Western Riverside County
Multiple Species Habitat Conservation Plan (MSHCP)
Biological Monitoring Program

Arroyo chub (*Gila orcutti*)
Survey Report 2010

23 March 2011

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

LIST OF APPENDICES

NOTE TO READER:

This report is an account of survey activities conducted by the Biological Monitoring Program for the Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP). The MSHCP was permitted in June 2004. The Monitoring Program monitors the distribution and status of the 146 Covered Species within the Conservation Area to provide information to Permittees, land managers, the public, and the Wildlife Agencies (i.e., the California Department of Fish and Game and the U.S. Fish and Wildlife Service). Monitoring Program activities are guided by the MSHCP species objectives for each Covered Species, the information needs identified in MSHCP Section 5.3 or elsewhere in the document, and the information needs of the Permittees.

Reserve assembly of the MSHCP is ongoing and it is expected to take 20 or more years to construct the final Conservation Area. The Conservation Area includes lands acquired for conservation under the terms of the MSHCP and other lands that have conservation value in the Plan Area (called public or quasi-public lands in the MSHCP). In this report, the term "Conservation Area" refers to the Conservation Area as understood by the Monitoring Program at the time the surveys were planned and conducted.

We would like to thank and acknowledge the land managers in the MSHCP Plan Area, who in the interest of conservation and stewardship facilitate Monitoring Program activities on the lands for which they are responsible. A list of the lands where data collection activities were conducted in 2010 is included in Section 7.0 of the Western Riverside County Regional Conservation Authority (RCA) Annual Report to the Wildlife Agencies. Partnering organizations and individuals contributing data to our projects are acknowledged in the text of appropriate reports.

While we have made every effort to accurately represent our data and results, it should be recognized that data management and analysis are ongoing activities. Any reader wishing to make further use of the information or data provided in this report should contact the Monitoring Program to ensure that they have access to the best available or most current data.

The primary preparer of this report was the 2010 Herpetofauna Program Lead, Robert Packard. If there are any questions about the information provided in this report, please contact the Monitoring Program Administrator. If you have questions about the MSHCP, please contact the Executive Director of the RCA. Further information on the MSHCP and the RCA can be found at www.wrc-rca.org.

Contact Information:

Executive Director
Western Riverside County
Regional Conservation Authority
4080 Lemon Street, 12th Floor
P.O. Box 1667
Riverside, CA 92502-1667
Ph: (951) 955-9700

Western Riverside County MSHCP
Monitoring Program Administrator
c/o Adam Malisch
4500 Glenwood Drive, Bldg. C
Riverside, CA 92501
Ph: (951) 248-2552

INTRODUCTION

The State of California lists arroyo chub, *Gila orcutti*, as a species of special concern. They are endemic to southern California and, within the MSHCP Plan Area, historically occur in the Santa Ana, San Jacinto, and Santa Margarita River systems. The species-specific conservation objectives for arroyo chub require the Biological Monitoring Program to document the continued use of 75 % of Core Areas listed in the MSHCP at least once every 8 years (Dudek & Associates 2003). Arroyo chub Core Areas include: Santa Margarita River, De Luz Creek, Sandia Creek, Cole Creek, Santa Ana River, Temecula Creek, and Murrieta Creek.

The Biological Monitoring Program has never conducted any fish surveys in the Santa Ana River; however, other local entities have surveyed this river for the federally threatened Santa Ana sucker (*Catostomus santaanae*). Currently, San Marino Environmental Associates (SMEA), under contract with the Santa Ana Watershed Project Authority (SAWPA), conducts annual surveys for Santa Ana sucker in the Riverside and San Bernardino County portions of the Santa Ana River Watershed. In addition, the Santa Ana Watershed Association (SAWA) has surveyed for Santa Ana sucker in the Santa Ana River. These surveys also documented the presence of arroyo chub and other native and non-native fish species.

From the fall of 1997 to the spring of 2000, the U.S. Geological Survey (USGS) conducted comprehensive fish surveys in the Santa Margarita Watershed for The Nature Conservancy (TNC) (Warburton et al. 2000). These surveys documented the presence of arroyo chub in that watershed, as well as many non-native fish species, such as green sunfish (*Lepomis cyanellus*), redeye bass (*Micropterus coosae*) and black bullhead (*Ameiurus melas)*, that compete with and/or prey on arroyo chub (Warburton et al. 2000).

