United States Department of the Interior

U.S. Fish and Wildlife Service
Arizona Ecological Services Office
2321 West Royal Palm Road, Suite 103
Phoenix, Arizona 85021-4951
Telephone: (602) 242-0210 FAX: (602) 242-2513

In Reply Refer To:

December 20, 2011

AESO/SE
22410-2011-F-0290

Memorandum

To: Chief, Wildlife and Sportfish Restoration Program, U.S. Fish and Wildlife Service, Albuquerque, New Mexico (Attn: Nicole Jimenez)

From: Field Supervisor

Subject: Biological and Conference Opinion for Federal Funding of Aquatic Inventory, Survey, and Monitoring Activities, and Conservation Activities for Aquatic Species by Arizona Game and Fish Department, 2011-2020

Thank you for your request for formal consultation and conference with the Arizona Ecological Services Office (AESO) pursuant to section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544), as amended (Act). Your request was dated June 26, 2011, and received by us on June 27, 2011. At issue are impacts that may result from the proposed Federal funding by Wildlife and Sportfish Restoration (WSFR) of a suite of activities related to aquatic species management by Arizona Game and Fish Department (AGFD) under the State Wildlife Grant (SWG) and Sport Fish Restoration (SFR) Grant for a period of 10-years beginning on July 1, 2011. The project area covers all aquatic habitats in Arizona where the activities included in the proposed action would be undertaken by AGFD in the 10-year period covered by this consultation.

The proposed action may directly or indirectly affect listed, proposed, and candidate species and designated or proposed critical habitats in Arizona. In your request for consultation, you indicated that 34 listed, proposed, or candidate species would not be affected by the proposed action. Those species are not aquatic or riparian dependent and would not come into contact with AGFD personnel conducting covered activities in and adjacent to aquatic habitat. Forty nine species provided to us were considered to have a "may affect" determination; however, these were not differentiated into likely or not likely to be adversely affected. Direct and indirect effects are anticipated to all aquatic animal species, and indirect effects are anticipated to marsh-dwelling or riparian-dwelling animal species and plant species. Appendix A contains these tables with the determination made for that species as provided in your request and as determined through our evaluations. Concurrences for species with findings of "may affect, not likely to adversely affect" for aquatic, marsh, or riparian animal and plant species are provided in Appendix B.

This biological and conference opinion (BCO) is based on information provided in the project description and supporting information provided with your request for consultation, other materials provided subsequent to June 27, 2011, by WSFR or AGFD, additional information from capture and handling protocols for aquatic animal species, and other sources of information. Literature cited in this BCO is not a complete bibliography of all literature available on the species of concern, survey and monitoring protocols, effects of such activities on aquatic species, or on other subjects considered in this opinion. A complete administrative record of this consultation is on file at this office.

Because this BCO is lengthy and complex, we have provided a Table of Contents to assist in your examination of the document.

Contents

CONSULTATION HISTORY

Management activities implemented by AGFD for endangered or threatened species involve three USFWS offices; the Division of Threatened and Endangered Species (TES) in the Regional Office in Albuquerque that issues the section 10(a)(1)(A) research and recovery permit and tracks the work plans and Section 6 agreement authority under the Act, WSFR for funding for conservation actions under SWG and sportfish management under SFR, and the AESO for coordination of actions with FWS species lead biologists. The biological opinion (BO) on the section 10(a)(1)(A) research and recovery permit prepared by TES (USFWS 2010a) evaluates effects to endangered species and CITES appendix 1 species from the activities described in the 10(a)(1)(A) permit. The 10(a)(1)(A) permit activities and those described in the AGFD section 6 work plan focus on conservation actions to be taken; however, in implementing those actions (particularly those that involve capture and handling of individual animals), there may be injury or mortality to some individuals, which is why there is a level of take included in the permit and the incidental take statement in the BO. The permit and its BO do not include designated take (incidental or direct) for species with special rules under section 4(d), designated section 10(j) populations, threatened species, or candidate species as AGFD does not need coverage for take of those species under the Act. For threatened species, AGFD may take individuals for conservation purposes that are consistent with the purposes of the Act under their section 6 authorities and their section 6 conservation agreement. No take levels are set. The BO on the permit issuance provides section 7 coverage to the USFWS for permit issuance only.

WSFR is a separate branch of the USFWS in the Regional Office and provides funding to AGFD for fish and wildlife management actions through a variety of grant programs. Pertinent to this consultation are the SWG funds for conservation work to benefit wildlife and their habitat, including those not hunted or fished, and SFR funds for activities involved in sportfish restoration (SFR funds are not used for conservation activities for nongame aquatic species). For the 2010 permit cycle (beginning July 1, 2010 and ending June 30, 2011), AGFD and WSFR completed informal consultation for the subject grant programs with WSFR signing off on findings of "may affect, not likely to adversely affect" for all species based on the limited level of disturbance resulting from these routine survey and monitoring activities over the short timeframe and that any potential "take" was covered by the section 10(a)(1)(A) permit and AGFD's Section 6 authorities under the Act, other authorities deriving from section 4(d) rules or section 10(j) designations, or through incidental take statements in completed biological opinions for specific projects. If the amount of take included in the section 10(a)(1)(A) permit was exceeded, consultation would be reinitiated.

Subsequently, further review of the coverage for WSFR contained in the section 10(a)(1)(A) permit and state Section 6 authorities indicated that while AGFD and TES had incidental take coverage for their actions on the ground through the aforementioned authorities and USFWS had the BO for issuance of the permit, WSFR could not utilize that approval for its Federal funding

of SWG and SFR programs. The TES "take" coverage under the permit BO was limited in scope since it only covered conservation actions for endangered aquatic species and did not address effects to any listed or proposed species from activities where endangered or threatened species could be impacted by actions taken for sportfish management that do not hav conservation benefits. Because the types of activities undertaken under SFR may have adverse effects to listed species that are not the target of the activity, including the potential for take not authorized under any incidental take statement or permit, WSFR elected to review the adequacy of providing blanket "may affect, not likely to adversely affect" coverage for their SWG and SFR grants to AGFD. WSFR determined that it did not currently have any incidental take coverage for activities undertaken by AGFD under these grants.

In May, 2011, WSFR and AGFD initiated discussions with AESO to develop a process to provide section 7 and incidental take coverage for actions by AGFD taken under the SWG and SFR grant programs for WSFR. Issues identified for consideration in the consultation included:

- Many of the types of activities to be covered under the consultation are those AGFD has implemented in the past and will continue to implement into the future. However, not all activities identified for a particular species have been implemented in the past; and future management opportunities may develop where they would be used. The term of coverage for the consultation should be long enough to take into account that most actions are continuing year to year and reduce the need for repetitive consultation.

- The role in the consultation of the existing research and recovery permit and its BO in a consultation for WSFR funding of conservation (SWG) and non-conservation (SFR) activities is complex. The 10(a)(1)(A) permit and its BO provided incidental take coverage for SWG funded conservation activities targeting endangered species only and this coverage can extend to WSFR as the funding entity if referenced here. No incidental take is included for threatened or special 4(d) rule species, as a section 10 permit is not needed for take of these species. Thus, there is no incidental take coverage for WSFR for these species and take authorization will be provided through this consultation. Because the term of the permit and its BO with the incidental take statement is not the same as for this consultation, we assume that incidental take for SWG funded activities for endangered species may change over the 10-year period for this consultation. Thus, for endangered species, the controlling document for incidental take levels is the section 10(a)(1)(A) permit not this consultation. If a threatened species with take included in this consultation is uplisted to endangered status, the take from the subsequent section 10(a)(1)(A) permits will apply with a need for additional take associated with this consultation considered at that time.

- SFR funds are used by AGFD for surveys and monitoring related to sportfish projects (including for Apache and Gila trout, and roundtail chub which are native sportfish), and there is a potential for adverse effects to non-target (listed and candidate species) aquatic species if sportfish-related activities take place in occupied habitats of listed and candidate aquatic or riparian species. While the amount of overlap will vary among listed and candidate species, the potential for incidental take exists and coverage is required for WSFR as the funding agency.

- Limited SFR funds will be used to implement the Conservation and Mitigation Program (CAMP) included as required conservation and mitigation for effects evaluated in the recently completed Federal funding of sportfish stocking activities consultation (USFWS 2011a). These are conservation activivities and are allowed to be funded under SFR because they are directly related to the continuation of sportfish stocking programs in Arizona. These activities target the CAMP species and there may be occasions where adverse effects to individuals occur and incidental take coverage is required for WSFR as the funding entity.

- The full range of potential activities that AGFD could take for any of the 49 aquatic, marsh, or riparian dependent species should be included in the proposed action, and be identified as those that could be used directly with a species ("targeted" activities), those that were not directly used with a species but incidental interactions were possible if that activity was used in occupied habitats ("non-targeted" activities), and activities that were not used directly with a species and incidental interactions were not expected even if the activity was used in occupied habitat ("not applicable" activities). These formed the basis for the effect evaluations in this consultation.

In addressing the points above, WSFR, AGFD, and AESO decided that this consultation would cover 10-years of WSFR funding. The level of incidental take for endangered species contained in the current section 10(a)(1)(A) permit and its BO would be used as the amount of incidental take for those endangered species from SWG activities in this BCO. To avoid limitations on conservation actions through assigning any SFR take on these species to the amount of take contained in the permit, an additional amount of take for endangered species will be provided, as appropriate, in the incidental take statement contained in this BCO. For threatened and 4(d) rule species, the incidental take statement in this BCO will provide take coverage for targeted and non-targeted activities under both SWG and SFR.

In the period after the initiation of consultation on June 27, 2011, WSFR, AGFD, and AESO made minor changes to the proposed action and other supporting material to ensure that the information used in the consultation was complete and contained all relevant activities for each species or taxonomic group of species. Examples of these changes include the addition of activities under the headings of Transplant/Translocation/Reestablishment and Propagation/Rearing/Holding to the proposed action in September, 2011. These are conservation actions that are essential for moving toward recovery of species and since funding under SWG and SFR (through the CAMP) could be used for these activities they were added to the species matrices.

Also during the period after June 27, 2011, the list of species considered in the consultation was amended slightly to include the Yaqui catfish and the Virgin spinedace. The Yaqui catfish is found on the San Bernardino National Wildlife Refuge and has been reintroduced under a Safe Harbor Agreement onto private lands. Additional reintroductions may be anticipated over the 10-year period covered by the consultation and covered activities may be used by AGFD in reintroduction habitats. The Virgin spinedace is found in the Virgin River drainage in Mohave County, Arizona and has a Conservation Strategy (UDWR 2002) in lieu of listing and AGFD is a partner in the implementation of the Strategy and participates in surveys with the Virgin

Spinedace Conservation Team and other activities for the Virgin spinedace that are covered actions under this consultation.

The Wright's marsh thistle was eliminated from consideration under this consultation (it had been included with species with "may affect" determinations) since Wright's marsh thistle is considered to be extirpated from Arizona (USFWS 2010b). Therefore there is no effect to this species.

We received the request for formal consultation and conference on June 27, 2011. The 2011 grant cycle would begin on July 1, 2011, and there was insufficient time to complete consultation prior to that date to allow AGFD to continue its operations covered by the grants. WSFR requested that AESO consider providing concurrence that implementing the proposed actions prior to completion of section 7 consultation not be considered to violate the prohibition under section 7(d); which prohibits any irreversible or irretrievable commitment of resources that foreclose the formulation of reasonable and prudent alternatives to address a potential jeopardy or adverse modification finding resulting from this consultation. AESO was able to provide that concurrence in our June 29, 2011, memorandum initiating formal consultation and conference due to the existence of the section 10(a)(1)(A) permit which had completed section 7 consultation, that based on past records of incidental take the likelihood of any significant level of take occurring was low, and that any reasonable and prudent alternative to an activity resulting in significant take would be to cease the activity immediately.

Significant events

November 7, 2011: DBCO provided to WSFR and AGFD. Request for extension of consultation period to November 30, 2011 made to WSFR.
November 9, 2011: WSFR grants extension.
November 22, 2011: comments received from WSFR.
November 29, 2011: WSFR grants extension of consultation till January 1, 2012.
December 1, 2011: comments received from AGFD.
December 2, 2011: revised DBCO sent to WSFR and AGFD.
December 8, 2011: comments on revised DBCO received from WSFR and AGFD.
December 9, 2011: revisions to incidental take statement sent to AESO species leads, WSFR, and AGFD for discussions.
December 19, 2011: final comments on incidental take statement received.

BIOLOGICAL AND CONFERENCE OPINION

DESCRIPTION OF THE PROPOSED ACTION

The proposed action was described in the materials provided with the request for consultation which included the description of the proposed action, the matrix of activities and species, past levels of take reported under section 10 for fiscal years 2006-2010, and a series of best management practices documents prepared by AGFD for use when implementing their activities funded through the grants. The information in these documents is incorporated by reference. To enable understanding of the types of activities contemplated under the proposed action, a list of activities is presented in Appendix C.

The proposed action is 1) the continuation of AGFD's ongoing aquatic inventory, survey, and monitoring activities for sportfish funded by SFR, and 2) implementation of conservation activities that provide native aquatic species status information through survey, inventory, monitoring data collection and conservation benefits for aquatic invertebrates, fish, amphibians, and aquatic reptiles funded by SWG. Conservation actions under the CAMP will be funded through SFR. This consultation is only for activities funded by WSFR. The broad categories of activities are:

- Survey (passive or active but not involving capture of the organism)
- Capture
- Handling
- Marking
- Tissue samples
- Diet samples
- Transplant/Translocation/Reestablishment
- Propagation/Rearing/Holding
- Tracking
- Removal from the wild
- Salvage
- Animal health
- Habitat and water sampling methods.

Materials developed for this consultation include matrices containing all potentially affected species, the categories and specific activities under each category activities to be covered under the consultation for those species and if those activities "targeted," "non-targeted," or "not applicable." The species matrices and definitions of activities documents were provided with the request for consultation and are available in the consultation record. Included in the proposed action were nine best management practices (BMPs) documents developed by AGFD that are intended to guide field activities and reduce adverse effects to individual animals. Appendix C contains these BMP documents and references other AGFD guidelines that are relevant to the consultation.

SWG and SFR funded survey, inventory, monitoring, capture, and translocation activities for aquatic species by AGFD follow established and accepted techniques (Piper et al. 1982; Schreck

and Moyle 1990; Heyer et al. 1994; Merritt and Cummins 1996; Murphy and Willis 1996; Carmichael et al. 2001; Beaupre et al. 2004, USFWS 2007a. McDiarmid et al. 2012) that are designed to minimize stress, injury, or mortality from capture, handling, and holding of individual animals. AGFD has a statewide standard fish sampling protocol for fish species (AGFD 2004). Species-specific monitoring protocols also exist for some species; for example, the Kanab ambersnail (Stevens et al. 1997) and Page springsnail (AGFD and USFWS 2009). Holding and propagation in hatchery settings also follow accepted hatchery practices and may involve species specific plans (AGFD 2005a, 2009, Gurtin 2010). Hatchery management and Hazard Analysis of Critical Control Point (HACCP) plans developed by AGFD are also relevant to the proposed action. In addition, AGFD uses their own BMPs to further minimize risk of wildlife injury associated with survey, inventory, monitoring, capture, translocation, or propagation activities. By using accepted standards and BMPs designed to minimize adverse effects to species exposed to the activities, AGFD is in effect using them as conservation measures that reduce the potential adverse effects of the proposed action. The plans and protocols are adaptively updated and modified as necessary to minimize impacts to wildlife, optimize effectiveness, and incorporate scientifically accepted techniques/protocols. All these plans and protocols are considered part of the proposed action and the conservation benefit they provide to reduce adverse effects is acknowledged. Other reports that address methods used include the annual Central Arizona Project reports (for example, Robinson 2010), and section 6 reports to USFWS as part of permit documentation (AGFD 2010).

The AGFD does not have specific, written guidelines or protocols for most invertebrates, amphibians, and reptiles; however, AGFD uses standard scientifically accepted guidelines and protocols available for these species that include measures to reduce stress, injury, and mortality. An example of a comprehensive set of guidelines for amphibians and reptiles is from the American Society of Ichthyologists and Herpetologists: Guidelines for use of live amphibians and reptiles in field and laboratory research (Beaupre et al. 2004) that addresses the types of target activities likely to be used with these species. Because AGFD personnel that handle these species undergo training (either at the college level or post-hiring) in proper handling techniques, these guidelines are generally followed. The BMP for minimizing the risk of aquatic invasive species transport (BMP #6) addresses concerns related to these groups of species for transport of New Zealand mud snail, chytrid fungus, and other nonnative species and disease vectors. This is standard operating procedure regardless of the target organism for the activity. Further, BMP #8 addresses precautions to be taken to avoid drowning of frogs, gartersnakes, and aquatic turtles during the use of nets and traps to catch fish or crayfish. This addresses the concern for that mortality risk for these groups.

AGFD also uses standard hatchery practices for housing native fish species. Creating refugia or breeding populations of other species (springsnails, frogs, and gartersnakes) in captivity is a developing process; however, standard techniques from zoos and other research facility operations (for example, Beaupre et al. 2004) are used. The holding and rearing protocol for Chiricahua leopard frog (USFWS 2007a) is applicable to other leopard frog species.

Reporting on activities undertaken under the SWG and SFR grant funding will be submitted annually to WSFR and AESO and will identify the funding source, location, techniques used, results and amount of take. This reporting is separate from the annual section 6 report.

Inventory, survey, monitoring, capture, and translocation activities are proposed for aquatic systems statewide and may, for some species, also involve work in adjacent states or Mexico. The activities are proposed for aquatic habitats, including lakes, rivers, streams, springs, seeps and other wet areas where wildlife occur. The survey, inventory, and monitoring activities identified are proposed for a frequency of no more than 20 surveys at any individual site over the 10-year timeframe with the exception of special circumstance which may warrant an increase in survey intensity at particular sites (e.g., monitoring results of establishment attempts, monitoring for nonnative species invasion, monitoring potential impacts of land management or other activities). Translocations would be undertaken throughout the 10-year time frame to support conservation of native wildlife (e.g., establish additional populations, augment existing populations, establish refuge populations) in accordance to existing recovery strategies or conservation programs. Propagation activities include management actions to maintain species in captivity and would be used over the 10-year time frame to provide individuals for translocations and other purposes.

ORGANIZATION OF THE BCO

As indicated in Table 2 in Appendix A, this consultation considered the potential effects to 49 species including listed or proposed threatened or endangered species, candidate species, species under consideration for candidate status, and species with Candidate Conservation Agreements (CCAs) or with Assurances (CCAAs) or Conservation Strategies (CS) in lieu of listing. Of those 49 species, 10 were determined not to be adversely affected and our concurrances for these species are in Appendix B. For the remaining 39 species each species in a species group (Plants, Invertebrates, Fish, Amphibians, Reptiles, Birds, and Mammals), has the status of a particular species rangewide and environmental baseline sections combined into one discussion. Species are arranged alphabetically within their respective group. The conclusions section, incidental take statements, and conservation recommendations are also organized by groups and alphabetically within the group. Since these sections are reflective of species-specific information, each species should be discussed separately.

For the effects of the action section, the analysis will focus on the effects by groups; that is, the evaluation will not generally be species-specific except when a particular facet of the analysis requires it. Since the effects of the covered actions for, for example, fish, are essentially the same regardless of the species of fish, the group-wise analysis will not require repeating the same information under all members of a group.

STATUS OF THE SPECIES/ENVIRONMENTAL BASELINE

Invertebrates

Huachuca springsnail

Status of the species rangewide

Listing history

The Huachuca springsnail became a candidate species on February 28, 1996 (61 FR 7596, USFWS 1996a).

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the Huachuca springsnail. This information was taken from the 2010 Species Assessment and Listing Priority Assignment Form (USFWS 2010c) and references cited therein. All information in that document is incorporated by reference.

Life history

In the arid Southwest, snails of the family Hydrobiidae are largely relicts of the wetter Pleistocene Age (1.6 million – 10,000 years ago) and are typically distributed across the landscape as geographically isolated populations exhibiting a high degree of endemism (found only in a particular area or region). Springsnails are strictly aquatic and respiration occurs through an internal gill. Springsnails in the genus *Pyrgulopsis* are egg-layers with the larval stage completed in the egg capsule and upon hatching; tiny snails emerge into their adult habitat. The sexes are separate and physical differences are noticeable between them, with females being larger than males. Mobility is limited and significant migration likely does not occur, although aquatic snails have been known to disperse by becoming attached to the feathers of migratory birds.

Hydrobiid snails feed primarily on periphyton, which is a complex mixture of algae, bacteria, microbes, and detritus that live upon submerged surfaces in aquatic environments. The life span of most aquatic snails is 9 to 15 months. Predators of springsnails include waterfowl, shorebirds, amphibians, fishes, crayfish, leeches, and aquatic insects. Limited information on disease or parasites in springsnails is available, though aquatic snails can serve as intermediate hosts for trematodes (parasitic flatworms).

Habitat use

Hydrobiid snails occur in springs, seeps, marshes, spring pools, outflows, and diverse lotic (flowing) waters. Springsnail habitats are typically isolated, permanently saturated, spring-fed aquatic climax communities commonly described as ciénegas. The most common habitat for the Huachuca springsnail is a rheocrene ecosystem (water emerging from the ground as a flowing stream). Substrate is typically firm and characterized by cobble, gravel, woody debris, and aquatic vegetation. These substrate types provide suitable surfaces for grazing and egg laying. *Pyrgulopsis* species are rarely found on or in soft sediment. They are typically found more often, and in greater abundance, in gravel to cobble size substrates. The habitat of the Huachuca springsnail is characterized by various aquatic and emergent plant species that occur within plains grassland, oak and pine-oak woodlands, and coniferous forest vegetation communities within the Huachuca Mountains and the San Rafael Valley. The species is typically found in the shallower areas of springs, often in gravelly seeps at the spring source.

Based on our current knowledge, important habitat elements appear to include: 1) permanent free-flowing springs; 2) shallow, unpolluted water; 3) coarse firm substrates such as pebble, gravel, cobble, and woody debris; and 4) native aquatic macrophytes, algae, and periphyton.

Current distribution

Huachuca springsnails are found in Cochise and Santa Cruz counties in Arizona and in Sonora, Mexico in 15 spring localities: Garden Canyon (two distinct springs), Huachuca Canyon (two distinct springs), McClure Spring, Broken Pipe Spring, Cave Spring, Sawmill Spring, and Blacktail Spring on Fort Huachuca; Scotia Canyon/Peterson Ranch Spring, Monkey Spring, Cottonwood Spring, Sheehy Spring, and Canelo Hills Cienega on private lands; and Ojo Caliente in Mexico. Nine of these localities are from the Fort Huachuca Army Post including Garden Canyon upper spring, Garden Canyon middle spring, McClure Spring, Broken Pipe Spring, Cave Spring, Sawmill Spring, Huachuca Canyon upper spring, Huachuca Canyon main spring, and Blacktail Spring. There are three other potential but unconfirmed sites including Mattie Canyon, Tombstone Reservoir, and Ramsey Canyon. Other sources list most of the same sites mentioned above, but recognized two other sites on the Coronado National Forest, Sylvania Spring and Tombstone Reservoir and another lists 13 sites: Monkey Canyon, Sonoita Creek, Santa Cruz River, Canelo Hills Cienega, Scotia Canyon, Garden Canyon, McClure Canyon, Sawmill Canyon, Huachuca Canyon, Blacktail Canyon, Ramsey Canyon, Cienega Creek, and Redfield Canyon. They are also reported from Cienega Los Fresnos in Sonora, Mexico.

Threats

The Huachuca springsnail is threatened by habitat modification and loss through catastrophic wildfire, drought, streamflow alteration, and, potentially, grazing, recreation, military activities, and timber harvest. Altered stream flows, whether by drought, groundwater pumping, impoundment, or other direct stream alterations, could affect the Huachuca springsnail by eliminating habitat, if flows stop completely, or altering the specific habitat parameters so that the habitat is no longer suitable.

The threat from disease or predation to the Huachuca springsnail has not been investigated. However, springsnails and other mollusks are known to serve as the intermediate hosts for a variety of trematodes and as prey for nonnative fish and crayfish. At this time, disease or predation is not known to be a factor threatening the Huachuca springsnail.

Concern exists for the spread of the nonnative New Zealand mud snail (*Potomopyrgus antipodarum*) into native mollusk habitats in Arizona. The mud snail is easily transported and it could be unintentionally introduced into aquatic environments by birds or people.

Conservation actions

The Huachuca springsnail is identified as a *Species of Greatest Conservation Need* (tier 1a) in the Arizona State Wildlife Action Plan prepared by AGFD. This plan helps guide AGFD and other agencies in determining what biotic resources should receive priority management consideration. Conservation benefits would mostly come from proactive initiatives.

The Huachuca springsnail is a covered species in the draft San Rafael HCP (USFWS 2010d).

The USFWS began discussions with Fort Huachuca in 1995 regarding the development of a conservation agreement. A prelisting notification letter was sent out to experts, interested persons, and potentially affected parties in November 1998. Fort Huachuca indicated that it has taken, or would be taking in the near future, considerable measures to alleviate impacts to the species. AGFD has also contacted Fort Huachuca and expressed interest in a conservation agreement. Because almost 50 percent of the known sites in the United States are on private lands, participation by private landowners would be critical for an agreement to be viable. The City of Sierra Vista has indicated that they believe a conservation agreement may suffice to conserve the species. No substantial progress has been made on the development of a conservation agreement to date.

Previous consultations

The Huachuca springsnail is a candidate for listing under the Act and as such is not subject to the consultation requirements of section 7 for activities of Federal agencies. Federal agencies may, at their discretion, include consideration for candidate species in their environmental compliance under the Act. However, it is the policy of the USFWS that candidate species are considered in intra-Service consultations on USFWS actions, including funding activities of other entities such as AGFD.

Environmental baseline (in the action area)

Description of the action area

The action area for this consultation is the state of Arizona including the range of the Huachuca springsnail in Cochise and Santa Cruz counties, Arizona and adjoining areas of Sonora, Mexico. AGFD personnel may be involved in activities for this species in Sonora, so it is appropriate to include this area. The action area thus encompasses the entire known range of the species.

A. Status of the species within the action area

The status of the Huachuca springsnail in the action area is essentially the same as the rangewide status.

B. Factors affecting the species' environment within the action area

The threats identified for the rangewide status of the species are affecting the Huachuca springsnails and their habitats in the action area.

Page springsnail

Status of the species rangewide

Listing history

The Page springsnail became a candidate on February 28, 1996 (61 FR 7596, USFWS 1996a). A final CCAA was prepared by AESO and AGFD and was finalized in October, 2009 (AGFD and USFWS 2009).

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the Page springsnail. This information was taken from the CCAA (AGFD and USFWS 2009) and the 2010 species assessment form (USFWS 2010e) and references cited therein. Information in these documents is incorporated by reference.

Life history

The Page springsnail is strictly aquatic and respiration occurs through internal gills. Most freshwater gastropods are herbivores or detritivores that consume algae, bacteria, and decaying organic material, or that passively ingest small invertebrates while feeding. Food is consumed by scraping from hard surfaces with a radula (tongue).

Pyrgulopsis snails are oviparous (egg-laying), though no quantitative information has been published on the reproductive biology of the Page springsnail, though information suggests Page springsnails reproduce in December and hatch in January, though anecdotal observation of size-class distribution data by USFWS biologists suggests the species experienced a birth pulse during the spring of 2001. Additional research is needed to clarify the reproductive biology of the species. Many prosobranch snails are annual species that reproduce several times during the breeding period (spring-fall) with varying degrees of replacement of generations. Among many prosobranchs the larval stage is completed in the egg capsule and upon hatching tiny snails crawl out into their adult habitat. The lifespan of the Page springsnail is unknown, but for the majority of aquatic gastropods the usual lifespan is 9 to 15 months.

Habitat use

The Page springsnail occurs in springs, seeps, marshes, spring pools, outflows, and diverse lotic (flowing) waters, at approximately 3,510 feet (ft) (1070 meters (m)) elevation. The most common habitat is a rheocrene, or a spring emerging from the ground as a flowing stream. Habitats of hydrobiid snails are isolated, mid-elevational, permanently saturated, spring-fed aquatic climax communities commonly described as ciénegas. The substrate is typically firm and consists of cobble, gravel, woody debris, and aquatic vegetation. These substrates provide a suitable surface for grazing and egg laying.

Based on our current knowledge of habitat and life history characteristics of the Page springsnail, important characteristics of its habitat appear to include: 1) permanent free-flowing springs; 2) shallow, unpolluted water; 3) coarse firm substrates such as pebble, gravel, cobble, and woody debris; 4) native aquatic macrophytes, algae, and periphyton; and 5) few or no predatory species.

Current distribution

The current range is approximately 10 ac (4 ha) in a complex of springs within an area approximately 1.0 mi (1.5 km) in length along the west side of Oak Creek and in a small area along Spring Creek, a tributary of Oak Creek. All extant populations are known to exist only within the Oak Creek Springs complex and in springs along Spring Creek. Springs where the species is currently known to occur include the outflow channel of Lo Lo Mai Springs, a small area along Spring Creek, Bubbling Springs Pond, Cave (Page) Springs, Ash Tree Springs, and a few unnamed springs and seeps at Page Springs and Bubbling Ponds fish hatcheries. The species is believed to be extirpated from Shea Springs and Bass House Spring (but occurs in low numbers in a weir outflow near this site). Its status in Fry Springs and Turtle Springs is unknown (USFWS 2010e). A previously unknown population of Page springsnails was discovered on private property in the Spring Creek area (Sheepshead Canyon), a tributary of Oak Creek in July 2007.

Threats

The destruction, modification, and curtailment of habitat and range have had the greatest influence on the decline of the Page springsnail. At least six springs where the species occurs, or previously occurred, have been subject to some level of modification to meet domestic, agricultural, ranching, fish hatchery, and recreational needs. Human activity has contributed to widespread modification of the species' habitats resulting in the loss of natural springhead integrity and, in some instances, the entire elimination of the aquatic environment.

Groundwater pumping in the Verde River basin, particularly along Oak Creek, has not yet affected springflows that support Page springsnails; however, this threat may have more potential in the future. Groundwater pumping has been implicated in the decline of other springsnails.

The introduction of nonnative predators and competitors (other mollusks, crayfish, and fish) into springsnail habitats can be detrimental to native springsnails. The endemism characteristic of springsnails that resulted from biogeographical isolation may contribute to the evolutionary adaptability of springsnails to respond to novel predators or competitors (USFWS 2010e).

Concern exists for the spread of the nonnative New Zealand mud snail (*Potomopyrgus antipodarum*) into native mollusk habitats in Arizona. The mud snail is easily transported and it could be unintentionally introduced into aquatic environments by birds or people.

Conservation actions

The Page springsnail is identified as a priority species in the State Wildlife Action Plan. This plan helps guide AGFD and other agencies in determining what biotic resources should receive priority management consideration.

Seasonal monitoring surveys within the Oak Creek Springs complex began in 2001 by the Service and AGFD. The monitoring protocol was revised in 2002, and AGFD had three staff biologists working on Page springsnail conservation and monitoring. Initial funding for AGFD to manage the species was provided from State and Federal grants. AGFD has secured a State

Wildlife Grant for the conservation and management of mollusks of greatest conservation need in Arizona, which includes the Page springsnail.

More importantly, on October 8, 2009, the Service and AGFD entered into a CCAA for the Page springsnail that is aimed at improving the conservation status of the species and its habitats. We anticipate that implementation of the CCAA will greatly improve the status of the species.

Previous consultations

The Page springsnail is a candidate for listing under the Act and as such is not subject to the consultation requirements of section 7 for activities of Federal agencies. Federal agencies may, at their discretion, include consideration for candidate species in their environmental compliance under the Act. However, it is the policy of the USFWS that candidate species are considered in intra-Service consultations on USFWS actions, including funding activities of other entities such as AGFD. The Page springsnail was considered in the intra-Service consultation on Federal funding of sportfish stocking in Arizona (USFWS 2011a).

Environmental baseline (in the action area)

Description of the action area

The action area for this consultation is the state of Arizona including the entire range of the Page springsnail in Yavapai County, Arizona.

A. Status of the species within the action area

The status of the Page springsnail in the action area is essentially the same as the rangewide status.

B. Factors affecting the species' environment within the action area

The threats identified for the rangewide status of the species are affecting the Page springsnail and their habitats in the action area.

San Bernardino springsnail

Status of the species and proposed critical habitat rangewide

Listing history

The San Bernardino springsnail became a candidate on December 6, 2007 (72 FR 69034, USFWS 2007b). The species was proposed for listing as endangered with proposed critical habitat in 2011 (76 FR 20464, USFWS 2011c).

Critical habitat was proposed for 2.013 acres in four units; one on the San Bernardino National Wildlife Refuge (Refuge) and three on the privately owned Slaughter Ranch. Physical and biological factors (PBFs) for the proposed critical habitat are:

1. Adequately clean spring water (free from contamination) emerging from the ground and flowing on the surface;

2. Periphyton (attached algae), bacteria, and decaying organic material for food;

3. Substrates that include cobble, gravel, pebble, sand, silt, and aquatic vegetation , for egg-laying, maturing, feeding, and escape from predators; and

4. Either an absence of nonnative predators (crayfish) and competitors (snails) or their presence at low population levels.

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the species. This information was taken from the 2007 Candidate Assessment Form (USFWS 2007c) and the proposed rule (USFWS 2011c) and references cited therein. Information in these documents is incorporated by reference.

Life history

Pyrgulopsis snails are strictly aquatic and respiration occurs through an internal gill known as a ctenidium. Their primary food source is believed to be periphytic diatoms, and perhaps bacteria and detritus. Food is consumed by scraping from hard surfaces with the radula. *Pyrgulopsis* snails are largely oviparous, though no specific data are available on the reproductive biology of the San Bernardino springsnail. Among most prosobranchs, the veliger, or larval, stage is completed in the egg capsule and upon hatching, tiny snails crawl out into their adult habitat. Death and birth rates are unknown. Significant migration most likely does not occur, although small snails have been known to disperse by becoming attached to the feathers of migratory birds. The species' life span is unknown, but for the majority of aquatic gastropods the usual length of life is 9 to 15 months.

Habitat use

Hydrobiid snails occur in springs, seeps, marshes, spring pools, outflows, and diverse lotic (flowing) waters. The most common habitat for *Pyrgulopsis* snails is a rheocrene, or a spring emerging from the ground as a flowing stream. In arid desert environments, these lentic systems are often aquatic climax communities referred to as cienegas. Substrate is typically firm and characterized by cobble, gravel, woody debris, and aquatic vegetation. These substrate types provide a suitable surface for grazing and egg laying. *Pyrgulosis* snails are rarely found on or in soft sediment.

Based on our current knowledge, primary constituent elements appear to include: 1) permanent free-flowing spring water; 2) shallow, unpolluted water; 3) coarse firm substrates such as pebble, gravel, cobble, and woody debris; 4) native aquatic macrophytes, algae, and periphyton; and 5) few or no non-native predatory species.

Current distribution

The San Bernardino springsnail is found in the Rio San Bernardino (which is a portion of the Rio Yaqui headwaters) in Cochise County, Arizona. A similar springsnail that may be of the same species exists in the same drainage in Sonora, Mexico; however this species has not yet been fully compared to the San Bernardino springsnail. Six populations in a complex of spring systems were historically known, located on the Refuge and the adjacent, privately owned, Slaughter Ranch. The species is now known from two sites; Goat Tank Spring and Horse Spring, and may still be extant at Snail Spring. All occupied sites are on the Slaughter Ranch (USFWS 2011c).

Threats

The greatest threat to the continued existence of the San Bernardino springsnail is habitat loss believed to be attributable to groundwater depletion and domestic water use. The loss of several populations of San Bernardino springsnail is believed to have been caused by the loss of water flow attributable to water diversion or springhead modification. Three unnamed springs on the Slaughter Ranch were converted into an artificial pond and while the species had not been found at these springs, it is believed they previously occurred there. While the USFWS owns all the water rights for the Refuge and Slaughter Ranch, water use on the ranch continues to be a threat to occupied springsnail habitat (USFWS 2011c).

Currently, there are no nonnative predators or competitors in San Bernardino springsnail habitats. However, concern exists for the spread of the nonnative New Zealand mud snail (*Potomopyrgus antipodarum*) into native mollusk habitats in Arizona. The mud snail is easily transported and it could be unintentionally introduced into aquatic environments by birds or people.

Conservation actions

Efforts to restore San Bernardino springsnails to the Refuge at Tule Spring have not proceeded successfully due to problems with inconsistent water flow. The Refuge continues to work with the owners of the Slaughter Ranch to address water use on the ranch, and is seeking support to purchase the ranch and add it to the Refuge (USFWS 2011c).

Previous consultations

The San Bernardino springsnail is now a proposed species under the Act and section 7 conference is appropriate when Federal actions may adversely affect the species. To date, no consultations have taken place.

Environmental baseline (in the action area)

Description of the action area

The action area for this consultation is the state of Arizona including the entire range of the San Bernardino springsnail in Cochise County, Arizona.

A. Status of the species and critical habitat within the action area

The status of the San Bernardino springsnail in the action area is essentially the same as the rangewide status.

B. Factors affecting the species' environment within the action area

The threats identified for the rangewide status of the species are affecting the San Bernardino springsnail and their habitats in the action area.

Three Forks springsnail

Status of the species and proposed critical habitat rangewide

Listing status

The Three Forks springsnail became a candidate on October 17, 2001 (66 FR 54808, USFWS 2001a). The species was proposed for listing as endangered with proposed critical habitat in 2011 (76 FR 20464, USFWS 2011c). An additional critical habitat unit was included in the November 17, 2011 re-opening of the proposed rule (76 FR 71300, USFWS 2011j).

Critical habitat was proposed for three occupied habitat areas; the Three Forks Spring Unit, Boneyard Bog Springs Unit, and Boneyard Creek Spring Unit. PBFs for the proposed critical habitat are:

1. Adequately clean spring water (free from contamination) emerging from the ground and flowing on the surface;

2. Periphyton (attached algae), bacteria, and decaying organic material for food;

3. Substrates that include cobble, gravel, pebble, sand, silt, and aquatic vegetation , for egg-laying, maturing, feeding, and escape from predators; and

4. Either an absence of nonnative predators (crayfish) and competitors (snails) or their presence at low population levels.

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the species. This information was taken from the 2007 Candidate Assessment Form (USFWS 2007d) and the proposed rule (USFWS 2011c) and references cited therein. Information in these documents is incorporated by reference.

Life history

Three Forks springsnails are sexually dimorphic, with females larger than males. *Pyrgulopsis* snails are primarily oviparous, and although no quantitative information is available on the reproductive biology of the Three Forks springsnail, members of the genus are believed to lay eggs on hard surfaces during one annual period of reproduction. However, many other prosobranch snails are annual species that reproduce several times during the breeding period (spring-fall) with varying degrees of replacement of generations. Among most prosobranchs the veliger, or larval, stage is completed in the egg capsule and upon hatching tiny snails crawl out into their adult habitat.

Death and birth rates are not known. Significant migration most likely does not occur, although small snails have been known to disperse by becoming attached to the feathers or the mud on the feet and legs of waterfowl and shorebirds. The life span of the Three Forks springsnail is unknown, but for the majority of aquatic gastropods the usual length of life is 9 to 15 months. Natural predators of springsnails include fish, waterfowl, shorebirds, amphibians, leeches, aquatic insects, and other snails. Although no specific information on disease or parasites is available for the Three Forks springsnail, other aquatic snails have been known to serve as the intermediate hosts for a variety of trematodes.

Habitat use

Hydrobiid snails occur in springs, seeps, marshes, spring pools, outflows, and diverse lotic (flowing) waters. The most common habitat for *Pyrgulopsis* snails is a rheocrene, or a spring emerging from the ground as a flowing stream. In arid desert environments, these lentic systems are often aquatic climax communities referred to as cienegas. Substrate is typically firm and characterized by cobble, gravel, woody debris, and aquatic vegetation. These substrate types provide a suitable surface for grazing and egg laying. *Pyrgulosis* snails are rarely found on or in soft sediment.

Based on our current knowledge, primary constituent elements appear to include: 1) permanent free-flowing spring water; 2) shallow, unpolluted water; 3) coarse firm substrates such as pebble, gravel, cobble, and woody debris; 4) native aquatic macrophytes, algae, and periphyton; and 5) few or no non-native predatory species.

Current distribution

Three Forks springsnails are found at Three Forks Springs, which is an off-channel springs complex from the East Fork Black River located at Three Forks (13.7 miles downstream of Big Lake and 4.6 miles upstream from the East Fork stocking reach), and Boneyard Bog Springs, which is located at the headwaters of Boneyard Creek (18.4 miles downstream of Big Lake and 8.9 miles upstream of the East Fork stocking site via Boneyard Creek). All sites are on the Apache-Sitgreaves National Forest (ASNF).

Threats

A significant threat to springsnails is crayfish. Carpenter and McIvor (1999) reported lower invertebrate diversity in sites at Three Forks that had higher densities of crayfish. Fernandez and Rosen (1996) reported significantly lower numbers and mass of invertebrates at sites with

crayfish at Three Forks. The specific organisms that showed significant declines in the presence of crayfish during this study were caddisflies, snails, and a mussel (*Anadonta californiensis*). The Three Forks Springs population has been significantly affected by the invasion of nonnative crayfish. Crayfish are believed to have eliminated springsnails from springboxes where they had previously been abundant (Myers 2000). Crayfish trapping efforts have attempted to reduce the crayfish population, but elimination of crayfish via that method is not likely to occur. Crayfish have also affected the Boneyard Bog Springs springsnail population.

Conservation actions

The ASNF instituted a closure around the Three Forks Springs to prevent unauthorized access. The AGFD has implemented a crayfish trapping program and a monitoring program. A captive refugium at the Phoenix Zoo has not been successful; however, lessons learned are being used to establish other holding facilities. USFWS staff participates in surveys and research on habitat relationships. Conservation actions with The Nature Conservancy (TNC) on property they own at Boneyard Springs are under consideration (USFWS 2011c).

Previous consultations

The Three Forks springsnail is now a proposed species under the Act and section 7 conferences are appropriate when Federal actions may adversely affect the species. To date, no consultations have taken place.

Environmental baseline (in the action area)

Description of the action area

The action area for this consultation is the state of Arizona including the entire range of the Three Forks springsnail in Apache County, Arizona.

A. Status of the species and critical habitat within the action area

The Three Forks Fire in 2004 did not directly burn any of the springs holding springsnails However, surface waters within the Three Forks fire area were exposed to fire retardant (chemicals used to suppress fire) that likely drifted from high elevation retardant releases from aircraft (USFS 2005). The population at Three Forks has reduced dramatically in size and surveys since 2004 rarely find more than two to six springsnails at a time (pers com. J. Sorenson) but they are present in low numbers (Cox 2007, Bailey 2008). Populations in Boneyard Bog Springs are abundant and were not affected by the 2004 retardant drops (Cox 2007).

The 2011 Wallow Fire burned in the watershed above the spring complex containing the springsnails. Salvage of springsnails was accomplished before any post-fire runoff could convey ash or sediment to the occupied habitat and proposed critical habitat. The amount of damage to the PBFs of proposed critical habitat from the post-fire runoff events is currently unknown, and damaging flows may occur over the next year. Springsnails still present in the system may be killed or injured during these events.

B. Factors affecting the species' environment within the action area

The threats identified for the rangewide status of the species are affecting the Three Forks springsnail and their habitats in the action area.

Kanab ambersnail

Status of the species rangewide

Listing history

The Kanab ambersnail was listed as an endangered species in 1992 (56 FR 37671, USFWS 1992a). No critical habitat was designated for the Kanab ambersnail at the time of listing.

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the species. This information was taken from the final rule (USFWS 1992a), the Kanab Ambersnail Recovery Plan (USFWS 1995a) and the draft 5-year review (USFWS 2011d) and references cited therein. Information in these documents is incorporated by reference.

Life history

The Kanab ambersnail is a small endemic snail with a life expectancy of up to 15 months. Kanab ambersnails are hermaphroditic and capable of self-fertilization. Mature Kanab ambersnail mate and reproduce during the summer months (July and August), and deposit clear, gelatinous egg masses on undersides of moist to wet live stems, on the roots of water-cress, and on dead stems of crimson monkey-flower. In some years with relatively warm winters, more than one reproductive period can occur. Adult mortality increases in late summer and autumn leaving the overwintering population dominated by subadults. Young snails enter dormancy in October-November and typically become active again in March-April. Over-winter mortality of Kanab ambersnail can range between 25 and 80 percent (Stevens et al. 1997). Kanab ambersnail feed on plant tissue, bacteria, fungi and algae that are scraped off of dead plant tissue by means of a radula or rasp tongue. Stevens et al. (1997) observed Kanab ambersnail feeding largely on crimson monkey-flower and watercress.

Habitat use

Although Kanab ambersnails are terrestrial snails, they only live in moist-to-wet habitats associated with springs and seeps and containing cattail and bulrush, herbaceous plants, ferns, and other vegetation.

The Kanab ambersnail is dependent upon wetland vegetation for food and shelter, living in association with wetland plants including watercress (*Nasturtium*), monkeyflower (*Mimulus*), cattails, sedges (*Carex* spp.), and rushes (*Juncus* spp.). Kanab ambersnail populations in the Grand Canyon region occur in areas where water sources originate from limestone or sandstone

geologic strata. Kanab ambersnail at Vaseys Paradise predominantly use crimson monkeyflower and water-cress for food and shelter The other Grand Canyon population, Upper Elves Chasm, is located above the 100,000 cfs stage of the river and is characterized by predominately crimson monkeyflower and maidenhair fern (*Adiantum capillus-veneris*), with lesser amounts of sedges, rushes, cattails, water-cress, helleborine orchids (*Epipactis gigantea*) and grasses (Poaceae). From evidence collected in laboratory conditions, microclimatic conditions such as higher humidity and lower air temperatures relative to the surrounding environments and high vegetative cover may be important habitat features related to Kanab ambersnail survival. The population in upper Kanab Creek in Utah is in a wet meadow/marshy area next to three artificial ponds (USFWS 1995a).

Current distribution

Kanab ambersnails are in three populations, two natural (Three Lakes near Kanab, Utah, and Vasey's Paradise in the Grand Canyon) and one translocated population at Elves Chasm in Grand Canyon. Translocations to two other sites in Grand Canyon were unsuccessful. Population numbers at Elves Chasm are low.

Threats

Loss of wet meadow and marsh habitat at Three Lakes continues to be a concern since this site is on private land. Prior to listing, the owner had already filled in some marshy areas for future development, and listing under the Act has reduced the level of threat from development (USFWS 2011d). Flash flooding in the Three Lakes drainage can cause siltation or scouring in the area of occupied habitat (USFWS 1995a).

The Vasey's Paradise site is threatened by flood events arising from the talus slope above the site, but more particularly from changing flows released from Glen Canyon Dam (USFWS 2008a) that remove portions of the occupied vegetation when the river experiences managed high flows. Other threats to this population are trampling by recreationists (river rafters), although the dense thicket of poison ivy reduces the likelihood of recreationists accessing the habitat area. Bighorn sheep may seasonally use the Kanab ambersnail habitat for foraging and the removal of vegetation and trampling can have adverse effects to the population.

The Elves Chasm site is above the fluctuation level of the Colorado River and it is sufficiently remote that it has little human visitation or use (USFWS 2011d).

Predation by birds, mice, and other natural predators is not considered a threat to the Kanab ambersnail (USFWS 1995a). Although there is a level of parasitism by trematode worms in the population, it does not appear to have significant effects to the Kanab ambersnail (USFWS 2011d).

Conservation actions

Conservation actions for the Kanab ambersnail include surveys, habitat evaluations, translocation efforts, and attempts to create refuge populations away from the Grand Canyon. USFWS staff

has continued to try and work with the landowner at Three Lakes, and access was granted in 2005 to obtain voucher specimens for taxonomic and genetic analysis, and again in 2011.

Most conservation actions for the Kanab ambersnail are the result of section 7 consultations for the U.S. Bureau of Reclamation's (Reclamation's) operation of Glen Canyon Dam. Conservation actions included in these consultations have included establishment of additional populations (Elves Chasm resulted from this action), monitoring of the effects, translocation of potentially affected individual ambersnails to habitat above the inundation zone for high flows, and temporary removal of both snails and their vegetation habitat from the inundation zone until after high flows were completed. These measures are summarized in USFWS (2008a) and implementation was reported in 2009 (Sorensen 2009).

The National Park Service (NPS) also provide conservation actions related to recreational use of the Grand Canyon in the form of educating river guides about the Kanab ambersnail and avoiding its habitat and in supporting research and monitoring.

Previous consultations

Section 7 consultations on Kanab ambersnail in Arizona are primarily with Reclamation on Colorado River water management and the NPS on recreational effects. Since the species is only found on private land in Utah, there is a limited Federal nexus for consultations. Biological opinions on actions potentially affecting Kanab ambersnail in Arizona may be found at our website www.fws.gov/southwest/es/arizona in the Section 7 Biological Opinion page of the Document Library.

Environmental baseline (in the action area)

Description of the action area

The action area is the state of Arizona, which includes the two populations of Kanab ambersnail in the Grand Canyon, Coconino County, Arizona. This encompasses two of the three extant populations for this species.

A. Status of the species within the action area

The Kanab ambersnail populations in the Grand Canyon have provided the majority of status information for this species, owing to the lack of access to the Three Lakes population in Utah. Thus, the status of the species in the action area is essentially the status of the species rangewide.

B. Factors affecting the species' environment within the action area

Factors affecting the species' environment within the action area are those discussed for the Vasey's Paradise and Elves Chasm populations in the Grand Canyon.

Stephan's riffle beetle

Status of the species rangewide

Listing history

The Stephan's riffle beetle became a candidate on June 13, 2002 (67 FR 40657, USFWS 2002a).

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the species. This information was taken from the most recent Candidate Assessment (USFWS 2010f) and references cited therein. Information in this document is incorporated by reference.

Life history

Elmid larvae are strictly aquatic and respiration occurs through gills. Riffle beetles attach their eggs to the underside of submerged rocks, woody debris, or aquatic plants. Life histories of elmids are quite variable with a short incubation period and a larval stage lasting from 6 to 36 months.

Upon reaching maturity, riffle beetle larvae crawl out of the aquatic environment to pupate under cover of sand, rock, bark, or other debris. In temperate zones, pupation typically requires 1-2 weeks and occurs from late spring through summer. After emergence, adults commonly fly and may be attracted to lights during their sole dispersal flight. Adults are small, typically less than 3 mm (0.12 in) in total length. Upon reentering the aquatic environment, most elmid adults never again leave the water. Respiration for adults occurs through the use of a plastron (a semi-permanent bubble of air through which respiratory gases are exchanged in some aquatic invertebrates). Riffle beetle diet consists of microorganisms and debris, such as diatoms and detritus, scraped from substrate surfaces.

Habitat use

Beetles of the family Elmidae gain their common name "riffle beetle" from their propensity to be found living in shallow streams, rapids, or other comparable flowing waters. The springs can be described as a typical isolated, mid-elevational, permanently saturated, spring-fed aquatic climax community that is commonly referred to as a ciénega.

Current distribution

Stephan's riffle beetle was known from three springs in the Madera Canyon drainage in the Santa Rita Mountains, in Santa Cruz County, Arizona. All lands are under the ownership of the Coronado National Forest (CNF). Currently, the species is known only from Sylvester Spring on the CNF. During field investigation in 2005, Forest Service personnel confirmed that Sylvester Spring was still flowing and providing suitable habitat conditions for the beetle. Although they did not conduct beetle surveys, the confirmation of flowing water indicates that conditions conducive to survival of the species remain intact. The population in the seepage from Bog Springs has been extirpated since water ceased flowing from the water tank in 1976.

Threats

The springs where Stephan's riffle beetle is known to occur no longer exist within their natural conditions. The springs have all have been boxed, capped, or channeled into pipes. Concrete boxes were constructed around spring heads in the 1930s by the Civilian Conservation Corps. The most significant habitat losses occurred after the species was originally described. The type locality, where the species was originally collected, no longer exists as habitat for the species. After conferring with the original collector, it was determined that the type locality was not Bog Springs proper but actually a site 2.4 kilometers (1.5 miles) away near a U.S. Forest Service (USFS) campground. Apparently the original population was maintained by seepage from a pipe which was believed to be overflow seepage from a tank nearby storing water diverted from Bog Springs. Seepage from the tank ceased in 1976 and the tank was removed entirely in 1992. During the surveys conducted in the 1990s only one adult riffle beetle was collected from Sylvester Spring. They were unable to find the beetle in Bog Springs proper. Based on the 71 beetle specimens originally collected in 1969 it appears the species was once very common, but as of 1993 is now quite rare. The loss of habitat at the type locality represents a significant portion of the range of Stephan's riffle beetle.

All of these springs are located immediately off a USFS maintained recreational trail. It is unlikely that recreationists are entirely aware of the sensitive nature of those spring ecosystems. In the absence of public education, recreationists may unknowingly degrade habitat by introducing chemicals or allowing pets into the springs. The unintentional killing of larvae may also occur as a result of trampling.

While disease or predation has not been identified as a current threat to Stephan's riffle beetle, the introduction of nonnative competitors or predators could be detrimental to this endemic species.

Conservation actions

In 2007, the USFS acquired funds to conduct updated surveys for the species. Unfortunately, they were unable to procure the appropriate expertise, so no surveys were conducted. The USFS will continue to coordinate with the USFWS as new information becomes available. Additionally, we have informally contacted the USFS and expressed an interest in developing a candidate conservation agreement. We have also contacted the Arizona Department of Agriculture and expressed an interest in developing an agreement that would allow us to award Section 6 dollars to the State of Arizona for insect conservation. No progress has been made on these efforts.

Previous consultations

The Stephan's riffle beetle is a candidate for listing under the Act and as such is not subject to the consultation requirements of section 7 for activities of Federal agencies. Federal agencies may, at their discretion, include consideration for candidate species in their environmental compliance under the Act. However, it is the policy of the USFWS that candidate species are considered in intra-Service consultations on USFWS actions, including funding activities of other entities such as AGFD.

Environmental baseline (in the action area)

Description of the action area

The action area for this consultation is the entire range of the Stephan's riffle beetle in Santa Cruz County, Arizona.

A. Status of the species within the action area

The status of the Stephan's riffle beetle in the action area is essentially the same as the rangewide status.

B. Factors affecting the species' environment within the action area

The threats identified for the rangewide status of the species are affecting the Stephan's riffle beetle and their habitats in the action area.

Fish

Apache trout

Status of the species rangewide

Listing

The Apache trout was listed as an endangered species under the 1966 Federal Endangered Species Preservation Act. It was downlisted to threatened in 1975 after re-evaluation of its status in light of recovery actions taken by the White Mountain Apache Tribe (WMAT), AGFD, USFWS, and other partners. The downlisting contained a 4(d) rule allowing the WMAT and AGFD to set up recreational fisheries for the Apache trout. Angler take of Apache trout is not considered incidental take if done in accordance with relevant Tribal or State law (USFWS 2009a).

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the Apache trout. This information was taken from the Apache Trout Recovery Plan (USFWS 2009a) and recent 5-year review (USFWS 2010g) and references cited therein. Information in these documents is incorporated by reference.

Life history

Apache trout are opportunistic feeders that eat a variety of aquatic and terrestrial invertebrates, the utilization of which can vary by season and size of the fish. They forage in the water column on drifting invertebrates and may also forage on the substrate, particularly in lakes. While less piscivorous than other trout, they may take small fish. They feed at higher light intensities than

brown trout, which may be a factor in the amount of competition between them for foraging spots.

Apache trout spawn in March through mid-June, with redds constructed at the downstream ends of pools on a variety of substrates. Maturation may take three years, with larger and older fish producing more eggs. A single female may deposit eggs in more than one redd during the spawning season.

Habitat use

Apache trout spend a considerable portion of the day feeding and residing in portions of pools exposed to direct sunlight. In the absence of competition, Apache trout select pools with slower current and abundant cover. Apache trout also appear to select pools with greater width, lower width to depth ratios, and more eddy flows.

Current distribution

The Apache trout recovery populations occupy 119 miles of streams in 29 populations (both relict and replicated) on the WMAT and ASNF in the Salt (Black and White Rivers) and Little Colorado River drainages. Additional streams and lakes are stocked with Apache trout that are surplus to the recovery efforts to create recreational fisheries. In addition to populations within the currently identified historical range, Apache trout are in North Canyon Creek, a tributary to the Colorado River in the Grand Canyon, and in several locations in the Pinaleño Mountains (Ash, Big, Grant, and Marijilda creeks), and tributaries to the Blue River (Coleman, KP and Grant creeks). The Pinaleño Mountains and Blue River populations are scheduled to be removed as these areas are now considered historical habitat for the Gila trout, not the Apache trout.

Recreational fisheries for Apache trout are managed on the WMAT at several locations and on the ASNF as indicated in the description of the proposed action above.

Threats

Threats to the Apache trout include land management and land uses that degrade the watersheds or stream systems, and the presence of nonnative aquatic organisms, particularly fishes. Nonnative trout are of particular concern for the Apache trout, as rainbow trout can hybridize with them, and all introduced trouts may compete for food and space and there is the potential for predation on small Apache trout by the nonnative species.

Conservation actions

A full discussion of the various conservation actions that have been taken for the Apache trout is included in the recovery plan (USFWS 2009a). Funding for conservation actions is provided by AGFD, USFWS, ASNF, and WMAT. As part of their ongoing commitment to conservation for this species, AGFD is an active participant in implementation of the Apache trout recovery plan.

Apache trout are also a keystone species for the National Fish and Wildlife Federation, which is providing additional funding for recovery actions for a 10-year period. Actions include

construction and maintenance of barriers on recovery streams to prevent nonnative species from invading the streams, chemical treatments to eliminate nonnative fishes from recovery streams, restocking of recovery streams with one of the relict lineages or with hatchery stock, and land management actions to improve watershed conditions. Until the recent Wallow Fire, overall, population trends were upward, with additional recovery populations in development. Fortunately, the Wallow Fire only affected one of the historical populations, and of the recovery streams in Arizona (streams on the WMAT were not affected), most of the affected populations were either hybrids scheduled to be replaced with pure populations or were small and in streams with compromised barriers also due for remedial attention (Lopez 2011). Continuing implementation of recovery actions to regain any ground lost is anticipated.

The Apache trout is also a species considered in the Sportfish consultation (USFWS 2011a) and some conservation measures were included in that consultation under the CAMP.

Previous consultations

Section 7 consultations on Apache trout include programmatic efforts for Forest Land Management Plans that address watershed management and multiple uses (livestock grazing, timber harvest, recreation, and other issues), and more site-specific efforts that are more focused on implementing recovery actions such as barrier construction and stream renovations. Biological opinions on actions potentially affecting Apache trout may be found at our website www.fws.gov/southwest/es/arizona in the Section 7 Biological Opinion page of the Document Library.

Environmental baseline (in the action area)

Description of the Action Area

The action area for this consultation is the state of Arizona including the range of the Apache trout in Apache and Navajo counties and in Coconino County including lands of the WMAT. The cooperative nature of the Apache trout recovery efforts may allow for some AGFD activities under the proposed action to occur on the reservation, so WMAT tribal lands are included as part of the proposed action. The proposed action encompasses the entire range of the species.

A. Status of the species within the action area

The status of the Apache trout in the action area is essentially the same as the rangewide status.

B. Factors affecting the species' environment within the action area

The threats identified in the rangewide status of the species are affecting Apache trout and their habitats in the action area.

Beautiful shiner

Status of the species and critical habitat rangewide

Listing history

The beautiful shiner was listed as a threatened species with critical habitat on August 31, 1984 (49 FR 34490, USFWS 1984a). Critical habitat was designated on all aquatic habitats on the San Bernardino National Wildlife Refuge (Refuge). The constituent elements are:

1. Clean, small permanent streams and spring pools without any exotic fishes.

2. The streams should have deep pool areas separated by riffles and flowing areas of moderate current.

3. Backwater areas of stream and springs with overgrown cut bankes and accumulations of detritus are necessary for feeding and shelter.

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the species. This information was taken from the final rule (USFWS 1984a), the Rio Yaqui Fishes Recovery Plan (USFWS 1995b), the biological opinions for the Refuge Fire Management Plan (USFWS 2006a) and Leslie Canyon Watershed Safe Harbor Agreement (USFWS 2008b) and the draft 5-year review for the species (USFWS 2009b) and references cited therein. Information in these documents is incorporated by reference.

Life history

The beautiful shiner is a small cyprinid fish. Males are blue-bodied and possess orange fins during the breeding season while females and non-reproductive males are silvery. Beautiful shiner spawn from February through June and egg deposition may occur over small gravel and in crevices. Little is known about its live history or ecology; however, is likely similar to the red shiner. It appears that natural densities are low even in protected habitats. Asian tapeworm, a nonnative parasite may have adverse effects to the species on a population level.

The beautiful shiner was listed as a single full species in 1984 and some taxonomy issues exist within the listed range. The "Yaqui" form is found in the Rio Yaqui drainage of Arizona and Mexico with the "Guzman" form in the Rio Mimbres of New Mexico. There may or may not be two species instead of two subspecies.

