LONG-TERM MONITORING PLAN FOR NATIVE FISH POPULATIONS IN THE GILA RIVER BASIN

VERSION 1.0

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The Long-Term Monitoring Plan for Native Fish Populations in the Gila River Basin continues to be a work in progress, and the reader is encouraged to provide feedback to help us further improve this document. Errors herein of omission or fact are the responsibility of the authors.

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INTRODUCTION

The Gila River Basin Native Fishes Conservation Program (Program) was established to conserve native fishes and manage against non-native fishes in response to several Endangered Species Act biological opinions between the Bureau of Reclamation (Reclamation) and the U.S. Fish and Wildlife Service (USFWS) on Central Arizona Project (CAP) water transfers to the Gila River basin (USFWS 1994, 2001, 2008). The biological opinions established five conservation measures to minimize effects from the potential spread of non-native aquatic species through the CAP canal: 1) construction of fish barriers, 2) fish monitoring, 3) native fish recovery funding, 4) non-native fish control funding, and 5) information and education program.

Prior to 2011, fish monitoring was directed at the CAP canal and its primary connected waters for the purpose of detecting invasions of new non-native species. Although successful in its intended purpose, this monitoring mostly occurred in highly degraded systems that were dominated by non-native fishes and harbored only tiny remnants of their historical assemblage of native fishes. Therefore, the fish monitoring was determined to have limited potential to contribute to the improvement of the conservation status of native fishes, a primary intention of the biological opinions. As a result, Reclamation and USFWS, in cooperation with the Arizona Game and Fish Department and New Mexico Department of Game and Fish, shifted emphasis away from the CAP canal and its primary connected waters toward monitoring the status of wild populations of listed fishes (spikedace [*Meda fulgida*], loach minnow [*Tiaroga cobitis*], Gila topminnow [*Poeciliopsis occidentalis*], and Gila chub [*Gila intermedia*][1]) throughout the Gila River basin. The CAP and its primary connected waters are now monitored once every 5 years according to Clarkson et al. (2011).

A workshop was held on August 9 and 10, 2017, with fish biologists from Arizona and New Mexico to evaluate the progress of the Program, including Reclamation's native fish monitoring which, at the time, had been implemented for 5 years. Some of the monitoring recommendations from the workshop included reviewing the monitoring goals/objectives, evaluating the capacity to expand beyond presence/absence, assessing what other agencies are doing for monitoring, and revisiting how resources are allocated. As a result, Reclamation began efforts to further evaluate its native fish monitoring program through a series of workshops and meetings. This *Long-Term Monitoring Plan for Native Fish Populations in the Gila River Basin* (Plan) represents a synthesis of these discussions into a standardized monitoring protocol.

This Plan defines objectives and methodologies, including data collection and analysis, considered necessary to assess the conservation status of the federally listed Gila topminnow, loach minnow, spikedace, and Gila chub (herein referred to as the focal species), and the co-occurring fish assemblage. The appendices provide a comprehensive summary of the native fish sampling locations, including site-specific information and sampling methods. This protocol serves as a guide for Reclamation and/or its agent to standardize monitoring activities and ensure comparability of results.

1 Gila chub, roundtail chub (*Gila robusta*), and headwater chub (*Gila nigra*) were reclassified and merged into a single species known as roundtail chub in 2016. However, Gila chub remains federally listed as endangered and, therefore, will be reported herein as Gila chub.

GOALS AND OBJECTIVES

Goal

Assess the conservation status of the federally listed focal species, and the co-occurring fish assemblage.

Overall Objectives

1. Calculate population size indices for each focal species.
2. Determine the fish assemblage and assemblage structure (percent composition) of all species captured including non-native aquatic species.
3. Evaluate size-structure to document reproduction and recruitment of focal species.
4. Determine geographic extent and distribution of each focal species population, where feasible.

Species-Specific Objectives

Gila Topminnow[2]

- Verify that the population contains at least 500 overwintering adults or meets estimated effective population size requirements.

Loach Minnow, Spikedace, and Gila Chub[3]

- Evaluate trends of recruitment and population size indices over the most recent rolling 10-year period.

[2] Gila Topminnow species-specific objectives are taken from the 1999 Gila Topminnow Draft Revised Recovery Plan and may change pending outcome of genetic monitoring.

