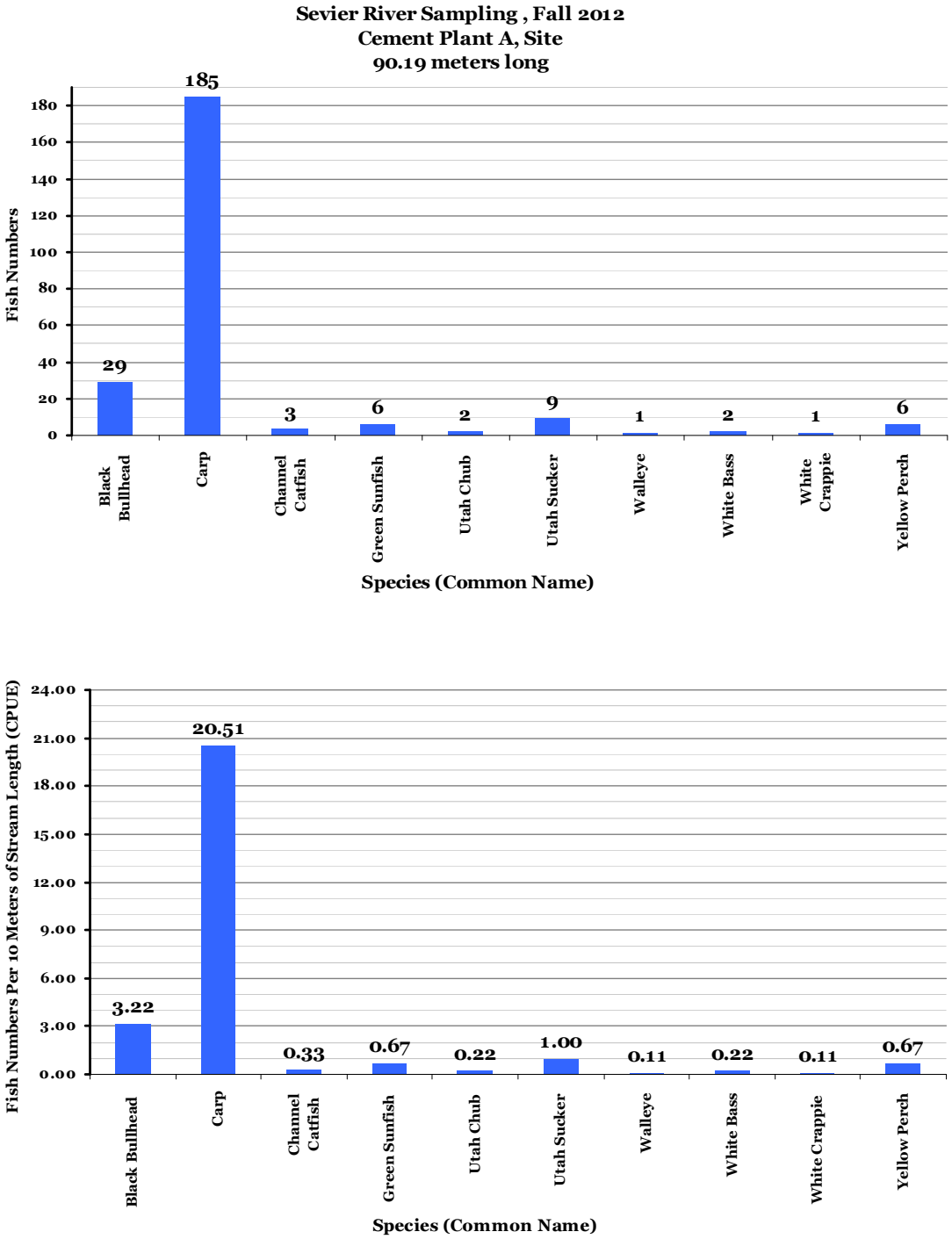


Figure A6. The Cement Plant A site, captured fish numbers and relative density (10 m of stream length, OR CPUE) by species.

Table A6. Cement Plant A basic data.

Cement Plant A

Date of Sampling: Tuesday, November 06, 2012

Location	UTM, 12N, NAD 83	
Sub Reach	Easting	Northing
Upper	396384.6	4379700.7

River Mile[2]	69.82

Length of Site (m)	90.19
Area (m^2)	1644.66

Native Species				
Common Name	Scientific Name	Number Captured	10m length[1]	100 m^2
Utah Chub	*Gila atraria*	2	0.22	1.216E-01
Utah Sucker	*Catostomus ardens*	9	1.00	5.472E-01

Non-Native Species				
Common Name	Scientific Name	Number Captured	10m length[1]	100 m^2
Black Bullhead	*Ameiurus melas*	29	3.22	1.763E+00
Carp	*Cyprinus carpio*	185	20.51	1.125E+01
Channel Catfish	*Ictalurus punctatus*	3	0.33	1.824E-01
Green Sunfish	*Lepomis cyanellus*	6	0.67	3.648E-01
Walleye	*Sander vitreus*	1	0.11	6.080E-02
White Bass	*Morone chrysops*	2	0.22	1.216E-01
White Crappie	*Pomoxis anularis*	1	0.11	6.080E-02
Yellow Perch	*Perca flavescens*	6	0.67	3.648E-01

Native Species. Sub-Total	11
Non-Native Species Sub-Total	233
Total Number of Fish Captured	244

Native Species Percent	4.51
Non-Native Species Percent	95.49

Native Species - 10m length[1]	1.22
Non-Native Species - 10m length[1]	25.83
All Fish 10m - length[1]	27.05

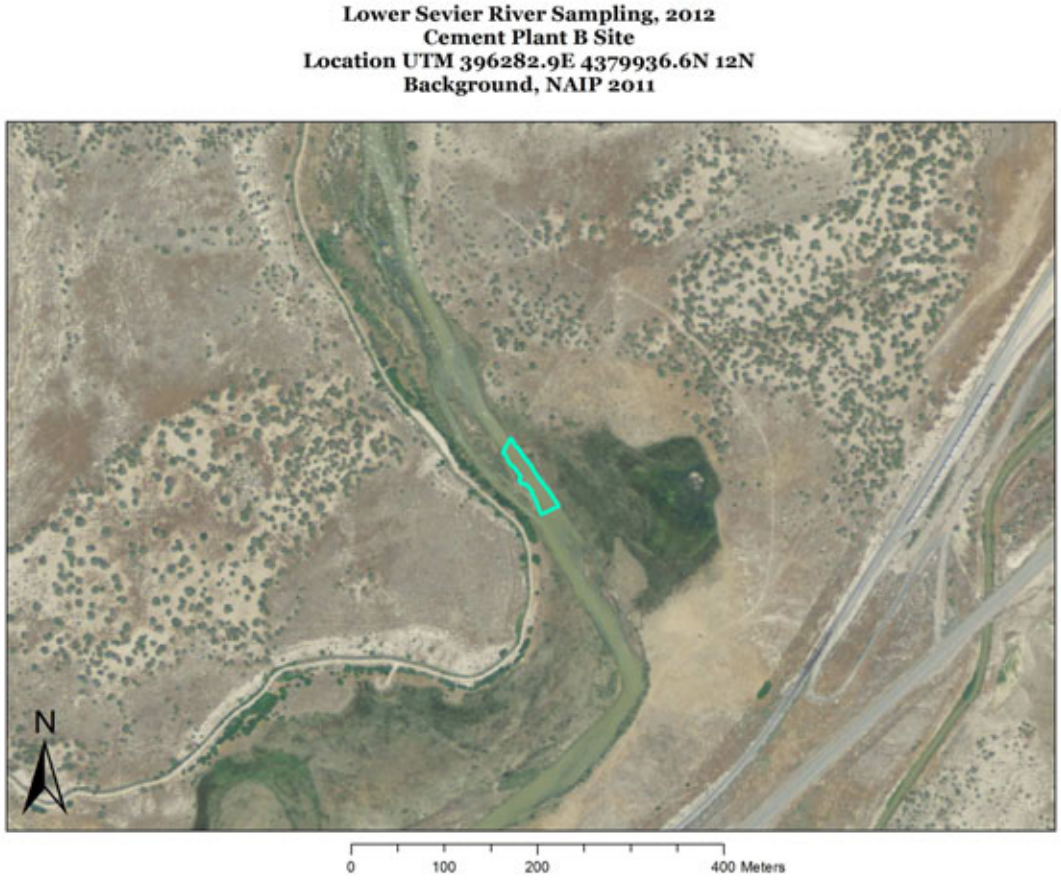
[1] Estimated numbers of fish captured per 10 meters of stream length - similar to a catch per unit of effort (CPUE).

[2] River miles are calculated moving upriver from Conk Dam (354785.05E, 4349062.13N, 12N, NAD83)

Note: 100 m^2 is defined as estimated numbers of fish per a 10 x 10 meter square.

Cement Plant B

The Cement Plant B site has been previously sampled by USU. Sampling began at the bottom of the site and proceeded upstream. No block net was used and one pass was made for a qualitative sample. Meso-habitat begins at a riffle at the downstream boundary and moves into a run with a riffle at the top. Substrates are sand, silt, gravel, cobbles and a few boulders. The fish captured were dominated by non-natives with carp and black bullheads the most numerous.



Aerial Photo A7. Cement Plant B location (blue polygon).

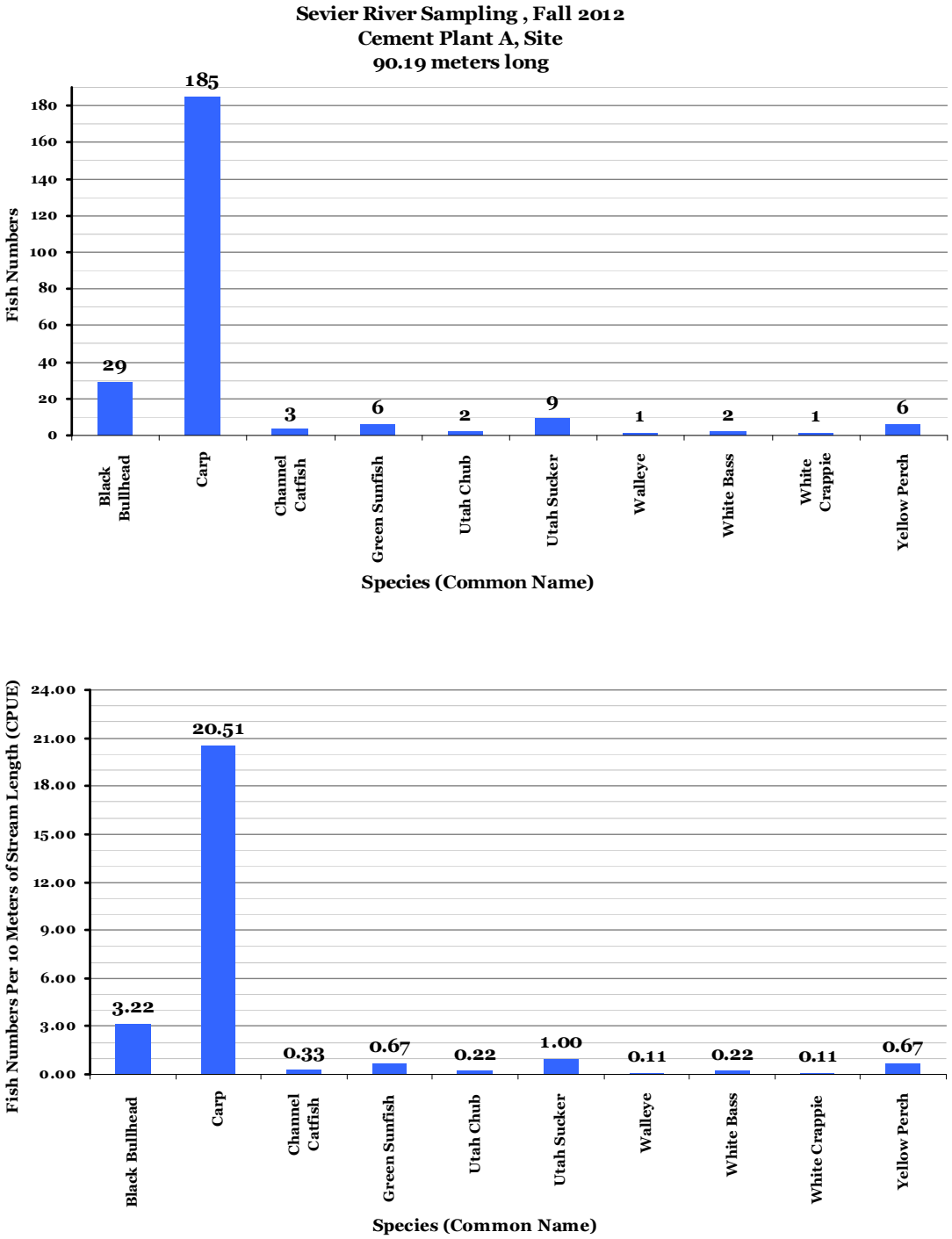


Figure A6. The Cement Plant B site, captured fish numbers and relative density (10 m of stream length, OR CPUE) by species.

Table A7. Cement Plant B basic data.

Cement Plant B

Date of Sampling: Tuesday, November 06, 2012

Location	UTM, 12N, NAD 83	
Sub Reach	Easting	Northing
Upper	396282.9	4379936.6

River Mile[2]	69.99

Length of Site (m)	83.79
Area (m^2)	1382.31

Native Species				
Common Name	Scientific Name	Number Captured	10m length[1]	100 m^2
Utah Chub	*Gila atraria*	1	0.12	7.234E-02

Non-Native Species				
Common Name	Scientific Name	Number Captured	10m length[1]	100 m^2
Black Bullhead	*Ameiurus melas*	10	1.19	7.234E-01
Carp	*Cyprinus carpio*	10	1.19	7.234E-01
Green Sunfish	*Lepomis cyanellus*	2	0.24	1.447E-01
Yellow Perch	*Perca flavescens*	1	0.12	7.234E-02

Native Species. Sub-Total	1
Non-Native Species Sub-Total	23
Total Number of Fish Captured	24

Native Species Percent	4.17
Non-Native Species Percent	95.83

Native Species - 10m length[1]	0.12
Non-Native Species - 10m length[1]	2.75
All Fish 10m - length[1]	2.86

[1] Estimated numbers of fish captured per 10 meters of stream length - similar to a catch per unit of effort (CPUE).
[2] River miles are calculated moving upriver from Conk Dam (354785.05E, 4349062.13N, 12N, NAD83)
Note: 100 m^2 is defined as estimated numbers of fish per a 10 x 10 meter square.

Central Canal Diversion

The Central Canal Diversion site has been previously sampled by USU. Sampling began at the bottom of the site and proceeded upstream. No block net was used and one pass was made for a qualitative sample. Meso-habitat begins at a pool tail out at the downstream boundary and moves into a fast riffle at the top. Substrates are gravel, cobbles and a few boulders. The fish captured were dominated by natives with redside shiners and Utah suckers the most numerous. Some very large specimens were captured here with Utah suckers up to 526 mm (total length), carp 686 mm and smallmouth bass at 393 mm.

Aerial Photo A8. Central Canal Diversion location (blue polygon).

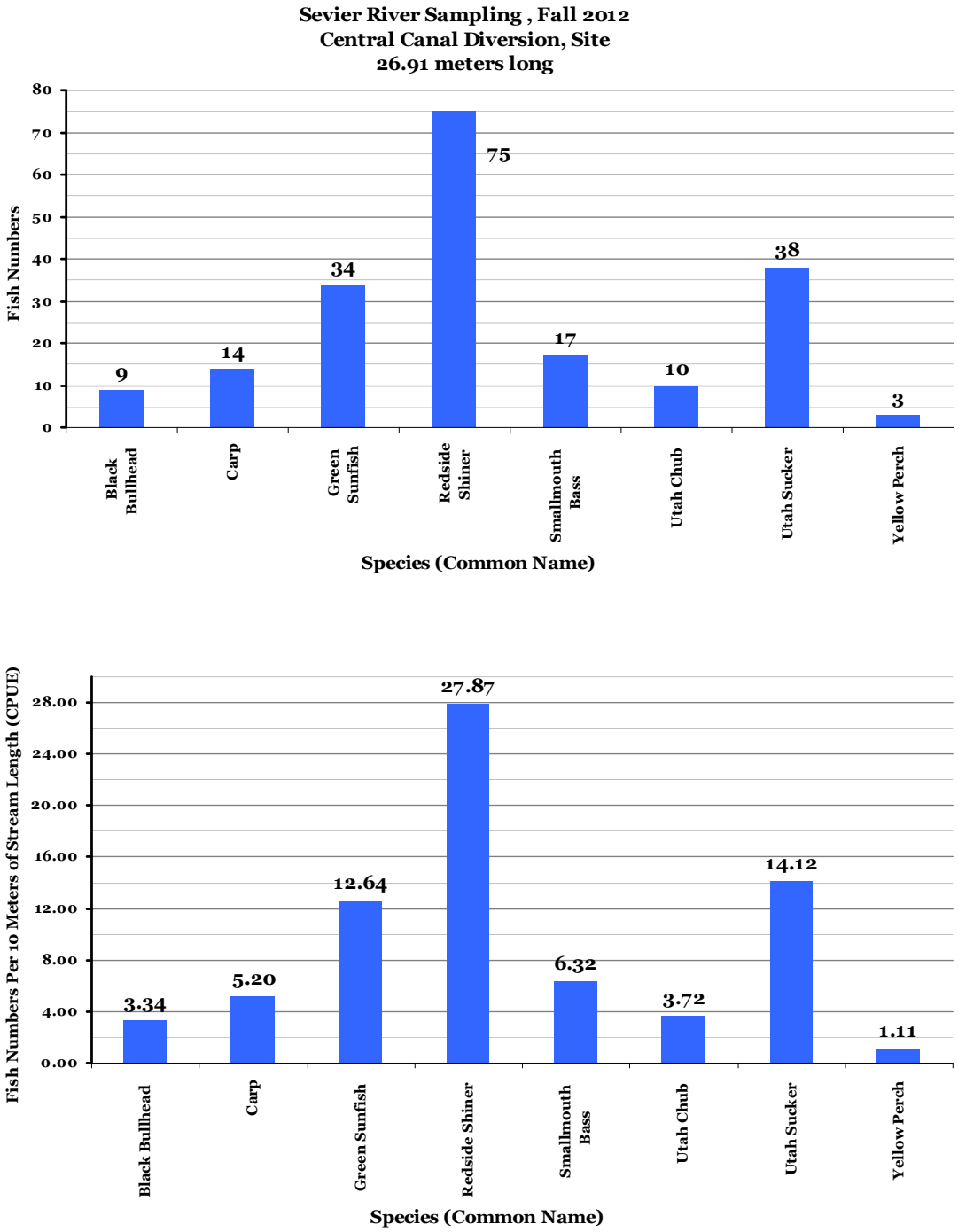


Figure A8. The Central Canal Diversion site, captured fish numbers and relative density (10 m of stream length, OR CPUE) by species.

Table A8. Central Canal Diversion basic data.

Central Canal Diversion

Date of Sampling: Tuesday, November 06, 2012

Location	UTM, 12N, NAD 83	
Sub Reach	Easting	Northing
Upper	397500.6	4381283.9

River Mile[2]	71.64

Length of Site (m)	26.91
Area (m^2)	347.03

Native Species				
Common Name	Scientific Name	Number Captured	10m length[1]	100 m^2
Redside Shiner	*Richardsonius balteatus*	75	27.87	2.161E+01
Utah Chub	*Gila atraria*	10	3.72	2.882E+00
Utah Sucker	*Catostomus ardens*	38	14.12	1.095E+01

Non-Native Species				
Common Name	Scientific Name	Number Captured	10m length[1]	100 m^2
Black Bullhead	*Ameiurus melas*	9	3.34	2.593E+00
Carp	*Cyprinus carpio*	14	5.20	4.034E+00
Green Sunfish	*Lepomis cyanellus*	34	12.64	9.797E+00
Smallmouth Bass	*Micropterus dolomieu*	17	6.32	4.899E+00
Yellow Perch	*Perca flavescens*	3	1.11	8.645E-01

Native Species. Sub-Total	123
Non-Native Species Sub-Total	77
Total Number of Fish Captured	200

Native Species Percent	61.50
Non-Native Species Percent	38.50

Native Species - 10m length[1]	45.71
Non-Native Species - 10m length[1]	28.61
All Fish 10m - length[1]	74.32

[1] Estimated numbers of fish captured per 10 meters of stream length similar to a catch per unit of effort (CPUE).

[2] River miles are calculated moving upriver from Conk Dam (354785.05E, 4349062.13N, 12N, NAD83)

Note: 100 m^2 is defined as estimated numbers of fish per a 10 x 10 meter square.

New Hwy 132, Backwater and Main Channel

The New Hwy 132 site was selected to replace the Hwy 132 site previously sampled by USU, it is slightly upstream from the USU site Hwy 132 C. The original Hwy 132 was highly altered in a realignment of the river under the bridge at Hwy 132. The New Hwy 132 site is broken into two sections or sub-sites, a backwater and a main channel. This allows a comparison of two classifications that adjoin each other. Sampling began at the top (upstream) of the Backwater portion and proceeded into the shallows and shore. An upstream turn was made and sampling moved upstream through the main channel. The Backwater is knee deep and less with low velocities. The Main Channel portion meso-habitat begins at a fast riffle and moves upstream through a run. No block net was used and one pass was made for a qualitative sample. Substrates are gravel, cobbles and some silt in the back water. Woody debris as cover was present in both the Backwater and Main Channel along the bank.