The Biological Monitoring Program has previously conducted stream surveys for covered amphibian species [e.g., California newt (*Taricha torosa*), California red-legged frog (*Rana draytonii*), Sierra Madre yellow-legged frog (*Rana muscosa*), and arroyo toad (*Anaxyrus californicus*)] in 2 of the arroyo chub Core Areas: De Luz Creek and Santa Margarita River. However, identifying fish was not a priority during these surveys and no official training for fish identification was required. We also surveyed the Santa Margarita watershed for southwestern pond turtle (*Actinemys marmorata pallida*) using minnow traps, as well as large and small hoop traps. While these surveys did document captured fish species, surveyors received no formal fish identification training prior to surveys. In the recent past, arroyo chub were observed in lower Temescal Wash (Swift 2001) and by Biological Monitoring Program staff in the San Jacinto River.

We describe here a strategy for systematically surveying Core Areas to determine presence of arroyo chub while characterizing the overall condition of surveyed waterways.

Goals and Objectives

1. Document the presence of arroyo chub in Core Areas and other potential watersheds.
    a. Record arroyo chub and other fish species detected during fish surveys.
    b. Document habitat characteristics associated with arroyo chub.

METHODS

Protocol Development

We developed our survey protocol after extensive hands-on training and guidance while assisting Drs. Jonathan Baskin and Thomas Haglund of SMEA with their surveys. Surveyors used electrofishers and seine nets to survey for native fish species including Santa Ana sucker, speckled dace (*Rhinichthys osculus*), and threespine stickleback (*Gasterosteus aculeatus*) in various areas of southern California, and routinely detected arroyo chub in appropriate habitat. Electrofishing is a safe and commonly employed method that uses electricity to stun fish before they are caught. This field experience allowed us to assess the appropriateness of the different survey techniques as well as gain hands-on experience. We also extensively researched the literature on arroyo chub to understand its biology and habitat needs. For the appropriate use of the electrofisher, we referenced the Smith-Root LR-24 Electrofisher User's Manual, available at http://www.smith-root.com/support/. We modified SMEA's survey protocol because of our limited staff resources. The SMEA protocol required at least 7 people per crew; our modifications allowed us to collect the needed information using 5 people per crew. Specifically, we modified the practice of blocking whole sections of streams and electroshocking repeatedly to get depletion rates. Instead, we shocked 50-m segments using seine and dip-nets to capture and identify fish.

Personnel and Training

Prior to the start of surveys, select crewmembers worked with SMEA staff electrofishing and seining for Santa Ana sucker, arroyo chub, speckled dace, and threespine stickleback in various areas of southern California. These crewmembers also worked with Mike Giusti of the California Department of Fish and Game electrofishing and dip-netting streams in the San Jacinto Mountains to capture and eradicate rainbow trout from Sierra Madre yellow-legged frog habitat. These crewmembers, in turn, trained Biological Monitoring Program staff in the identification of covered fish using local and national field guides, as well as locally-occurring species using in-house materials. Additionally, new surveyors participated in field-based training sessions geared toward fish identification, the safe operation of electrofishing equipment, and survey methods following the *Western Riverside County MSHCP Biological Monitoring Program 2010 Arroyo Chub Protocol* (Appendix A). When possible, new staff also worked with Dr. Baskin electrofishing waterways for Santa Ana sucker.

The California Department of Fish and Game and Regional Conservation Authority funded Biological Monitoring Program staff. Listed below are staff that surveyed stream reaches in 2010. Staff who trained with Jonathan Baskin, Thomas

Haglund and Mike Giusti are indicated with an asterisk (*); volunteers are noted.

- Bob Packard* (Herpetofauna Program Lead, Biological Monitoring Program)
- Ashley Ragsdale* (Biological Monitoring Program)
- Betsy Dionne* (Biological Monitoring Program)
- Brett Mills (Volunteer, Santa Ana Watershed Association)
- Chad Young (Volunteer, Riverside County Environmental Planning Dept)
- Elise Hinger (Biological Monitoring Program)
- Esperanza Sandoval (Biological Monitoring Program)
- Joanna Gibson (Biological Monitoring Program)
- Joe Sherrock (Biological Monitoring Program)
- John Dvorak (Biological Monitoring Program)
- Jonathan Reinig* (Biological Monitoring Program)
- Julie Golla (Biological Monitoring Program)
- Laura Magee (Biological Monitoring Program)
- Lauren Ross (Biological Monitoring Program)
- Lynn Miller* (Biological Monitoring Program)
- Masanori Abe (Biological Monitoring Program)
- Michael Richard (Volunteer, Riverside County Environmental Planning Dept)
- Michael Robinson (Biological Monitoring Program)
- Nick Peterson (Biological Monitoring Program)
- Samantha Treu (Biological Monitoring Program)
- Sloane Seferyn (Biological Monitoring Program)
- Tara Graham (Biological Monitoring Program)