Habitat use

The beautiful shiner is known from small and medium-sized streams and open lentic habitats. It uses the mid to upper portion of the water column near but rarely within beds of plants or other cover near the margins of ponds. It also uses riffle habitats in small streams, moving into pools during periods of higher flow. It has done well in ponds at the Refuge.

Current distribution

In the United States, the Yaqui beautiful shiner exists in the Twin Ponds on the Refuge, and captive populations are at the Arizona-Sonora Desert Museum. It is extirpated from the Mimbres River in New Mexico. In Mexico the Yaqui form is found in the Rio Yaqui in Sonora and Chihuahua and in the Guzman form in the Guzman basin in Chihuahua.

Threats

Threats to the beautiful shiner come from surface water development and groundwater pumping that reduces or eliminates springflows or surface water in small streams. Introduced nonnative fish are predators or competitors on beautiful shiner and have been eliminated from the Refuge; however nonnative bullfrogs remain and are predators on small fish. Nonnative fish and bullfrogs are present in some portions of the range in Mexico.

Conservation actions

Wetland-specific conservation measures have been implemented on the Refuge to maintain or improve habitat conditions. The captive breeding program was initiated in 2008 to provide additional fish for reintroductions within its historical range. In 2008 the USFWS completed a Habitat Conservation Plan with the Malpai Borderlands Project (USFWS 2008c) and the Leslie Canyon Watershed Safe Harbor Agreement (USFWS 2008b) that includes conservation benefits for the beautiful shiner.

The ability to undertake conservation for beautiful shiner in Mexico is more complex; additional surveys throughout the range in Mexico are needed. The Cuenca los Ojos has purchased and protected thousands of acres in the Rio Yaqui drainage but long-term legal protection is not assured.

Previous consultations

Section 7 consultations on beautiful shiner include programmatic efforts for Forest Land Management Plans that address watershed management and multiple uses (livestock grazing, timber harvest, recreation, and other issues), and more site-specific efforts for fire management on the Refuge and for conservation programs. Biological opinions on actions potentially affecting beautiful shiner may be found at our website www.fws.gov/southwest/es/arizona in the Section 7 Biological Opinion page of the Document Library.

Environmental baseline (in the action area)

Description of the action area

The action area for this consultation is the state of Arizona including the range of beautiful shiner in Cochise County, Arizona. This encompasses all occupied habitats in the United States.

A. Status of the species and critical habitat within the action area

The status of the beautiful shiner and its critical habitat in the action area is essentially the same as the rangewide status.

B. Factors affecting the species' environment within the action area

The threats identified for the rangewide status of the species are affecting the beautiful shiner and its habitats in the action area.

Bonytail

Status of the species and critical habitat rangewide

Listing history

The bonytail was listed as an endangered species on April 24, 1980 (45 FR 27710, USFWS 1980a). The Bonytail Recovery Plan was updated in 1990 (USFWS 1990a) and Recovery Goals were approved in 2002 (USFWS 2002b). Critical habitat was designated in six river reaches in the historical range of the bonytail on March 21, 1994 (59 FR 13374, USFWS 1994a). In the Upper Colorado River Basin, critical habitat was designated in portions of the Green, Colorado, and Yampa rivers. In the Lower Colorado River Basin, critical habitat was designated in Lake Mohave, Lake Havasu, and a portion of the Colorado River above Lake Havasu.

Critical habitat was listed for the four big river fishes (Colorado pikeminnow, humpback chub, bonytail, and razorback sucker) concurrently in 1994, and the PBFs were defined for the four species as a group (USFWS 1994a). However, note that the PBFs vary somewhat for each species on the ground, particularly with regard to physical habitat, because each of the four species has different habitat preferences.

The general PBFs are:

- Water- This includes a quantity of water of sufficient quality (i.e., temperature, dissolved oxygen, lack of contaminations, nutrients, turbidity, etc.) that is delivered to a specific location in accordance with a hydrologic regime that is required for the particular life stage.

- Physical habitat- this includes areas of the Colorado River system that are inhabited by fish or potentially habitable for use in spawning, nursery, feeding, rearing, or corridors between these areas. In addition to river channels, these areas also include bottomlands, side channels, secondary channels, oxbows, backwaters, and other areas in the 100-year floodplain, which, when inundated, provide spawning, nursery, feeding, and rearing habitats.

- Biological environment- Food supply, predation, and competition are important elements of the biological environment and are considered components of this constituent element. Food supply is a function of nutrient supply, productivity, and availability to each life stage of the species. Predation, although considered a normal component of this

environment, may be out of balance due to introduced fish species in some areas. This may also be true of competition, particularly from nonnative fish species.

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the bonytail. This information was taken from the 2002 Recovery Goals (USFWS 2002b), and the Lower Colorado River Multi-Species Conservation Program Species Status documents (LCR MSCP 2005) and references cited therein. Information in these documents is incorporated by reference.

Life history

The bonytail was originally described from specimens taken in Arizona. The bonytail is a highly streamlined fish with a very thin, pencil-like, caudal peduncle and large, falcate fins. A nuchal hump may be present behind the head. Maximum length is about 600 millimeters (mm), with 300-350 mm more common. Weights are generally less than one kilogram (kg). Bonytail are long-lived fish; some have reached at least 49 years of age.

Bonytail are opportunistic feeders with a diet of terrestrial insects, plant material, and fish. They are active mostly at night, and probably forage then.

Spawning takes place in the late spring to early summer in water temperatures about 18^0 C. Riverine spawning of the bonytail has not been documented; however in reservoirs, gravel bars or shelves are used. Bonytail may be flexible in their spawning habitat needs as evidence from successful spawning in hatchery ponds at Dexter National Fish Hatchery and raceways at Willow Beach National Fish Hatchery.

Habitat use

With their streamlined bodies, bonytail appear to be adapted to the Colorado River and large tributary streams. Even with these adaptations, this species does not select areas of high velocity currents and use of pools and eddies by the fish is significant as is their use of backwaters. Bonytail use cover, particularly rocky crevices. There is limited information on migrations or other movements.

Habitat needs of larval and juvenile bonytails are not well known. Few larvae have been identified in the Lower Basin; in the Upper Basin, there is confusion between larvae of the bonytail and other chubs, so interpreting data is difficult. It is known that young prey on aquatic invertebrates, especially chironomid larvae and mayfly nymphs. It is likely that quiet water habitats are preferred habitats for young fish, given the success of raising them in man-made ponds. Backwaters temporarily or permanently connected to the main river channel are also believed to be important habitat for all life stages.

Current distribution

The range-wide trend for the bonytail is for a continued range-wide decrease in wild populations due to lack of sufficient recruitment of young adults with the loss of old adults due to natural mortality. Loss of the extant wild populations is expected. Extinction of this fish in the wild throughout its historic range is being forestalled by the stocking of sub-adult fish into the Upper Colorado River Basin, and lakes Mohave and Havasu and the Parker Strip in the Lower Colorado River Basin. These stockings are intended to create populations of young adults that may be expected to persist for 40-50 years. To date, these stockings have had limited success.

Threats

Changes to water flow due to construction of large water storage dams and operation of water diversions has affected bonytail habitats. Channelization as well as changes in flows has separated the floodplains from the existing river channels which has reduces habitat diversity. The introduction of nonnative fish species is the greatest impediment to survival and recovery of the bonytail. Predation on young bonytail is the primary adverse effect, although there may be some degree of competition for food or space.

Conservation actions

The Upper Colorado River Endangered Fish Recovery Program (UCREFRP) has implemented considerable research, habitat management, nonnative species removal, and stocking actions to benefit the bonytail in Colorado, Utah, and Wyoming. The Lower Colorado River Multi-Species Conservation Plan (LCR MSCP) is also engaged in research and stocking actions to benefit the bonytail in the lower Colorado River of Arizona, California, and Nevada. Essential to these programs is the broodstock maintained at Dexter National Fish Hatchery and Technology Center (DNFH&TC) since the bonytail is functionally extinct in the wild.

Previous consultations

Section 7 consultations on bonytail include programmatic efforts for the Upper Colorado River Basin and Lower Colorado River Multi-Species Conservation Program for new water diversions or changes in points of diversion. Information on these programs is available at their websites. Biological opinions on actions potentially affecting bonytail in Arizona may be found at our website www.fws.gov/southwest/es/arizona in the Section 7 Biological Opinion page of the Document Library.

Environmental baseline (in the action area)

Description of the Action Area

The action area for this consultation is the Colorado River from Hoover Dam to the Southerly International Boundary with Mexico. This represents the potential range of the species in Arizona and adjacent portions of California and Nevada. Since activities by AGFD along the Colorado River are coordinated with the wildlife agencies of the adjacent states, activities that may affect the bonytail can occur anywhere on the river or lakes Mohave and Havasu.

A. Status of the species and critical habitat within the action area

Bonytail are currently stocked by the LCR MSCP into the lower Colorado River below Parker Dam. A total of 1,208 bonytail were stocked into the Parker Strip at River Island State Park in December 2007 (LCR MSCP 2009a), 535 in 2008 (LCR MSCP 2009b) and 2,506 in 2009 (LCR MSCP 2010). This site is about three miles upstream of La Paz County Park. Six bonytail were recaptured in 2007 during electrofishing surveys (Schooley et al. 2008). Stockings of bonytail and subsequent monitoring are expected to continue in this reach for the foreseeable future in an attempt to establish a population. Survival rate for the stocked bonytails is unknown; and few were contacted post-stocking. The existing nonnative fish population in the Parker Strip is robust with significant numbers of potential predators and competitors.

Over the last year, bonytail stocked into Lake Havasu are being captured by anglers at the fishing dock near the Bill Williams River National Wildlife Refuge Headquarters. Captured individuals are mostly released by the anglers; however, some data on individual fish is obtained (Thorson 2011) showing these are survivors of previous stockings and they are healthy.

B. Factors affecting the species' environment within the action area

As noted previously, creation of dams and subsequent water management actions and the introduction of nonnative fish species are the primary factors affecting bonytail in the action area. All bonytail present are the result of past or ongoing stocking actions.

The LCR MSCP is a combined section 7 and section 10 that covers management of the lower Colorado River by the Bureau of Reclamation (Reclamation), and water uses by Federal and non-Federal parties. Part of the mitigation required for the covered actions involves conservation for bonytail, particularly stocking into the Parker Strip and areas downstream above Imperial Dam, creation of isolated backwaters, monitoring of stocked fish, and targeted research to address issues that may interfere with successful establishment of bonytail populations. These mitigation and conservation actions do not alter the physical conditions in the river that result from water management, nor do they address nonnative species effects except that the isolated backwaters will be managed to keep nonnative fish out.

Colorado pikeminnow

Status of the species (and critical habitat) rangewide

Listing history

The Colorado pikeminnow was listed as an endangered species on March 11, 1967 (32 FR 4001, USFWS 1967a). The Colorado Pikeminnow Recovery Goals were approved in 2002 (USFWS 2002c). Critical habitat was designated in six river reaches in the historical range of the Colorado pikeminnow on March 21, 1994 (59 FR 13374, USFWS 1994a). All designated critical habitat units are in the Upper Colorado River Basin in the Colorado, Green, San Juan, White, and Yampa rivers.

Critical habitat was listed for the four big river fishes (Colorado pikeminnow, humpback chub, bonytail, and razorback sucker) concurrently in 1994, and the PBFs were defined for the four

species as a group (USFWS 1994a). However, note that the PBFs vary somewhat for each species on the ground, particularly with regard to physical habitat, because each of the four species has different habitat preferences.

The general PBFs are:

- Water- This includes a quantity of water of sufficient quality (i.e., temperature, dissolved oxygen, lack of contaminations, nutrients, turbidity, etc.) that is delivered to a specific location in accordance with a hydrologic regime that is required for the particular life stage.

- Physical habitat- this includes areas of the Colorado River system that are inhabited by fish or potentially habitable for use in spawning, nursery, feeding, rearing, or corridors between these areas. In addition to river channels, these areas also include bottomlands, side channels, secondary channels, oxbows, backwaters, and other areas in the 100-year floodplain, which, when inundated, provide spawning, nursery, feeding, and rearing habitats.

- Biological environment- Food supply, predation, and competition are important elements of the biological environment and are considered components of this constituent element. Food supply is a function of nutrient supply, productivity, and availability to each life stage of the species. Predation, although considered a normal component of this environment, may be out of balance due to introduced fish species in some areas. This may also be true of competition, particularly from nonnative fish species.

The USFWS established "nonessential" experimental population areas for the pikeminnow in Arizona on July 24, 1985 (50 FR 30188, USFWS 1985a). Two population areas were designated on the Salt and Verde rivers.

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the species. This information was taken from the 2002 Recovery Goals (USFWS 2002c) and the 2011 sportfish BO (USFWS 2011a) and references cited therein. Information in these documents is incorporated by reference.

Life history

The pikeminnow is a large minnow endemic to the Colorado River Basin of the southwestern United States. Pikeminnow attain a maximum size of 1.8 meters total length (six feet) and can weigh up to 36 kilograms (80 pounds). The pikeminnow was the largest predatory fish in the Colorado River Basin, and movements to areas with high concentrations of forage species may also have occurred.

Habitat use

Large to medium sized rivers with pools, deep runs and eddies provide habitat for pikeminnow. Adults migrate long distances to and from spawning areas. Over the course of a year, they use a variety of depths, flow velocities, and substrates in the main channel, shorelines, backwaters, and flooded bottomlands. Long-distance spawning runs were an annual occurrence, and there is significant spawning site fidelity.

Current distribution

Pikeminnow populations are found in the San Juan River in New Mexico and Utah; the Colorado and Yampa rivers in Colorado; and the Colorado and Green rivers in Utah. Naturally occurring populations of the pikeminnow in Arizona and surrounding states have been extirpated.

Under the 10(j) permit, pikeminnow were stocked into the Salt River in 1988-1990 and into the Verde River in 1995-1999 and 2002-to the present by the Arizona Game and Fish Department in cooperation with the Fish and Wildlife Service (unpublished data, Arizona Game and Fish Department). Survival of stocked fish in the Verde River has been documented through recaptures by Arizona Game and Fish Department. Future stockings into the Verde River above Horseshoe Dam are anticipated.

Threats

Two major changes to the river system have resulted in the reduction or elimination of pikeminnow populations. Physical changes to the river system with the construction of dams and diversions that interrupt migrations, creation of reservoirs that eliminate riverine habitats and alter the natural hydrograph and water temperatures, and channelization of rivers that eliminates backwaters and floodplains used by adults for foraging and as nursery areas for young fish. The introduction of numerous non-native fish species that prey on eggs, larvae or young pikeminnow and their native fish prey base has reduced or eliminated recruitment of both pikeminnow and the other native fish. Additions of pesticides and pollutants to the river system may also have affected pikeminnow populations.

Conservation actions

The Upper Colorado River Endangered Fish Recovery Program (UCREFRP) has implemented considerable research, habitat management, nonnative species removal, and stocking actions to benefit the bonytail in Colorado, Utah, and Wyoming. The pikeminnow is also a species included in the Bartlett-Horseshoe HCP on the Verde River. (SRP 2008) AGFD continues to stock pikeminnow into the Verde River.

Previous consultations

For section 7 consultations in Arizona, the 10(j) status of the pikeminnow provides for a different level of evaluation than for other endangered species. As a designated experimental non-essential population, the pikeminnow is treated as a species proposed for listing. Conference under section 7 is appropriate when a Federal action is likely to jeopardize the continued existence of a proposed species. A Federal agency may, at its discretion, request conference if a proposed action may affect a proposed species. For a determination of jeopardy, the status of the

species as a whole, not just within the experimental non-essential population, must be considered.

Section 7 consultations on Colorado pikeminnow in the Upper Basin are on the endangered entity and are focused on water depletions, river management actions, and conservation actions.

Environmental baseline (in the action area)

Description of the action area

The action area for this consultation is the state of Arizona including the Verde River basin where pikeminnow are currently stocked. The action area is outside of the current recovery range of the species in the Upper Basin.

A. Status of the species within the action area

The status of the Colorado pikeminnow in the action area is described in USFWS (2011a).

B. Factors affecting the species' environment within the action area

The threats identified for the rangewide status of the species are affecting the Colorado pikeminnow and their habitats in the action area.

Desert and Quitobaquito pupfishes

Status of the species and critical habitat rangewide

Listing history

The desert pupfish (*Cyprinodon macularius*) was listed as an endangered species with critical habitat in on March 31, 1986 (51 FR 10642, USFWS 1986a). The Quitobaquito, or Sonoyta, pupfish (C. *eremus*) was, at the time of listing a subspecies of desert pupfish (*C. m. eremus*), but was recognized as a distinct species in 2000 (Echelle et al. 2000) inhabiting the Rio Sonoyta drainage in Pima County, Arizona and Sonora, Mexico. Although the Quitobaquito pupfish is listed under the ESA as the desert pupfish, the taxonomic status of the species is currently under review and it is assumed that it will in time be listed as a separate species with a similar status (endangered) as the desert pupfish. Critical habitat was designated for the desert pupfish (Quitobaquito pupfish) in Arizona at Quitobaquito Springs in Pima County and for the desert pupfish in Imperial County, California.

The PBFs for critical habitat include clean, unpolluted water that is relatively free of exotic organisms, especially exotic fishes, in small, slow-moving desert streams and spring pools with marshy backwater areas.

Background

The following is a summary of life history, habitat use, current distribution, threats, and conservation actions for the two species. This information was taken from the Desert Pupfish Recovery Plan (USFWS 1993a) and the 5-year review (USFWS 2010h) and references cited therein.

Life history

This is a small fish (5 cm (2 in) long) with a smoothly rounded body shape and narrow, vertical dark bars on the sides. Breeding males are blue on the tops and sides, and have yellow fins. Females and juveniles have tan to olive colored backs and silvery sides. It is found in shallow water of desert springs, small streams, and marshes below 500 m (1,500 ft) elevation. The species tolerates high salinities and high water temperatures.

Habitat use

The pupfishes historically occupied springs; cienegas; shallow pools; slow, shallow stream flows; or the margins of larger water bodies. Substrates were usually soft, with varying amounts of submerged and emergent vegetation.

Current distribution

Desert pupfish continue to persist in natural populations around the Salton Sea in California and in the Laguna Salada Basin in Mexico. Desert pupfish in Arizona are found only in reintroduction areas where populations may contribute to the conservation of the species. Approximately 16 of these conservation populations exist, with more expected to be established over the 10-year period of this consultation.

The Quitobaquito pupfish occurs in Quitobaquito pond, spring channel, and springs on Organ Pipe Cactus National Monument (OPCNM). Refuge populations were established at OPCNM ('La Cienega') and Cabeza Prieta National Wildlife Refuge (CPNWR) visitor centers in the winter of 2004-5. Populations in Quitobaquito Pond are currently low due to removal of pupfish during repairs to the pond. Sonora, Mexico, the Quitobaquito pupfish is found in the Rio Sonoyta.

Threats

Threats to the pupfishes include loss of habitat due to groundwater pumping and surface water depletions, increasing salinity at the Salton Sea, and the spread of nonnative predators and competitors.

Conservation actions

Protections for desert pupfish in California are being implemented to maintain populations around the Salton Sea. In Arizona, reintroductions of desert pupfish are facilitated by a Safe Harbor Agreement (USFWS 2008d). Recent conservation efforts for the Quitobaquito pupfish have focused on repairing Quitobaquito Pond and holding pupfish in safe areas until that work is completed.

Previous consultations

Section 7 consultations on the pupfishes include programmatic efforts for Forest Land Management Plans that address watershed management and multiple uses (livestock grazing, timber harvest, recreation, and other issues), issues involving the Salton Sea in California, and more site-specific efforts that are more focused on implementing recovery actions such as barrier construction and stream renovations. Biological opinions on actions potentially affecting the pupfishes in Arizona may be found at our website www.fws.gov/southwest/es/arizona in the Section 7 Biological Opinion page of the Document Library.

Environmental baseline (in the action area)

Description of the action area

The action area for this consultation is the state of Arizona, Imperial County, California, and adjacent areas of Sonora and Baja California where pupfish maintain natural or reintroduced populations. This encompasses the entire range of the desert and Quitobaquito pupfishes.

A. Status of the species and critical habitat within the action area

As discussed under the rangewide status, no natural desert pupfish populations exist in Arizona although there are reintroduced populations. The species persists in California and Mexico. The Quitobaquito pupfish remains extant within its historical habitat in Arizona and in Mexico.

B. Factors affecting the species' environment within the action area

The threats identified for the rangewide status of the species are affecting the pupfishes and their habitats in the action area.

Gila chub

Status of the species and critical habitat rangewide

Listing history

A final rule listing Gila chub as an endangered species was published Nov. 2, 2005 (70 FR 66664) (USFWS 2005a). Critical habitat was designated in 25 units totaling 258.1 km (160.3 mi) within seven areas: the Agua Fria, Babocomari, lower San Pedro, lower Santa Cruz, middle and upper Gila, and upper Verde rivers.

Critical habitat was designated for 25 stream reaches in the occupied range of the species. There are seven PBFs, which include those habitat features required for the physiological, behavioral, and ecological needs of the species. These are:

1) Perennial pools, areas of higher velocity between pools, and areas of shallow water among plants or eddies all found in headwaters, springs, and cienegas, generally of smaller tributaries;

2) Water temperatures for spawning ranging from 63 to 75 °F (17-24 °C), and seasonally appropriate temperatures for all life stages (varying from about 50 to 86 °F [10 °C to 30 °C]);

3) Water quality with reduced levels of contaminants, including excessive levels of sediments adverse to Gila chub health, and adequate levels of pH (e.g. ranging from 6.5-9.5), dissolved oxygen (e.g. ranging from 3.0-10.0 ppm) and conductivity (e.g. 100-1000 mmhos);

4) Food base consisting of invertebrates (e.g. aquatic and terrestrial insects) and aquatic plants (e.g. diatoms and filamentous green algae);

5) Sufficient cover consisting of downed logs in the water channel, submerged aquatic vegetation, submerged large tree root wads, undercut banks with sufficient overhanging vegetation, large rocks and boulders with overhangs, a high degree of streambank stability, and a healthy, intact riparian vegetation community;

6) Habitat devoid of nonindigenous aquatic species detrimental to Gila chub or habitat in which detrimental nonindigenous species are kept at a level that allows Gila chub to continue to survive and reproduce; and

7) Streams that maintain a natural flow pattern including periodic flooding.

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the Gila chub. This information was taken from the final rule listing the species (USFWS 2005a), Weedman et al. (1996), Desert Fishes Team (2003), and the most recent Central Arizona Project biological opinion (USFWS 2008e) and references cited therein. Information in these documents is incorporated by reference.

Life history

Generally breeding is initiated with warmer water temperatures of 20 – 26.5 ºC (68 – 79.7 ºF). Gila chub prefers to spawn over submerged aquatic vegetation or root wads.

Gila chub are omnivorous; feeding on large and small aquatic and terrestrial invertebrates, and small fishes. Smaller individuals feed on organic debris, aquatic plants (especially filamentous algae), and diatoms (unicellular or colonial algae). Gila chub in Redfield Canyon consumed speckled dace (*Rhinichthys osculus*), dobsonfly nymphs (order Megaloptera), and terrestrial insects (i.e. ants, caterpillars, and beetles). A high presence of algae (diatoms), and small gravel (indicating bottom feeding) was also found to be present in their diet.

Habitat use

Gila chub commonly inhabit pools in smaller streams, springs, and cienegas, and can survive in artificial impoundments. Generally, Gila chub are often associated with cover including: terrestrial vegetation, boulders, and fallen logs and undercut banks created by over hanging

terrestrial vegetation. Habitat selection is lifestage-specific with adults commonly found in deep pools and eddies below areas with swift currents. Young-of-the-year inhabit shallow water among plants or eddies, and older juveniles use higher-velocity stream areas such as riffles. There is temporal variation in habitat selection in Sabino Canyon whereby Gila chub occupied dark interstitial spaces during winter and sub-adults were observed farther from cover and frequently in shallow areas or higher current areas during summer as water temperature warmed.

Current distribution

Gila chub populations remain extant in tributaries to the Agua Fria, Blue, Gila, San Francisco, Santa Cruz, and Verde rivers in Arizona and New Mexico. Populations are spread across the drainages, and most are isolated from other populations.

Threats

Primary threats to Gila chub survival include habitat loss. Deleterious activities include groundwater pumping, damming, diversions, and stream channelization, all leading to dewatering and alteration of channel morphology. In southeast Arizona poor watershed conditions due to overgrazing, mining, timber harvesting and fire suppression are identified as habitat threats. Recreation (e.g. all-terrain vehicles, concentrated walking, stream hiking, wading, and swimming) may negatively affect habitat through increased sediment disturbance, fish displacement, and trampling bank vegetation. Destruction of stream habitat and dewatering lead to fragmentation of habitat and populations which in turn restricts movement, and reduces colonization and gene flow.

Perhaps the most serious threat to Gila chub is predation by and competition with nonnative organisms, including numerous nonnative fish species, bullfrogs, and virile crayfish. The impacts of nonnative fish species on native fish including Gila chub have been well documented.

Conservation actions

Conservation measures under the Gila River Basin Native Fishes Conservation Program for the Gila chub include barrier construction and renovation of streams to remove nonnative species and reintroductions into the historical range. Robinson (2010) summarizes the latest information on implementation of this program.

The Gila chub is a covered species in the draft San Rafael HCP (USFWS 2010d).

Previous consultations

Section 7 consultations on Gila chub in Arizona and New Mexico include programmatic efforts for Forest Land Management Plans that address watershed management and multiple uses (livestock grazing, timber harvest, recreation, and other issues), and more site-specific efforts that are more focused on implementing recovery actions such as barrier construction and stream renovations. Biological opinions on actions potentially affecting Gila chub in Arizona may be found at our website www.fws.gov/southwest/es/arizona in the Section 7 Biological Opinion page of the Document Library.

Environmental baseline (in the action area)

Description of the Action Area

The action area for this consultation is the state of Arizona which encompasses the most of the occupied range of the Gila chub. The New Mexico populations are not included in the action area as it is unlikely that SWG or SFR funds would be used by AGFD in CAP-related actions for those populations.

A. Status of the species and critical habitat within the action area

The status of the Gila chub in the action area is essentially the same as the rangewide status.

B. Factors affecting the species' environment within the action area

The threats identified for the rangewide status of the species are affecting the Gila chub and their habitats in the action area.

Gila topminnow

Status of the species rangewide

Listing

Gila topminnow was listed as endangered in 1967 without critical habitat (32 FR 4001, USFWS 1967a). Only Gila topminnow populations in the United States, and not in Mexico, are listed under the ESA.

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the Gila topminnow. This information was taken from the 1984 recovery plan (USFWS 1984b), the draft revised Gila topminnow recovery plan (Weedman 1999), and the most recent CAP biological opinion (USFWS 2008e) and references cited therein. Information in these documents is incorporated by reference.

Life history

Gila topminnow is a live-bearing minnow species with females reaching two inches and males one inch. Breeding is primarily from March to August; however pregnant females may be found at any time of year in habitats supported by warm springs. Brood time is 24-28 days, and young Gila topminnow may take a few weeks to a few months to mature. Gila topminnow is short-lived, with an average life span of less than a year.

Gila topminnow is an opportunistic feeder on bottom debris, vegetation, amphipods, and insect larvae.

Habitat use

Gila topminnow use shallow shorelines and slackwater areas of small streams, springs, and marshes. They concentrate in protected inlets, shoreward of sandbars or debris, or associated with aquatic or streamside vegetation. They are tolerant of a wide range of temperature and water chemistry.

Current distribution

As of 2008, Gila topminnow existed in nine of the 16 recent natural populations and in 21 reintroduced localities (USFWS 2008d). Two of the natural populations are contaminated by nonnative fish species. Voeltz and Bettaso (2003) reported that three of 18 extant reintroduced populations (as of 2003) were contaminated by nonnative fish species. Additional reintroductions by the Gila River Basin Native Fishes Conservation Program of Gila topminnow were made since 2008 (Robinson 2010).

Threats

The reasons for decline of this fish include past dewatering of rivers, springs and marshlands, impoundment, channelization, diversion, regulation of flow, land management practices that promote erosion and arroyo formation, and the introduction of predacious and competing nonindigenous fishes.

Conservation actions

As part of their ongoing commitment to conservation for this species, AGFD is an active participant in implementation of the Gila topminnow recovery plan. Conservation measures under the Gila River Basin Native Fishes Conservation Program are underway in the range of the species and include creation of reestablishment areas through barrier construction and chemical renovation to remove nonnative species. Gila topminnow is also a covered species in the Horseshoe-Bartlett Habitat Conservation Plan (SRP 2008) for the Verde River. In addition, the Safe Harbor Agreement for Gila topminnow and desert pupfish allows private individuals in Arizona to establish populations of this species for conservation purposes (USFWS 2008d).

Previous consultations

Section 7 consultations on Gila topminnow include programmatic efforts for Forest Land Management Plans that address watershed management and multiple uses (livestock grazing, timber harvest, recreation, and other issues), and more site-specific efforts that are more focused on implementing recovery actions such as barrier construction and stream renovations. Biological opinions on actions potentially affecting Gila topminnow may be found at our website www.fws.gov/southwest/es/arizona in the Section 7 Biological Opinion page of the Document Library.

<u>Environmental baseline (in the action area)</u>

Description of the Action Area

The action area for this consultation is the state of Arizona and includes all remaining natural populations and all reintroduced populations of Gila topminnow.

A. Status of the species within the action area

The status of the Gila topminnow in the action area is essentially the same as the rangewide status.

B. Factors affecting the species' environment within the action area

The threats identified for the rangewide status of the species are affecting the Gila topminnow and their habitats in the action area.

Gila trout

Status of the species rangewide

Listing

The Gila trout was listed as an endangered species under the 1966 Federal Endangered Species Preservation Act and endangered status continued under the 1973 Endangered Species Act. Gila trout was downlisted to threatened on July 18, 2006 (71 FR 40657, USFWS 2006b) based on significant improvements to the species status through implementation of the Gila Trout Recovery Plan (USFWS 2003a) that allowed for downlisting.

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the Gila trout. This information was taken from the 2003 recovery plan (USFWS 2003a) and the 2006 reclassification final rule (USFWS 2006b) and references cited therein. Information in these documents is incorporated by reference.

Life history

Spawning of Gila trout occurs mainly in April, with temperatures of 46°F. Day length may also be a cue for spawning to initiate. Females reach maturity at age two to four, at about six inches or greater. Males reach maturity at age two or three and at approximately the same size.

Gila trout are primarily insectivorous with adult dipterans, aquatic insect larvae or nymphs, and aquatic beetles commonly taken. Gila trout may also be somewhat piscivorous. In streams, they establish a feeding hierarchy in the pools and larger fish would chase away smaller fish.

Habitat use

Adult Gila trout are mainly found in pools, particularly those over one foot deep with low velocity areas adjacent to higher velocity waters where the individual may forage but not be exposed to the higher velocity waters. Large woody debris is an important component for both pool formation and cover. Subadults are primarily found in riffles.

Current distribution

All remaining natural populations of Gila trout are in New Mexico. The four original pure populations have been replicated at least once; Main Diamond four times, South Diamond once, Whiskey Creek once, and Spruce Creek three times. Two of the Spruce Creek replicates are in Arizona, of which one, Dude Creek, is known to have failed. The other, in Raspberry Creek persisted until 2010 but was entirely lost after the Wallow Fire in 2011. Gila trout were stocked into Grapevine Creek (a tributary of the Agua Fria River) and Frye Mesa Creek (a tributary of the Gila River) in Arizona in 2009 (USFWS 2011a)

Threats

The Gila trout remains threatened by land management actions and the spread of nonnative aquatic species. As identified in the final rule reclassifying the species to threatened, improper livestock grazing, timber harvest, wildfire, and effects from the introduction of nonnative aquatic organisms continue to be of concern. For nonnative aquatic organisms effects can be from competition and predation with newly arrived species, hybridization with conspecific rainbow trout, and the transmission of parasites and diseases through the introduction of nonnative aquatic species. An example of the latter is the presence of bacterial kidney disease in nonnative brown trout.

Conservation actions

Conservation actions for the Gila trout include replicating populations into secure streams that have barriers and were chemically treated to remove nonnative species. Expansion of the species into historical range in Arizona is continuing to promote recovery of the species.

Previous consultations

Section 7 consultations on Gila trout include programmatic efforts for Forest Land Management Plans that address watershed management and multiple uses (livestock grazing, timber harvest, recreation, and other issues), and more site-specific efforts that are more focused on implementing recovery actions such as barrier construction and stream renovations. Biological opinions on actions potentially affecting Gila trout in Arizona may be found at our website www.fws.gov/southwest/es/arizona in the Section 7 Biological Opinion page of the Document Library.

Environmental baseline (in the action area)

Description of the Action Area

The action area for this consultation is the state of Arizona. The Gila trout was reintroduced into two streams in Arizona in 2009 to contribute to recovery and into Frye Mesa Lake to provide for sportfishing opportunities in 2010. Additional stockings for recovery or sportfishing purposes is anticipated over the 10-year period covered by this consultation, so it is appropriate to consider the state of Arizona as the action area. AGFD personnel may assist in moving Gila trout from New Mexico for stocking purposes, and that activity is covered.

A. Status of the species within the action area

The status of the Gila trout in the action area is essentially the same as the rangewide status.

B. Factors affecting the species' environment within the action area

The threats identified for the rangewide status of the species are affecting the Gila trout and their habitats in the action area.

Headwater chub

Status of the species rangewide

Listing history

Headwater chub became a candidate species in May, 2006 (71 FR 26007, USFWS 2006c).

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the headwater chub. This information was taken from Voeltz (2002), the 12-month finding (USFWS 2006c), the 2009 petition for emergency listing (Stefferud et al. 2009), and the most recent candidate assessment form (USFWS 2010i) and references cited therein. Information in these documents is incorporated by reference.

Life history

Spawning in Fossil Creek (which contains both roundtail and headwater chub) occurred in spring and was observed in March in pool-riffle areas with sandy-rocky substrates. The diet of headwater chub included aquatic insects, ostracods, and plant material.

The species is closely related to the Gila chub (*Gila intermedia*) and roundtail chub (*G. robusta*) and has only recently been identified as a separate taxon (Minckley and DeMarais 2000).

Habitat use

Headwater chubs occur in the middle to upper reaches of moderately-sized streams. Habitats containing both Gila and headwater chubs consisted of tributary and mainstem habitats in the Gila River at elevations of 1,325 m (4,347 ft) to 2,000 m (6,562 ft). Maximum water temperatures for habitats of the Gila, headwater and roundtail chub vary from 20° to 27°C (68°

to 81°F), with minimum water temperatures of 7° C (45°F). Typical adult habitats containing both Gila and headwater chub consisted of nearshore pools adjacent to swifter riffles and runs over sand and gravel substrate, with young of the year and juveniles using smaller pools and areas with undercut banks and low velocity.

Current distribution

The historical range of headwater chub is the Gila River basin in Arizona and New Mexico. The historical distribution of headwater chub in Arizona remains poorly understood due in part to the taxonomic confusion with other *Gila*, the lack of early collections, and widespread manmade changes to habitats within the basin that likely affected distribution.

The species occupies the East, Middle, and West forks of the Gila River and may occupy lower Turkey Creek below a barrier and the Gila River below the forks area in New Mexico, although these fish have not been definitively identified (Stefferud et al. 2009). In Arizona, headwater chub occupy: tributaries of the Verde River including Fossil Creek, East Verde River (including tributaries The Gorge, Pine Creek, and Webber Creek), Wet Bottom Creek, and Deadman Creek; and Tonto Creek and several of its tributaries (Buzzard Roost, Dinner, Gordon, Gunn, Haigler, Horton, Marsh, Rock, Spring, Turkey creeks) (Voeltz 2002, Stefferud et al. 2009). Headwater chub may still occur in parts of the San Carlos River basin, although recent survey information for these streams is unavailable because San Carlos Tribal survey information is proprietary and confidential (Voeltz 2002, Stefferud et al. 2009). The taxonomic status of chub in upper West Clear Creek has still not been resolved; however, the most recent findings do not place them clearly with either species (Dowling 2010). Genetic and morphometric confirmation as headwater chub is also lacking for The Gorge and Pine Creek sites on the East Verde River, and for Wet Bottom Creek on the Verde River. Recently completed genetic research includes recommendations for management units for headwater chub, as well the related Gila and roundtail chubs (Schwemm 2006, Dowling et al. 2008).

Threats

Threats to headwater chub include loss of habitat due to water withdrawals and other modifications to streamflow, channelization, improper livestock grazing, mining, roads, logging, and development activities has been significant and continues to occur. Climate change may also have an effect on the availability of habitat in the future if droughts continue. Catastrophic wildfires are also a risk to the species since it is found in isolated headwater streams with little ability for reoccupation of affected streams.

The introduction and spread of nonnative fish that can be predators or competitors on headwater chub has significantly affected the species.

Conservation actions

As part of their ongoing commitment to conservation for this species, AGFD is an active participant in implementation of conservation actions for the headwater chub.

Survey and recovery work for the headwater chub is guided by the Recovery Plan in New Mexico (Carman 2006) and includes monitoring of the extant populations. In Arizona, headwater chub is covered by the Six Species Conservation Program (AGFD 2006). This program has provided administrative oversight on the species and is making progress on numerous projects planned for implementation over the next ten years. The conservation efforts of this program, led by the AGFD, have led to the completion of a considerable amount of genetic research as well as the documentation of two new occupied waters. The Fossil Creek restoration funded by the Gila River Basin Native Fishes Conservation Program provided significant benefits for headwater chub; and further benefits could be realized from this program if the Spring Creek restoration project moves forward. This project may not be implemented for several years.

The recently completed sportfish consultation (USFWS 2011a) contains a suite of required conservation measures for headwater chub that will be implemented over the next 10 years. These measures include additional surveys, and securing populations of headwater chub within its historical range in Arizona.

Previous consultations

Headwater chub is a candidate for listing under the Act and as such is not subject to the consultation requirements of section 7 for activities of Federal agencies. Federal agencies may, at their discretion, include consideration for candidate species in their environmental compliance under the Act. However, it is the policy of the USFWS that candidate species are considered in intra-Service consultations on USFWS actions, including funding activities of other entities such as AGFD.

Environmental baseline (in the action area)

Description of the action area

The action area for this consultation is the state of Arizona. This encompasses the majority of the occupied habitats for the species. We do not at this time believe that AGFD personnel will work with New Mexico Department of Game and Fish (NMDGF) on this species in the upper Gila River.

A. Status of the species within the action area

The status of the headwater chub in the action area is essentially the same as the rangewide status.

B. Factors affecting the species' environment within the action area

The threats identified for the rangewide status of the species are affecting the headwater chub and their habitats in the action area.

Humpback chub

Status of the species and critical habitat rangewide

Listing history

Humpback chub were listed as an endangered species on March 11, 1967 (32 FR 4001, USFWS 1967a). Critical habitat for humpback chub was designated in 1994 (59 FR 13374; USFWS 1994a). Seven reaches of the Colorado River system were designated as critical habitat for humpback chub for a total river length of 379 miles in the Yampa, Green, and Colorado rivers in the Upper Basin and the Colorado and Little Colorado rivers in the Lower Basin.

Critical habitat was listed for the four big river fishes (Colorado pikeminnow humpback chub, bonytail, and razorback sucker) concurrently in 1994, and the PBFs were defined for the four species as a group (USFWS 1994a). However, note that the PBFs vary somewhat for each species on the ground, particularly with regard to physical habitat, because each of the four species has different habitat preferences.

The general PBFs are:

- Water- This includes a quantity of water of sufficient quality (i.e., temperature, dissolved oxygen, lack of contaminations, nutrients, turbidity, etc.) that is delivered to a specific location in accordance with a hydrologic regime that is required for the particular life stage.

- Physical habitat- this includes areas of the Colorado River system that are inhabited by fish or potentially habitable for use in spawning, nursery, feeding, rearing, or corridors between these areas. In addition to river channels, these areas also include bottomlands, side channels, secondary channels, oxbows, backwaters, and other areas in the 100-year floodplain, which, when inundated, provide spawning, nursery, feeding, and rearing habitats.

- Biological environment- Food supply, predation, and competition are important elements of the biological environment and are considered components of this constituent element. Food supply is a function of nutrient supply, productivity, and availability to each life stage of the species. Predation, although considered a normal component of this environment, may be out of balance due to introduced fish species in some areas. This may also be true of competition, particularly from nonnative fish species.

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the humpback chub. This information was taken from the Humpback Chub Recovery Goals (2002d), the 2008 biological opinion for the operation of Glen Canyon Dam (USFWS 2008a) and the 2009 supplement to that biological opinion (USFWS 2009c) and references cited therein. Information in these documents is incorporated by reference.

Life history

The humpback chub is a medium-sized freshwater fish (to about 20 inches) of the minnow family, Cyprinidae. The adults have a pronounced dorsal hump, a narrow flattened head, a fleshy snout with an inferior-subterminal mouth, and small eyes. It has silvery sides with a brown or olive-colored back. The humpback chub is endemic to the Colorado River Basin and is part of a native fish fauna traced to the Miocene epoch in fossil records.

The humpback chub spawn from March-May in the Little Colorado River and April-June in the Upper Basin. Spawning is believed to occur over gravel substrates. Humpback chub are omnivorous.

Habitat use

Humpback chub prefer warm, turbid water in canyon-bound reaches of large rivers. They use areas of deep water, swift currents, and rocky substrates as adults and more sheltered, shallow water habitats as sub-adults.

Current distribution

There are six populations of humpback chub in the Colorado River basin; five in the upper basin, and one in the lower basin. The status of these six populations was described in the 2008 biological opinion (USFWS 2008a).

Conservation actions

The Upper Colorado River Endangered Fish Recovery Program (UCRRP) is an ongoing effort to provide conservation that leads to the recovery of the humpback chub. The Glen Canyon Adaptive Management Program (GCDAMP) in Grand Canyon is primarily focused on mitigation measures to offset effects of the operation of Glen Canyon Dam, but those actions do provide conservation benefits.

Previous consultations

Section 7 consultations on humpback chub include those for management of water in the Upper Colorado River Basin and Glen Canyon Dam and more site-specific efforts that are more focused on implementing recovery actions such as barrier construction and stream renovations. Biological opinions on actions potentially affecting humpback chub in Arizona may be found at our website www.fws.gov/southwest/es/arizona in the Section 7 Biological Opinion page of the Document Library.

Environmental baseline (in the action area)

Description of the Action Area

The action area for this consultation is the state of Arizona focusing on the Little Colorado and Colorado rivers in the Grand Canyon. The action area contains only one of the six known populations of humpback chub.

A. Status of the species and critical habitat within the action area

The status of the humpback chub in the action area is described in USFWS (2008a).

B. Factors affecting the species' environment within the action area

The threats identified for the rangewide status of the species are affecting the humpback chub and their habitats in the action area.

Little Colorado spinedace

Status of the species and critical habitat rangewide

Listing

The spinedace was first listed as a threatened species under the Endangered Species Preservation Act of 1966 (32 FR 2001), and was considered a Category 1 candidate in the Review of Vertebrate Wildlife for Listing as Endangered or Threatened Species in 1982 (47 FR 58454). The species was listed 1987 as threatened with critical habitat (52 FR 35034, USFWS 1987a). As part of the listing process, a special rule under section 4(d) to allow for take of individual spinedace under a valid State permit was included in the listing of the species. This special rule regulates take of spinedace for educational purposes, scientific purposes, zoological exhibition, and other conservation purposes consistent with the Act through applicable state fish and wildlife conservation laws and regulations.

Areas designated as critical habitat were in the East Clear Creek drainage (East Clear Creek from its confluence with Leonard Canyon upstream 15 miles to CC Cragin Reservoir and from the upper limit of the reservoir upstream 13 miles to Potato Lake), Chevelon Creek (from the confluence with the Little Colorado River upstream eight miles to Bell Cow Canyon), and in the Little Colorado drainage (Nutrioso Creek from the ASNF boundary upstream five miles to Nelson Reservoir dam).

The critical habitat designation described the constituent elements to include clean, permanent flowing water, with pools and a fine gravel or silt-mud substrate and that these were considered essential for the conservation of the species. The designation discussed the types of activities that could adversely modify critical habitat, focusing on activities that would deplete, lessen, or alter the natural hydrograph of stream flows, extensively alter the channel morphology, or extensively alter the water chemistry. There is no discussion of the presence of nonnative species as a concern for the biological feature of critical habitat in the designation; this is a result of differing standards in place during the period when the spinedace was listed and critical habitat designated. The PBFs were considered as being present at the time of designation. All critical habitat units are essential for the conservation of the species.

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the spinedace. This information was taken from the 1998 recovery plan (USFWS 1998a) and the most recent 5-year review (USFWS 2008f) and references cited therein. Information in these documents is incorporated by reference.

Life history

Spinedace are omnivorous, and food items include chironomid larvae, other dipterans, filamentous green algae, and crustaceans. Spinedace are late-spring to early-summer spawners although some females have been found to contain mature eggs as late as October. A complete discussion of the taxonomic, distributional, and life history information of the spinedace has been compiled in the Little Colorado Spinedace Recovery Plan (USFWS 1998a).

Habitat use

Available information indicates that suitable habitat for the spinedace is characterized by clear, flowing pools with slow to moderate currents, moderate depths, and gravel substrates. Cover provided by undercut banks or large rocks is often a feature. Spinedace have also been found in pools and flowing water conditions over a variety of substrates, with or without aquatic vegetation, in turbid and clear water. Both mountain streams and lower-gradient streams and rivers have provided habitat for the spinedace. Residual pools and spring areas are important refuges during periods of normal low water or drought.

Current distribution

The spinedace historically occupied the Little Colorado River and its northward flowing tributaries off the Mogollon Rim and the White Mountains. Between 1939 and 1960, many spinedace populations were lost. Currently, spinedace is found in disjunct locations in the East Clear Creek watershed, Chevelon Creek, the upper Little Colorado River, and Silver Creek. Populations are small and undergo yearly fluctuations that make long-term assessment of population trends difficult to determine. Populations are known to be extant in all drainages listed above; however, no spinedace has been found in Silver Creek since 1997. Genetically, the spinedace populations in the first three drainages are separate sub-groups (genetic analysis on Silver Creek fish has not been done) and maintaining each group is important to conserve genetic variation.

Threats

Threats to the spinedace pose a significant challenge to the conservation of the species. Availability of habitats with permanent water in the drainages, particularly East Clear Creek and Chevelon drainages and below Nelson Reservoir is limited due to a variety of factors, including groundwater withdrawals, surface water diversions, dams controlling flows and continuing drought that reduces spring runoff that supports habitat.

The presence of nonnative fish species, both coldwater and warmwater species, and crayfish in spinedace habitats have negative effects on spinedace populations. The presence of nonnative species was a primary reason for listing the species, and the effects of these species on spinedace

through competition and predation varies. Some, such as channel catfish, black bullheads, yellow bullheads, green sunfish, largemouth bass, brown trout, and rainbow trout are likely predators, with fathead minnows, golden shiners, and rainbow trout also competing for food and space. Golden shiners were particularly mentioned as a problem in Chevelon Creek although they have been absent from surveys for the last decade. Crayfish may prey on and compete with spinedace, plus, their activities alter physical habitat conditions through removal of vegetation and burrowing in the substrate. The recent illegal stockings of largemouth bass, smallmouth bass, green sunfish, yellow bullhead, and yellow perch into headwater lakes in East Clear and Chevelon Creek drainages has added another layer of predators and competitors to the existing degraded condition of the biological environment.

Conservation actions

As part of their ongoing commitment to conservation for this species, AGFD is an active participant in implementation of the (species) recovery plan. To assist in the conservation of the spinedace, several actions and programs have been developed and are being implemented. These include (summarized from USFWS 2008f):

- Refuge and conservation populations for the three identified lineages have been developed. Refuge populations for two of the three lineages exist in the Arboretum at Flagstaff (East Clear Creek) and the Grasslands Wildlife Area (Little Colorado River). A refuge for the Chevelon population is under development at Winslow High School.

- Supplemental stocking into Bear, Dane, and Yeager canyons in the East Clear Creek drainage to expand population sites has been accomplished, other movement of spinedace from drying pools to what are hoped is more secure pools was done, and a new population was created in West Chevelon Creek through translocation in 2007.

- The East Clear Creek Watershed Recovery Strategy for spinedace and other riparian species identified activities to assist in recovery of spinedace and its habitats in the drainage. Improved livestock management, protection for headwater meadows, and other actions to protect and improve spinedace habitats have been completed and others will be implemented. Wildland Urban Interface (WUI) projects in East Clear Creek and Nutrioso Creek drainages assist in watershed rehabilitation and reduction in wildfire risks.

- AGFD has secured land and water rights in their Wildlife Areas (Becker, Chevelon, Grasslands, Sipes, and Wenima) that provide stream flows and refuge areas for the spinedace.

- Funding from a variety of sources has allowed for riparian restoration efforts along a portion of Nutrioso Creek occupied by spinedace. Additionally, a Safe Harbor Agreement on the EC Bar Ranch has provided some longer term management for this reach of occupied habitat.

- Research on genetic variation between spinedace populations has provided insights on management needs to maintain the extant lineages. Additional research on spinedace life

history and habitat requirements, spinedace/trout interactions, and effects to spinedace of crayfish have assisted in defining threats and identifying suitable habitats for translocation and future nonnative management actions.

Previous consultations

Section 7 consultations on spinedace include programmatic efforts for Forest Land Management Plans that address watershed management and multiple uses (livestock grazing, timber harvest, wildfire suppression, recreation, and other issues), and more site-specific efforts that are more focused on implementing recovery actions such as barrier construction and stream renovations. Biological opinions on actions potentially affecting spinedace may be found at our website www.fws.gov/southwest/es/arizona in the Section 7 Biological Opinion page of the Document Library.

Environmental baseline (in the action area)

Description of the action area

The action area for this consultation is the state of Arizona including the range of the spinedace. This encompasses the entire range of the species.

A. Status of the species and critical habitat within the action area

The status of the spinedace in the action area is essentially the same as the rangewide status.

B. Factors affecting the species' environment within the action area

The threats identified for the rangewide status of the species are affecting the spinedace and their habitats in the action area.

Loach minnow

Status of the species and critical habitat rangewide

Listing

Loach minnow was listed as a threatened species on October 28, 1986 (51 FR 39468, USFWS 1986b). Although it is currently listed as threatened, the FWS determined in 1994 that a petition to uplist the species to endangered status is warranted (USFWS 1994b). The FWS confirmed this decision in 2001 (USFWS 2001a). A reclassification proposal to list the species as endangered was published with the latest critical habitat proposal on October 28, 2010 (75 FR 66482, USFWS 2010j). Critical habitat was designated on March 21, 2007 (72 FR 13356, USFWS 2007e). Following a legal challenge to that designation, we filed a motion for voluntary remand to develop a new critical habitat proposal. The proposed rule for the new critical habitat designation was published on October 28, 2010 (75 FR 66482, USFWS 2010j). Those areas designated as critical habitat in the 2007 rule remain in place until a new designation can be finalized in October, 2011. For the purposes of this consultation, the loach minnow is a

threatened species with designated critical habitat, and a species proposed for endangered status with proposed critical habitat.

In Arizona, the current designation (USFWS 2007e) includes portions of the East Fork Black River, North Fork East Fork Black River, and Boneyard Creek; Aravaipa Creek and its tributaries Deer and Turkey creeks; the San Francisco River, Eagle Creek, and the Blue River and its tributaries, Campbell Blue Creek and Little Blue Creek. In New Mexico, the current designation includes portions of the Blue River; the San Francisco River and its tributary Whitewater Creek; the Tularosa River and its tributary, Negrito Creek; Campbell Blue Creek; Dry Blue Creek and its tributaries Frieborn and Pace creeks; the Gila River, including portions of its West, Middle, and East forks.

The October 28, 2010, proposed rule for critical habitat included all the designated critical habitat reaches and new sites in several drainages (USFWS 2010j). In the Verde River, critical habitat was proposed for the loach minnow on the mainstem from Sullivan Lake to the confluence with Wet Beaver Creek, the lower two miles of Granite Creek above its confluence with the Verde River, 33 .7 miles of Oak Creek upstream from its confluence with the Verde River, 20.8 miles of Beaver Creek and Wet Beaver Creek upstream from the Beaver Creek confluence with the Verde River, and 4.7 miles of Fossil Creek from its confluence with the Verde River. Of these proposed critical habitat areas, only Fossil Creek may contain loach minnow at the present time if they move out of the stocking reach above the critical habitat boundary.

The PBFs for the October 28, 2010, proposed critical habitat for loach minnow are:

1. Habitat to support all egg, larval, juvenile, and adult loach minnow. This habitat includes perennial flows with a stream depth of generally less than 1 m (3.3 ft), and with slow to swift flow velocities between 0 and 80 cm per second (0.0 and 31.5 in. per second). Appropriate microhabitat types include pools, runs, riffles, and rapids over sand, gravel, cobble, and rubble substrates with low or moderate amounts of fine sediment and substrate embeddedness. Appropriate habitats have a low stream gradient of less than 2.5 percent, are at elevations below 2,500 m (8,202 ft). Water temperatures should be in the general range of 8.0 to 25.0 °C (46.4 to 77 °F);

2. An abundant aquatic insect food base consisting of mayflies, true flies, black flies, caddisflies, stoneflies, and dragonflies;

3. Streams with no or no more than low levels of pollutants;

4. Perennial flows, or interrupted stream courses that are periodically dewatered but that serve as connective corridors between occupied or seasonally occupied habitat and through which the species may move when the habitat is wetted;

5. No nonnative aquatic species, or levels of nonnative aquatic species that are sufficiently low to allow persistence of loach minnow; and

6. Streams with a natural, unregulated flow regime that allows for periodic flooding or, if flows are modified or regulated, a flow regime that allows for adequate river functions, such as flows capable of transporting sediments.

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the loach minnow. This information was taken from the 2007 critical habitat designation (USFWS 2007e) and the 2008 Species Assessment and Listing Priority Assignment Form developed for the annual Candidate Notice of Review (USFWS 2008g) and literature cited therein. Information in these documents is incorporated by reference.

Life history

Loach minnow is a small fish from the minnow family Cyprinidae. Loach minnow are olivaceous in color, and highly blotched with darker spots. Whitish spots are present at the front and back edges of the dorsal fin, and on the dorsal and ventral edges of the caudal fin. A black spot is usually present at the base of the caudal fin. Breeding males have bright red-orange coloration at the bases of the paired fins and on the adjacent body, on the base of the caudal lobe, and often on the abdomen. Breeding females are usually yellowish on the fins and lower body.

Loach minnow live two to three years with reproduction occurring primarily in the second summer of life. Spawning occurs March through May; however, under certain circumstances loach minnow also spawn in the autumn. The eggs of loach minnow are attached to the underside of a rock that forms the roof of a small cavity in the substrate on the downstream side. Limited data indicate that the male loach minnow may guard the nest during incubation.

Loach minnow feeds exclusively on aquatic insects

Habitat use

Loach minnow is a bottom-dwelling inhabitant of shallow, swift water over gravel, cobble, and rubble substrates. Loach minnow uses the spaces between, and in the lee of, larger substrate for resting and spawning. It is rare or absent from habitats where fine sediments fill the interstitial spaces. Some studies have indicated that the presence of filamentous algae may be an important component of loach minnow habitat.

Current distribution

Loach minnow is endemic to the Gila River basin of Arizona and New Mexico within the United States, and Sonora, Mexico, where it was recorded only in the Rio San Pedro. Currently, in Arizona there are populations in the Black, Blue, San Francisco, and White rivers, and in Aravaipa and Eagle creeks. Loach minnow have not been found in the Black River drainage since 2005. In New Mexico, there are populations in the upper Gila, San Francisco, and Tularosa rivers. Reintroduced populations also exist in Arizona.

Threats

Threats to loach minnow were summarized in the 2008 Species Assessment and Listing Priority Assignment Form for the annual Candidate Notice of Review (USFWS 2008g). Threats include loss of habitat due to groundwater pumping, surface water diversions, impoundments, improperly managed livestock grazing, wildfire, land conversion for mining, agriculture or urban developments, and the introduction of nonnative invertebrates, amphibians (bullfrogs), and fish that compete with, prey on, or transmit novel parasites or diseases to loach minnow. As recently demonstrated, wildfire is also a threat to loach minnow and the quality of its habitat.

Conservation actions

Ongoing conservation actions for the loach minnow are provided by the Central Arizona Project Gila River Basin Native Fishes Conservation Program (CAP Program). The CAP Program is federally funded and implements surveys and monitoring, barrier construction with subsequent renovations to remove nonnative fish species and stocking of loach minnow and other native species, and collection of loach minnow for hatchery-rearing to provide individuals for repatriation. Stocking of loach minnow into Fossil Creek, Muleshoe Ecosystem (Hot Springs and Redfield Canyon), and Bonita Creek have proceeded under the Program. Augmentations with additional fish will occur for the next several years. Monitoring will be conducted at each of these sites to determine if populations ultimately become established at these new locations. Loach minnow are also a covered species in the Horseshoe-Bartlett HCP (SRP 2008).

The recently completed sportfish consultation (USFWS 2011a) contains a suite of required conservation measures for loach minnow that will be implemented over the next 10 years. These measures include additional surveys, and securing populations of loach minnow within its historical range in Arizona.

Previous consultations

Section 7 consultations on loach minnow include programmatic efforts for Forest Land Management Plans that address watershed management and multiple uses (livestock grazing, timber harvest, recreation, and other issues), and more site-specific efforts that are more focused on road crossings, water withdrawals, and implementing recovery actions such as barrier construction and stream renovations. Biological opinions on actions potentially affecting loach minnow may be found at our website www.fws.gov/southwest/es/arizona in the Section 7 Biological Opinion page of the Document Library.

Environmental baseline (in the action area)

Description of the Action Area

The action area for this consultation is the state of Arizona, encompassing all natural and reintroduced loach minnow populations within the state and loach minnow populations held in captivity. The loach minnow population on the WMAT in the White River may not be affected by AGFD activities, but it is included for completeness. The New Mexico populations are not included in the action area as AGFD would be using CAP funds for any work on those populations. Those activities are not part of this consultation.

A. Status of the species within the action area

The status of the loach minnow in the action area is essentially the same as the rangewide status.

B. Factors affecting the species' environment within the action area

The threats identified for the rangewide status of the species are affecting the loach minnow and their habitats in the action area.

Razorback sucker

Status of the species and critical habitat rangewide

Listing

The proposed rule to list the species as endangered was published on May 22, 1990, and the final rule published on October 23, 1991 (56 FR 54957, USFWS 1991a). Critical habitat was designated in 15 river reaches in the historical range of the razorback sucker on March 21, 1994 (59 FR 13374; USFWS 1994a). Critical habitat included portions of the Colorado, Duchesne, Green, Gunnison, San Juan, White, and Yampa rivers in the Upper Colorado River Basin, and the Colorado, Gila, Salt, and Verde rivers in the Lower Colorado River Basin.

The biological support document (Maddux et al. 1993) discusses in depth how each reach contributes to the physical and biological factors (PBFs). The PBFs are:

- Water- This includes a quantity of water of sufficient quality (i.e., temperature, dissolved oxygen, lack of contaminations, nutrients, turbidity, etc.) that is delivered to a specific location in accordance with a hydrologic regime that is required for the particular life stage.

- Physical habitat- this includes areas of the Colorado River system that are inhabited by fish or potentially habitable for use in spawning, nursery, feeding, rearing, or corridors between these areas. In addition to river channels, these areas also include bottomlands, side channels, secondary channels, oxbows, backwaters, and other areas in the 100-year floodplain, which, when inundated, provide spawning, nursery, feeding, and rearing habitats.

- Biological environment- Food supply, predation, and competition are important elements of the biological environment and are considered components of this constituent element. Food supply is a function of nutrient supply, productivity, and availability to each life stage of the species. Predation, although considered a normal component of this environment, may be out of balance due to introduced fish species in some areas. This may also be true of competition, particularly from nonnative fish species.

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the razorback sucker. This information was taken from the 2002 Recovery Goals (USFWS 2002e), and the Lower Colorado River Multi-Species Conservation Program Species Status documents (LCR MSCP 2005) and references cited therein. Information in these documents is incorporated by reference.

Life history

This native sucker is distinguished from all others by the sharp-edged, bony keel that rises abruptly behind the head. The body is robust with a short and deep caudal peduncle. The razorback sucker may reach lengths of 3.3 feet and weigh 11 to 13 pounds. Adult fish in Lake Mohave reached about half this maximum size and weight.

Razorback sucker diet varies depending on life stage, habitat, and food availability. Larvae feed mostly on phytoplankton and small zooplankton and, in riverine environments, on midge larvae. Diet of adults taken from riverine habitats consisted chiefly of immature mayflies, caddisflies, and midges, along with algae, detritus, and inorganic material.

Adults can live 45-50 years and, once reaching maturity between two and seven years of age, apparently produce viable gametes even when quite old. The ability of razorback suckers to spawn in a variety of habitats, flows, and over a long season are also survival adaptations. In the event of several consecutive years with little or no recruitment, the demographics of the population might shift, but future reproduction would not be compromised. Spawning takes place in the late winter to early summer depending upon local water temperatures. Spawning habitat is most commonly over mixed cobble and gravel bars on or adjacent to riffles.