Utah chub dominated the sample in the Backwater with leatherside (southern) and Utah chub in the Main. This is the only location where leathersides were sampled during the 2012 effort.

Aerial Photo A9. New HWY 132 location (blue polygon). Note that the backwater and main channel are side by side.

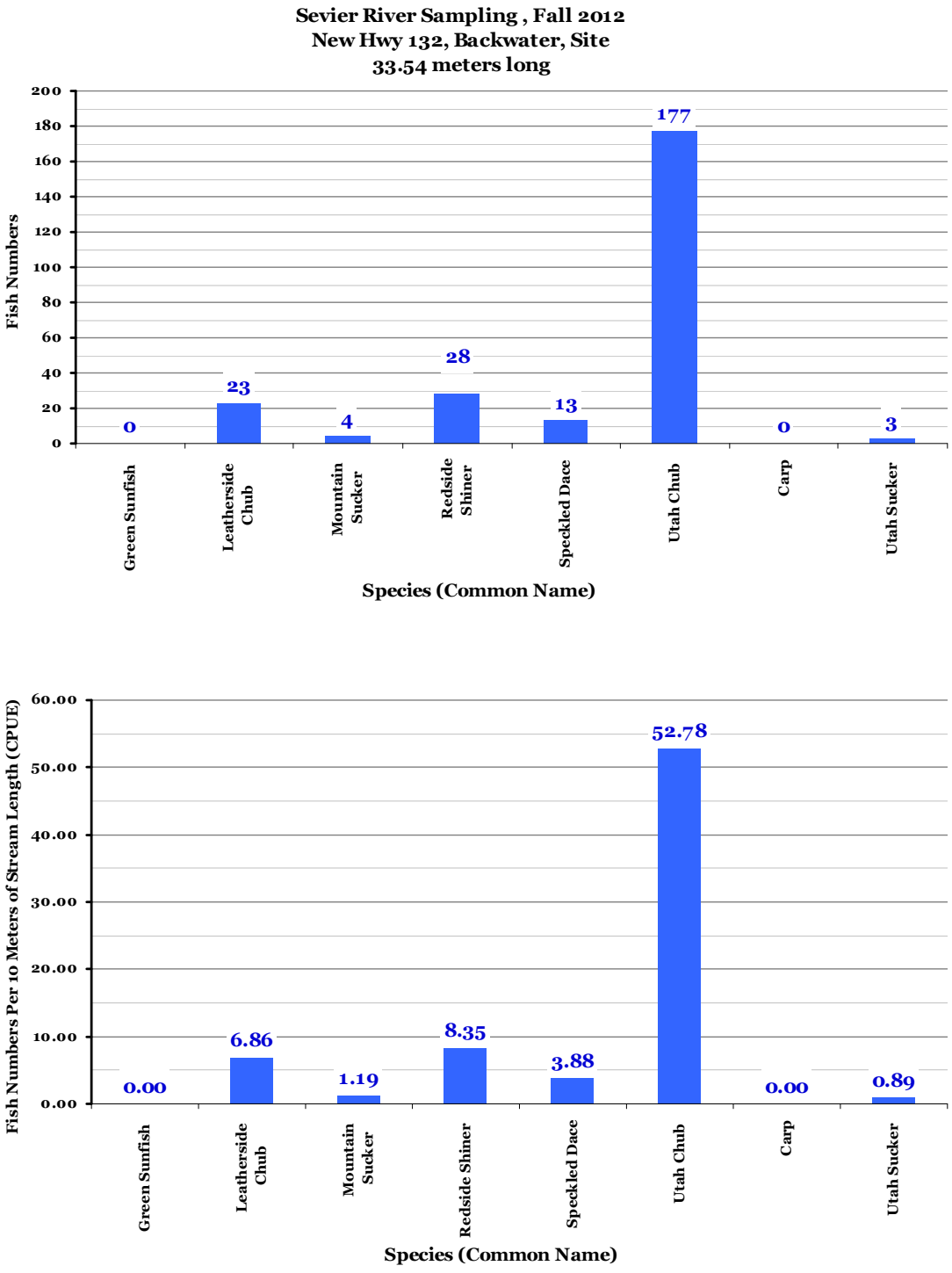


Figure A9. The New HWY 132 Backwater site, captured fish numbers and relative density (10 m of stream length, OR CPUE) by species.

Table A9. New HWY 132 Backwater basic data.

New Hwy 132 - Backwater

Date of Sampling: Thursday, November 08, 2012

Location	UTM, 12N, NAD 83	
Sub Reach	Easting	Northing
Upper	400281.4	4382366.9

River Mile[2]	73.94

Backwater	
Length of Site (m)	33.54
Area (m^2)	317.38

Native Species - Backwater

Common Name	Scientific Name	Number Captured	10m length[1]	100 m^2
Leatherside Chub	*Lepidomeda copei*	23	6.86	7.247E+00
Mountain Sucker	*Catostomus platyrhynchus*	4	1.19	1.260E+00
Redside Shiner	*Richardsonius balteatus*	28	8.35	8.822E+00
Speckled Dace	*Rhinichthys osculus*	13	3.88	4.096E+00
Utah Chub	*Gila atraria*	177	52.78	5.577E+01
Utah Sucker	*Catostomus ardens*	3	0.89	9.452E-01

Non-Native Species - Backwater

Common Name	Scientific Name	Number Captured	10m length[1]	100 m^2
No non-natives were captured				

Native Species. Sub-Total	248
Non-Native Species Sub-Total	0
Total Number of Fish Captured	248

Native Species Percent	100.00
Non-Native Species Percent	0.00

Native Species - 10m length[1]	73.95
Non-Native Species - 10m length[1]	0.00
All Fish 10m - length[1]	73.95

[1] Estimated numbers of fish captured per 10 meters of stream length similar to a catch per unit of effort (CPUE).

[2] River miles are calculated moving upriver from Conk Dam (354785.05E, 4349062.13N, 12N, NAD83)

Note: 100 m^2 is defined as estimated numbers of fish per a 10 x 10 meter square.

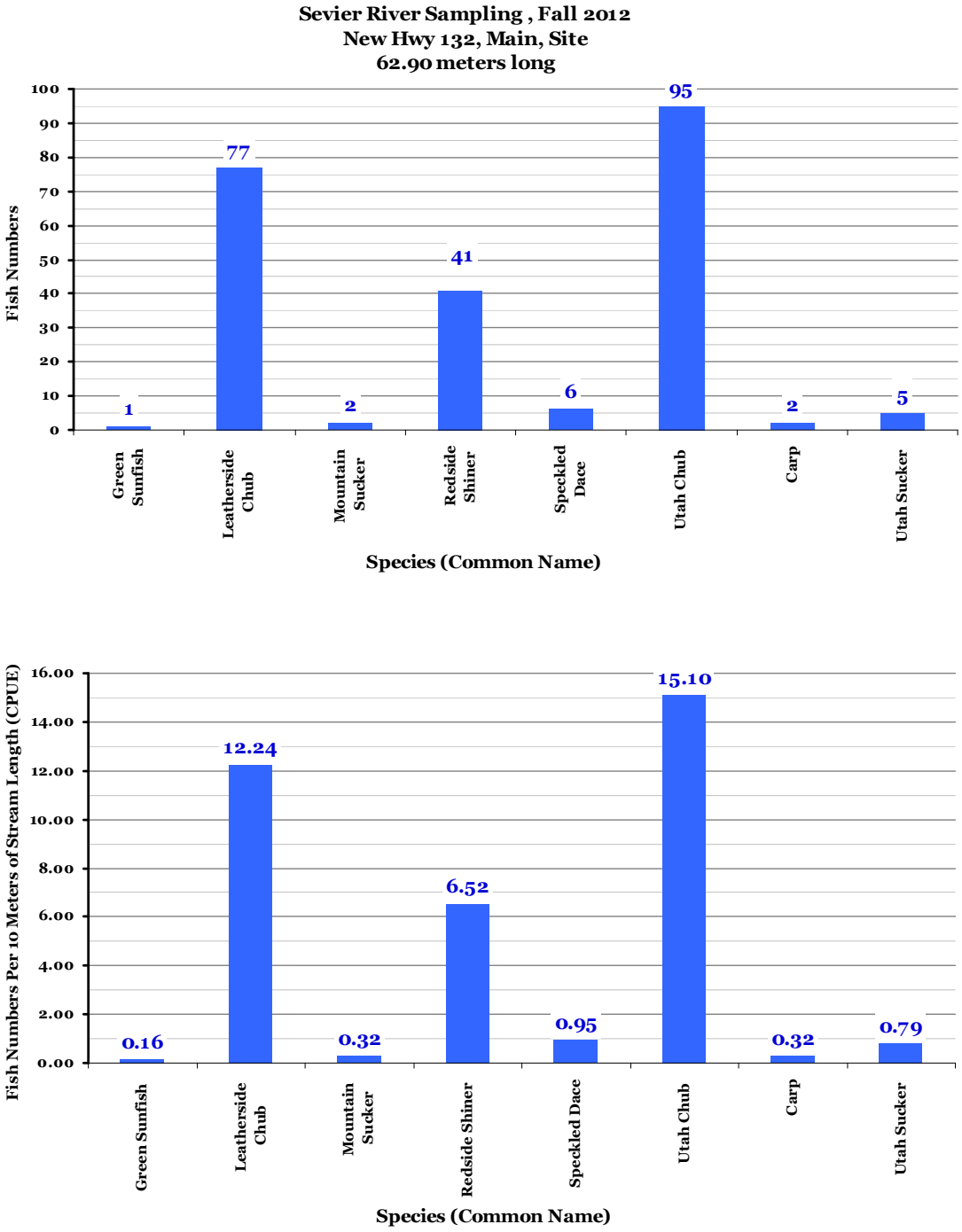


Figure A10. The New HWY 132 Main site, captured fish numbers and relative density (10 m of stream length, OR CPUE) by species.

Table A10. New HWY 132 Main Channel basic data.

New Hwy 132 - Main Channel

Date of Sampling: Thursday, November 08, 2012

Location	UTM, 12N, NAD 83	
Sub Reach	Easting	Northing
Upper	400284.2	4382354.5

River Mile[2]	73.95

Backwater	
Length of Site (m)	62.90
Area (m^2)	1062.17

Native Species - Main				
Common Name	Scientific Name	Number Captured	10m length[1]	100 m^2
Leatherside Chub	*Lepidomeda copei*	77	12.24	7.249E+00
Mountain Sucker	*Catostomus platyrhynchus*	2	0.32	1.883E-01
Redside Shiner	*Richardsonius balteatus*	41	6.52	3.860E+00
Speckled Dace	*Rhinichthys osculus*	6	0.95	5.649E-01
Utah Chub	*Gila atraria*	95	15.10	8.944E+00
Utah Sucker	*Catostomus ardens*	5	0.79	4.707E-01

Non-Native Species - Main				
Common Name	Scientific Name	Number Captured	10m length1	100 m2
Green Sunfish	*Lepomis cyanellus*	1	0.16	9.415E-02
Carp	*Cyprinus carpio*	2	0.32	1.883E-01

Native Species. Sub-Total	226
Non-Native Species Sub-Total	3
Total Number of Fish Captured	229

Native Species Percent	98.69
Non-Native Species Percent	1.31

Native Species - 10m length[1]	35.93
Non-Native Species - 10m length[1]	0.48
All Fish 10m - length[1]	36.41

[1] Estimated numbers of fish captured per 10 meters of stream length similar to a catch per unit of effort (CPUE).

[2] River miles are calculated moving upriver from Conk Dam (354785.05E, 4349062.13N, 12N, NAD83)

Note: 100 m^2 is defined as estimated numbers of fish per a 10 x 10 meter square.

New Sevier Canyon, Main and Side Channel

The New Sevier Canyon, Main and Side Channel sites were selected to replace the Sevier Canyon site that was previously sampled by USU. The sites partially overlap the USU 2005 Sevier Canyon 6. There are two distinct sites that are separated by an island.

Side Channel

Sampling began at the bottom of the site and proceeded upstream. No block net was used and one pass was made for a qualitative sample. Meso-habitat begins with riffle at a pool tail out (downstream boundary) and moves into a long pool and ends with a fast riffle at the top. Substrates are sand, gravel, and cobbles. Woody debris and vegetation as cover were limited. The fish captured were dominated by natives with mountain suckers, Utah chubs were the most numerous.

Main Channel

Sampling began at the bottom of the site and proceeded upstream. No block net was used and one pass was made for a qualitative sample. Meso-habitat begins with riffle at a pool tail out (downstream boundary) and moves into a long pool and ends with a fast riffle at the top. Substrates are sand, gravel, and cobbles. Woody debris and vegetation as cover were limited to the river left bank (looking downstream). The fish were dominated by natives but were captured. This is the only site where the mottled sculpin was captured.

Aerial Photo A10. New Sevier Canyon, Main and Side locations (blue polygon). Note that and Side and Main channel are separated by an island and are two distinct sites.

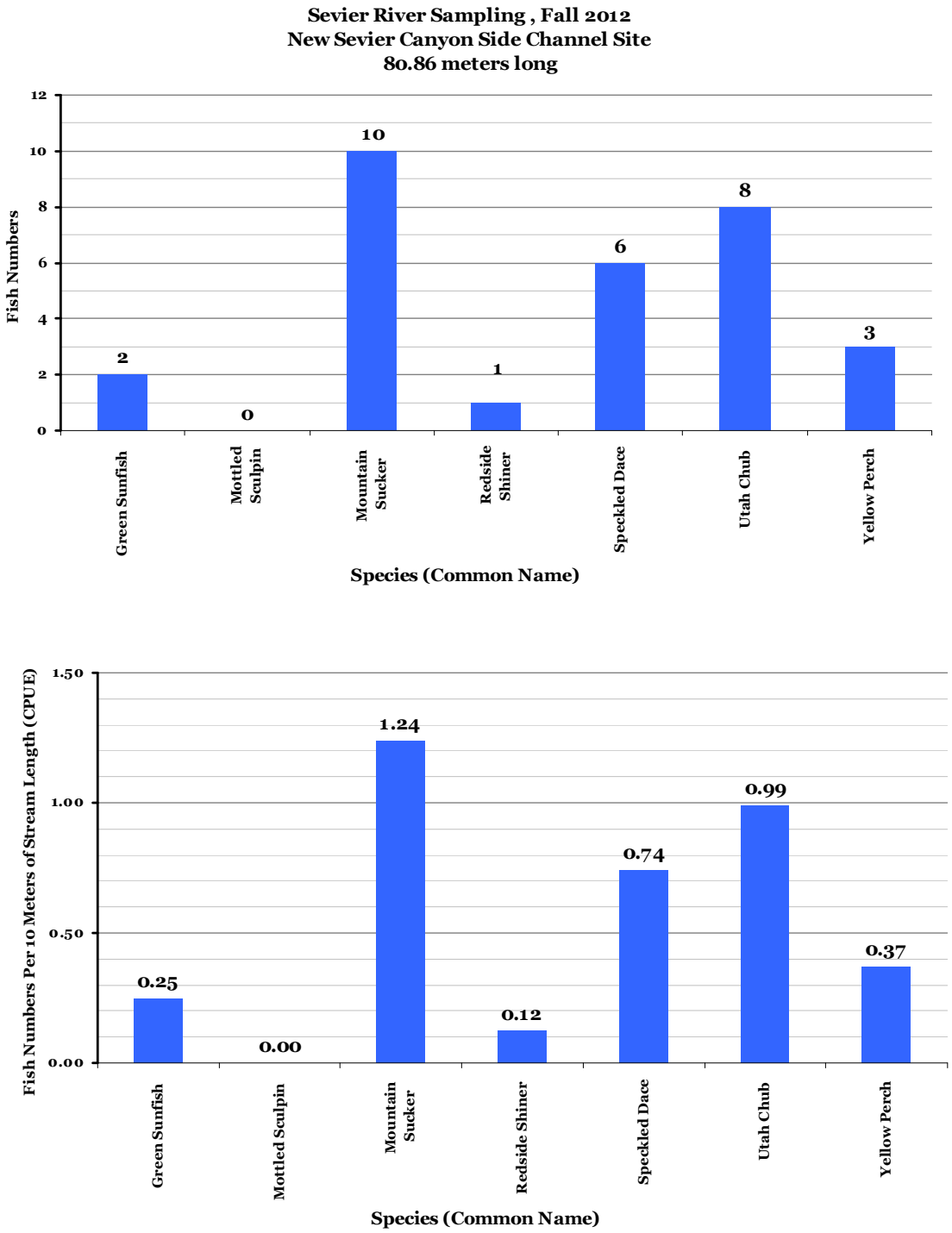


Figure A11. The New Sevier Canyon Side Channel site, captured fish numbers and relative density (10 m of stream length, OR CPUE) by species.

Table A11. New Sevier Canyon Main Channel basic data.

New Sevier Canyon, Main Channel

Date of Sampling: Thursday, November 08, 2012

Location	UTM, 12N, NAD 83	
Sub Reach	Easting	Northing
Upper	400284.2	4382354.5

River Mile[2]	78.68

Main	
Length of Site (m)	100.41
Area (m^2)	1709.98

Native Species - Main				
Common Name	Scientific Name	Number Captured	10m length[1]	100 m^2
Mottled Sculpin	*Cottus bairdii*	3	0.30	1.754E-01
Mountain Sucker	*Catostomus platyrhynchus*	3	0.30	1.754E-01
Redside Shiner	*Richardsonius balteatus*	2	0.20	1.170E-01
Speckled Dace	*Rhinichthys osculus*	2	0.20	1.170E-01
Utah Chub	*Gila atraria*	2	0.20	1.170E-01

Non-Native Species - Main				
Common Name	Scientific Name	Number Captured	10m length[1]	100 m^2
No non-natives captured				

Native Species. Sub-Total	12
Non-Native Species Sub-Total	0
Total Number of Fish Captured	12

Native Species Percent	100.00
Non-Native Species Percent	0.00

Native Species - 10m length[1]	1.20
Non-Native Species - 10m lengtl	0.00
All Fish 10m - length[1]	1.20

[1] Estimated numbers of fish captured per 10 meters of stream length similar to a catch per unit of effort (CPUE).

[2] River miles are calculated moving upriver from Conk Dam (354785.05E, 4349062.13N, 12N, NAD83)

Note: 100 m^2 is defined as estimated numbers of fish per a 10 x 10 meter square.

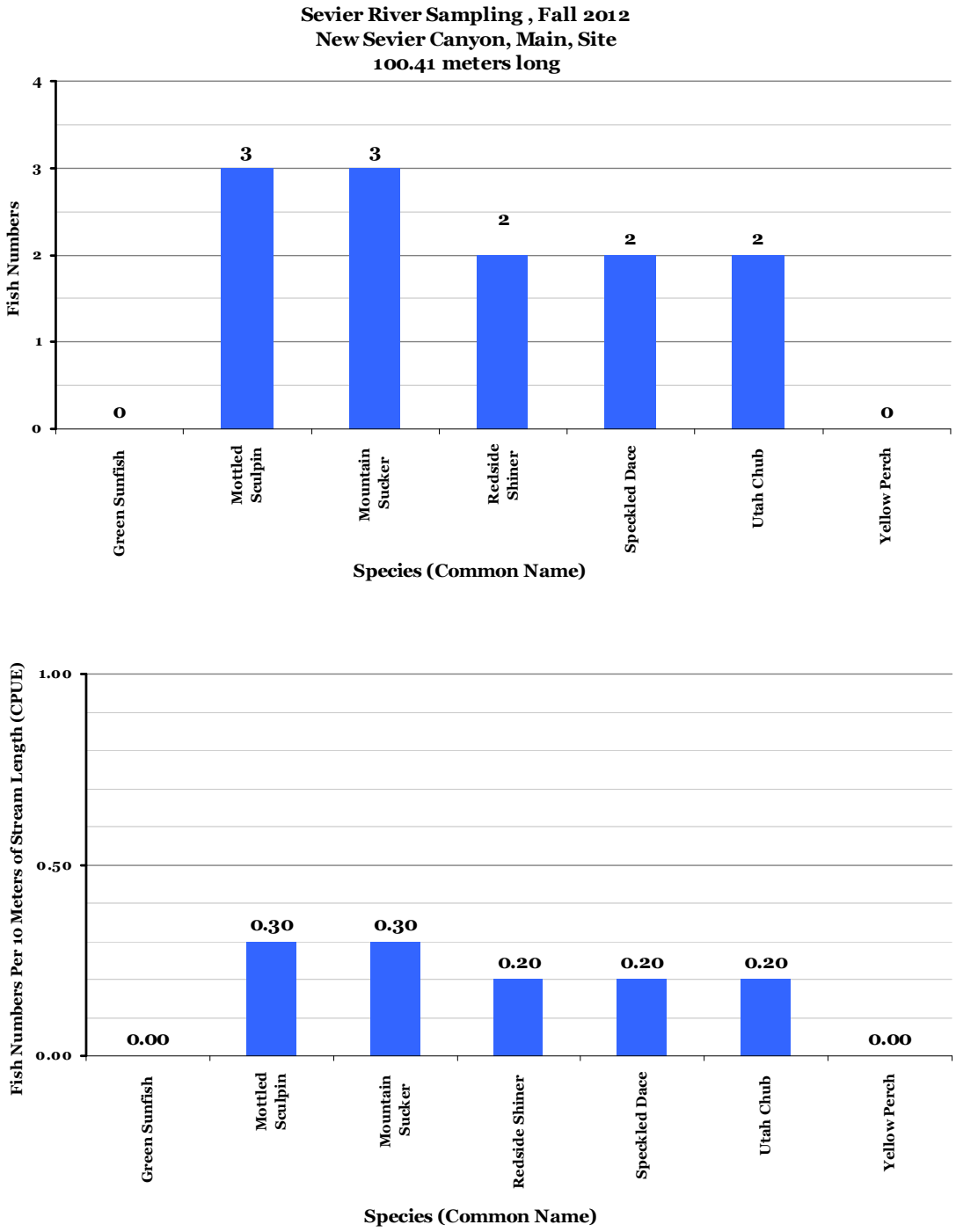


Figure A12. The New Sevier Canyon Main Channel site, captured fish numbers and relative density (10 m of stream length, OR CPUE) by species.