Study Site Selection

We scouted waterways to note ease of access, presence and depth of water, as well as the presence of any aquatic vertebrates. We focused our scouting on 6 of 7 Core Areas for arroyo chub, excluding the Santa Ana River as SMEA crews are conducting long-term fish surveys in this river. The Core Areas where we found appropriate conditions to conduct surveys were the Santa Margarita River, Murrieta Creek, and Sandia Creek (Figure 1). One section of Murrieta Creek that has historical records for arroyo chub is currently not in the Conservation Area. The Sandia Creek Core Area has just 264 m currently in the Conservation Area. The specific sections designated as Core Areas for De Luz Creek, Temecula Creek, and Cole Creek are not presently in the Conservation Area. We did scout portions of Temecula Creek and Cole Creek that were not included in the MSHCP's definitions of Core Areas, and a stream near De Luz Creek that was in the Conservation Area, but found no appropriate habitat except for a small section of Temecula Creek next to the Santa Margarita River.

We also scouted portions of Temescal Wash and the San Jacinto River because there were recent observations of arroyo chub in these waterways, although they are not listed Core Areas. We determined that both of these areas had appropriate habitat. Temescal Wash near the confluence with the Santa Ana River was a very difficult area to

survey, as the vegetation was very thick, and a few reaches were not accessible due to the overhanging vegetation and/or woody debris in the river. The water level of the main river would also fluctuate dramatically from day to day, presumably due to outflows from a water treatment plant upstream. There were also small upwellings outside of the main river, stranded stagnant lagoons, and short sections of intermittent streams that would appear and disappear in the area. We surveyed all of these wetted areas that we could locate, and for purposes of clarity named everything outside of the main river Butterfield Drain. We also surveyed a short distance along each of 2 tributaries upstream of the San Jacinto River where there was appropriate habitat (Strawberry Creek and the south fork of the San Jacinto River), to determine how far upstream arroyo chub and threespine stickleback occur.

Establishing Sampling Units

For stream surveys in previous years we used ArcGIS v. 9.2 (ESRI 2006) to generate 250-m-long reaches in streams throughout the Conservation Area. We created these uniquely numbered stream reaches following the USGS Stream Survey Protocol (2005) to better track surveyed areas and extent of distribution for waterways occupied by Covered Species (e.g., arroyo toad, southwestern pond turtle). For chub surveys, we subdivided each 250-m reach into 50-m sampling units using the Hawth's Tools extension (Beyer 2004) within targeted waterways. We used 50-m reaches as we thought this to be a reasonable length to keep captured fish cool and aerated while still being able to electrofish and process all fish.

In all targeted waterways except the Santa Margarita River, we surveyed every 50-m sampling unit with permanent water located in the Conservation Area that we could reasonably access with an electrofisher. In the Santa Margarita River we surveyed the first two 50-m sampling units from the downstream end of every 250-m stream reach (n = 65), when not prevented by prohibitively deep water or dense vegetation. We treated the Santa Margarita River differently because there were too many potential 50-m sampling units (n = 160) to survey in 1 season given available field personnel.

Survey Methods

Using handheld GPS units, surveyors navigated to the downstream point of a designated 50-m stream reach and flagged the upstream and downstream ends. At the beginning of each 50-m reach, surveyors took a photo of the reach, facing upstream from the downstream start-point, and recorded conditions at the beginning of the reach including: water temperature (°C), water transparency (clear, moderate/translucent, opaque), pH, dissolved oxygen (concentration [mg/l] and percent), conductivity (mS/cm), salinity (ppt), total dissolved solids (g/l), wetted depth at thalweg (m), width (m) of the stream channel, and water velocity (m/s). Upon completion of each 50-m reach surveyors again recorded water velocity (m/s), wetted width (m), and thalweg depth (m) at the mid-point (25m) and end of the reach. We recorded field data on hardcopy datasheets using waterproof Rite-in-the-Rain paper (J. L. Darling Corporation).

We conducted surveys using a Smith-Root LR-24 Electrofisher over 50-m reaches of each waterway, starting downstream and working upstream. Surveyors used the electrofisher's default factory settings (30 Hz, 12% duty cycle at 25 watts average output

power) at the start of each survey and made adjustments based on the reaction of the fish. In general, fish should not take more than 5 sec to recover from being shocked (Smith-Root 2009). All surveyors wore chest or hip waders, depending on the depth of the water, and rubber gloves to insulate their hands when using the electrofisher. We also used long-handled nets and dip-nets that were insulated with plastic or made of non-conductive materials.

In still water, the operator of the electrofisher walked slowly upstream from the start-point, moving in a zigzag pattern, completely covering the 50-m reach. If the stream was over 3 m wide, the surveyor shocked each side while moving upstream. While the electrofishing occurred, 2 surveyors with long-handled dip nets followed the operator of the electrofisher, catching all available fish. Behind these surveyors, another crew member followed with a bucket of fresh cool water and a small dip net for temporarily storing captured fish.