[3] Loach Minnow, Spikedace, and Gila Chub species-specific objectives are taken from the 1991 Spikedace Recovery Plan, 1991 Loach Minnow Recovery Plan, and 2015 Gila Chub Draft Recovery Plan.

SAMPLING DESIGN AND METHODOLOGY

A generalized sampling design and methodology centered on focal species and water type was developed to assess the conservation status of each focal species, and the co-occurring fish assemblage, within the Gila River basin. In most cases sampling methodologies followed the guidelines provided by the Standard Methods for Sampling North American Freshwater Fishes (Bonar et al. 2009). In addition, due to the diversity and remoteness of habitats across the basin, site-specific monitoring protocols were developed for each waterbody to ensure investigators monitor the correct locations in a repeatable and comparable fashion (Appendix A). Site-specific sampling protocols include the following information: site description, monitoring objective and focal species, geographic extent, land ownership, access, frequency, timing, and sampling design and methodology.

Gila Topminnow

Ponds and Spring Pools

Gila topminnow often persist in ponds or spring pools. Spring pools are short sections of stream (typically <300 meters [m]) below springs, with mostly pool habitat. Gila topminnow in these habitats can be effectively captured with minnow traps or if substrate is smooth, with seines. Sampling should target the entire pond and spring pool habitat. See *Data Recorded* section for more information regarding data recording requirements for each gear type, as well as size classes for Gila topminnow and non-focal species.

MINNOW TRAP

Ten minnow traps (with 3 mm mesh) will be set within each pond or 100-m reach of spring pool habitat and set a minimum of 2 m apart, unless the habitat is too small to accommodate that amount of effort. Traps will be left in the water for 2 – 4 hours, distributed across the site in suitable habitat, and baited with dry dog food. Traps will be set at a varying distance from the shore with 75% of the traps set within 1 m of the shoreline, and the other 25% set within 5 m of the shoreline. If the site falls within the range of native leopard frogs (*Lithobates* spp.), garter snakes (*Thamnophis* spp.), or mud turtles (*Kinosternon* spp.), traps should be set with a portion of the trap above the water surface to reduce potential incidental mortality of these taxa. Individual traps will be worked up separately so that catch per unit effort (CPUE) (fish/hour) per trap can be reported.

SEINE

Seine hauls may also be conducted within a pond or spring pool where setting minnow traps is not conducive. If minnow traps are unable to be set at a site (too shallow) or the habitat is relatively open (free of snags and aquatic vegetation), 10 uniquely located seine hauls per 100 m will be performed, unless the habitat is too small to accommodate that amount of effort. Individual hauls will be worked up separately so that CPUE (fish/m^2) per haul can be reported.

DIP NET

If habitat is too shallow for traps and seines, dip netting will be used. Dip net sweeps will be 1 m in length and each sweep will be done in a unique location. Enough dip net sweeps will be conducted to sample 20% of the available habitat. Individual sweeps will be worked up separately so that CPUE (fish/m^2) per sweep can be reported.

Streams and Rivers

Gila topminnow also persist in perennial and interrupted streams and rivers. In these habitats, Gila topminnow can be effectively captured with minnow traps or if substrate is smooth, with seines. Surveys will consist of sampling a minimum of 20% of available habitat at a site; however, if the perennial extent of the site is relatively short (<0.5 kilometers [km]), sampling should target the entire perennial habitat. See *Data Recorded* section for more information regarding data collection requirements for each gear type, as well as size classes for Gila topminnow and non-focal species.

The standard length of a sample station will be 100 m. The number of sample stations to be sampled will be adequate to cover a minimum of 20% of the available habitat at a site. At least one fixed station will be surveyed within each site and the remaining 100-m sample stations will be chosen randomly prior to sampling using ArcMap or other appropriate software.

MINNOW TRAP

Ten minnow traps (with 3 mm mesh) will be set within each sample station, set a minimum of 2 m apart, and target backwater, pool, run, and eddy habitat (traps should be set proportionally across these habitat types), unless the habitat is too small to accommodate that amount of effort. Traps will be left in the water for 2 – 4 hours, distributed across the site in suitable habitat, and baited with dry dog food. Traps will be set at a varying distance from the shore with 75% of the traps set within 1 m of the shoreline, and the other 25% set within 5 m of the shoreline, with all traps between 5 and 10 m apart from each other. If the site falls within the range of native leopard frogs, garter snakes, or mud turtles, traps should be set with a portion of the trap above the water surface to reduce potential incidental mortality of these taxa. Individual traps will be worked up separately so that CPUE (fish/hour) per trap can be reported.