Table A12. New Sevier Canyon Side Channel basic data.

New Sevier Canyon, Side Channel

Date of Sampling: Thursday, November 08, 2012

Location	UTM, 12N, NAD 83	
Sub Reach	Easting	Northing
Upper	402557.2	4379219.8

River Mile[2]	78.68

Side	
Length of Site (m)	80.86
Area (m^2)	660.78

Common Name	Native Species - Side Scientific Name	Number Captured	10m length[1]	100 m^2
Mountain Sucker	*Catostomus platyrhynchus*	10	1.24	1.513E+00
Redside Shiner	*Richardsonius balteatus*	1	0.12	1.513E-01
Speckled Dace	*Rhinichthys osculus*	6	0.74	9.080E-01
Utah Chub	*Gila atraria*	8	0.99	1.211E+00

Common Name	Non-Native Species - Side Scientific Name	Number Captured	10m length[1]	100 m^2
Green Sunfish	*Lepomis cyanellus*	2	0.25	3.027E-01
Yellow Perch	*Perca flavescens*	3	0.37	4.540E-01

Native Species. Sub-Total	25
Non-Native Species Sub-Total	5
Total Number of Fish Captured	30

Native Species Percent	83.33
Non-Native Species Percent	16.67

Native Species - 10m length[1]	3.09
Non-Native Species - 10m length[1]	0.62
All Fish 10m - length[1]	3.71

[1] Estimated numbers of fish captured per 10 meters of stream length similar to a catch per unit of effort (CPUE).

[2] River miles are calculated moving upriver from Conk Dam (354785.05E, 4349062.13N, 12N, NAD83)

Note: 100 m^2 is defined as estimated numbers of fish per a 10 x 10 meter square.

Mills Valley, Main and Side Channel

The Mills Valley, Main and Side Channel sites were previously sampled by USU. Sites are distinct and separated by a small island.

Side Channel

Sampling began at the bottom of the site and proceeded upstream. No block net was used and one pass was made for a qualitative sample. Meso-habitat at the flows sampled consists of shallow riffles, runs, and small pools. Substrates are sand, small pea gravels, and silt. Aquatic vegetation grows on river right (looking downstream). The fish captured were native species. Only 5 fish were captured.

Main Channel

Sampling began at the top of the site and proceeded downstream. No block net was used and one pass was made for a qualitative sample. Meso-habitat at the flows sampled consists of shallow riffles, and runs. Substrates are sand, small pea gravels, and silt. Small patches of aquatic vegetation and small woody debris were present. No fish were captured.

Aerial Photo A11. Mills Valley location (blue polygon). Note that and Side and Main channel are separated by an island and are two distinct sites.

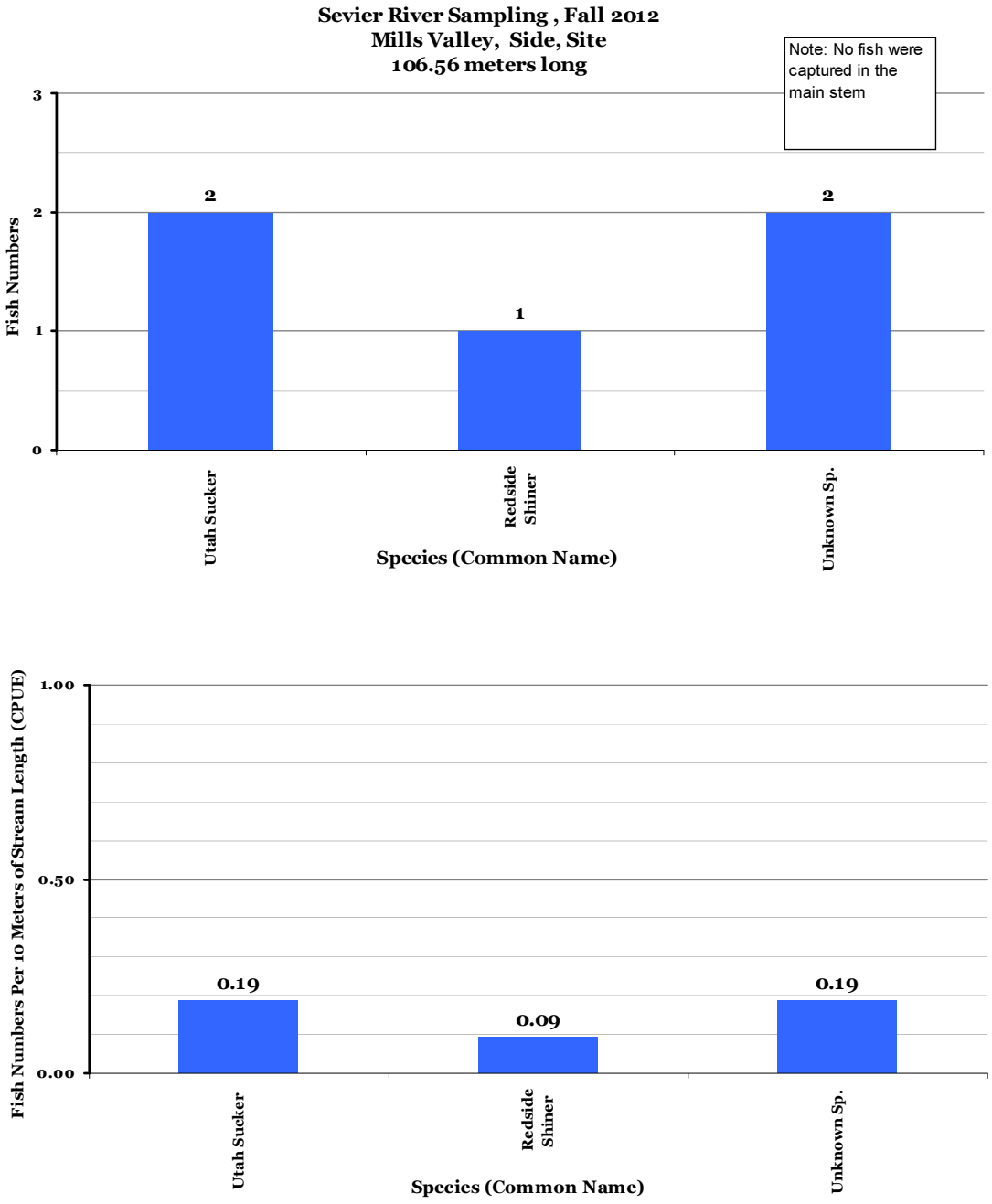


Figure A13. The Mills Valley Side Channel site, captured fish numbers and relative density (10 m of stream length, OR CPUE) by species. No fish were captured in the Main Channel.

Table A13. Mills Valley Main Channel basic data.

Mills Valley, Main Channel

Date of Sampling: Thursday, November 08, 2012

Location	UTM, 12N, NAD 83	
Sub Reach	Easting	Northing
Upper	409739.8	4371689.0

River Mile[2]	90.51

Main	
Length of Site (m)	104.00
Area (m^2)	1804.22

Native Species - Main				
Common Name	Scientific Name	Number Captured	10m length[1]	100 m^2
No native species captured				

Non-Native Species - Main				
Common Name	Scientific Name	Number Captured	10m length[1]	100 m^2
No non-natives captured				

Native Species. Sub-Total	0.00
Non-Native Species Sub-Total	0.00
Total Number of Fish Captured	0.00

Native Species Percent	0.00
Non-Native Species Percent	0.00

Native Species - 10m length[1]	0.00
Non-Native Species - 10m length[1]	0.00
All Fish 10m - length[1]	0.00

[1] Estimated numbers of fish captured per 10 meters of stream length similar to a catch per unit of effort (CPUE).

[2] River miles are calculated moving upriver from Conk Dam (354785.05E, 4349062.13N, 12N, NAD83)

Note: 100 m^2 is defined as estimated numbers of fish per a 10 x 10 meter square.

Table A14. Mills Valley Side Channel basic data.

Mills Valley, Side Channel

Date of Sampling: Thursday, November 08, 2012

Location	UTM, 12N, NAD 83	
Sub Reach	Easting	Northing
Upper	409762.6	4371664.2

River Mile[2]	90.51

Side	
Length of Site (m)	106.56
Area (m^2)	1032.46

Native Species - Side				
Common Name	Scientific Name	Number Captured	10m length[1]	100 m^2
Utah Sucker	*Catostomus ardens*	2	0.19	1.937E-01
Redside Shiner	*Richardsonius balteatus*	1	0.09	9.686E-02
Unknown Sp.	*na*	2	0.19	1.937E-01

Non-Native Species - Side				
Common Name	Scientific Name	Number Captured	10m length[1]	100 m^2
No non-natives captured				

Native Species. Sub-Total	5
Non-Native Species Sub-Total	0
Total Number of Fish Captured	5

Native Species Percent	100.00
Non-Native Species Percent	0.00

Native Species - 10m length[1]	0.47
Non-Native Species - 10m length[1]	0.00
All Fish 10m - length[1]	0.47

[1] Estimated numbers of fish captured per 10 meters of stream length similar to a catch per unit of effort (CPUE).

[2] River miles are calculated moving upriver from Conk Dam (354785.05E, 4349062.13N, 12N, NAD83)

Note: 100 m^2 is defined as estimated numbers of fish per a 10 x 10 meter square.

Appendix B
Lower Sevier River
Electrofishing Sampling
Length Frequency
Historgrams
2012

Table of Contents - Appendix B

List of Figures - Appendix B

Bunker Farm

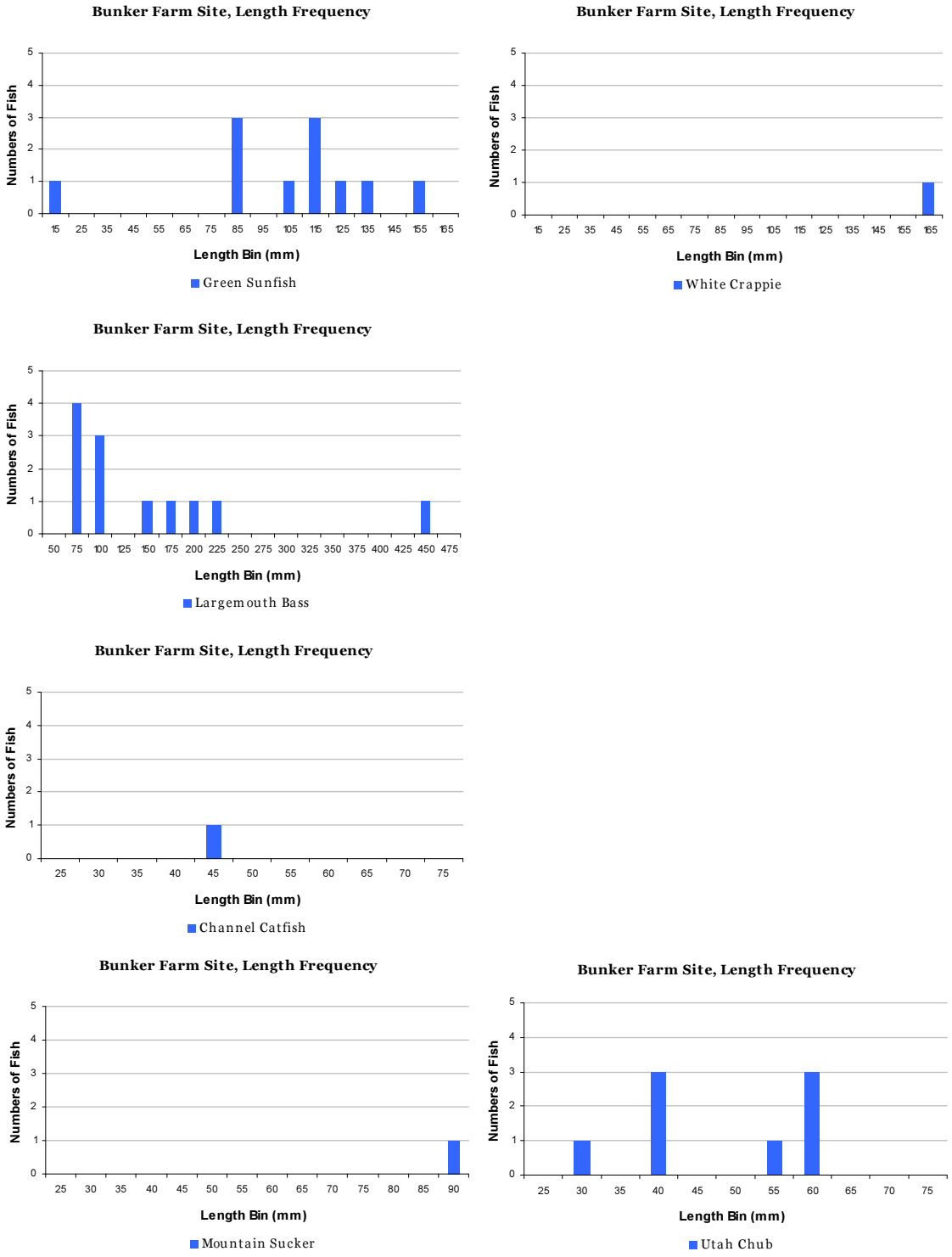


Figure B1. The Bunker Farm site, length frequency of fish by species. Note, not all captured fish were measured.

Flume

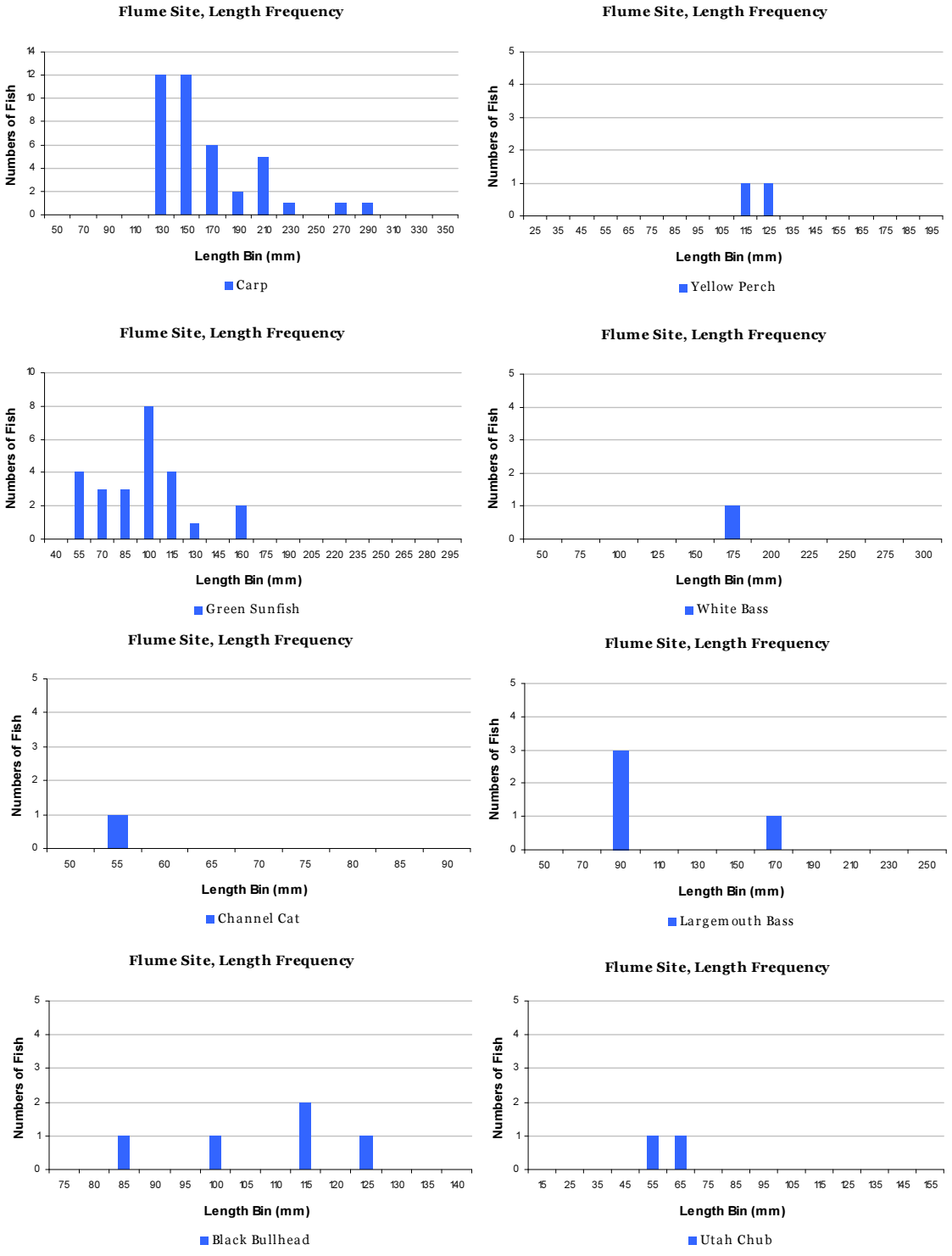


Figure B2. The Flume site, length frequency of fish by species. Note, not all captured fish were measured.

Powerline A, Downstream

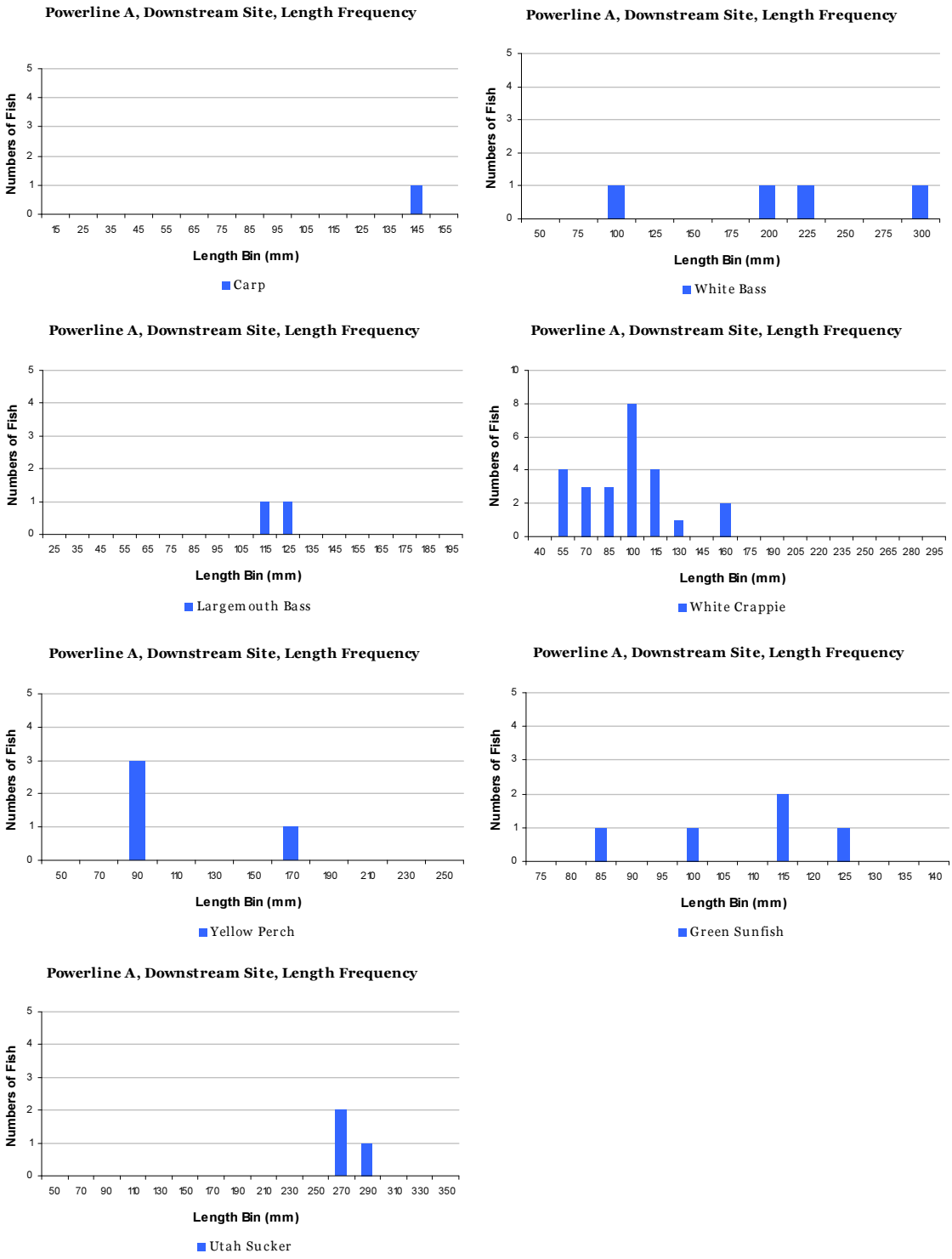


Figure B3. The Powerline A, Downstream site, length frequency of fish by species. Note, not all captured fish were measured.