In flowing water, the operator of the electrofisher shocked in approximately 10-m stretches, starting 10 m upstream of the start point and working back to a seine net held by 2 surveyors at the start point. At least 1 surveyor followed with a long-handled dip net to catch any available fish before arriving at the seine net. Once the operator completed electrofishing the 10-m section, surveyors lifted the seine net and temporarily stored all captured fish in the bucket of cool water. We repeated this process for the remainder of the 50-m reach, moving upstream in 10-m increments.

At the end of each 50-m reach, we processed all captured fish. We kept captured fish cool and aerated by repeatedly replenishing the water in the buckets or coolers, at least every 10 min before processing. We identified native fish to species, measured them using standard length (mm), categorized them by age (fry, juvenile, or adult), and, if possible, determined sex. For any unusual or difficult-to-identify species, we took detailed photographs to document and identify them upon returning to the office. For all non-native fish, we identified and tallied them according to age and, according to each crew member's personal preference, either released them back into the stream or destroyed them.

Surveys were conducted from 0824 h to 1411 h and took from 9 to 109 min (mean = 48 min), depending on substrate, water depth, and number of animals captured and processed.

RESULTS

We detected arroyo chub in only 1 surveyed Core Area in 2010, the Santa Margarita River (Figure 2). SMEA also confirmed arroyo chub in the Santa Ana River Core Area in 2010. We additionally detected arroyo chub in the San Jacinto River, a non-core area. In the Santa Margarita River, we surveyed sixty-five 50-m reaches and detected 3 arroyo chub in 2 reaches. In the San Jacinto River, we detected 76 adult and 253 juvenile arroyo chub in fourteen 50-m reaches.

We also detected threespine stickleback in the San Jacinto River (17 adults and 14 juvenile partially armored threespine stickleback) and the south fork of the San Jacinto River (8 adults) (Figure 3).

We detected a number of other native and non-native species of interest. In the south fork of the San Jacinto River, we detected several California chorus frogs, and no non-native animals. In the Santa Margarita River, Murrieta Creek, Butterfield Drain, and Temescal Wash, there were many non-native species, including fish, bullfrogs (*Lithobates catesbeiana*), and red swamp crayfish (*Procambarus clarkia*) (Appendix B). We also detected beavers (*Castor canadensis*) or their sign in the Santa Margarita River and Murrieta Creek. In the San Jacinto River itself, we detected no non-native fish, amphibians, or crayfish. In Strawberry Creek we detected only California chorus frogs, and again no non-native animals. Non-native plants were dominant along many stretches of these 4 waterways.

We did not detect any fish during our surveys in the short section of Sandia Creek that is in the Conservation Area. Nor did we detect fish in the very short and shallow section of Temecula Creek next to the Santa Margarita River where we had access. This section of Temecula Creek is not part of the Core Area for the species, which is much farther upstream. We surveyed this section because it was contiguous with the Santa Margarita River where we were surveying for arroyo chub. We did not survey either De Luz Creek or Cole Creek because of current lack of conservation within proper habitat.

DISCUSSION

Arroyo chub was documented in 2 of 7 Core Areas identified in the species objectives in 2010. Monitoring Program biologists found chub in the Santa Margarita River and SMEA found arroyo chub in the Santa Ana River. We have added SMEA's data to the Biological Monitoring Program database and a report is available through the SAWPA web site (http://www.sawpa.org/). Arroyo chub were also documented in all 14 stream reaches surveyed in the San Jacinto River, and were found in good abundance in this stream, although this location is not a listed Core Area. Pending future acquisition of appropriate arroyo chub habitat in listed Core Areas, and potential results from surveying those areas, the San Jacinto River should be considered as a replacement for a listed Core Area where arroyo chub do not currently occur.

Electrofishing surveys should reveal all species of fish within a surveyed waterway. We expect that a few individuals will escape detection during electrofishing, but only if a population is limited to a few individuals will any particular species go undetected. Populations that are this small are most likely not viable in a given waterway. Since the last survey done for TNC (Warburton et al. 2000) at the Santa Margarita Ecological Reserve detected over 1000 arroyo chub, it is concerning how few we detected during our extensive survey of the Santa Margarita River within the reserve. The TNC study seined nine 100-m segments along the river and did visual surveys between points, while we surveyed sixty-five 50-m reaches throughout the reserve. The upper Santa Margarita River is also listed as one of 3 sites where arroyo chub are common in southern California (the other 2 being Trabuco Creek and Malibu Creek) (Swift et al. 1993). The TNC survey also documented large stretches of the Santa Margarita River within the reserve being absent of any non-native fish. However, we found non-native fish throughout the river. Redeye bass, a potential predator of arroyo chub, were absent from the river north of the Via Tornado river crossing during the USGS survey, and were still absent during our surveys, although we did capture 2 largemouth bass north of Via

Tornado. Fortunately, we did not detect any fathead minnows (*Pimephales promelas*) or red shiners (*Cyprinella lutrensis*) in the river, both of which can directly compete with arroyo chub (Warburton et al. 2000).