SEINE

Seine hauls may also be conducted within streams and rivers where setting minnow traps is not conducive. If minnow traps are unable to be set at a site (too shallow) or the habitat is relatively open (free of snags and aquatic vegetation), 10 uniquely located seine hauls per 100-m station will be performed, unless the habitat is too small to accommodate that amount of effort. Individual hauls will be worked up separately so that CPUE (fish/m^2) per haul can be reported.

DIP NET

If habitat is too shallow for traps and seines, dip netting will be used. Dip net sweeps will be 1 m in length and each sweep will be done in a unique location. Individual sweeps will be worked up separately so that CPUE (fish/m^2) per sweep can be reported.

Loach Minnow and Spikedace

Streams and Rivers

Loach minnow and spikedace are predominantly found in wadeable habitat in streams and rivers. These habitats can be effectively sampled using backpacking electrofishing; however, seining or kick-seining may also be used to better target these species. Monitoring protocols for loach minnow and spikedace differ in Arizona and New Mexico. To best align with current long-term monitoring practices in each state and ensure comparable results, sampling methodologies are broken down by state.

ARIZONA

The standard length of a sample station will be 100 m, which is typically long enough to encompass one pool-run-riffle sequence. In larger systems, a longer sample station will be used to ensure that all sample stations have at least one pool-run-riffle sequence. The number of sample stations to be sampled will be adequate to cover a minimum of 20% of the available habitat at a site, unless it is considered to not be logistically feasible to complete within a 1-week or other project-appropriate timeframe. At least one fixed station will be surveyed within each site or reach, and the remaining 100-m sample stations will be chosen randomly prior to sampling using ArcMap or other appropriate software.

At each sample station, a single pass will be conducted in an upstream direction using a backpack electrofisher and dip nets. Electrofishing gear will be standardized to electrical configuration and power output following guidelines by the Arizona Game and Fish Department for minimizing electrofishing injury. The reach will be broken up into major habitat types (Table 1) along the thalweg, and captured fish will be processed at the end of each habitat break. Between habitat breaks, captured fish will be held in an aerated bucket. The sampled area between habitat breaks will be recorded as an individual effort and given a sequential name (e.g., EF1, EF2, EF3); backpack electrofishing seconds will also be recorded for each effort.

Table 1. Description of Arizona Mesohabitat Types in the Gila River Basin

Habitat	Description
Pool	Little to no flow; generally deeper than surrounding areas and often found on the outside of stream meanders. Typically formed by damming, waterfalls, boulders, and rootwads/logs.
Run	Moderate flow with little to no surface turbulence; generally, the water depth is uniform/homogenous with no major flow obstructions.
Riffle	Moderate to fast flow; generally shallow with significant surface turbulence caused by water flowing completely or partially over cobble and boulder substrate.

At each habitat break/processing point, captured fish will be identified to species, enumerated, and measured, and fish will be released in the center of the mesohabitat from which they were captured. All focal species and non-native piscivorous fish captured will be measured for total length (in millimeters [mm]). See *Data Recorded* section for more information regarding data recording requirements for backpack electrofishing, as well as size classes for non-focal species.

NEW MEXICO

The standard length of a sample station will be 200 m. The number of sample stations to be sampled will be adequate to cover a minimum of 20% of the available habitat at a site, unless it is considered to not be logistically feasible to complete within a 1-week or other project-appropriate timeframe. At least one fixed station will be surveyed within each site or reach, and the remaining 200-m sample stations will be chosen randomly prior to sampling using ArcMap or other appropriate software.

At each sample station, the reach will be broken into major mesohabitat types (Table 2). The gear type used within the reach will vary depending on the mesohabitat type being sampled. Broad shallow runs, and similar mesohabitats with smooth substrates will be sampled by seine (typically 3.0 × 1.2 m with 3.2-mm mesh). All other mesohabitat types (e.g., cobble-bottomed runs, debris pools, riffles, chutes) will be sampled via single-pass backpack electrofishing with dip nets in an upstream direction. Electrofishing gear will be standardized to electrical configuration and power output following guidelines by the New Mexico Department of Game and Fish for minimizing electrofishing injury. Captured fish will be held in an aerated bucket during sampling and processed at the end of each mesohabitat break.