Powerline B, Upstream

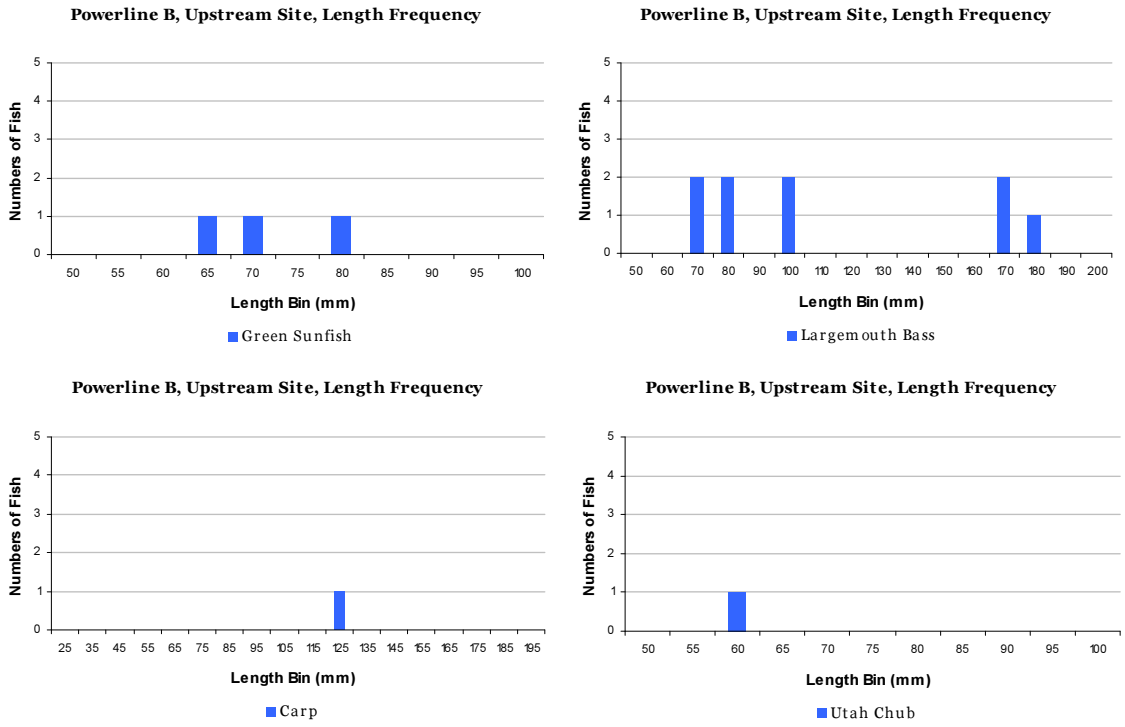


Figure B4. The Powerline B, Upstream site, length frequency of fish by species. Note, not all captured fish were measured.

Rifle Range

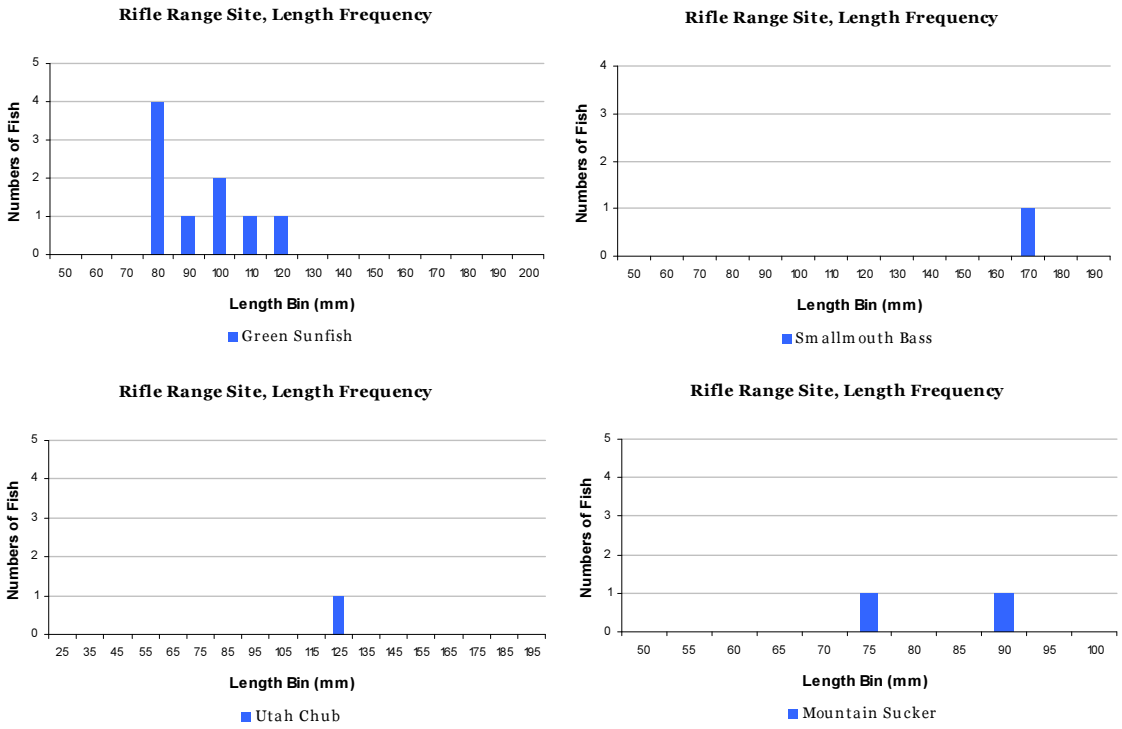


Figure B5. The Rifle Range site, length frequency of fish by species. Note, not all captured fish were measured.

Cement Plant A

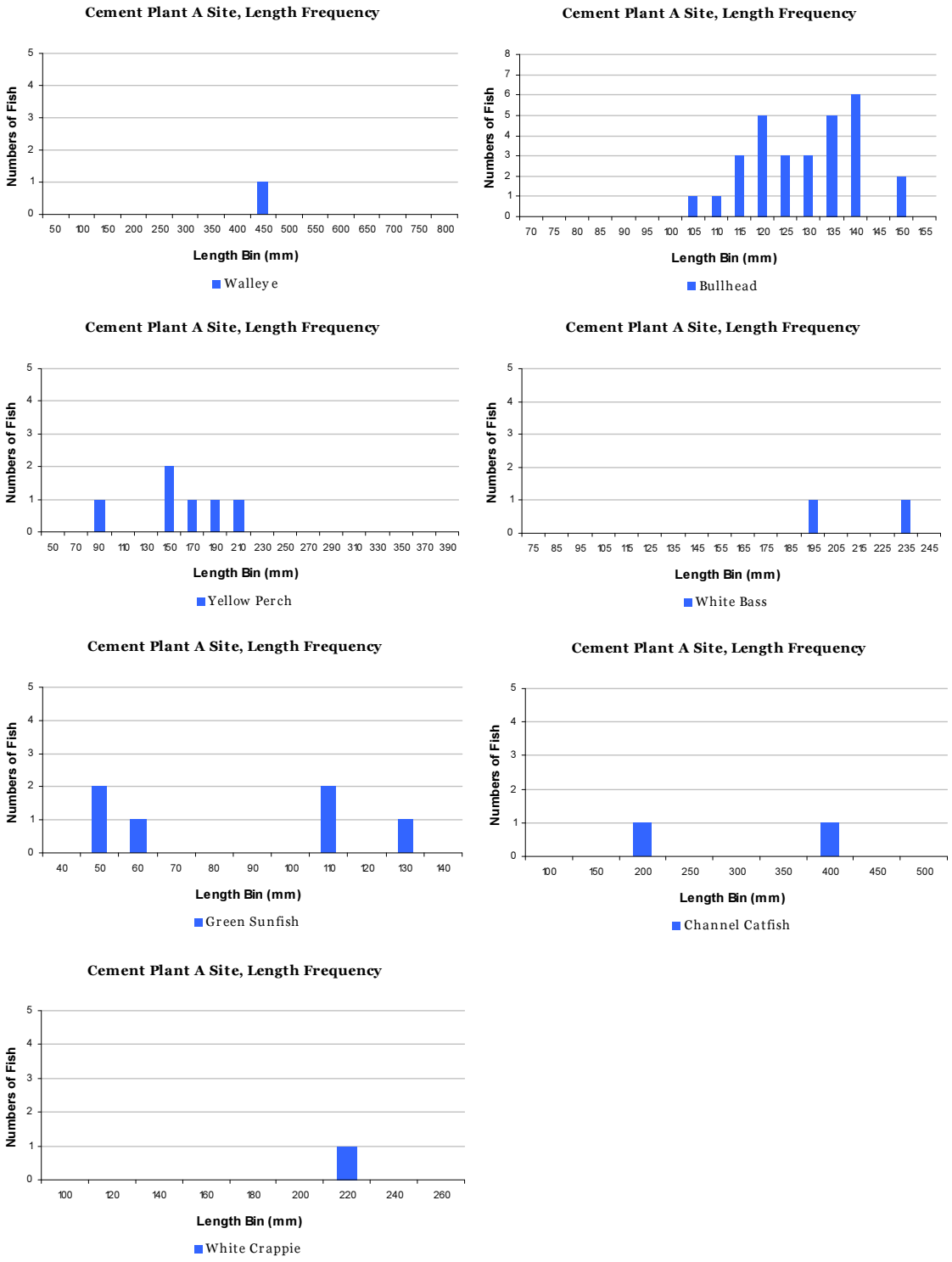


Figure B6. The Cement Plant A site, length frequency of fish by species. Note, not all captured fish were measured.

Cement Plant A Continued

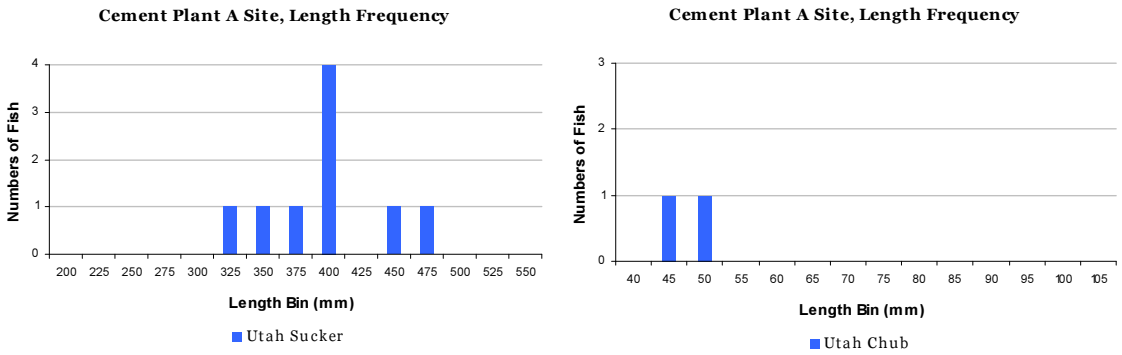


Figure B7. The Cement Plant A site continued, length frequency of fish by species. Note, not all captured fish were measured.

Cement Plant B

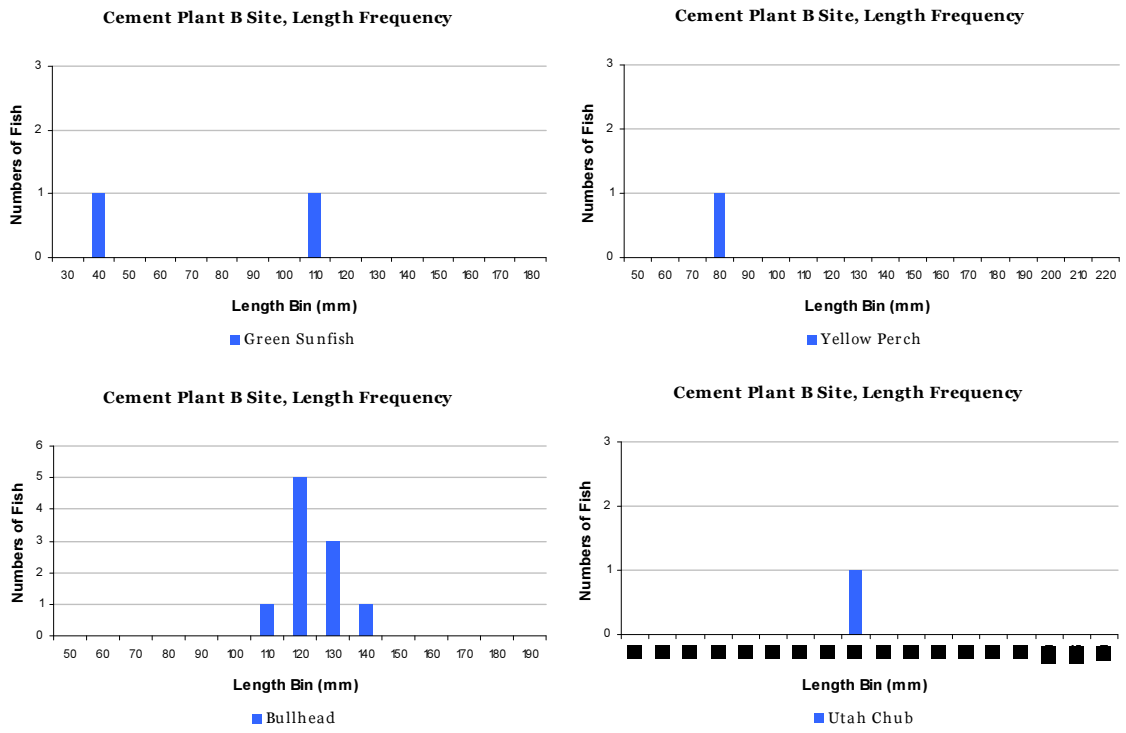


Figure B7. The Cement Plant B site, length frequency of fish by species. Note, not all captured fish were measured.

Central Canal Diversion

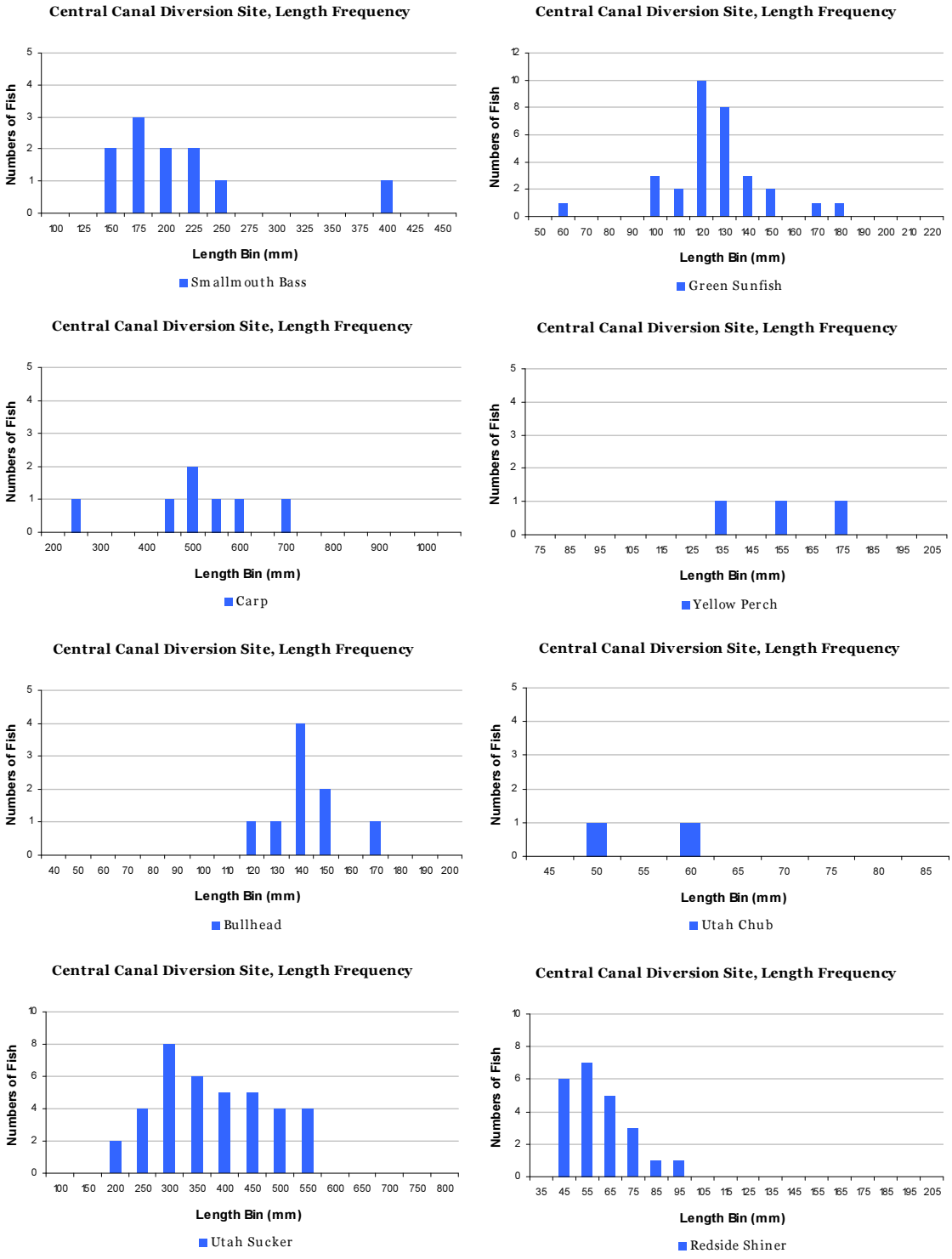


Figure B8. The Central Canal Diversion site, length frequency of fish by species. Note, not all captured fish were measured.

New Hwy 132 Main Channel

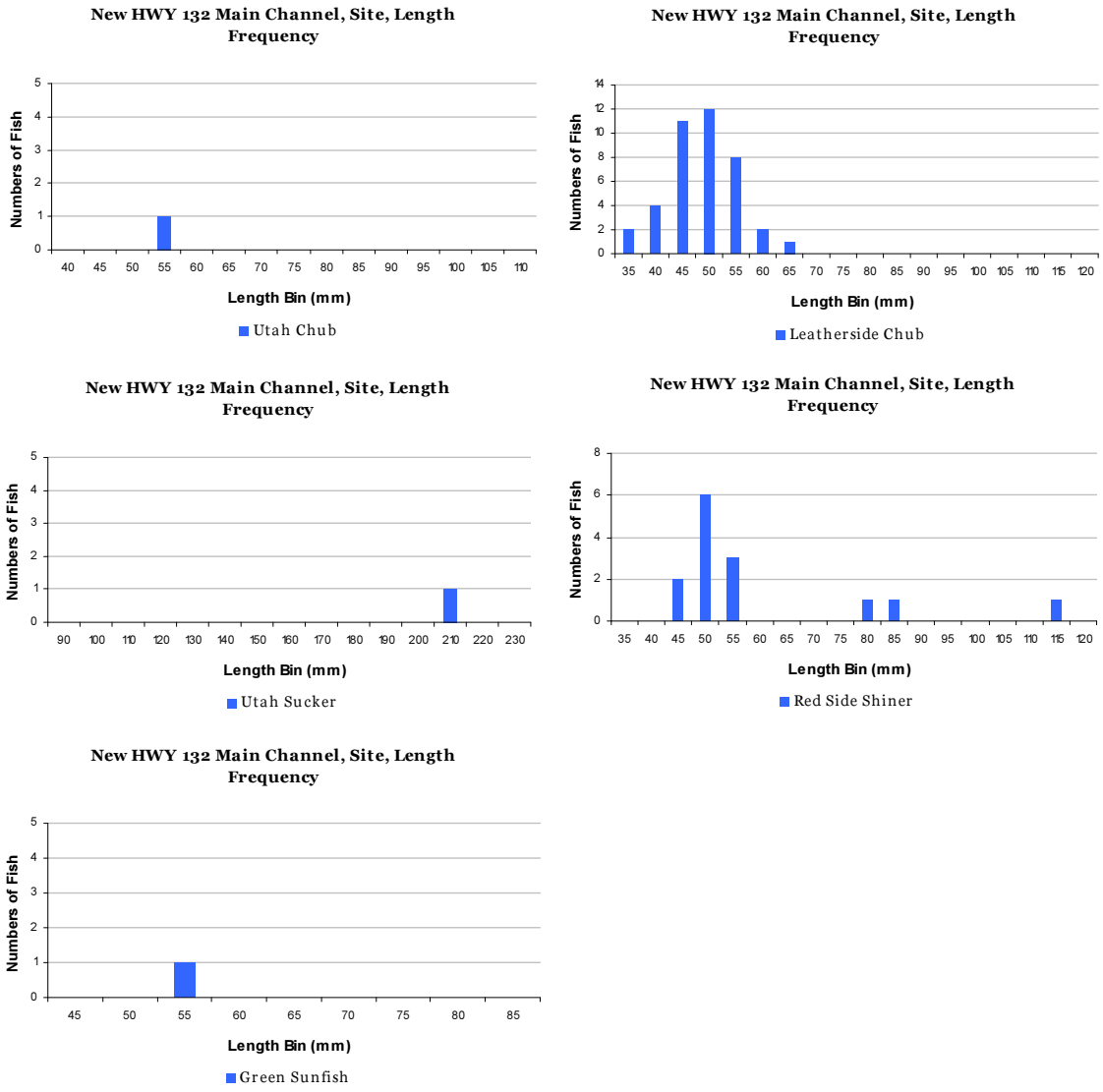


Figure B9. The New NWY 132, Main Channel site, length frequency of fish by species. Note, not all captured fish were measured.