The number and variety of non-native fish, frogs, and crayfish in the Santa Margarita River is concerning. Prickly sculpin (*Cottus asper*) is a recent invader into the Santa Margarita River system, and is known to prey on arroyo chub and arroyo toad (*Robert Fisher, USGS, personal communication*). Non-native plants also dominated the shoreline in many areas. Management actions to remove non-native species and restore watersheds will help ensure the long-term viability of aquatic Covered Species, including arroyo chub.

The only other native fish species detected during our surveys was threespine stickleback (partially armored form), in the San Jacinto River and the south fork of the San Jacinto River. There was also an unverified sighting of a species of salmonid in the Santa Margarita River by a crew member during a scouting survey, but we never saw or captured it subsequently.

Recommendations for Future Surveys

Given that these waterways are extremely vulnerable to the vagaries of weather, pollution, non-native species, and municipal water flow, it is critical that we conduct surveys on a more regular basis, certainly shorter than the current 8-year interval recommended in the MSHCP. Moyle (1976) recommends surveying all known locations of arroyo chub at least every 5 years, a recommendation we endorse.

The Biological Monitoring Program has limited access to some of the Core Areas for arroyo chub, such as Sandia Creek, Cole Creek, De Luz Creek, and Temecula Creek. The specific area of Murrieta Creek cited as having a historical population of arroyo chub is not currently in the Conservation Area. Efforts should be made to gain access to these waterways through right-of-entry agreements or outright purchase to ensure that the Biological Monitoring Program can check on the status of arroyo chub in these areas.

Acknowledgements:

We would like to thank Camm Swift and Robert Fisher for suggestions on specific areas to survey for arroyo chub, and Jonathan Baskin and Thomas Haglund for their advice and training related to these surveys.

LITERATURE CITED

Beyer HL. 2004. Hawth's Analysis Tools for ArcGIS [software]. Available at http://www.spatialecology.com/htools.

Dudek & Associates. 2003. Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP). Final MSCHSP, volumes I and II. Prepared for County of Riverside Transportation and lands Management Agency by Dudek & Associates, Inc. Approved June 17, 2003.

[ESRI] Environmental Systems Research Institute. ArcGIS: Release 9.2 [software]. 2006. Redlands (CA): Environmental Systems Research Institute.

Moyle PB 1976. Inland fishes of California. University of California Press, Berkeley.

Smith-Root. 2009. User's Manual, LR-24 Backpack Electrofisher. Vancouver (WA). Available at http://www.smith-root.com/support/.

Swift CC, Haglund T, Ruiz M and Fisher RN. 1993. The status and distribution of the freshwater fishes of southern California. Bull. So. Calif. Acad. Sci. 92.

[USGS] U.S.Geological Survey. 2005. Draft USGS Aquatic species and habitat assessment protocol for southcoast ecoregion rivers, streams, and creeks. Western Ecological Research Center. Sacramento, CA.

[USGS] U.S. Geological Survey. 2006. USGS western pond turtle (*Emys marmorata*) trapping survey protocol for the southcoast ecoregion. U. S. Geological Survey protocol. San Diego, CA.

Warburton ML, Swift CC, Fisher RN. 2000. Status and Distribution of Fishes in the Santa Margarita River Drainage. Final Report to The Nature Conservancy. 27 pages.

Appendix A. Western Riverside County MSHCP Biological Monitoring Program 2010 Arroyo Chub Protocol

INTRODUCTION

Arroyo chub, *Gila orcutti*, is a species of special concern in California. They are endemic to southern California and are native to the Santa Ana, San Jacinto, and Santa Margarita river systems in the MSHCP Plan Area. The Biological Monitoring Program has never conducted any fish surveys in the Plan Area although other entities have surveyed some of these watersheds for Santa Ana sucker and other fish species. Currently San Marino Environmental Associates (SMEA), under contract with the Santa Ana Watershed Project Authority (SAWPA), is surveying for Santa Ana sucker in the Santa Ana River Watershed. The Santa Ana Watershed Association (SAWA) has also done surveys in the Santa Ana River for Santa Ana sucker. These surveys also document the presence of arroyo chub and other fish species. The U.S. Geological Survey conducted comprehensive fish surveys in the Santa Margarita Watershed from the fall of 1997 until the spring of 2000 for The Nature Conservancy (Warburton et al. 2000). These surveys documented the presence of arroyo chub in the watershed. The upper Santa Margarita River is also listed as one of the 3 sites where it is common in southern California (the other 2 being Trabuco Creek and Malibu Creek) (Swift et al 1993). The USGS surveys also documented the presence of many invasive fish species, which can compete with and/or prey on arroyo chub, such as green sunfish, largemouth bass and black bullhead (Warburton et al. 2000).