Habitat use

Adult razorback suckers use most of the available riverine habitats, although there may be an avoidance of whitewater type habitats. Main channel habitats used tend to be low velocity ones such as pools, eddies, nearshore runs, and channels associated with sand or gravel bars. Adjacent to the main channel, backwaters, oxbows, sloughs, and flooded bottomlands are also used by this species. From studies conducted in the upper Colorado River basin, habitat selection by adult razorback suckers changes seasonally. They move into pools and slow eddies from November through April, runs and pools from July through October, runs and backwaters during May, and backwaters, eddies, and flooded gravel pits during June. In early spring, adults move into flooded bottomlands. They use relatively shallow water (ca. three feet) during spring, and deeper water (five to six feet) during winter.

Current distribution

The razorback sucker was once abundant in the Colorado River and its major tributaries throughout the Basin, occupying 3,500 miles of river in the United States and Mexico. It now occurs in portions of the upper Colorado, Duchesne, Green, Gunnison, White, and Yampa rivers in the Upper Basin and in the lower Colorado River from Grand Canyon down to Imperial Dam and in the Verde River.

Threats

Construction of dams, reservoirs, and diversions destroyed, altered, and fragmented habitats needed by the sucker. Channel modifications reduced habitat diversity, and degradation of riparian and upland areas altered stream morphology and hydrology. Finally, invasion of these degraded habitats by a host of nonnative predacious and competitive species has created a hostile environment for razorback sucker larvae and juveniles. Although the suckers bring off large spawns each year and produce viable young, the larvae are largely eaten by the nonnative fish species.

Conservation actions

The range-wide trend for the razorback sucker is a continued decrease in wild populations due to a lack of sufficient recruitment and the loss of old adults due to natural mortality. Stocking and other recovery efforts by the UCRBRIP are ongoing and information on those actions is available at their website. The LCR MSCP is also implementing conservation actions for the species which include stocking, research, and monitoring.

Since 1997, significant new information on recruitment to the wild razorback sucker population in Lake Mead has been developed (Albrecht et al. 2008) that indicates some degree of successful recruitment is occurring. This degree of recruitment has not been documented elsewhere in the species remaining populations.

Reintroduction efforts continue in the Verde River by AGFD. Very few razorback suckers were recaptured from these efforts. The Horseshoe-Bartlett HCP (SRP 2008) contains conservation actions to be implemented in the Verde River for the razorback sucker, including funding for continued stocking of the species.

Previous consultations

Section 7 consultations on razorback sucker include consultations on large-scale water management activities. The UCRBRIP addresses the effects of such consultations on the species and provides conservation to offset the effects. In the lower Colorado River, the LCR MSCP addresses effects of water management and provides conservation to offset effects. Smaller site-specific consultations address channelization, recreational development, and implementing recovery actions. Biological opinions on actions potentially affecting razorback sucker in Arizona may be found at our website www.fws.gov/southwest/es/arizona in the Section 7 Biological Opinion page of the Document Library.

Environmental baseline (in the action area)

Description of the action area

The action area for this consultation is the state of Arizona including all rivers were the razorback sucker was historically stocked and the Colorado River from Glen Canyon to the Southerly International Boundary with Mexico. This represents the potential range of the species

in Arizona and adjacent portions of California and Nevada. Since activities by AGFD along the Colorado River are coordinated with the wildlife agencies of the adjacent states, activities that may affect the razorback sucker can occur anywhere on the river or lakes Mead, Mohave and Havasu.

A. Status of the species and critical habitat within the action area

The status of the razorback sucker in the action area is essentially the same as the rangewide status.

B. Factors affecting the species' environment within the action area

The threats identified for the rangewide status of the species are affecting the razorback sucker and their habitats in the action area.

Roundtail chub

Status of the species rangewide

Listing

Roundtail chub in the Lower Colorado River basin became a candidate species under the Act on July 7, 2009 (74 FR 32352, (USFWS 2009d).

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the roundtail chub. This information was taken from the 2010 report for the Candidate Notice of Review (USFWS 2010k), which was developed from the 2009, 12-month finding (USFWS 2009d) and references therein. Information in these documents is incorporated by reference.

Life history

Spawning has been documented from 57 to 75 °F (14 to 24 °C) from February through June in pool, run, and riffle habitats, with slow to moderate water velocities. Roundtail chubs live for five to seven years and spawn from age two on. Roundtail chubs are omnivores, consuming foods proportional to their availability, including aquatic and terrestrial invertebrates, aquatic plants, detritus, and fish and other vertebrates; algae and aquatic insects can be major portions of the diet.

Habitat use

Roundtail chubs in the lower Colorado River basin are found in cool to warm waters of rivers and streams, and often occupy the deepest pools and eddy of large streams. Although roundtail chubs are often associated with various cover features such as boulders, vegetation, and undercut

banks, they are less likely to use cover than other related species such as the headwater chub and Gila chub.

Current distribution

The roundtail chub is found in the upper and lower Colorado River basins; however, the candidate entity is the Distinct Population Segment (DPS) in the lower Colorado River basin of Arizona and New Mexico (USFWS 2009d). Streams containing roundtail chub in the DPS are found in five separate drainages that are isolated from one another (the Little Colorado River, Bill Williams River, Gila River, Salt River, and Verde River), and occupied streams within the drainages have varying amounts of connectivity between them.

Roundtail chub in the lower Colorado River basin in Arizona currently occurs in two tributaries of the Little Colorado River; eight tributaries of the Bill Williams River; the Salt River and 10 of its tributaries; the Verde River and five of its tributaries; Aravaipa Creek (a tributary of the San Pedro River); Eagle Creek (a tributary of the Gila River); and in New Mexico, in the upper Gila River (USFWS 2010k). The Salt and Verde rivers are occupied in several reaches that are fragmented and isolated by two large dams and reservoirs on the Verde River, and four large dams and reservoirs on the Salt River. Roundtail chubs also occur in canals in Phoenix that are fed by the lower Salt and Verde Rivers.

Threats

Threats to the roundtail chub are fully examined in the 12-month finding (USFWS 2009d) and in the 2010 candidate assessment (USFWS 2010k). The information in those documents is incorporated herein by reference. Major threats include loss of habitat due to dewatering of rivers and streams and the introduction of nonnative predators and competitors.

Conservation actions

The AGFD initiated and leads the ''Arizona Statewide Conservation Agreement for Roundtail Chub (*Gila robusta*), Headwater Chub (*Gila nigra*), Flannelmouth Sucker (*Catostomus latipinnis*), Little Colorado River Sucker (*Catostomus* spp.), Bluehead Sucker (*Catostomus discobolus*), and Zuni Bluehead Sucker (*Catostomus discobolus yarrowi*)'' (AGFD 2006). Recent conservation actions implemented by signatories to the plan are detailed in USFWS (2010) and listed below.

- Acquisition of lands within the upper and middle Verde River by The Nature Conservancy and AGFD that assist in protection of instream flows and adjacent riparian areas.

- Acquisition of lands in Arivaipa Canyon by The Nature Conservancy to enhance flows and restore aquatic habitats for native fish including roundtail chub.

- Efforts by the U.S. Forest Service, AGFD, and SRP to protect stream flows in Cherry Creek and on the Verde River

- Creation of two new roundtail chub populations in Ash Creek and Roundtree Canyon by AGFD.

- Establishment of broodstocks and refugia at AGFD's Bubbling Ponds State Fish Hatchery of Verde River and Eagle Creek roundtail chub for use in restoration projects funded through the agreement partners.

- The Gila River Basin Native Fishes Conservation Program projects such as Fossil Creek that provide benefits to roundtail chub as part of the benefits to target species.

- Roundtail chub is a covered species under the Horseshoe-Bartlett HCP (SRP 2008) and some recent conservation actions are related to this HCP and undertaken with SRP funding by AGFD.

The recently completed sportfish consultation (USFWS 2011a) contains a suite of required conservation measures for roundtail chub that will be implemented over the next 10 years. These measures include additional surveys, and securing populations of roundtail chub within its historical range in Arizona.

Previous consultations

The roundtail chub is a candidate for listing under the Act and as such is not subject to the consultation requirements of section 7 for activities of Federal agencies. Federal agencies may, at their discretion, include consideration for candidate species in their environmental compliance under the Act. However, it is the policy of the USFWS that candidate species are considered in intra-Service consultations on USFWS actions, including funding activities of other entities such as AGFD. The species was considered the intra-Service consultation on Federal funding of sportfish stocking in Arizona (USFWS 2011a).

Environmental baseline (in the action area)

Description of the action area

The action area for this consultation is the state of Arizona including the range of the DPS of roundtail chub. The portion of the DPS in New Mexico is also included in the action area since there may be cooperative actions taken by AGFD for roundtail chub in the upper Gila River in New Mexico that may use SWG funds.

A. Status of the species within the action area

The status of the roundtail chub in the action area is essentially the same as the rangewide status for the DPS.

B. Factors affecting the species' environment within the action area

The threats identified for the rangewide status of the species are affecting the roundtail chub and their habitats in the action area.

Sonora chub

Status of the species and critical habitat rangewide

Listing history

The Sonora chub was listed rangewide (United States and Mexico) as a threatened species with designated critical habitat in the United States on April 30, 1986 (51 FR 16042, USFWS 1986c). A recovery plan was completed in 1992 (USFWS 1992b).

Critical habitat for the Sonora chub consists of Sycamore Creek from Hank and Yank Spring downstream to the Southerly International Boundary with Mexico, the lower two kilometers of Peñasco Creek (a tributary to Sycamore Creek draining from the east), and the bottom 0.4 kilometer of an unnamed tributary to Sycamore Creek draining from the west and joining the creek upstream of the confluence with Peñasco Creek. The critical habitat contains a 25 foot wide riparian area along each side of Sycamore Creek and Peñasco Creek. There were no primary constituent elements identified for the critical habitat; however the final rule (USFWS 1986c) discussed the types of activities that could modify critical habitat, implying that these were critical elements. Those activities area summarized below:

- Any activity that depletes flows or significantly alters the natural flow regime in the critical habitat reaches.
- Any activity that would extensively alter the channel morphology of the critical habitat reaches.
- Any activity that would significantly alter the water chemistry of the critical habitat reaches.
- Any activity that introduced exotic fish (and associated parasites) to the critical habitat reaches.

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the species. This information was taken from the final rule (USFWS 1986c), the recovery plan (USFWS 1992b), and most recently updated in the biological opinion for the Montana Allotment (USFWS 2001b) and references cited therein.

Life history

The Sonora chub is a small minnow with a maximum length of 200mm (7.8 inches) although most individuals do not exceed 150 mm (5.0 inches). Breeding individuals are brilliantly colored, and spawning takes place at multiple times over the spring and summer, most likely in

response to floods or freshets during rainstorms. Sonora chub are omnivorous, taking advantage of seasonally available resources.

Habitat use

Sonora chub are stream-dwellers and prefer riverine habitats although during periods of low water it is found in pools adjacent to or near areas of swift current, usually with sand and gravel substrates. They are adept at exploiting small, marginal habitats and they are able to maneuver upstream past small waterfalls and other obstructions to recolonize areas during wet seasons.

Current distribution

At the time of listing, the Sonora chub was known in the United States in Sycamore Creek from Yanks Springs and the lower portion of two tributaries to the creek to the Southerly International Boundary. Sycamore Creek is part of the headwaters of the Rio Altar, a tributary of the Rio Magdalena in Mexico. Sonora chub were also known from the Rio Altar and the Rio Magdalena at the time of listing. In 1995, Sonora chub were documented in the lower two miles of California Gulch, a separate tributary to the Rio Altar west of Sycamore Creek. In 2010, Sonora chub were illegally introduced into Ronquillo Tank in the Peña Blanca watershed. This is outside of the historical range of the species. While present in Ronquillo Tank, these Sonora chub may be exposed to nonnative species or diseases that may preclude their return to Sycamore Creek.

Threats

Threats to the Sonora chub include loss or degradation to habitat by mining, improper livestock grazing, and the introduction of nonnative species (fish, bullfrogs) into its habitats. A number of nonnative species, including bullfrogs, mosquitofish, goldfish, black bullhead, channel catfish, bluegill, green sunfish, and largemouth bass have been recorded from occupied Sonora chub habitats in the United States and Mexico (Douglas 2009). Green sunfish and mosquitofish were identified as present in Sycamore Canyon in the final rule (USFWS 1986c). Bullfrogs, mosquitofish, black bullheads, bluegill and green sunfish were identified in California Gulch in 1995 (USFWS 2001b) when Sonora chub were located there. Largemouth bass are also known from California Gulch. The origin of these nonnative species is unclear; however, there are private ponds in the California Gulch and Sycamore Canyon watersheds that contain nonnative species that are the likely sources of these nonnatives.

The 2011 Murphy Fire burned a portion of the eastern watershed of Sycamore Creek. Post-fire runoff from the burned area may introduce ash and sediment into the occupied habitat and parts of designated critical habitat. The extent of these effects is unknown at this time.

Conservation actions

Conservation actions for the Sonora chub have focused on habitat protection, including the construction of a bridge at the Ruby Road crossing of Sycamore Creek, stabilization of the tank at Yank Spring, and livestock exclosures and managed livestock grazing along California Gulch.

Previous consultations

Section 7 consultations on Sonora chub include programmatic efforts for Forest Land Management Plans that address watershed management and multiple uses (livestock grazing, timber harvest, recreation, and other issues) and conservation actions. Biological opinions on actions potentially affecting Sonora chub may be found at our website www.fws.gov/southwest/es/arizona in the Section 7 Biological Opinion page of the Document Library.

Environmental baseline (in the action area)

Description of the action area

The action area for this consultation is the state of Arizona including the range of the Sonora chub in Santa Cruz County, Arizona. The occupied habitat in Mexico is also included in the action area as activities by AGFD for this species may occur in Mexico.

A. Status of the species and critical habitat within the action area

The status of the Sonora chub in the action area is essentially the same as the rangewide status.

B. Factors affecting the species' environment within the action area

The threats identified for the rangewide status of the species are affecting the Sonora chub and their habitats in the action area.

Spikedace

Status of the species and critical habitat rangewide

Listing

Spikedace was listed as a threatened species on July 1, 1986 (51 FR 23769, USFWS 1986d). Although it is currently listed as threatened, the FWS determined in 1994 that a petition to uplist the species to endangered status is warranted (USFWS 1994b). The FWS confirmed this decision in 2001 (USFWS 2001a). A reclassification proposal to list the species as endangered was published with the latest critical habitat proposal on October 28, 2010 (USFWS 2010j). For the purposes of this consultation, the spikedace is a threatened species with designated critical habitat, and a species proposed for endangered status with proposed critical habitat.

Critical habitat was designated on March 21, 2007 (72 FR 13356, USFWS 2007e). Critical habitat includes portions of the Verde; middle Gila, lower San Pedro, and upper Gila rivers, and Aravaipa Creek, as well as several tributaries of those streams. Following a legal challenge to that designation, we filed a motion for voluntary remand and are currently re-evaluating critical habitat. However, those areas designated as critical habitat in the 2007 rule remain in place until a new designation can be finalized in October 2011. The new critical habitat proposal was published on October 28, 2010 (75 FR 66482, USFWS 2010j).

The PBFs for the October 28, 2010, proposed critical habitat for spikedace and loach minnow are:

1. Habitat to support all egg, larval, juvenile, and adult spikedace. This habitat includes perennial flows with a stream depth generally less than 1 m(3.3 ft), and with slow to swift flow velocities between 5 and 80 cm per second (1.9 and 31.5 in. per second). Appropriate stream microhabitat types include glides, runs, riffles, the margins of pools and eddies, and backwater components over sand, gravel, and cobble substrates with low or moderate amounts of fine sediment and substrate embeddedness. Appropriate habitat will have a low gradient of less than approximately 1.0 percent, at elevations below 2,100 m (6,890 ft). Water temperatures should be in the general range of 8.0 to 28.0 °C (46.4 to 82.4 °F);

2. An abundant aquatic insect food base consisting of mayflies, true flies, black flies, caddisflies, stoneflies, and dragonflies;

3. Streams with no or no more than low levels of pollutants;

4. Perennial flows, or interrupted stream courses that are periodically dewatered but that serve as connective corridors between occupied or seasonally occupied habitat and through which the species may move when the habitat is wetted;

5. No nonnative aquatic species, or levels of nonnative aquatic species that are sufficiently low as to allow persistence of spikedace;

6. Streams with a natural, unregulated flow regime that allows for periodic flooding or, if flows are modified or regulated, a flow regime that allows for adequate river functions, such as flows capable of transporting sediments.

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the spikedace. This information was taken from the 2009 candidate assessment form (USFWS 2009e), and proposed rule for critical habitat and reclassification to endangered (USFWS 2010j) and references cited therein. Information in these documents is incorporated by reference.

Life history

Spikedace is a small silvery fish whose common name alludes to the well-developed spine in the dorsal fin. Spikedace spawns from March through May with some yearly and geographic variation. Actual spawning has not been observed in the wild, but spawning behavior and captive studies indicate eggs are laid over gravel and cobble where they adhere to the substrate. Spikedace live about two years with reproduction occurring primarily in one-year old fish. It feeds primarily on aquatic and terrestrial insects.

Habitat use

Spikedace live in flowing water with slow to moderate velocities over sand, gravel, and cobble substrates. Specific habitat for this species consists of shear zones where rapid flow borders slower flow, areas of sheet flow at the upper ends of mid-channel sand/gravel bars, and eddies at the downstream riffle edges.

Current distribution

Spikedace historically occurred throughout the mid-elevations of the Gila River drainage, but is currently known only from the middle, and upper Gila River in New Mexico, and Aravaipa and Eagle creeks in Arizona. The species also occurs in the upper Verde River, but appears to be declining in numbers. It has not been documented in the Verde River since 1999 despite annual surveys, and additional survey work is needed to determine its current status.

The status of spikedace is declining rangewide. It is now restricted to approximately 10 to 15 percent of its historical range. Within occupied areas, it is common to very rare, but is presently common only in Aravaipa Creek and some parts of the upper Gila River in New Mexico. Although it is currently listed as threatened, the FWS has found that a petition to uplist the species to endangered status is warranted. A reclassification proposal was included in the October 28, 2010 proposed critical habitat.

Threats

Threats to spikedace were summarized in the 2009 species assessment (USFWS 2009f). Habitat destruction along with competition and predation from introduced nonnative species are the primary causes of the species decline. Threats include loss of habitat due to groundwater pumping, surface water diversions, impoundments, improperly managed livestock grazing, wildfire, land conversion for mining, agriculture or urban developments, and the introduction of nonnative invertebrates, amphibians, and fish that compete with, prey on, or transmit novel parasites or diseases to spikedace.

Conservation actions

Ongoing conservation actions for the spikedace are provided by the Central Arizona Project Gila River Basin Native Fishes Conservation Program (CAP Program). The CAP Program is federally funded and implements surveys and monitoring, barrier construction with subsequent renovations to remove nonnative fish species and stocking of spikedace and other native species, and collection of spikedace for hatchery-rearing to provide individuals for repatriation. Stocking of spikedace into Fossil Creek (a tributary of the Verde River), Muleshoe Ecosystem sites, and Bonita Creek have proceeded under the Program. Stocking of spikedace into the San Francisco River near Glenwood, New Mexico was initiated in 2008. Spikedace are also a covered species under the Horseshoe-Bartlett HCP (SRP 2008).

Previous consultations

Section 7 consultations on spikedace deal with the effects of road and bridge construction and maintenance, grazing, water developments, fire, utilities development and maintenance, species control efforts, restoration of habitat and species, or recreation. There are a high number of consultations for urban development and utilities, however, these projects typically do not result in adverse effects to the species but are for technical assistance only. Small numbers of projects occur for timber, land acquisition, agriculture, sportfish stocking, flooding, Habitat Conservation Planning, native fish restoration efforts, alternative energy development, and mining. Biological opinions on actions potentially affecting spikedace may be found at our website www.fws.gov/southwest/es/arizona in the Section 7 Biological Opinion page of the Document Library.

Environmental baseline (in the action area)

Description of the Action Area

The action area for this consultation is the state of Arizona, encompassing all natural and reintroduced spikedace populations within the state and spikedace populations held in captivity. The New Mexico populations are not included in the action area as AGFD would be using CAP funds for any work on those populations. Those activities are not part of this consultation.

A. Status of the species within the action area

The status of the spikedace in the action area is essentially the same as the rangewide status.

B. Factors affecting the species' environment within the action area

The threats identified for the rangewide status of the species are affecting the spikedace and their habitats in the action area.

Virgin River chub

Status of the species and critical habitat rangewide

Listing history

The Virgin River chub was listed as an endangered species on August 24, 1989 (54 FR 35305, USFWS 1989a). Only the population in the Virgin River is listed; the Muddy River population was not considered to be the same subspecies as the Virgin River population at the time of listing. Critical habitat was designated on January 26, 2000 (65 FR 4140, USFWS 2000) and includes 87.5 miles of the Virgin River and its associated 100-year flood plain, extending from the confluence of La Verkin Creek, Utah, to Halfway Wash, Nevada.

The physical and biological factors (PBFs) of critical habitat determined necessary for the survival and recovery of the Virgin River chub are water, physical habitat, and biological environment. The desired conditions for each of these elements are further discussed below:

Water:

A sufficient quantity and quality of water (i.e., temperature, dissolved oxygen, contaminants, nutrients, turbidity, etc.) that is delivered to a specific location in accordance with a hydrological regime that is identified for the particular life stage for each species. This includes the following:

1 Water quality characterized by naturally seasonally variable temperature, turbidity and conductivity;

2 Hydrologic regime characterized by the duration, magnitude, and frequency of flow events capable of forming and maintaining channel and instream habitat necessary for particular life stages at certain times of the year; and

3 Flood events inundating the floodplain necessary to provide the organic matter that provides or supports the nutrient and food sources of the listed fishes.

Physical habitat:

Areas of the Virgin River that are inhabited or potentially habitable by a particular life stage for each species, for use in spawning, nursing, feeding, and rearing, or corridors between such areas.

For Virgin River chub these habitats include the following:

1 River channels, side channels, secondary channels, backwaters, and springs, and other areas which provide access to these habitats; and

2 Areas with slow to moderate velocities, within deep runs or pools, with predominantly sand substrates, particularly habitats which contain boulders or other instream cover.

Biological environment:

Food supply, predation, and competition are important elements of the biological environment and are considered components of this constituent element. Food supply is a function of nutrient supply, productivity, and availability to each life stage. Predation and competition, although considered normal components of this environment, are out of balance due to non-native fish species in many areas. For both species, a properly functioning biological environment contains:

1 Seasonally flooded areas that contribute to the biological productivity of the river system by producing allochthonus (humus, silt, organic detritus, colloidal matter, and plants and animals produced outside the river and brought into the river) organic matter which provides and supports much of the food base of the listed fishes; and

2 Few or no predatory or competitive non-native species in occupied Virgin River fishes' habitats or potential reintroduction sites.

The entire designated critical habitat is essential for the conservation of the Virgin River chub.

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the species. This information was taken from the Virgin River Fishes Recovery Plan (USFWS 1995c) updated with species status information from the 5-year review (USFWS 2008h) and recent biological opinions on management actions for the species (USFWS 2010l) and literature cited therein. Information in these documents is incorporated by reference.

Life history

The Virgin River chub is omnivorous, showing considerable dietary shifts with age. Young fish feed almost entirely on macro-invertebrates while adults feed almost exclusively on algae and debris. Spawning is known to occur in the spring, and ripe females have been reported during the months of April, May, and June. Good spawning years appear to coincide with good spawning years for woundfin. It is likely that Virgin River chub live for many years, perhaps for decades, but they mature rapidly and probably spawn in their second or third year of life.

Habitat use

The Virgin River chub is most often associated with deep runs or pool habitats of slow to moderate velocities with large boulders or instream cover, such as root snags. Adults and juveniles are often associated together within these habitats; however, the larger adults are collected most often in the deeper pool habitats within the river.

Current distribution

Virgin River chub are currently found in the Virgin River in Utah, Arizona, and Nevada, with the majority of the population in Utah and Arizona.

Threats

Threats to Virgin River chub include loss of habitat due to surface water and groundwater diversions from the Virgin River in Utah, Arizona, and Nevada. The spread of nonnative fish into the Virgin River had significant adverse effects on the species. Red shiner and most other potential predators and competitors have been largely eliminated from the Virgin River in Utah through conservation actions.

Conservation actions

The Virgin River Fishes Recovery Team monitors the native fish community in the Virgin River in the spring and fall and has done so for over 25 years. Additional funding for monitoring in Arizona and Nevada is provided by Southern Nevada Water Authority and other partners with the Lower Virgin River Recovery Implementation Team. The Utah Virgin River Resource Management and Recovery Program (Program) was established in 2002 and has implemented numerous recovery actions including barrier construction, protection of instream flows,

monitoring, and renovations to remove nonnative fish species. Work by the Program has moved into Arizona with the construction of the Virgin River Gorge Fish Barrier and planned efforts to renovate the reach of the river upstream of the barrier to the Arizona-Utah border. Virgin River chub are included in the Habitat Conservation Plan under development for the Nevada reach of the river.

Stocks of Virgin River chub are held at Dexter National Fish Hatchery and Technology Center for propagation and release into historical habitats.

Previous consultations

The Virgin River chub is found in three states: Arizona, Nevada, and Utah. Consultations on effects to these species are completed by three FWS Ecological Services Offices based on the location of the proposed action. In Utah, consultations address water-resource issues and implementation of recovery actions under the Program. In Arizona and Nevada, land-management, flood-control, and recovery actions sponsored by the Recovery Team are generally the topics for consultation. Biological opinions on actions potentially affecting Virgin River chub in Arizona may be found at our website www.fws.gov/southwest/es/arizona in the Section 7 Biological Opinion page of the Document Library.

Environmental baseline (in the action area)

Description of the action area

The action area for this consultation is the state of Arizona and the Virgin River in Utah, Arizona, and Nevada. Owing to the cooperative actions taken by the Virgin River Fishes Recovery Team, AGFD personnel using funding from WSFR may implement monitoring or other activities anywhere in the occupied range of the species.

A. Status of the species and critical habitat within the action area

The status of the Virgin River chub in the action area is essentially the same as the rangewide status.

B. Factors affecting the species' environment within the action area

The threats identified for the rangewide status of the species are affecting the Virgin River chub and its habitats in the action area.

Virgin spinedace

Status of the species rangewide

Listing history

The Virgin spinedace was proposed for listing as threatened on May 18, 1994 (59 FR37688, USFWS 1994c) and critical habitat was proposed in 1995 along with that for the woundfin and

Virgin River chub on April 5, 1995 (60 FR 17296, USFWS 1995d). The proposed rules for listing and critical habitat designation for Virgin spinedace were withdrawn on February 6, 1996 (61 FR 4401, USFWS 1996b) when the Virgin Spinedace Conservation Agreement and Strategy (VSCAS) was signed and implementation began to reduce threats to the species that otherwise would warrant its listing under the Act. The VSCAS was updated in 2002 (UDWR 2002) and an agreement to continue implementation through February, 2019 was signed in 2009 (UDWR 2009).

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the species. This information was taken from the VSCAS (UDWR 2002) and the assessment of progress under the VSCAS for 2000-2008 (UDWR 2008) and more recent survey information available on its status in Arizona (BioWest 2011) and references cited therein. Information in these documents is incorporated by reference.

Life history

The Virgin spinedace can reach 80-120 mm (3 to 5 inches) in length and have a broad, flat, silvery body with the first two fin rays on the dorsal fin fused and hardened and a similar structure in the pelvic fin. Virgin spinedace live about three years, and reach sexual maturity in one year. Populations are mostly comprised of young-of-the-year and age-1 fish. Spawning occurs April through June, with the few age-2 and age-3 fish having higher fecundity than the more numerous age-1 spawners. Virgin spinedace feed primarily on aquatic insects.

Habitat use

The Virgin spinedace are typically found in clear, cool, swift streams that have interspersed pools, runs, and riffles. They are most often found in pools with some type of protective cover such as undercut banks, boulders, or debris; however, variations in habitat preferences are known with the spinedace also using narrow, shallow runs whit large amounts of emergent vegetation and the shear zones between high and low velocity waters that contain cover.

Current distribution

Virgin spinedace are found in the Virgin River in Utah and 11 tributaries to the river in Arizona, Nevada, and Utah. Virgin spinedace in Arizona and Nevada are only found in Beaver Dam Wash. Surveys in the Arizona portion of Beaver Dam in July, 2011, documented 88 Virgin spinedace.

Threats

Threats to Virgin spinedace include loss of habitat due to surface water and groundwater diversions from the Virgin River in Utah, Arizona, and Nevada. The spread of nonnative fish into the Virgin River had significant adverse effects on the species. Red shiner and most other potential predators and competitors have been largely eliminated from the Virgin River in Utah through conservation actions.

Conservation actions

The VSCAS assessment report (UDWR 2008) contains a summary of conservation actions accomplished for Virgin spinedace from 2000-2008. Achievements in re-establishment of population maintenance flows, habitat enhancement, selective control of nonnative fish reestablishment of populations, monitoring, and project mitigation have occurred to the extent that the VSCAS continues to be successful.

Previous consultations

The Virgin spinedace has no status under the Act; however, as a species with a conservation program in lieu of listing, it is considered by the signatories to the VSCAS in their evaluation of actions with potential adverse effects to the species.

Environmental baseline (in the action area)

Description of the action area

The action area for this consultation is the state of Arizona and the Virgin River and tributaries in Utah, Arizona, and Nevada. Owing to the cooperative actions taken by the Virgin River Fishes Recovery Team and the VSCAS, AGFD personnel using funding from WSFR may implement monitoring or other activities anywhere in the occupied range of the species.

A. Status of the species within the action area

The status of the Virgin spinedace in the action area is essentially the same as the rangewide status.

B. Factors affecting the species' environment within the action area

The threats identified for the rangewide status of the species are affecting the Virgin spinedace and its habitats in the action area.

Woundfin

Status of the species and critical habitat rangewide

Listing history

Woundfin were listed as an endangered species on October 13, 1970 (35 FR 16047) under a precursor to the Act. Critical habitat was designated on January 26, 2000 (65 FR 4140, USFWS 2000) and includes 87.5 miles of the Virgin River and its associated 100-year flood plain, extending from the confluence of La Verkin Creek, Utah, to Halfway Wash, Nevada.

The physical and biological factors (PBFs) of critical habitat determined necessary for the survival and recovery of the woundfin are water, physical habitat, and biological environment. The desired conditions for each of these elements are further discussed below:

Water:

A sufficient quantity and quality of water (i.e., temperature, dissolved oxygen, contaminants, nutrients, turbidity, etc.) that is delivered to a specific location in accordance with a hydrological regime that is identified for the particular life stage for each species. This includes the following:

1 Water quality characterized by naturally seasonally variable temperature, turbidity and conductivity;

2 Hydrologic regime characterized by the duration, magnitude, and frequency of flow events capable of forming and maintaining channel and instream habitat necessary for particular life stages at certain times of the year; and

3 Flood events inundating the floodplain necessary to provide the organic matter that provides or supports the nutrient and food sources of the listed fishes.

Physical habitat:

Areas of the Virgin River that are inhabited or potentially habitable by a particular life stage for each species, for use in spawning, nursing, feeding, and rearing, or corridors between such areas.

For woundfin these habitats include the following:

1 River channels, side channels, secondary channels, backwaters, and springs, and other areas which provide access to these habitats;

2 Areas inhabited by adult and juvenile woundfin include runs and pools adjacent to riffles that have sand and sand/gravel substrates;

3 Areas inhabited by juvenile woundfin are generally deeper and slower. When turbidity is low, adults also tend to occupy deeper and slower habitats; and

4 Areas inhabited by woundfin larvae include shoreline margins and backwater habitats associated with growths of filamentous algae.

Biological environment:

Food supply, predation, and competition are important elements of the biological environment and are considered components of this constituent element. Food supply is a function of nutrient supply, productivity, and availability to each life stage. Predation and competition, although considered normal components of this environment, are out of balance due to non-native fish species in many areas. For both species, a properly functioning biological environment contains:

1 Seasonally flooded areas that contribute to the biological productivity of the river system by producing allochthonus (humus, silt, organic detritus, colloidal matter, and plants and animals produced outside the river and brought into the river) organic matter which provides and supports much of the food base of the listed fishes; and

2 Few or no predatory or competitive non-native species in occupied Virgin River fishes' habitats or potential reintroduction sites.

The entire designated critical habitat is essential for the conservation of the woundfin.

The USFWS established "nonessential" experimental population areas for the woundfin in Arizona on July 24, 1985 (50 FR 30188, USFWS 1985a). Five population areas were designated on the Hassayampa, Gila, San Francisco, and Verde rivers and Tonto Creek.

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the species. This information was taken from the Virgin River Fishes Recovery Plan (USFWS 1995c) updated with species status information from the 5-year review (USFWS 2008h) and recent biological opinions on management actions for the species (USFWS 2010l) and references cited therein. Information in these documents is incorporated by reference.

Life history

Woundfin are small, silvery fish found only in the Virgin River below Zion National Park in Utah. Woundfin feed on a variety of items, including filamentous algae, detrital material, seeds, and aquatic insects; displaying a seasonal shift in food selectivity. Dietary overlap with introduced red shiners is greatest when food is most abundant. During periods of lower food abundance, woundfin and red shiners may experience greater competition for food, leading to a more pronounced partitioning of the food niche. Spawning has been documented from April to August

Habitat use

Adult woundfin are often collected from runs and quiet waters adjacent to riffles. Larvae are found in backwaters or slowly moving water along the stream margin, and often are associated with dense growths of filamentous algae. Juveniles use habitats that are slower and deeper than those characteristic of adults. Woundfin greater than 1.6 inches total length are collected most

frequently at depths between 0.48 and 1.4 feet, in current velocities ranging from 0.78 to 1.6 feet per second, over sand and sand-gravel substrate. There is some indication that when water clarity is high, adult woundfin move into deeper water. The critical thermal maximum temperature for woundfin in the Virgin River is about 102^0 F (with acclimation at 77^0 F) with mean preferred temperatures of about 52 to 75^0 F, depending on the overall stream temperature.

Current distribution

Woundfin are currently found in the Virgin River in Utah, Arizona, and Nevada, with the majority of the population in Utah. They were introduced into the experimental non-essential reach of the Hassayampa River in 2007 by AGFD and subsequent surveys have not located them.

Threats

Threats to woundfin include loss of habitat due to surface water and groundwater diversions from the Virgin River in Utah, Arizona, and Nevada. The spread of the nonnative red shiner into the Virgin River beginning in the 1970s resulted in the virtual eradication of woundfin from the river in Arizona and Nevada. Red shiners have largely been eliminated from the Virgin River in Utah through conservation actions.

Conservation actions

The Virgin River Fishes Recovery Team monitors the native fish community in the Virgin River in the spring and fall and has done so for over 25 years. Additional funding for monitoring in Arizona and Nevada is provided by Southern Nevada Water Authority and other partners with the Lower Virgin River Recovery Implementation Team. The Utah Virgin River Resource Management and Recovery Program (Program) was established in 2002 and has implemented numerous recovery actions including barrier construction, protection of instream flows, monitoring, and renovations to remove nonnative fish species. Work by the Program has moved into Arizona with the construction of the Virgin River Gorge Fish Barrier and planned efforts to renovate the reach of the river upstream of the barrier to the Arizona-Utah border. Woundfin are included in the Habitat Conservation Plan under development for the Nevada reach of the river.

Stocks of woundfin are held at Dexter National Fish Hatchery and Technology Center for propagation and release into historical habitats.

Previous consultations

The woundfin is found in three states: Arizona, Nevada, and Utah. Consultations on effects to these species are completed by three FWS Ecological Services Offices based on the location of the proposed action. In Utah, consultations address water-resource issues and implementation of recovery actions under the Program. In Arizona and Nevada, land-management, flood-control, and recovery actions sponsored by the Recovery Team are generally the topics for consultation. Biological opinions on actions potentially affecting woundfin in Arizona may be found at our website www.fws.gov/southwest/es/arizona in the Section 7 Biological Opinion page of the Document Library.

Environmental baseline (in the action area)

Description of the action area

The action area for this consultation is the state of Arizona and the Virgin River in Utah, Arizona, and Nevada. Owing to the cooperative actions taken by the Virgin River Fishes Recovery Team, AGFD personnel using funding from WSFR may implement monitoring or other activities anywhere in the occupied range of the species.

A. Status of the species (and critical habitat) within the action area

The status of the woundfin in the action area is essentially the same as the rangewide status.

B. Factors affecting the species' environment within the action area

The threats identified for the rangewide status of the species are affecting the woundfin and its habitats in the action area.

Yaqui catfish

Status of the species and critical habitat rangewide

Listing history

The Yaqui catfish was listed as a threatened species with critical habitat on August 31, 1984 (49 FR 34490, USFWS 1984a). Critical habitat was designated on all aquatic habitats on the San Bernardino National Wildlife Refuge (Refuge). The constituent elements are:

1. Clean, small permanent streams and spring pools without any exotic fishes.

2. The streams should have deep pool areas separated by riffles and flowing areas of moderate current.

3. Backwater areas of stream and springs with overgrown cut banks and accumulations of detritus are necessary for feeding and shelter.

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the species. This information was taken from the final rule (USFWS 1984a), the Rio Yaqui Fishes Recovery Plan (USFWS 1995b), the biological opinions for the Forest Service Land Management Plan biological opinion (USFWS 2005b) and the draft 5-year review for the species (USFWS 2009f) and references cited therein. Information in these documents is incorporated by reference.

Life history

The Yaqui catfish is the only known native catfish west of the Continental Divide. Little is known of its ecology and life history; however, it is believed to be similar in these regards to channel catfish. It is a medium to large catfish and can grow rapidly and achieve large sizes in ponds.

There may be other, related forms of catfish in other river basins in Mexico within the Rio Yaqui and connected drainages. Additional work on native catfish in Mexico is needed. There has not been any introgression of nonnative catfish into the lineage of the Yaqui catfish currently in the United States.

Habitat use

The Yaqui catfish is a bottom-dwelling species most commonly found in larger rivers in areas of medium to slow current over gravel/sand substrates. It is also found in intermediate to low elevation warmwater creeks, cienegas, and moderate to large-sized rivers. Habitats have alternating riffles and pools with undercut banks, boulders, and wood debris. Pools may be preferred in small streams.

Current distribution

In the United States, the Yaqui catfish exists in House Pond on the Slaughter Ranch next to the Refuge and on the El Coronado Ranch where they were stocked under a Habitat Conservation Plan (USFWS 1998b). Yaqui catfish were reintroduced on the Refuge into Twin Pond on the Refuge in 1990 using progeny of captive stocks held at Dexter National Fish Hatchery and Technology Center, but the species has not been observed there since 2005.

Threats

Threats to the Yaqui catfish come from surface water development and groundwater pumping that reduces or eliminates spring flows or surface water in small streams. Introduced nonnative fish are predators or competitors on Yaqui catfish and have been eliminated from the Refuge; however nonnative bullfrogs remain and are predators on small fish. Nonnative fish and bullfrogs are present in some portions of the range in Mexico.

Conservation actions

Wetland-specific conservation measures have been implemented on the Refuge to maintain or improve habitat conditions. The El Coronado Ranch populations were founded in 1999 and at least one remains extant. In 2008 the USFWS completed the Leslie Canyon Watershed Safe Harbor Agreement (USFWS 2008b) and a Habitat Conservation Plan with the Malpai Borderlands Project (USFWS 2008c) and that includes conservation benefits for the Yaqui catfish.

The ability to undertake conservation for Yaqui catfish in Mexico is more complex; additional surveys throughout the range in Mexico are needed. The Cuenca los Ojos has purchased and protected thousands of acres in the Rio Yaqui drainage but long-term legal protection is not assured.

Previous consultations

Section 7 consultations on Yaqui catfish include programmatic efforts for Forest Land Management Plans that address watershed management and multiple uses (livestock grazing, timber harvest, recreation, and other issues), and more site-specific efforts for fire management on the Refuge and for conservation programs. Biological opinions on actions potentially affecting Yaqui catfish may be found at our website www.fws.gov/southwest/es/arizona in the Section 7 Biological Opinion page of the Document Library.

Environmental baseline (in the action area)

Description of the action area

The action area for this consultation is the state of Arizona including the range of Yaqui catfish in Cochise County, Arizona. This encompasses all occupied habitats in the United States

A. Status of the species and critical habitat within the action area

The status of the Yaqui catfish and its critical habitat in the action area is essentially the same as the rangewide status.

B. Factors affecting the species' environment within the action area

The threats identified for the rangewide status of the species are affecting the Yaqui catfish and its habitats in the action area.

Yaqui chub

Status of the species and critical habitat rangewide

Listing history

The Yaqui chub was listed as an endangered species with critical habitat on August 31, 1984 (49 FR 34490, USFWS 1984a). Critical habitat was designated on all aquatic habitats on the San Bernardino National Wildlife Refuge (Refuge). The constituent elements are:

1. Clean, small permanent streams and spring pools without any exotic fishes.

2. The streams should have deep pool areas separated by riffles and flowing areas of moderate current.

3. Backwater areas of stream and springs with overgrown cut banks and accumulations of detritus are necessary for feeding and shelter.

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the species. This information was taken from the final rule (USFWS 1984a), the Rio Yaqui Fishes Recovery Plan (USFWS 1995b), the biological opinion for the Forest Service Land Management Plan biological opinion (USFWS 2005b) and the draft 5-year review for the species (USFWS 2009g) and references cited therein. Information in these documents is incorporated by reference.

Life history

The Yaqui chub is a small to medium sized cyprinid fish native to a small section of the Rio San Bernardino in the Upper Rio Yaqui drainage. Males in breeding condition are bluish and females and non-reproducing males are brownish-grey. Breeding occurs from March to September. Yaqui chub are omnivores. Yaqui chub exposed to Asian tapeworm have considerably lower growth rates than those not exposed. The population-level effect of this lower growth rate is unknown, and field observations show no pattern.

In the original listing, chubs from other areas of the Rio Yaqui were assumed to be Yaqui chub; however, recent taxonomic information has separated the chubs in the western portion of the range to be a different species.

Habitat use

The Yaqui chub occupies deeper pools in creeks and cienegas. Adults prefer deep water with silt and plant substrates. Submerged vegetation is an important habitat component as it provides escape cover and higher densities of invertebrate food resources.

Current distribution

In the revision of species taxonomy, the historical range of the Yaqui chub was reduced to a small section of the Rio San Bernardino in Cochise County, Arizona, and nearby Sonora, Mexico. In the United States, the Yaqui chub exists in 18 known sites on the San Bernardino and Leslie Canyon National Wildlife Refuges, West Turkey Creek on the Coronado National Forest, the El Coronado Ranch where they were stocked under a Habitat Conservation Plan (USFWS 1998b) and in an area upstream of Leslie Canyon NWR on private lands. There have been no recent surveys in Mexico.

Threats

Threats to the Yaqui chub come from surface water development and groundwater pumping that reduces or eliminates spring flows or surface water in small streams. Introduced nonnative fish are predators or competitors on Yaqui chub and have been eliminated from the Refuge; however nonnative bullfrogs remain and are predators on small fish. Nonnative fish and bullfrogs are present in some portions of the range in Mexico.

Conservation actions

Wetland-specific conservation measures have been implemented on the Refuge to maintain or improve habitat conditions. The El Coronado Ranch populations were founded in 1999 and at least one remains extant. In 2008 the USFWS completed the Leslie Canyon Watershed Safe Harbor Agreement (USFWS 2008b) and a Habitat Conservation Plan with the Malpai Borderlands Project (USFWS 2008c) and that includes conservation benefits for the Yaqui chub.

The ability to undertake conservation for Yaqui chub in Mexico is more complex; additional surveys throughout the range in Mexico are needed.

Previous consultations

Section 7 consultations on Yaqui chub include programmatic efforts for Forest Land Management Plans that address watershed management and multiple uses (livestock grazing, timber harvest, recreation, and other issues), and more site-specific efforts for fire management on the Refuge and for conservation programs. Biological opinions on actions potentially affecting Yaqui chub may be found at our website www.fws.gov/southwest/es/arizona in the Section 7 Biological Opinion page of the Document Library.

Environmental baseline (in the action area)

Description of the action area

The action area for this consultation is the state of Arizona including the range of Yaqui chub in Cochise County, Arizona. This encompasses all occupied habitats in the United States.

A. Status of the species and critical habitat within the action area

The status of the Yaqui chub and its critical habitat in the action area is essentially the same as the rangewide status.

B. Factors affecting the species' environment within the action area

The threats identified for the rangewide status of the species are affecting the Yaqui chub and its habitats in the action area.

Yaqui topminnow

Status of the species rangewide

Listing history

The Yaqui topminnow was listed as an endangered species as the Gila topminnow on March 11, 1967 (32 FR 4001, USFWS 1967a) under a precursor to the 1973 Endangered Species Act. The Yaqui topminnow is now a recognized species separate from the Gila topminnow only found in the Rio Yaqui drainage. The species was listed only in the United States. No critical habitat was designated for the topminnow.

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the species. This information was taken from the Rio Yaqui Fishes Recovery Plan (USFWS 1995b), biological opinions and the draft 5-year review for the subspecies (USFWS 2009h) and references cited therein. Information in these documents is incorporated by reference.

Life history

The Yaqui topminnow is a small, live-bearing fish that produce broods of up to 20 young every 20 or so days. Reproduction is generally between April and October, but can occur all year in habitat areas supported by warm water discharges from springs. The Yaqui topminnow is omnivorous. Few live longer than one year. Asian tapeworm does not apparently present a significant threat to the species.

Habitat use

Yaqui topminnow lives in shallow, warm, quiet waters of spring pools, cienegas, and occasionally in backwaters or shallow edges of streams. Preferred habitats usually includes dense mats of algae and debris along stream margins or in eddies below riffles, typically over sandy substrates covered with organic mud and debris.

Current distribution

The Yaqui topminnow is only found on the San Bernardino and Leslie Canyon National Wildlife Refuges in Cochise County. The subspecies is known from the Rio Yaqui drainage in Mexico, however, Yaqui topminnow in Mexico are not listed under the Act. Refuge populations of Yaqui topminnow are in an artificial habitat at Douglas High School in Douglas, Arizona.

Threats

Threats to the Yaqui topminnow come from surface water development and groundwater pumping that reduces or eliminates spring flows or surface water in small streams. Introduced nonnative fish are predators or competitors on Yaqui topminnow and have been eliminated from the Refuge; however nonnative bullfrogs remain and are predators on small fish.

Conservation actions

Wetland-specific conservation measures have been implemented on the Refuges to maintain or improve habitat conditions. In 2008 the USFWS completed the Leslie Canyon Watershed Safe Harbor Agreement (USFWS 2008b) and a Habitat Conservation Plan with the Malpai Borderlands Project (USFWS 2008c) and that includes conservation benefits for the Yaqui topminnow.

Previous consultations

Section 7 consultations on Yaqui topminnow include programmatic efforts for Bureau of Land Management Fire Management Plans, and more site-specific efforts that are more focused on implementing recovery actions such as barrier construction and stream renovations. Biological opinions on actions potentially affecting Yaqui topminnow may be found at our website www.fws.gov/southwest/es/arizona in the Section 7 Biological Opinion page of the Document Library.

Environmental baseline (in the action area)

Description of the action area

The action area for this consultation is the state of Arizona including the range of Yaqui topminnow chub in Cochise County, Arizona. This encompasses the entire range of the listed entity.

A. Status of the species and critical habitat within the action area

The status of the Yaqui topminnow in the action area is essentially the same as the rangewide status.

B. Factors affecting the species' environment within the action area

The threats identified for the rangewide status of the species are affecting the Yaqui topminnow and its habitats in the action area.

Zuni bluehead sucker

Status of the species rangewide

Listing history

Zuni bluehead sucker was considered for listing in 1980, but no listing package was developed. The species was a Category 2 candidate in 1991-1996 when the USFWS discontinued the Category 2 list. Zuni bluehead sucker became a candidate again on October 30, 2001 (66 FR 54808, USFWS 2001a).

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the species. This information was taken from the most recent Candidate Assessment document (USFWS 2010m) and the species recovery plan (Carman 2004) and references cited therein. Information in these documents is incorporated by reference.

Life history

Zuni bluehead sucker a medium-sized sucker reaching 20-25 cm (8-9 inches) in length. It is a recognized subspecies of bluehead sucker that may be of hybrid origin in the late Pleistocene.

Zuni bluehead suckers spawn from April to early June and mature by age-2. They may live up to five years; however, individuals older than three are rare. Zuni bluehead sucker feeds primarily on algae scraped from rocks, rubble, and gravel substrates.

It is uncertain if Zuni bluehead suckers in Arizona are the same subspecies as those in New Mexico. Additional genetics and taxonomy work needs to be accomplished to resolve these questions.

Habitat use

Zuni bluehead suckers prefer streams with clean, perennial water flowing over hard substrates. Silt-laden substrates are poor to marginal habitats. Large pools and pool-run habitats that have shade and are edged by emergent aquatic vegetation with gravel to bedrock substrates provide excellent habitat.

Current distribution

Zuni bluehead suckers are endemic to the headwaters of the Little Colorado River tributaries in Arizona and New Mexico. In New Mexico, it is limited to three semi-isolated populations on Zuni Pueblo, the Cibola National Forest, and private lands in the Upper Rio Nutria in McKinley County. In Arizona, it is limited to the Kinlichee Creek drainage on the Navajo Nation in Apache County.

Threats

Threats to Zuni bluehead sucker come from human activities in the watersheds including logging, road construction, improper grazing, reservoir construction, irrigation diversions from surface and groundwater, stocking of nonnative fishes and crayfishes, and piscicide treatments to promote sportfishing. The expansion of beavers into the habitat of the species results in degraded habitats from the formation of beaver ponds.

Conservation actions

New Mexico Department of Game and Fish (NMDGF) is the lead agency for conservation of Zuni bluehead sucker. There is a Recovery Plan (Carman 2004), and cooperators include the Zuni Pueblo, Cibola National Forest, The Nature Conservancy (TNC), and other private partners. Monitoring, habitat restoration, habitat protection through acquisition, conservation genetics, and preliminary work into captive propagation have been accomplished.

In Arizona, Zuni bluehead sucker is on the Six Species Conservation Strategy (AGFD 2006) and is a Class 4 species on the Navajo Nation Endangered Species List (NNHP 2005). The Navajo Nation is also a signatory to the conservation strategy.

Previous consultations

Zuni bluehead sucker is a candidate for listing under the Act and as such is not subject to the consultation requirements of section 7 for activities of Federal agencies. Federal agencies may,

at their discretion, include consideration for candidate species in their environmental compliance under the Act. However, it is the policy of the USFWS that candidate species are considered in intra-Service consultations on USFWS actions, including funding activities of other entities such as AGFD.

Environmental baseline (in the action area)

Description of the action area

The action area for this consultation is the state of Arizona including the Navajo Nation in Apache County, Arizona. This encompasses the range of the species in Arizona but omits the larger populations in New Mexico as it is unlikely that AGFD will work with this species in New Mexico.

A. Status of the species (and critical habitat) within the action area

The status of the Zuni bluehead sucker in the action area is essentially the same as the rangewide status. However, the last surveys of the Kinlichee Creek drainage were in 2000 and no more recent surveys exist to document species status.

B. Factors affecting the species' environment within the action area

The threats identified for the rangewide status of the species are affecting the Zuni bluehead sucker and their habitats in the action area.

Amphibians

Arizona treefrog Huachuca DPS

Status of the species rangewide

Listing history

The Arizona treefrog DPS became a candidate on December 6, 2007 (72 FR 69034, USFWS 2007b). The area covered by the DPS includes lands on the Coronado National Forest and Fort Huachuca in Arizona and Rancho Los Fresnos in Sonora, Mexico. That land is owned by Naturalia, a non-governmental environmental protection organization. The DPS population is disjunct from other Arizona treefrog populations and has a limited amount of breeding habitat; less than 10 acres in Arizona and less than 20 acres in Sonora (USFWS 2010n).

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the species. This information was taken from the most recent Candidate Assessment document (USFWS 2010n) and references cited therein. Information in this document is incorporated by reference.

Life history

Arizona treefrogs are active from late June to early October and use mesic habitats such as shaded oak groves, wet seeps, and other moist locations during the day and only converge on breeding ponds at night. This use of refuge sites away from breeding ponds may reduce the risk of predation by aquatic predators. Breeding takes place primarily in ephemeral waters.

Habitat use

Although they sometimes use permanent sites, such as stock tanks, they are less likely to support treefrog larvae because of the increased presence of aquatic invertebrate and vertebrate predators, including predatory insects, and nonnative crayfish, bullfrogs or fish species. Arizona treefrogs are not generally found in permanent waters containing nonnative aquatic predators and permanent waters are seldom used for breeding.

Current distribution

There are 13-16 known localities in Arizona, with only eight documented to have Arizona treefrogs present in the last decade, and observed breeding populations range in size between two and 30 individuals. In Rancho Los Fresnos, there are two sites with another nearby. Population sizes of Arizona treefrogs outside of the DPS tend to be larger and more robust.

Threats

Loss or degradation of habitat due to catastrophic fire, drought, floods, improper livestock grazing, contaminants, and off-highway vehicles is a major threat to the Arizona treefrog. The 2011 Monument Fire likely affected Arizona treefrog populations in Brown and Carr canyons (Douglas 2011). Predation by introduced species is also significant, and both types of threats are exacerbated by the small population size and limited habitat area. No Arizona treefrogs in the Huachuca-Canelo Hills region have been tested for chytridiomycosis. Frogs of this species have occasionally tested positive for the disease in the Mogollon Rim region of Arizona; however, no die offs of frogs have been noted in those populations and the species generally appears to avoid infections in nature.

Previous consultations

The Arizona tree frog is a candidate for listing under the Act and as such is not subject to the consultation requirements of section 7 for activities of Federal agencies. Federal agencies may, at their discretion, include consideration for candidate species in their environmental compliance under the Act. However, it is the policy of the USFWS that candidate species are considered in intra-Service consultations on USFWS actions, including funding activities of other entities such as AGFD.

<u>Environmental baseline (in the action area)</u>

Description of the action area

The action area for this consultation is the state of Arizona including the range of the Arizona treefrog in Cochise and Santa Cruz counties, Arizona and in Sonora, Mexico. This encompasses the entire range of the DPS. We are including the Mexican portion of the range because there is a potential for AGFD to work on the species there using SWG or SFR funding over the next 10-years.

A. Status of the species within the action area

The status of the Arizona treefrog in the action area is essentially the same as the rangewide status.

B. Factors affecting the species' environment within the action area

The threats identified for the rangewide status of the species are affecting the Arizona treefrog and their habitats in the action area.

Chiricahua leopard frog

Status of the species and critical habitat rangewide

Listing history

The Chiricahua leopard frog was listed as a threatened species without critical habitat in a Federal Register notice dated June 13, 2002 (67 FR 40790, USFWS 2002f). Included was a special rule to exempt operation and maintenance of livestock tanks on non-Federal lands from the section 9 take prohibitions of the Act. The Recovery Plan was signed in 2007 (USFWS 2007a). The Ramsey Canyon leopard frog (*Lithobates* "*subaquavocalis*"), found on the eastern slopes of the Huachuca Mountains, Cochise County, Arizona, has recently been subsumed into *Lithobates chiricahuensis* (Crother 2008) and recognized by the FWS as part of the listed entity (USFWS 2009j). Critical habitat for the Chiricahua leopard frog was proposed on March 15, 2011 (76 FR 14126, USFWS 2011d).

The 2011 proposed rule (USFWS 2011d) contained 40 critical habitat units across the range of the species in Arizona and New Mexico.

Based on the above needs and our current knowledge of the life history, biology, and ecology of the species, and the habitat requirements for sustaining the essential life-history functions of the species, we have determined that the PBFs essential to the conservation of the Chiricahua leopard frog are:

(1) Aquatic Breeding Habitat and Immediately Adjacent Uplands. These aquatic sites and uplands exhibit the following characteristics:

(a) Perennial or nearly perennial pools or ponds at least 6.0 ft (1.8 m) in diameter and 20 in. (0.5 m) in depth;

(b) Wetted in most years, and do not or only very rarely driy for more than a month;

(c) pH greater than or equal to 5.6;

(d) Salinity less than 5 parts per thousand;

(e) Pollutants absent or only present at levels that do not exceed the tolerances of the Chiricahua leopard frog;

(f) Emergent and or submerged vegetation, root masses, undercut banks, fractured rock substrates, or some combination thereof; but emergent vegetation does not completely cover the surface of water bodies;

(g) Nonnative crayfish, predatory fishes, bullfrogs, Barred tiger salamanders, and other introduced predators absent or occurring at levels that do not preclude presence of the Chiricahua leopard frog;

(h) Absence of chytridiomycosis or conditions (e.g., water temperatures that do not drop below 20° C (68° F), pH of greater than 8 during at least part of the year) that allow persistence of Chiricahua leopard frogs with the disease; and

(i) Uplands immediately adjacent to breeding sites that Chiricahua leopard frogs use for foraging and basking.

(2) Dispersal Habitat. Consisting of ephemeral, intermittent, and or perennial drainages that are generally not suitable for breeding, and associated uplands that provide overland movement corridors for frogs among breeding sites in a metapopulation with the following characteristics:

(a) Are not more than 5.0 mi (8.0 km) along perennial drainages, 3.0 mi (4.8 km) along ephemeral or intermittent drainages, 1.0 mi (1.6 km) overland, or some combination thereof not to exceed 5.0 mi (8.0 km);

(b) Provide some vegetation cover for protection from predators, and in drainages, some ephemeral, intermittent, and or perennial aquatic sites, and

(c) Are free of barriers that block movement by Chiricahua leopard frogs, including urban, industrial, or agricultural development; or reservoirs that are 50 ac (20 ha) or more in size and stocked with predatory fishes, bullfrogs, or crayfish; highways that do not include frog fencing and culverts; and walls, major dams, or other structures that physically block movement.

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the Chiricahua leopard frog. This information was taken from the 2007 Recovery Plan (USFWS 2007a) and references cited therein. Information in this document is incorporated by reference.

Life history

The life history of the frog is complex, with eggs and larvae (tadpoles) that are entirely aquatic and adults that are primarily aquatic. Post-metamorphic juveniles and adults are generally inactive between November and February; however, tadpoles can remain active under the ice in 41°F water. Tadpoles metamorphose to froglets in three to nine months, although some may overwinter before metamorphizing. Juvenile frogs are small; approximately two inches and adults are up to 5.4 inches.

Egg masses have been reported in all months except November through January, with oviposition in June uncommon. Water temperature may be a governing factor in oviposition; sites with warmer water, such as spring-fed sites, may have oviposition year round. Frog populations at elevations below 5,900 feet tend to oviposit from spring to late summer, with most activity before June. Frog populations at elevations over 5,900 feet oviposit in June through August. Egg masses are attached to submerged vegetation. Hatching is in approximately 14 days (depending on temperature) and the tadpoles remain in the water to feed.

Tadpoles are primarily vegetarian, with bacteria, phytoplankton, green algae, submerged vascular plants, and detritus forming the forage base. Adult frogs are carnivores, with aquatic and terrestrial invertebrates and small vertebrates (fish, smaller frogs) forming the forage base.

Habitat use

Historically, the frog was an inhabitant of a wide variety of aquatic habitats, including cienegas, pools, livestock tanks, lakes, reservoirs, streams, and rivers at elevations of 3,281 to 8,890 feet. Frogs may be active during the day or at night, with water and air temperature and wind predictors of activity. Permanent waters are better frog habitat, since the eggs and tadpoles must remain in water. Underwater cover, including plants, deep pools, undercut banks, and root masses are important for retreats from predators and as shelter during cold periods. Juvenile and adult frogs may disperse from the breeding site using uplands (during the rainy season) and stream courses. Movement of up to five miles (down-or up-stream from the point of origin) is documented. Tadpoles may be carried downstream by normal or higher flows. Where several breeding sites are located in dispersal range, a metapopulation can form.

Current distribution

The range of the Chiricahua leopard frog includes central and southeastern Arizona; west-central and southwestern New Mexico; and, in Mexico, northeastern Sonora, the Sierra Madre Occidental of northwestern and west-central Chihuahua, and possibly as far south as northern Durango.

Based on 2009 data, the species is still extant in the major drainage basins in Arizona and New Mexico where it occurred historically; with the exception of the Little Colorado River drainage in Arizona and possibly the Yaqui drainage in New Mexico. As of 2009, there were 84 sites in Arizona at which Chiricahua leopard frogs occur or are likely to occur in the wild, with additional four captive or partially captive refugia sites. At least 33 of the wild sites support

breeding. In 2009 in New Mexico, Chiricahua leopard frogs were found at 39 sites, at least 26 of which were breeding sites. The species has been extirpated from about 80 percent of its historical localities in Arizona and New Mexico. Nineteen and eight localities are known from Sonora and Chihuahua, respectively. The species' current status in Mexico is poorly understood; however, it has been found in recent years in western Chihuahua.