New HWY 132 Backwater

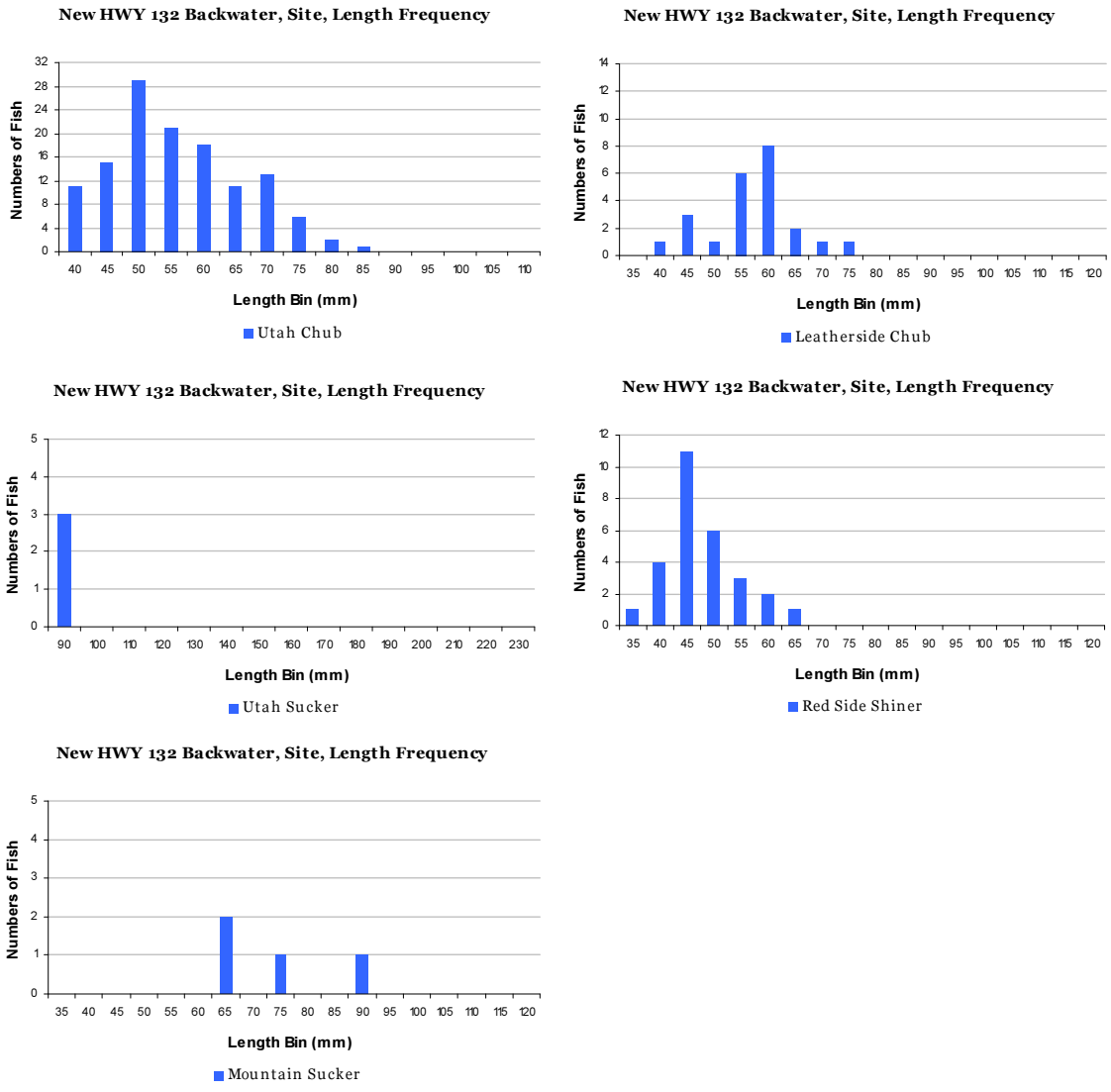


Figure B10. The New NWY 132, Side Channel site, length frequency of fish by species. Note, not all captured fish were measured.

New Sevier Canyon Main Channel

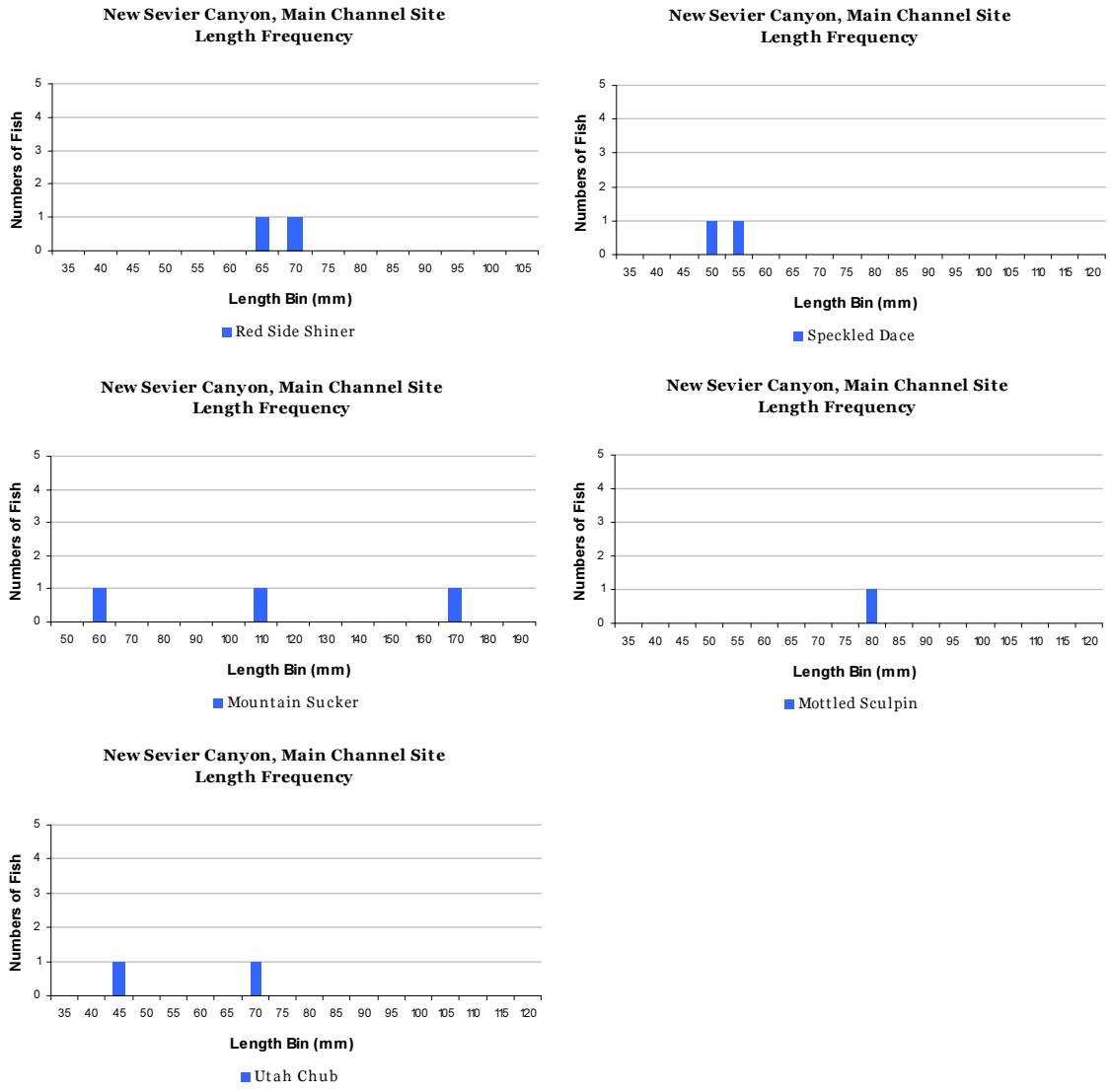


Figure B11. The New Sevier Canyon, Main Channel site, length frequency of fish by species. Note, not all captured fish were measured.

New Sevier Canyon Side Channel

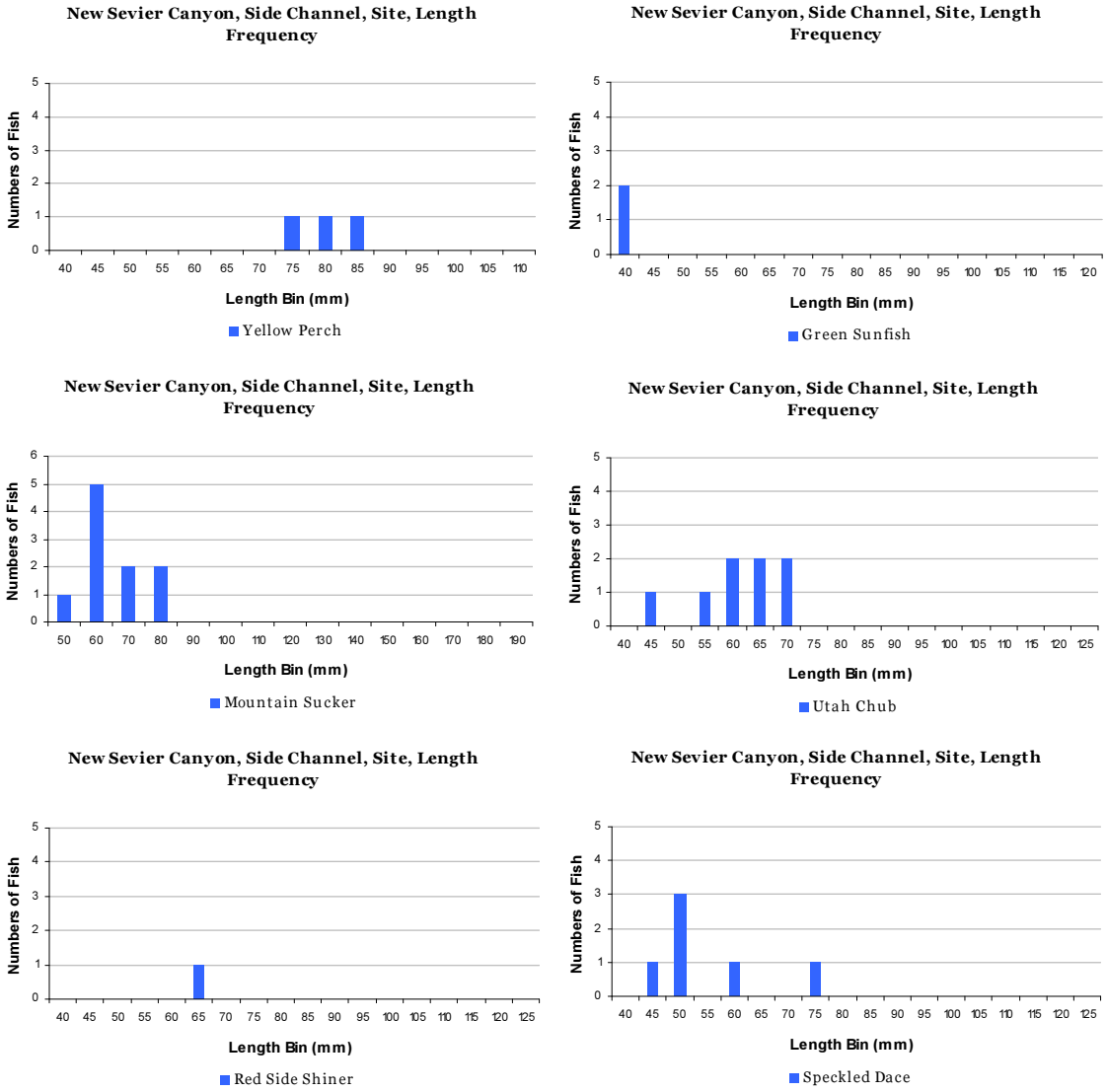


Figure B12. The New Sevier Canyon, Side Channel site, length frequency of fish by species. Note, not all captured fish were measured.

Mills Valley Site

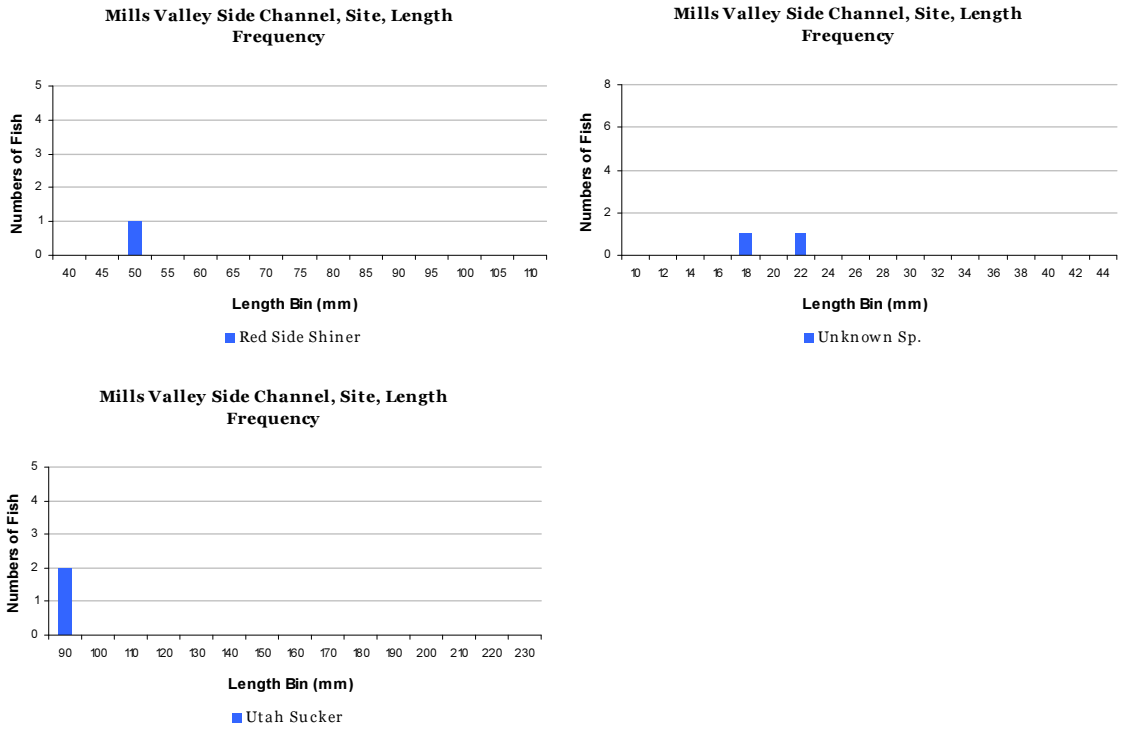


Figure B13. The Mills Valley, Side Channel site, length frequency of fish by species. Note, not all captured fish were measured.

Appendix C
Lower Sevier River
Electrofishing Sampling
Length Frequency Histograms
Length and Weight Relationships
All Fish Sampled Combined By Species
2012

List of Figures - Appendix C

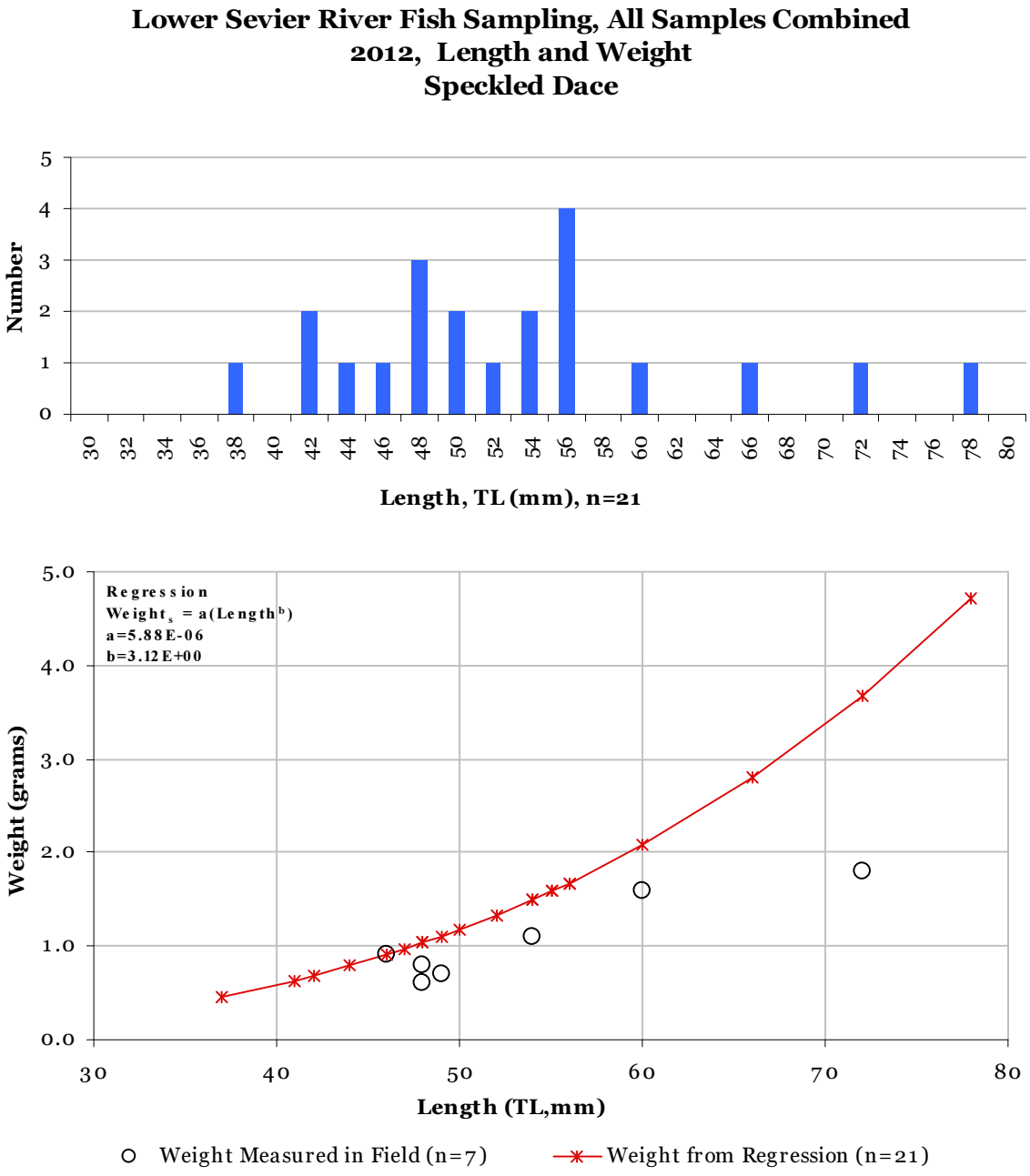


Figure C1. Length histogram and length to weight relationship for speckled dace, the non-linear regression model is from Combes and Hardy, 2007. Note: Not all fish that were measured for length were weighed.