The Biological Monitoring Program has conducted stream surveys in a few of the Core Areas for arroyo chub (De Luz Creek, Santa Margarita River), but these did not target fish species, and the identification of fish was not a priority during these surveys, and no official training for fish identification was required. We have also surveyed for western pond turtle in the Santa Margarita Watershed, using large and small hoop traps and minnow traps. These surveys did document fish species caught in the traps but, again, we did no formal fish identification training prior to conducting these surveys.

The Core Areas for arroyo chub include all or part of the following waterways: Santa Margarita River, De Luz Creek, Sandía Creek, Cole Creek, Santa Ana River, Temecula Creek, and Murrieta Creek. Arroyo chub has also been documented in the recent past in lower Temescal Creek (Swift 2001) and in the San Jacinto River during stream surveys by Biological Monitoring staff in June of 2010. We will also survey these areas for arroyo chub.

Goals and Objectives

2. Document presence of arroyo chub and other fish species in Core Areas, San Jacinto River, and Temescal Creek.
    c. Record arroyo chub and other fish species detected during fish surveys.
    d. Document habitat characteristics utilized by arroyo chub.

3. Work in collaboration with USGS to collect genetic material for an on-going population study of fish species in southern California.

a. Retrieve tissue samples from USGS Target Species for genetic analysis.

METHODS

Survey Design

We will survey for arroyo chub in the Santa Margarita watershed, including the main stem of the river and 4 of its tributaries, Murrieta Creek, Temecula Creek, De Luz Creek, and Sandía Creek. We will also survey Cole Creek, which is a tributary of Murrieta Creek. These are all Core Areas for arroyo chub. In addition, we will survey a few areas that have historical records for chub, but are not currently MSHCP Core Areas, including portions of the San Jacinto River and lower Temescal Creek. We will survey 50-meter reaches in each 250-meter reach of the pre-existing stream points used for stream surveys and turtle trapping.

Field Methods

We will survey for arroyo chub by electrofishing 50-meter reaches of river or stream from downstream to upstream, capturing and identifying all fish and other vertebrates and crayfish that "turn", or go belly up. We will use a Smith-Root LR-24 Electrofisher to stun the fish and facilitate netting. We will record field data on hardcopy datasheets using waterproof Rite-in-the-Rain paper (J. L. Darling Corporation - 2614 Pacific Hwy., E.Tacoma, WA).

Field Procedure

1. Crews will navigate to the downstream point of a designated 50-meter reach. The reach will be measured and flagged at the upstream and downstream ends. A photo will be taken, facing upstream, at the beginning of the survey.

2. Before beginning the survey and at the start-point of each reach, we will record water temperature (C), water transparency, pH, dissolved oxygen (concentration [mg/l], and percent), conductivity (mS/cm), salinity (ppt), total dissolved solids (g/l), wetted depth (m), width (m) of stream channel, and water velocity (m/s), so as not to disturb fish before surveying. After the survey of each reach is completed, we will also record water velocity (m/s), wetted width (m), and thalweg depth (m) again at the end of the reach and at every 25-m interval.

3. The electrofisher will be turned on at the default factory setting (30 Hz, 12% duty cycle at 25 watts average output power) to start. These settings will be adjusted according to the reaction of the fish. Fish should not take more than 5 seconds to recover from being shocked. The person using the electrofisher will move slowly upstream from the start point, electrofishing in a zigzag pattern. If the stream is over 3 meters wide, then the two sides of the stream will be shocked separately, by shocking one side then walking back to the start point and shocking the other side, both while moving from downstream to upstream. While the electrofishing is occurring, two people with long-handled dip nets will follow behind the electrofisher, catching all animals that have turned belly up or that can be easily captured. Behind these people, another crewmember will follow with a bucket with fresh cool water and a small dip net. This person

will take all animals caught and place them into a bucket for transporting. At the end of the reach all of the fish captured will be given to a fifth crewmember who will process all fish.