Threats

The primary threats to this species are predation by nonnative organisms and die offs caused by a fungal skin disease – chytridiomycosis. Additional threats include drought; floods; degradation and loss of habitat as a result of water diversions and groundwater pumping; poor livestock management; altered fire regimes due to fire suppression and livestock grazing; mining, development, and other human activities; disruption of metapopulation dynamics; increased chance of extirpation or extinction resulting from small numbers of populations and individuals; and environmental contamination (USFWS 2007a). Some threats, such as introduced nonnative predators and the threat of catastrophic wildfire, appear to be less important south of the border, particularly in the mountains where Chiricahua leopard frogs have been found.

Conservation actions

The Gila River Basin Native Fishes Conservation Program (also known as the Central Arizona [CAP] Program) also includes a component for CLF for head-starting eggs and tadpoles to provide individuals for reestablishment. Two umbrella Safe Harbor Agreements under which non-Federal landowners can enroll their properties with a certificate of inclusion are in place in Arizona and southwestern New Mexico. A third Safe Harbor Agreement is in place for a ranch in southeastern Arizona. These agreements provide opportunities for conservation on private lands. Conservation actions are also implemented under biological opinions (USFWS 2011a and e)

Previous consultations

Section 7 consultations on Chiricahua leopard frog include programmatic efforts for Forest Land Management Plans that address watershed management and multiple uses (livestock grazing, watershed management, water quality, and other issues), for conservation activities covered under the Safe Harbor Agreements, and more site-specific efforts that are more focused on implementing recovery actions. Biological opinions on actions potentially affecting Chiricahua leopard frog in Arizona may be found at our website www.fws.gov/southwest/es/arizona in the Section 7 Biological Opinion page of the Document Library.

Environmental baseline (in the action area)

Description of the proposed action

The action area for this consultation is the current range of the species in Arizona and Sonora. The New Mexico populations are not included in the action area as it is unlikely that SWG or SFR funds would be used by AGFD in CAP-related actions for those populations.

A. Status of the species and critical habitat within the action area

The status of the Chiricahua leopard frog in the action area is essentially the same as the rangewide status.

B. Factors affecting the species' environment within the action area

The threats identified for the rangewide status of the species are affecting the Chiricahua leopard frog and their habitats in the action area.

Northern leopard frog

Status of the species rangewide

Listing

The western populations of northern leopard frog were the subject of a positive 90-day finding in 2009, however, the 12-month finding (76 FR 61896, USFWS 2011f) determined the western populations did not warrant listing. It is not a candidate species but as it is covered by the CAMP as a Focal species, it will be considered here.

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the northern leopard frog. This information was taken from the 12-month finding (USFWS 2011f) and references cited therein. Information in from this document is incorporated by reference.

Life history

The northern leopard frog is a smooth-skinned green, brown, or sometimes yellow-green frog with large, oval dark spots surrounded by a lighter border or halo. Adult snout-vent lengths are two to 4.5 inches. They lay egg masses in shallow, still water that is exposed to sunlight, usually attached to vegetation just below the surface of the water. Tadpoles are generalist herbivores eating attached and free-floating algae. Adult and subadult frogs are generalist insectivores with prey including insects, spiders, mollusks and crustaceans.

Habitat use

A variety of habitats is needed by different life stages of northern leopard frog and includes overwintering, breeding, foraging, and upland post-breeding habitats. Adults overwinter on the bottom of deeper streams or pools that do not freeze to the bottom. Breeding habitats include slow-moving or still waters along streams and rivers, wetlands, permanent or temporary pools, beaver ponds, earthern stock tanks, or other human-created waters. Emergent vegetation and other types of cover are important features for breeding sites and tadpole habitats. Metamorphosed and adult frogs will disperse from the breeding area along drainages to feeding sites in open or semi-open wet meadows and fields with shorter vegetation usually near the margins of water bodies.

Current distribution

The western populations of northern leopard frog are found in Arizona, California, Colorado, Idaho, Iowa, Minnesota, Missouri, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oregon, Texas, Utah, Washington, Wisconsin, and Wyoming. It has declined significantly in all these states, and is or is almost completely extirpated in California, Oregon, Texas, and Washington.

Threats

Threats facing the northern leopard frog identified in the 90-day finding include loss and degradation of habitat due to improper livestock grazing, agricultural development, urban development, oil and gas development, road development, poor forestry practices, groundwater pumping, mining, and invasive species. Of relevance to this consultation, the introduction of nonnative invertebrates (crayfish), amphibians (bullfrogs) and fish species has adverse affects to northern leopard frog through degrading habitat conditions and direct predation on eggs, tadpoles, and adult frogs. Additionally, northern leopard frog populations are subject to die offs caused by a fungal skin disease – chytridiomycosis, that has expanded across the western United States in part through introductions of nonnative tiger salamanders and bullfrogs that carry this disease.

Conservation actions

As part of their ongoing commitment to conservation for this species, AGFD is an active participant in implementation of conservation actions for the northern leopard frog. Surveys for the northern leopard frog have been accomplished through the cooperation of partners (AGFD, Coconino National Forest, and USFWS). The AGFD Heritage Fund provided funding for an ongoing genetics study. Conservation actions are also included in the 2011 sportfish consultation (USFWS 2011a)

Previous consultations

The species is not currently a listed, proposed or candidate species under the ESA so has not been the subject of previous section 7 consultations.

Environmental baseline (in the action area)

Description of the action area

The action area for this consultation is the state of Arizona. We are including this species under this consultation due to AGFD's commitments to conservation programs for this species in Arizona under the CAMP.

A. Status of the species within the action area

The status of the northern leopard frog in the action area is essentially the same as the rangewide status.

B. Factors affecting the species' environment within the action area

The threats identified for the rangewide status of the species are affecting the northern leopard frog and their habitats in the action area.

Relict leopard frog

Status of the species rangewide

Listing history

The relict leopard frog was considered extinct until seven populations were rediscovered in 1991 (RLFT 2005). It became a candidate species on June 13, 2002 (67 FR 40659, USFWS 2002a). A Conservation Agreement and Strategy (CAS) was developed and signed by partners in Arizona, Nevada, and Utah (RLFT 2005) and is being implemented with the intent that listing will not be needed.

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the species. This information was taken from the CAS (RLFT 2005) and literature cited therein. Information in this document is incorporated by reference.

Life history

Compared to other leopard frogs, the relict leopard frog is small with proportionately short limbs. The taxonomy of this species and other closely related species (Vegas Valley and lowland leopard frogs) continues to be uncertain; particularly for leopard frogs from the Virgin River basin.

Relict leopard frogs are active year-round and breed in fall and winter and eggs are deposited on stems of vegetation. Tadpoles metamorphose approximately six months after hatching. Adults may live up to three years. Adult relict leopard frogs consume a variety of aquatic and terrestrial invertebrates and small vertebrates (other frogs, fish). Tadpoles are herbivores.

Habitat use

Relict leopard frogs use shallow waters in the margins of pools and channels including marshy areas and riparian corridors. Most habitats are small and isolated.

Current distribution

The relict leopard frog is known from springs in lower Grand Canyon, the Overton arm of Lake Mead, Black Canyon below Hoover Dam, and in the Black Mountains east of Black Canyon.

Threats

Threats to relict leopard frogs include elimination of aquatic habitats due to dams and diversions, marsh draining, or spring development. The spread of nonnative predators and competitors (crayfish, fish and bullfrogs) is also a significant threat. A fungal disease, chytridiomycosis, is an additional threat.

Conservation actions

The parties implementing the CAS have reestablished populations, monitored extant populations, and addressed habitat restoration within the range of the species. The species is covered under the LCR MSCP and conservation actions for that program are implemented through the CAS.

Previous consultations

Relict leopard frog is a candidate for listing under the Act and as such is not subject to the consultation requirements of section 7 for activities of Federal agencies. Federal agencies may, at their discretion, include consideration for candidate species in their environmental compliance under the Act. However, it is the policy of the USFWS that candidate species are considered in intra-Service consultations on USFWS actions, including funding activities of other entities such as AGFD.

Environmental baseline (in the action area)

Description of the action area

The action area for this consultation is the state of Arizona particularly Mohave County and adjacent areas of Nevada and Utah. AGFD is a partner in the CAS and work on the species may occur anywhere in the currently occupied range.

A. Status of the species within the action area

The status of the relict leopard frog in the action area is essentially the same as the rangewide status.

B. Factors affecting the species' environment within the action area

The threats identified for the rangewide status of the species are affecting the relict leopard frog and their habitats in the action area.

Sonoran tiger salamander

Status of the species rangewide

Listing

The Sonoran tiger salamander was listed as an endangered species in 1997 (62 FR 665) (USFWS 1997a) as the Sonora tiger salamander. The listing covered the entire historical range in the United States and Mexico. Critical habitat was not designated for the salamander.

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the salamander. This information was taken from the recovery plan (USFWS 2002g) and the 5-year review (USFWS 2007f) and references cited therein. Information in these documents is incorporated by reference.

Life history

The Sonoran tiger salamander is a large salamander with a dark venter and light-colored blotches, bars, or reticulation on a dark background. Snout-vent lengths of metamorphosed individuals vary from approximately 2.6-4.9 inches.

Larval salamanders are aquatic with plume-like gills and well-developed tail fins. Larvae hatched in the spring are large enough to metamorphose into terrestrial salamanders from late July to early September, but only an estimated 17 to 40 percent metamorphose annually. Remaining larvae mature into branchiates (aquatic and larval-like, but sexually mature salamanders that remain in the breeding pond) or over-winter as larvae.

Habitat use

Historically, the Sonoran tiger salamander probably inhabited springs, ciénegas, and possibly backwater pools of the Santa Cruz River and streams in the San Rafael Valley where permanent or nearly permanent water allowed survival of mature branchiates. The grassland community of the San Rafael Valley and adjacent montane slopes, where all extant populations of Sonoran tiger salamander occur, may represent relictual grassland and a refugium for grassland species. Tiger salamanders in this area might have become isolated and, over time, genetically distinct from ancestral *A. m. mavortium* and *A. m. nebulosum*.

Although most records for Sonoran tiger salamanders occur at stock tanks where breeding occurs, terrestrial metamorphs potentially may wander considerable distances from these aquatic habitats, and are occasionally encountered in upland habitats. A Sonoran tiger salamander was captured in a pit fall trap at Oak Spring in Copper Canyon, Huachuca Mountains, by Arizona Game and Fish Department personnel. The nearest known breeding site is approximately 0.6 mile to the south, suggesting the salamander may have moved at least that far. Capture in a pit fall trap also confirms that the individual was surface active. In other subspecies of *Ambystoma mavortium* and the closely related *A. tigrinum*, metamorphs may disperse hundreds of meters from the breeding pond, or may remain nearby. Of hundreds of marked *Ambystoma m. nebulosum* in northern Arizona, two were found to move from 0.9-1.2 miles to new ponds (J. Collins, pers. comm. 1998). On Fort Huachuca, Sheridan Stone (pers. comm. 1998) reported finding terrestrial tiger salamanders (probably *A. m. mavortium*) 1.9-2.5 miles from the nearest known breeding pond. Referring to conservation of the California tiger salamander, *A. californiense*, Surveys indicate that based on studies of movements of other *Ambystoma* species,

conservation of a 650-1,650 foot radius of natural vegetation around a breeding pond would protect the habitat of most of the adult terrestrial population. Adults of *A. mavortium* subspecies typically live in or about mammal burrows, although metamorphs may construct their own burrows, as well. Some species of salamanders exhibit seasonal migrations of up to several miles each way from breeding sites to upland habitats. If such migrations occur in the Sonoran tiger salamander, we have no information about migration corridors or non-breeding habitat. Because of the arid nature of the environments in the region where the subspecies occurs, if salamanders move very far from breeding ponds, they likely do so during more mesic times of year, such as during the monsoon season.

The Sonoran tiger salamander apparently has opportunistically taken advantage of available stock tank habitats as natural habitats disappeared or were invaded by nonnative predators with which the salamander cannot coexist (USFWS 2002g).

Current distribution

All sites where Sonoran tiger salamanders have been found are located in Arizona in the Santa Cruz and San Pedro river drainages, including sites in the San Rafael Valley and adjacent portions of the Patagonia and Huachuca mountains in Santa Cruz and Cochise counties. All confirmed historical and extant aquatic populations are found in cattle tanks or impounded cienegas within 19 miles of Lochiel, Arizona. Salamanders collected from a ciénega at Rancho Los Fresnos in the San Rafael Valley, Sonora, may be *A. m. stebbinsi*. However, surveys during 2006-2008 failed to locate additional salamanders and most waters on the ranch are now occupied by nonnative bullfrogs, crayfish, green sunfish, and/or black bullhead (trip reports, USFWS files).

The Sonoran tiger salamander is known from 71 aquatic localities, although not all are currently occupied (USFWS 2002g and files). During intensive surveys in 1997, from one to 150 Sonoran tiger salamanders were found at 25 stock tanks. Populations and habitats are dynamic, thus the number and location of extant aquatic populations change over time, as exhibited by the differences between survey results in 1985 and 1993-1996. In 1999, the lab of Dr. James Collins, Arizona State University, found Sonoran tiger salamanders at 17 localities. During surveys by the Arizona Game and Fish Department from 2001-2006, Sonoran tiger salamanders were found at 37 of 139 stock tanks, which were sampled from 1-7 times each. At 23 of 29 tanks where salamanders were found, and which were sampled more than once, salamanders were not found on at least one visit. The 5-year review acknowledges that there is no current information that clearly defines the abundance or population trends for this species (USFWS 2007f) but does state that the current survey data are consistent with population levels discussed in the recovery plan (USFWS 2002g).

Threats

Primary threats to the salamander include predation by nonnative fish and bullfrogs, diseases, catastrophic floods and drought, illegal collecting, introduction of other subspecies of salamanders that could genetically swamp *A. m. stebbinsi* populations, and stochastic extirpations or extinction characteristic of small populations. Predation by catfish, bass, mosquito fish, and sunfish can eliminate stock tank populations of Sonoran tiger salamander.

The salamanders can apparently coexist with bullfrogs, but bullfrogs prey on salamanders (J. Snyder, pers. comm. 1996) and perhaps if they are present in sufficient densities could reduce or eliminate salamander populations. Tadpoles of wood frogs (*Lithobates sylvatica*), are known to feed on spotted salamander (*Ambystoma maculatum*) eggs, but under experimental conditions bullfrog tadpoles did not feed on viable salamander eggs or hatchlings.

Recent genetic analysis confirmed that barred salamanders (*A. m. mavortium*) or hybrids between barred salamanders and Sonoran tiger salamanders are present at seven stock tanks along Highway 83 and near Parker Canyon Lake in the San Rafael Valley (Ziemba et al. 1998, Storfer et al. 2004). A salamander population in Garden Canyon, Fort Huachuca, near the crest of the Huachuca Mountains, also contains hybrids. Barred tiger salamanders are likely present due to their illegal use as fish bait in and around Parker Canyon Lake, although there is no way of knowing when those animals were introduced. Continuing introgression by nonnative salamander genes into the Sonoran tiger salamander may eventually eliminate the species as a distinct evolutionary unit.

Tiger salamander populations in the western United States and Canada, including populations of the Sonoran tiger salamander, exhibit frequent epizootics (Collins et al. 1988, Collins et al. 2001). Sonoran tiger salamander populations experience frequent disease-related die-offs (approximately eight percent of populations are affected each year) in which almost all salamanders and larvae in the pond die. *Ambystoma tigrinum* virus (ATV) is the pathogen believed to be primarily responsible for these die-offs.

Sonoran tiger salamanders also contract chytridiomycosis, a fungal disease associated with global declines of frogs and toads. In the laboratory, infected Sonoran tiger salamanders did not die from the disease and were capable of ridding themselves or much reducing chytrid infections by frequent sloughing of the skin. The effect of the disease on salamander populations needs further study.

Conservation actions

Conservation actions ongoing for the salamander throughout its range include surveys and monitoring of populations, improvements to stock tanks that provide habitat, and when documented, enforcement of prohibition of illegal stocking of barred tiger salamanders in the habitat of the salamander. The species is a covered species in the draft San Rafael Cattle Company Habitat Conservation Plan, which will provide conservation benefits for the species in a portion of the San Rafael Valley.

The recently completed sportfish consultation (USFWS 2011a) contains a suite of required conservation measures for Sonoran tiger salamander that will be implemented over the next 10 years. These measures include additional public awareness programs on restrictions on use of salamanders at Parker Canyon Lake.

Previous consultations

Section 7 consultations on Sonoran tiger salamanders include programmatic efforts for Forest Land Management Plans that address watershed management and multiple uses (livestock

grazing, and wildfire/prescribed burns), and military base operations, conservation actions for the species. Biological opinions on actions potentially affecting Sonoran tiger salamanders may be found at our website www.fws.gov/southwest/es/arizona in the Section 7 Biological Opinion page of the Document Library.

Environmental baseline (in the action area)

Description of the action area

The action area for this consultation is the state of Arizona and potentially occupied salamander habitats in Mexico. Because AGFD may pursue activities for the species in Mexico, we are including that area as part of the action area.

A. Status of the species within the action area

The status of the Sonoran tiger salamander in the action area is essentially the same as the rangewide status.

B. Factors affecting the species' environment within the action area

The threats identified for the rangewide status of the species are affecting the Sonoran tiger salamander and their habitats in the action area.

Reptiles

Narrow-headed gartersnake

Status of the species rangewide

Listing

The narrow-headed gartersnake is under consideration for candidate species status under the Act.

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the narrow-headed gartersnake. This information was taken from Rosen and Schwalbe (1988), the New Mexico Recovery Plan (Pierce 2007), Holycross et al. (2006), and Brennan and Rosen (2009) and references cited therein. Information in these documents is incorporated by reference.

Life history

The narrow-headed gartersnake is surface-active generally between March and November. Little information on suitable temperatures for surface activity of the narrow-headed gartersnake exists, however it is presumed to be rather cold-tolerant based on its natural history and foraging behavior that often involves clear, cold streams at higher elevations. Along Oak Creek in

Arizona, the species was be active in air temperatures ranging from 52-89°F and water temperatures ranging from 54-72°F.

Narrow-headed gartersnakes are generally recognized to specialize on fish as their primary prey item. Native fish species most often associated as prey items for the narrow-headed gartersnake include Sonora sucker, desert sucker, speckled dace, roundtail chub, Gila chub, and headwater chub. Nonnative species used as prey by narrow-headed gartersnakes are most often salmonid species (trout); most commonly brown and rainbow trout as these species are commonly stocked or established in, or near, occupied narrow-headed gartersnake habitat.

Sexual maturity in narrow-headed gartersnakes occurs at 2.5 years of age in males and at two years of age in females. Narrow-headed gartersnakes are ovoviviparous (eggs develop and hatch within the oviduct of the female). Female narrow-headed gartersnakes breed annually and give birth to 4-17 offspring from late July into early August (perhaps earlier at lower elevations.

The life span of narrow-headed gartersnake in the wild is unknown; however, other similar species may live up to nine or ten years under suitable conditions.

Habitat

The narrow-headed gartersnake is widely considered to be one of the most aquatic of the gartersnakes. This species is strongly associated with clear, rocky streams using predominantly pool and riffle habitat that includes cobbles and boulders and has been observed using lake shoreline habitat in New Mexico. Narrow-headed gartersnakes occur at elevations from approximately 2,300 – 8,200 feet in elevation. Where narrow-headed gartersnakes are typically found in the water, little aquatic vegetation exists. However, bank-line vegetation is an important component to suitable habitat for this species.

Current distribution

Narrow-headed gartersnake is only found in the United States in Arizona and New Mexico, ranging across the Mogollon Rim and along its associated perennial drainages from central and eastern Arizona, southeast to southwestern New Mexico (Wood et al. 2010). More specifically, the species was historically distributed in headwater streams of the Gila River watershed that drain the Mogollon Rim and White Mountains in Arizona, and the Gila Wilderness in New Mexico; major sub-watersheds in its historical distribution included the Salt, Verde, and Gila sub-watersheds (Holycross et al. 2006). Holycross et al. (2006) suspect the species was likely not historically present in the lowest reaches of the Salt, Verde, and Gila rivers, even where perennial flow persists.

Threats

Threats to narrow-headed gartersnakes include loss of habitats due to groundwater pumping, water diversions, elimination of riparian areas due to improper watershed uses including improper livestock management, urban development including roads, and other factors. The introduction of nonnative invertebrates, amphibians, and fishes to Arizona and New Mexico has significant effects to narrow-headed gartersnake in the form of predation and competition

(particularly predation on neonates and juveniles by crayfish, centrarchids (largemouth bass, smallmouth bass), catfish, and bullfrogs) that affects recruitment, and, perhaps more significantly, alterations to their prey base from nonnative species preying on native fish.

Conservation actions

Ongoing conservation actions for narrow-headed gartersnake are undertaken by the Gartersnake Conservation Working Group (GCWG) include monitoring, telemetry studies, captive propagation projects, and conservation planning for future reintroductions (GCWG 2008).

The recently completed sportfish consultation (USFWS 2011a) contains a suite of required conservation measures for narrow-headed gartersnakes that will be implemented over the next 10 years. These measures include additional surveys, and securing populations of narrow-headed gartersnakes within its historical range in Arizona.

Previous consultations

The narrow-headed gartersnake is not yet a listed or candidate species and has not been considered in section 7 consultations.

Environmental baseline (in the action area)

Description of the action area

The action area for this consultation is the state of Arizona and that portion of New Mexico occupied by narrow-headed gartersnakes.

A. Status of the species within the action area

The status of the narrow-headed gartersnake in the action area is essentially the same as the rangewide status.

B. Factors affecting the species' environment within the action area

The threats identified for the rangewide status of the species are affecting the narrow-headed gartersnake and their habitats in the action area.

Northern Mexican gartersnake

Status of the species rangewide

Listing

The northern Mexican gartersnake was designated a candidate species for listing under the Act on December 10, 2008 (73 FR 75176, USFWS 2008i).

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the northern Mexican gartersnake. This information was taken from the 12-month findings for 2006 (USFWS 2006d) and 2008 (USFWS 2008i) and references cited therein. Information in these documents is incorporated by reference.

Life history

The northern Mexican gartersnake is surface active at ambient temperatures ranging from 71 degrees Fahrenheit (˚F) to 91˚F (22 degrees Celsius (˚C) to 33 ˚C), generally March through October and forages along the banks of waterbodies. Northern Mexican gartersnakes spend approximately 60 percent of their time moving, 13 percent of their time basking on vegetation, 18 percent of their time basking on the ground, and 9 percent of their time under surface cover; body temperatures ranged from 24-33˚C (75-91˚F) and averaged 28˚C (82˚F), which is lower than other, similar species with comparable habitat and prey preferences.

The northern Mexican gartersnake is an active predator and is believed to heavily depend upon a native prey base. Northern Mexican gartersnakes forage generally along vegetated banklines, searching for prey in water and on land, using different strategies. Generally, its diet consists predominantly of amphibians and fishes, such as adult and larval native leopard frogs (e.g., lowland leopard frog (*Rana yavapaiensis*) and Chiricahua leopard frog), as well as juvenile and adult native fish species (e.g., Gila topminnow, desert pupfish, Gila chub, and roundtail chub) (Rosen and Schwalbe 1988).

Sexual maturity in northern Mexican gartersnakes occurs at two years of age in males and at two to three years of age in females. Northern Mexican gartersnakes are ovoviviparous (eggs develop and hatch within the oviduct of the female). Mating occurs in April and May followed by the live birth of between 7 and 26 newborns (newly born individuals) (average is 13.6) in July and August.

Habitat

Throughout its rangewide distribution, the northern Mexican gartersnake occurs at elevations from 130 to 8,497 feet (ft) (40 to 2,590 meters (m)). The northern Mexican gartersnake is a riparian obligate (restricted to riparian areas when not engaged in dispersal behavior) and occurs chiefly in the following general habitat types: (1) Source-area wetlands (e.g., cienegas (mid-elevation wetlands with highly organic, reducing (basic or alkaline) soils), stock tanks (small earthen impoundment), etc.); (2) large-river riparian woodlands and forests; and (3) streamside gallery forests (as defined by well-developed broadleaf deciduous riparian forests with limited, if any, herbaceous ground cover or dense grass). Generally, it is believed that northern Mexican gartersnake spends most of its time within the boundaries of the 100-year floodplain along the streams or tanks where it forages. Recent information from telemetry studies indicates that NM gartersnake will move away from such areas to dry hillsides. The extent of overland movements between drainages is unknown; however, most semi-aquatic and aquatic amphibians and reptiles are known to move overland during wet seasons and at night when dispersing.

Current distribution

Within Mexico, northern Mexican gartersnakes historically occurred within the Sierra Madre Occidental and the Mexican Plateau in the Mexican states of Sonora, Chihuahua, Durango, Coahila, Zacatecas, Guanajuato, Nayarit, Hidalgo, Jalisco, San Luis Potosí, Aguascalientes, Tlaxacala, Puebla, México, Veracruz, and Querétaro, comprising approximately 85 percent of the total rangewide distribution of the species.

Within the 15 percent of the range contained in the United States, the northern Mexican gartersnake historically occurred predominantly in Arizona at elevations ranging from 130 to 6,150 ft (40 to 1,875 m). Currently, in the United States portion of the range, northern Mexican gartersnake persists in only in limited portions of Apache, Gila, Pima, Navajo, Santa Cruz and Yavapai counties, Arizona, and Grant County, New Mexico. Populations in California and Nevada are extirpated.

Threats

The first 12-month finding (USFWS 2006d) detailed the threats to northern Mexican gartersnake including loss of habitats dues to groundwater pumping, elimination of cienegas, water diversions, elimination of riparian areas due to improper watershed uses including improper livestock management, urban development including roads, and other factors. The introduction of nonnative invertebrates, amphibians, and fishes to Arizona has significant effects to northern Mexican gartersnake in the form of predation and competition (particularly predation on neonates and juveniles by centrarchid fish, catfish, and bullfrogs) that affects recruitment, and, perhaps more significantly, alterations to their prey base from nonnative species preying on and competing with native fish and frogs. Northern Mexican gartersnake are predators with native frogs forming a major portion of their diet with small, soft-bodied native fish also important.

Conservation actions

Ongoing conservation actions for northern Mexican gartersnake are undertaken by the Gartersnake Conservation Working Group (GCWG) include monitoring, telemetry studies, captive propagation projects and conservation planning for future reintroductions (GCWG 2008). Northern Mexican gartersnake is also included as a covered species in the draft San Rafael Cattle Company Habitat Conservation Plan and the final Horseshoe-Bartlett HCP (SRP 2008). There is ongoing conservation work in the form of monitoring for northern Mexican gartersnake at Bubbling Ponds and Page Springs State Fish Hatcheries.

The recently completed sportfish consultation (USFWS 2011a) contains a suite of required conservation measures for northern Mexican gartersnake that will be implemented over the next 10 years. These measures include additional surveys, and securing populations of northern Mexican gartersnake within its historical range in Arizona.

Previous consultations

Northern Mexican gartersnake is a candidate for listing under the Act and as such is not subject to the consultation requirements of section 7 for activities of Federal agencies. Federal agencies may, at their discretion, include consideration for candidate species in their environmental

compliance under the Act. However, it is the policy of the USFWS that candidate species are considered in intra-Service consultations on USFWS actions, including funding activities of other entities such as AGFD.

Environmental baseline (in the action area)

Description of the action area

The action area for this consultation is the state of Arizona, the portion of New Mexico occupied by northern Mexican gartersnakes and adjacent occupied areas in Mexico.

A. Status of the species within the action area

The status of the northern Mexican gartersnake in the action area is essentially the same as the rangewide status.

B. Factors affecting the species' environment within the action area

The threats identified for the rangewide status of the species are affecting the northern Mexican gartersnake and their habitats in the action area.

Sonoyta mud turtle

Status of the species rangewide

Listing history

The Sonoyta mud turtle was designated as a candidate species for listing under the Act on September 19, 1997 (62 FR 49398, USFWS 1997b).

Background

The most recent information on the subspecies was compiled for the 2010 Species Assessment and Listing Priority Assignment Form (USFWS 2010o) and references cited therein. This document is incorporated by reference.

Life history

The Sonoyta mud turtle is an isolated, endemic subspecies of mud turtle found only in and near the Rio Sonoyta drainage in Pima County in southwestern Arizona and northern Sonora, Mexico.

The Sonoyta mud turtle is a dark, medium-sized aquatic turtle with a hinged plastron, chin barbles, and webbed feet. The Sonoyta mud turtle becomes mature at three to four years old and may live to be 25. Females deposit an average of 1.5 clutches per year with an average of four eggs between July and September. Eggs are buried in soil on land near the water. They feed mostly on aquatic invertebrates and plants, but may take fish or other vertebrates on occasion.

Habitat use

Sonoyta mud turtles live in ponds and streams and suitable habitat should include emergent and shoreline vegetation, basking sites for thermoregulation, and accessible shorelines for nesting substrates.

Current distribution

In Arizona, the subspecies occurs only at Quitobaquito Spring on Organ Pipe Cactus National Monument (OPCNM). In Sonora, the subspecies is only found in seven sites; six locations in the Rio Sonoyta and one at Quitovac Spring (outside the Rio Sonoyta drainage), all within or near the town of Sonoyta.

In Sonora, the population in the Rio Sonoyta occupies intermittent reaches of the Rio Sonoyta, an ephemeral dam pool and sewage lagoon, and the spring complex at Quitovac. The total population is considered stable and estimated at 1,200 individuals (range 600-2,700).

Threats

Threats to the Sonoyta mud turtle are largely related to loss of the aquatic habitats occupied by the subspecies due to groundwater withdrawals, elimination of effluent sources that support a portion of the population in Sonora, and water management problems (leaks) at Quitobaquito Pond. Other threats include environmental contaminants from pesticide use and in sewage effluent, watershed degradation by improper land management activities and introduction of nonnative plant species that alter riparian corridors or increase fire risks, and international border enforcement activities that may damage Quitobaquito Pond.

Illegal introduction of nonnative aquatic species is a threat to the Sonoyta mud turtle. Bullfrogs and crayfish are documented predators on other aquatic turtles, including the Sonoran mud turtle, a related subspecies, and do not currently occur in Sonoyta mud turtle habitats. Nonnative fish such as black bullhead and mosquitofish inhabit the Rio Sonoyta. Introduction of nonnative fish species to Sonoyta mud turtle habitats may not directly affect individuals through predation; however, competition for the available forage base (aquatic invertebrates, plants, frogs, and small fish) may lead to reduced fitness in the Sonoyta mud turtle.

Conservation actions

The Quitobaquito/Rio Sonoyta Working Group was established in 2001 with agencies and groups representing interested parties in the United States and Mexico to develop a conservation strategy and agreement for the unique species of the Rio Sonoyta, including the Sonoyta mud turtle (AGFD 2011). Conservation measures completed, underway, or in the planning process include surveys in Mexico, development of a captive breeding program at the Phoenix Zoo, a population viability analysis to assist in population management, work on correcting the water problems at Quitobaquito Pond, and preservation and enhancement of Sonoyta mud turtle habitat at the Rio Sonoyta after the replacement of the existing sewage treatment plant.

In 2007, the water levels at Quitobaquito Pond dropped precipitously, and individuals were translocated to a refuge site. Between 2008 and 2009, additional individuals were relocated to the refuge site which now supports 66 individuals. Some Sonoyta mud turtles likely remain in the pond. Sonoyta mud turtles will not be returned to Quitobaquito Pond until the water issues (leaks in the pond) have been corrected.

The AESO provided comments and recommendations to minimize effects and provide conservation to the Sonoyta mud turtle related to the expansion of the wastewater collection system and construction of a new wastewater treatment facility in Sonoyta funded by the Environmental Protection Agency (USFWS 2007g, 2008j). In 2008, the Mexican Secretaria de Medio Ambiente y Recursos Naturales (SEMARNAT) issued a Resolutivo with binding conditions for the project to negotiate an agreement with the Pinacate Biosphere Reserve to 1) ensure all treated water from the new facility is returned to the Rio Sonoyta, 2) build a pond for Sonoyta mud turtles near the new facility, and 3) hire a biologist to oversee management of these measures. Construction of the new facility was expected to begin in 2010 but is pending agreement on the conditions specified in the Resolutivo.

Previous consultations

Sonoyta mud turtle is a candidate for listing under the Act and as such is not subject to the consultation requirements of section 7 for activities of Federal agencies. Federal agencies may, at their discretion, include consideration for candidate species in their environmental compliance under the Act. However, it is the policy of the USFWS that candidate species are considered in intra-Service consultations on USFWS actions, including funding activities of other entities such as AGFD.

Since 2000, the Sonoyta mud turtle has been considered in informal section 7 consultations with the National Park Service for OPCNM, and for Environmental Protection Agency-funded projects for the Sonoyta sewage treatment plant.

Environmental baseline (in the action area)

Description of the action area

The action area for this consultation is the state of Arizona including the range of the Sonoyta mud turtle in Pima County and adjacent areas of Sonora, Mexico where the species is found.

A. Status of the species within the action area

The status of the Huachuca springsnail in the action area is essentially the same as the rangewide status.

B. Factors affecting the species' environment within the action area

The threats identified for the rangewide status of the species are affecting the Huachuca springsnails and their habitats in the action area.

Mammals

New Mexico meadow jumping mouse

Status of the species (and critical habitat) rangewide

Listing history

The New Mexico meadow jumping mouse (jumping mouse) was designated as a candidate species for listing under the Act on December 6, 2007 (72 FR 69034, USFWS 2007b).

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the jumping mouse. This information was taken from the New Mexico Recovery Plan (NMDGF 2008), and the most recent candidate assessment (USFWS 2010p) and literature cited therein. Information in these documents is incorporated by reference.

Life history

The jumping mouse is generally nocturnal, but occasionally diurnal. It is active only during the growing season of the grasses and forbs on which it depends. During the growing season, the jumping mouse accumulates fat reserves by consuming seeds. Preparation for hibernation (weight gain, nest building) seems to be triggered by day length. The jumping mouse hibernates about 9 months out of the year, longer than most other mammals.

The longest known lifespan of this species in the wild is 3 years, with an average lifespan less than 1 year. Females breed shortly after emerging from hibernation and may give birth to 2 to 7 young after an average 19 day gestation. One litter is produced each year, usually between May and September. Young are fully developed and weaned at 4 weeks. The female provides all the care for their young until they are weaned and independent. Females born in the spring are sexually reproductive at 2 months of age.

Habitat use

The jumping mouse is a habitat specialist. It nests in dry soils, but uses moist, streamside, dense riparian/wetland vegetation up to an elevation of about 8,000 feet (ft) (2,438 meters (m)). The jumping mouse appears to only utilize two riparian community types: 1) persistent emergent herbaceous wetlands (i.e., beaked sedge and reed canarygrass alliances); and 2) scrub-shrub wetlands (riparian areas along perennial streams that are composed of willows and alders). It especially uses microhabitats of patches or stringers of tall dense sedges on moist soil along the edge of permanent water. Home ranges vary between 0.37 and 2.7 ac (0.15 and 1.1 ha) and may overlap.

Current distribution

Of the original 103 known historical localities, 95 have been surveyed since the early to mid-1990s. Of the 95 historical localities surveyed, currently only 16 are extant; nine in New Mexico (including one that is contiguous with the Colorado locality) and seven in Arizona. The known extant locations are: two localities in the Sangre de Cristo Mountains along the border of Colorado and New Mexico; five localities in the Jemez Mountains, New Mexico; two localities in the Sacramento Mountains, New Mexico; and seven localities in the White Mountains, Arizona.

Threats

The jumping mouse is an obligate riparian species known only from two riparian types: persistent emergent herbaceous vegetation (beaked sedge and reed canarygrass alliances) and scrub-shrub wetland (willow and alder alliances). Several risk factors related to habitat have been identified, including excessive grazing pressure from livestock, water use and management, highway reconstruction, development, recreation, and beaver removal. The 2010 candidate assessment form goes into considerable detail about threats facing the species (USFWS 2010p).

Of particular concern is human access to jumping mouse habitats that can result in habitat degradation from trampling or creation of trails.

Conservation actions

Most recent biological information has been obtained by surveys at historical locations and sites showing potential for the jumping mouse to be present. New Mexico has a recovery plan for the jumping mouse (NMDGF 2008) that contains recommendations for conservation actions to be implemented in the future. In addition, the USFWS in New Mexico has identified conservation actions needed for the species (USFWS 2010p). None of the non-survey related measures identified in these two documents have been implemented. The jumping mouse is also a species under the CAMP (USFWS 2011a).

Previous consultations

The jumping mouse is a candidate for listing under the Act and as such is not subject to the consultation requirements of section 7 for activities of Federal agencies. Federal agencies may, at their discretion, include consideration for candidate species in their environmental compliance under the Act. However, it is the policy of the USFWS that candidate species are considered in intra-Service consultations on USFWS actions, including funding activities of other entities such as AGFD.

Environmental baseline (in the action area)

Description of the action area

The action area for this consultation is the state of Arizona including the range of the jumping mouse in Apache and Greenlee counties. This encompasses only the occupied areas in Arizona. It is unlikely that AGFD would implement activities under this consultation in New Mexico.

A. Status of the species within the action area

The status of the jumping mouse in the action area is essentially the same as the rangewide status.

B. Factors affecting the species' environment within the action area

The threats identified for the rangewide status of the species are affecting the jumping mouse and their habitats in the action area.

EFFECTS OF THE ACTION

Effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action, that will be added to the environmental baseline. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

The majority of effects to all aquatic species considered in this BCO from implementing the activities included in the proposed action are the result of targeted actions for those species for conservation purposes funded by SWG and for CAMP species funded by SFR. These activities would take place in occupied habitats and one or more of the aquatic species may be present in any one location (for example, loach minnow, spikedace, and roundtail chub are all present in Aravaipa Creek whereas Stephan's riffle beetle is the only consultation species in its habitat). Not all consultation species occupying a particular stream, pond, or other habitat may be the target of a particular conservation activity. Using Aravaipa Creek as an example capture efforts for spikedace or loach minnow to create or augment hatchery populations may affect individual roundtail chub through disturbance by field crews during the capture process for the other two species. Leopard frogs in ponds also containing native fish may not be the target of electrofishing but may be caught in the electric field during operations for fish surveys.

Consultation species can be present in habitats occupied by sportfish species that would be the subject of sportfish management actions funded by SFR. Sportfish, particularly the bass and catfish families, are predators and competitors on native fish and frogs and persistence of viable populations of some native species in habitats containing sportfish or other nonnative aquatic species has not been documented; instead, the two groups appear to be incompatible at various levels depending on the species.. There are exceptions to complete incompatibility, for example roundtail chub and the two gartersnake species are present in the Verde River which supports robust populations of smallmouth bass and channel catfish. Established populations of nonnative trouts (brook, brown, and rainbow) also occupy habitats of consultation species including loach minnow, headwater chub and the two gartersnakes. At the other extreme, the three springsnails, desert pupfish, Gila topminnow and the Yaqui fishes are unlikely to be in any area where sportfish are present and thus management actions under SFR are unlikely. However, because the separation between the consultation species and sportfish management activities is not absolute, we assume that over the 10-year period covered by this consultation, that there will be a

level of effect from sportfish management activities funded under SFR to the consultation species.

As stated previously, this section will look as species groups since for the most part, effects of AGFD's activities will be the same for all species in the group.

Invertebrates

For the most part, activities under the proposed action that could affect the six invertebrate species would be those that focus on conservation actions for those species funded by SWG as there is limited overlap of other aquatic species considered under this consultation. The potential for effects from activities targeting other species is most likely to the Page springsnail and Huachuca springsnail owing to the location of their occupied habitats near occupied gartersnake and native fish/Chiricahua leopard frog habitats respectively. Three Forks springsnail may have some overlap with introduced Chiricahua leopard frogs, and the San Bernardino springsnail may have some future overlap with the Yaqui fishes (but it is unlikely that AGFD would be involved in those actions on the San Bernardino NWR). The two remaining species (Kanab ambersnail and Stephan's riffle beetle) are not co-located with any other consultation species. Overlap with any sportfish species for any of the six invertebrates is unlikely; however, we consider it possible at least for Page springsnail and Three Forks springsnail due to the location of their habitats.

A variety of techniques are used in surveys and monitoring of invertebrate species and the generic techniques are well documented (Lattin 1956, Bowles et al. 2007). In addition, species-specific protocols exist for some species; Kanab ambersnail (Stevens et al. 1997) and Page springsnail (AGFD and USFWS 2009) that can have applicability to other similar species.

The act of accessing habitat for these invertebrates to initiate survey and monitoring activities can have adverse effects to the species and habitat features. Surveyors may damage shorelines or shoreline vegetation while accessing the site. The Kanab ambersnail is a terrestrial snail and is found in lush vegetation supported by springs or seeps. Accessing ambersnail habitat can result in trampling of the vegetation community supporting the species. The sampling protocol (Stevens et al. 1997) specifically cautions that no more than two or three trained surveyors be used to avoid widespread damage to stems of the host plants and the number of survey plots is limited. While care is taken to not disturb host plants or damage habitat, some vegetation may be trampled or disturbed during field operations. These effects may be immediate and may result in the death or injury of a few individuals who may be dislodged from host plants and/or trampled while surveyors move through the habitat.

For the five aquatic species, bankline vegetation may be important to provide stability to the aquatic habitat or provide cover or foraging areas and accessing the area may result in damage to the plants or the substrate by trampling, slipping, or otherwise disturbing the bankline either during targeted surveys or work for other consultation species present in the same area. Additional damage may occur with placement of survey and monitoring equipment on the bank while setting up the survey effort and during processing of samples.

The in-water survey techniques used for springsnails and riffle beetles can be disruptive to habitat through disturbance of the substrates by dredges or grabs, and movement of rocks and

other substrate items to flush out individuals of the species. These techniques are fully described in the citations given above. Adverse effects of the actual survey to substrates are reduced through protocols that limit the number and size of sites selected within the entire habitat to be surveyed. This can also reduce the amount of sediment disturbed in the habitat or amount of bankline areas used for staging. Replacement of rocks and other large substrate after work is complete enables the habitat to recover more quickly. There will be incidental injury or loss of individuals of the species during in-water actions due to trampling which can crush these small invertebrates. Limitations on the amount of actual in-water work serve to limit these losses.

Survey techniques for fish, amphibians, and gartersnakes can be disruptive to habitats for invertebrates. Use of substrate samplers and nets that scrape along the substrate can disturb habitat features such as rocks, plants, or other debris, and movement of field researchers in the water can dislodge rocks or other habitat structure and potentially crush individuals. Movement of people or equipment also raises sediments that can cover clean rocks that previously supported algae or other food resources. Page springsnails may be affected by surveys for gartersnakes if the surveyors work in proximity to the occupied habitats. Reintroductions of fish, amphibians, or gartersnakes to the larger aquatic habitats occupied by Huachua springsnail may alter the food web of the site or introduce a potential predator. Since these reintroductions are of species historically found at these sites with the Huachuca springsnail, the restoration of the historical aquatic community may not be significantly adverse if suitable habitat conditions are maintained.

Electrofishing can be used as a technique for benthic invertebrate sampling (Taylor et al. 2001) since the stunned individuals move up from the substrates and into the water column, facilitating collection. AGFD does not propose to use this technique for invertebrates, and it is unlikely that electrofishing would be done for other consultation species in habitats of the springsnails and riffle beetles, with the possible execption of the Huachuca springsnail where it co-exists with native fish in the San Rafael Valley. Taylor et al. (2001) found the method allowed collections of live specimens for laboratory work, so mortality events are limited. Snails may not be dislodged from the substrate due to their weight and thus not be subject to displacement from suitable habitats. This technique is unlikely to be used in the habitat of the Stephan's riffle beetle since it is not co-located with any other consultation or sportfish species.

With the exception of the Stephan's riffle beetle, the proposed action includes activities relating to other conservation options including captive propagation and translocations for the five invertebrates. The removal of limited numbers (set at 25 individuals for the Kanab ambersnail) of individuals for these purposes is not anticipated to result in population level effects based upon the size of known populations. Numbers for the four springsnails have not been established and if these types of activities were proposed during the period covered by the consultation, the USFWS and AGFD would determine the number of individuals to be removed. While the removal of these individuals will result in a short term adverse affect, the long-term effects of this sampling will be a conservation benefit for these species.

Any captive population developed for one or more of the snail species will be used for research, propagation, reestablishment, and augmentation of wild and translocation populations. Husbandry of any captive species will result in death or injury of individuals due to disease, loss of controlled climate conditions, handling, and transport. Catastrophic loss of the entire captive populations is possible. There will be no direct effects to the wild and translocated populations

from the loss of any number of individuals up to all individuals in the captive population. Indirect effects may include the loss of individuals to genetically augment translocated populations and refugium populations to be used to reestablish populations that may become extirpated.

Actions to measure physical components of aquatic habitat including water quality, substrate types, aquatic vegetation, and flow parameters may also have adverse effects. Measurements of habitat parameters that require physical movement or manipulation (particularly when dealing with substrates) disturb the habitat feature and may release sediments or other materials into the water column. The need to be in the water to undertake these actions increases the amount of trampling and sediment disturbance that results.

The introduction of nonnative species or parasites and diseases to habitats of these invertebrates has the potential for significant adverse effects. This is particularly true for the expansion of the New Zealand mud snail into springsnail habitats. Protocols to sanitize and clean survey equipment between uses and other best management practices are in place and would be used by AGFD personnel implementing activities covered under this consultation. These are listed in Appendix C.

Fish

All the consultation fish species are subject to targeted actions under SWG and are also likely to have some non-targeted effects when activities for other consultation species (particularly frogs and gartersnakes) are implemented. We expect the amount of non-targeted effects would be limited, since in most conservation work, AGFD is aware of the presence of other native species in the habitat and the BMPs help to reduce the potential for adverse interactions. As noted previously, there may be some cases where there is harassment and the potential for mortality during non-target events. With the exception of activities conducted for the native sportfish species (Apache and Gila trout and roundtail chub) and under the CAMP, SFR funds are not used for "conservation" work for consultation fish species. Some species, such as the pupfishes, Sonora chub, and Gila topminnow are generally not found in areas where sportfish monitoring activities are likely to occur and non-target effects to these species from sportfish-related activities are likely to be very limited. Other species, such as razorback sucker, bonytail, Colorado pikeminnow, loach minnow, Apache trout and headwater and roundtail chubs are found in habitats where sportfish management activities are likely to occur and there may be take of individuals through non-target effects.

The methods used to survey and monitor sportfish are identical to those used with consultation fish species, although as included in Appendix C, there are BMP protocols to minimize adverse effects to native fish species through limitations on gear types or other methods of capture and transport. These BMPs are not always followed for some sportfish targeted work. A particular example is AGFD's use of gill nets for extended sets in the Colorado River lakes and mainstem as part of joint sportfish surveys with other wildlife management agencies. Razorback suckers are in some of these areas, and the BMP for native fish capture does not allow for the use of gill nets with extended set times. Special cases such as this one are the exception, and to date significant mortality of razorback suckers from these projects has not been documented.

The effects of capturing fish species is related to the type of sampling gear, size and age class of the fish, and the conditions under which the fish are captured. All methods result in some level of stress to the captured animal, and the results of that stress can vary from species to species and within different lineages of the same species (Cone and Krueger 1988, Hunt 2008). The peer-reviewed literature on capture and handling stress on fish provides extensive documentation of this effect. The standard guidelines in books on fisheries management (Nickum 1988, Schreck and Moyle 1990, Murphy and Willis 1996, and Bonar et al. 2009) were designed around this knowledge to incorporate guidelines that minimize the potential for injury and mortality during survey and monitoring activities. As indicated in Appendix C, AGFD has developed its own guidelines based on the previous references to reduce adverse effects to captured fish from implementing these activities through their Standard Fish Sampling Protocol for State of Arizona Waters (AGFD 2004). Mueller et al. (2008) evaluated several techniques for survey of razorback sucker that included various nets, electrofishing, and passive survey from boats or helicopters and documented some strengths and weaknesses.

Electrofishing is intended to stun fish so that they can be collected in dip nets. While this is effective method of sampling, it sometimes can result in injury or death of fish depending on their size, water chemistry, level of power/wattage used and the experience level of personnel operating the generator or electrofishing unit (Holliman et al. 2003). Guidance is in place to assist field crews in determining the proper settings to reduce injury or mortality to fish. In addition, if areas are sampled multiple times (for depletion efforts as an example), repeated electroshocking can have a negative effect on individual fish through stress and injury resulting from tetany once exposed to the electric field. Snyder (2003) presents a comprehensive review of the effects of electrofishing on fish.

Trammel nets and experimental gill nets can capture larger fish effectively when used properly; however, there is always a level of stress involved that can be fatal in some more sensitive species (Hunt 2008, Paukert et al. 2005). Fish can end up injured or dead from the physical trauma or exhaustion while in these nets, especially when set in flowing water such as the Colorado River. Individuals can also be killed if left in these nets too long, and the combined stress of time in the net plus the handling can cause delayed mortality.

Traps such as fyke nets, hoop nets, and minnow traps are less likely to result in physical trauma as the capture is passive and the fish either swims into these traps randomly or are baited into them. Some fish may be captured with a predatory fish or a larger fish that may begin eating smaller fish within the trap, resulting in mortality of the smaller fish or size classes.

More active methods of capture include cast nets, dip nets, hand captures, angling, seines, and trotlines. These methods are less likely to result in injury or death from being left too long attached to the gear, with the possible exception of the use of trotlines. The use of dip nets, hand captures and angling will result in the immediate handling of the fish upon capture. The use of trotlines or angling may result in hook related injuries that may affect feeding, but these effects generally are not anticipated to be significant. In some cases, the use of hook and line to capture fish can result in the fish swallowing the hook or a hook snagging a fish. This can lead not only to injury, slowing the intake of food, but also to death as a result of stomach perforations associated with swallowing hooks. There is a delayed mortality factor with hook and line captures (Bartholomew and Bohnsack 2005, DuBois et al. nd).

Passive surveys such as snorkeling or scuba can also result in disturbance to fish that can result in changes to behavior over the short term (Brignon et al. 2011) but has limited effects over the long-term since there is no capture stress.

Removing fish from various sampling gear, holding, handling, and release can also result in injury and mortality from physical trauma, secondary infections, and stress (Cho et al. 2011, Francis-Floyd 2009, Harper and Wolf 2009, Portz et al. 2006, Sharpe et al. 1998). Handling may include data collection on reproductive status (palping for egg masses), physical measurements, weighing, marking of individuals and taking tissue or gastrointestinal content samples.

Captured fish removed from the wild during salvage operations or capture events to provide hatchery stock or immediate transfer to another site are also at risk of injury or mortality from the act of transporting them to another location. BMP #4 addresses guidelines for safe transport of fish and, as evinced by many successful transport events, these are effective in reducing risk. However, there is always a chance of some mortality occurring during this activity.

The act of field crews moving through the water with nets or other equipment also has a risk to eggs or larvae if activities are conducted during the spawning and nursery period for a species. Some species remain vulnerable to trampling as adults (for example, the loach minnow) because they shelter in the substrate under rocks and may not move out of cover quickly enough to avoid harm. Activites in the stream or pond also stir up sediments that temporarily increase turbidity and may result in re-deposition of these sediments on hard surfaces that support algae or other food resources. Accessing streams from the banks may also disturb rooted vegetation that may result in bank erosion.

Marking individuals with fin clips, PIT tags, nares tags, coded wire tags, Floy tags, fluorescent dyes, and possibly branding or tattooing is common practice and carries some degree of risk due to injection or surgery (Montony 2008, Northwest Marine Technology 2008). In addition, telemetry implants are used to mark and follow individual fish. Marking with any of these methods can result in entry sites for secondary bacterial or fungal infections that could permanently disable or kill individuals.

Consultation fish species captured during SWG and CAMP activities may be used in restocking, augmenting populations, genetic management, and as refuge populations in accordance with recovery activities coordinated with land managers, land owners, and approved by USFWS. These activities for native sportfish species are funded under SFR. Transport can lead to death or injury to individuals from declining water conditions, poor oxygenation, and temperature control. Smaller individuals may be preyed upon by large individuals or predatory species during a mixed community restocking. There is potential for all individuals transported to be lost if release is delayed and/or water quality and temperature control is lost. Release of individuals should not add additional stress to the individuals if acclimatized appropriately. Some physical injuries may occur during releases, but these are anticipated to be minimal.

AGFD has stocks of listed fish in hatcheries and in refuges around the action area. These fish are used for reestablishment, population augmentation, and genetic management efforts. In addition, these individuals are used to research basic biology of these species, husbandry and

reproduction, conservation needs, and pathology and treatment of disease and parasites. The species in captivity are subject to all the effects from capture, handling, and transport as described above, but due to the constructed aquatic habitat in which they are raised, all the individuals could be affected by degraded water quality or disease if water control and disease management systems fail. This could result in up to all the individuals of a species or stock being injured or killed. While this risks many individuals, the recovery benefit of providing data to inform recovery activities, individuals to augment and establish wild populations, and provide refuges and individuals to reestablish extirpated sites, far outweighs the risk of a catastrophic loss of the captive individuals.

Actions to measure physical components of aquatic habitat including water quality, substrate types, aquatic vegetation, and flow parameters may also have adverse effects. Measurements of habitat parameters that require physical movement or manipulation (particularly when dealing with substrates) disturb the habitat feature and may release sediments or other materials into the water column. The need to be in the water to undertake these actions increases the amount of trampling and sediment disturbance that results.

Conservation activities targeted to invertebrates, amphibians, and reptile species that involve surveys and monitoring may also result in disturbance to any fish species present and to habitat conditions (particularly substrate disturbance and temporary increases in turbidity. In-water traps for amphibians and gartersnakes may also capture fish and result in injury or death. Predation on captured fish by gartersnakes may also occur. Native aquatic species are more likely to be found in the same locations since there are limited areas that do not support nonnative species (including sportfish).

Adverse effects to designated or proposed critical habitat for listed fish species covered under this BCO are not expected to reach a level of significance that could result in long-term degradation of the PBFs. Activities in the water related to work on any species covered by this consultation would be limited in extent and duration. There will be some short-term disturbance of substrates, shorelines or banklines, and water quality (from disturbance of sediments); however, these are of short duration and do not represent any significant effect.

Amphibians

The five amphibian consultation species are all subject to targeted activities under SWG-funded conservation efforts. There is also some level of overlap with consultation invertebrates for Chiricahua leopard frog (Huachuca springsnail) that may result in non-target effects to the frog. Native fish and gartersnake conservation actions also overlap with Chiricahua leopard frog, northern leopard frog, and possibly Arizona treefrog in a few locations, and there may be non-target effects to these species. Sonoran tiger salamanders may overlap with native fish, Chiricahua leopard frogs, Arizona treefrogs and gartersnakes so non-target effects may occur between them. Relict leopard frogs are isolated from the other consultation species and no non-target effects are anticipated for this species. Northern leopard frogs are also isolated; however, there may be some opportunity for co-occurrence with northern Mexican gartersnakes if the latter persists above the Mogollon Rim. Relict leopard frog and Arizona treefrog are unlikely to have non-target effects from sportfish-related activities since there are no sportfish in their habitats. The occupied habitats of Sonoran tiger salamander may harbor some sportfish species;

however, surveys and monitoring activities connected to SFR funding are unlikely to occur in those locations as they are not managed for sportfishing purposes. Chiricahua and northern leopard frogs have some overlap with sportfish populations and there may be non-target effects from SFR funded actions as well as CAMP activities directed at these species.

There are standardized published guidelines for handling amphibians in general (Heyer et al. 1994, Beaupre et al. 2004), and species specific protocols (Appendices E, F, and G in USFWS 2007a). AGFD also has disease and parasite protocols (see Appendix C) that reduce the risks of transmission of chytrid fungus and the ATV virus. Additionally, in the section 10(a)(1)(A) permit, AGFD is required to conform to the Declining Amphibians Population Task Force Fieldwork Code of Practice (DAPTF nd) with the exception that a 10% bleach solution or quarternary ammonia (Quat 128) should be used to clean equipment rather than 70% ethanol. While the permit requirements only addresse Chiricahua leopard frog and Sonoran tiger salamander, these measures are followed for all amphibian species activities under SWG and where there may be incidental exposure of amphibian species during SFR funded activities.

Death or injury during capture efforts, and holding of individuals during processing or transportation, can be minimized by following guidelines and protocols discussed above. Use of dip nets, seines, and hand capture for all five amphibian species is included in the proposed action.

Capture, handling, and short-term holding (<2 hours) of amphibians during targeted survey and monitoring could result in injury or death of some individuals. These direct effects would be limited; however, because only appropriately trained and permitted individuals will be allowed to capture and handle amphibians. The number of amphibians likely to be killed or injured will depend on the number of sites sampled and the size and number of animals captured and held. If seines are used to capture amphibians or native fish where the two groups are present together some small individuals or larval forms that escape capture and any eggs present could certainly die as a result of mechanical trauma from the seining itself. These individuals may be killed or injured from passing through the seine mesh or having the weight line push them into the mud. Eggs, as well as some small larval forms which are not powerful swimmers, could also be buried in sediment as the silt stirred up will settle back to the bottom or on vegetation. Eggs and small adult or larval forms could be crushed and larger adults or larval forms and metamorphs could be crushed or injured by sampling personnel walking in habitat while seining or dip-netting for frogs or conducting instream activities for other consultation species. Based on prior experience, larger salamanders (>4.33 inches in length) should be able to be captured and handled with relatively low mortality. Although there is less available information on mortality of captured frogs, we anticipate that adult frogs captured in targeted activities would also have relatively low mortality if proper procedures are followed. Field crews conducting surveys or other activities for native fish or gartersnakes in occupied amphibian habitats should take care to avoid effects to frogs or salamanders during seining and netting activities. Frogs are at less risk to be trapped in large-mesh nets (gill nets or trammel nets) due to the size of the openings; however, there is a risk of being tangled in in these devices and drowning. These types of nets are not generally used in the small habitats occupied by consultation amphibian species but there is a risk if they are.

When using aquatic traps in habitats where there are concerns for conservation amphibian species, ADFG follows BMP#8 (Trap Gear) requirements that allow hoop nets, minnow, and crayfish traps to be used in such a way that a portion of the trap is above water to allow captured amphibians to breathe. Amphibians captured in these devices are at risk of predation or harassment by other captured organisms including bullfrogs, gartersnakes, and crayfish.

AGFD does not propose using electroshocking as a survey method for amphibians but there may be non-target effects to leopard frogs and salamanders from its use as a survey method for native fish and sportfish. The effect of electroshocking on amphibians is not well studied. Electroshocking is sometimes used as a survey method for frogs (Kaufmann and Hughes 2006) and salamanders (Williams et al. 1981) but other authors strongly discourage the method for salamanders as ineffective and potentially dangerous (Nickerson and Krysko 2003) due to the stress it puts on the animals from electronarcosis and electrotetany, particularly when individuals are under rocks or other cover and cannot surface.

Repeated electric shocks can kill ranid frogs (McGill 1960 cited in Rice and Taylor 1995), particularly in species where their predator avoidance behavior is to remain motionless and they do not leave the electric field. Adult frogs can, before immobilized by the field, jump out of the water to escape but tadpoles cannot and may not be able to swim fast enough to avoid the field. Tadpoles and metamorphosed sub-adult and adult frogs do become immobilized from the electric field, and there may be initial body spasms when the field is contacted. These spasms in fish species are documented to cause damage to the spine and other injuries (Snyder 2003) and such injuries may manifest in frogs. Unfortunately, this potential has not been examined by researchers. The effects on egg masses of exposure to an electric field are also unknown.

Non-target electrofishing for native or sportfish monitoring is unlikely to affect the Arizona treefrog since it breeds mostly in ephemeral waters lacking any fish and adults and metamorphed sub-adults are found in moist areas not in aquatic habitats (USFWS 2010n).

The Canadian Council on Animal Care (CCAC nd) discusses in detail methods for handling amphibians to minimize stress or other harm to the individual animal. Amphibians are susceptible to heat, cold, dehydration, and stress from capture and handling. Thermal stress can occur in traps or holding containers and due to heat transfer from human contact, and handling time can also negatively affect hormonal balance and the natural antibacterial properties of amphibian skin. Capture methods can also remove the protective mucus layer on the skin. Appendices in the Chiricahua leopard frog recovery plan (USFWS 2007a) also contain detailed procedures for handling frogs to reduce stress and mortality from handling and processing. These procedures are generally followed by AGFD personnel in the field when implementing conservation actions for amphibian species, which serves to reduce the stress and potential injury or mortality to handled individuals.

Marking methods for amphibians in the proposed action includes clipping body parts (fins and toes) as well as use of PIT tags and radio transmitters (Hoffman et al. 2008, Matthews and Pope 1999).

The marking of individual Sonoran tiger salamanders may be accomplished through the use of PIT tags implanted into the body cavity. These tags are implanted using a modified hypodermic

syringe or similar device using a hollow needle. This results in increase in handling time and a small cut in the skin and body cavity. This can result in a pathway for pathogens to enter the body, as the slime layer and dermis have been breached. However, there have been no reports of increased mortality or morbidity related to the use of PIT tags in salamanders. A laboratory study, using *Ambystoma opacum*, found no significant impact of the use of PIT tags on growth and survival (Ott and Scott 1999). However, Ott and Scott (1999) did document two deaths related to PIT tag use which they attribute to their inexperience in the use of these tags.