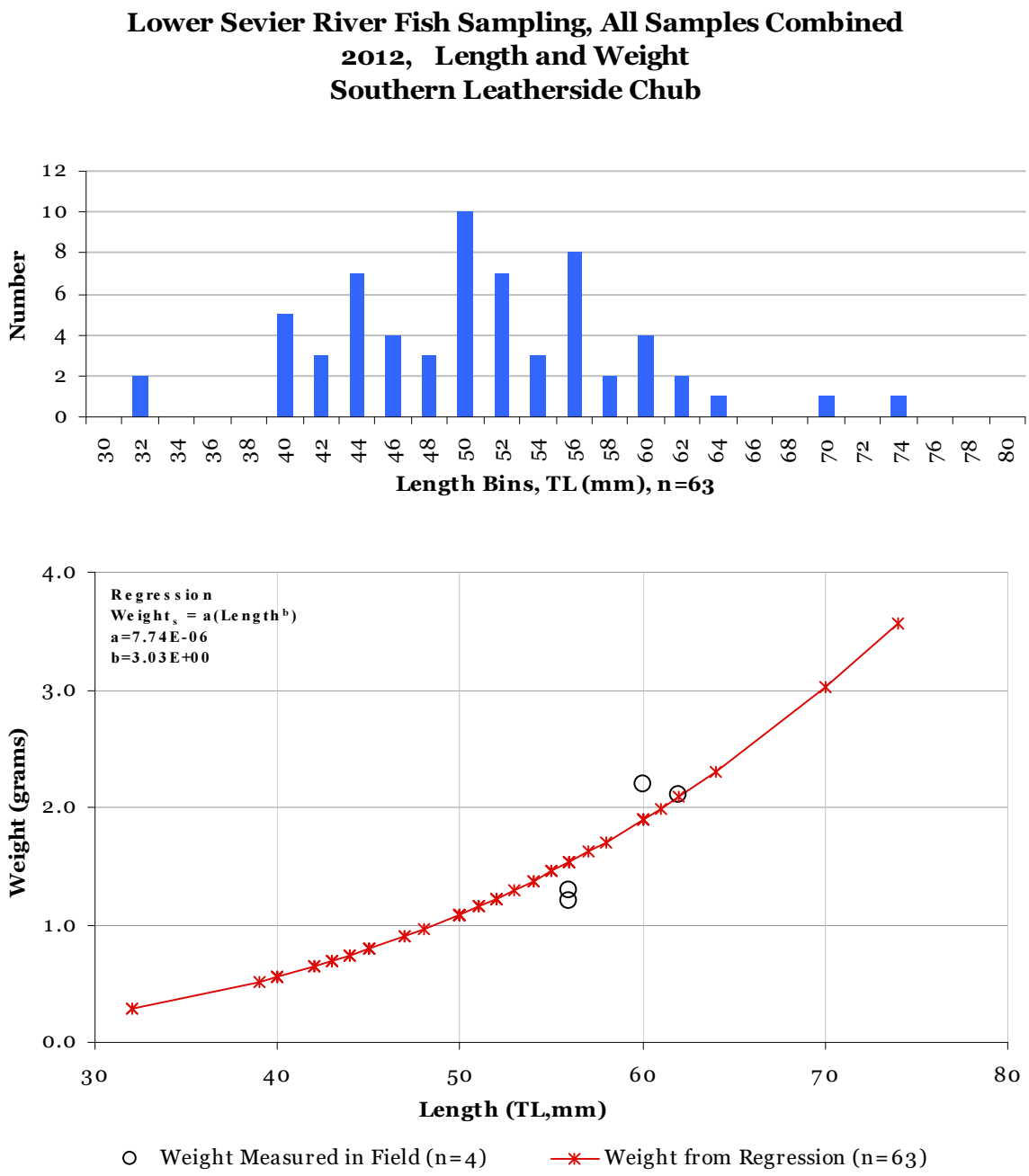


Figure C2. Length histogram and length to weight relationship for southern leatherside chub, the non-linear regression model is from Combes and Hardy, 2007. Note: Not all fish that were measured for length were weighed.

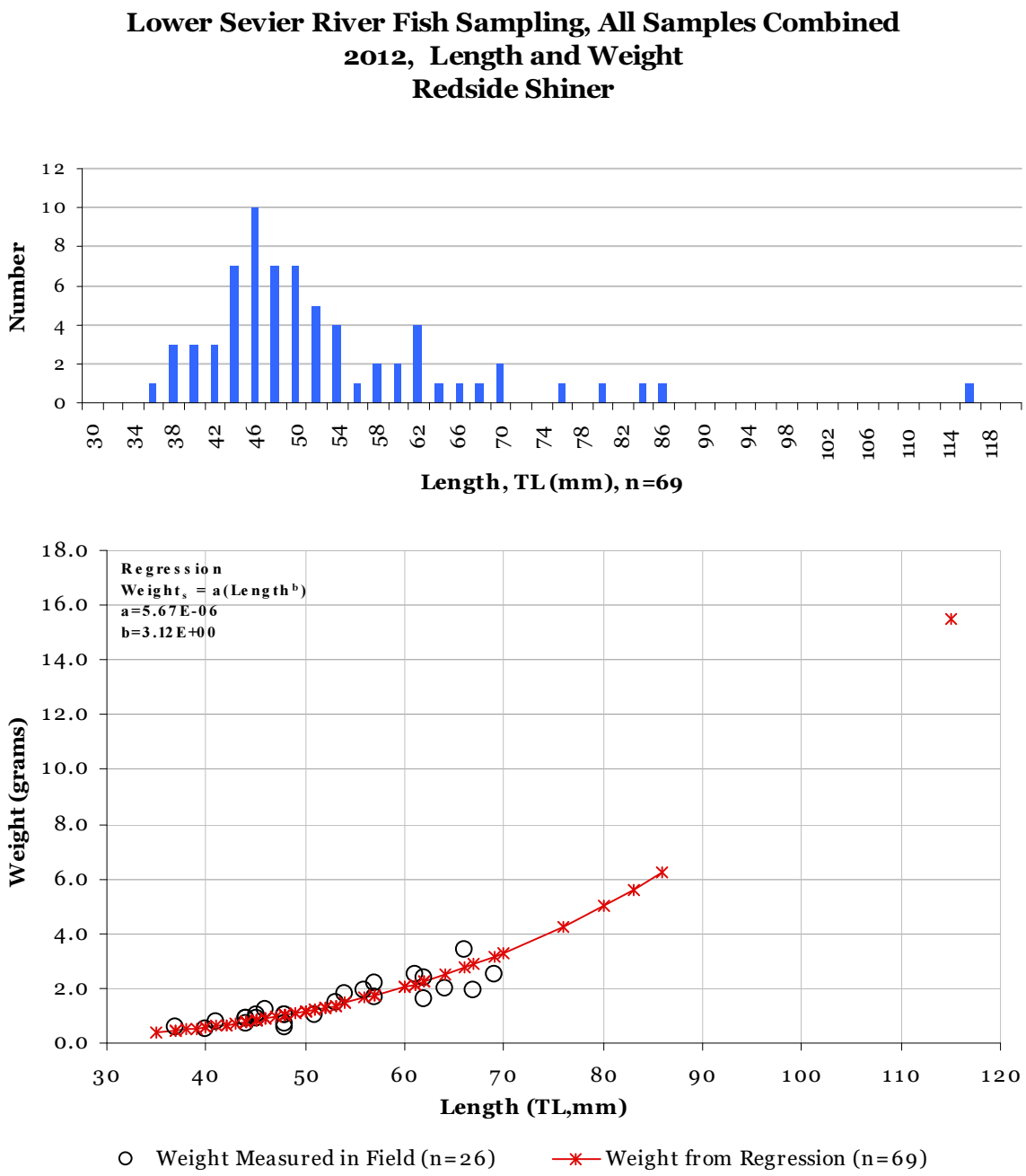


Figure C3. Length histogram and length to weight relationship for redside shiner, the non-linear regression model is from Combes and Hardy, 2007. Note: Not all fish that were measured for length were weighed.

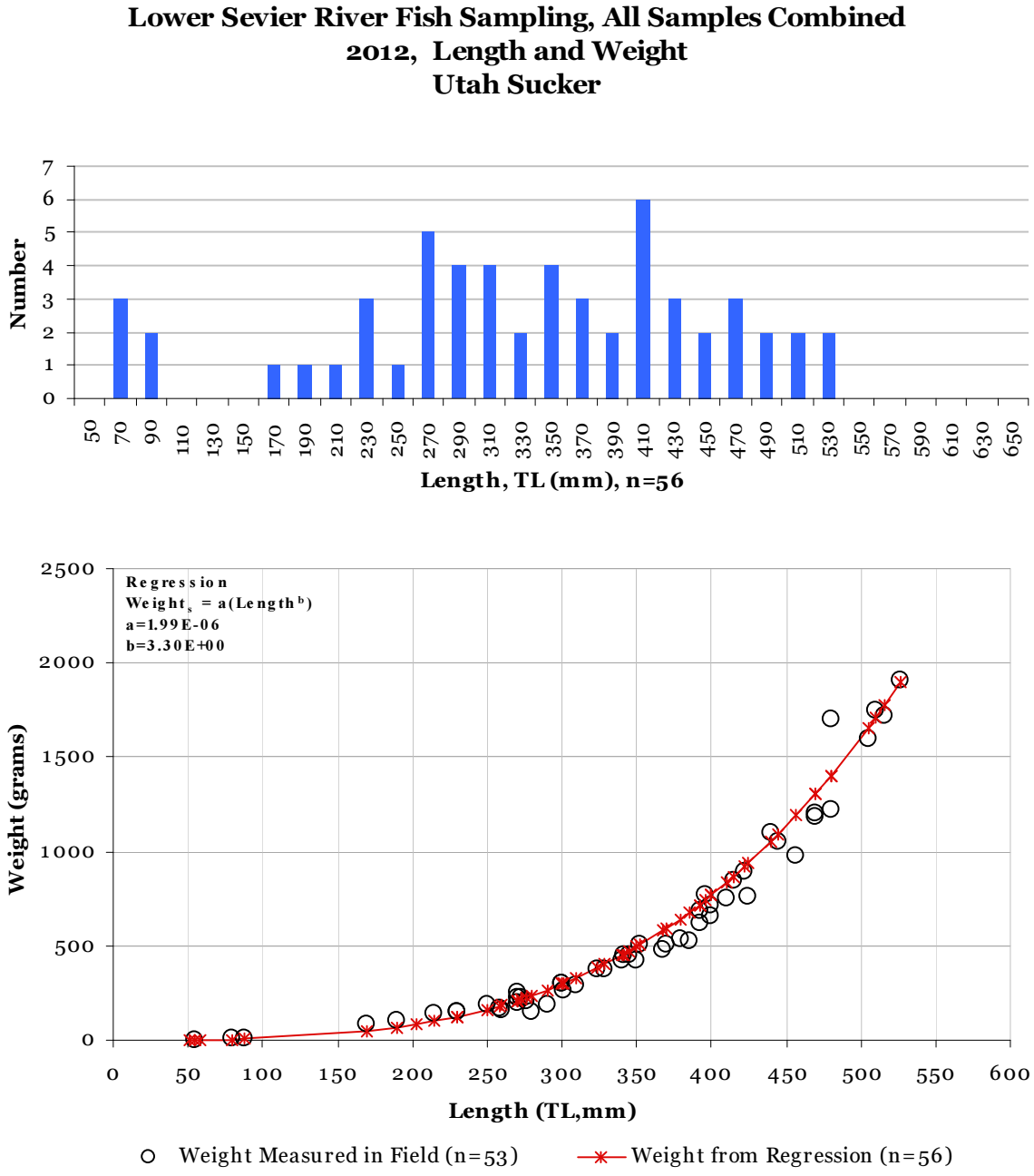


Figure C4. Length histogram and length to weight relationship for Utah sucker, the non-linear regression model is from Combes and Hardy, 2007. Note: Not all fish that were measured for length were weighed.

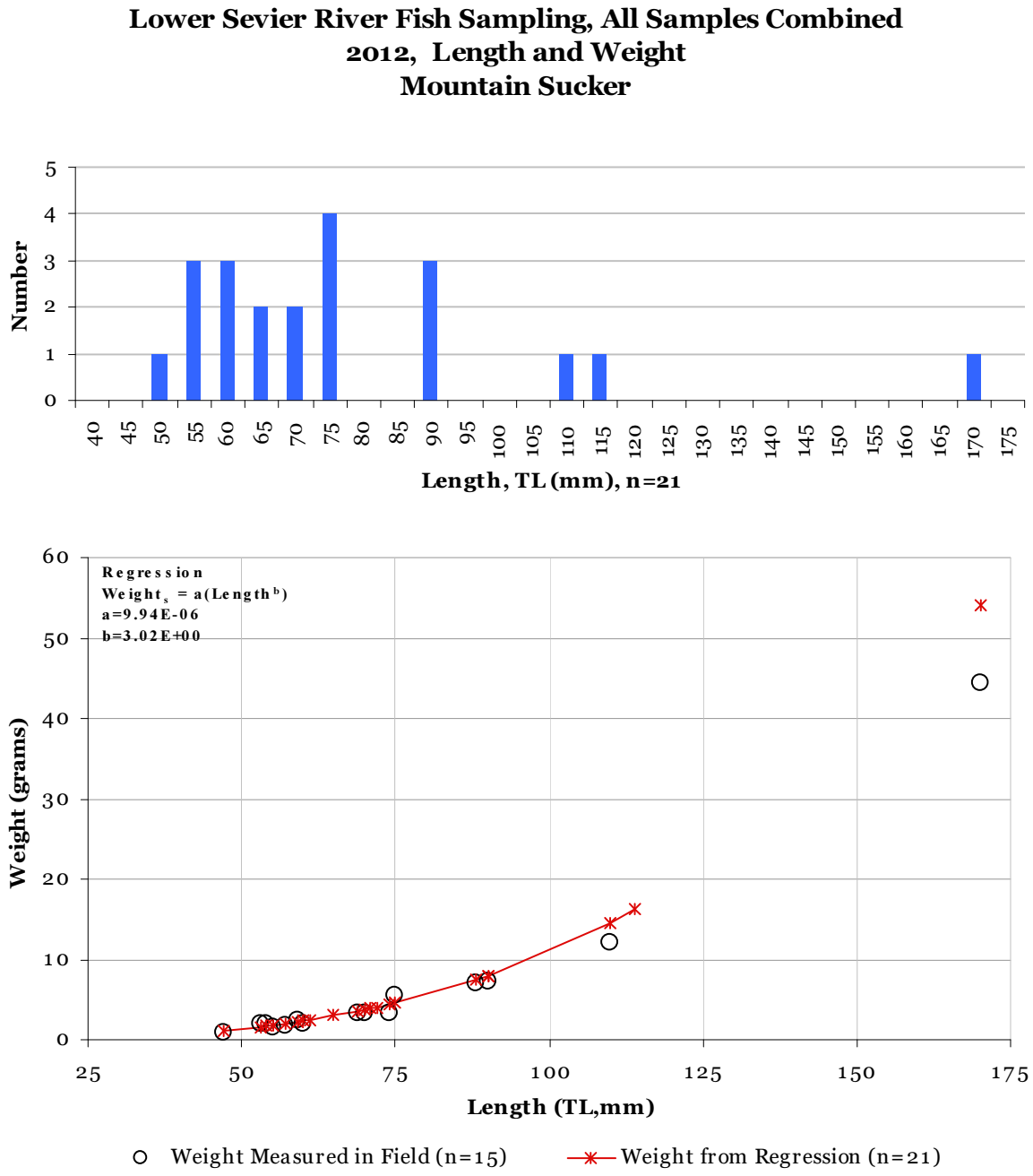


Figure C5. Length histogram and length to weight relationship for mountain sucker, the non-linear regression model is from Combes and Hardy, 2007. Note: Not all fish that were measured for length were weighed.

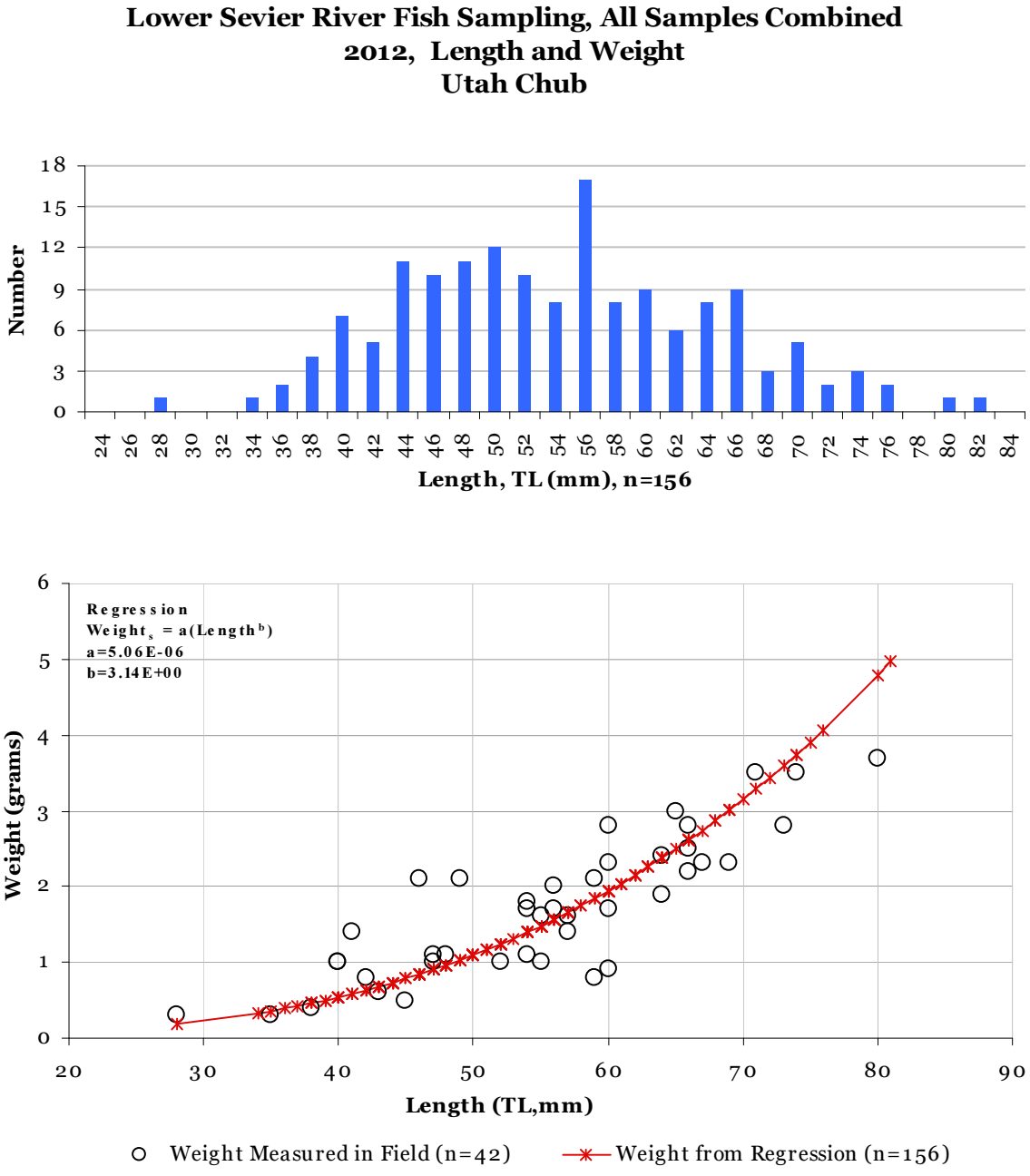


Figure C6. Length histogram and length to weight relationship for Utah chub, the non-linear regression model is from Combes and Hardy, 2007. Note: Not all fish that were measured for length were weighed.

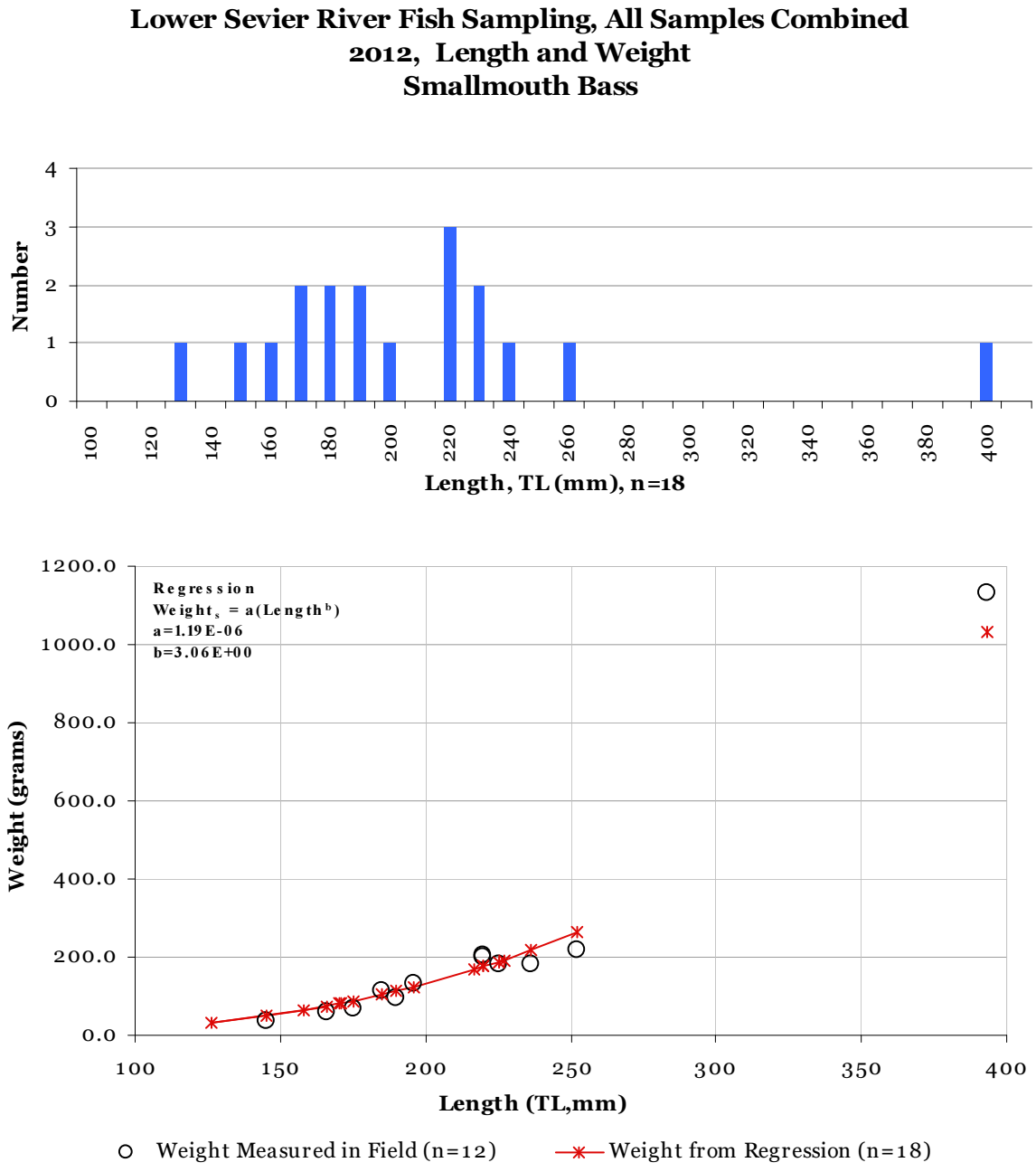


Figure C7. Length histogram and length to weight relationship for smallmouth bass, the non-linear regression model is from Combes and Hardy, 2007. Note: Not all fish that were measured for length were weighed.