4. Fish will be processed by identifying them to species and tallying them according to age and sex if possible. Native fish species will have a tissue sample taken from at least 5 % of the number caught (or 10 max) in each reach by taking a fin clip from the dorsal fin. Detailed photographs will be taken of any unusual or difficult-to-identify fish species. Invasive fish species will be identified and tallied and either released back into the stream or destroyed, according to each crew member's personal preference. Fish will be kept cool and aerated by repeatedly replenishing the water in the buckets or coolers, at least every 10 minutes. If many native fish are captured, they will be stored in coolers, and the water replenished at the same rate.

5. All personnel will wear chest waders or waterproof boots, depending on the depth of the water, and rubber gloves to prevent being shocked when using the electrofisher.

SAFETY MEASURES (Smith-Root 2009)

Do:

1. Always be sure that all personnel are clear of the electrodes before turning on the power.
2. Know how to administer first aid treatment for electrical shock.
3. Wear flotation devices in deep water.
4. Have electrical circuits checked only by qualified technicians.
5. Disconnect the power supply when the electrofisher is not in use.
6. Disconnect chest strap before crossing or entering water!

Don't:

1. Electrofish alone!
2. Electrofish when you are over-tired
3. Continue to electrofish if the boots or gloves get wet inside.
4. Operate an electrofisher if you have had any prior heart ailments.

Equipment

- Electrofisher with extra battery
- GPS Unit
- Long-handled Dip Nets (2)
- Small Dip Nets (3)
- Buckets (3)
- 8 ft by 4 ft 3/16” mesh Seine nets
- Chest Waders/Boots
- Specimen jars
- Datasheets
- Water quality meters
- Hand lens
- Flow meter
- Camera
- Measuring tape (100 m)
- Rangefinder
- Cm ruler (15 cm)
- Pesola scales
- Maps
- Small coolers (2)
- Identification guide
- Rubber gloves
- Seine net (for difficult-to-access areas)
- Pond turtle PIT tag list
- PIT tag reader w/ extra batteries
- Calipers
- Triangular file
- Flagging
- Extra batteries
- Tissue sampling kit

TRAINING

Current Herp Crew Staff (Bob Packard, Jonathan Reinig, Betsy Dionne, Ashley Ragsdale, Lynn Miller) worked with Dr. Jonathan Baskin of San Marino Environmental Associates (SMEA) in 2009 surveying for Santa Ana sucker, arroyo chub, speckled dace, and threespine stickleback in various areas of southern California in anticipation of MSHCP Arroyo Chub surveys. These crew members also worked with Mike Giusti of the California Department of Fish and Game in 2009 removing rainbow trout from streams in the San Jacinto Mountains using electrofishing and dip nets. Bob Packard has also been working with Dr. Baskin since 2007, and has helped with electrofishing and snorkeling surveys in Massachusetts with Dr. Alex Haro of the Silvio Conte Anadromous Fish Laboratory. These crew members will train all new staff, who will also receive training by working with SMEA in 2010. We will also train new staff in fish identification using local and national field guides, and in-house materials targeting locally-occurring species. We will also train them in fish identification in the field during training sessions, and by observation of live specimens at the RCRCD facility in Riverside, which has populations of arroyo chub, speckled dace, and Santa Ana sucker. Brett Mills of the Santa Ana Watershed Association has extensive experience surveying for fish in southern California and will also be assisting in these surveys.

Training Results

We trained staff on the fish crew on July 9, 2010, on the use of the electrofisher and seine nets in Mill Creek in the Prado Basin, and we detailed identifying characteristics of all fish species captured. We also did mock surveys using the 2010 Arroyo Chub Protocol, and went over all safety procedures while using the electrofisher during this training.

DATA MANAGEMENT

Data will be entered daily into the Biological Monitoring Program multi-taxa database (Microsoft Corporation 2007) after the Program Lead has performed quality assurance.

LITERATURE CITED

Dudek & Associates. 2003. Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP). Final MSCHSP, volumes I and II. Prepared for County of Riverside Transportation and Lands Management Agency by Dudek & Associates, Inc. Approved June 17, 2003.

Microsoft Corporation. Microsoft Access 2007 [software]. 2007. Redmond (WA): Microsoft Corporation.

Moyle PB. 1976. Inland Fishes of California. University of California Press, Berkeley.

Smith-Root. 2009. User's Manual, LR-24 Backpack Electrofisher. Vancouver (WA). Available at http://www.smith-root.com/support/.

Swift CC, Haglund T, Ruiz M, Fisher RN. 1993. The status and distribution of the freshwater fishes of southern California. Bull. So. Calif. Acad. Sci. 92.

[USGS] U.S.Geological Survey. 2005. Draft USGS Aquatic species and habitat assessment protocol for southcoast ecoregion rivers, streams, and creeks. Western Ecological Research Center. Sacramento, CA.