Matthews and Pope (1999) used external transmitters on mountain yellow legged frogs and followed individuals for several months. Three frogs had small abrasions noted when the belt was removed; however these healed within a day or two. Additionally, 10 of the 14 tagged frogs gained weight over the period when the transmitters were deployed. They also cited from a previous survey using PIT tags on over 500 frogs where similar weight gains were noted.

Long term holding of frogs in captivity requires creation and maintenance of suitable habitat conditions for all life stages. Even with the best care, there can be incidents where significant mortality can occur. The causes of such mortality should be documented and subsequent management to avoid those causes made part of the protocol.

Mortality can result from long-term holding of Sonoran tiger salamanders in association with renovation projects to remove nonnative predators and competitors, restoration of habitats, or as a response to a catastrophic event, such as a large wildfire that may result in large ash flows into occupied Sonoran tiger salamander habitat. We do not expect excessive mortality in large salamanders due to extended holding periods associated with such projects. However, the situation is likely to be different for small larval salamanders. In 2008, 1,536 salamanders were seined from Lone Mountain Tank on the western edge of the San Rafael Valley as part of the Bullfrog Removal at Four Stock Tanks project conducted under the aforementioned AGFD Enhancement of Survival Permit (TE083686-0). These animals were held overnight in kiddie pools onsite. Unfortunately, 527 of them died, all of which were larval salamanders from 1.18 to 4.33 inches total length. Based on this experience, if larval salamanders are present during activities such as renovation or catastrophic event response, there could be relatively high mortality of larval salamanders during the capture and holding process. In addition, smaller salamanders held with larger salamanders may bepreyed on by the larger individuals. Mortality, including cannibalism, may be minimized if small salamanders (<4.3 inches total length) are readily moved to sites with adequate food and cover for them. Transport and release in association with long-term holding of Sonoran tiger salamanders is not expected to increase the likelihood of injury or mortality over that of the long-term holding of individuals. Overall, the long-term holding of Sonoran tiger salamanders, while having some mortality, will result in long-term benefits to the species when associated with renovation projects and have relatively low mortality compared to environmental catastrophes. Similar effects may be expected for renovation efforts for frogs when they are removed from their habitats.

Adverse effects due to spread of disease is possible without following proper amphibian disease prevention protocols. Effects from the spread of iridovirus or chytrid fungus can range from reduction in population sizes to local extirpation. The use of disease prevention protocols minimize or eliminate this source of adverse effects.

The section 10(a)(1)(A) permit authorizes the intentional collection of no more than 10 voucher specimens (larvae or metamorphs) from the wild to document newly discovered Sonoran tiger salamander populations. These animals will be used for taxonomic and genetic analysis to confirm whether the population is Sonoran tiger salamanders, a non-native sub-species, or a hybrid of the two. In addition, the permit authorizes the collection of no more than 30 specimens (including eggs masses) for contaminants and/or disease analyses and necropsy purposes, and/or genetic analysis. The effects of the removal of eggs or larvae from a population site are not as large as the removal of adults; however the removal of any life stage is not likely in population level effects. This is based upon the reproductive potential Sonoran tiger salamanders, the presence of terrestrial forms in the upland habitat, and the ability of the terrestrial forms to move between suitable aquatic sites for breeding. Therefore, if there is a localized effect on a population, it is not likely to be more than short-term, as recolonization and recruitment will make-up for the loss of these individuals. We do not anticipate any additional collection efforts for Sonoran tiger salamanders as a part of this consultation.

The permit also authorizes intentional collection of Chiricahua leopard frogs for voucher specimens (two per population) and no more than 10 (or 20 from large populations) for genetics, contaminants, disease analysis and necropsy purposes. Removal of egg masses is not included in the permit; however, this action is covered under this consultation and is implied in the permit based on the ability of AGFD to hold unlimited numbers of all life stages in captivity. Before any efforts to remove egg masses from the wild are initiated, guidelines to determine a safe number for removal will be in place to avoid significant impacts to the source populations. This applies to the other frog species as well, particularly the relict leopard frog where population establishment actions are ongoing. Collection of Chiricahua or northern leopard frog egg masses for CAMP reintroduction activities may occur. Eggs may be held in approved facilities and the tadpoles head-started until their release. The number of egg masses collected will be limited through the development of the guidelines mentioned above.

Actions to measure physical components of aquatic habitat including water quality, substrate types, aquatic vegetation, and flow parameters may also have adverse effects. Measurements of habitat parameters that require physical movement or manipulation (particularly when dealing with substrates) disturb the habitat feature and may release sediments or other materials into the water column and can disturb egg masses or tadpoles. The need to be in the water to undertake these actions increases the amount of trampling and sediment disturbance or vegetation disturbance that results.

The implementation of these actions in support of recovery, while having some short-term effects, will have long-term beneficial effects for the amphibian species. Survey and monitoring of populations sites and suspected population sites help to provide information on threats and assist in focusing recovery actions towards these sites. When nonnative competitors and predators are found in a population site or in nearby aquatic sites; work can begin on restoration plans which may include coordination with land management agencies, land owners, and non-governmental organizations. In addition, long-term approaches to control nonnatives across a watershed can be developed and prioritized based upon occupancy. These activities will reduce threats, increase population sizes, and improve metapopulation stability.

The amount of adverse effect to amphibian species by sportfish management activities is limited by the low number of sites where sportfish activities are likely to occur that also support the five amphibian species of concern. The use of BMPs as included in the proposed action reduces the risks to amphibian species from sportfish management activities.

Reptiles

Two gartersnake species and the Sonoyta mud turtle are included in the proposed action. The restricted range of the Sonoyta mud turtle limits the amount of SFR funded sportfish surveying and monitoring activites that could occur in its occupied habitat and by far the most work would be under SWG for conservation purposes. For the two gartersnakes, conservation actions are implemented using SWG funding and for implementation of the CAMP, by SFR funds. Sportfish-related activities using SFR funds may have non-target interactions with the gartersnakes because there are aquatic habitats that support both gartersnakes and sportfisheries in the same area. For example, the Verde River and its tributaries support both sportfish and gartersnake populations.

Beaupre et al. (2004), McDiamid et al. (2012) and the CCAC (CCAC nd) contain survey and handling guidelines for gartersnakes and turtles that address the breadth of potential activities directly focused on these species and some of the non-target activities where an individual of one of these species is affected. AGFD does not have any specific protocols for reptiles that were provided with the proposed action; however, AGFD staff operates using guidelines in the references cited above when interacting with these species, since the types of activities proposed for these species are included in those documents.

Gartersnakes do show signs of stress from handling (Lutterschmidt and Mason 2005, Moore and Mason 2001, Moore et al. 2000, 2001) but should be handled with care and released quickly if inadvertently contacted during sportfish-related activites. Capture techniques can also injure individuals if not properly used; for example, when using traps in water for aquatic reptiles ensure they are secured such that a portion of the trap is above water to allow breathing (Bandas 2003). Use of snake tongs should hold the animal securely but not result in injury. While most fish nets or traps are unlikely to entrap snakes, they may affect turtles if they are placed in the water and left for several hours and the animal drowns. Small minnow traps may also be a danger to young gartersnakes if not placed such that a portion of the trap is above water. The protocols in BMP#8 (Trap Gear) reduce the risk of injury or mortality from underwater traps. Small gartersnakes captured in traps may be preyed upon or harassed by other animals captured, including crayfish and bullfrogs.

Gartersnakes in the water are susceptible to electric fields generated by electroshocking for fish (native and sportfish). In either case, the gartersnake is not the target species for the action. Individuals far enough from the electrofishing unit may have time to leave the water prior to the electric field becoming strong enough to stun them. Individual gartersnakes that are in hiding from the approaching field crews may not attempt to move out of cover and be stunned by the electric field. Individuals that cannot be seen (due to cover) may be stepped on or otherwise injured by field crews passing their location. The effect of the electric shock is to stun the individual and there may be spasms as the shock is felt. In fish, electric shock can cause damage to the vertebra (Snyder 2003); however the effects on gartersnakes have not been well studied.

Actions to measure physical components of aquatic habitat including water quality, substrate types, aquatic vegetation, and flow parameters may also have adverse effects. Measurements of habitat parameters that require physical movement or manipulation (particularly when dealing with substrates) disturb the habitat feature and may release sediments or other materials into the water column. The need to be in the water to undertake these actions increases the amount of trampling and sediment disturbance that results.

Development of holding and rearing facilities for gartersnakes is underway and these efforts will continue over the period covered by the proposed action. Loss of individuals in such settings is possible due to a number of causes, particularly failure of the facility to maintain suitable habitat parameters. During the development of facilities there is opportunity to have unexpected failures despite best efforts to prevent them.

The implementation of these actions in support of recovery, while having some short-term effects, will have long-term beneficial effects for the reptile species. Survey and monitoring of population sites and suspected population sites help to provide information on threats and assist in focusing recovery actions towards these sites. When nonnative competitors and predators are found in a population site or in nearby aquatic sites; work can begin on restoration plans which may include coordination with land management agencies, land owners, and non-governmental organizations. In addition, long-term approaches to control nonnatives across a watershed can be developed and prioritized based upon occupancy. These activities will reduce threats, increase population sizes, and improve metapopulation stability.

Non-target effects to gartersnakes from conservation management actions for native fish and amphibians may occur through traps, nets, or electrofishing. Management actions for the suite of native species that should be found in an area have short-term adverse effects to all species; however, the long-term benefits of properly managed multi-species communities outweigh the adverse effects.

Gartersnakes may be inadvertently affected by sportfish-related activities. The numbers of such sites where these effects may occur are limited due to the restricted range of the gartersnakes and that mostly they are not found with sportfish (the Verde River and Oak Creek are among the exceptions).

Mammals

Only the New Mexican meadow jumping mouse (jumping mouse) was determined to have the potential for adverse effects from the implementation of the proposed action. The habitat of the jumping mouse runs parallel to streams in the White Mountains in the Little Colorado River and Black River watersheds. These streams contain several species of native fish and may also support gartersnakes or leopard frogs. The concern is for trampling in the vegetated riparian areas that support the jumping mouse and any resultant damage to the vegetation component of the habitat. In some cases, there may not be existing trails to access the stream at all desired sample points, resulting in the need to walk along the bank. Location of staging areas for equipment and processing areas in already disturbed areas could result in additional damage to soils or bank stabilization, as areas of dense grass and sedge growth are less likely to be usable

for this purpose. While this does reduce the potential for damage to the intact habitat, the unstable areas may result in changes in flood flows and erosion that enlarge the damaged area at the cost of suitable habitat.

The extant protocols for AGFD field crews do not contain measures to avoid or reduce damage to jumping mice; however, it is usual practice to use established trails or paths to access streams and once surveys are initiated, the work is in the water. Suitable jumping mouse habitat can be quite dense, which provides protection to the bankline through plant roots, and also discourages creation of new pathways or access points. If these practices are followed, the damage to jumping mouse habitat should be limited. The following protocol is included in this consultation as a conservation measure and is part of the proposed action:

In occupied habitat of jumping mice, access to aquatic habitats will be limited to the minimum necessary by minimizing trips and personnel and being careful not to create trails by moving back and forth on the same pathway.

Critical habitat

The action area contains designated and proposed critical habitat for 14 species. The locations of the critical habitat units and PBFs of critical habitat in the action area are briefly discussed under each species' status. This BCO does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the Act to complete the following analysis with respect to critical habitat.

"Critical habitat," as defined in Section 3(5)(A) of the Act, means: (i) the specific areas within the geographical area occupied by the species at the time it is listed, on which are found those physical and biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by a species at the time it is listed upon a determination by the Secretary that such areas are essential for the conservation of the species. The term "conservation," as defined in Section 3(3) of the Act, means: the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this Act are no longer necessary. Therefore, in the case of critical habitat, conservation represents the areas required to recover a species to the point of delisting (i.e., the species is recovered and is removed from the list of endangered and threatened species). In this context, critical habitat preserves options for a species' eventual recovery.

In our analysis of the effects of the action on critical habitat, we consider whether or not the proposed action will result in the destruction or adverse modification of critical habitat. In doing so, we must determine if the proposed action will result in effects that appreciably diminish the value of critical habitat for the recovery of a listed species (see p. 4-34, USFWS and NMFS 1998). To determine this, we analyze whether the proposed action will adversely modify any of those physical or biological features (PBFs) that were the basis for determining the habitat to be critical. To determine if an action results in an adverse modification of critical habitat, we must also evaluate the current condition of all designated critical habitat units, and the PBFs of those

units, to determine the overall ability of all designated critical habitat to support recovery. Further, the functional role of each of the critical habitat units in recovery must also be defined.

The types of activities that occur in the boundaries of critical habitat are primarily capture techniques and measurements of physical habitat parameters using a variety of methods (see Appendix C). The actions do not include habitat manipulations, are not of a duration that will impact any PBFs in the long-term, and/or are not of an extent to be a significant impact on PBFs or critical habitat units/areas based upon the area of impacts. Implementation of these recovery and management actions may result in direct short-term temporary effects to PBFs related to substrates (which may be disturbed by nets or movement of rocks or other substrates during sampling actions), bankline conditions (which may be affected by trampling as the site is accessed), and water quality (due to disturbance of sediments in the substrate) within the designated critical habitat. Further, survey and monitoring activities are limited over time since there are limits on the number of surveys to the site allowed under the proposed action.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Assessing cumulative effects for this consultation is difficult since the action area included Arizona and portions of adjoining states and Mexico. Continuing development of private lands for human purposes is likely to continue to occur, as is acquisition and development of new water supplies to support this growth. Aquatic and riparian habitats that are the sites of covered activities may decline over this period as a result of this additional growth.

It is well known that southeastern Arizona and much of the American southwest have experienced serious drought recently. What is less certain is how long droughts will last. State-of-the-art climate science does not yet support multi-year or decade-scale drought predictions. However, instrumental and paleoclimate records from the southwest indicate that the region has a history of multi-year and multi-decade drought (Hereford et al. 2002, Sheppard et al. 2002, Jacobs et al. 2005). Multi-decade drought in the southwest is controlled primarily by persistent Pacific Ocean-atmosphere interactions, which have a strong effect on winter precipitation (Brown and Comrie 2004, Schneider and Cornuelle 2005); persistent Atlantic Ocean circulation is theorized to have a role in multi-decadal drought in the southwest, particularly with respect to summer precipitation (Gray et al. 2003, McCabe et al. 2004). Given these multi-decade "regimes" of ocean circulation, and the severity and persistence of the present multi-year drought, there is a fair likelihood that the current drought will persist for many more years (Stine 1994, Seager et al. 2007), albeit with periods of high year-to-year precipitation variability characteristic of southwest climate.

The information on how climate change might impact Arizona and adjoining states is less certain than current drought predictions. However, virtually all climate change scenarios predict that the American southwest will get warmer during the 21st century (IPCC 2001, 2007). Precipitation predictions show a greater range of possibilities, depending on the model and emissions scenario,

though precipitation is likely to be less (USGCRP 2001, Seager et al. 2007). To maintain the present water balance with warmer temperatures and all other biotic and abiotic factors constant, precipitation will need to increase to keep pace with the increased evaporation and transpiration caused by warmer temperatures.

Key projections to keep in mind include:

- decreased snowpack — an increasing fraction of winter precipitation could fall as rain instead of snow, periods of snowpack accumulation could be shorter, and snowpacks could be smaller; ironically, due to changes in snow-precipitation characteristics, runoff may decrease even if total precipitation increases (Garfin 2005, Seager et al. 2007);

- earlier snowmelt — increased minimum winter and spring temperatures could melt snow packs sooner, causing peak water flows to occur much sooner than the historical spring and summer peak flows (Steward et al. 2004).

- enhanced hydrologic cycle—in a warmer world an enhanced hydrologic cycle is expected; flood extremes could be more common causing more large floods; droughts may be more intense, frequent, and longer-lasting (Seager et al. 2007).

Continuing drought and climate change, when added to the historical and continuing threats, will make native aquatic species conservation in the action area even more difficult. The impact of site desiccation to fish is obvious. Many less obvious effects could occur with drought and a warmer climate. A site with reduced streamflow, or a pond or pool with low water levels could become fishless due to reduced dissolved oxygen. We have seen this occur at three important natural Gila topminnow sites (i.e. Sharp Spring, Redrock Canyon, Cienega Creek). Nonnative aquatic species may become more restricted in distribution as well; however, both native and nonnative species will be competing for remaining aquatic habitats, and extensive case history suggests that nonnative species could out-compete the natives. Disease and parasites will become more prevalent in warmer water conditions such as *Lernaea* which is already found on razorback sucker in the Verde River.

Drought and climate change will also impact watersheds and subsequently the water bodies in those watersheds. Long term drought will affect how ecosystems and watersheds function. These changes will cause a cascade of ecosystem changes, which may be hard to predict and are likely to occur non-linearly (Seager et al. 2007). As an example, drought and climate change will cause changes in fire regimes in all vegetation communities in the action area. The timing, frequency, extent, and destructiveness of wildfires are likely to increase and may facilitate the invasion and increase of nonindigenous plants. These changed fire regimes will change vegetation communities, the hydrological cycle, and nutrient cycling in affected watersheds (Brown et al. 2004). Some regional analyses conservatively predict that acreage burned annually will double with climate change (MacKenzie et al. 2004). Such watershed impacts could cause enhanced scouring and sediment deposition, more extreme flooding (quicker and higher peak flows), and changes to water quality due to increases in ash and sediment within stream channels. Severe watershed impacts such as these, when added to reductions in extant aquatic habitats, will severely restrict sites available for the conservation of native fish and other aquatic vertebrates and make management of extant sites more difficult.

Many of the predictions about the impacts of climate change are based on modeling, but many predictions have already occurred. The tree die-offs and fires that have occurred in the south-west early in this century show the impacts of the current drought. Because of drought, climate change, and human population growth, negative effects to aquatic habitat in the action area continue to occur. The basin's rivers, streams, and springs continue to be degraded, or lost entirely.

CONCLUSION

After reviewing the current status of the species considered above, the environmental baseline for the action area, the effects of the proposed action as described in this and supporting documents and the cumulative effects, it is the FWS's biological opinion that the action of WSFR funding under SFR and SWG grants actions of the AGFD, as proposed, is not likely to jeopardize the continued existence of the following species, and is not likely to destroy or adversely modify designated or proposed critical habitat.

In their management of aquatic wildlife, AGFD has implemented the activities analyzed in this BCO and has documented minimal losses to target species. Even in the most complex salvage, capture, or transport operations, the number of mortalities is minimal. The documentation of effects to non-target species, particularly from sportfish-related activitities is limited. As discussed in the effects section, the opportunity for sportfish activities to occur in occupied habitats of consultation species exists in a number of locations. For SWG funded conservation actions, there is also limited overlap between most native aquatic species due to their restricted ranges. However, particularly over the last decade, AGFD has implemented BMPs and other guidelines to reduce the potential for effects to aquatic wildlife from the covered activities, and those will be in place (and updated as appropriate) for the 10-year period covered by this consultation. The use of these guidelines in the past has been effective in reducing incidental mortality. Annual reporting on AGFD's section 6 program documents the limited amount of mortality observed as a result of these activities. Appendix D shows the take reporting for 2006-2010).

Although there are minor differences between the species groups in terms of potential effects, overall, our conclusions for all groups are based on the following:

- There are proper guidelines and protocols in place that guide how procedures are implemented under the proposed action. These procedures are based on accepted research methods acceptable to the scientific community. These address the conservation actions associated with these species.

- For some species, the actions involved in recovery implementation via the SWG grant were authorized by issuance of the section 10(a)(1)(A) permit for these species. The additional effects to these species from SFR-funded activities that are likely to occur (either through the CAMP or sportfish monitoring) do not significantly increase the total level of adverse effects.

- For species where there is no section 10(a)(1)(A) permit connection, this BCO evaluated

the types and potential level of adverse impacts from implementing conservation actions associated with these species under SWG. Wth the use of BMPs and other guidelines during those conservation actions, we determined the effects did not compromise any species survival or recovery. SFR-funded activities either through the CAMP, management actions for native sportfish, or sportfish survey and monitoring actions as described in the proposed action have the potential for targeted and incidental non-target interactions. With the use of BMPs and other guidelines during these sportfish or CAMP related activities, we determined the effects did not compromise any species survival or recovery. The long-term benefits to species populations from the activities conducted under the SWG grant and the CAMP outweigh the short-term adverse effects to individuals. The effects to consultation species from implementation of sportfish-related SFR activities is limited in both breadth and scope due to the limited overlap of occupied habitats of consultation species with areas managed for sportfish.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined (50 CFR 17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Harass" is defined (50 CFR 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by WSFR so that they become binding conditions of any grant or permit issued to the AGFD, as appropriate, for the exemption in section 7(o)(2) to apply. WSFR has a continuing duty to regulate the activity covered by this incidental take statement. If WSFR (1) fails to assume and implement the terms and conditions or (2) fails to require the AGFD to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the AGFD must report the progress of the action and its impact on the species to WSFR as specified in the incidental take statement. [50 CFR §402.14(i)(3)].

AMOUNT OR EXTENT OF TAKE

Additions to take covered by section 10 permit

The BO for the issuance of the section 10(1)(a)(A) permit included incidental take for 13 species considered in this consultation. The text for that incidental take is presented below. A portion of this incidental take would result from the implementation of activities funded through SWG and covered in this consultation, with the remainder resulting from activities under other funding sources not related to SFR. We believe that the level of incidental take provided through the section 10(a)(1)(A) consultation for those species is sufficient to address any incidental take that may occur due to activities funded by SWG. The levels of incidental take for WSFR for these species and their funding of SWG is the same as that provided in the permit. This does not mean the amount of covered take is doubled; it remains as stated in the permit and both AGFD and WSFR will lose coverage if that level is exceeded. The level of incidental take for these species will be set through the subsequent issuance of the section 10(a)(1)(A) permit and will vary over the term of this consultation depending on changes in future permits.

To address potential take from SFR-funded activities on these 13 species, we reviewed each species and provided an incremental additional level of incidental take to cover funding of these actions by WSFR, including implementation of the CAMP using SFR funds. For species without species-specificconservation measures included in the CAMP, we are not including any potential incidental take from implementation of those activities. Because we are not aware of what those activities might entail, it is not possible to issue take for those actions at this time.

Below, we present the incidental take level as presented in the biological opinion and section 10(a)(1)(A) permit, with the additions for this consultation at the bottom.

Kanab ambersnail

The USFWS anticipates incidental take of Kanab ambersnail will be difficult to detect for the following reason(s): the species is cryptic, small in size, lives in dense vegetation, and accurate quantification of take will be difficult as individuals taken will be difficult to locate. However, the following level of take of this species can be anticipated by the amount of habitat disturbed during the authorized activities. Therefore, we anticipate that no more than 20 percent of an occupied vegetation patch will be temporarily disturbed during authorized activities. This temporary disturbance will be from moving through the vegetation and following the sampling protocol and result in incidental take in the form of harass, harm and mortality. Incidental take will be from individuals dislodged from the vegetation, individuals being crushed under foot, and the loss of egg masses attached to vegetation through physical trauma and changes in environmental condition. We anticipate the actual take of individuals to be less than five percent of the population, as many individuals will not be affected by the authorized activities and related vegetation disturbance. Incidental take shall be exceeded if more than 20 percent of an occupied vegetation patch is temporarily disturbed or more than five (5) percent is permanently disturbed by the authorized activities.

We do not anticipate any additional take is needed for this species as it would not be affected by SFR-funded activities.

Bonytail

The USFWS anticipates all captured, handled, held, transported and released bonytail chub in the form of harass will be taken as a result of the proposed action. The USFWS anticipates up to five bonytail chub in the wild will be taken in the form of mortality as a result of this proposed action, annually. All individuals in the captive populations may be taken in the form of harass, harm and mortality due to environmental control failure, research activities, husbandry, and disease.

We anticipate additional bonytail in the wild will be harassed as a result of capture and handling during sportfish surveys and monitoring in Lake Mohave, Lake Havasu, and the Colorado River from Parker Dam to Imperial Dam. We anticipate an additional one bonytail in the wild will be taken in the form of mortality as a result of the non-target interactions with the proposed action, annually.

Bonytail chub is a CAMP species; however, the mandatory measures (placement of a barrier net and posting signs at La Paz Lagoon) do not require any additional incidental take.

Humpback chub

The USFWS anticipates all captured, handled, held, transported and released humpbacked chub in the form of harass will be taken as a result of the proposed action. The USFWS anticipates up to 200 humpback chub from the wild will be taken in the form of mortality as a result of this proposed action, annually. All individuals in the captive populations may be taken in the form of harass, harm and mortality due to environmental control failure, research activities, husbandry, and disease.

We do not anticipate any additional take is needed for this species as it would not be affected by SFR-funded activities.

Humpback chub is a CAMP species; however, the conservation measure (consideration of potential for nonnative fish to reach the Little Colorado River in Grand Canyon) does not require and additional incidental take.

Razorback sucker

The USFWS anticipates all captured, handled, held, transported and released razorback sucker in the form of harass will be taken as a result of the proposed action. The USFWS anticipates up to 100 razorback sucker will be taken in the form of mortality as a result of this proposed action, annually. All individuals in the captive populations may be taken in the form of harass, harm and mortality due to environmental control failure, research activities, husbandry, and disease.

We anticipate additional razorback suckers in the wild will be harassed as a result of capture and handling during sportfish surveys and monitoring in Lake Mead, Lake Mohave, Lake Havasu, the Colorado River from Parker Dam and the Verde River. We anticipate up to five additional razorback suckers from the wild will be taken in the form of mortality as a result of the non-target interactions with the proposed action, annually.

Razorback sucker is a CAMP species; however, the mandatory measures (placement of a barrier net and posting signs at La Paz Lagoon) do not require any additional incidental take.

Gila chub

The USFWS anticipates all captured, handled, held, transported and released Gila chub in the form of harass will be taken as a result of the proposed action. The USFWS anticipates up to 500 Gila chub will be taken in the form of mortality as a result of this proposed action, annually. All individuals in the captive populations may be taken in the form of harass, harm and mortality due to environmental control failure, research activities, husbandry, and disease.

We anticipate additional Gila chub in the wild will be harassed as a result of capture and handling during sportfish surveys and monitoring in occupied habitats in the Verde River basin and the Agua Fria River basin. Gila chub in the Santa Cruz River basin are unlikely to be in areas where SFR funds are expended. We anticipate up to 10 additional Gila chub from the wild will be taken in the form of mortality as a result of the non-target interactions with the proposed action, annually.

Implementation of CAMP activities for Gila chub (two surveys of Spring Creek) are unlikely to require additional incidental take over the 10 individuals per year for sportfish-related activities included above.

Yaqui chub

The USFWS anticipates all captured, handled, held, transported and released Yaqui chub in the form of harass will be taken as a result of the proposed action. The USFWS anticipates up to 100 Yaqui chub will be taken in the form of mortality as a result of this proposed action, annually. All individuals in the captive populations may be taken in the form of harass, harm and mortality due to environmental control failure, research activities, husbandry, and disease.

We do not anticipate any additional take is needed for this species as it would not be affected by SFR-funded activities. Yaqui chub is not a CAMP species.

Virgin River chub

The USFWS anticipates all captured, handled, held, transported and released Virgin River chub in the form of harass will be taken as a result of the proposed action. The USFWS anticipates up to 20 Virgin River chub will be taken in the form of mortality as a result of this proposed action, annually. All individuals in the captive populations may be taken in the form of harass, harm and mortality due to environmental control failure, research activities, husbandry, and disease.

We do not anticipate any additional take is needed for this species as it would not be affected by SFR-funded activities. Virgin River chub is not a CAMP species.

Woundfin

The USFWS anticipates all captured, handled, held, transported and released woundfin in the form of harass will be taken as a result of the proposed action. The USFWS anticipates up to 125 woundfin will be taken in the form of mortality as a result of this proposed action, annually. All individuals in the captive populations may be taken in the form of harass, harm and mortality due to environmental control failure, research activities, husbandry, and disease.

We do not anticipate any additional take is needed for this species as it would not be affected by SFR-funded activities. Woundfin is not a CAMP species.

Desert pupfish

The USFWS anticipates all captured, handled, held, transported and released desert pupfish in the form of harass will be taken as a result of the proposed action. The USFWS anticipates up to 5,000 desert pupfish will be taken in the form of mortality as a result of this proposed action, annually. All individuals in the captive populations may be taken in the form of harass, harm and mortality due to environmental control failure, research activities, husbandry, and disease.

We do not anticipate any additional take is needed for this species as it is unlikely to be affected by SFR-funded activities. There are no species-specific measures under the CAMP for this species.

Quitobaquito pupfish

The USFWS anticipates all captured, handled, held, transported and released Quitobaquito pupfish in the form of harass will be taken as a result of the proposed action. The USFWS anticipates up to 500 Quitobaquito pupfish will be taken in the form of mortality as a result of this proposed action, annually. All individuals in the captive populations may be taken in the form of harass, harm and mortality due to environmental control failure, research activities, husbandry, and disease.

We do not anticipate any additional take is needed for this species as it would not be affected by SFR-funded activities. There are no species-specific measures under the CAMP for this species.

Gila topminnow and Yaqui topminnow

The USFWS anticipates all captured, handled, held, transported and released Gila topminnow and Yaqui topminnow in the form of harass will be taken as a result of the proposed action. The USFWS anticipates up to a combined total of 10,000 Gila topminnow and Yaqui topminnow will be taken in the form of mortality as a result of this proposed action, annually. All individuals in the captive populations may be taken in the form of harass, harm and mortality due to environmental control failure, research activities, husbandry, and disease.

We do not anticipate any additional take is needed for these species as they are unlikely to be affected by SFR-funded activities. There are no species-specific measures under the CAMP for these species.

Sonoran tiger salamander

The USFWS anticipates all captured tiger salamanders in the form of harass will be taken as a result of the proposed action. The USFWS anticipates up to two (2) tiger salamanders will be taken in the form of mortality as a result of this proposed action, beyond the 10 voucher specimens authorized in the permit, at each populations site, annually. Incidental take will be exceeded if more than 12 individuals are taken in the form of mortality (intentionally and incidentally) at a population site, annually.

We anticipate additional Sonoran tiger salamander in the wild will be harassed by actions taken to implement the CAMP measure to address the risk of hybridization between native and nonnative salamanders. During those targeted capture operations, we anticipate up to 10 larval or adult salamanders per site will be taken in the form of mortality from injuries occurring during the capture operation. Other SFR funded sportfish survey and monitoring activities are unlikely to occur in occupied Sonoran tiger salamander habitat.

The measure to evaluate angler information on use of salamanders at Parker Canyon Lake will not require any additional incidental take.

Chiricahua leopard frog

Chiricahua leopard frog was not included in the BO for the permit; however, the permit itself included specified survey protocols and disease protocols and direct take levels for adults of this species as follows:

- Completion of a Chiricahua leopard frog survey training seminar or 40 hours of fieldwork under the mentorship of a qualified individual is required of Designated Agents conducting scientific research, surveys, and recovery activities for Chiricahua leopard frog. These surveys shall be conducted in accordance with the "Chiricahua leopard frog survey protocol" developed by AGFD, New Mexico Department of Game and Fish, and USFWS.

- The Permittees are authorized for scientific research and recovery purposes to take no more than 2 voucher specimens from the wild to document newly discovered populations; to take no more than 10 specimens per population for genetics, contaminants, and/or disease analyses and necropsy purposes (20 specimens per population for populations containing>100 adult frogs; and to take unlimited moribund frogs for scientific research purposes.

- The Permittees are further authorized to hold, for recovery (i.e., stocking or re-stocking approved sites) and on-site refugium purposes, and maintain, for future scientific research and/or recovery actions, unlimited numbers of frogs, tadpoles/larval forms, and eggs.

> The AGFD may designate other facilities to hold, for recovery (i.e., stocking or re-stocking approved sites) and on-site refugium purposes, and maintain, for future scientific research and/or recovery actions, unlimited numbers of frogs, tadpoles/larval forms, and eggs. Administrative files on each such refugium population and all pertinent specimen disposal or stocking records will be maintained by AGFD and reported in the section 6 project performance reports.

We anticipate additional Chiricahua leopard frogs in the wild will be harassed by actions taken to implement the CAMP measures to secure or establish new populations. These actions include targeted surveys, monitoring of population status, handling, and other activities. Further, to establish new populations, portions of egg masses or wild-born tadpoles may be removed from the wild, transported and either held in captive rearing facilities prior to reintroduction to the wild or released to a new site after a limited holding period. The section 10(a)(1)(A) permit allows for unlimited numbers of all life stages of frogs to be held for recovery purposes, and actions taken under the CAMP are additive to the number of frogs AGFD would hold for other recovery actions. For CAMP purposes, AGFD is authorized to acquire from the wild, hold and transport unlimited numbers of frogs, tadpoles/larval forms, and eggs for use in securing or establishing the three populations of Chiricahua leopard frogs. The number of specimens (eggs, tadpoles, metamorphs or adults) taken from the wild at any location will not exceed a "safe" level for the population as determined by AGFD and AESO species leads.

All Chiricahua leopard frogs in all life stages at a site where surveys and monitoring aimed at other CAMP species and for other conservation activities taken under SWG may be harassed by non-target interactions. Depending on the site and the particular activities, there is the potential for mortality from trampling, netting or electroshocking. Because mortality from these actions has not been identified as an issue for this species, we believe the number of individuals that could be taken is low. Take from mortality is authorized for up to three frogs (adult, sub-adult, or larval), per site, per year from the referenced activities.

Chiricahua leopard frogs generally do not overlap with managed sportfisheries; however, a wild population of frogs is in Peña Blanca Lake and reintroduced populations are near the Black River and the East Verde River where sportfish management actions may take place. In the future, there may be other areas of potential overlap where non-target interactions may occur. At such sites, all Chiricahua leopard frogs in all life stages may be harassed by non-target interactions arising from sportfish survey and monitoring activities. Because mortality from actions has not been identified as an issue for this species, we believe the number of individuals that could be taken is low. Take from mortality is authorized for up to three frogs (adult, sub-adult, or larval), per site, per year from the referenced activities.

Take covered by this consultation

The following listed species have incidental take provided in this incidental take statement. The levels of take are the combination of SWG, SFR sportfish, and CAMP related activities as appropriate to each species and include effects from all targeted and non-targeted actions as included in the proposed action. Because we are unable to separate the amount of take arising from each funding source, all take is combined. Where there are species-specific CAMP

measures, those are discussed separately. To the extent practicable, the following use the format for take provided in the section 10(a)(1)(A) BO.

Apache trout

The USFWS anticipates all captured, handled, held, transported and released Apache trout will be taken in the form of harassment as a result of the proposed action. The USFWS anticipates that up to 500 Apache trout will be taken in the form of mortality as a result of all activities included in this proposed action, annually. All individuals in the captive populations may be taken in the form of harassment, harm and mortality due to environmental control failure, handling, transport, research activities, husbandry, and disease.

Implementation of species-specific CAMP activities for Apache trout (barrier evaluation and repair) is unlikely to require additional incidental take. Surveys for nonnative species in Apache trout streams is covered in the previous paragraph, as is any salvage or capture activities for Apache trout.

Beautiful shiner

The USFWS anticipates all captured, handled, held, transported and released beautiful shiner will be taken in the form of harassment as a result of the proposed action. The USFWS anticipates that up to five beautiful shiner will be taken in the form of mortality as a result of this proposed action, annually. All individuals in the captive populations may be taken in the form of harassment, harm and mortality due to environmental control failure, research activities, husbandry, and disease.

Beautiful shiner is not a CAMP species.

Gila trout

The USFWS anticipates all captured, handled, held, transported and released Gila trout will be taken in the form of harassment as a result of the proposed action. The USFWS anticipates that up to 500 Gila trout will be taken in the form of mortality as a result of all activities included in this proposed action, annually. All individuals in the captive populations may be taken in the form of harassment, harm and mortality due to environmental control failure, handling, transport, research activities, husbandry, and disease.

Gila trout is a CAMP species but does not have any species-specific measures.

Little Colorado spinedace

The USFWS anticipates all captured, handled, held, transported and released Little Colorado spinedace will be taken in the form of harassment as a result of the proposed action. The USFWS anticipates that up to 25 Little Colorado spinedace will be taken in the form of mortality

as a result of routine activities under this proposed action, annually. Mortality from capture, handling, and transport of Little Colorado spinedace from the wild for translocations, augmentations, establishment of captive refuge populations or emergency salvage operations are not considered "routine" activities as they are not expected to occur except through specific, targeted plans. Past mortality of Little Colorado spinedace from these types of activities was very low, however, that may not always be the case. In a worst case scenario, there would be mortality of all individuals. For this incidental take statement, the USFWS sets a limit of 10 percent mortality of captured, held, and transported Little Colorado spinedace (per capture, handling, and transport event per site). The 10 percent is based on the total number of Little Colorado spinedace captured alive or killed during capture and any additional mortality during handling, or transport. All individuals in the refuge or captive populations may be taken in the form of harassment, harm and mortality due to environmental control failure, handling, transport, research activities, husbandry, and disease.

Little Colorado spinedace is a CAMP species. The implementation of the monitoring at CC Cragin Reservoir, Knoll Lake, and Nelson Reservoir will not require any additional incidental take for spinedace as stream monitoring is covered above.

The other species-specific measures for Little Colorado spinedace may result in incidental take due to survey and monitoring activities in the proposed action. This take is included in the above limits.

Loach minnow

The USFWS anticipates all captured, handled, held, transported and released loach minnow will be taken in the form of harassment as a result of the proposed action. The USFWS anticipates that up to 32 loach minnow will be taken in the form of mortality as a result of routine activities under this proposed action, annually. This number is based on projected take levels per stream (based on number of annual surveys) and exceedence criteria are based on the per-stream number, not the total number. In addition, up to 20 mortalities are associated with repatriation projects that may or may not be implemented within the next 10-years, and the projected amount of incidental take from those actions does not add to the total take until that project is implemented.

Take for loach minnow (annual, per stream, routine activities):

- Blue River: 8
- Eagle Creek: 4
- East Fork Black River: 4
- Fossil Creek: 4
- Redfield Canyon: 4

- Hot Springs Canyon: 4
- Bonita Creek: 4

Take for loach minnow (annual, per stream, based on potential future repatriations):

- Spring Creek (Tonto Creek drainage): 4
- Spring Creek (Oak Creek drainage): 4
- West Fork Black River: 4
- Fish Creek (Black River drainage): 4
- Lime Creek (Verde River drainage): 4

Mortality from capture, handling, and transport of loach minnow from the wild for translocations, augmentations, establishment of captive refuge populations or emergency salvage operations are not considered "routine" activities as they are not expected to occur except through specific, targeted plans. Past mortality of loach minnow from these types of activities was very low, however, that may not always be the case. In a worst case scenario, there would be mortality of all individuals. For this incidental take statement, the USFWS sets a limit of 10 percent mortality of captured, held, and transported loach minnow (per capture, handling, and transport event per site). The 10 percent is based on the total number of loach minnow captured alive or killed during capture and any additional mortality during handling, or transport. All individuals in the refuge or captive populations may be taken in the form of harassment, harm and mortality due to environmental control failure, research activities, husbandry, and disease.

Loach minnow is a CAMP species with four species-specific measures Stocking of Apache trout does not require any incidental take. The Big Lake weir and monitoring, and the planned surveys may result in take and that is included above. Take from establishment or securing of two populations of loach minnow will require capture, handling and transport of wild-caught loach minnow and that take is also included above.

Sonora chub

The USFWS anticipates all captured, handled, held, transported and released Sonora chub will be taken in the form of harassment as a result of the proposed action. The USFWS anticipates that up to 10 Sonora chub will be taken in the form of mortality as a result of routine activities under this proposed action, annually. Mortality from capture, handling, and transport of Sonora chub from the wild for translocations, augmentations, establishment of captive refuge populations or emergency salvage operations are not considered "routine" activities as they are not expected to occur except through specific, targeted plans. Past mortality of Sonora chub from these types of activities was very low, however, that may not always be the case. In a worst case scenario, there would be mortality of all individuals. For this incidental take statement, the USFWS sets a limit of 10 percent mortality of captured, held, and transported Sonora chub (per capture, handling, and transport event per site). The 10 percent is based on the total number of Sonora

chub captured alive or killed during capture and any additional mortality during handling, or transport. All individuals in the refuge or captive populations may be taken in the form of harassment, harm and mortality due to environmental control failure, research activities, husbandry, and disease.

Sonora chub is a CAMP species but does not have any species-specific measures.

Spikedace

The USFWS anticipates all captured, handled, held, transported and released spikedace will be taken in the form of harassment as a result of the proposed action. The USFWS anticipates that up to 32 spikedace will be taken in the form of mortality as a result of routine activities under this proposed action, annually. This number is based on projected take levels per stream (based on number of annual surveys) and exceedence criteria are based on the per-stream number, not the total number. In addition, up to 20 mortalities are associated with repatriation projects that may or may not be implemented within the next 10-years, and the projected amount of incidental take from those actions does not add to the total take until that project is implemented.

Take for spikedace (annual, per stream for routine activities):

- Blue River: 8
- Eagle Creek: 4
- Verde River: 4
- Fossil Creek: 4
- Redfield Canyon: 4
- Hot Springs Canyon: 4
- Bonita Creek: 4

Take for spikedace (annual, per stream, based on potential future repatriations):

- Spring Creek (Tonto Creek drainage): 4
- Spring Creek (Oak Creek drainage): 4
- West Fork Black River: 4
- Fish Creek (Black River drainage): 4
- Lime Creek (Verde River drainage): 4

Mortality from capture, handling, and transport of spikedace from the wild for translocations, augmentations, establishment of captive refuge populations or emergency salvage operations are not considered "routine" activities as they are not expected to occur except through specific, targeted plans. Past mortality of spikedace from these types of activities was very low, however, that may not always be the case. In a worst case scenario, there would be mortality of all individuals. For this incidental take statement, the USFWS sets a limit of 10 percent mortality of captured, held, and transported spiekdace (per capture, handling, and transport event per site). The 10 percent is based on the total number of spikedace captured alive or killed during capture and any additional mortality during handling, or transport. All individuals in the refuge or captive populations may be taken in the form of harassment, harm and mortality due to environmental control failure, research activities, husbandry, and disease.

Spikedace is a CAMP species with one species-specific conservation measure for the continuation of surveys in the upper Verde River. Any incidental take from that activitity is included above.

Yaqui catfish

The USFWS anticipates all captured, handled, held, transported and released Yaqui catfish will be taken in the form of harassment as a result of the proposed action. The USFWS anticipates that one Yaqui catfish will be taken in the form of mortality as a result of this proposed action, annually. All individuals in the captive populations may be taken in the form of harassment, harm and mortality due to environmental control failure, research activities, husbandry, and disease.

Yaqui catfish is not a CAMP species.

EFFECT OF THE TAKE

In this BCO, the USFWS determines that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat for the reasons stated in the Conclusions section.

REASONABLE AND PRUDENT MEASURES and TERMS AND CONDITIONS

All Species

The following reasonable and prudent measure(s) are necessary and appropriate to minimize take of all species:

1. AGFD field crews will take appropriate precautions before commencing activities covered under this consultation when there is the possibility of non-target species being present at the work area.

2. The level of incidental take authorized in this BCO is limited to the amounts provided above. Should any mortality occur to an individual of the species during permitted

activities (above the amount that may be specified below), operations that resulted in the take must immediately cease and you are required to contact WSFR and AESO within 24 hours.

3. Monitor incidental take resulting from the proposed action and report the findings of that monitoring to USFWS.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, WSFR and through the grant agreements, AGFD must comply with the following terms and conditions, which implement the reasonable and prudent measure(s) described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

The following term and condition implements reasonable and prudent measure #1 for all species:

1.1 AGFD will compile a list of sites where rarely encountered consultation or sensitive species are likely present (other consultation species distribution and natural history information are well recognized by field crews). These rarely encountered species include Huachuca springsnail, Page springsnail, Three Forks springsnail, Kanab ambersnail, Stephans riffle beetle, Navajo sedge, Canelo hills ladies-tresses, Huachuca water umbel, Arizona treefrog, Chiricahua leopard frog, northern leopard frog, Sonoran tiger salamander, narrow-headed gartersnake, Northern mexican gartersnake, and New Mexico meadow jumping mouse. The list and species biographies will be shared with the field crews to enable them to implement BMPs appropriately for the conservation species present and to minimize and monitor for any incidental take.

The following term and condition implements reasonable and prudent measure #2 for all species:

2.1 AGFD will provide WSFR with an annual report of the activities conducted (including field data forms, if appropriate) under authority of this consultation including any take that resulted from actions funded by the SWG and SFR grants. This reporting is separate from that required for the section 10(a)(1)(A) permit or the Section 6 report. WSFR shall ensure that a copy of the report containing the incidental take reporting is provided to AESO for distribution to species leads.

Candidate and other status species

There are two species proposed for listing, 12 candidate species and two species without current status under the Act that are evaluated in this BCO. They are:

Invertebrates: Huachuca springsnail, Page springsnail, San Bernardino springsnail, Stephan's riffle beetle, and Three Forks springsnail
Fish: headwater chub, roundtail chub, Virgin spinedace, and Zuni bluehead sucker
Amphibians: Arizona treefrog, northern leopard frog, relict leopard frog
Reptiles: narrow-headed gartersnake, northern Mexican gartersnake, Sonoyta mud turtle
Mammals: New Mexico meadow jumping mouse

The prohibitions against taking these species found in section 9 of the Act do not apply until the species is listed. In the analysis of effects of the proposed action, we have identified some potential areas where incidental take from the proposed action may occur; however, we are not providing an incidental take statement for these species at this time. If and when these species are proposed for, and listed under the ESA, we will re-evaluate the effects analysis in this BCO and the implementation of the conservation measures to develop an incidental take statement, if appropriate, at that time.

Disposition of Dead or Injured Listed Species

Upon locating a dead, injured, or sick listed species initial notification must be made to the FWS's Law Enforcement Office, 2450 W. Broadway Rd, Suite 113, Mesa, Arizona, 85202, telephone: 480/967-7900) within three working days of its finding. Written notification must be made within five calendar days and include the date, time, and location of the animal, a photograph if possible, and any other pertinent information. The notification shall be sent to the Law Enforcement Office with a copy to this office. Care must be taken in handling sick or injured animals to ensure effective treatment and care, and in handling dead specimens to preserve the biological material in the best possible state.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

A considerable amount of the work included in the proposed action is focused on conservation actions for the covered species through the SWG grant that results in net benefits for the species concerned. The BMPs related to implementation of these conservation activities are designed to minimize adverse effects from the covered activities and serve as effective conservation recommendations.

Additional conservation in the CAMP is related to the continuation of sportfish stocking funded by WSFR is funded through SFR funds, and while there may be some short-term adverse effects to species, overall the implementation of the CAMP provides a net benefit to species and the appropriate BMPs will be followed, minimizing adverse effects.

The CAMP program does not provide any conservation benefit for other SFR funded activities. For sportfish survey and monitoring activities included in the proposed action, the protocols and BMP documents used to undertake these sportfish management actions are designed to have minimal adverse effects to aquatic organisms, and they serve as effective conservation recommendations.

With the execption of the conservation recommendation for the New Mexico meadow jumping mouse, we have not identified any additional conservation recommendations for this consultation.

REINITIATION NOTICE

Formal conference:

This concludes the conference for SWG and SFR funded activities for AGFD. You may ask the USFWS to confirm the conference opinion as a biological opinion issued through formal consultation if the proposed species is listed or critical habitat is designated. The request must be in writing. If the USFWS reviews the proposed action and finds there have been no significant changes in the action as planned or in the information used during the conference, the USFWS will confirm the conference opinion as the biological opinion for the project and no further section 7 consultation will be necessary.

After listing as threatened or endangered and any subsequent adoption of this conference opinion, the Federal agency shall request reinitiation of consultation if: 1) the amount or extent of incidental take is exceeded; 2) new information reveals effects of the agency action that may affect the species in a manner or to an extent not considered in the conference opinion; 3) the agency action is subsequently modified in a manner that causes an effect to the species that was not considered in this opinion; or 4) a new species is listed or critical habitat designated that may be affected by the action.

The incidental take statement provided in this conference opinion does not become effective until the species is listed and the conference opinion is adopted as the biological opinion issued through formal consultation. At that time, the project will be reviewed to determine whether any take of the proposed species has occurred. Modifications of the opinion and incidental take statement may be appropriate to reflect that take. No take of the currently proposed species may occur between the listing of the species and the adoption of the conference opinion through formal consultation, or the completion of a subsequent formal consultation. Although not required, we recommend that the Federal agency implement the reasonable and prudent measures and terms and conditions herein prior to our final listing decision. If the species is subsequently listed, implementation of reasonable prudent measures and terms and conditions in any conference opinion adopted as a biological opinion, is mandatory.

This concludes formal consultation on the proposed action outlined in the request for consultation. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

AESO appreciates the level of commitment to safe and effective survey, monitoring, and handling techniques demonstrated by AGFD through the materials provided for this consultation. Funding provided by WSFR for conservation and sportfish management purposes results in significant benefits to aquatic species. If you have any questions about this consultation, or we can be of additional assistance, please contact Lesley Fitzpatrick at (602) 242-0210 (x236) or me x244. In future communications about this consultation, please refer to consultation number 22410-2011-F-0290.

/s/ Debra Bills for Steven L. Spangle

cc: Regional Director, Fish and Wildlife Service, Southwest Region, Albuquerque, NM (ARD-ES, Permits)
Assistant Field Supervisor, Fish and Wildlife Service, Phoenix, AZ
Assistant Field Supervisor, Fish and Wildlife Service, Flagstaff, AZ
Assistant Field Supervisor, Fish and Wildlife Service, Tucson, AZ

Josh Avey, Chief, Habitat Branch, Arizona Game and Fish Department, Phoenix, AZ

W:\Lesley Fitzpatrick\F7 WSFR Grant 2011\Final BCO.docx:cgg

LITERATURE CITED

Albrecht, B., T. Sanderson, and P. Holden. 2008. Razorback sucker studies on Lake Mead, Nevada and Arizona. 1996-2007 Comprehensive Report. PR 1093-2. Bio-West Inc for U.S. Bureau of Reclamation, Boulder City, Nevada, and Southern Nevada Water Authority, Las Vegas Nevada. 133 pp.

Arizona Game and Fish Department. 2000. Spiranthes delitescens. Unpublished draft abstract compiled and edited by the Heritage Data Management System. Arizona Game and Fish Department, Phoenix. 4 pp.

Arizona Game and Fish Department (AGFD). 2004. Standard Fish Sampling Protocol for State of Arizona Waters.

Arizona Game and Fish Department (AGFD). 2005a. Protocol for collection, transport, quarantine and disease treatment, maintenance, and propagation of roundtail chub from the mainstem Verde River. 10 pp.

Arizona Game and Fish Department (AGFD). 2005b. Carex specuicola. Unpublished draft abstract compiled and edited by the Heritage Data Management System. Arizona Game and Fish Department, Phoenix. 7 pp.

Arizona Game and Fish Department (AGFD). 2006. Arizona Statewide Conservation Agreement for Roundtail chub (*Gila Robusta*), Headwater Chub (*Gila Nigra*), Flannelmouth Sucker (*Castostomus Latipinnis*), Little Colorado River Sucker (*Catastomus SPP*.), Bluehead Sucker (*Castostomus Discobolus*), and Zuni Bluehead Sucker (*Cataostomus Discobolous Yarrowi*): Arizona Game and Fish Department, Phoenix, Arizona.

Arizona Game and Fish Department (AGFD). 2009. Spikedace and loach minnow captive propagation priorities. 4 pp.

Arizona Game and Fish Department (AGFD). 2010. Section 6 E5 Segment 20 Closeout Performance Report and Section 6 E33 Interim Performance Report. July 1, 2008-June 30, 2010. Nongamd and Endangered Wildlife Program, Phoenix. 168 pp.

Arizona Game and Fish Department (AGFD). 2011. Conservation agreement and rangewide conservation assessment and strategy for the Sonoyta mud turtle, Sonoyta pupfish, Quitobaquito springsnail, and longfin dace in Quitobaquito and Rio Sonoyta. Version 4. Prepared by the Quitobaquito/Rio Sonoyta Working Group. 68 pp.

Arizona Game and Fish Department and U.S. Fish and Wildlife Service (AGFD and USFWS). 2009. Candidate Conservation Agreement with Assurances for the Page Springsnail (*Pyrgulopsis morrisoni)*. Signed October 8, 2009. 58 pp.

Backer, D. and D. Gori. 1998. 1998 monitoring results for Canelo Hills Ladies'-tresses Orchid (Spiranthes delitescens) at Canelo Hills Cienega Preserve. The Nature Conservancy, Arizona. 1 p.

Bailey, A. 2008. Electronic mail communication to M. Martinez, U.S. Fish and Wildlife Service, from A. Bailey, Arizona Game and Fish Department. July 24, 2008. 2 pp.

Bandas, S.J. 2003. Geographical distribution and morphometrics of South Dakota turtles. Masters Thesis, South Dakota State University. 120 pp.

Bandeen, J. and J.F. Leatherland. 1997. Transportation and handling stress of white suckers raised in cages. Aquaculture International 5: 385-396.

Bartholomew, A. and J.A. Bohnsack. 2005. A review of catch-and-release angling mortality with implications for no-take reserves. Reviews in Fish Biology and Fisheries 15: 129-154.

Beaupre, S. J., E. R. Jacobson, H. B. Lillywhite, and K. Zamudio. 2004. Guidelines for the use of live amphibians and reptiles in field and laboratory research. A publication of the American Society of Ichthyologists and Herpetologists, Approved by board of Governors June 30, 2004, Norman Oklahoma.

Bio-West 2011. Summer sampling efforts on Virgin River, July 18-21, 2011. Provisional data. Bio-West, Provo, Utah. 1 p.

Bonar, S.A., W.A. Hubert, and D.W. Willis (eds). 2009. Standard methods for sampling North American freshwater fishes. American Fisheries Society, Bethesda, Maryland.

Bowles, D. E., J. A. Luraas, L. W. Morrison, H. R. Dodd, M. H. Williams, G. A. Rowell, M. D. DeBacker, J. A. Hinsey, F. D. Usrey, J. L. Haack. 2007. Protocol for Monitoring Aquatic Invertebrates at Ozark National Scenic Riverways, Missouri, and Buffalo National River, Arkansas. Natural Resource Report NPS/HTLN/NRR—2007/009. National Park Service, Fort Collins, Colorado.

Brennan, T.C. and P.C. Rosen. 2009. Report on narrow-headed gartersnake (Thamnophis rufipunctatus) surveys at Oak Creek and the Black River, Arizona. Unpublished report to AGFD.

Brignon, W.R., M.B. Davis, D.E. Olsen, H.A. Schaller, and C.B. Schreck. 2011. Snorkler's in-water observations can alter salmonid behavior. Journal of Fish and Wildlife Management 2(1): 90-98.

Brown, D. P., and A. C. Comrie. 2004. A winter precipitation 'dipole' in the western United States associated with multidecadal ENSO variability. Geophysical Research Letters 31.

Brown, T. J., B. L. Hall, and A. L. Westerling. 2004. The impact of twenty-first century climate change on wildlife fire danger in the western United States: An applications perspective. Climatic Change 62:365-388.

Canadian Council on Animal Care (CCAC). ND. CCAC species-specific recommendations on: Amphibians and Reptiles. 30 pp.

Carman, S.M. 2004. Zuni Bluehead Sucker (*Catostomus discobolus yarrow*) Recovery Plan. New Mexico Department of Game and Fish, Santa Fe. 41 pp.

Carman, S. M. 2006. Colorado River Basin chubs, roundtail chub *Gila robusta,* Gila chub *Gila intermedia*, headwater chub (*Gila nigra*), recovery plan. New Mexico Department of Game and Fish, Conservation Services Division, Sante Fe, New Mexico. 63 pp.

Carmichael, G.J., J.R., Tomasso Jr., and T.E. Schwedler. 2001. Fish transportation. Pages 641-660 in G. A. Wedemeyer, editor. *Fish hatchery management, 2nd edition*. American Fisheries Society, Bethesda, Maryland.

Carpenter, J. and C. McIvor. 1999. Effects of an introduced crayfish on native Arizona fishes. Final report to Arizona Game and Fish Department. IIPAM Project No. I95034. Arizona Cooperative Fish and Wildlife Research Unit, Tucson, AZ. 100 pp.

Cho, S.J., C.A. Caldwell, and W.R. Gould. 2011. Physiological stress responses of Rio Grande silvery minnow: effects of individual and multiple physical stressors of handling, confinement, and transport. North American Journal of Fisheries Management 29: 1698-1706.

Collins, J.P., T.R. Jones and H.J. Berna. 1988. Conservation and management of genetically distinctive populations: The case of the Huachuca tiger salamander (Ambystoma tigrinum stebbinsi Lowe). pp. 45-53. In. Szaro, R.C., K.E. Severson, and D.R. Patton (eds.) Proc. Symp. Management of Amphibians, Reptiles and Small Mammals in North America. USDA Forest Service GTR-RM-166, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.

Collins, J.P., E.W. Davidson, J.E. Loncore, A.P. Pessier, M.J. Perris, and A.T. Storfer. 2001. Viral and fungal pathogens in tiger salamanders in the Western United States and Canada. Pages 20-21 in Abstracts of the Annual Conference of The Western Section of The Wildlife Society, Sacramento, California, 22-24 February 2001.

Cone, R.S. and C.C. Krueger. 1988. Comparison of survival, emigration, habitat use, marking mortality, and growth between two strains of brook trout in Adirondack ponds. North American Journal of Fisheries Management 8: 497-504.

Cox, D. 2007. Electronic mail communication from Dan Cox, Arizona Game and Fish Department, to Mike Martinez, Fish and Wildlife Service, regarding Three Forks Surveys. March 2, 2007. 2 pp.

Crother, B.I. (ed.). 2008. Scientific and Common Names for Amphibians and Reptiles of North America North of México. Society for the Study of Amphibians and Reptiles, Herpetological Circular No. 37:1-84.

Declining Amphibian Task Force. nd. Fieldwork Code of Practice. 1 p.

Desert Fishes Team. 2003. Status of Federal- and State-listed fishes of the Gila River Rasin, with recommendations for management. Desert Fishes Team Report Number 1, Desert Fishes Team, Phoenix, Arizona. 21 pp.

Douglas, J. 2009. Nonnatives sympatric with Sonora chub. Email to Lesley Fitzpatrick, August 13, 2009. 1 p.

Douglas, J. 2011. Southeast Arizona fire effects. Email to Lesley Fitzpatrick July 26, 2011. 1 p.

Dowling, T.E., P.C. Marsh, C.D. Anderson, M.S. Rosenberg, and A.T. Kelsen. 2008. Population structure in the roundtail chub (Gila robusta complex) of the Gila River basin as determined by microsatellites. Draft Final Report to Arizona Game and Fish Department, Contract # AGR 4/21/04. Arizona State University, School of Life Sciences, Tempe, AZ. 57 pp.

DuBois, R.B., K.E. Kuklinski, and R.R. Dublelzig. ND. Trout hooking mortality research. 2 pp.

Echelle, A. A., R. A. Van Den Bussche, T. P. Malloy, Jr., M. L. Haynie, and C. O. Minckley. 2000. Mitochondrial DNA variation in pupfishes assigned to the species Cyprinodon macularius (Atherinomorpha: Cyprindontidae): Taxonomic implications and conservation genetics. Copeia 2000(2):353-364.

Eddleman, W.R. 1989. Biology of the Yuma clapper rail in the southwestern U.S. and northwestern Mexico. Final Report to Bureau of Reclamation, Yuma Projects Office and Fish and Wildlife Service, Region 2. Wyoming Cooperative Fish and Wildlife Research Unit, University of Wyoming. 127 pp.

Engineering Page. 2009. Noise attenuation by distance calculator. Downloaded 12/10/2009 from http//:www.engineeringpage.com/cgi-bin/noise/dis_one.pl 1p

Fernandez, P.J. and P.C. Rosen, 1996. Effects of the introduced crayfish Orconectes virilis on native aquatic herpetofauna in Arizona. IIPAM Project No I94054. Heritage Program, Arizona Game and Fish Department, Phoenix, Arizona.

Fishbein, M., D. Gori, and D. Meggs. 1994. Prescribed burning as a management tood for Sky Island Bioregion wetlands with reference to the management of the endangered orchid Spiranthes delitescens. Pages 468-477 In: Biodiversity and Management of the Madrean Archipelago: The Sky Islands of Southwestern United States and Northwestern Mexico. General Technical Report RM-GTR-264. USDA Rocky Mountain Forest and Range Experiment Station, Ft. Collins, Colorado.

Fort Huachuca. 2006. Draft Endangered Species Management Plan for the Huachuca water umbel (Liliaopsis schaffneriana ssp. recurva). Environmental and Natural Resources Division, Directorate of Public Works, Ft. Huachuca, Sierra Vista, Arizona.

Francis-Floyd, R. 2009. Stress: its role in fish disease. Circular CIR919. Institute of Food and Agricultural Sciences, Florida Cooperative Extension Service, University of Florida, Gainesville. 4 pp.

Galen Carol Audio. 2009. Decibel loudness comparison chart. Downloaded 12/10/2009 from http//:www.gcaudio.com/resources/howtos/loudness.html 3 pp.