At each mesohabitat, captured fish will be identified to species, enumerated, measured (total length in millimeters), and released. If a seine is used, total area sampled (m^2) per seine haul for each mesohabitat sampled will be recorded. If a backpack electrofisher is used with dip nets, elapsed electrofishing time for each mesohabitat sampled will be recorded. See *Data Recorded* section for more information regarding data recording requirements for each gear type.

Table 2. Description of New Mexico Mesohabitat Types in the Gila River Basin

Type	Habitat	Description
Slow	Isolated pool	Standing water not directly connected to wetted channel; depth and substrate variable.
	Embayment	An off-channel inundated area with mouth facing upstream; directly connected to wetted channel; generally shallow (<20 centimeters [cm]) with silt or sand substrate and no, or almost no, flow.
	Backwater	An off-channel inundated area with mouth facing downstream; directly connected to wetted channel; depth typically >20 cm and often >50 cm; silt, sand, or gravel substrate; banks may be undercut.
	Pool	An area of low-velocity water (<10 cm/second), typically >20 cm deep and normally >50 cm with silt or sand substrate but sometimes gravel substrate. Pools often formed by and around instream obstructions such as boulders, uprooted trees, or in association with root masses.
	Shoal	A shallow (5- to 20-cm), low-velocity area (5 to 20 cm/second) with sand and cobble substrate; shoals most typically found on inside curve of long bend.
Moderate	Eddy	Typically, a moderately deep (20- to 50-cm) area with slow to moderate velocity (5 to 30 cm/second) reverse current and sand or small gravel substrate. Eddies most frequently found in association with riffles and instream obstructions.
	Plunge	The transition area below a riffle or chute where the channel deepens into a run with transition from high to low velocity.
	Shoreline run	Moderate velocity (20 to 60 cm/second) and moderately deep (30- to 70-cm) areas along stream margins. Substrate usually sand, gravel, or cobble. Banks steeply sloping and often undercut.
	Mid-channel run	Moderate to rapid velocity (20 to 80 cm/second) and moderate to deep (30- to 80-cm) habitat with gravel or cobble substrate. Instream cover is rare. Habitat typically astride thalweg.
Rapid	Riffle	Moderately steep-gradient areas with predominantly cobble substrate, rapid velocity water (typically >50 cm/second), and shallow to moderate depths (normally <30 cm). Water surface agitated.
	Chute	Steep-gradient areas where bedform really concentrates flow (typically central channel). Velocity frequently >100 cm/second, depths usually 50 to 150 cm, and substrate is large cobbles.

Gila Chub

Ponds and Spring Pools

Gila chub may persist in ponds or spring pools. Spring pools are short sections of stream (typically <300 m) below springs, with mostly pool habitat. Gila chub in these habitats can be effectively captured with hoop nets or, if substrate is smooth, with seines. Sampling should target the entire pond and spring pool habitat. See *Data Recorded* section for more information regarding data recording requirements for each gear type, as well as measurement requirements (length and weight) for Gila chub and size classes for non-focal species.

HOOP NET

Ten hoop nets (with 6-mm mesh) will be set within each pond or 100-m reach of spring pool habitat, unless the habitat is too small to accommodate that amount of effort. For spring pool habitat, one hoop net will be set in each pool; however, if spring pools are over 20 m long, one trap per 10 m of pool length will be set. Nets will be left in the water overnight, distributed across the site in suitable habitat, and baited with dry dog food. If the site falls within the range of native leopard frogs, garter snakes, or mud turtles, nets will be set with a portion of the trap above the water surface to reduce potential incidental mortality of these taxa. Individual nets will be worked up separately so that CPUE (fish/hour) per net can be reported.

SEINE

Seine hauls may also be conducted within ponds and spring pools where water is too shallow to effectively set hoop nets If setting hoop nets is not possible at a site (too shallow) and the habitat is relatively open (free of snags and aquatic vegetation), 10 uniquely located seine hauls per 100 m will be performed, unless the habitat is too small to accommodate that amount of effort. Individual hauls will be worked up separately so that CPUE (fish/m^2) per haul can be reported.

Streams and Rivers

Gila chub also persist in perennial and interrupted streams and rivers. Gila chub in these habitats can be effectively captured with backpack electrofishing and hoop nets, or if substrate is smooth, with seines. Surveys will consist of sampling a minimum of 20% of the available habitat at a site; however, if the perennial extent of the site is relatively short (<0.5 km), sampling will target the entire perennial habitat.