[USGS] U.S. Geological Survey. 2006. USGS western pond turtle (*Emys marmorata*) trapping survey protocol for the southcoast ecoregion. U. S. Geological Survey protocol. San Diego, CA.

Warburton ML, Swift CC, Fisher RN. 2000. Status and Distribution of Fishes in the Santa Margarita River Drainage. Final Report to The Nature Conservancy. 27 pages.

Appendix B. Species detected in 50-m stream reaches during arroyo chub surveys in 2010 (target species in red).

Site	Common Name	Scientific Name	#	Notes
San Jacinto River (26-30 July, 18 Aug) 14 reaches	Arroyo Chub	*Gila orcutti*	322	Adults and juveniles (fry present but not counted)
	Threespine Stickleback	*Gasterosteus aculeatus*	34	Adults and juveniles, native population
	California Chorus Frog	*Pseudacris cadaverina*	55	Tadpoles and metamorphs
Strawberry Creek (28 July) 3 reaches	California Chorus Frog	*Pseudacris cadaverina*	926	Tadpoles and metamorphs
South Fork San Jacinto River (18 Aug) 3 reaches	Threespine Stickleback	*Gasterosteus aculeatus*	8	All adults , native population
	California Chorus Frog	*Pseudacris cadaverina*	8	All adults
Murrieta Creek (4-17 Aug) 6 reaches	Red Swamp Crayfish	*Procambarus clarkii*	15	Adults and juveniles
	Black Bullhead	*Ameiurus melas*	8	Adults and juveniles
	Mosquitofish	*Gambusia affinis*	292	Adults and juveniles
	Bluegill	*Lepomis macrochirus*	24	Adults and juveniles
	Green Sunfish	*Lepomis cyanellus*	189	Adults and juveniles
	Unidentified Fish		100	Fry
	Bullfrog	*Lithobates catesbeianus*	256	Tadpoles and metamorphs
	Unidentified Anuran		25	Tadpoles
Sandia Creek (23 Aug) 4 reaches	Red Swamp Crayfish	*Procambarus clarkii*	17	Juveniles
	Baja California Chorus Frog	*Pseudacris hypochondriaca*	4	Tadpoles and metamorphs
Butterfield Drain (24-26 Aug) 12 reaches	Red Swamp Crayfish	*Procambarus clarkii*	81	Adults and juveniles
	Fathead Minnow	*Pimephales promelas*	9	Adults
	Common Carp	*Cyprinus carpio*	3	Juveniles
	Yellow Bullhead	*Ameiurus natalis*	2	Adults and juveniles
	Mosquitofish	*Gambusia affinis*	60	Adults and juveniles
	Green Sunfish	*Lepomis cyanellus*	3	Adults and juveniles
	Largemouth Bass	*Micropterus salmoides*	5	Juveniles
	Unidentified fish		1	Fry

Appendix B. cont.

Site	Common Name	Scientific Name	#	Notes
Temescal Wash (30 Aug-3 Sept) 18 reaches	Red Swamp Crayfish	*Procambarus clarkii*	7	Adults and juveniles
	Fathead Minnow	*Pimephales promelas*	3	Adults and juveniles
	Common Carp	*Cyprinus carpio*	20	Adults and juveniles
	Black Bullhead	*Ameiurus melas*	2	Adults and juveniles
	Yellow Bullhead	*Ameiurus natalis*	19	1 adult, remainder juveniles
	Mosquitofish	*Gambusia affinis*	8	Adults and juveniles
	Green Sunfish	*Lepomis cyanellus*	34	Adults and juveniles
	Largemouth Bass	*Micropterus salmoides*	40	1 adult, remainder juveniles
	Bullfrog	*Lithobates catesbeianus*	3	Adults
Santa Margarita River (7 Sept-1 Oct) 65 reaches	Red Swamp Crayfish	*Procambarus clarkii*	366	Adults and juveniles
	Arroyo Chub	*Gila orcutti*	3	One adult and 2 juveniles in 2 reaches
	Common Carp	*Cyprinus carpio*	6	Adults and juveniles
	Black Bullhead	*Ameiurus melas*	216	Adults and juveniles
	Mosquitofish	*Gambusia affinis*	1430	Adults, juveniles, and fry
	Prickly Sculpin	*Cottus asper*	1	Adult at southern end of ecological reserve
	Green Sunfish	*Lepomis cyanellus*	679	Adults and juveniles
	Largemouth Bass	*Micropterus salmoides*	2	Juveniles
	Redeye Bass	*Micropterus coosae*	79	Adults and juveniles, None upstream of Via Tornado road
	Bullfrog	*Lithobates catesbeianus*	1201	Adults, tadpoles, and metamorphs
Temecula Creek (4 Oct) 3 reaches	No animals detected	N/A	N/A	N/A