Garfin, G. 2005. Climate change in the Colorado River Basin. Pages 36-44 in Colorado River Basin Climate: Paleo, Present, Future, at http://wwa.colorado.edu/resources/colorado_river/Colorado_River_Basin_Climate.pdf

Gartersnake Conservation Working Group (GCWG). 2008. 2008 Annual Report. 29 pp.

Gori, D. 1994. Monitoring plan for Canelo Hills Ladies'-tresses orchid (Spiranthes delitescens) at Canelo Hills Cienega Preserve. The Nature Conservancy, Tucson, Arizona. 14 pp.

Gurtin, S. 2010. Mexican gartersnake best management practices. Arizona Game and Fish Department, Phoenix. 1 p.

Gray, S. T., J. L. Betancourt, C. L. Fastie, and S. T. Jackson. 2003. Patterns and sources of multidecadal oscillations in drought-sensitive tree-ring records from the central and southern Rocky Mountains. Geophysical Research Letters 30:10.1029/2002GL016154.

Halterman, M.D. 2010. Effects of recreationists on yellow-billed cuckoos. Email to Lesley Fitzpatrick, USFWS. January 25, 2010.

Harper, C. and J.C. Wolf. 2009. Morphologic effects of the stress response in fish. ILAR Journal 50(4): 387-396.

Hendrickson D.A. and W.L. Minckley. 1984. Ciénegas-vanishing climax communities of the American Southwest. Desert Plants 6(3):130-175.

Hereford, R., R. H. Webb, and S. Graham. 2002. Precipitation history of the Colorado Plateau Region, 1900-2000. USGS Fact Sheet 119-02 (http://geopubs.wr.usgs.gov/ fact-sheet/fs119-02/).

Heyer, W. R., Donnelly, M. A., McDiarmid, R. W., Hayek, Lee-Ann C. and Foster, M., S., editors. 1994. *Measuring and Monitoring Biological Diversity: Standard Methods for Amphibians*. Smithsonian Institution Press.

Hoffmann, K., M.E. McGarrity, and S.A. Johnson. 2008. Technology meets tradition: a combined VIE-C technique for individually marking anurans. Applied Herpetology 5: 265-280.

Holliman, F.M., J.B. Reynolds, and T.J. Kwak. 2003. A predictive risk model for electroshock-induced mortality of the endangered Cape Fear shiner. North American Journal of Fisheries Management 23(3): 905-912.

Holycross, A. T., W. P. Burger, E. J. Nigro, and T. C. Brennan. 2006. Surveys for Thamnophis eques and Thamnophis rufipunctatus in the Gila River Watershed of Arizona and New Mexico. Report to Submitted to the Arizona Game and Fish Department. 105 pp.

Hunt, T.A. 2008. The effects of capture by trammel nets on native Arizona fishes. Masters Thesis, Northern Arizona University, Flagstaff. 57 pp.

Interagency Field Team. 2005. Mexican Wolf Blue Range Reintroduction Project 5-Year Review. Technical Component. 75 pp.

Interagency Field Team. 2009. Mexican Wolf Blue Range Reintroduction Project Interagency Field Team Annual Report. Reporting Period: January 1 – December 31, 2008. 42 pp.

Interagency Field Team. 2010a. Aerial locations for wolves with radio collars, January 1, 2010 – March 31, 2010. Map downloaded from www.azgfd.gov.

Interagency Field Team. 2010b. Blue Range Wolf Reintroduction Area (BRWRA) Monthly Project Updates for June 8, 2010. Downloaded from www.fws.gov/southwest/es/mexicanwolf/BRWRP_notes.cfm

Intergovernmental Panel on Climate Change (IPCC). 2001. Climate change 2001: The scientific basis. Contribution of Working Group I to the third assessment report of the Intergovernmental Panel on Climate Change. Houghton, J. T.,Y. Ding, D. J. Griggs, M. Noguer, P. J. van der Linden, X. Dai, K. Maskell, and C. A. Johnson, eds., Cambridge Univ. Press, Cambridge, United Kingdom and New York, NY.

Intergovernmental Panel on Climate Change (IPCC). 2007. Climate change 2007: The physical science basis summary for policymakers. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. IPCC Secretariat, Geneva, Switzerland, http://www.ipcc.ch

Jacobs, K. L., G. M. Garfin, and B. J. Morehouse. 2005. Climate science and drought planning: The Arizona experience. J. of the American Water Resources Association 41:437-445.

Kaufman, P.R. and R.M. Hughes. 2006. Geomorphic and anthropogenic influences on fish and amphibians in Pacific Northwest coastal streams. American Fisheries Society Symposium 48: 429-455.

Latta, M.J., C.J. Beardmore, and T.E. Corman. 1999. Western Yellow-Billed Cuckoo (coccycus americanus occidentalis). Pages 190-194. *In* Arizona Partners in Flight Bird Conservation Plan. Technical Report 142. Non-game and Endangered Wildlife Program, Arizona Game and Fish Department, Phoenix.

Lattin, J.D. 1956. Equipment and technique. Chapter B (pages 50-67) in Usinger, R.L. (ed). Aquatic Insects of California: with keys to North American genera and California species. University of California Press, Berkeley and Los Angeles.

Laymon, S.A. 1998. Yellow-billed cuckoo (Coccycus americanus). *In* The Riparian Bird Conservation Plan: a strategy for reversing the decline of riparian-associated birds in California. Calfornia Partners in Flight. http://www.prbo.org/calpif/htmldocs/riparian_v-2.html

Lopez, M.A. 2011. Apache trout populations in Wallow Fire. Email from M. Lopez, Arizona Game and Fish Department. 4 pp.

Lower Colorado Multi-Species Conservation Program (LCR MSCP). 2005. Colorado River Backwaters Enhancement Species Profiles Report. Submitted by Bio-West, Inc., Logan, Utah to USBR, Lower Colorado Region, Boulder City, Nevada. 102 pp.

Lower Colorado Multi-Species Conservation Program (LCR MSCP). 2009a. Stocking summary for bonytail and razorback sucker in Reaches 4 and 5. Table provided by Mr. Tom Burke, LCR MSCP, U.S. Bureau of Reclamation, Boulder City, Nevada.

Lower Colorado Multi-Species Conservation Program (LCR MSCP). 2009b. Final Implementation Report, Fiscal Year 2010 Work Plan, and Budget, Fiscal Year 2008 Accomplishment Report. LCR MSCP, bureau of Reclamation, Lower Colorado Region, Boulder City, Nevada. 315 pp.

Lower Colorado Multi-Species Conservation Program (LCR MSCP). 2010 Final Implementation Report, Fiscal Year 2011 Work Plan, and Budget, Fiscal Year 2009 Accomplishment Report. LCR MSCP, bureau of Reclamation, Lower Colorado Region, Boulder City, Nevada. 315 pp.

Luneau, G. 2002. The Moral is: don't mess with a cuckoo nest. Texas Partners in Flight. Flyway 9: 7-8.

Lutterschmidt, D.I. and R.T. Mason. 2005. A serotonin receptor antagonist, but not melatonin, modulates hormonal responses to capture stress in two populations of gartersnakes (*Thamnophis sirtalis parietalis* and *Thamnophis sirtalis concinnus*). General and Comparative Endocrinology 141 (2005): 259-270.

MacKenzie, D., Z. Gedalof, D. L. Peterson, and P. Mote. 2004. Climatic change, wildlife, and conservation. Conservation Biology 18(4):890-902.

Maddux, H.R, W.R. Noonan, and L.A. Fitzpatrick. 1993. Draft Colorado River endangered fishes critical habitat, biological support document. U.S. Fish and Wildlife Service, Salt Lake City, Utah. 225 pp.

Matthews, K.R. and K.A. Pope. 1999. A telemetric study of the movement patterns and habitat use of *Rana mucosa*, the mountain yellow-legged frog, in a high-elevation basin in Kings Canyon National Park. Journal of Herpetology 33(4): 615-624.

McCabe, G. J., M. A. Palecki, and J. L. Betancourt. 2004. Pacific and Atlantic Ocean influences on multidecadal drought frequency in the United States. Proceedings of the National Academy of Sciences 101(12):4136-4141.

McDiarmid, R.W., M.S. Foster, C. Guyer, J.W. Gibbons, and N. Chernoff (eds.). 2012. Reptile biodiversity: Standard methods for inventory and monitoring. University of California Press. 424 pp.

McLaren, M.P., and P.C. Sundt. 1992. Population dynamics of the rare orchid Spiranthes delitescens. The Southwestern Naturalist 37(3) 299-333.

Merritt, R. W. and K.W. Cummins, editors. 1996. *An introduction to the aquatic insects of North America, 3rd edition*. Kendall/Hunt Publishing, Dubuque Iowa.

Mesick, C.F. and J.C. Tash. 1980. Effects of electricity on some benthic stream insects. Transactions of the American Fisheries Society 109(4): 417-422.

Minckley, W.L. and B.D. DeMarais. 2000. Taxonomy of chubs (Teleostei, Cyprinidae, Genus Gila) in the American Southwest with comments on conservation. Copeia 2000(1): 251-256.

Montony, A.D. 2008. Passive integrated transponders in *Gila elegans*: location, retention, stress, and mortality. Masters Thesis. University of Nevada, Las Vegas. 56 pp.

Moore, I.T. and R.T. Mason. 2001. Behavioral and hormonal responses to corticosterone in the male red-sided garter snake, *Thamnophis sirtalis parietalis*. Physiology and Behavior 72 (2001); 669-674.

Moore, I.T., M.P. LeMaster, and R.T. Mason. 2000. Behavioural and hormonal responses to capture stress in the male red-sided garter snake, *Thamnophis sirtalis parietalis*. Animal Behaviour 59(3): 529-534.

Moore, I.T., M.J. Greene, and R.T. Mason. 2001. Environmental and seasonal adaptions of the adrenocortical and gonadal responses to capture stress in two populations of the male garter snake *Thamnophis sirtalis*. Journal of Experimental Zoology 289: 99-108.

Mueller, G.A., R. Wydoski, E. Best, S. Hiebart, J. Lantow, M. Santee, B. Goettlicher, and J. Millosovich. 2008. Techniques for monitoring razorback sucker in the lower Colorado River. Hoover to Parker Dams, 2006-2007. Final Report U.S. Geological Survey Open File Report 2008-1245. 34 pp.

Murphy, B.R., and D.W. Willis, editors. 1996. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

Myers, T.L. 2000. Letter from Terry Myers, Apache-Sitgreaves National Forest, to Mike Martinez, U.S. Fish and Wildlife Service. January 7, 2000. 2 pp.

Navajo Natural Heritage Program. 2005. Species accounts version 2.05 for Navajo Endangered Species List, May, 2005. Navajo Natural Heritage Program, Window Rock, AZ. 90 pp.

New Mexico Department of Game and Fish (NMDGF). 2008. Riparian rodent recovery plan: Meadow jumping mouse, *Zapus hudsonius*, and Arizona montane vole, *Microtus montanus arizonensis*. New Mexico Department of Game and Fish, Conservation Services Division, Santa Fe, New Mexico. 33 p.

Nickum, J.G. 1988. Guidelines for Use of Fishes in Field Research. Fisheries 13(2): 16-23.

Nickerson, M.A. and K.L. Krysko. 2003. Surveying for hellbender salamanders *Cryptobranchus alleganiensis* (Daudin): a review and critique. Applied Herpetology 1: 327-44.

Oregon Museum of Science and Industry. 2005. Dangerous Decibels Teacher Resource Guide, Appendix C. Download from www.dangerousdecibels.org. December 10, 2009. 1 p.

Ott, J.A. and D.E. Scott. 1999. Effects of Toe-Clipping and PIT-Tagging on Growth and Survival in Metamorphic *Ambystoma opacum. Journal of Herpetology* 33(2): 344-348

Paukert, C.P., D.L. Ward, P.J. Sponholtz, and K.D. Hilwig. 2005. Effects of repeated hoopnetting and handling on bonytail chub. Journal of Freshwater Ecology 20(4): 649-653.

Pierce, L.J.S. 2007. Narrow-headed Gartersnake (Thamnophis rufipunctatus) Recovery Plan. Report Prepared for New Mexico Department of Game and Fish, Santa Fe, New Mexico.

Piper, R.G., I.B. McElwain, L.E. Orme, J.P. McCraren, L.G. Fowler, and J.R. Leonard. 1982. *Fish hatchery management*. U.S. Fish and Wildlife Service, Washington, D.C.

Portz, D.E. 2009. Stress inducing factors of bonytail hatchery and stocking practices. Report to Lower Colorado River Multi-Species Conservation Program from Bureau of Reclamation, Denver Technical Service Center, Denver, CO. 50 pp.

Portz, D.E., C.M. Woodley, and J.J. Cech, Jr. 2006. Stress-associated impacts of short-term holding on fishes. Review of Fish Biology and Fisheries 16: 125-170.

Relict Leopard Frog Conservation Team (RLFCT). 2005. Conservation Agreement and Rangewide Conservation Assessment and Strategy for the Relict Leopard Frog (*Rana onca*). National Park Service, Lake Mead National Recreation Area. Boulder City, Nevada. 164 pp.

Rice, T.M. and D.H. Taylor. 1995. Frogs (Anura:Ranidae) can learn to inhibit the righting reflex without electric shock. Journal of Herpetology 29(4): 631-633.

Robinson, A. 2010. Arizona Native Fish Recovery and Nonnative Fish Control. Final Report, May 28, 2010. FWS Agreement No 201816J808. Arizona Game and Fish Department, Phoenix. 34 pp.

Rosen, P.C. and C.R. Schwalbe. 1988. Status of the Mexican and narrow-headed garter snakes (Thamnophis eques megalops and Thamnophis rufipunctatus rufipunctatus) in Arizona. Unpublished report from AGFD to USFWS.

Roth, D. 2004. *Carex specuicola*, Navajo Sedge, Status Report. Navajo Natural Heritage Program, P.O. Box 1480, Window Rock, AZ 86515. 13 pp.

Salt River Project (SRP). 2008. Habitat Conservation Plan Horseshoe and Bartlett Reservoirs. Submitted to U.S. Fish and Wildlife Service by Salt River Project; Prepared by ERO Resources Corp. and Salt River Project, Phoenix, AZ.

Schneider, N., and B. D. Cornuelle. 2005. The forcing of the Pacific Decadal Oscillation. Journal of Climate 18:4355-4373.

Schooley, J.D., B.R. Kesner, J.R. Campbell, J.M. Barkstedt, and P.C. Marsh. 2008. Survival of razorback sucker stocked into the lower Colorado River. Final Project Report January 2006-April 2008 to U.S. Bureau of Reclamation, Boulder City, Nevada, from Arizona State University, Tempe. Agreement Number 06-FC-30-0002. 86 pp.

Schreck, C.B. and P.B. Moyle, editors. 1990. *Methods for fish biology*. American Fisheries Society. Bethesda, Maryland.

Schwemm M. R. 2006. Genetic variation in the Gila robusta complex (Teleostei: Cyprinidae) in the lower Colorado River. Masters Thesis, Arizona State University, Tempe, Arizona. 117 pp.

Seager, R., T. Mingfang, I. Held, Y. Kushnir, J. Lu, G. Vecchi, H. Huang, N. Harnik, A. Leetmaa, N. Lau, C. Li, J. Velez, and N. Naik. 2007. Model projections of an imminent transition to a more arid climate in southwestern North America. Science 316:1181-1184.

Sharpe, C.S., D.A. Thompson, H.L. Blankenship, and C.B. Schreck. 1998. Effects of routine handling and tagging procedures on physiological stress responses in juvenile Chinook salmon. The Progressive Fish Culturist 60(2): 81-87.

Sheppard, P. R., A. C. Comrie, G. D. Packin, K. Angersbach, and M. K. Hughes. 2002. The climate of the Southwest. Climate Research 21:219-238.

Snyder, D.E. 2003. Electrofishing and its harmful effects on fish. Information and Technology Report USGS/BRD/ITR—2003-2002. U.S. Government Printing Office, Denver, CO. 161 pp.

Sogge, M.K., D. Ahlers, and S.J. Sferra. 2010. A natural history summary and survey protocol for the southwestern willow flycatcher. U.S. Geological Survey Techniques and Methods 2A-10. 38 pp.

Sorensen, J.A. 2009. Kanab ambersnail habitat mitigation for the 2008 high flow experiment. Draft Report. Technical Report 257. Nongame and Endangered Wildlife Program, Arizona Game and Fish Department, Phoenix. 12 pp.

Stefferud, S.E., J.A. Stefferud, P.C. Marsh, and T.E. Dowling. 2009. Petition for Listing Priority Restoration and Emergency Listing of Headwater Chub (Gila Nigra) As An Endangered Species. Petition to U.S. Fish and Wildlife Service, Albuquerque, NM. 44 pp.

Stevens, L.E., F.R. Protiva, D.M. Kubly, V.J. Meretsky, and J. Patterson 1997. The ecology of Kanab ambersnail (Succineidae: *Oxyloma haydeni kanabensis* Pilsbry, 1948) at Vaseys Paradise, Grand Canyon, Arizona: 1995 Final Report to the Grand Canyon Monitoring and Research Center, Flagstaff, Arizona. 42 pp.

Stewart, I. T., D. R. Cayan, and M. D. Dettinger. 2004. Changes in snowmelt runoff timing in western North American under a 'business as usual' climate change scenario. Climatic Change 62: 217-32.

Stine, S. 1994. Extreme and persistent drought in California and Patagonia during mediaeval time. Nature 369:546-549.

Storfer, A., S.G. Mech, M.W. Reudink, R.E. Ziemba, J. Warren, and J.P. Collins. 2004. Evidence for introgression in the endangered tiger salamander, *Ambystoma tigrinum stebbinsi* (Lowe). Copeia (2004)4:783-796.

Taylor, B.W., A.R. McIntosh, and B.L. Peckarsky. 2001. Sampling stream invertebrates using electroshocking techniques: implications for basic and applied research. Canadian Journal of Fisheries and Aquatic Sciences 58: 437-445.

Thorson, M. 2011. Bonytail captures at Bill Williams River National Wildlife Refuge. USFWS, Arizona Fish and Wildlife Conservation Office, Parker. 1 pp.

U.S. Fish and Wildlife Service (USFWS). 1967a. Native Fish and Wildlife: Endangered Species. Federal Register. March 11, 1967. 32 FR 4001.

U.S. Fish and Wildlife Service (USFWS). 1980a. Endangered and threatened wildlife and plants: the bonytail chub (Gila elegans) determined to be an endangered species. Federal Register. April 23, 1980. 45 FR 27710.

U.S. Fish and Wildlife Service (USFWS). 1984a. Endangered and Threatened Wildlife and Plants: Final rule to determine the Yaqui chub to be an endangered species with critical habitat, and to determine the beautiful shiner and Yaqui catfish to be threatened species with critical habitat. Federal Register. August 31, 1984. 49 FR 34490.

U.S. Fish and Wildlife Service (USFWS). 1984b. Sonoran topminnow recovery plan. U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 56 pp.

U.S. Fish and Wildlife Service (USFWS). 1985a. Endangered and threatened wildlife and plants: determination of experimental population status for certain introduced populations of Colorado squawfish and woundfin. Federal Register. July 24, 1985. 50 FR 30188.

U.S. Fish and Wildlife Service (USFWS). 1985b. Final rule listing the Navajo sedge as threatened with critical habitat. U. S. Fish and Wildlife Service, Region 2, Albuquerque, New Mexico. 5 pp.

U.S. Fish and Wildlife Service (USFWS). 1986a. Endangered and threatened wildlife and plants; determination of endangered status and critical habitat for the desert pupfish. Federal Register. February 28, 1986. 51 FR 10842.

U.S. Fish and Wildlife Service (USFWS). 1986b. Endangered and threatened wildlife and plants; determination of threatened status for the loach minnow. Federal Register October 28, 1986. 51 FR 39468.

U.S. Fish and Wildlife Service (USFWS). 1986c. Endangered and Threatened Wildlife and Plants; Final Rule To Determine the Sonora Chub To Be a Threatened Species and To Determine Its Critical Habitat. Federal Register. April 30, 1986. 51 FR 16042.

U.S. Fish and Wildlife Service (USFWS). 1986d. Endangered and threatened wildlife and plants; determination of threatened status for the spikedace. Federal Register. July 1, 1986. 51 FR 23769.

U.S. Fish and Wildlife Service (USFWS). 1987a. Endangered and threatened wildlife and plants; final rule to determine *Lepidomeda vittata* to be a threatened species with critical habitat. Federal Register. September 16, 1987. 52 FR 35034.

U.S. Fish and Wildlife Service. 1987b. Navajo sedge recovery plan. U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 39 pp.

U.S. Fish and Wildlife Service. 1987c. Endangered and threatened wildlife and plants; determination of endangered status for the Mount Graham red squirrel. Federal Register. June 3, 1987. 52 FR 994.

U.S. Fish and Wildlife Service (USFWS). 1988. Biological opinion for the Coronado National Forest Plan and Mt. Graham Astrophysical Area Plan. Consultation number 22410-1986-F-0075. Arizona Ecological Services Office, Phoenix. 46 pp.

U.S. Fish and Wildlife Service (USFWS). 1989. Endangered and threatened wildlife and plants: determination of endangered status for the Virgin River Chub. Federal Register. August 29, 1989. 54 FR 35305.

U.S. Fish and Wildlife Service (USFWS). 1990a. Bonytail Recovery Plan. Prepared by Colorado Fishes Recovery Team for the U.S. Fish and Wildlife Service, Region 6, Denver, Colorado. 35 pp.

U.S. Fish and Wildlife Service (USFWS). 1990b. Endangered and threatened wildlife and plants; designation of critical habitat for the endangered Mount Graham red squirrel (*Tamiasciurus hudsonicus grahamensis*). Federal Register. January 5, 1990. 55 FR 425.

U.S. Fish and Wildlife Service (USFWS). 1991a. Endangered and threatened wildlife and plants: the razorback sucker (Xyrauchen texanus) determined to be an endangered species. Federal Register. October 23, 1991. 56 FR 54957.

U.S. Fish and Wildlife Service (USFWS). 1992a. Endangered and threatened wildlife and plants: final rule to list the Kanab ambersnail as endangered. Federal Register, April 17, 1992. 57 FR 13657.

U.S. Fish and Wildlife Service (USFWS). 1992b. Sonora Chub (*Gila ditaenia*) Recovery Plan. Prepared by J.A. Stefferud for Region 2, U.S. Fish and Wildlife Service. Albuquerque NM. 44 pp. with appendices.

U.S. Fish and Wildlife Service (USFWS). 1993a. Desert pupfish recovery plan. Southwest Region. Albuquerque, New Mexico.

U.S. Fish and Wildlife Service (USFWS). 1993b. Endangered and Threatened Wildlife and Plants; final rule to list the Mexican spotted owl as threatened. Federal Register. March 16, 1993. 58 FR 14248.

U.S. Fish and Wildlife Service (USFWS). 1993c. Mount Graham red squirrel recovery plan. U.S. Fish and Wildlife Service, Albuquerque, NM.

U.S. Fish and Wildlife Service. 1994a. Determination of critical habitat for the Colorado River endangered fishes: Razorback sucker, Colorado squawfish, humpback chub and bonytail chub. Federal Register. March 31, 1994. 59 FR 13374.

U.S. Fish and Wildlife Service (USFWS). 1994b. Notice of 90-day and 12-month findings on a petition to reclassify spikedace (Meda fulgida) and loach minnow (Tiaroga cobitis) from threatened to endangered. Federal Register. July 11, 1994. 59 FR 35303.

U.S. Fish and Wildlife Service (USFWS). 1994c. Endangered and threatened wildlife and plants: proposal to list the Virgin spinedace as a threatened species. Federal Register, May 18, 1994. 59 FR 25875.

U.S. Fish and Wildlife Service (USFWS). 1995a. Kanab Ambersnail (*Oxyloma haydeni kanabensis*) Recovery Plan. Mountain/Prairie Region, Denver, Colorado. 27 pp.

U.S. Fish and Wildlife Service (USFWS). 1995b. Fishes of the Rio Yaqui Recovery Plan. Southwest Region, Albuquerque, New Mexico. 56 pp.

U.S. Fish and Wildlife Service (USFWS). 1995c. Virgin River Fishes Recovery Plan. Region 6, Salt Lake City, UT.

U.S. Fish and Wildlife Service (USFWS). 1995d. Endangered and threatened wildlife and plants: proposed rule and notice of hearing: designation of critical habitat for three Virgin River fishes. Federal Register, April 5, 1995. 60 FR 17296.

U.S. Fish and Wildlife Service (USFWS). 1995e. Masked bobwhite (Colinus virginianus ridgwayi) Recovery Plan. Albuquerque, New Mexico. 82 pp.

U.S. Fish and Wildlife Service (USFWS). 1995f. Recovery Plan for the Mexican Spotted Owl. Albuquerque, New Mexico.

U.S. Fish and Wildlife Service (USFWS). 1995g. Final rule determining endangered status for the southwestern willow flycatcher. Federal Register. February 27, 1995. 60 FR 10694.

U.S. Fish and Wildlife Service (USFWS). 1996a. Endangered and threatened wildlife and plants: Review of plant and animal taxa that are candidates for listing as endangered or threatened species. Federal Register. February 28, 1996. 61 FR 7596.

U.S. Fish and Wildlife Service (USFWS). 1996b. Endangered and threatened wildlife and plants: withdrawal of the proposed rule to list the fish Virgin spinedace as threatened and withdrawal of the proposed rule to designate critical habitat for the Virgin spinedace. Federal Register. February 6, 1996. 61 FR 4401.

U.S. Fish and Wildlife Service (USFWS). 1997a. Endangered and threatened wildlife and plants; determination of endangered status for three wetland species found in southern Arizona and northern Sonora, Mexico. Federal Register. January 6, 1997. 62 FR 665.

U.S. Fish and Wildlife Service (USFWS). 1997b. Endangered and threatened wildlife and plants: Review of plant and animal taxa that are candidates for listing as endangered or threatened species. Federal Register. September 19, 1997. 62 FR 49398.

U.S. Fish and Wildlife Service (USFWS). 1998a. Little Colorado River Spinedace, *Lepidomeda vittata*, Recovery Plan. Albuquerque, NM. 51 pp.

U.S. Fish and Wildlife Service (USFWS). 1998b. Intra-Service Biological and Conference Opinion regarding the proposed issuance of an Incidental Take Permit (PRT-837858) to the El Coronado Ranch and Cattle Company, Cochise County, Arizona. Consultation number 2-21-96-F-241. April 14, 1996. Arizona Ecological Services Office, Phoenix. 15 pp.

U.S. Fish and Wildlife Service (USFWS). 1998c. Final Rule: Establishment of a Nonessential Experimental Population of the Mexican Gray Wolf in Arizona and New Mexico. Federal Register. January 12, 1998. 63 FR 1752.

U.S. Fish and Wildlife Service (USFWS). 1999. Determination of critical habitat for the Huachuca water umbel. Federal Register. July 12, 1999. 64 FR 37441.

U.S. Fish and Wildlife Service (USFWS). 2000. Final Rule: Critical Habitat for Virgin River Chub and Woundfin. Federal Register. January 26, 2000. 65 FR 4140.

U.S. Fish and Wildlife Service (USFWS). 2001a. Endangered and threatened wildlife and plants: Review of plant and animal taxa that are candidates for listing as endangered or threatened species. Federal Register. October 30, 2001. 66 FR 54808.

U.S. Fish and Wildlife Service (USFWS). 2001b. Final Biological Opinion for Livestock Grazing and its Management on the Montana Allotment. June 6, 2001. Arizona Ecological Services Office, Phoenix. 75 pp. available at www.fws.gov/southwest/es/arizona

U.S. Fish and Wildlife Service (USFWS). 2001c. 12-Month Finding for a Petition to List the Yellow-billed Cuckoo (*Coccyzus americanus*) in the Western Continental United States. Federal Register. July 25, 2001. 66 FR 38611.

U.S. Fish and Wildlife Service (USFWS). 2002a. Endangered and threatened wildlife and plants: Review of plant and animal taxa that are candidates for listing as endangered or threatened species. Federal Register. June 13, 2002. 67 FR 40657.

U.S. Fish and Wildlife Service (USFWS). 2002b. Bonytail (Gila elegans) Recovery Goals: amendment and supplement to the Bonytail Chub Recovery Plan. U.S. Fish and Wildlife Service, Mountain-Prairie Region (6), Denver, Colorado.

U.S. Fish and Wildlife Service (USFWS). 2002c. Colorado pikeminnow (Ptychocheilus lucius) Recovery Goals: amendment and supplement to the Colorado Squawfish Recovery Plan. U.S. Fish and Wildlife Service, Mountain-Prairie Region (6), Denver, Colorado.

U.S. Fish and Wildlife Service (USFWS). 2002d. Humpback chub recovery goals: amendment and supplement to the humpback chub recovery plan. U.S. Fish and Wildlife Service, Mountain-Prairie Region (6), Denver, Colorado.

U.S. Fish and Wildlife Service (USFWS). 2002e. Razorback sucker (Xyrauchen texanus) recovery goals : Amendment and supplement to the Razorback Sucker Recovery Rlan. U.S. Fish and Wildlife Service, Mountain-Prairie Region (6), Denver, Colorado.

U.S. Fish and Wildlife Service (USFWS). 2002f. Endangered and Threatened Wildlife and Plants: listing of the Chiricahua leopard frog (Rana chiricahuensis). Federal Register. June 13, 2002. 67 FR 40790.

U.S. Fish and Wildlife Service (USFWS). 2002g. Sonora tiger salamander (Ambystoma tigrinum stebbinsi) recovery plan. U.S. Fish and Wildlife Service, Phoenix, Arizona. 67 pp.

U.S, Fish and Wildlife Service (USFWS). 2002h. Southwestern Willow Flycatcher Recovery Plan, Region 2, Albuquerque, NM.

U.S. Fish and Wildlife Service (USFWS). 2003. Gila Trout (*Oncorhynchus gilae*) Recovery Plan. Third Revision. Southwest Regional Office, Albuquerque, New Mexico. 86 pp.

U.S. Fish and Wildlife Service (USFWS). 2004a. Biological Opinion for the Reinitiation of Section 7 Consultation for Buenos Aires National Wildlife Refuge Fire Management Plan for the 2004 Burn Season. May 18, 2004. Consultation number 22410-2002-F-0068R1. Arizona Ecological Services Office, Phoenix. 20 pp.

U.S. Fish and Wildlife Service (USFWS). 2004b. Final Rule: final designation of critical habitat for the Mexican spotted owl. Federal Register. August 31, 2004. 69 FR 53182.

U.S. Fish and Wildlife Service (USFWS). 2005a. Endangered and threatened wildlife and plants; Final rule listing the Gila chub as endangered with critical habitat. Federal Register. November 2, 2005. 67 FR 51948.

U.S. Fish and Wildlife Service (USFWS). 2005b. Programmatic Biological and Conference Opinion for the Continued Implementation of the Land and Resource Management Plans for the Eleven National Forests and National Grasslands of the Southwestern Region. Dated June 10, 2005. Arizona Ecological Services Field Office, Phoenix, Arizona. 830 pp. + Appendices.

U.S, Fish and Wildlife Service (USFWS). 2005c. Designation of Critical Habitat for the Southwestern Willow Flycatcher: Federal Register. October 19, 2005. 70 FR 60886.

U.S. Fish and Wildlife Service (USFWS). 2006a. Biological Opinion for the Implementation of the Fire Management Plan at San Bernardino and Leslie Canyon National Wildlife Refuges. Consultation number 02-21-05-F-0495. January 23, 2006. Arizona Ecological Services Office, Phoenix. 46 pp.

U.S. Fish and Wildlife Service (USFWS). 2006b. Reclassification of the Gila Trout (*Oncorhynchus gilae*) From Endangered to Threatened: Special Rule for Gila Trout in New Mexico and Arizona. Federal Register. July 18, 2006. 71 FR 40657.

U.S. Fish and Wildlife Service (USFWS). 2006c. 12-Month Finding on a Petition to List a Distinct Population Segment of the Roundtail Chub in the Lower Colorado River Basin and to List the Headwater Chub as Endangered or Threatened with Critical Habitat. Notice of 12-month petition findings. Federal Register. May 3, 2006. 71 FR 26007.

U.S. Fish and Wildlife Service (USFWS) 2006d. Endangered and threatened wildlife and plants; 12-Month finding on a petition to list the northern Mexican gartersnake (*Thamnophis eques megalops*) as threatened or endangered with critical habitat. Federal Register. September 26, 2006. 71 FR 56228.

U.S. Fish and Wildlife Service (USFWS). 2007a. Chiricahua leopard frog *(Rana chiricahuensis)* Recovery Plan. U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

U.S. Fish and Wildlife Service (USFWS). 2007b. Endangered and threatened wildlife and plants: Review of plant and animal taxa that are candidates for listing as endangered or threatened species. Federal Register. December 6, 2007. 72 FR 69034.

U.S. Fish and Wildlife Service (USFWS). 2007c. San Bernardino springsnail. Species assessment and listing priority assignment form. Arizona Ecological Services Office, Phoenix. 12 pp.

U.S. Fish and Wildlife Service (USFWS). 2007d. Species Assessment and Listing Priority Assignment Form. Three Forks Springsnail. Region 2. 14 pp.

U.S. Fish and Wildlife Service (USFWS). 2007e. Endangered and threatened wildlife and plants; final designation of critical habitat for the spikedace (Meda fulgida) and loach minnow (Tiaroga cobitis). Federal Register. March 21, 2007. 72 FR 13356.

U.S. Fish and Wildlife Service (USFWS). 2007f. 5-Year Review. Sonora tiger salamander (*Ambystoma tigrinum stebbinsi*). Arizona Ecological Services Office. U.S. Fish and Wildlife Service, Region 2, Albuquerque, NM.

U.S. Fish and Wildlife Service (USFWS). 2007g. AESO 22410-2008-TA-0092. U.S. Fish and Wildlife Service file of technical assistance to Environmental Protection Agency for expansion of wastewater treatment facility, Sonoyta, Sonora, Mexico. Arizona Ecological Services Field Office, Tucson, Arizona. 5 pp.

U.S. Fish and Wildlife Service (USFWS). 2007h. Biological opinion on the proposed ongoing and future military operations and activities at Fort Huachuca. June 14 letter (22410-2007-F-0132) from Steven L. Spangle, Field Supervisor, AESO, USFWS, to Colonel Jonathan B. Hunter, Commander, U.S. Army Garrison. 202pp.

U.S. Fish and Wildlife Service (USFWS). 2008a. Final Biological Opinion for the Operation of Glen Canyon Dam. U.S. Fish and Wildlife Service, Phoenix, Arizona. 88 p.

U.S. Fish and Wildlife Service (USFWS). 2008b. Biological Opinion on the Leslie Canyon Watershed Safe Harbor Agreement. September 11, 2008. Consultation number 22410-2006-F-0724. Arizona Ecological Services Office, Phoenix. 56 pp.

U.S. Fish and Wildlife Service (USFWS). 2008c. Biological Opinion on the Malpai Borderlands Habitat Conservation Plan, Arizona and New Mexico. August 12, 2008. Consultation number 22410-2006-F-0408. Arizona Ecological Services Office, Phoenix. 135 pp.

U.S. Fish and Wildlife Service (USFWS). 2008d. Intra-Service Biological and Conference Opinion on Issuance of an Enhancement of Survival Permit (TE-083686-0) to the Arizona Game and Fish Department. Arizona Ecological Services Office, Phoenix, AZ. 84 pp.

U.S. Fish and Wildlife Service (USFWS). 2008e. Reinitiated Biological Opinion on Transportation and Delivery of Central Arizona Project Water to the Gila River Basin in

Arizona and New Mexico and its Potential to Introduce and Spread Nonindigenous Aquatic Species. U.S. Fish and Wildlife Service, Phoenix, AZ. 156 pp.

U.S. Fish and Wildlife Service (USFWS). 2008f. Little Colorado Spinedace (*Lepidomeda vittata*). 5-Year Review: Summary and Evaluation. Arizona Ecological Services Office, Phoenix. 30 pp.

U.S. Fish and Wildlife Service (USFWS). 2008g. Species assessment and listing priority assignment form for Loach Minnow. Arizona Ecological Services Office, Phoenix. 31 pp.

U.S. Fish and Wildlife Service (USFWS). 2008h. The Virgin River Fishes (Woundfin and Virgin River Chub) 5-year Review. Utah Field Office, West Valley City. 73 pp.

U.S. Fish and Wildlife Service (USFWS). 2008i. Endangered and threatened wildlife and plants; 12-Month finding on a petition to list the northern Mexican gartersnake (*Thamnophis eques megalops*) as threatened or endangered with critical habitat; proposed rule. Federal Register. November 25, 2008. 73 FR 71788.

U.S. Fish and Wildlife Service (USFWS). 2008j. U.S. Fish and Wildlife Service file of technical assistance to Reserva de la Biosfera El Pinacate y Gran Desierto de Altar expansion of wastewater treatment facility, Sonoyta, Sonora, Mexico. AESO 22410-2009-TA-0019. Arizona Ecological Services Field Office, Tucson, Arizona. 4 pp.

U.S. Fish and Wildlife Service (USFWS). 2008k. Biological Opinion on Aquatic Species Conservation at the San Pedro Riparian and Las Cienegas National Conservation Areas, Arizona Consultation 22410-2008-F-0103. December 31, 2008. Arizona Ecological Services Office, Phoenix. 54 pp.

U.S. Fish and Wildlife Service (USFWS).2008l. (Mt.) Mount Graham Summerhome Special Use Permit Residence Renewals. Consultation number 22410-2007-F-0163. Arizona Ecological Services Office, Phoenix.

U.S. Fish and Wildlife Service (USFWS). 2008m. Mount Graham red squirrel. 5-Year Review. Arizona Ecological Services Office, Phoenix.

U.S. Fish and Wildlife Service (USFWS). 2009a. Apache Trout (Oncorhynchus apache) Recovery Plan. Second Revision. Albuquerque, New Mexico. 84 pp.

U.S. Fish and Wildlife Service (USFWS). 2009b. Beautiful shiner. Draft 5-Year Review. San Bernardino National Wildlife Refuge, Douglas, Arizona. 15 pp.

U.S. Fish and Wildlife Service (USFWS) 2009c. Supplement to the 2008 Final Biological Opinion for the Operation of Glen Canyon Dam. Consultation number 22410-1993-F-167R1. Arizona Ecological Services Office, Phoenix. 148 pp.

U.S. Fish and Wildlife Service (USFWS). 2009d. 12-Month Finding on a Petition to List a Distinct Population Segment of the Roundtail Chub (*Gila robusta*) in the Lower Colorado River Basin; Proposed Rule. Federal Register. July 7, 2009. 74 FR 32352.

U.S. Fish and Wildlife Service (USFWS). 2009e. Species Assessment and Listing Priority Assignment Form: Spikedace. Arizona Ecological Services Office, Phoenix. 31 pp.

U.S. Fish and Wildlife Service (USFWS). 2009f. Yaqui catfish. Draft 5-Year Review. San Bernardino National Wildlife Refuge, Douglas, Arizona. 13 pp.

U.S. Fish and Wildlife Service (USFWS). 2009g. Yaqui chub. Draft 5-Year Review. San Bernardino National Wildlife Refuge, Douglas, Arizona. 15 pp.

U.S. Fish and Wildlife Service (USFWS). 2009h. Yaqui topminnow. Draft 5-Year Review. San Bernardino National Wildlife Refuge, Douglas, Arizona. 14 pp.

U.S. Fish and Wildlife Service (USFWS). 2009i. Endangered and threatened wildlife and plants; partial 90-day finding on a petition to list 475 species in the Southwestern United States as threatened or endangered with critical habitat; proposed rule. Federal Register. January 6, 2009. 74 FR 66866.

U.S. Fish and Wildlife Service (USFWS). 2010a. Biological opinion on issuance of a section 10(a)(1)(A) permit under the Endangered Species Act for conservation activities undertaken by Arizona Game and Fish Department. Southwestern Regional Office, Albuquerque, NM. 122 pp.

U.S. Fish and Wildlife Service (USFWS). 2010b. Endangered and Threatened Wildlife and Plants: 12-Month finding on a petition to list Cirsium wrightii (Wright's marsh thistle) as endangered or threatened. Federal Register. November 4, 2010. 75 FR 67925.

U.S. Fish and Wildlife Service (USFWS). 2010c. Huachuca springsnail. Species assessment and listing priority assignment form. Arizona Ecological Services Office, Phoenix. 16 pp.

U.S. Fish and Wildlife Service (USFWS). 2010d. Draft San Rafael Ranch Low Effect Habitat Conservation Plan, Santa Cruz County, Arizona. Prepared by David l. Harlow Environmental Consulting for San Rafael Cattle Company. 58 pp.

U.S. Fish and Wildlife Service (USFWS). 2010e. Page springsnail. Species assessment and listing priority assignment form. Arizona Ecological Services Office, Phoenix. 21 pp.

U.S. Fish and Wildlife Service (USFWS). 2010f. Stephan's riffle beetle. Species assessment and listing priority assignment form. Arizona Ecological Services Office, Phoenix. 11 pp.

U.S. Fish and Wildlife Service (USFWS). 2010g. Apache Trout 5-Year Review: Summary and Evaluation. Arizona Fish and Wildlife Conservation Office, Pinetop, AZ. 8 pp.

U.S. Fish and Wildlife Service (USFWS). 2010h. Desert Pupfish (*Cyprinodon macularius*). 5-Year Review: Summary and Evaluation. Arizona Ecological Services Office, Phoenix, AZ. 42 pp.

U.S. Fish and Wildlife Service (USFWS). 2010i. Species Assessment and Listing Priority Assignment Form for Headwater Chub. Arizona Ecological Services Office, Phoenix. 40 pp.

U.S. Fish and Wildlife Service (USFWS). 2010j. Endangered and threatened wildlife and plants; draft designation of critical habitat for the spikedace (Meda fulgida) and loach minnow (Tiaroga cobitis). Federal Register. October 28, 2010. 75 FR 66482.

U.S. Fish and Wildlife Service (USFWS). 2010k. Species Assessment and Listing Priority Form for Roundtail chub. Arizona Ecological Services Office, Phoenix. 90 pp.

U.S. Fish and Wildlife Service (USFWS). 2010l. Final Biological Opinion on the Virgin River Gorge (Gorge) Rotenone Treatment between the Stateline Fish Barrier in Washington County, Utah and the Virgin River Gorge Fish Barrier, Mohave County, Arizona. October 14, 2010. Consultation number 22410-2010-F-0567. Arizona Ecological Services Office, Phoenix. 29 pp.

U.S. Fish and Wildlife Service (USFWS). 2010m. Zuni bluehead sucker. Species assessment and listing priority assignment form. New Mexico Ecological Services Office, Albuquerque. 20 pp.

U.S. Fish and Wildlife Service (USFWS). 2010n. Draft Species Assessment and Listing Priority Assignment. Arizona Treefrog Huachuca/Canelo Distinct Population Segment. Arizona Ecological Services Office, Phoenix. 46 pp.

U.S. Fish and Wildlife Service (USFWS). 2010o. Species Assessment and Listing Priority Assignment Form. Sonoyta Mud Turtle. Arizona Ecological Services Office, Tucson, Arizona. 18 pp.

U.S. Fish and Wildlife Service (USFWS) 2010p. New Mexico Meadow Jumping Mouse. Species assessment and listing priority assignment form. New Mexico Ecological Services Office, Albuquerque. 29 pp.

U.S. Fish and Wildlife Service (USFWS). 2010q. Yuma Clapper Rail Recovery Plan (*Rallus longirostris yumanensis*). Draft First Revision. U.S. Fish and Wildlife Service, Southwestern Region, Albuquerque, New Mexico. 64 pp.

U.S. Fish and Wildlife Service (USFWS). 2010r. Mexican Wolf Conservation Assessment. USFWS, Southwest Region, Albuquerque, New Mexico. 130 pp.

U.S. Fish and Wildlife Service (USFWS). 2011a. Biological and Conference Opinion for

Wildlife and Sport Fish Restoration Funding of Arizona Game and Fish Department's Statewideand Urban Fisheries Stocking Program for 2011-2021. Consultation Number 22410-2008-F-0486. Arizona Ecological Services Office, Phoenix, AZ. 781 pp.

U.S. Fish and Wildlife Service (USFWS). 2011b. Proposed rule to list Three Forks Springsnail and San Bernardino Springsnail as Endangered Species with Proposed Critical Habitat. Federal Register. April 12, 2011. 76 FR 20464.

U.S. Fish and Wildlife Service. 2011c. Kanab Ambersnail. Draft Five-Year Review. Rocky Mountain Region, Utah Field Office, West Valley City. 28 pp.

U.S. Fish and Wildlife Service (USFWS). 2011d. Endangered and threatened wildlife and plants: draft designation of critical habitat for the Chiricahua leopard frog. Federal Register . March 15, 2011. 76 FR 14126.

U.S. Fish and Wildlife Service (USFWS). 2011e. Biological opinion on stocking of warmwater fish at Peña Blanca Lake, Santa Cruz County, Arizona. Consultation number 22410-2010-F-0330. Arizona Ecological Services Office, Phoenix. 39 pp.

U.S. Fish and Wildlife Service (USFWS). 2011f. Endangered and Threatened Wildlife and Plants: 12-Month finding on a petition to list the northern leopard frog in the western United States as Threatened. Federal Register. October 5, 2011. 76 FR 61896.

U.S. Fish and Wildlife Service (USFWS). 2011g. Draft Effects Analysis for Canelo Hills ladies'-tresses for U.S. Forest Service fire retardant use consultation. Arizona Ecological Services Office, Phoenix. 5 pp.

U.S. Fish and Wildlife Service (USFWS). 2011h. Biological Opinion for the Reinitiation of Section 7 Consultation for Buenos Aires National Wildlife Refuge Fire Management Plan 2005-2008 for the 2011 Fire Season. February 1, 2011. Consultation number 22410-2005-F-0243-R003. Arizona Ecological Services Office, Phoenix. 26 pp.

U.S. Fish and Wildlife Service (USFWS). 2011i. Endangered and threatened wildlife and plants: designation of revised critical habitat for southwestern willow flycatcher. Federal Register. August 15, 2011. 76 FR 50542.

U.S. Fish and Wildlife Service (USFWS). 2011j. Endangered and threatened wildlife and plants: reopening of comment period for San Bernardino springsnail and Three Forks springsnail. Federal Register. November 17, 2011. 76 FR 71300.

U.S. Fish and Wildlife Service and National Marine Fisheries Service. 1998. Endangered Species Act Consultation Handbook: Procedures for Conducting Section 7 Consultations and Conferences. U.S. Fish and Wildlife Service and National Marine Fisheries Service.

U.S. Forest Service (USFS). 2005. Biological Assessment of the Effects to Threatened, Endangered, Proposed, and Candidate Fish and Wildlife Species for Fire Suppression Actions and Burned Area Emergency Response (BAER) Treatments associated with the

Blue River Complex and KP/Three Forks Fires on the Alpine Ranger District of the Apache-Sitgreaves National Forest. August 26, 2005. 23 pp.

U.S. Global Change Research Program (USGCRP). 2001. Preparing for a changing climate: the potential consequences of climate variability and change – Southwest. A Report of the Southwest Regional Assessment Group for the U.S. Global Change Research Program. Institute for the Study of Planet Earth, University of Arizona, Tucson. 60pp.

Unsworth, R., L. Genova, K. Wallace, and A. Harp. 2005. Mexican Wolf Blue Range Reintroduction Project 5-Year Review. Socioeconomic Component. Prepared for USFWS, Division of Economics by Industrial Economics, Incorporated and Berven, Harp & Associates.

Utah Division of Wildlife Resources (UDWR). 2002. Virgin Spinedace Conservation Agreement and Strategy. 2002 Revision. Publication Number 02-22. Salt Lake City, Utah. 68 pp.

Utah Division of Wildlife Resources (UDWR) 2008. Virgin Spinedace Conservation Agreement and Strategy. 2000-2008 Assessment. Publication Number 08-56. Salt Lake City, Utah. 37 pp.

Utah Division of Wildlife Resources (UDWR). 2009. Memorandum of Understanding. Virgin Spinedace Conservation Agreement and Strategy. Salt Lake City, Utah. 11 pp.

Voeltz, J. B. 2002. Roundtail chub (Gila robusta) status survey of the lower Colorado River basin. Nongame and Endangered Wildlife Program Technical Report 186. Arizona Game and Fish Department, Phoenix, Arizona.

Voeltz, J.B, and R.H. Bettaso. 2003. Status of the Gila Topminnow and Desert Pupfish in Arizona. Technical report #226. Nongame and Endangered Wildlife Program. Arizona Game and Fish Department, Phoenix. 128 pp.

Weedman, D.A. 1999. Revised Gila topminnow recovery plan. Arizona Game and Fish Department. Phoenix, Arizona. Fish and Wildlife Service. Albuquerque New Mexico. 89 pp.

Weedman, D., A.L. Girmendonk, and K. Young. 1996. Status Review of Gila Chub, Gila intermedia, in the United States and Mexico. Technical Report 91, Nongame and Endangered Wildlife Program, Arizona Game and Fish Department. 120 pp.

Wiggins, D.A. 2005. Yellow-Billed Cuckoo (Coccycus americanus): A Technical Conservation Assessment. USDA Forest Service, Rocky Mountain Region. http://www/fs.fed.us/r2/projects/scp/assessments/yellowbilledcuckoo.pdf

Williams, R.D., J.E. Gates, and C.H. Hocutt. 1981. An evaluation of known and potential sampling techniques for hellbender, *Cryptobranchus alleganiensis*. Journal of Herpetology 15: 23-27.

Wood, D.A., A.G. Vandergast, J.A. Lemos Espinal, R.N. Fisher, and A.T. Holycross. 2010. Refugial isolation and divergence in the narrow-headed gartersnake species complex (*Thamnophis rufipunctatus*) as revealed by multilocus DNA sequence data. Final Report for Heritage Grant I08011 to Arizona Game and Fish Department, Phoenix. 41 pp.

Ziemba, R.E., A.T. Storfer, J. Warren, and J.P. Collins. 1998. Genetic variation among populations of the Sonora tiger salamander (*Ambystoma tigrinum stebbinsi* Lowe). Report to Arizona Game and Fish Department, Arizona Game and Fish Department Heritage Fund Program Grant #196046.

APPENDICES

Appendix A: Final determinations for species to be considered in this consultation

Table 1: All other listed, proposed, or candidate species in Arizona determined not to be affected by direct or indirect effects of the proposed action and rationale for that determination.

Common Name	Scientific Name	Status	Rationale
Black footed ferret	*Mustela nigripes*	E	Not aquatic or riparian dependent. No population in vicinity of proposed action
Hualapai Mexican vole	*Microtus mexicanus hualpaiensis*	E	Not aquatic or riparian dependent. No population in vicinity of proposed action
Jaguar	*Panthera onca*	E	Exposure risk for disturbance to individuals from proposed action is unlikely.
Lesser long-nosed bat	*Leptonycteris curasoas yerbabuenae*	E	Not aquatic or riparian dependent. No population in vicinity of proposed action
Ocelot	*Leopardus (= Felis) pardalis*	E	Not aquatic or riparian dependent. Exposure risk for disturbance to individuals from action is low.
Sonoran pronghorn	*Antilocapra americana sonoriensis*	E	Not aquatic or riparian dependent. No population in vicinity of proposed action
California condor	*Gymnogyps californicus*	10j	Not aquatic or riparian dependent. No population in vicinity of proposed action
Gunnison sage grouse	*Centrocercus minimus*	C	Not aquatic or riparian dependent. No population in vicinity of proposed action
Northern Aplomado falcon	*Falco femoralis septentrionalis*	10j	Not aquatic or riparian dependent. No population in vicinity of proposed action
Sprague's pipit	*Anthus spragueii*	C	Not aquatic or riparian dependent. No population in vicinity of proposed action
Desert tortoise (Mohave)	*Gopherus (= Xerobates = Scaptochelys) agassizii*	T with CH	Not aquatic or riparian dependent. No population in vicinity of proposed action
Desert tortoise (Sonora)	*Gopherus (= Xerobates = Scaptochelys) agassizii*	C	Not aquatic or riparian dependent. Individuals not likely to be found in association with aquatic or riparian habitats
New Mexico ridge-	*Crotalus willardi*	T with	Not aquatic or riparian dependent. No

nosed rattlesnake	*obscurus*	CH	population in vicinity of proposed action
Common Name	**Scientific Name**	**Status**	**Rationale**
Tucson shovel-nosed snake	*Chionactis occipitalis klauberi*	C	Not aquatic or riparian dependent. No population in vicinity of proposed action
Acuna cactus	*Echinomastus erectocentrus* var. *acunensis*	C	Not aquatic or riparian dependent. No population in vicinity of proposed action
Arizona cliffrose	*Purshia subintegra*	E	Not aquatic or riparian dependent. No population in vicinity of proposed action
Arizona hedgehog	*Cehinocereus triglochidiatus* var. *arizonicus*	E	Not aquatic or riparian dependent. No population in vicinity of proposed action
Brady pincushion cactus	*Pediocactus bradyi*	E	Not aquatic or riparian dependent. No population in vicinity of proposed action
Cochise pincushion cactus	*Coryphantha robbinsorum*	T	Not aquatic or riparian dependent. No population in vicinity of proposed action
Fickeisen plains cactus	*Pediocactus peeblesianus* var. *fickeiseniae*	C	Not aquatic or riparian dependent. No population in vicinity of proposed action
Gierisch mallow	*Sphaeralcea gierischii*	C	Not aquatic or riparian dependent. No population in vicinity of proposed action
Holmgren (Paradox) milkvetch	*Astragalus homgreniorum*	E	Not aquatic or riparian dependent. No population in vicinity of proposed action
Jones' cycladenia	*Cycladenis humilis* var. *jonesii*	T	Not aquatic or riparian dependent. No population in vicinity of proposed action
Kearney blue star	*Amsonia kearneyana*	E	Not aquatic or riparian dependent. No population in vicinity of proposed action
Lemmon fleabane	*Erigeron lemmonii*	C	Not aquatic or riparian dependent. No population in vicinity of proposed action
Nichol Turk's head cactus	*Echinocactus horizonthalonius* var. *nicholii*	E	Not aquatic or riparian dependent. No population in vicinity of proposed action
Peebles Navajo cactus	*Pediocactus peeblesianus* var. *peeblesianus*	E	Not aquatic or riparian dependent. No population in vicinity of proposed action
Pima pineapple cactus	*Coryphantha scheeri* var. *robustispina*	E	Not aquatic or riparian dependent. No population in vicinity of proposed

			action
Common Name	**Scientific Name**	**Status**	**Rationale**
San Francisco Peaks groundsel (ragwort)	*Packera franciscana*	T	Not aquatic or riparian dependent. No population in vicinity of proposed action
Sentry milk vetch	*Astragalus cremnophylax* var. *cremnophylax*	E	Not aquatic or riparian dependent. No population in vicinity of proposed action
Siler pincushion cactus	*Pediocactus sileri*	T	Not aquatic or riparian dependent. No population in vicinity of proposed action
Welsh's milkweed	*Asclepias welshii*	T	Not aquatic or riparian dependent. No population in vicinity of proposed action
Zuni (rhizome) fleabane	*Erigeron rhizomatus*	T	Not aquatic or riparian dependent. No population in vicinity of proposed action
Wright's marsh thistle	*Cirsium wrightii*	C	No populations exist in Arizona
Rosemont talussnail	*Sonorella rosemontensis*	C	Not aquatic or riparian dependent. No population in vicinity of proposed action

Table 2: List of aquatic species found in Arizona considered in biological and conference opinion with initial determination of "may affect" and a final effect determination.

Common Name	**Scientific Name**	**ESA Status**	**Critical Habitat**	**Final Effect Determination**
Huachuca springsnail	*Pyrgulopsis thompsoni*	C		LAA
Page springsnail	*Pyrgulopsis morrisoni*	C w/CCA		LAA
San Bernardino springsnail	*Pyrulopsis bernardina*	PE	PCH	LAA
Three Forks springsnail	*Pyrgulopsis trivialis*	PE	PCH	LAA
Kanab ambersnail	*Oxyloma haydeni kanabensis*	E		LAA
Stephan's riffle beetle	*Heterelmis stephani*	C		LAA
Apache trout	*Oncorhynchus apache*	T		LAA
Beautiful shiner	*Cyprinella formosa*	T	DCH	LAA
Bonytail	*Gila elegans*	E	DCH	LAA
Colorado pikeminnow	*Ptychocheilus lucius*	10j		NJ/LAA
Desert pupfish	*Cyprinodon macularius*	E		LAA
Gila chub	*Gila intermedia*	E	DCH	LAA
Gila topminnow	*Poeciliopsis occidentalis occidentalis*	E		LAA
Gila trout	*Oncorhynchus gilae*	T		LAA
Headwater chub	*Gila nigra*	C		LAA
Humpback chub	*Gila cypha*	E	DCH	LAA
Little Colorado spinedace	*Lepidomeda vittata*	T	DCH	LAA
Loach minnow	*Tiaroga cobitis*	T	DCH/PCH	LAA
Quitobaquito pupfish	*Cyprinodon eremus*	E	DCH	LAA
Razorback sucker	*Xyrauchen texanus*	E	DCH	LAA
Roundtail chub	*Gila robusta*	C		LAA
Sonora chub	*Gila ditaenia*	T	DCH	LAA
Spikedace	*Meda fulgida*	T	DCH/PCH	LAA
Virgin River chub	*Gila seminuda*	E	DCH	LAA
Virgin spinedace	*Lepidomeda mollispinus mollispinus*	CS		LAA
Woundfin	*Plagopterus argentissimus*	10j E	DCH	NJ/LAA LAA
Yaqui catfish	*Ictalurus pricei*	T	DCH	LAA
Yaqui chub	*Gila purpurea*	E	DCH	LAA
Yaqui topminnow	*Poeciliopsis occidentalis sonoriensis*	E		LAA

Common Name	Scientific Name	ESA Status	Critical Habitat	Final Effect Determination
Zuni bluehead sucker	*Catostomus discobolus yarrowi*	C		LAA
Arizona treefrog Huachuca DPS	*Hyla wrightorum*	C		LAA
Chiricahua leopard frog	*Lithobates (= Rana) chiricahuensis*	T	PCH	LAA
Northern leopard frog	*Lithobates (= Rana) pipiens*	PC		LAA
Relict leopard frog	*Lithobates (=Rana) onca*	C		LAA
Sonoran tiger salamander	*Ambystoma malvortium stebbinsi*	E		LAA
Narrow-headed garter snake	*Thamnophis rufipunctatus*	PC		LAA
Northern Mexican garter snake	*Thamnophis eques megalops*	C		LAA
Sonoyta mud turtle	*Kinosteron sonoriense longifemorale*	C		LAA
Masked bobwhite	*Colinus virginianus ridgewayi*	E		NLAA
Mexican spotted owl	*Strix occidentalis lucida*	T	DCH	NLAA
Southwestern willow flycatcher	*Empidonax traillii extimus*	E	DCH/PCH	NLAA
Yellow-billed cuckoo	*Coccyzus americanus*	C		NLAA
Yuma clapper rail	*Rallus longirostris yumanensis*	E		NLAA
Mexican gray wolf	*Canis lupis baileyi*	10j		NJ/NLAA
Mount Graham red squirrel	*Tamiasciurus hudsonicus grahamensis*	E		NLAA
New Mexico meadow jumping mouse	*Zapus hudsonius luteus*	C		LAA
Canelo Hills ladies'-tresses	*Spiranthes delitescens*	E		NLAA
Huachuca water-umbel	*Lilaeopsis schaffneriana* ssp. *recurva*	E	DCH	NLAA
Navajo sedge	*Carex specuicola*	E	DCH	NLAA

Key to abbreviations:

C	candidate species
CCA	candidate conservation agreement
CS	conservation strategy in lieu of listing
DCH	designated critical habitat (included in table only if DCH could be affected by proposed action)
E	endangered
LAA	likely to adversely affect (included in BCO)
NE	no effect
NLAA	not likely to adversely affect (concurrence provided in Appendix B0
PC	potential candidate within the 10-years covered by consultation
PE	proposed endangered
PCH	proposed critical habitat
T	threatened
10j	experimental non-essential population

Appendix B: Concurrences with "may affect, not likely to adversely affect" determinations

Canelo Hills ladies'-tresses

Status of the species and critical habitat rangewide

Listing history

The Canelo Hills ladies'-tresses was listed as an endangered species on January 6, 1997 (62 FR 665, USFWS 1997a). No critical habitat was designated for the ladies'-tresses to protect it from illegal collection for the orchid trade.

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the species. This information was taken from the final rule (USFWS 1997a), and species status sections in formal biological opinions (USFWS 2011g) and the draft San Rafael Habitat Conservation Plan (USFWS 2010d) and references cited therein. Information in these documents is incorporated by reference.

Life history

The ladies'-tresses is a slender, erect, terrestrial orchid that reaches 50 centimeters (cm) tall when in flower. Five to 10 linear-lanceolate, grass-like leaves rise from a basal stem supported by fleshy, swollen underground roots. The species is presumed to be perennial; however individual plants are not found blooming in consecutive years and may not show any aboveground structures in some years. The time between seedling establishment and maturity is unknown.