The standard length of a sample station will be 100 m. The number of sample stations to be sampled will be adequate to cover a minimum of 20% of the available habitat at a site. At least one fixed station will be surveyed within each site and the remaining 100-m sample stations will be chosen randomly prior to sampling using ArcMap or other appropriate software.

BACKPACK ELECTROFISHING

Backpack electrofishing is the most widely applicable active sampling method over the widest variety of habitats. Unless habitats are not conducive to backpack electrofishing, it is required that backpack electrofishing be used as the primary gear type at each sample station. Electrofishing gear is to be standardized to electrical configuration and power output following guidelines by the Arizona Game and Fish Department and New Mexico Department of Game and Fish for minimizing electrofishing injury.

At each sample station, a single pass will be conducted in an upstream direction using a backpack electrofisher and dip nets. The reach will be broken into major habitat types (see Table 1) along the thalweg, and captured fish will be processed at the end of each habitat break. Between habitat breaks, captured fish will be held in an aerated bucket. The sampled area between habitat breaks will be recorded as an individual effort and given a sequential name (e.g., EF1, EF2, EF3); backpack electrofishing seconds will also be recorded for each effort.

At each habitat break/processing point, captured fish will be identified to species, enumerated, measured, and released in the middle of the habitat type from which it was captured. All focal species and non-native piscivorous fish captured will be measured for total length (in millimeters). See *Data Recorded* section for more information regarding data recording requirements for backpack electrofishing, as well as size classes for non-focal species.

HOOP NET

If the site consists predominantly of pool habitat that is >1.5 m deep, then hoop nets will be set within the sample station. One hoop net (with 6-mm mesh) will be set in each pool, baited with dry dog food, and left to trap overnight. For streams with pools over 20 m long, one trap per 10 m of pool length will be set. If the site falls within the range of native leopard frogs, garter snakes, or mud turtles, traps will be set with a portion of the trap above the water surface to reduce potential incidental mortality of these taxa. Individual nets will be worked up separately so that CPUE (fish/hour) per net can be reported.

SEINE

Seine hauls may also be conducted within streams and rivers where electrofishing or setting hoop nets in the habitat is not conducive. If electrofishing or setting hoop nets is not possible at site and the habitat is relatively open (free of snags and aquatic vegetation), 10 uniquely located seine hauls per 100-m station will be performed, unless the habitat is too small to accommodate that amount of effort. Individual hauls will be worked up separately so that CPUE (fish/m^2) per haul can be reported.

Habitat Sampling

At ponds and spring pools, the following habitat measurements will be recorded.

- Length, width, and maximum depth (in meters) of pond and each sampled spring pool.
- Water quality (water temperature, pH, dissolved oxygen, and conductivity; recorded from pond shoreline or at spring/start of spring pools).
- Notes about other habitat features, such as overhead cover, debris, and vegetation.
- For ponds, take a photograph at an established photo point location and record the global positioning system (GPS) coordinates. For spring pools, take upstream- and downstream-facing photographs at start and end of perennial water, and record GPS coordinates.

At streams and rivers, habitat measurements will be recorded within each fixed 100-m sample station. Within each fixed 100-m sample station, the following measurements will be recorded.

- Length (in meters; one measurement from start to end of each mesohabitat).
- Discharge (see Appendix B for protocol [Lazorchak et al. 1998]).
- Water quality (water temperature, pH, dissolved oxygen, and conductivity; recorded at the upstream end of the sample station).
- Notes about other habitat features, such as overhead cover, debris, and vegetation.
- Take upstream- and downstream-facing photographs at upper and lower boundaries of the station, and record GPS coordinates.

Data Recorded

The information below is required to be recorded at each sample station for each gear type. A copy of the survey data sheet is provided in Appendix C.

Fish capture and habitat data to be recorded.