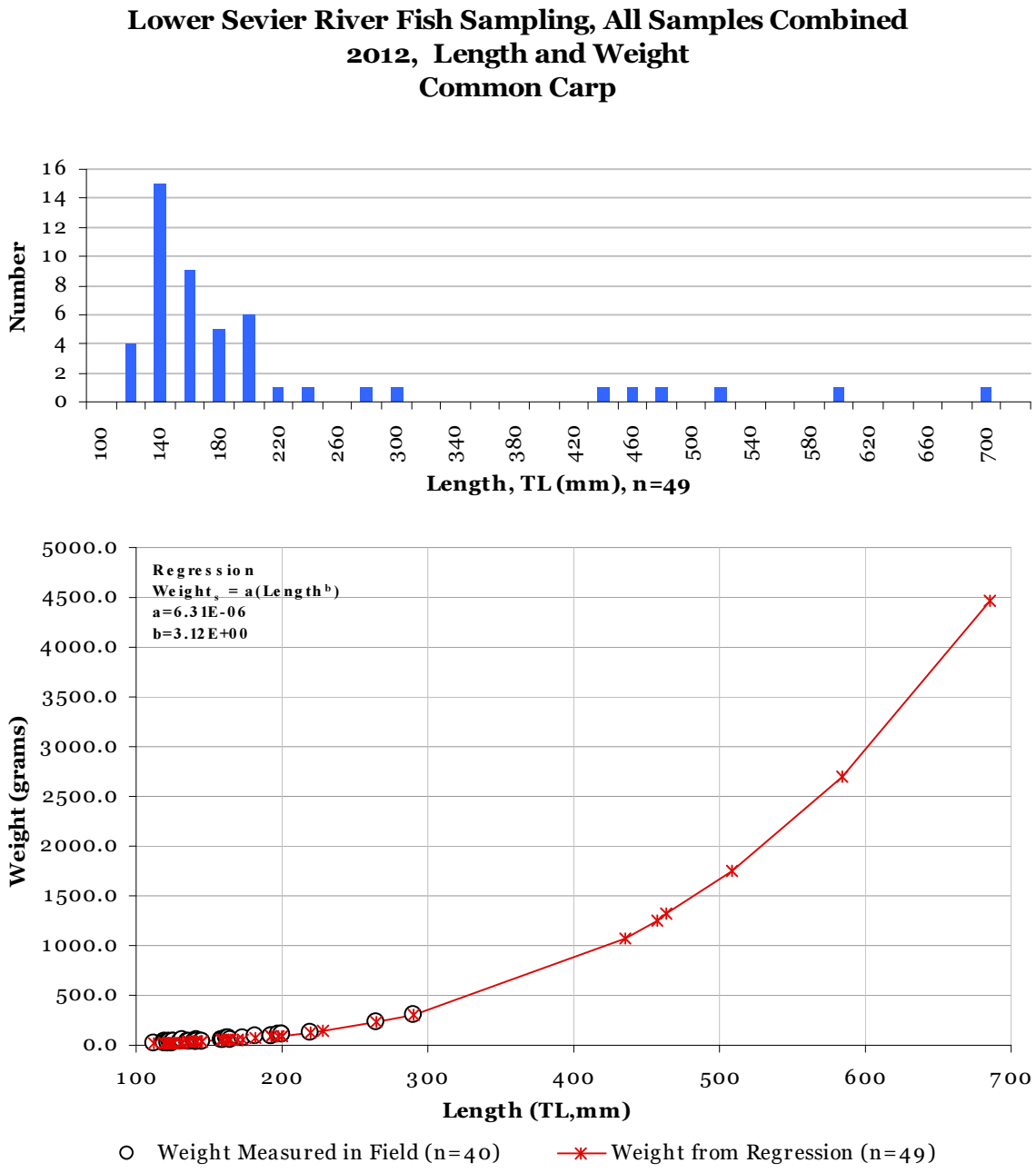


Figure C8. Length histogram and length to weight relationship for common carp, the non-linear regression model is from Combes and Hardy, 2007. Note: Not all fish that were measured for length were weighed.

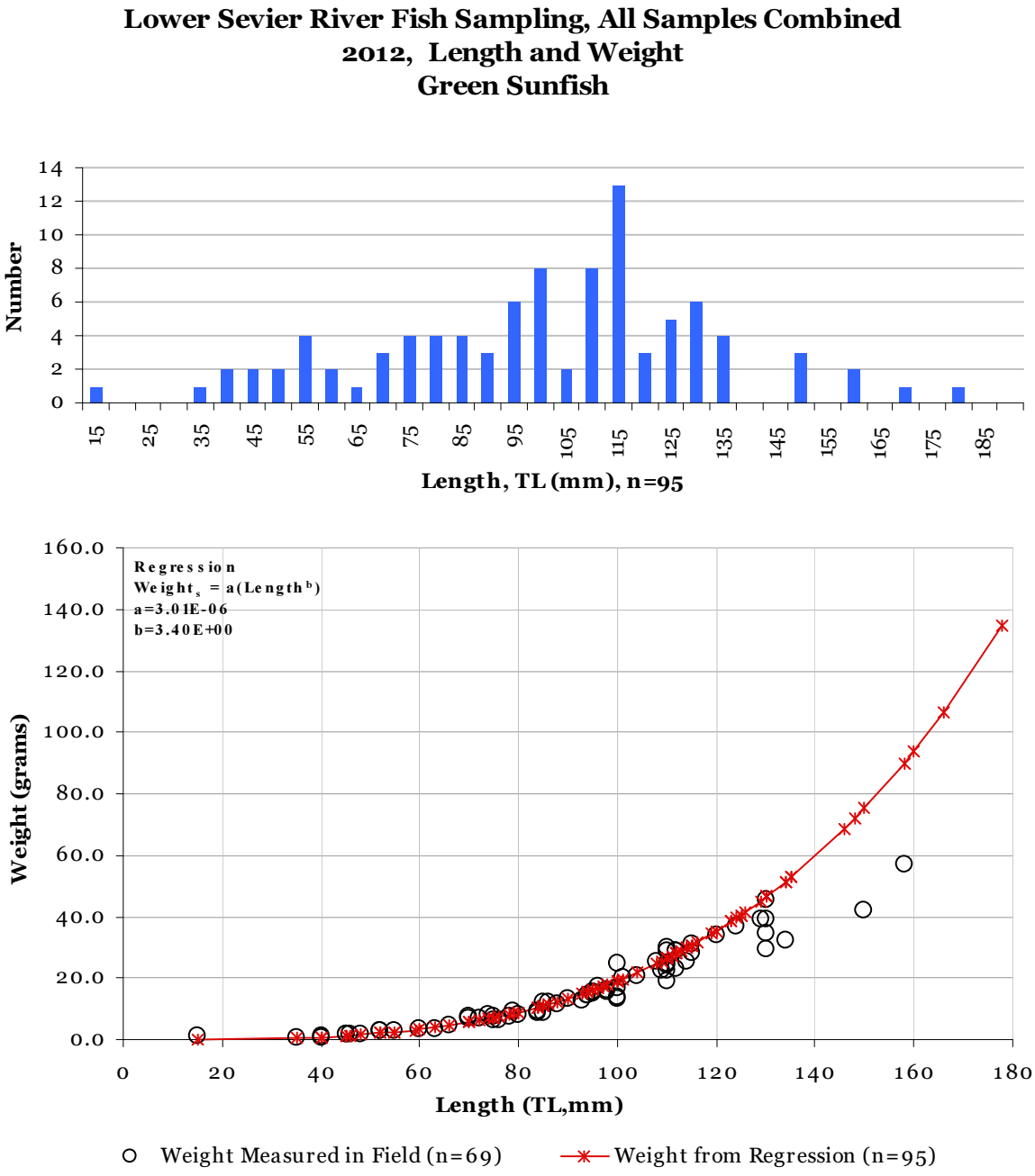


Figure C9. Length histogram and length to weight relationship for green sunfish, the non-linear regression model is from Combes and Hardy, 2007. Note: Not all fish that were measured for length were weighed.

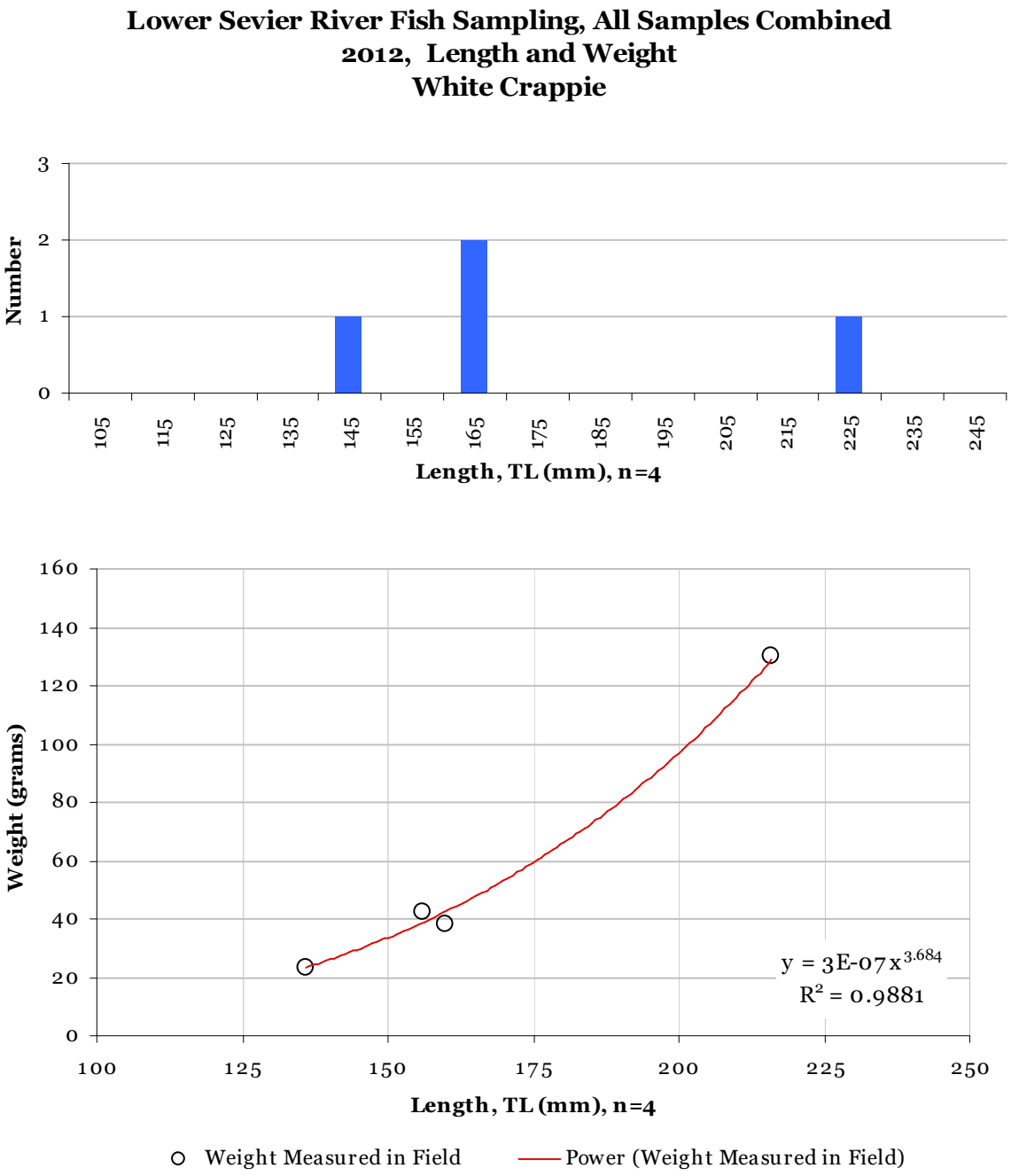


Figure C10. Length histogram and length to weight relationship for white crappie, the non-linear regression model is from Microsoft Excel. Note: Not all fish that were measured for length were weighed.

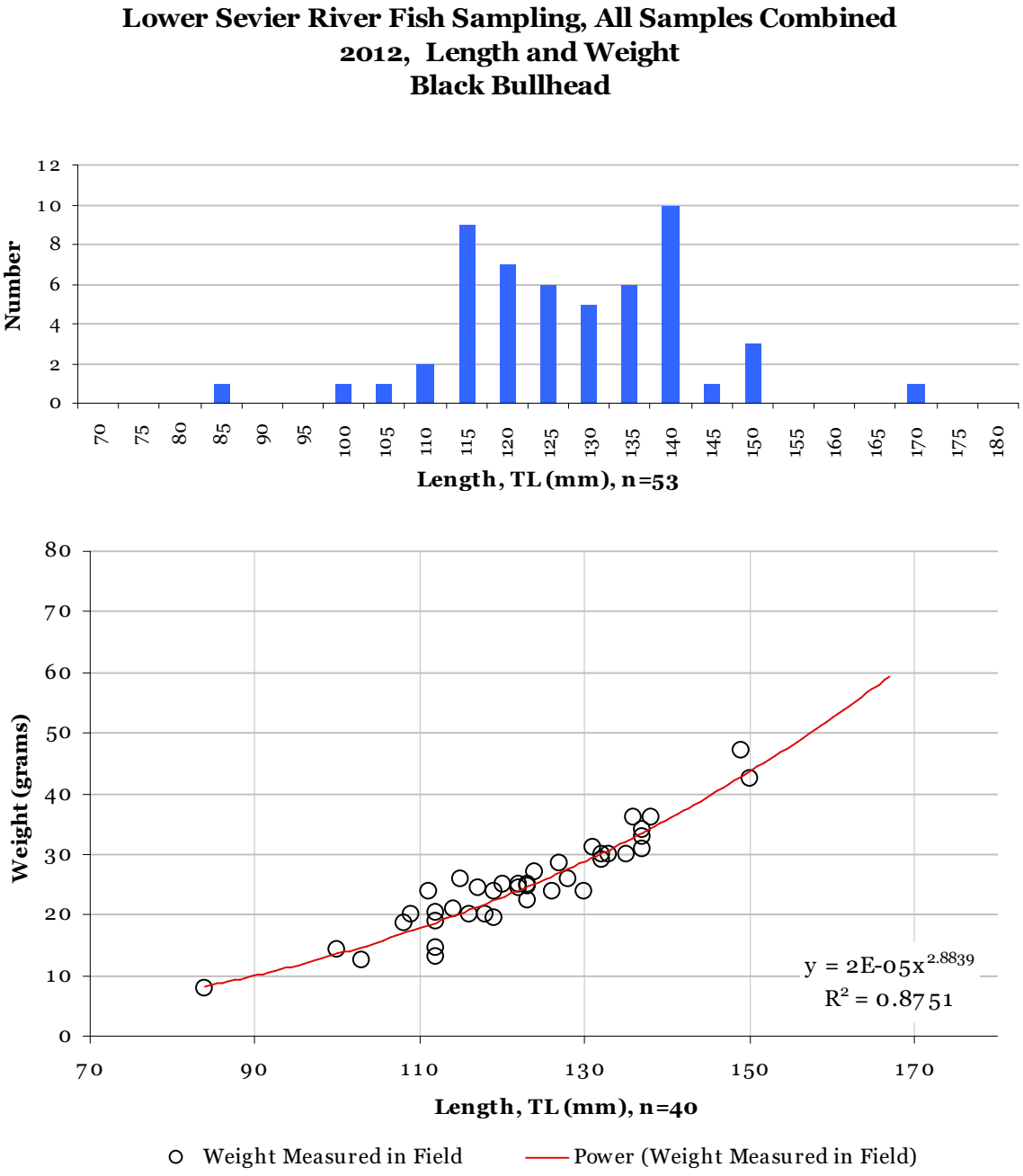


Figure C11. Length histogram and length to weight relationship for black bullhead, the non-linear regression model is from Microsoft Excel. Note: Not all fish that were measured for length were weighed.

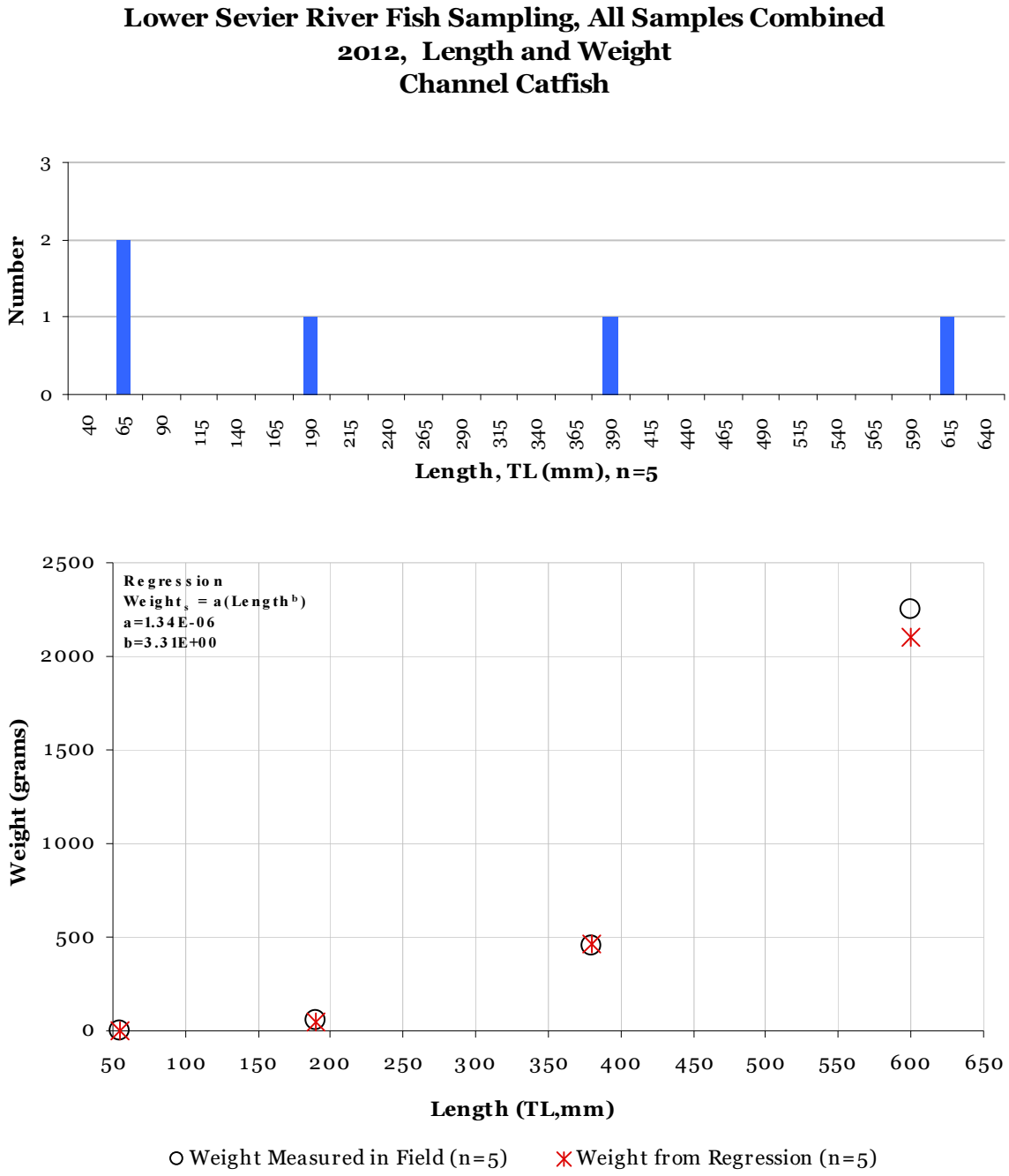


Figure C12. Length histogram and length to weight relationship for channel catfish, the non-linear regression model is from Combes and Hardy, 2009. Note: Not all fish that were measured for length were weighed.