Habitat use

Ladies'-tresses are found in riparian areas along the edges of cienegas (Hendrickson and Minckley 1984) in southern Arizona. Habitat is in fine-grained, highly organic sediments that are seasonally or perennially saturated. Other vegetation present in these habitats includes grasses, sedges, rushes, spike-rush, cattails, and other plants associated with wet soils. Generally, ladies'-tresses prefer areas with sparse, herbaceous vegetation present and may not be tolerant of dense vegetation. Ladies'-tresses are not found near the active stream channel where scouring floods may occur; but found in secure cienegas away from the streams.

Current distribution

At the time of listing, ladies'-tresses were known from five sites in the San Pedro River watershed in Santa Cruz and Cochise counties, Arizona. The total occupied area was less than 81 hectares (200 acres). Four populations are on private lands with one of those owned by The Nature Conservancy (TNC) (AGFD 2000); the remaining small population on the Coronado National Forest. No additional populations have been found and the overall species status may be declining (USFWS 2010d).

Threats

Draining of cienegas, channelization of rivers and streams, and groundwater pumping are threats to the ladies'-tresses through drying of their habitat. Improper watershed management that alters runoff patterns into the drainages can result in scouring floods or headcutting that also affect the near surface water table supporting the moist soils needed for this species. The spread of nonnative plant species such as Johnson grass into the habitat of ladies'-tresses may result in the loss of ladies'-tresses at those sites (Gori 1994). Managed livestock grazing may or may not have adverse effects on the species since ladies'-tresses prefer landscapes with limited amount of competing vegetation (McLaren and Sundt 1992).

Conservation actions

The population on the TNC's Canelo Hills Preserve has been monitored annually and managed through removal of livestock grazing and use of prescribed burning to eliminate competing plants. These actions have had limited success (McLaren and Sundt 1992, Fishbein et al. 1994). The population at the Canelo Hills Preserve is closed to human access except for research purposes. The Coronado National Forest has fenced the population on their lands along O'Donnell Creek to protect it from cattle grazing (Backer and Gori 1998). The population on the San Rafael Ranch is proposed to be covered under the HCP currently in development (USFWS 2010d).

Previous consultations

Section 7 consultations on Canelo Hills ladies'-tresses include programmatic efforts for Forest Land Management Plans that address wildland fire control using fire retardants and that address watershed management and multiple uses (livestock grazing, timber harvest, recreation, and other issues). Plants on private land are not subject to section 7 consultations except when federal funding or permitting is involved. Biological opinions on actions potentially affecting Canelo Hills ladies'-tresses may be found at our website www.fws.gov/southwest/es/arizona in the Section 7 Biological Opinion page of the Document Library.

Effects

In at least three of the known population sites, there are populations of other species covered under this consultation that may be subject to survey and monitoring or other conservation activities covered by this consultation. Specific work on the Canelo Hills ladies'-tresses is not anticipated since the SFR and SWG funds are not expended on plant species.

Trampling by AGFD field crews accessing sites to implement covered activities and use of staging areas for equipment placement and sample processing could result in damage to individual plants during the season when they are above ground (which corresponds to the field season for most survey and monitoring work). Some degree of ground disturbance that removes competing vegetation is beneficial, and the Canelo Hills ladies's-tresses can coexist with limited amounts of trampling. Further, the limited number of survey trips to the three sites where the species overlaps with other aquatic species reduces the extent of potential damage over both time and space. Based on discussions with AESO botanists, the amount of such damage to individual

Canelo Hills ladies'-tresses is insignificant and discountable (Julie Crawford, pers. comm. October 19, 2011).

Conservation recommendation

Prior to any covered activities work in occupied Canelo Hills ladies'-tresses habitat, crews should be made aware of the presence of the species and make reasonable efforts on-site to avoid damaging plants.

Huachuca water umbel

Status of the species and critical habitat rangewide

Listing history

The Huachuca water umbel was listed as an endangered species on January 6, 1997 (62 FR 665, USFWS 1997a). Critical habitat was designated on July 12, 1999 (64 FR 37441, USFWS 1999a) for seven units totaling 83.2 kilometers (51.7 miles) of streams or rivers in Cochise and Santa Cruz counties, Arizona. Primary constituent elements of designated critical habitat are:

1. Sufficient perennial base flows to provide a permanently or nearly permanently wetted substrate for growth and reproduction of *Lilaeopsis*;

2. A stream channel that is relatively stable, but subject ti periodic flooding that provides for rejuvenation of the riparian plant community and produces open microsites for *Lilaeopsis* expansion;

3. A riparian plant community that is relatively stable over time and in which nonnative species do not exist or are at a density that has little to no adverse effect on resources available for *Lilaeopsis* growth and reproduction; and

4. In streams and rivers, refugial sites in each watershed and in each reach, including but not limited to springs or backwaters of mainstream rivers,that allow each population to survive catastrophic floods and recolonize larger areas.

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the species. This information was taken from the final rule and critical habitat designation (USFWS 1997a, 1999a), and comprehensive biological opinions concerning this species (USFWS 2005b, 2007h, 2008k) and literature cited therein. Information in these documents is incorporated by reference.

Life history

Huachuca water umbel is a rare, herbaceous semi-aquatic to fully aquatic perennial emergent plant found only in marshes and cienegas. The slender cylindrical leaves are hollow and grow erect from the nodes of creeping, shallow (1-2 cm depth), rhizomes. Vegetative reproduction is common and can produce dense stands with individual plants difficult to distinguish. Flowering provides seeds for dispersal, and high water events that move clumps of plants downstream is also a means of replicating a population elsewhere in a drainage.

Habitat use

Huachuca water umbel is found in cienegas, backwaters, and along the floodplain of small rivers and streams. Refuge sites away from the mainstem provide protection for portions of the population during floods that can erode the substrate at bankside habitats and wash plant clumps downstream. Thus, the density and size of water umbel populations vary in response to site characteristics and flood cycles. Water umbel populations can expand rapidly after flood events where other vegetation is reduced or eliminated and open, wet soils are available for the plants to root and expand.

Current distribution

At the time of listing, water umbel had been documented in 22 locations in Cochise, Pima, and Santa Cruz counties in Arizona and in adjacent Sonora, Mexico. Six of those populations were extirpated at the time of listing. The remaining 16 populations were in the San Pedro River (nine extant populations), Santa Cruz River (four extant populations), Rio Yaqui (two extant populations), and Rio Sonora (one extant population) drainages. In the rule designating critical habitat, 26 sites were reported, with 20 sites extant. Land ownership is a mix of Federal (Coronado National Forest, Bureau of Land Management, Ft. Huachuca Military Reservation, and San Bernardino National Wildlife Refuge), and private lands. Additional sites have been documented since then (Ft. Huachuca 2006).

Threats

Draining of cienegas, channelization of rivers and streams, and groundwater pumping are threats to the water umbel through drying of their habitat. Loss of surface or near-surface flows in rivers and streams due to groundwater pumping is a significant risk factor for water umbel in the San Pedro River and other sites. Improper watershed management that alters runoff patterns into the drainages can result in scouring floods or headcutting that also affect the near surface water table supporting the moist soils needed for this species. Improperly managed livestock grazing is also a threat in terms of trampling along the moist soil areas occupied by the species. Human access to streams and rivers also poses a risk of trampling of plants.

Conservation actions

Huachuca water umbel populations are found on the San Pedro Riparian Conservation Area, the Las Cienegas National Conservation Area, and the San Bernardino and Leslie Canyon National Wildlife Refuges where management to benefit the species is incorporated into planning

documents. The Ft. Huachuca Military Reservation has a (draft) Endangered Species Management Plan to address conservation needs for the three known and seven potential sites on the Fort (Ft. Huachuca 2006) and along the San Pedro River. The Bureau of Land Management also has ongoing conservation actions for the species at their two conservation areas (USFWS 2008k).

Previous consultations

Section 7 consultations on Huachuca water umbel include programmatic efforts for National Forest or Bureau of Land Management Land Management Plans that address watershed management and multiple uses (livestock grazing, timber harvest, recreation, and other issues), and the effects of additional groundwater pumping to support growth and development in the San Pedro River drainage near Sierra Vista and Ft. Huachuca. The most recent biological opinion on Ft. Huachuca (USFWS 2007h) contains extensive background information on these issues. Biological opinions on actions potentially affecting Huachuca water umbel may be found at our website www.fws.gov/southwest/es/arizona in the Section 7 Biological Opinion page of the Document Library.

Effects

Populations of Huachuca water umbel may occupy habitats also used by Huachuca springsnails, leopard frogs, gartersnakes, or native fish species and as such be accessed by AGFD field staff during activities covered under this consultation, particularly surveys and monitoring. Trampling of individual plants may occur at that time, and there is also a potential for plants to be damaged by seines or other equipment moved across the ground or adjacent waters. Trampling of adjacent vegetation may be beneficial to Huachuca water umbel populations as it reduces competition from other plants.

The limited number of survey and monitoring activities that may take place in any one Huachuca water umbel population in one year reduces the potential significance of any covered activities. Based on discussions with AESO botanists, the amount of such damage to individual Huachuca water umbels is insignificant and discountable (Julie Crawford, pers. comm. October 19, 2011).

Conservation recommendation

Prior to any covered activities work in occupied Huachuca water umbel habitat, crews should be made aware of the presence of the species and make reasonable efforts on-site to avoid damaging plants. Further, if any Huachuca water umbel are observed at a new site, information regarding that discovery should be provided to Julie Crawford at the Tucson AESO suboffice.

Navajo sedge

Status of the species and critical habitat rangewide

Listing history

Navajo sedge was listed as a threatened species with critical habitat on June 7, 1985 (50 FR 19370, USFWS 1985b).

Critical habitat was designated in three units containing groups of springs near Inscription House Ruins on the Navajo Nation in Coconino County, Arizona. The constituent elements identified were moist, sandy to silty soils at shady seep-springs within the Navajo Sandstone Formation.

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the species. This information was taken from the final rule (USFWS 1985b), the Navajo Sedge Recovery Plan (USFWS 1987b), and the 2004 status update (Roth 2004). Information in these documents is incorporated by reference.

Life history

Navajo sedge is a slender perennial forb, 2.5 to 4.5 dm (10-18 inches) high. The triangular stem extends from an elongate slender rhizome. The leaves are pale green, 1 to 2 mm (<0.1 inch wide), 12 to 20 cm (about 5-8 inches) long, and are clustered near the base of the plant. The flowers are concentrated in 2 to 4 groups or spikes. The terminal spike has both male and female flowers, with the latter above the former. The flowers are reduced and inconspicuous. They consist of small green-brown, scale-like parts 2 to 3 mm (<0.12 inch) long and 1 to 1.5 mm (<0.06 inch) wide. Flowering and fruit set occur from spring through summer. Most reproduction appears to be vegetative.

Habitat use

Navajo sedge occurs in hanging gardens within the Great Basin Conifer Woodland. The seep-spring pockets are on Navajo Sandstone bedrock at an elevation of 1740 to 1824 m (5710 to 5980 feet). The species occurs in a variety of situations in the sandstone from almost inaccessible sheer cliff faces to accessible alcoves. The dominant associated species include monkey flower (*Mimulus eastwoodiae*), *Epipactis gigantea*, water bentgrass (*Agrostis semiverticillata*), sand bluestem (*Andropogon hallii*), *Cirsium* sp., foxtail barley (*Hordeum jubatum*), and common reed (*Phragmites communis*).

Current distribution

At the time of listing, Navajo sedge was known from three spring groups near Inscription House Ruins on the Navajo Nation (USFWS 1985b). Other sites nearby were documented in the recovery plan (USFWS 1987b) and in subsequent surveys in northern Arizona and southern Utah (AGFD 2005b, Roth 2004). Most of the known sites are on the Navajo Nation in Arizona with

some populations on the Nation in San Juan County, Utah, and on National Park Service lands at Canyon de Chelly National Monument in Arizona (Roth 2004).

Threats

Threats to Navajo sedge are from groundwater pumping that may reduce flows from springs and seeps that support the habitat of the species or development of springs or seeps for livestock or domestic uses. Poorly managed livestock grazing in the vicinity of Navajo sedge populations at the bottom of cliffs can result in overuse of Navajo sedge as forage, trampling of plants, and changes to the plant community that may have adverse effects to the microclimate needed by the species (USFWS 1985b, 1987b, Roth 2004).

Conservation actions

Navajo sedge is a Group 3 Species on the Navajo Nation list of endangered species (NNHP 2005). A minimum 200 foot buffer is recommended to avoid disturbance to the species or its habitat; additional measures may be needed for groundwater development projects. With the exception of surveys to document presence of the species, little conservation work has been accomplished.

Previous consultations

The remote location of Navajo sedge populations has reduced the number of section 7 consultations for Federal actions that may affect this species. Our records do not indicate a finding of "may affect, likely to adversely affect" or "destroy or adversely modify" designated critical habitat has been made for this species in any consultation completed by AESO.

Effects

There are no other aquatic species covered by this consultation known to coexist with Navajo sedge. However, over the 10-year period covered by this consultation, additional species may be identified and survey and monitoring efforts by AGFD undertaken.

Navajo sedge may be trampled by field crews accessing the seeps and springs that support this plant. Such trampling is less likely on the high seeps where access is restricted than along the base of the cliffs where the plant grows at ground level. The limited number of survey and monitoring activities that may take place in any one Navajo sedge population in one year reduces the potential significance of any covered activities to insignificant and discountable.

Conservation recommendation

Prior to any covered activities work in occupied Navajo sedge habitat, crews should be made aware of the presence of the species and make reasonable efforts on-site to avoid damaging plants. Further, if any Navajo sedge is observed at a new site, information regarding that discovery should be provided to John Nystedt at the Flagstaff AESO suboffice.

Masked bobwhite

Status of the species rangewide

Listing history

The masked bobwhite was listed as an endangered species in 1967 (USFWS 1967a.) There is no critical habitat designated for the species.

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the species. This information was taken from the Recovery Plan (USFWS 1995e) and recent biological opinions (USFWS 2004a, 2011h) and references cited therein. Information in these documents is incorporated by reference.

Life history

Masked bobwhites remain in coveys until late June when pair bonds begin to form. Breeding is in response to the summer rains, which provide impetus for plant growth beneficial for nesting cover and later feeding areas for adults and chicks.

Masked bobwhites eat seeds and small invertebrates. Survival is attuned to having sufficient amounts of dense cover to provide adequate foraging and nesting areas and as protection from predators.

Habitat use

Masked bobwhites inhabit summer-active savanna grasslands and desert grasslands that also contain a scrub (small trees, shrubs) component. The important feature is the abundance of grasses and forbs that provide food and cover. Such conditions can occur in bottomlands along washes or other areas where water can collect and provide suitable conditions for growth of grasses. A degree of low, dense, shrub and tree cover in these areas is also important for roosting and protective cover.

Current distribution

In Arizona, the species was generally associated with the Santa Cruz and Altar valleys of southeastern Arizona and portions of Sonora, Mexico. The known populations of masked bobwhite have shown a significant decline in recent years. Survey efforts in Mexico have located a few individuals in recent years, but no coveys have been located. In Arizona, masked bobwhite had been found primarily on the Buenos Aires National Wildlife Refuge (BANWR) and ranchlands immediately adjacent to the BANWR. Several observations in the north end of the Altar Valley have been made along SR 286. Detections during summer call-count surveys have declined in recent years.

After several years of not finding masked bobwhite within the United States, the BANWR, in July 2010, released 74 masked bobwhites from their captive breeding program onto the refuge. These birds were from the new outdoor breeding facilities, as opposed to earlier releases from the indoor facilities. It is too early to be able to assess the success of this latest release.

Threats

The loss of the historical grassland community through overgrazing and drought at the end of the 1880s was the significant event affecting masked bobwhites. Sites in Arizona vanished earlier than those in Sonora; however, grasslands there continue to be lost.

Conservation actions

The BANWR was established exclusively as a refuge for the masked bobwhite. Research into habitat use and reintroductions continue on this property and adjacent areas. Additional work to support masked bobwhite in Sonora also continues.

Previous consultations

The formal section 7 consultations on masked bobwhite are on the BANWR Fire Management Plans. This species has been included in several informal consultations related to the BANWR's Comprehensive Conservation Plan, Altar Valley Fire Management Plan, and various masked bobwhite related management actions. Formal consultations on border security projects also consider the species. Biological opinions on actions potentially affecting masked bobwhites may be found at our website www.fws.gov/southwest/es/arizona in the Section 7 Biological Opinion page of the Document Library.

Effects

Masked bobwhites are found in areas of dense grass and forb cover in bottomlands. These areas are likely to be near stock tanks, springs, or other aquatic habitats, and recent releases of masked bobwhites were near such areas and some birds were reported near springs or tanks in 2010. Covered activities related to Chiricahua leopard frogs, Gila topminnow, and possibly northern Mexican gartersnakes are likely to occur at tanks on the BANWR. Some of these tanks have earthen berms that do not support vegetation and are unlikely to have masked bobwhites resident in the immediate vicinity where staging areas for work in the tanks would be placed. Masked bobwhite may be found in areas further removed from the shorelines of the tanks; one was observed near Carpenter Tank which supports Chiricahua leopard frogs and another near Rock Tank which has both frogs and topminnow. Rock Tank is near the Huatcheta Springs release area; no occupied tanks for frogs or topminnow are currently in the other release area.

It is unlikely that covered activities on BANWR would have adverse effects to masked bobwhite habitat. All tanks are accessed by existing roads or trails that do not support habitat for the species. Further, the tanks themselves do not have habitat (though the Huatcheta Springs site is near Rock Tank it is a separate area with a berm between them). The only identifiable risk is from driving to and from work areas where masked bobwhite may fly or run across the road and

be injured. One masked bobwhite was identified as flying across the main entrance road in front of a BANWR vehicle.

All AGFD activities on the BANWR for masked bobwhites are included in the section 10(a)(1)(A) permit and its BO and an incidental take of two is authorized due to risks from active survey efforts. There are no SFR funded activities on BANWR. Close coordination with the refuge is required for those activities. Activities for aquatic species are also coordinated with the refuge staff and follow protocols to reduce the risks of unintentional damage to habitat and mortality of masked bobwhite from vehicles. The risk from vehicles was not identified in the permit BO, and is unlikely to be an issue. For these reasons, the level of risk to masked bobwhites from covered activities is insignificant and discountable.

Mexican spotted owl

Status of the species and critical habitat in the action area

Listing history

The Mexican spotted owl was listed as a threatened species in 1993 (58 FR 14248, USFWS 1993b). Critical habitat was designated in 2004 (69 FR 53182, USFWS 2004b).

The PBFs of designated critical habitat for the spotted owl were described in detail in the final rule (USFWS 2004)b. Three categories of PBFs were developed: 1) elements related for forest structure; 2) elements related to maintenance of adequate prey species; and 3) elements related to canyon habitats. Important components are the presence of a variety of conifer and hardwood tree species in the community and the physical structure of the community (canopy closure, tree diameter, snags, fallen trees and other woody debris, other shrub/herbaceous plants) that will vary between particular critical habitat units based on location. The KHCs for restricted and protected spotted owl habitat, as described in the Recovery Plan (USFWS 1995f) consist of similar habitat components (e.g., large trees, large logs and snags, high canopy closure) and there is little to no distinction that needs to be made between them for the analysis.

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the species. This information was taken from the Recovery Plan (USFWS 1995f) and references cited therein. Information in this document is incorporated by reference.

Life history

The spotted owl is mottled in appearance with irregular white and brown spots on its abdomen, back, and head. Juveniles, subadults and adults are distinguished by plumage characteristics while sexes can be determined by the calls. Breeding occurs from March through August. A mated pair may use the same nesting territory year after year and the nesting territory overlaps with the non-breeding season activity area. Young owls disperse in September and may remain near the natal area or move considerable distances away.

Spotted owls are “perch and pounce” predators on small mammals, particularly woodrats. They hunt primarily at night and remain perched in cover during the day.

Habitat use

The spotted owl lives in a variety of biotic communities; however occupied areas are typified by mature or old growth forest with complex internal structure of multiple levels of vegetation and high canopy closure. These shady conditions provide a cooler microclimate that may be important for the species.

Current distribution

Spotted owls are known from many counties in Arizona, primarily on National Park Service and U.S. Forest Service lands.

Threats

Threats to spotted owls are particularly focused on loss of suitable nesting habitat through improper forest management. Extensive clear cut logging of mature and old growth forests can eliminate habitat over large areas. Rigorous fire control also leads to accumulations of fuels that result in more severe wildfire events than the vegetation community faced historically.

Conservation actions

Identification of protected activity centers (PACs) on Federal lands has allowed for consideration of the needs of spotted owls in management of these areas.

Previous consultations

Section 7 consultations on Mexican spotted owl include programmatic efforts for Forest Land Management Plans that address watershed management and multiple uses (livestock grazing, timber harvest, recreation, and other issues). Biological opinions on actions potentially affecting spotted owls Arizona may be found at our website www.fws.gov/southwest/es/arizona in the Section 7 Biological Opinion page of the Document Library.

Effects

The designated boundaries of Mexican spotted owl PACs may overlap with aquatic habitats such as springs, streams, rivers, and lakes. The effect of human presence to Mexican spotted owls was discussed in detail in the Sportfish BO (USFWS 2011a) and is summarized below.

The effects of AGFD field crew disturbance to individual spotted owls depends on location of the access relative to important owl habitat (intensity), the number of such encounters (frequency), and the time over which the effect occurs (duration) (USFWS 1995f). Location of the disturbance effect during the breeding season outside the PAC or within the PAC contributes to the potential level of the effect to a particular pair of owls during the breeding season.

For effects within a PAC, those that are closest to the nest or roosting sites are more likely to result in a disturbance effect to spotted owl. Spotted owls at nest and roosting sites alter their behavior when humans are present, with human presence within 200 feet potentially resulting in a flushing response. Spotted owls use the entire PAC during the breeding season and since the location of nest and roost sites may change over time, disturbance effects within a PAC are not distinguished by where in the PAC they occur. The more human presence at one time (intensity) likely exacerbates the disturbance effects.

Intensity of the effect can be related to the noise level resulting from human presence as well as the nearness of the humans to the spotted owl. AGFD field crews walking toward a work site may be speaking among themselves. Normal conversation at three to five feet away is 60-70db (GCAudio 2009), and sound attenuates with distance. At distances of over 200 feet, sound levels from normal conversation (70 db) attenuate to 25 db (Engineering Page 2009). This level of sound is comparable to whispering or rustling leaves (OMSI 2005) and may no longer be detectable over background noise.

Habitat alteration outside of the PAC through creation or maintenance of access for recreationists includes the access needed by AGFD field crews is not identified as a significant issue for spotted owl survival and recovery (USFWS 1995f) but may occur on a localized scale. As noted previously, this assumption is based on the limited amount of significant effects to PBFs and KHCs from any recreationists, or other infrequent human presence, accessing spotted owl habitats.

The effect to Mexican spotted owls and designated critical habitat from the proposed action is insignificant. AGFD field crew-related disturbances are not going to occur often in any particular PAC due to limits on the number of visits to any aquatic habitat over the 10-year period. At the elevations occupied by spotted owls, the prime field season, which also coincides with the spotted owl breeding season (March 1- August 31), so the timing of the peak risk of disturbance is also the most sensitive period for disturbances within the PAC. However, the amount of potential disturbance in any particular PAC during a breeding season is limited by the low frequency of potential survey efforts and, given the size of most PACs and the location of prime nesting habitat within the PAC that most of those efforts will not occur close to spotted owl nests.

Southwestern willow flycatcher

Status of the species and critical habitat in the action area

Listing history

The southwestern willow flycatcher was listed as an endangered species on February 27, 1995 (60 FR 10694, USFWS 1995g). Critical habitat was designated on October 19, 2005 (70 FR 60886, USFWS 2005) and was re-proposed in 2011 (USFWS 2011i).

The PBFs of the 2011 proposed critical habitat are similar to those contained in the 2005 designation. The 2011 PBFS are:

PBF 1: *Riparian vegetation.* Riparian habitat in a dynamic river or lakeside, natural or manmade successional environment (for nesting, foraging, migration, dispersal, or shelter) that is comprised of trees and shrubs (that can include Gooddings willow, coyote willow, Geyers willow, arroyo willow, red willow, yewleaf willow, pacific willow, boxelder, tamarisk, Russian olive, buttonbush, seep willow, oak, rose, sycamore, false indigo, Pacific poison ivy, grape, Virginia creeper, Siberian elm, and walnut) and some combination of:

(a) Dense riparian vegetation with thickets of trees and shrubs that can range in height from about 2 m to 30 m (about 6 to 98 ft). Lower-stature thickets (2 to 4 m or 6 to 13 ft tall) are found at higher elevation riparian forests and tall-stature thickets are found at middle- and lower-elevation riparian forests; and/or

(b) Areas of dense foliage at least from the ground level up to approximately 4 m (13 ft) above ground or dense foliage only as the shrub or tree level as a low, dense, canopy; and/or

(c) Sites for nesting that contain a dense (about 50 percent to 100 percent) tree or shrub (or both) canopy (the amount of cover provided by tree and shrub branches measured from the ground); and/or

(d) Dense patches of riparian forests that are interspersed with small openings of open water or marsh or areas with shorter and sparser vegetation that creates a variety of habitat that is not uniformly dense. Patch size may be as small as 0.1 ha (0.25 ac) or as large as 70 ha (175 ac); and

PBF 2: *Insect prey populations*. A variety of insect prey populations found within or adjacent to riparian floodplains or moist environments, which can include: flying ants, wasps, and bees (Hymenoptera); dragonflies (Onodonta); flies (Diptera); true bugs (Hemiptera); beetles (Coleoptera); butterflies, moths, and caterpillars (Lepidoptera); and spittlebugs (Homoptera).

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the species. This information was taken from the Recovery Plan (USFWS 2002h) and recent biological opinions (USFWS 2011a) and references cited therein. Information in these documents is incorporated by reference.

Life history

The southwestern willow flycatcher is a small grayish-green passerine bird (Family Tyrannidae) measuring approximately 5.75 inches. The song is a sneezy “fitz-bew” or a “fit-a-bew”, the call is a repeated “whitt”. It is one of four currently recognized willow flycatcher subspecies. It is a neotropical migrant that breeds in the southwestern U.S. and migrates to Mexico, Central America, and possibly northern South America during the non-breeding season.

Flycatchers arrive in the United States beginning in May and a few may still be present in September. Males sing to establish territories and attract a female. The female selects the nest site within the territory and builds the nest. Generally one nesting attempt is made in a season.

Flycatchers are insectivorous, taking prey on the wing or gleaning from vegetation. They can exploit a wide array of arthropod taxa which gives them flexibility in foraging across a season. Terrestrial insects such as bees, wasps, ants, and true flies are particularly important.

Habitat use

The southwestern willow flycatcher breeds in dense riparian habitats from sea level in California to approximately 8,500 feet in Arizona and southwestern Colorado. Historical egg/nest collections and species' descriptions throughout its range describe the southwestern willow flycatcher's widespread use of willow as a primary habitat.

Based on the diversity of plant species composition and complexity of habitat structure, four basic habitat types can be described for the southwestern willow flycatcher: monotypic willow, monotypic exotic, native broadleaf-dominated, and mixed native/exotic. Suitable habitat conditions at a particular location area subject to changes over time as vegetation matures out of the desirable size class or plant density changes.

Current distribution

Approximately 35 percent of known territories for southwestern willow flycatcher are known from Arizona: 459 territories at 124 sites along rivers and streams or in the vicinity of fluctuating reservoirs.

Threats

Threats to the species and its habitat include degradation and loss of native riparian vegetation due to stream channelization, stream dewatering due to construction of dams, surface diversions or groundwater pumping, conversion of floodplains that once supported riparian habitats to agricultural or other development activities, creation of hydrological conditions that do not allow for replacement of riparian areas lost to other causes, the expansion of nonnative plants such as Russian olive and tamarisk, improper livestock management, and fire. Flycatchers are also affected directly through increases in brood parasitism due to increased cowbird presence at agricultural and urbanized areas. Recreation was also identified as a threat, particularly as riparian areas offer shade and opportunities for water based recreation, including angling. Effects of recreational access include reduction in vegetation through trampling, wood cutting, prevention of seedling establishment through soil compaction, bank erosion, creation of trails and paths that fragment the habitat an may alter essential microclimates, and open areas to greater access by predators and competitors.

Conservation actions

Conservation actions associated with some consultations and Habitat Conservation Plans (Roosevelt and Horseshoe-Bartlett HCPs) have helped to acquire lands specifically for

flycatchers on the San Pedro, Verde, and Gila rivers in Arizona and the Kern River in California. Additionally, along the lower Colorado River, the LCR MSCP is currently attempting to establish riparian vegetation to expand and improve the distribution and abundance of nesting flycatchers. A variety of Tribal Management Plans have been established to guide conservation of the flycatchers. Additionally, during the development of the critical habitat rule, management plans were developed for some private lands along the Owens River in California and Gila River in New Mexico. These are a portion of the conservation actions that have been established across the subspecies' range.

Previous consultations

Section 7 consultations on southwestern willow flycatcher include programmatic efforts for Forest Land Management Plans that address watershed management and multiple uses (livestock grazing, timber harvest, recreation, and other issues), and more site-specific efforts that are more focused on implementing site-specific projects such as highway bridges, vegetation removal, flood protection, and other types of projects. Biological opinions on actions potentially affecting southwestern willow flycatcher in Arizona may be found at our website www.fws.gov/southwest/es/arizona in the Section 7 Biological Opinion page of the Document Library.

Effects

Southwestern willow flycatchers are surveyed using audio tape-callback and all surveyors must complete official training prior to any field work. The protocol (Sogge et al. 2010) includes information on proper behavior for surveyors and encourages access into the habitat to ensure the survey is effective at locating birds. That there is no discussion of "harassment" to southwestern willow flycatchers from surveyors conducting multiple surveys (up to seven) inside the habitat in the permit language, and this species is not included in the BO with incidental take implies that the amount of more close-in disturbance from survey activities does not rise to the level of incidental take. With that as the metric, we do not believe that the more limited, more distant noise and human presence resulting from AGFD field crews conducting covered actions represents a meaningful disturbance for nesting flycatchers. AGFD field crews are unlikely to be moving through such dense vegetation to access streams, lakes and reservoirs to implement covered activities. Further, the number and extent of such activities is limited over the course of a year in any one occupied habitat area, which further reduces the amount of disturbance to the individual birds at a nesting territory to insignificant.

The extent of insect or invertebrate collections that could reduce the prey base for southwestern willow flycatchers is unlikely to occur with the limited sampling protocols used for invertebrate collections.

Effects to the PBFs of designated or proposed critical habitat are also limited in extent. As noted previously, AGFD field crews are unlikely to attempt to cross through dense riparian habitat that meets the PBFs. Adjacent areas with less opportunity to meet the PBFs at the time of access are more likely to be used. There may be some effects to the potential for riparian areas to develop into the PBFs of critical habitat due to the maintenance of trails or other access through riparian areas to aquatic habitats where covered activities may be conducted. These trails or other access

points are also used by other people; Federal land management staff, recreationists (including hikers, birdwatchers, and anglers), and under current use patterns, are unlikely to be naturally restored to support the PBFs.

Yellow-billed cuckoo

Status of the species in the action area

Listing history

The yellow-billed cuckoo became a candidate for listing under the Act on July 25, 2001 (66 FR 36811, USFWS 2001c).

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the species. This information was taken from the 12-month finding (USFWS 2001c), and the technical conservation assessment (Wiggins 2005) and references cited therein. Information in these documents is incorporated by reference.

Life history

Yellow-billed cuckoos are neotropical migrants that breed in late spring and summer along riparian areas. Adults arrive between late May and June with nesting in July and August. Yellow-billed cuckoos complete their nesting cycle in three weeks; however the fledged young remain dependent on their parents for an additional three weeks.

Primary prey items are insects, spiders and other large invertebrates gleaned from the vegetation.

Habitat use

During migration, yellow-billed cuckoos are found in a variety of riparian vegetation communities that offer short-term feeding and resting locations. Breeding habitats tend to be large dense riparian forests of willow and cottonwood or mesquite adjacent to water or marshy areas that serve to provide thermal refuge from summer heat. Breeding habitats are structurally dense and difficult for larger animals to access.

Current distribution

Yellow-billed cuckoos are found in several locations in Arizona, particularly along the major rivers still supporting a riparian corridor. They are not found along ephemeral rivers or in the higher elevations of the White Mountains.

Threats

Threats to the species and its habitat include degradation and loss of native riparian vegetation due to stream channelization, stream dewatering due to construction of dams, surface diversions

or groundwater pumping, conversion of floodplains that once supported riparian habitats to agricultural or other development activities, creation of hydrological conditions that do not allow for replacement of riparian areas lost to other causes, the expansion of nonnative plants such as Russian olive and tamarisk, improper livestock management, and fire.

Conservation actions

The yellow-billed cuckoo is a species covered by the LCR MSCP which is creating new breeding habitat for the species on the lower Colorado River.

Previous consultations

Yellow billed cuckoo is a candidate for listing under the Act and as such is not subject to the consultation requirements of section 7 for activities of Federal agencies. Federal agencies may, at their discretion, include consideration for candidate species in their environmental compliance under the Act. However, it is the policy of the USFWS that candidate species are considered in intra-Service consultations on USFWS actions, including funding activities of other entities such as AGFD.

Effects

Yellow-billed cuckoos may be disturbed by AGFD field crews moving through the riparian areas to initiate covered actions. Human-related disturbance during the migration period (either spring or fall) is likely to have a very limited effect on YBC since individuals are highly mobile and suitable migration habitat is more available than nesting habitat and avoidance of areas of high human use is more feasible. The information on the degree to which human presence in YBC nesting habitat can affect behavior of the adults and thus the success of the nesting attempt is not entirely consistent. Wiggins (2005) noted that any capture of adult birds for banding should not be done at the nest since the danger of abandonment of the nest is high. Similarly, he cautioned against banding the young birds while they are in the nest for the same reason. Latta et al. (1999) reported that YBCs will abandon nests if disturbed repeatedly and suggested avoidance of intense and repeated human disturbance in nesting areas between May 20 and September 1. Halterman (2010) indicated that a steady human presence during nest building or normal, regular human activity in the vicinity of yellow-billed cuckoos has a low potential for effects; however more intensive use could result in nest failure. One report from Texas (Luneau 2002) documented nest abandonment during incubation by yellow-billed cuckoo after less than three minutes observation at a distance of 35 feet from the nest. Adults are not likely to abandon the nest once the first egg hatches and foraging birds are largely oblivious to human presence (Laymon 1998). The survey protocol notes that adult birds do not go to their nest if under observation, and that nest abandonment is a concern particularly during the nest building stage.

The physical structure of the breeding habitat for yellow-billed cuckoos is such that it is difficult to move through, particularly when carrying field equipment. AGFD field crews are more likely to access work sites via existing paths or trails, or move along the edge of the water body. The limited time period when the yellow-billed cuckoos are breeding does overlap in some areas of the state where AGFD field crews could be working. Although reclusive at times, cuckoos do not appear to be overly sensitive to low level human activity occurring outside of the immediate

breeding area. Like most nesting birds, cuckoos will alter their behavior due to human activity when nesting, but will typically resume normal behavior once the presumed danger has passed. Continuing disturbance events over several days, or for long periods during the day are more disruptive than one-time or limited period exposures. AGFD field crews are unlikely to be in an area of breeding habitat for more than one day or two over several years, and are unlikely to be in the dense vegetation that supports the nest. These disturbances are not significant.

Yuma clapper rail

Status of the species rangewide

Listing history

The Yuma clapper rail was listed as an endangered species on March 11, 1967 (32 FR 4001, USFWS 1967a). There is no critical habitat designated for the species.

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the species. This information was taken from the revised Recovery Plan (USFWS 2010q) and references cited therein. Information in this document is incorporated by reference.

Life history

The Yuma clapper rail is the only clapper rail to live in fresh water as well as in brackish water. Yuma clapper rails initiate breeding activities with pair-bonding calls in February with initiation of nesting in March with a peak in May on the lower Colorado River (Eddleman 1989). Along the Gila River in the metropolitan Phoenix area, calling is later (March) with nesting probably peaking later in the spring than along the lower Colorado River. Nests are constructed in dense vegetation within the marsh or associated riparian vegetation. Young Yuma clapper rails are cared for by the adults for several weeks following hatching. Adults molt during the summer and are flightless during that period.

Crayfish, small fish, tadpoles, clams and other aquatic invertebrates comprise the diet of all life stages of Yuma clapper rail (summarized in USFWS 2010q). They forage on mud banks and small open areas next to the cattails or within the cattail stand. They hunt by sight and have an acute sense of smell.

Habitat use

Yuma clapper rails are secretive marsh birds that are found in cattail and cattail bulrush marshes along the lower Colorado, Gila, and Salt rivers in Arizona. They are seldom seen as they tend to remain in dense cover provided by marsh and adjacent low-growing riparian vegetation. They are generally presumed to be resident and non-migratory along the lower Colorado and lower Gila rivers (Eddleman 1989); however, it is uncertain if the Gila River/Phoenix metro population remains in the area year round.

Current distribution

Yuma clapper rails are found along the lower Colorado River from Mexico up past Lake Mead to the Virgin River. They are also found along the watered portions of the Gila River from its confluence with the Colorado River up through the Phoenix Metropolitan Area up to at least the confluence of the Salt and Verde rivers. There is a documented report of a Yuma clapper rail on lower Tonto Creek near Roosevelt Lake, and several undocumented reports from the vicinity of Tuzigoot Marsh on the Verde River.

Threats

Threats to Yuma clapper rail come from water management activities that destroy backwaters and marshes along a river floodplain. Managed backwaters or ponds can also become overgrown with cattails and become less suitable as habitat.

Conservation actions

The Yuma clapper rail is a covered species under the Roosevelt HCP and the LCR MSCP. The latter program includes the construction of new marsh habitats for the species and maintenance actions to restore degraded marshes along the Colorado River.

Previous consultations

Section 7 consultations on Yuma clapper rail are more focused on site-specific projects such as highway bridges, vegetation removal, flood protection, and other types of projects that may affect marshes. Biological opinions on actions potentially affecting southwestern willow flycatcher in Arizona may be found at our website www.fws.gov/southwest/es/arizona in the Section 7 Biological Opinion page of the Document Library.

Effects

AGFD field crews moving through Yuma clapper rail habitat may result in trampling of some vegetation, particularly the adjacent riparian shrubs. Attempts to create trails through extant cattail patches would be extremely difficult. Existing trails created by recreationists or other animals can fragment habitat patches; however, these are limited in scope and the resultant open area can be used by Yuma clapper rails for foraging when humans are not present. Where there is no or small amounts of cattail/bulrush habitat present, it is unlikely to be used by the species.

Literature and anecdotal information on Yuma clapper rail does not suggest they are particularly vulnerable to disturbance events even during nesting. Nests are sheltered within dense habitats, and noise from human presence likely attenuates due to the vegetation and distance from the source. Boat motors may be heard within habitats; however, field crews with boats approaching marshes to set nets or electrofish can be loud and at night, the bright lights could be disturbing. Most of this type of work is along the lower Colorado River, where field work is generally confined to limited netting and electrofishing trips over the course of a year and is generally not

in the breeding season. Yuma clapper rails may become habituated to boats or other noise where there is considerable boating activity.

In areas along the Gila and Virgin rivers, the amount of aquatic work by AGFD field crews is limited, and avoids the habitat patches of the species. These actions generally take less than a day and have very limited disturbance potential.

Overall, the amount of disturbance to Yuma clapper rails resulting from the proposed action is insignificant.

Mexican gray wolf

Status of the species in the action area

Listing history

The Mexican wolf experimental non-essential population was designated by the U.S. Fish and Wildlife Service (USFWS) in March 1998 by a 10j rulemaking (USFWS 1998c). The area covered by the designation is the Blue Range Wolf Recovery Area (BRWRA) in east central Arizona and west central New Mexico. The area includes the Alpine, Clifton, and Springerville Ranger Districts in the Apache National Forest and the Gila National Forest. In 2002 the White Mountain Apache Tribe signed an agreement with USFWS that allowed direct release and translocation on to the Fort Apache Indian Reservation. Recovery planning efforts for Mexican wolves outside of the 10j boundaries is under development by USFWS and its partners.

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the species. This information was taken from the most recent 5-year review (Unsworth et al. 2005) and conservation assessment (USFWS 2010r) and references cited therein. Information in these documents is incorporated by reference.

Life history

The Mexican gray wolf is one of five subspecies of gray wolf in North America. It is the smallest of the subspecies, at 50-90 pounds, with long legs and a patchy black, brown to cinnamon and cream in color.

Mexican gray wolves live four to five years in the wild, maturing at two years of age. Pups are born in the spring and remain with their pack until they disperse to new territories.

Habitat use

Mexican gray wolves have flexible habitat requirements, but generally require undeveloped habitats that support robust populations of medium to large ungulates. In the BRWRA, they are found in montane woodlands characterized by sparsely-to densely-forested mountainous terrain and adjacent grasslands.

Current distribution

Mexican wolves were first reintroduced to the BRWRA in 1998 with additional releases through 2008 (Interagency Field Team [IFT] 2005, 2009). By the end of 2008, the wild population had grown to 52 animals in 10 packs (IFT 2009). In Arizona, Mexican wolf packs that may use areas in the vicinity of stocking sites in the Black River, Little Colorado (Upper Little Colorado River and West Fork Little Colorado River particularly), and San Francisco River (Luna Lake) stocking sites are the Bluestem, Hawks Nest, Paradise, and Fox Mountain packs (IFT 2010a). Additionally, lone wolves, such as M619, and dispersing young wolves may move more widely out of usual use areas of the established packs (IFT 2010b).

Threats

Threats to Mexican gray wolves include starvation, disease, human-caused mortality, and interactions with other wolves or predators. Most deaths are attributable to illegal shooting.

As part of the annual operations of the IFT, project personnel make contact with campers, hunters, and other members of the public within the BRWRA and provide them with information about the Mexican wolf reintroduction project. These contacts are to provide the public with information on the potential for encountering wolves and general recommendations for recreation in wolf-occupied areas, and to collect information on wolf sightings or signs of wolves from these groups.

Conservation actions

The establishment of the BRWRA provided opportunities to reintroduce the Mexican gray wolf to the wild in Arizona and New Mexico. Wolf populations are monitored and augmented in accordance with the management plan.

Previous consultations

As a 10j population, the BRWRA Mexican wolf population is considered in section 7 consultations that evaluate programmatic effects for Forest Land Management Plans that address watershed management and multiple uses (livestock grazing, timber harvest, recreation, and other issues). Biological opinions on actions potentially affecting Mexican gray wolves in Arizona may be found at our website www.fws.gov/southwest/es/arizona in the Section 7 Biological Opinion page of the Document Library.

Effects

Effects to individual Mexican wolves from the proposed action are limited to indirect effects resulting from the presence of AGFD field crews at aquatic habitats in the White Mountains within the range of the population. AGFD field crews at lakes are generally in the company of anglers and other recreationists, and most lakes in the proposed action area also have campgrounds or other features that would tend to create more of an inducement to wolves to investigate. Along streams, AGFD field crews are again gathered at access locations which may

or may not involve campgrounds or other recreationists being present, and may not present an inducement to a wolf to investigate.

AGFD field crews follow the guidance provided by the IFT and are less likely to have behaviors that attract wolves. Further, the number of trips to any site within the BRWRA is limited, and the number of potential encounters is low. Effects to wolves from AGFD field crews are insignificant.

Mt Graham red squirrel

Status of the species and critical habitat in the action area

Listing history

The Mount Graham red squirrel (red squirrel) was listed as endangered in 1987 (52 FR 20994, USFWS 1987c). Critical habitat was designated in 1990 (55 FR 425, USFWS 1990b). Critical habitat occurs in three areas in the Pinaleño Mountains (Hawk Peak/Mount Graham, Webb Peak, and Heliograph Peak) and covers a total of about 2,000 acres. The only identified constituent element was dense spruce-fir forest. The Mount Graham Red Squirrel Recovery Plan was signed in 1993 (USFWS 1993c) and is currently under revision.

Background

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the species. This information was taken from the most recent biological opinion for the species (USFWS 2008m) and the 5-year review (USFWS 2008n) and references cited therein. Information in these documents is incorporated by reference.

Life history

Red squirrels are small arboreal rodents that live in conifer forests. Breeding takes place in the spring and the nest is usually in a hollow snag, tree hollow, downed log, or other sites that can provide a sheltered canopy. The usual is one litter of two to eight young, although two litters in one season has been reported.

Foods of the red squirrel include the seeds of Englemann spruce and Douglas fir, which are cached in middens for winter storage. Mushrooms are also important seasonally and some may be stored in the midden. Other seasonal foods such as berries, bark cambium, pistillate cones (pollen), and other types of seeds. Between nine and twelve mature trees are sufficient to support one adult and these form the core of the territory.

Habitat use

Red squirrels are territorial and one squirrel per territory is the norm. Young leave the mother's territory to establish their own. Mixed-conifer and spruce-fir communities provide shelter, a food base, and moist conditions needed to maintain middens for winter food storage. Territory sites are in patches of forest that are generally denser in foliage volume and canopy cover than

adjoining areas. Downed logs, snags and other structure is important for midden placement and nest sites.

Current distribution

The red squirrel is only known from the Pinaleño Mountains on the Coronado National Forest. The current number of known middens, which includes those that are active, inactive, and abandoned, is 1288. Areas that support middens continue to do so if habitat parameters remain suitable although old middens may be abandoned and new ones developed. The population has been estimated since 1986 with estimates ranging from 99 to 562 squirrels; there is no statistical evidence suggesting a rise or decline in the population from these estimates (T. Snow pers.comm.). The fall 2009 survey estimated the population at 250 (+/- 11) squirrels.

Threats

Threats facing red squirrels include predation, loss of habitat due to native and exotic insect infestations, direct mortality and loss of habitat and middens due to large-scale wildfires , loss of habitat due to human factors (e.g., disturbance, conversion to roads, trails, and/or recreation sites, permitted special uses, etc.; USFWS 1993c), and loss or reduction of food sources due to drought, and apparent dietary and territory competition with Abert's squirrel, which were introduced in the 1940s by the AGFD. The loss of significant areas of habitat to the Clark Peak and Nuttall-Gibson wildfires and insect infestation has reduced the available habitat area and thus increases the value of the remaining habitats.

Conservation actions

Conservation actions for the red squirrel were identified in the 1988 BO (USFWS 1988a), and the 2008 Mt. Graham summer homes BO (USFWS 2008m). In addition, multi-agency surveys of red squirrels are conducted in the fall to document population size and trends. A captive breeding program was also recommended, the concept of which has been endorsed by the Mount Graham Red Squirrel Recovery Team. Until recently, funding has not been available to implement captive propagation.

Previous consultations

Section 7 consultations on red squirrels include programmatic efforts for Forest Land Management Plans that address watershed management and multiple uses (particularly recreation, wildfire suppression and post-fire restoration, and astrophysical site development). Biological opinions on actions potentially affecting red squirrel may be found at our website www.fws.gov/southwest/es/arizona in the Section 7 Biological Opinion page of the Document Library.

Effects

Effects to the red squirrel from AGFD field crews working at Riggs Flat Lake or on the streams in the Piñaleno Mountains are primarily limited to noise and human presence disturbance and the risk of road-kill mortality of red squirrels by official vehicles. There is no red squirrel habitat at

Riggs Lake (suitable habitat is on the wooded slopes above the lake), and the distance from the lake to the occupied habitat is sufficient that noise would be attenuated and no human presence would occur in the habitat.

The Piñaleno Mountains contain at least five streams that contain trout populations. Apache trout were once stocked into four streams in the Piñalenos; Ash, Grant, Big, and Marijilda creeks and hybridized populations remain along with established nonnative trout populations. Grant and Big creeks drain to the south towards Wilcox Playa and their upper reaches are within habitat of red squirrels. Ash and Marijilda creeks drain north toward the Gila River and their upper reaches are within habitat of red squirrels. Frye Creek was stocked in 2009 with Gila trout and is currently closed to fishing but is subject to continuing conservation-related actions over the next 10 years. Ash and Marijilda creeks are now considered to be within the historical range of the Gila trout and renovations with subsequent stocking of Gila trout are planned. The renovations are not covered under the proposed action and will require separate evaluation for effects on red squirrels. Stocking (as "release") is a covered action; however, in the planning process for the establishment of these populations, the potential for disturbance effects to red squirrels will be addressed. As described in the proposed action, routine monitoring of any of these streams will be limited and the amount of disturbance insignificant.

Vehicle-related mortality was identified as a threat to red squirrels in the 1988 BO on the Coronado National Forest Plan and Mount Graham Astrophysical Area Plan (USFWS 1988). Incidental take for up to six red squirrels a year was provided in that BO; four from traffic on roads and two middens from increased recreational activity and astrophysical development.

Since the Mount Graham red squirrel was listed as endangered in 1987, a total of eight road-killed squirrels have been reported, with two being the most reported in any one year (both 1989 and 2004) (USFWS, personal comment 2008). However, the total number of red squirrels killed on the road is likely greater due to irregular monitoring and the rapidity at which dead animals are removed from the road by scavengers.

Access to all potential work sites is by Swift Trail and unpaved Forest roads and trails. The number of vehicle trips likely to occur as part of AGFD field activities covered by the proposed action is limited by the proposed action and is unlikely to create additional risk to red squirrels.

The PBFs of critical habitat will not be affected by AGFD field crews, so no effects to critical habitat are anticipated.

Appendix C: Proposed action and supporting documents

Proposed Action Documents

Activity descriptions

AGFD Resource Management: including research, community inventory, and community information collection activities. The following inventory, monitoring and information collection activities incorporate techniques and methodology commonly used and accepted throughout the scientific/academic community to ensure negligible animal mortality or habitat destruction. These activities are necessary to acquire baseline wildlife information, ascertain community assemblages, and to meet the Arizona Game and Fish Department's wildlife management statutory responsibilities. Wildlife community status information is essential to conservation of all wildlife species, regardless of status (e.g. native, nonnative, invasive, federally listed, etc.).

Note: In the course of routine sampling, monitoring, and inventory, the discriminate removal of undesirable organisms (such as: exotic snails, quagga and zebra mussels, crayfish, bullfrogs, green sunfish, bullhead catfish, and other recognized aquatic invasive species) may be conducted when encountered in areas where native fish and wildlife are threatened by those species.

Survey and Monitoring Activities, Tools, and Methods - Aquatic
The following community survey and monitoring activities, tools, and methods present no or negligible risk of mortality and are essential in collecting wildlife information regarding health, diet, movement patterns, population estimates, growth, natural mortality, etc, and include, the following:

NON-INVASIVE MONITORING TECHNIQUES
PIT Tag Arrays
Passive Integrated Transponder (PIT) tag arrays are remotely placed sensors that automatically detect and record the passage of tagged fish within a waterway as the fish pass over or in close proximity of the sensor. PIT tag arrays are typically located in shallow, narrow areas of streams and rivers, and sensor cables stretch from streambank to streambank along the bottom of the stream.

Acoustics & Sonar (e.g. hydroacoustics, Didson Camera)
Acoustics and sonar are used for surveying aquatic wildlife numbers and size. Sound waves are passed through water and when they hit an object the waves are reflected back to a submerged receiver. The intensity and number of returned waves indicates the size and density of the object (fish, substrate, etc.) that are sampled in a given volume of water. Methods include submerging a transducer (attached to a boat or in tow) below the surface of the water and following predetermined transects (geospatial data is also collected via a GPS interface); acoustic cameras can be submerged in water to determine images of lake bottom, fishes, etc. Receivers are attached via cable to a surface unit which contains a processor used for determining operational settings and data collection.

Sonic/Telemetry Tracking
Aquatic-based telemetry is an essential method of tracking deployed radio/sonic transmitters. Hand-held, boat-mounted, or static antenna/receiver systems are used to generate location, movement, and behavioral data for aquatic wildlife fitted with transmitters. It is also the primary method for recovery of transmitters that have halted movement due to expulsion or animal mortality.

Underwater Camera & Photography
Underwater camera monitoring (both still-camera and video surveillance) consists of either manually operated or remote operated camera surveillance. Underwater camera monitoring has been successfully used for identifying species, counting individuals, detecting presence/absence, measuring physical characteristics, recording behavior, and for other monitoring purposes.

Snorkel and Scuba Diving Surveys
Snorkel or scuba surveys consist of visual surveys while the observer is in the water using mask and either snorkel or scuba equipment. Snorkel and scuba diving surveys are used for identifying species, counting individuals, detecting presence/absence, visually estimating physical characteristics, observing behavior, and for other monitoring purposes.

Aquatic Visual Surveys
Visual aquatic surveys consist of looking for and observing aquatic wildlife from above the water (on land or wading through water). Aquatic visual surveys have been used for identifying species, counting individuals, detecting presence/absence, visually estimating physical characteristics, observing behavior, or for other monitoring purposes. Observer may remain at a single point during the observation period or may actively search for organisms (e.g. walking a transect or stream bank/lake shoreline). For aquatic mollusks counts, a standard size survey ring, sampling grid, or magnifier may be used in these observations to delineate an area searched.

CAPTURE & TRAPPING TECHNIQUES - AQUATIC
The following research, inventory, and information collection activities incorporate techniques and methodology commonly used and accepted throughout the scientific/academic community to ensure negligible mortality or habitat destruction.

The following sections include survey and monitoring techniques to target specific individual or species (i.e., "Selective") or involve indiscriminate, but safe capture of individuals of target and non-target species (i.e., "Non-Selective").

SELECTIVE CAPTURE AND TRAPPING TECHNIQUES
Umbrella/Crab Pot Traps
For active crayfish capture, wide mesh "umbrella traps" or crab pot traps are baited and set along stream bottoms or pond margins to allow crayfish to climb on top of. A hook pole and dipnet are used in combination to lift the umbrella and crab pot traps up from the substrate and capture any crayfish that are entangled in the wide mesh of the trap or fall through into the dipnet below.

NON-SELECTIVE CAPTURE AND TRAPPING TECHNIQUES
Entanglement

Entanglement gear, primarily gill and trammel nets, are used as a passive technique for collecting fish. Nets of varying length and design are set horizontally or vertically and entangle fish that swim into them. Less often, entanglement nets are actively used by pulling nets through the water in a "seining" technique. Entanglement gear is used following established protocols and is deployed at times of the year or in habitats that ensure negligible injury/mortality to wildlife.

> Gill Nets - used to entangle fish around the opercle flaps or "gills". Department Standard Fish Sampling Protocols For State of Arizona Waters (AGFD 2004) (attached) require use of trammel nets in areas where T&E species are expected to be encountered, and the use of short-set gill nets (set and remove fish on an hourly or 2 hour basis) if Sensitive Species are present.
>
> Trammel – designed to entangle fish without "gilling", and are widely used to sample sensitive and T&E species. By protocol, (AGFD 2004) trammel nets (or short set gill nets) are used in areas where T&E species are likely to be encountered.

Seines

Seines are nets that are pulled through the water to capture aquatic wildlife. Seines are typically rectangular in shape with a pole attached to each end. Seines are effectively used over smooth bottom substrates, in open water pelagic zones, or in combination with other gear (e.g., electrofishing) or techniques. Examples of seines are: bag seines, purse seines, straight seines, cast nets, etc.

Aquatic Traps

A variety of trap types are used to capture aquatic wildlife. Traps typically consist of a frame covered by some type of mesh (e.g., fabric, metal, plastic), with openings that angle in towards the center of the trap. Traps may be baited to attract aquatic wildlife, and are placed in the water. Aquatic wildlife enter the trap but cannot easily escape. Aquatic wildlife of a particular size can be targeted for capture by using traps with appropriate opening diameter and mesh size (e.g., small opening and mesh will capture small individuals, large opening and mesh will capture large individuals). When Sonoyta mud turtle, Northern Mexican gartersnake, Chiricahua leopard frog, Sonora tiger salamander, and other listed air-breathing species are present, design considerations include features which will allow escape of air-breathing animals. Any trap design which does not allow for air-breathing animals to escape would be checked frequently to avoid injury/mortality. Examples of traps are hoop nets, fyke nets, weir traps, minnow traps, crayfish traps, larval traps, etc.

Basking Traps

Basking traps are used to capture aquatic turtles for inventory and monitoring. They consist of a basking platform in the center of a wood frame, with a mesh basket underneath. The trap is floating, and is anchored to the water's bottom using a weight below the basket. Turtles climb onto the basking platform and fall into the basket after leaving the platform. Traps would be checked as frequently to avoid mortality of any animals trapped. Once captured, the animals are removed and placed outside of the trap. Mortality is not expected based on previous survey data and experience.

Cast Nets

Cast nets are circular nets designed to capture aquatic species by being thrown by hand, opening flat over the water and quickly sinking in the water column. Upon retrieval, the cast net is designed to close into one central point effectively trapping any aquatic species present. Although not completely selective, the diameter and mesh of the cast net influences the size of species likely to be trapped, any nontarget species can be released immediately.

Dip Nets
Dip nets are used similarly to seines in that they are swept through the water to capture aquatic wildlife. Dip nets can be used alone or in combination with other gear types (e.g., electrofishing). Dip nets consist of a simple two dimensional frame that can be of various shapes (square, circular, diamond shaped, etc.) with a net attached to the entire perimeter of the frame. Typically the frame is mounted on a pole.

Larval Tow and Drift Nets
Larval tow nets and drift nets are very-small meshed nets that are used to capture larval fish or invertebrates in the water column. The nets are conical in shape with a framed opening at the larger end and a collection bucket at the smaller end. Tow nets are pulled through the water to capture larval fish and invertebrates, whereas drift nets are fixed to the bottom substrate in flowing portions of streams to capture drifting fish and invertebrates. .

Electrofishing
Electrofishing uses electric current to temporarily stun fish which are then captured with dip nets or seines. In lakes, ponds, and large non-wadeable water bodies, electrofishers are typically mounted in boats (an electrofishing boat). In smaller water bodies backpack electrofishers may be used. Electrofisher settings for voltage, current, frequency, and duty cycle can be manipulated to effectively capture fish without causing undue harm. Settings are adjusted so that fish are stunned just enough to capture them.

Angling
Angling (fishing) is a technique that uses a rod and reel along with common angling equipment (hooks, spinners, lures, bait, etc.) to capture fish/aquatic wildlife.

Handling and Processing Activities, Tools, and Methods - Aquatic
The following handling and processing activities, tools, and methods rarely result in mortality and are essential in collecting wildlife information regarding inventory, health, diet, movement patterns, population estimates, growth, natural mortality, etc, and include, but are not limited to the following:

External Tags –
Tags that can be seen without the use of receivers or species dissection. The types of external tags include: fin clips, freeze branding, painting, visible implant elastomer, and, anchor/dart/spaghetti tags. Terrestrial and aquatic invertebrates may be marked with paints/dyes, ink, numbered microtags (adhered with glue or epoxy) to identify individuals or batches of cohorts for recapture data. Terrestrial and aquatic mollusks may have tail tips removed.

Fin Clips - involve removing a portion of a fish's fins, usually a portion of a paired fin.

Freeze Branding - uses cold instruments against the body in order to produce an identifiable mark for recognition.

Paint - applied in the as a short term method used when counting fish to ensure the same fish isn't counted twice. Mortality from paint is very low.

Visible Implant Elastomer Tags - injected as liquid that soon cure into a pliable biocompatible solid. Tags are implanted using a small needle beneath transparent tissue and remain externally visible.

Anchor/Dart/Spaghetti Tags - a category of tags that are inserted with a tagging gun into the fish by an anchor lock that attaches to the skeletal tissue. Part of the tag that remains outside the fish has a unique number that identifies the individual fish.

Internal Tags –

Tags and marks either injected or surgically implanted into wildlife. Routine survey and monitoring protocols often require animals to be marked (particularly invertebrates, fishes, amphibians and reptiles). These tagging types include coded wire tags, PIT tags, radio transmitters, sonic transmitters, and chemical submersion. With the exception of chemical submersion, internal tags are detected with a receiver that detects the presence of the tag and any other information that is stored within the tag. Internal tagging includes but is not limited to: Coded Wire Tags (small piece of wire injected into the fish using applicators or by hand. Tags can be applied in any location where there is enough muscular tissue.), PIT tags (size of a grain of rice and are injected into the body cavity or skeletal muscle. These tags allow users to uniquely identify individuals using a special PIT tag receiver.), Radio/Sonic Transmitters (tags that are surgically implanted into the fish's body cavity. The fish is placed under an anesthetic while the surgery is performed.), Chemical Submersion or Feed Marking **(**used to mark large amounts of fish. A fish is either submerged in a holding tank for an extended period of time to allow the chemical to absorb into the skeletal tissue or fed a diet containing the chemical marker. A common chemical used for this purpose is Oxytetracycline.)

Coded Wire Tags - small piece of wire injected into the fish using applicators or by hand. Tags can be applied in any location where there is enough muscular tissue. PIT Tags - are injected into the body cavity or skeletal muscle. These tags allow users to uniquely identify an individual species using a special PIT tag receiver. Mortality for implanting PIT tags is low.

Radio/Sonic transmitters - tags that are surgically implanted into the fish's body cavity. The fish is placed under an anesthetic while the surgery is performed. Mortality for implanting sonic/radio tags is low when fish is carefully monitored.