- Water name (e.g., Tule Creek)

- Station name (e.g., Tule Creek – Fixed 01)
- Coordinates (UTM NAD83; upper and lower boundaries of station)
- Date and time
- Names of surveyors
- Gear type and dimensions
    - Length, width, height, and mesh size of traps/nets, seines, and dip nets.
    - Manufacturer and model of electrofisher (e.g., Smith-Root LR-24) and settings.
- Effort name/number
    - Backpack electrofisher
        - Each sampled mesohabitat will be recorded as an individual effort (e.g., EF1, EF2, EF3).
        - Effort in seconds.
    - Minnow traps
        - Each minnow trap will be recorded as an individual effort (e.g., MT1, MT2, MT3).
        - Set time (hh:mm) and pull time (hh:mm) for each trap.
    - Dip nets/seines
        - Each dip net sweep or seine haul performed will be recorded as an individual effort (e.g., DN1, DN2, DN3; SN1, SN2, SN3).
        - Length and width (in meters) of area sampled for each dip net sweep or seine haul performed.
- Species captures
    - Counts will be recorded for each species per effort (i.e., number of Gila topminnow captured per minnow trap)
    - Lengths (total length in millimeters) for each focal species and non-native piscivorous fish will be recorded.
        - Gila topminnow will be recorded by size class: ≤20 and >20 mm TL
    - Weight (g) for each Gila Chub will be recorded.
    - Size class lengths for non-focal species will be recorded as follows:
        - Desert pupfish (*Cyprinodon macularius*): ≤20 and >20 mm TL
        - Speckled dace (*Rhinichthys osculus*) and longfin dace (*Agosia chrysogaster*): ≤40 and >40 mm TL
        - Sonoran sucker (*Catostomus insignis*) and desert sucker (*Catostomus clarki*): ≤50, 51 to 100, and >100 mm TL
        - Roundtail chub: ≤50, 51 to 100. and >100 mm TL
        - Gila trout (*Oncorhynchus gilae*) and Apache trout (*Oncorhynchus apache*): ≤50, 51 to 100, and >100 mm TL
        - Disposition
    - Released alive/mortality
    - All mortalities of threatened or endangered species will be preserved, labeled, and housed at Arizona State University, or an appropriate museum, in accordance with state and federal permits.

    - If novel species are detected within a waterbody, a specimen should be preserved (except threatened or endangered species) or a voucher photograph should be taken and reported to Reclamation.

- Habitat
    - Length of pond/spring pool or mesohabitat
    - Width of pond/spring pool or mesohabitat
    - Maximum depth of pond/spring pool
    - Water quality
        - Water temperature, pH, dissolved oxygen, and conductivity
        - Time (hh:mm) water quality was recorded
    - Discharge for streams and river sites
    - Station photographs should include a photograph board with the following information
        - Water name (e.g., Tule Creek)
        - Station name (e.g., Tule Creek – Fixed01)
        - Coordinates (UTM NAD83)
        - Location/direction of photograph (e.g., at upper boundary facing downstream [US > DS])
        - Date
- Notes/comments

DATA ANALYSIS AND REPORTING

The contractor will produce an annual report for Reclamation that describes all fish monitoring activities conducted during the calendar year. The annual report will include background information, methods, results, and discussion/sampling recommendations for each waterbody surveyed. Data will be summarized in tabular and/or graphical form for each waterbody and will clearly relate the species captured, lengths/size classes, counts, CPUE, and percent composition by gear type (Table 3). Habitat data will also be summarized for each waterbody and digital photographs taken at photo points during survey will be included in the report. The contractor will provide copies of field notes and enter all survey data in an Excel or Access database provided by Reclamation.

Mean CPUE will be reported as fish/hour for minnow traps, hoop nets, and backpack electrofishing, and fish/m^2 for dip net sweeps and seine hauls. For minnow traps and hoop nets, CPUE will be calculated per minnow trap, averaged across the sample station, and then averaged across the waterbody (if there are multiple sample stations). For backpack electrofishing, CPUE will be calculated per sample station, and then averaged across the waterbody (if there are multiple sample stations). For dip net sweeps and seine hauls, CPUE will be calculated per dip net sweep or seine haul, averaged across the sample station, and then averaged across the waterbody (if there are multiple sample stations).

Table 3. Example Summary Table for Fish Captures in 10 Minnow Traps

Species	# of Traps	Size Class	Count	Mean CPUE (fish/hour)	% of Total Catch
Gila topminnow	10	>20 mm	643	38.02	68.0
Gila topminnow	10	≤20 mm	284	16.79	30.0
Longfin dace	10	>40 mm	19	3.80	2.0

The contractor will also evaluate trends of recruitment and population size indices over the most recent rolling 10-year period for Gila topminnow, loach minnow, spikedace, and Gila chub. CPUE will be graphed for each focal species for the most recent rolling 10-year period to examine trends of population size (Figure 1). Length-frequency histograms will also be developed to evaluate the size structure for each focal species (Figure 2).