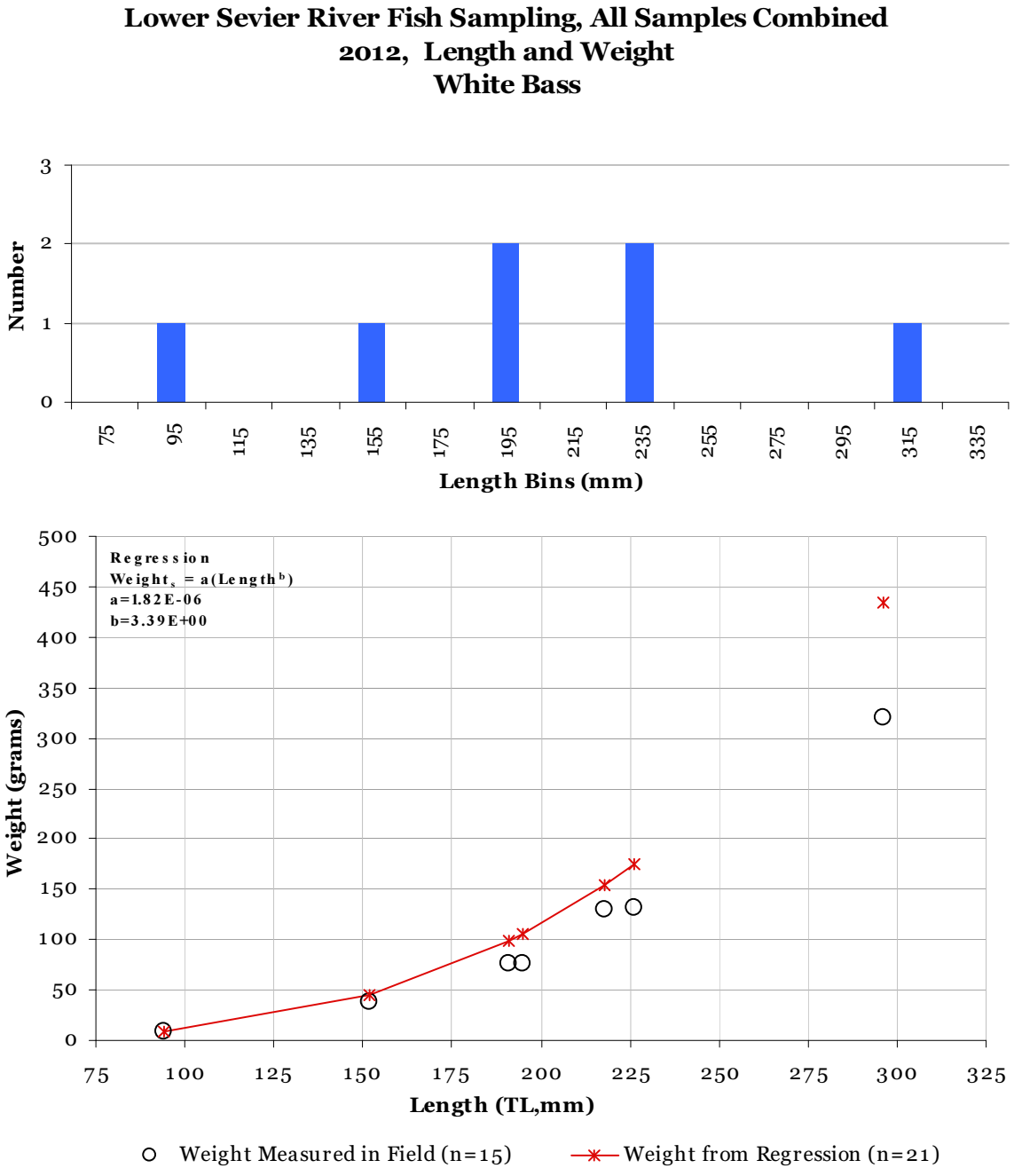


Figure C13. Length histogram and length to weight relationship for white bass, the non-linear regression model is from Combes and Hardy, 2007. Note: Not all fish that were measured for length were weighed.

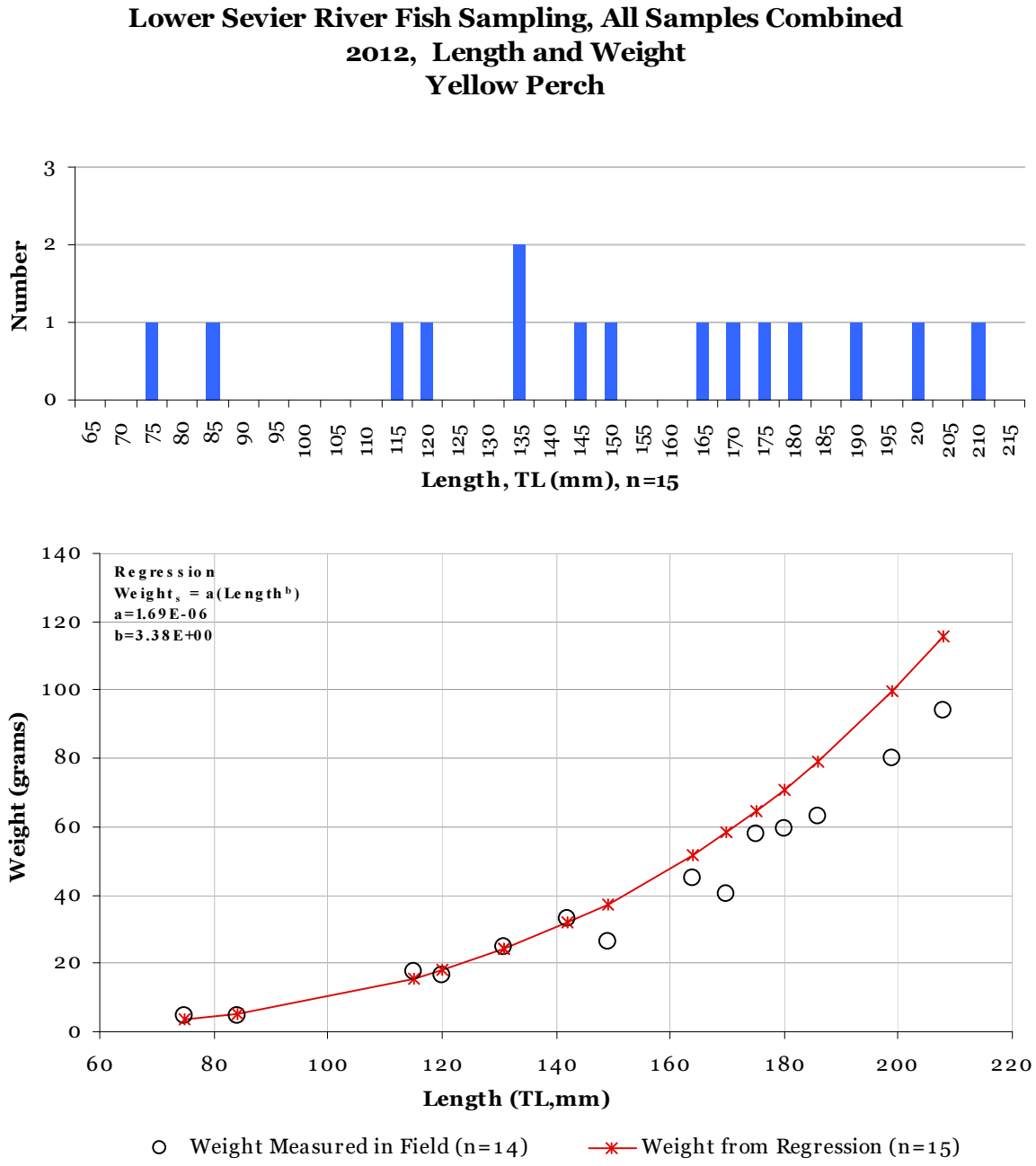


Figure C14. Length histogram and length to weight relationship for yellow perch, the non-linear regression model is from Combes and Hardy, 2007. Note: Not all fish that were measured for length were weighed.

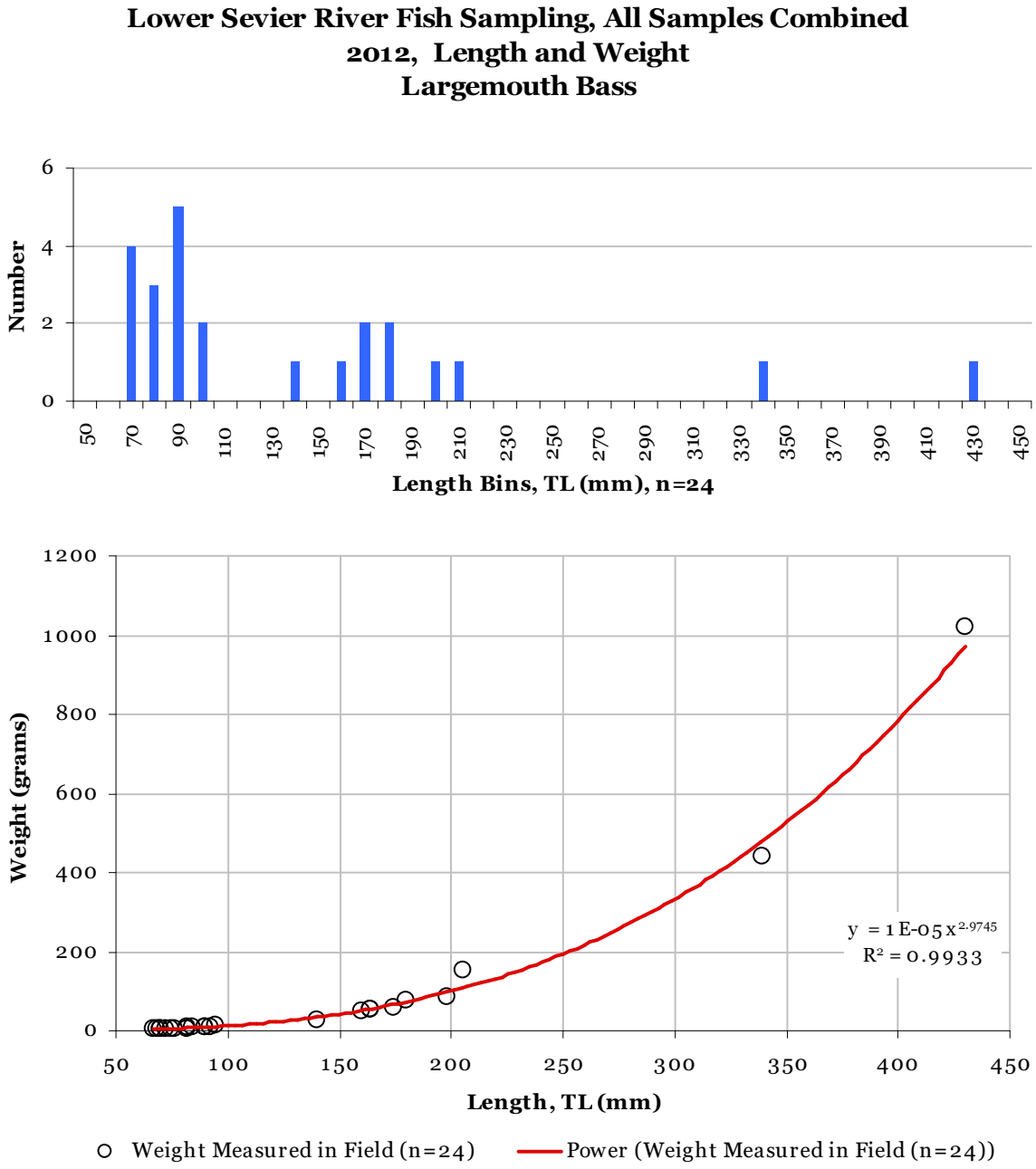


Figure C15. Length histogram and length to weight relationship for largemouth bass, the non-linear regression model is from Microsoft Excel. Note: Not all fish that were measured for length were weighed.

Appendix D
Lower Sevier River
Water Quality
2012

List of Tables - Appendix D

Table D1. Water quality, Sevier River, 2012, spot sampling during fish sampling. Not all sites were sampled for water quality.

Sevier River - 2012
Water Quality

Site	Date	Water Temperature °F	Water Temperature °C	Specific Conductance µS	pH	Oxygen O^2 %	Oxygen O^2 mg/l
Cement Plant A & B	11/06/12	50.47	10.26	1070	8.33	-	-
Central_Canal_Diversion	11/07/12	47.59	8.66	1067	8.17	86.5	10.07
New Hwy 132 -Main Channel and Backwater	11/08/12	49.91	9.95	1077	8.19	106.6	12
New Sevier Canyon, Main and Side Channel	11/08/12	47.12	8.4	1046	8.53	100.2	11.69
Mills Valley, Main and Side Channel	11/08/12	45.72	7.62	981	8.06	84	10.18

Appendix E
Lower Sevier River
Aerial Images
Comparing
Alluvial Fan/Delta Deposits
Between 2011 and 2014

All Images from Google Earth

List of Tables - Appendix E

List of Photos - Appendix E

To help compare images the flows in the Sevier River are given in Table E1.

Table E1. Flow is the Sevier River on date of the aerial images.

Sevier River
Flows Associated with Aerial Images
Mean Daily cfs

Date of Image	Flow at Lynndyl gage	Flow at Juab gage
9/24/2011	64.0	5.6
3/23/2014	29.0	1.6

Lynndyl gage - USGS #10224000
Jual gage - USGS #10219000

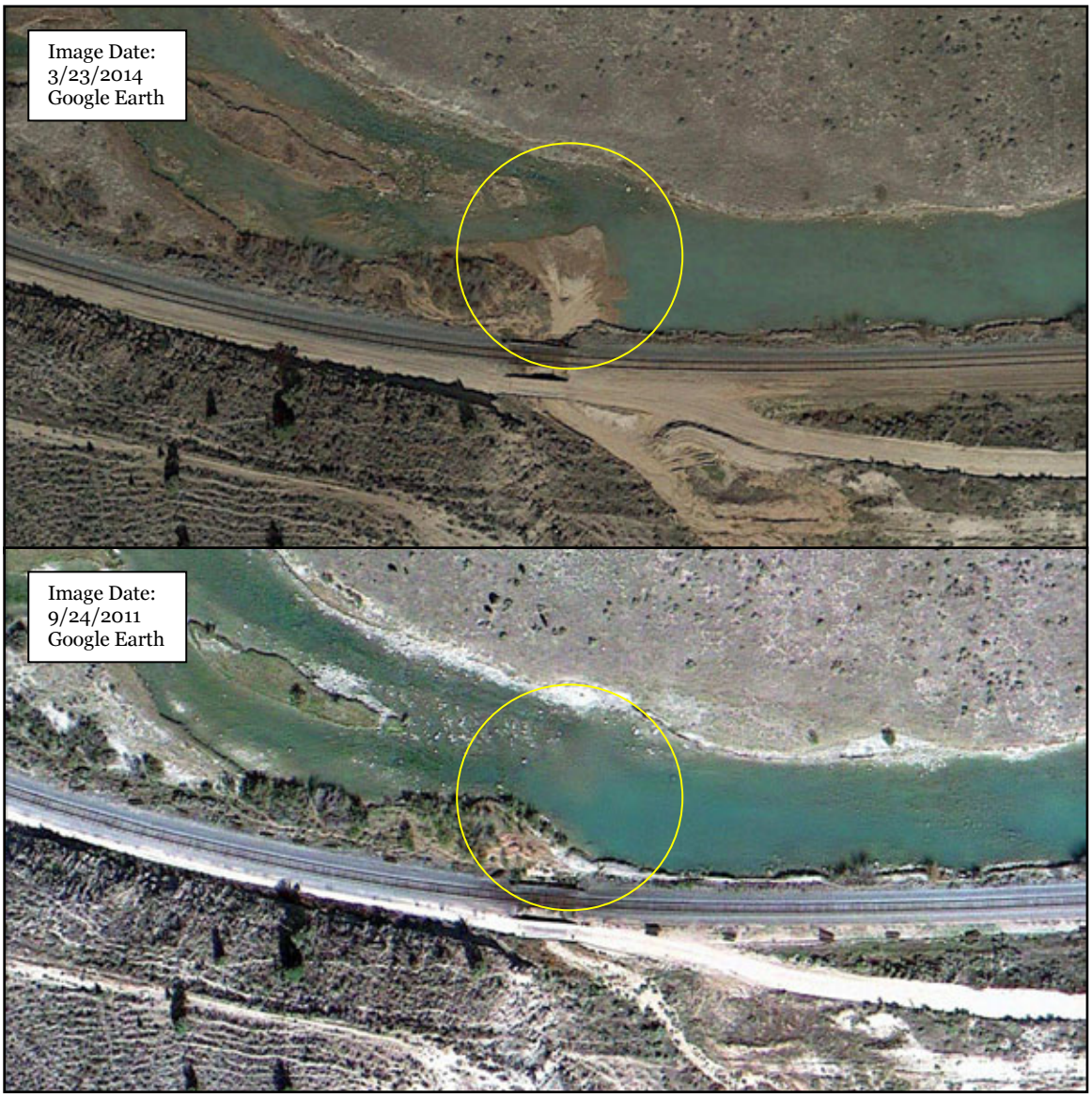


Photo E1. Aerial images of river change through alluvial deposition between 2011 and 2014 (Google Earth images). Location , UT 12N, 405386.6E 4374826.8N.

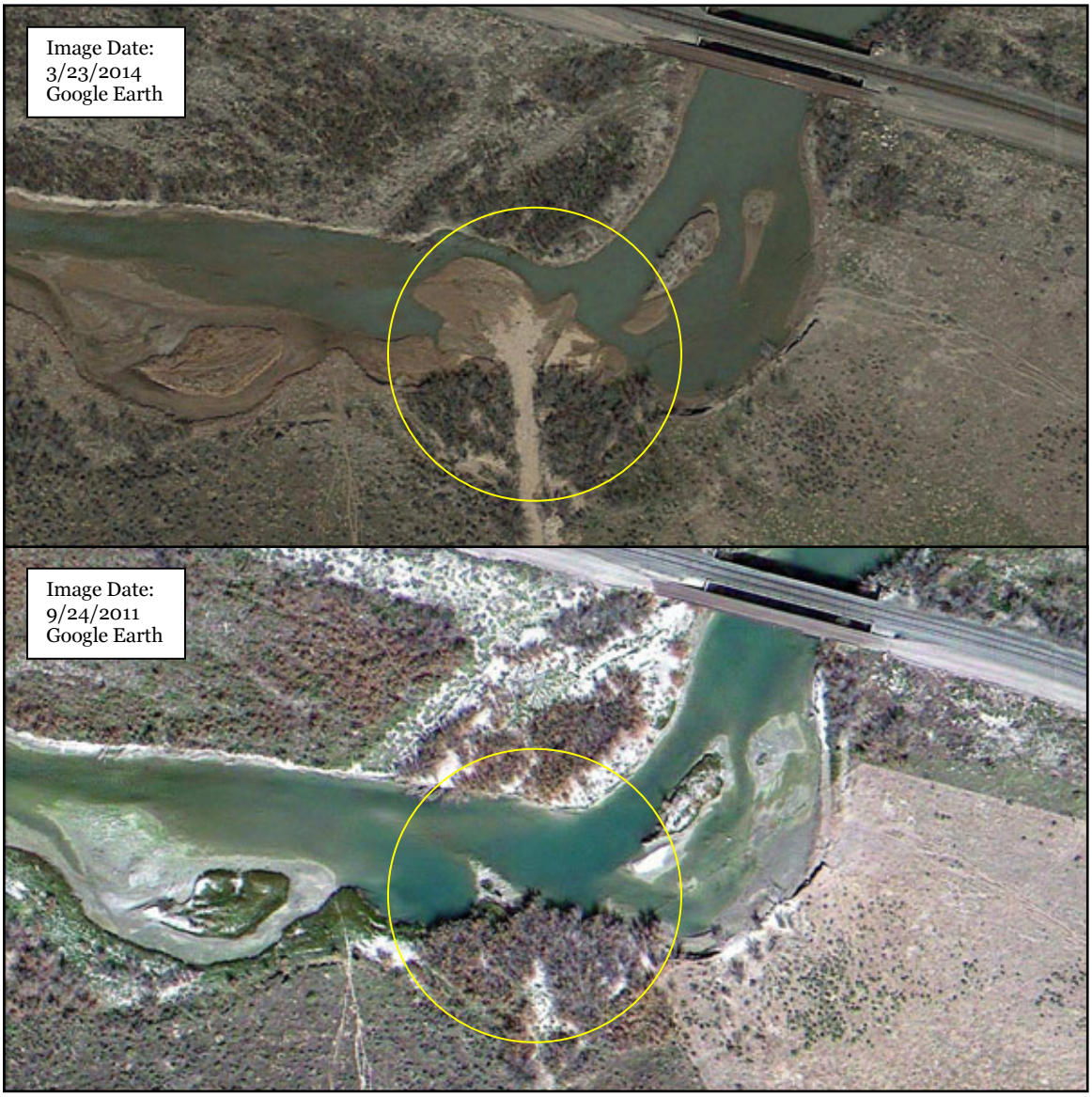


Photo E2. Aerial images of river change through alluvial deposition between 2011 and 2014 (Google Earth images). Location , UT 12N, 404501.5E 4376830.9N.