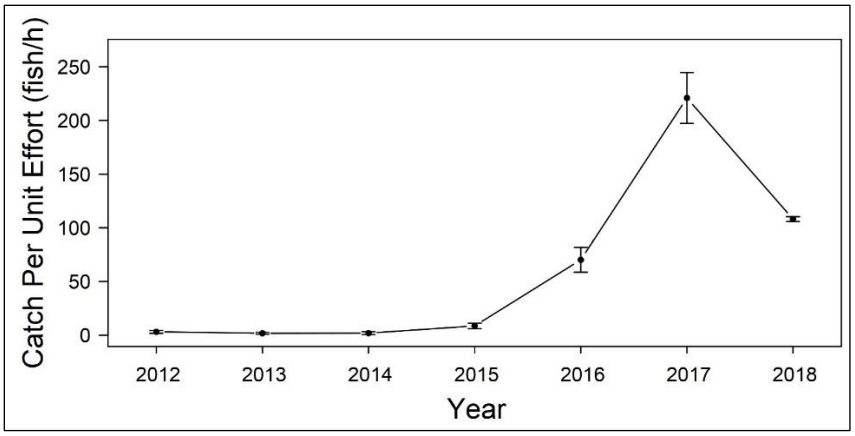

Figure 1. Example summary of mean CPUE for spikedace in Blue River over the most recent rolling 10-year period (Hickerson and Robinson 2019).

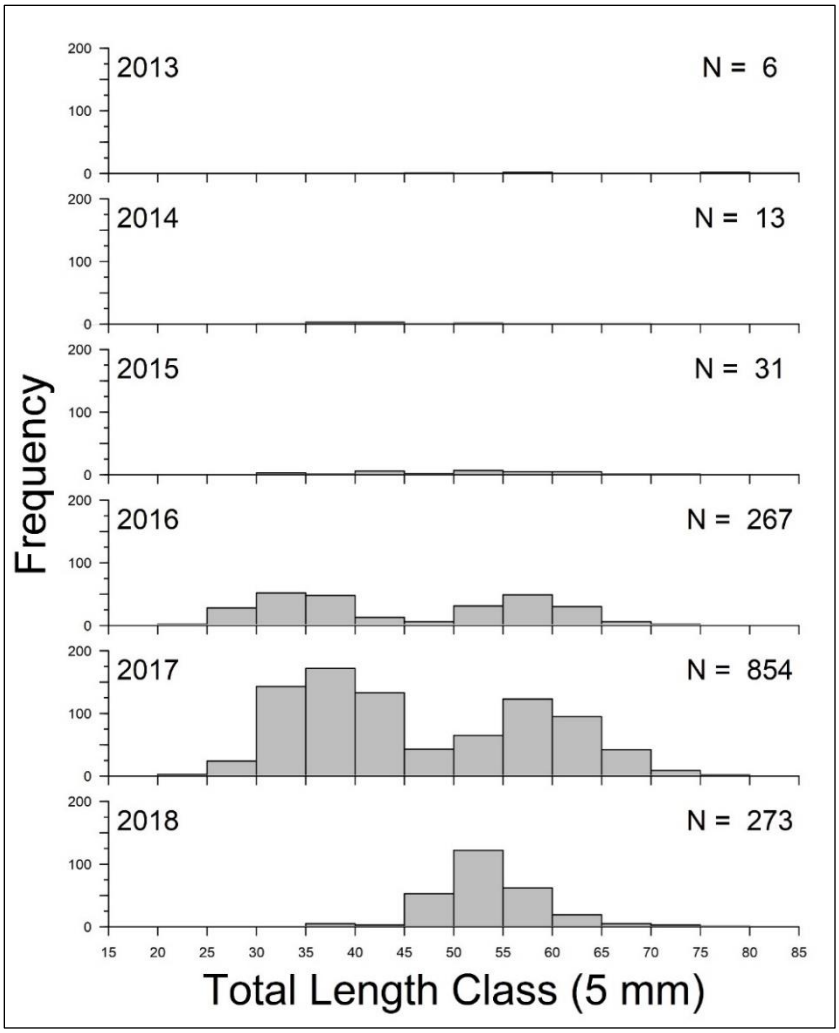

Figure 2. Example summary of size structure for spikedace in Blue River over the most recent rolling 10-year period (Hickerson and Robinson 2019).

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