Chemical Submersion or Feed Marking - a method used to mark large amounts of fish. A fish is either submerged in a holding tank for an extended period of time to allow the chemical to absorb into the skeletal tissue or fed a diet containing the chemical marker. A common chemical used for this purpose is Oxytetracycline.

GENETIC AND DISEASE SAMPLING METHODS

Sample/Specimen Collection

Fish and other aquatic wildlife are collected for a number of purposes including diet analysis, vouchers, pollution/Contaminants (Hg etc.) analysis, aging and growth assessment, invasive species monitoring, collection of whole vouchers or live tissue samples (e.g. blood and other tissue) for genetics or disease monitoring, punches, swabs, etc.

Habitat Survey, Monitoring, and Assessment - Aquatic

Surveys are conducted to determine habitat characteristics and quality. These involve site visits, visual assessments, photographs, and the collection of physical measurements. Variables measured may include canopy cover, riparian and aquatic vegetation identification or collection for identification, substrate characterization, invertebrate sampling, pebble counts, stream and bank measurements, stream depth and flow, slope, bank cover and erosion, water quality/quantity. These methods are commonly used and accepted throughout the scientific/academic community to evaluate habitat for fish and wildlife populations, including threatened and endangered species in furtherance of the Endangered Species Act.

Water Samplers (Kemmerer, Van Dorn, etc.)

A piece of equipment designed to collect a known volume of water from a predetermined depth. The sampler construction consists of a cylinder with closable rubber stoppers on each end. It is suspended in the water column with a rope; closure is accomplished when a messenger is sent down the rope and strikes a tripping device.

Secchi Disk

A secchi disk is a circular metal plate that is used to measure water clarity in meters. The disk is 20 centimeters in diameter, the upper surface of which is divided into four equal quadrants and painted so that the two quadrants opposite each other black and the intervening quadrants are white. The disk is lowered to a depth when the black and white quadrants are no longer distinguishable.

Plankton Net

A fabric net usually cone shaped used to collect plankton (mostly microscopic plant and animal organisms that have small powers of locomotion or drift in the water subject to the action of waves and current) samples. The typical mesh size is 64 microns and is towed through the water column for a predetermined distance or from a predetermined depth.

Sediment Samplers (Petersen, Ekman, Ponar, sediment corer, spoon, etc)

Sediment samplers are used to collect soil samples from the bottom of a lake or stream. Samplers vary in size and construction depending on the conditions (depth and flow) that they will be used. Typically only a maximum of one liter of sediment is collected.

Limnological Profiles (various electronic probes, etc.)

Physical parameters (temperature, pH, conductivity, dissolved oxygen, percent saturation, total dissolved solids and reduction oxidation potential, etc.) are measured by placing electronic probes into the water and recording data.

Artificial Substrate (concrete, ceramic, plastic, fiberboard, etc.)
Artificial substrates are used to sample the entire community of micro and macro-organisms that live attached to or on solid submerged surfaces, generally above the depth of light extinction. Primarily used for the detection of springsnails and invasive species (quagga mussels and others) and to monitor their colonization rates. Artificial substrates are typically less than one cubic foot in size.

Invertebrate Sampling
Invertebrate sampling occurs to document food availability, community health, monitor for invasive species, or assess species status and trends. Sampling involves visual examination of benthic and surface substrates to count invertebrates in situ, and/or agitating, brushing, scraping, or sifting benthic and surface substrates in water to flush invertebrates into collection filters or basins. Example gear for invertebrate sampling includes: Surber and Hess samplers, Ponar and Ekman grabs, sieve sets and mesh-bottomed wash buckets, Hester-Dendy plates, artificial substrate plates and tiles, ABS and PVC sections, D-frame sweep nets, aquatic kick nets, fine-mesh aquarium nets, clam rakes, forceps, submersible pumps/hoses, examination trays, etc. Relatively small areas are sampled on the order of 1-2 square meters. Samples are commonly collected and preserved for laboratory analysis.

> Dredge/Ponar Grabs - Sampling involves the collection of benthic or surface substrate, up to a depth of three inches and of a standard volume per gear type, using Ponar, Ekman, or other clam-shaped dredges. Samples of benthic and surface substrate are rinsed into examination trays, sieve sets, or mesh-bottomed wash buckets using water flush, forceps, tongs, or by hand.
>
> Hess Samplers/Surber Samplers - Sampling involves agitating or sifting benthic and surface substrates in water to flush organisms into collection filters or containers.

Flow Meters
Electronic or mechanical flow meters are typically hand held deployed from a metal rod. The meter is held in the current and produces a measure of the speed of the water.

DISEASE TREATMENT AND PREVENTION
The following methods are used for disease prophylaxis or for treating previously captured diseased or disabled wildlife. These methods are commonly used and accepted throughout the scientific/academic community to ensure minimal injury or mortality.

Dechlorination/Nitrate Neutralizing Solution
The use of dechlorination/nitrate neutralizing solutions in transport/holding tank water for fishes aids in reducing unhealthy levels of chlorine or nitrate waste products in the water.

Salt Bath
The use of conditioning salt in transport/holding tank water for fishes aids in reducing stress, maintaining electrolyte balance, and reducing or removing external parasites and pathogens on the fish.

Chemical Treatment

Chemical treatment involves the administration of drugs or biologics to treat or prevent disease. This method improves the health of the wildlife being handled. For example, captured fish might be treated with anti-bacterial agents to help protect against infection.

Quarantine
Quarantine involves the isolation of animals to prevent the spread of disease. This method typically does not cause harm to the animal except under rare instances when confinement of birds or mammals is involved. Quarantine may be followed by permanent removal (including euthanasia or maintaining alive) in some cases.

Emergency Salvage, Transport, and Holding Activities, Tools, and Methods - Aquatic
When wildlife individuals or populations are in imminent danger, the following methods are used to ensure long-term survival. These methods are commonly used and accepted throughout the scientific/academic community to ensure minimal mortality.

Designate Holding Facilities
When captive propagation is utilized by the Department, the Department may choose to use outside organizations and resources because of their expertise with a given species or because of the other resources available at the facilities. Department biologists and health specialists determine the infrastructure, personnel, health and nutrition necessary for the species in question. Management and procedures are directed by Department personnel.

Release Conditioning
Occasionally animals rescued, rehabilitated, or orphaned can be brought back to health and released into the wild. But while in captivity, many individuals can lose critical muscle mass, become tolerant of human activity, and forget how to acquire food. Conditioning allows biologists to prepare these individuals for the wild by conditioning the animal to swim or feed on its own.

Salvage, Transport, and Holding of Aquatic Species
The emergency salvage, transport, holding, and care of individuals, eggs, or populations from specific locations will be used in times of imminent threat to that population's immediate and long-term survival. Imminent threats include loss or degradation of remaining habitat resulting from drought or wildfire, anticipated flooding, encroachment of vegetation, spread of pollution and toxins, invasion by highly predatory or competitive nonnative species, widespread disease or injury, or in advance of chemical renovations or draining of water bodies to remove undesirable organisms. Salvage, transport, holding, and care of species of concern will be conducted following established precautions and protocols per species or like taxa (examples include those protocols for: Page springsnail, Gila trout, roundtail chub, desert fishes, Chiricahua leopard frogs, etc.). Various gear types will be used to capture target organisms—described above under survey and capture categories. Holding of salvaged animals may extend beyond 45 days depending on the threat situation and condition of habitat following the salvage. In all cases, Department staff will coordinate actions with U.S. Fish and Wildlife Service species leads and affected landowners/land managers, and ultimately attempt to return the salvaged animals back to their original location when appropriate. Transport always considers the appropriate health and safety of the animal and security of personnel. This includes wildlife specific containers and may involve sedation using suitable pharmaceutical drugs under the advice and counsel of a wildlife veterinarian.

Transport
Under most circumstances, when wildlife is being transported it is specifically addressed through a translocation environmental assessment checklist. However, in some instances, wildlife may be transported from one facility to another or during routine nuisance wildlife activities. Transport always considers the appropriate safety of the animal and security of personnel. This includes wildlife specific containers and may involve sedation using suitable pharmaceutical drugs under the advice and counsel of a wildlife veterinarian.

Best Management Practice Documents

All these documents are authored by AGFD and these are the current versions. Revisions to these documents over the next 10-years are anticipated as a result of new information on effects of these techniques on aquatic species. These are used in preparation for field work covered under the proposed action.

BMP 1: Electrofishing

Arizona Game and Fish Department

ELECTROFISHING BEST MANAGEMENT PRACTICE (BMP #1):
MINIMIZING ELECTROFISHING INJURY

June 2011

Electrofishing as a fish sampling technique follows the guidance outlined in the Department's "Standard Fish Sampling Protocol for State of Arizona Waters" (Bryan et al. 2004), the American Fisheries Society publication "Standard Methods for Sampling North American Freshwater Fishes" (Bonar, Hubert and Willis, editors 2009), and the USFWS course Principles and Techniques of Electrofishing (Koltz et al. 1998). The following text is provided to staff, external partners, and Department Scientific Collecting Permit investigators to minimize electrofishing injury to fishes.

Many factors influence electrofisher-induced fish injury: water temperature; conductivity; distance from anode; fish species, fish size; fish time in electrical field; pulse width; frequency of pulses; etc. Equipment output is one factor that can be readily controllable with modern electrofishers. Straight DC is the least injurious to fish, but pulsed DC, because it uses less energy is the most common waveform used to capture fish. In general, set the electrofisher to high voltage in low conductivity water and low voltage in high conductivity waters; most of Arizona waters have conductivities >300 µS/cm. Set frequency higher for small fish and lower for larger fish (e.g., 60 Hz for fish <70 mm total length, and 30Hz for fish >150 mm TL; Peck et al 2006). The most important aspect of pulsed DC causing injury to fish is frequency, followed by pulse width, and voltage is the least damaging (Kolz et al 1998). In areas or times of year where there are concerns over impacts to T&E or other sensitive species from the use of electrofishing gear, the following settings and protocols will be deployed:

RECOMMENDED BACKPACK ELECTROFISHER SETTINGS:

Voltage or Amplitude: use lowest possible effective voltage. Most waters in Arizona have conductivities greater than 300 µS, so start at 150 V and adjust upward towards 400 V.

Conductivity (µS)	Voltage
< 100	900-1100
100-300	500-800
> 300	150-400

Pulse shape: On older Smith-Root Models (12A, 12B, 15C, 12POW) set to straight DC if available, pulsed DC if not, never use AC. Note that when set on straight DC, frequency and pulse width are irrelevant. On the newer Smith-Root Model LR24 set to DC (same as straight DC or not pulsed), Standard Pulse, or Burst of Pulses. The newer Smith-Root Models LR20 or LR20B are fixed to Standard Pulses. On the newer Smith-Root models, setting to 100% duty cycle is equivalent to straight DC.

Pulse Rate or Frequency (pulsed DC): start no higher than 25Hz. Modify as necessary to effectively capture fish while minimizing injury. Exceeding 40Hz increases chance of injury to larger fish; avoid exceeding 60Hz if targeting larger fish.

Pulse Duration or Pulse Width (pulsed DC): start at 500*u*s, do not exceed 5ms.

Duty Cycle (pulse width/time between start of consecutive pulses): start at 12%. The battery will hold a charge longer, the lower the duty cycle. Setting duty cycle to 100% is equivalent to straight DC, which is best to reduce injuries to fish, but will drain batteries faster.

If using standard pulsed DC, start at low voltage (150V), pulse rate (25 Hz) and duration (500 µs). If fish are effectively captured, then stay at those settings. If catch rates are not acceptable, increase voltage incrementally until fish are effectively captured; do not change any other settings. If increasing voltage does not work, go back to the original voltage settings and increase pulse width and then incrementally increase voltage. Repeat this process until the maximum pulse width is achieved. If fish catch rate is still not acceptable, reset to original voltage and pulse width and increase frequency, and repeat the above mentioned steps. If using older Smith-Root models start by setting alphabet and numerical dials to achieve the base settings mentioned above. If using newer Smith-Root models (LR24) run the Quick Setup, which will automatically adjust the settings to the local water conditions. If catch rates are not acceptable follow the steps mentioned above using the Quick Setup settings as the base settings. If the electrofisher has variable pulse settings, use them because these are somewhat less harmful to fish than standard pulses, but may not be effective in real low or real high conductive waters.

RECOMMENDED BOAT ELECTROFISHER SETTINGS:

For boat electrofishers, such as the Coffelt VVP-15 or Smith-Root's GPP – use CPS or variable pulse settings. Start with low settings for voltage range (50-500), percentage of range (10%) and frequency (15 DC). If fish catch rate is unacceptable, incrementally increase percent range up to 90%. If catch rates are still unacceptable, switch percent range back to 10% and increase frequency to 30Hz, then incrementally increase percent range. If necessary, repeat the process at 60Hz. If that does not work, set the voltage range to the higher setting (100-1000), the frequency

to 15 DC, and percent range to 0% and incrementally increase the voltage range up to 40%. Repeat the process at 30 DC or 60 DC if necessary.

Handling recommendations:

- Minimize time fish are in electrical field, never dip-net with fish still in the net;
- Observe fish condition; dark bands or bruises and long recovery times may indicate frequency and/or voltage is too high;
- Aerate fish regularly; hold fish minimally;
- When using straight DC, keep electricity on until fish is netted.

Procedures to reduce electrofishing injury to fish excerpted from:

Kolz, A. L., J. Reynolds, A. Temple, J. Boardman, and D. Lam. 1998. Principles and Techniques of Electrofishing. Classroom Course #FIS2102, U.S. Fish and Wildlife Service, National Conservation Training Center.

National Marine Fisheries Service. 1998. Suggested protocol for the use of backpack electrofishing equipment in waters containing fish listed under the Endangered Species Act. Portland, Oregon. December 1998.

Peck, D.V., Herlihy, A.T., Hill, B.H., Hughes, R.M., Kaufmann, P.R., Klemm, D.J., Lazorchak, J.M., McCormick, F.H., Peterson, S.A., Ringold, P.L., Magee, T., and Cappaert, M.R. 2006. Environmental Monitoring and Assessment Program – Surface Waters Western Pilot Study: Field Operations Manual for Wadeable Streams. EPA Report EPA/620/R-06/003, U.S. Environmental Protection Agency, Washington, DC.

Smith-Root Inc.. 1999. Electrofisher workshop, principles and techniques of electrofishing. Smith-Root Inc., Vancouver, Washington.

Washington Department of Fish and Wildlife. 1997. Electrofishing and injury to salmonids as it relates to Stream Typing. Washington Department of Fish and Wildlife Survey Protocol Guidelines. Washington.

BMP 1- June 2011 v2

BMP 2: Entanglement gear

Arizona Game and Fish Department

ENTANGLEMENT GEAR BEST MANAGEMENT PRACTICE (BMP #2):
MINIMIZING INCIDENTAL TAKE OF NON-TARGET SPECIES USING ENTANGLEMENT GEAR

October 2011

Fish sampling gear and techniques follow the guidance outlined in the Department's "Standard Fish Sampling Protocol for State of Arizona Waters" (Bryan et al. 2004) and in the American

Fisheries Society publication "Standard Methods for Sampling North American Freshwater Fishes" (Bonar, Hubert and Willis, editors 2009). The following guidance is used when sampling areas or times of year where there are determined to be concerns over impacts to aquatic T&E or other species of conservation concern and special techniques are needed in order to minimize incidental take and reduce injury and mortality.

Entanglement Gear

Gill nets and trammel nets are used in fisheries surveys to sample juvenile and adult large-bodied fishes in large rivers, lakes, reservoirs, and other impounded waters. These nets are designed to entangle fish by "gilling" or "bagging" as they swim into the wide mesh openings. Gill nets have one net panel with openings of various dimensions. Trammel nets are gill nets with two outer, larger mesh net panels sandwiching the finer mesh panel. Trammel nets capture fish by wrapping the fish into a bag, avoiding capture by "gilling". The size of the mesh and the type of net selected is determined by the local conditions and the target species. These nets are typically set in calm waters, along eddy fences, or occasionally in slow currents; it is recommended they are not used in fast currents or in areas with lots of submerged vegetation or snags.

In areas where there are determined to be significant concerns over impacts to T&E species (through an evaluation of past "take" events or other concerns), gill nets should be checked every 2-4 hours to reduce injury or mortality or the use of other precautions should be incorporated as appropriate (net seining, set and electrofish or corral fish into nets for immediate removal, etc). As water temperatures reach and exceed 18°C, increased stress will occur to netted fish. In areas where T&E species are expected to be encountered, these nets should not be used when water temperatures reach and exceed 20°C.

BMP-2 31-October 2011

BMP 3: Native fish transfer (trout)

Arizona Game and Fish Department

NATIVE FISH TRANSFER BEST MANAGEMENT PRACTICE (BMP #3):
PROTOCOL FOR STOCKING NATIVE TROUT TO ESTABLISH NEW POPULATIONS

June 2011

This protocol is for transfer of trout from populations including fish health mitigation, collection of fish, how many fish to be taken and how often, transport of fish, stocking of trout, monitoring of trout and managing streams after stocking. The number of fish to be stocked is dependent on the number of trout in the host stream. Number of trout to be captured ranges from a 20 to 250 young-of-year and yearling fish in small populations to a high of 150 fish of all sizes in larger populations. This protocol should be the same whether transferring trout from Reservation streams onto the Forest or from Forest streams back onto the Reservation.

Fish Health Mitigation

Before transfer all populations will have a wild fish assessment within the last five years. All collecting equipment, buckets and holding containers will be treated with 2% bleach to minimize transfer of disease. Holding containers will be neutralized with sodium thiosulfate and rinsed to remove any residual bleach.

Collection

Timing: Trout will be collected during the summer and fall months. No collecting will be done from April 1 to mid-July because we may disturb the redds. If we plan on collecting young-of-year we would sample in August or later in the year. We would prefer to collect in the fall, however if we collect in the summer we will collect fish in the early morning or evenings (if appropriate) to avoid heat stress.

Collection and Holding Streamside: Trout will be collected with electrofishers and dip nets. Shockers will be set at direct current at the lowest possible setting to capture trout. We suggest that when starting, Smith-Root shockers be set at amperage of less than 0.1, 300 volts and "J" setting. Trout will be captured and put in buckets. Buckets will be outfitted with a bubbler and water needs to be changed every 15 minutes. Within 40 minutes of capture fish should be transferred to either a live cage or a holding container.

Trout should be kept in live cages in the stream rather than holding containers whenever possible to minimize build up of ammonia. Trout may be held over night in live cages if that will minimize the time spent in holding containers. We have had a lot of experience with holding fish for other projects in live cages in situ in streams and found they have done well.

Measuring and Marking Fish: We will not measure or mark fish from most stream because of the associated stress. However, we will record numbers and whether the trout are young-of-year, yearlings, or adults.

Transfer from Stream to Vehicles: Method of transfer will depend on the distance from the stream to the vehicle, the number and size of trout being moved and resources available. Temperature will be taken at the stream and the holding tank and fish will be tempered accordingly at the rate of one gallon per minute before transfer. We will use nonchlorinated ice placed in one gallon Ziplock® bags to keep the water at 12°C or less during transfer (one pound of ice will lower 2 gallons of water 10°F). In all cases the water used for transfer will be treated with chemicals to mitigate stress (19 g/gallon salt, 0.5 ml/gallon Polyaqua® or Stress Coat®, and 0.0228 g/gallon MS-222®). Table 1 provides the information we will use to decide which method we will use for transfer. The three methods we can use are:

1) Aerated buckets - This method will be used for short transfers (less than 30 minutes) when the holding tank is nearby or to disperse trout along the stream when stocking. Buckets will be filled halfway and a bubbler attached that will add air to the water.

2) Oxygen saturated transport - This method will be used for longer transports when it is impractical to bleed oxygen continuously during transport. Two garbage plastic bags will be placed in the panyard or bucket and filled halfway with water. After the fish

are placed inside the plastic bags, saturate the water with pure oxygen, inflate the inner most bag so that it is half oxygen and half water, and seal the bag.

3) Oxygen bleed transport - This is the preferred method for longer transports or when handling more fish because it provides a constant supply of oxygen. This requires panyards, coolers, or hatchery tanks that have an oxygen bottle attached. We will use regulators of at least 50 psi and ceramic stones when possible because they are most efficient in transferring the oxygen into the water. Oxygen will be bled at ½ liter per minute if the transport is three to five hours and ¼ liter per minute for longer transfers. If transport is longer than 8 hours we will use aquarium charcoal in a mesh bag to reduce ammonia.

Table 1. Methods of transporting Apache trout after capture. Number of fish can be calculated by using the fish density and the information in Table 2.

Method	**Equipment***	**Time of travel**	**Water amount**	**Fish Density**
Aerated buckets	5 gallon bucket bubbler with spare batteries	20 to 30 minutes	2.5 gallons	50 grams/liter
Oxygen saturated transport	5 gallon buckets with lids and backpacks or 10 gallon panyards and horses. Portable oxygen bottle with 50 psi regulator, 20 gallon or larger plastic bags, ties.	Up to 2 to 3 hours	Buckets: 2.5 gallons Panyards: 5 gallons	50 grams/liter
Oxygen bleed transport	Specially designed coolers or panyard that have oxygen bottles and regulators attached to bleed oxygen into the containers through ceramic stones	Up to 8 hours	Panyards: 5 gallons Coolers: to fill mark Hatchery Tank 150 gal	225 grams/l for 8” 112 grams/l for 4” Reduce by 25% if holding more than 8 hours

* In all cases we will also need ice and chemical to add to the water to mitigate stress.

Table 2. Estimated weight by length using condition relationship for Gila trout on Burnt Creek 1993 (Propst and Stefferud 1997).

Size (inches)	Estimated Weight (grams)
3	4
4	10
5	20
6	34
7	53
8	80
9	114

Number of Trout to be Collected and Frequency of Collections

In the past, we have had great success in establishing populations with both wild and hatchery trout. Before 1990 we used almost exclusively hatchery trout, since the mid 1990s we have been using mostly wild trout (Table 3). In both Ord and Squaw Creeks we had relatively low numbers within 2 years after stocking, but the fish expanded rapidly after two years.

It has been proven that fish populations can be established with small numbers of wild trout. Kitcheyan (1999) documented establishing an Apache trout population with 120 individuals spread over 4 sites. Gila trout and Paiute trout have been established with less than 40 individuals (Propst et al. 1992 and USFWS 2003). In Montana, they have had consistent success with stocking 60 trout (Brad Shepard, pers. comm.). In our own experience, we have established populations on Thompson Creek with low numbers of fish. Even though we can establish with fewer numbers we may not want to because of the chance of genetic bottlenecks. Ware et al. (2004) has documented genetic variation within lineages in separate populations. They have attributed some of this variation to stocking small populations of trout to begin with. We propose stocking at least 150 trout whenever possible. If less than 150 individuals are used than we will supplement the genetics with a later stocking if at all possible.

Number and sizes of trout taken for stocking will depend on the size of the host population. We propose the following protocol:

If under 500 adults -

Sample in late summer or fall and remove 50% of age 0 and 33% of age 1 trout and 10% of adult trout. A proportion of the smaller fish are likely to die because of density dependent mortality anyway. If less than 150 fish are captured then we will have to get additional fish and stock at a later date. Range of trout captured may be as low as 20 fish in smaller populations and 250 fish in larger populations such as Little Bonito Creek. Streams should be able to support this amount of removal on an annual basis.

If over 500 adults -

Remove up to 1/5 of fish from all age classes but taken from throughout stream. Take around 150 trout for each stream to be stocked. Make sure that at least 500 adults are left in the stream. Larger host streams (more than 1000 adults) should be able to support this amount of take each year. Streams with less than 1000 adults should be able to support this amount of take every other year

Transport of Trout

We will use 100-liter coolers or a 150-gallon insulated tank with oxygen bleed systems as describe previously to transport fish. Fish will be transported in two to three coolers so that if for some reason there is a problem with the system we will only lose a portion of the trout. Coolers will be checked hourly for oxygen flow, temperature and condition of fish during transport. Ice will be on the transport truck and temperature will be kept at 12°C or lower during transport. Oxygen bleed and temperature can be adjusted hourly as needed. Drivers will take care over bumpy roads to minimize jostling of the trout. In all cases (except stocking from North Canyon) transport by vehicle should take less than three hours. Trout will never be held overnight in transport. If fish cannot be moved on the same day of capture they will be held in live cages in the stream.

Stocking of Trout

Transfer from Vehicle to Stream: We will use the same methods we used as described in the section on transferring from the stream to the vehicle.

Tempering: Trout will be temper in either buckets or the holding containers before introduction at the rate of 20% of the water in the container per minute. Number of mortalities should be recorded.

Location of Stocking: Trout will be stocked in groups of 50 to 70 in a location. We have found that Apache trout do not move long distances, so fish in the group will be stocked close together so they can find each other during spawning season. If we have more than 70 trout to stock we will stock them in more than one location on the stream. One to three trout will be placed in each pool depending on the quality of the pool. We will select locations that historically have high densities of trout. We will stock all fish more than 500 meters above the barrier when practical to minimize loss of trout downstream.

Hatchery Fish: We will avoid stocking hatchery fish whenever possible, if they are used we will give preference toward stocking fingerlings versus adults. Trout from the hatchery will be visually observed before stocking by at least two biologists, any trout that are questionable as to purity will be discarded. Trout will be stocked throughout the stream at densities similar to historical records for the stream.

Monitoring of Trout Streams

If some of the fish looked stressed during stocking, we will go back to the stocking location the day after stocking to record any delayed mortalities.

The stream will be monitored either visually or by snorkeling the next year in the fall to determine if the trout are still present. At the end of 3-5 years we will do a population estimate for the stream using a modified basin wide technique (Hankin and Reeves 1988). This estimate will be repeated on 3-5 year intervals until the fish are established throughout the replicate stream.

Managing Streams After Stocking

In the past we have had problems in that Apache and Gila trout become established in the stream but not move freely throughout the available habitat. In Raspberry Creek, Gila trout were stocked and had recruitment, but trout had not moved below the area stocked. In Ord Creek, trout had become established above the barrier but had not moved up to the upper meadow where there is a lot of available habitat. After three years post stocking we will collect Apache trout in the replicate stream and move them to different locations within the stream.

If streams were stocked with less than 150 trout then we will stock additional trout into the stream from the host stream or from a stream with the same lineage.

Table 3. History of stocking Apache trout. Reductions in number of trout in established population is most likely due to drought conditions.

Stream	**Year stocked**	**Number and source stocked**	**recruitment**	**Population estimates of total fish (year sampled)**
Becoming established:				
Ord	1996, 1999	119 wild	Yes	631+ (2001)
Wohlenburg	2003		?	
Paradise	2003		?	
Lee Valley	2004	310 3” Hatchery	?	
Established				
Coyote/Mamie	Aug 1965 Sep 1967 Oct 1968	50 4” hatchery 100 7” hatchery 300 3” hatchery	Yes	2,675 (1988) 456 (1995) 132 (2002)
Mineral	Sep 1967 Oct 1968	100 7” hatchery 300 3” hatchery	Yes	87 (1986) 110 (1991) 183 (1995) 18 (2002)
Squaw	1996	115 wild	Yes	288 (1998) 6,000 (2004)
Thompson	1996	wild	Yes	
West Fork Black	Jul 1997 Jun 1998 Oct 1998	3722 6” hatchery 5000 6” hatchery 1060 8” hatchery	Yes	2480+ (2002) 7000 (2004)
Wildcat	Apr 1990	2000 5” hatchery	Yes	420 (1993)

	Nov 1990 May 1992 Apr 1994	2567 3" hatchery 2500 5" hatchery 1875 5" hatchery		
Coleman	Dec 1981 Jun 1983	104 4" hatchery 75 5" hatchery	Yes	155 (1990) 179 (2001)
North Canyon	Sep 1963 Oct 1968	35 10" hatchery 200 3" hatchery	Yes	
Home	May 1992 Apr 1994 Jun 1997	2500 5" hatchery 1875 5" hatchery 320 6" hatchery	Yes	590 (1994) 0 (2003)
Compromised by exotics:				
Bear Wallow	Nov 1981 June 1983	1500 4" hatchery 700 5" hatchery	Yes	
Hayground	May 1990 Nov 1990 May 1992	2000 5" hatchery 2550 3" hatchery 2500 5" hatchery	Yes	
Lee Valley	Jun 1988	929 7" hatchery	Yes	
Lee Valley	Nov 1992 May 1994	12,000 3" hatchery 1344 5" hatchery	Yes	
Stinky	Oct 1995 Apr 1996	5000 3" hatchery 2737 5" hatchery	Yes	

+ More fish then measured because only a portion of the stream sampled

Literature Cited

Hankin, D.G. and G.H. Reeves. 1988. Estimating total fish abundance and total habitat areas in small streams based on visual estimation methods. Canadian Journal of Fisheries and Aquatic Science 45: 834-844.

Kitcheyan, D.C. 1999. Population structure of Apache trout (*Oncorhynchus apache*) in Flash and Squaw Creek of the Fort Apache Indian Reservation. Masters thesis, University of Arizona, Tucson. 143 pp.

Propst, D.L., J.A. Stefferud, and P.R. Turner. 1992. Conservation and status of Gila trout, *Oncorhynchus gilae*. Southwestern Naturalist 37:117-125.

Propst, D.L. and J.A. Stefferud. 1997. Population dynamics of Gila trout in the Gila River drainage of the south-western United States. Journal of Fish Biology 51:1137-1154.

U.S. Fish and Wildlife Service (USFWS). 2003. Draft revised recovery plan for the Paiute cutthroat trout (*Oncoryhynchus clarki seleniris*). Portland, Oregon 84 pp.

Ware, J.P., D. Alo, and T.F. Turner. 2004. A genetic perspective on management and recovery of federally endangered tout (*Oncorhynchus gilae*) in the American Southwest. Canadian Journal of Fisheries and Aquatic Science 61: 1890-1899.

BMP 3- June 2011 v2

BMP 4: Small-bodied native fish collection

Arizona Game and Fish Department
FISH COLLECTION, TRANSPORT, AND STOCKING PROTOCOL: BEST MANAGEMENT PRACTICE (BMP #4)

June 2011

This protocol was developed based on published aquaculture literature, agency reports, internet publications, and input from numerous biologists with Arizona Game and Fish Department external agency partners, university researchers, aqua-culturists, and fisheries experts.

The purpose of this document is to provide proven and standardized methods to effectively catch, handle, transport, and stock native fishes from one location to another. Adherence to these methods should help reduce the risk of injury and mortality for fishes being handled and moved; for ESA-listed fishes this guidance may help reduce incidental take for recovery actions involving collection, transport, and stocking.

Collection

A. All fish sampling gear, transport containers, and waders should be disinfected with Quat-128 (Waxie Sanitary Supply) or bleach as per label, rinsed and allowed to dry prior to any fish collection activities.

B. Measure physical and chemical properties of water in the donor site (water temperature, dissolved oxygen, pH, and conductivity) and record on the Fish Collection/Transport/Stocking Form (Appendix B).

C. Prior to collecting fish, set up the fish transport containers (Harmon 2009). For large containers or for long duration transports (over 2 hours), container lids should be vented (preferably with ram-air ventilation) to allow the escape of carbon dioxide from the water during fish transport (Forsberg et al. 1999). Fill the coolers or fish transport tanks to near capacity with water from a clean well source. Avoid using water from the donor site

whenever possible to avoid transporting unwanted organisms. Avoid using tap water, as most municipal water sources are chlorinated.

- Install aeration devices (e.g., battery powered bubblers, or oxygen tanks with diffusers) to fully oxygenate the water. Start aeration before fish are placed in the tank to allow the water to reach 100% saturation (Harmon 2009). If using oxygen, avoid supersaturating the water. Keep spare batteries and one backup aerator per transport container on hand to ensure that proper aeration can be maintained. If using oxygen tanks, have extra tanks in case the primary tank empties during transport.
- Add salt to help reduce stress to fish and to kill external parasites (Harmon 2009). Add an appropriate amount of non-iodized NaCl to the water to attain a concentration of 0.5-1.0% (5-10 ppt; Harmon 2009). For a 100-quart (95L) capacity cooler filled ¾ full of water (i.e., about 75L), add 375 grams of non-iodized table salt; check label to ensure that salt does not contain yellow caking agent. However, Hoffman (1999) recommended a lower salt concentration, 0.2% (76g/10 gal) for a prolonged bath to remove external parasites from most fish.

- Add an ammonia reducing agent to the water, or install a mechanical filter with a submersible pump (Harmon 2009). Add AmQuel-plus® to the transport water, per label. AmQuel-plus® removes ammonia and nitrite waste products. AmQuel plus® is preferred over Stress Coat®, since the latter doesn't remove ammonia or nitrites; both can be bought at local pet stores or from Aquatic Ecosystems, Inc.

- Ideal pH for transport water is 7.0-7.5. Higher pH increases the toxicity of un-ionized ammonia. If high pH is an issue, fresh bottled water can be added to lower pH.

- Adjust the water temperature in the transport tank so that it is approximately 1-2°C cooler than the donor site. Cool water will slow fish metabolism, which in turn reduces ammonia production, oxygen consumption and ammonia toxicity and increases oxygen solubility (Harmon 2009). The container water can be cooled by adding bagged ice (ice should be placed in sturdy plastic bags such as Ziplock Freezer bags and sealed). Do not add ice directly to the water because most ice comes from chlorinated water sources, so melt water will mix with the transport container water. One pound of ice (0.45 kg) will lower two gallons (7.56L) of water 5.5°C (Timmons et al. 2002). If available, install a remote sensor water temperature gauge to monitor water temperature during the transportation process.

- At the time the transport containers are sealed, water quality from the containers should be recorded on the Fish Collection/Transport/Stocking Form (Appendix B).

D. Capture fish using gears that minimize injury or stress to fish (e.g., seines, dip nets, traps) If an electrofisher is used it should be set to the lowest possible setting that will be still stun fish and allow capture (see Appendix A). Capture and handling of fish prior to transport can be more stressful than the actual transport (Johnson and Metcalf 1982; Maule et al 1988; Robertson et al. 1988), so fish should be handled as little as possible and kept in water as much as possible.

E. Fish collected should be put immediately into buckets of donor-site water to reduce stress that may occur if fish are left in dip nets or seines for a period of time. Seines and dipnets should never be "beached" to sort fish. Fish should be handled using wet hands and wet nets. Take all precautions to minimize stress – handle as little as possible, place containers in the shade, etc.

F. Acclimate fish to the transport container water if necessary to avoid abrupt changes in temperature, pH, and hardness (Noga 2000). However, as mentioned previously, adding salts and reducing the transport container water temperature can be beneficial during transportation (Harmon 2009). Acclimation may be necessary if water temperature differs in the donor site and transport containers by more than 1.5°C or if pH differs by more than one unit (Timmons et al 2002). Salmonids (Wedemeyer 1996) can tolerate a 10°C change in water temperature and other species a 5.5°C change in 20 min (Timmons et al 2002). To acclimate fish, exchange 10-25% of the water in the buckets with transport container water (bring an extra cooler of water to use for tempering) every 10-20 minutes until temperature and pH are similar in the buckets and the transport containers (Timmons et al. 2002).

G. Fish should be sorted and each fish individually identified by at least two, but preferably three, qualified biologists to ensure that no non-target species are transported. Fish can be sorted from the buckets containing donor site water into buckets containing a mixture of the donor site and transport container water, thus combining the sorting and acclimation processes. At the final sort, enumerate fish to be transported and also record other fish species captured or observed on the Fish Collection/Transport/Stocking Form (Appendix B).

H. Aquatic vegetation, algae, leaf litter, woody debris, and rocks may have incidentally been moved in the process of adding fish to the transport containers. If so, remove as much of that material from the transport containers to reduce the risk of transporting unwanted organisms such as undesirable weeds, algae, exotic snails and clams, mussel veligers, young crayfish, fish eggs, fish larvae, etc.

Transport

The number of fish that can be successfully transported in each transport container depends on water quality, the duration of the transport, water temperature, fish species and fish size (Harmon 2009). Carmichael and Tomasso (1988) reported great variability in fish densities in transport of the same species: e.g., 0.05-0.29 kg/L for brown trout, 0.05-0.27 kg/L for grass carp, 0.02-0.29 kg/L for striped bass, 0.01-0.48 kg/L for channel catfish, and 0.02-0.30 kg/L for rainbow trout. This variability within a single species results from fish size, transport time, and personal preference (Harmon 2009). As a general rule, larval or early juvenile fish will succumb to stress more easily than older fish, therefore transport of later age-class fish preferred. It is ideal to maximize the number of fish transported while minimizing the mortality of transport.. Unfortunately, quantitative studies on loading rates for Arizona's native fishes are virtually non-existent (but see Widmer et al 2005). As a benchmark the table below offers some target numbers for transport loading rates, based on expert opinion of Nongame Branch fish biologists.

Species	Size of Fish	Number of fish per gallon of water

Gila topminnow	< 5 cm	20-60
desert pupfish	< 5 cm	15-30
longfin dace speckled dace	< 6 cm	10-35
loach minnow spikedace	< 6 cm	10-35
Gila chub	5-15 cm	1-10
roundtail chub desert sucker Sonora sucker	5-15 cm	1-10
other native fish	> 15 cm	Will likely be transported in large stocking trucks using existing protocols available from AGFD's Hatchery System and as cleared by the Fish Health Specialist (detailed information currently exists for salmonids including our native trout).

A. If coolers or other small transport containers are used, they should be set on pads (e.g., Paco Pads®) in the bed of the truck with a camper shell and secured in place. The pads will help insulate the containers and dampen vibrations and motion.

B. Make sure coolers are filled to near maximum to reduce sloshing of water (Winkler 1987). Secure lids and make sure any vents are screened.

C. Drive with caution. Accelerate and decelerate slowly, and drive slowly through turns and over bumpy areas to minimize disturbance and sloshing in the coolers.

D. Check water temperatures, aeration devices and fish condition periodically during transport, particularly any trip over two hours in duration. If water temperature in the transport container increases 2°C or more than the starting temperature, add ice (sealed in a plastic bag) to cool the water down. Water can be cooled to about 5°C less than the original temperature, because cooler water will reduce fish stress during transport (Harmon 2009). If pH has changed by more than 1.0 unit, add chorine free water to bring the water back to near neutrality. Repair or replace any aeration device that stops working. Remove any fish mortalities and preserve them in 10% formalin for deposition into a reputable museum for use in a reference collection.

Stocking

A. Upon arrival at stocking site, move transport containers to the release site if possible, or transfer fish to aerated buckets for transport to release site. If a hike more than 10 minutes in duration to the release site is necessary, then insulated buckets should be used to minimize changes in water temperature. The insulated buckets should be fitted with aerators.

B. Record water quality of both the release site and the transport container(s). Acclimate fish to local conditions by tempering the water (exchanging 10-25% of the water in the transport

containers with site water every 10-15 minutes). Perform at least one water exchange even if site and transport containers have nearly identical water conditions. Perform enough water exchanges such that the water temperatures in the transport container and site are within 1.5°C of each other. Record the number of water exchanges and the final water quality in the transport container prior to releasing fish. Water quality information should be recorded on the Fish Collection/Transport/Stocking Form (Appendix B).

C. Remove fish from the transport container using a dip net, identify each individual to species to make a final determination that no non-target fish will be stocked, count the fish, and gently release them by submerging the dip net in the water. If fish were previously enumerated and identified, they can be released by submerging the bucket and allowing the fish to swim out. Record the species and the number of fish stocked at each location on the Fish Collection/Transport/Stocking Form (Appendix B).

D. Record any observations after the release and preserve any fish mortalities in 10% formalin for deposition into a reputable museum for use in a reference collection.

E. Write a short post-stocking summary report. Include all pertinent information, including electrofisher settings, seine/dip net sizes, collection effort (electroshocking seconds, seines hauls, etc.), water quality measurements recorded throughout the event, transport time and distance, numbers of fish collected and transported, other species collected or observed, and any NEPA/ESA/EA checklist compliance information. It is also important to identify successes and failures with the project and to provide recommendations for how to improve the process as well as what post-stocking project evaluation will occur. The report should be distributed to interested parties, as appropriate.

F. Properly clean, disinfect, and dry all the gear used in fish collection, transport, and stocking per your project or program HACCP plan. Rinse equipment with water, soak in Quat128® , rinse with plenty of fresh water. Dry gear in full sun for at least an hour or more (summer months) or longer (rest of the year). Refer to the Intermountain West and Southwest Fire Management Workgroup (2008) guidance on effective decontamination methods (BMP#6).

Literature Cited

Carmichael, G. L., and J. R. Tomasso. 1988. Survey of Fish Transportation Equipment and Techniques. The Progressive Fish-Culturist 50:155 – 159.

Childs, M.R. 2005. Bubbling Ponds Hatchery development for native fishes: protocol for collection, transport, quarantine, maintenance, propagation, and repatriation of native fish species. Final report submitted to U.S. Bureau of Reclamation, Phoenix Area Office, Cooperative Agreement 04-FG-32-0310. Arizona Game and Fish Department, Phoenix, Arizona.

Forsberg, J. A., R. C. Summerfelt, and B. A. Barton. 1999. Effects of ram-air ventilation during transportation on water quality and physiology of fingerling walleyes. North American Journal of Aquaculture 61:220-229.

Harmon, T. 2009. Methods for reducing stressors and maintaining water quality associated with live fish transport in tanks: a review of the basics. Reviews in Aquaculture 1:58-66.

Hoffman, G. L. 1999. Parasites of North American freshwater fishes. Second edition. Comstock Publishing Associates, Cornell University Press, Ithaca, NY.

Intermountain West and Southwest Fire Management Workgroup. 2008. Table 1 of the Technical Guidelines for AIS Prevention 11-08.doc.

Johnson, D. L., and M. T. Metcalf. 1982. Causes and controls of freshwater drum mortality during transportation. Transactions of the American Fisheries Society 111:58 – 62.

Maule, A. G., C. B. Schreck, C. S. Bradford, and B. A. Barton. 1988. Physiological effects of collecting and transporting emigrating juvenile chinook salmon past dams on the Columbia River. Transactions of the American Fisheries Society 117:245 – 261.

Robertson, L., P. Thomas, and C. R. Arnold. 1988. Plasma cortisol and secondary stress responses of cultured red drum (*Scianenops ocellatus*) to several transportation procedures. Aquaculture 68:115-130.

Timmons, M. B., J. M. Ebeling, F. W. Wheaton, S. T. Summerfelt, and B. J. Vinci. 2002. Recirculating aquaculture systems. Cayuga Aqua Adventures, Ithaca, NY.

Widmer, A.M., C.J. Carveth, and S.A. Bonar. 2005. Transport and care of small desert fishes. Fisheries Research Report 03-05. Arizona Cooperative Fish and Wildlife Research Unit, University of Arizona.

Winkler, P. 1987. A method to minimize stress during fish transport. The Progressive Fish-Culturist 49:154 – 155.

BMP 4- June 2011 v2

BMP 5: Wild fish disease

Arizona Game and Fish Department

WILD FISH DISEASE TREATMENT BEST MANAGEMENT PRACTICE (BMP #5):
DISEASE TREATMENT PRESCRIPTION FOR NATIVE FISH BROUGHT IN FROM THE WILD

June 2011

This disease treatment prescription will remove most of the external and internal parasites commonly found on fish in Arizona that are likely to cause problems when fish are held in captivity (specifically, Ich, Lernea, Asian Tapeworm, Trichodina, Costia, and flukes). Dimilin and Praziquantel are not approved for use on food fish. Additional precautions and holding

times or other treatments may be needed for species that will be released back into the wild and could be legally harvested and eaten.

Note: This treatment program is for water temperatures that do not drop below 20°C (68°F).

Prior to receiving fish – Get biofilter established using disposable fish (koi, carp, sunfish, etc.) that are known to be free of pathogens. This process takes 2-3 weeks duration. WARNING-- Without this step water quality will deteriorate during treatments and fish will die.

Day 1 – Remove disposable fish and replace all water in disease treatment tank. Bring salinity up to 3 parts per thousand (ppt) (Approximately 3 lbs of table salt per 100 gallons of water). Introduce native fish, and make sure water temps stay above 20°C. Five tablespoons of salt per 10 gallons of water gives 3.3 ppt., or 1.5 cups in 50 gallons or about 3 cups in 100 gallons.

Day 2 – Add Dimilin at the recommended dose (1 tablespoon [15ml] for every 60 gallons of water). I usually just buy it at the pet store. Pondcare® products sells it in small quantities for use in backyard ponds. Shake well before using.

Day 14 – Change out water. Re-dose with Dimilin at (1 tablespoon [15ml] for every 60 gallons of water). Shake well before using.

Day 28 – Change out all water. Dose with Praziquantel at 1.5 mg/liter. One level teaspoon is about 0.9 grams and will treat about 150 gallons of water. I usually purchase Prazipond® online. It's the same thing as the expensive stuff from Sigma Chemical Co. and you don't have to jump through all the hoops to get it. Praziquantel has to be stored in the freezer to maintain effectiveness. Praziquantel will not readily dissolve in water so you have to mix it with a small amount (10-20 ml) of alcohol (isopropyl or ethanol) to get it to dissolve. I usually put it in a small bottle and shake it vigorously for a few minutes

Day 29 – Change out all water. Dose again with Praziquantel at 1.5 mg/liter.

Day 30 – One hour formalin bath in a smaller separate container at 26 ppm with lots of supplemental aeration. Note - (1 ml of formalin per 10 gallons of water = 26ppm.) I usually use Proform C® (dosed at the same dosage 1ml/10 gallons) which is a combination of formalin and malachite green and is very effective at eliminating parasites that are not killed by salt.

This treatment regime will ensure that you have taken care of any Ich problems (salt treatment), treated for *Lernea* (Dimilin treatment) and Asian tapeworm (Praziquantel treatment) and killed off any other external parasites (formalin bath) that are not killed by the salt (*Trichodina, Costia*, etc.)

Fast track treatment (but still need 22 days to complete)

Note: This treatment program usually always requires water heaters or a heated building and is for water temperatures that do not drop below 27°C (80°F).

Prior to receiving fish – Get biofilter established using disposable fish (koi, carp, sunfish, etc.)

This process takes 2-3 weeks duration. WARNING--Without this step water quality will deteriorate during treatments and fish will die.

Day 1 – Remove disposable fish and replace all water in disease treatment tank. Bring salinity up to 3 parts per thousand (ppt) (Approximately 3 lbs of non-iodized table salt per 100 gallons of water). Introduce native fish, and make sure water temperatures stay above 20°C (68°F).

Day 2 – Add Dimilin at the recommended dose (1 tablespoon [15ml] for every 60 gallons of water). Shake well before using.

Day 10 – Change out water. Re-dose with Dimilin at (1 tablespoon [15ml] for every 60 gallons of water). Shake well before using.

Day 20 – Change out all water. Dose with Praziquantel at 1.5 mg/liter (= Prazipond®). One level teaspoon is about 0.9 grams and will treat about 150 gallons of water. Praziquantel has to be stored in the freezer to maintain effectiveness. Praziquantel will not readily dissolve in water so you have to mix it with a small amount (10-20 ml) of alcohol (isopropyl or ethanol) to get it to dissolve. I usually put it in a small bottle and shake it vigorously for a few minutes

Day 21 – Change out all water. Dose again with Praziquantel at 1.5 mg/liter.

Day 22 – One hour formalin bath in a smaller separate container at 26 ppm with lots of supplemental aeration. Note - (1 ml of formalin per 10 gallons of water = 26 ppm.) I usually use Proform C® (dosed at the same dosage 1ml/10 gallons) which is a combination of formalin and malachite green and is very effective at eliminating parasites that are not killed by salt.

BMP 5- June 2011 v1

BMP 6: Aquatic invasive species

Arizona Game and Fish Department

AIS TREATMENT BEST MANAGEMENT PRACTICE (BMP #6):
EFFECTIVE TREATMENTS FOR AIS

June 2011

All Department fisheries and aquatic wildlife surveys, collections, transport, and stockings adhere to established cleaning and disinfection protocols—either identified in various project Hazard Analysis Critical Control Point (HACCP) plans, the Declining Amphibians Population Task Force Fieldwork Code of Practice (www.npwrc.usgs.gov/narcam/techinfo/daptf.htm), AGFD Director's Orders 1-3 (2011), or the AGFD Operating Manual policy I1.7 (2011).

Equipment Treatment for All Waters:
All equipment that has been deployed for five days or less in anybody of water is cleaned of all mud, algae, vegetation, thoroughly dried and treated with Quaternary Ammonia.

All equipment that has been deployed from more than five days in any body of water is cleaned of all mud, algae, vegetation, thoroughly dried for a minimum of 18 days between November and April and 7 days between May and October. This equipment is also treated with Quaternary Ammonia.

Equipment Treatment for Specific Waters:
All equipment that has been used in waters identified in Directors Order 2 are disinfected to the minimum standards identified in Directors Order 3.

The following are effective treatments that can also be used for aquatic invasive species (AIS). Copied from Table 1 of the "Technical Guidelines for AIS Prevention 11-08.doc" by the Intermountain West and Southwest Fire Management Workgroup (2008).

Aquatic Invasive Species	**Wash and remove organics (mud/algae/ vegetation)**	**Water Temperature**	**Minimum Drying Times**	**Bleach (Clorox®) 6% sodium hypochlorite** (NaClO)	**Quaternary ammonium compounds (Quat128®)** (n-alkyl dimethyl benzyl ammonium chloride; didecyl dimethyl ammonium chloride)
Whirling Disease	Yes	90°C (195°F); 10 min	Be dry for 24 hrs, in sunlight best	For 10 min soak: 1% bleach solution (1 oz/ 1gal water)	For 10-15 minutes: Quat 128 (6oz/1gal),
Viral Hemorrhagic Septicemia (VHS), other viruses	Thoroughly wash	46°C (120°F); 5 min Inactive after 24 hours at 20°C (68° F)	Be dry for 24 hrs, in sunlight best	For 10 min soak or circulate: 1% bleach solution (1 oz/1gal water)	Unknown, but likely effective. For 10-15 minutes soak or circulate: Quat 128 (6oz/1gal)
Amphibian Chytrid Fungus	Yes	60°C (140°F); 5 min	Be dry for 3 hrs, in sunlight best	For 30 sec: 20% solution (22oz/1 gal) - or- for 10 min: 7% solution 9oz/1gal	For 30 sec: Quat 128 (1/8 tsp/1gal)
New Zealand Mudsnails	Yes	46°C (120°F); 5 min	Be dry for 48 hrs, in sunlight best	Not effective	For 10-15 minutes: Quat 128 (6oz/1gal)

Aquatic Invasive Species	**Wash and remove organics (mud/algae/ vegetation)**	**Water Temperature**	**Minimum Drying Times**	**Bleach (Clorox®) 6% sodium hypochlorite** (NaClO)	**Quaternary ammonium compounds (Quat128®)** (n-alkyl dimethyl benzyl ammonium chloride; didecyl dimethyl ammonium chloride)
Zebra/Quagga Mussels	Yes, pressure wash flushes veligers	≥ 60°C (140°F) water	3-30 days, in sunlight best	For 1 min: 0.5% bleach solution (1/2 oz/1gal water)	No data, but likely effective on veligers
Didymo	Yes	60°C (140°F); 1 min	Be dry for 48 hrs, in sunlight best	For 1 min: 2% bleach solution (2 oz/ 1gal water)	No data, but likely effective
Golden Alga	Thoroughly wash	>104°F	Be dry for 2-3 days in direct sunlight	For 24 h at 62.5-500 mg/l (0.01-0.07 oz/gal); 1 h at 3,125 mg/l (0.42 oz/gal); or 15 min at 12,500 mg/l (1.67 oz/gal).	No data, but likely effective
Giant Salvinia	Yes	>43°C (109°F) or ≤3°C (26 °F) for > 2 hrs	Uncertain, but dry at least 48 hrs, in sunlight best	No data, but likely effective.	No data, but likely effective
Eurasian Watermilfoil and Parrot Feather	No data but likely killed with>60°C (140°F)	Uncertain, but completely dry at least 48 hrs, in sunlight best	No data, but likely effective.	No data, but likely effective	No data but likely effective
Hydrilla	Yes	No data but likely killed with>60°C (140°F)	Uncertain, but dry at least 48 hrs, in sunlight best	No data, but likely effective.	No data, but likely effective

Aquatic Invasive Species	Wash and remove organics (mud/algae/ vegetation)	Water Temperature	Minimum Drying Times	Bleach (Clorox®) 6% sodium hypochlorite (NaClO)	Quaternary ammonium compounds (Quat128®) (n-alkyl dimethyl benzyl ammonium chloride; didecyl dimethyl ammonium chloride)
Fish & Amphibians	Yes	≥60°C (140°F) water	Be dry for 3 hrs, in sunlight best	For 30 sec: 20% solution (22oz/1 gal)	Acute toxicity (EPA)
Crayfish	Yes	≥60°C (140°F) water	Be dry for 3 hrs, in sunlight best	For 30 sec: 20% solution (22oz/1 gal)	No data, but likely effective as ADBAC is toxic to most aquatic organisms
Other	(Similar species of snails, plants, pathogens, and vertebrate and invertebrate invasive species) No data but treatments for whirling disease and/or New Zealand mudsnails are likely effective				

Disinfection with quaternary ammonium compounds is the recommended treatment for most aquatic invasive species found in the Southwest. These products are labeled for use as fungicides/virucides.

Recipe for 5% cleaning solution using Quat 128®

Volume of clear water	Volume of Quat 128®
1 gallon water	6.35 liquid oz.
1 gallon water	12.7 tbsp
1 gallon water	0.79 cups

BMP 7: Fish evacuation decision guide

Arizona Game and Fish Department
FISH EVACUATION DECISION GUIDE BEST MANAGEMENT PRACTICE (BMP #7):

June 2011

Evacuation decisions are made by AZGFD for non-listed fish, or AZGFD and USFWS jointly for ESA-listed fish, in consultation with species and/or land management experts, as necessary.

Either agency or their designee may undertake an evacuation action of T&E species; approaches, personnel, timing, methods, etc. will be determined through consensus between the two agencies. All approvals will involve AZGFD Nongame Branch Chief and USFWS Desert Fishes Coordinator, or designees. This document is intended to aid evacuation decision-makers in their decisions to evacuate or not, and if so, to aid in evacuation logistics. Evacuation decision and logistical considerations are outlined below. Agency contacts and responsibilities and conceptual planning guidance (addressing communication and coordination between involved agencies, and establish general procedures that result in safe and effective evacuation of fish when necessary) are outlined in the Arizona Fish Emergency Evacuation Procedures document (Appendix A).

Decision Considerations:

SPECIES RARITY

Threatened or Endangered

Is population biologically unique?	Y – high;	N – medium or low
Is population replicated elsewhere?	Y – medium or low;	N – high

Non-listed

Is population biologically unique?	Y – high;	N – medium or low
Is population represented elsewhere?	Y – medium or low;	N – high

Other Species

Are there sensitive or ESA-listed/candidate populations of ranid frogs, gartersnakes, or snails present in area?

Are these populations biologically unique? Replicated?

SPECIES SENSITIVITY

- Species sensitivity – percids, cyprinids, and centrarchids respond quickly; catostomids respond intermediately; and salmonids respond slowest to recover to pulse disturbance – that is, short-term impacts relative to life span of fish (Dunham et al. 2003);

- Specialized habitat requirements, population isolation/fragmentation, small habitat distributions, and habitat degradation = increase vulnerability of species to fire (Dunham et al. 2003) [likelihood of population loss?]

FIRE IMPACTS

- Fuel load/type around population – scrub or desert habitats v. forested;
- Fire intensity – high intensity combined with high fuel loads;
- Fire severity - is a post-fire assessment of effects that incorporates both fire line intensity and heat per-unit-area. It is a qualitative and quantitative measure of the effects of fire on site resources such as soil and vegetation;
- Subject stream size – small stream, combined with heavy fuels, possible direct impact from fire;

DROUGHT/NONNATIVE INVASION

- Habitat loss due to desiccation – extent of loss, rate of loss, population status, general trend, habitat and or population triggers for action.

- Species interaction, mode of impact, history of impact, population status, general trend, predicted trend, population (native and nonnative) triggers for action.
- Specialized habitat requirements, population isolation/fragmentation, small habitat distributions, and habitat degradation = increase vulnerability to drought as well (?)

HOLDING FACILITY CAPABILITIES

- How long will population need to remain in captivity?
- What is disease pathogen risk to holding facility (golden alga, whirling disease, Asian tapeworm, etc), can it be managed?
- Will decision to hold a salvaged population deplete a facilities' capacity to hold higher priority species?
- Who will monitor and care for the fish, are they qualified, are they funded?
- Who will pay holding expenses (therapeutic drugs, specialized feed, etc.)?

Evacuation Planning:

LOGISTICAL COMPONENTS

- Timing – when will evacuation take place (rarely necessary pre-fire)?
- What are safety concerns, is it safe?
- Who will lead evacuation effort?
- Who will draft evacuation plan? Report?
- How will fish be transported from field?
- How many fish, and what sizes will be removed, minimum numeric genetic numbers?
- Have we considered other aquatic species that may be collected concurrently?
- Where will fish be held, how long?
- Is the action permitted, does it require consultation?
- Who will monitor evacuated or un-evacuated stream(s), trigger points?
- If decision is to wait, what are triggers for future action?

EVACUATION PLAN ASPECTS

- Timeframe
- Access – ingress, egress
- Fish collection, collection targets (numbers, sizes), methods, onsite holding, etc.
- Fish transport (from stream, to captive or wild site), therapeutics,
- Fish pathogen/disease, treatments, precautions
- Personnel Requirements
- Fish holding facility, preparation, staffing, duration, costs
- Action Authorization (permits, Section 7)
- Safety issues, preparation
- Key contacts and contact numbers
- Equipment needs
- Land Management notification/coordination
- ICT approval, if applicable

Literature Cited

J.B. Dunham, J.B., M.K. Young, R.E. Gresswell, and B.E. Rieman. 2003. Effects of fire on fish populations: landscape perspectives on persistence of native fishes and nonnative fish invasions. Forest Ecology and Management 178 (2003) 183–196.

Appendix A

ARIZONA FISH EMERGENCY EVACUATION PROCEDURES

Background

Conservation strategies for many species of native sensitive and/or threatened and endangered fish require capabilities for emergency evacuation to protect populations. Wildfire and associated impacts, drought, barrier failure, and invasion of non-native species are primary reasons for evacuation. Wildfire, drought, barrier failure, and non-native invasion are situations that require timely action to avert population losses. However, wildfire creates one of the greatest immediate dangers and poses the greatest threat to agency personnel involved in evacuation efforts.

Fish have been evacuated from several streams due to concerns of wildfire impacts on stream habitat (2005: Lime Creek - Gila topminnow; Sycamore Creek – Gila chub; Indian Creek – Gila chub; Camp Creek – speckled dace; 2004: Raspberry Creek – Gila trout; and 2003: Sabino Canyon – Gila chub). Drought resulted in the removal of Apache trout from Coyote Creek in 1996 and Little Colorado spinedace from Dines Tank and West Leonard Canyon in 2002. The evacuation of fish from Raspberry Creek followed the Gila Trout Emergency Evacuation Plan (Brooks 2004). Feedback from the Raspberry Creek evacuation indicated that the plan served as a valuable tool and resource, thus the Gila trout plan will serve as a template for this all-fish encompassing document. Other evacuations have been accomplished without use of a guiding plan or procedures, although various agency written and unwritten protocols have been followed, e.g. fish hauling protocols, Section 7 consultation, fire command plans, etc. Prioritization of individual streams to serve as a guide for evacuations has not been conducted. Although relict populations have received the greatest concern, species with few replicated populations may also require additional scrutiny when determining priorities. These considerations along with additional data will be used by decision agencies to determine if and when evacuation is warranted and prudent.

This document is intended to provide agency contacts and responsibilities, and conceptual planning guidance (addressing communication and coordination between involved agencies, and establish general procedures that result in safe and effective evacuation of fish when necessary) will be updated as appropriate. This document does not provide guidance for long-term management of populations that have been the focus of evacuation efforts.

EVACUATION PROCEDURES

In most cases, it is anticipated that evacuation procedures can be implemented within 1 to 2 weeks after stream impacts have occurred or have been detected. Large-scale wildfires and

associated flood/ash flows and flow/channel adjustment impacts may require near immediate responses and can pose the greatest logistical and safety concerns. Extreme flooding impacts, normally a concern of post-wildfire consequences, may occur during subsequent precipitation events. Therefore, evacuation efforts prior to flooding impacts should be considered. Channel drying due to drought conditions is foreseeable and high priority streams can be periodically assessed for evacuation needs prior to action. The failure of a barrier and/or discovery of deleterious non-native species often require an on-site assessment and action within the field season discovered to avoid losses caused by competition, predation, and/or hybridization. General procedures are presented by impacts (wildfire, drought, flood, barrier failure, deleterious non-native invasion) and general protocols for fish handling, regulatory compliance, and personnel management are outlined.

Evacuation decisions for non-federally listed fish will be determined by the Arizona Game and Fish Department (AGFD); evacuation of federally listed fish will be determined jointly by AGFD and the U.S. Fish and Wildlife Service (USFWS). Specific implementation protocols will be determined by AGFD and/or USFWS in consultation with the land management agency, and area and/or species experts or in the case of an active fire, with the Incident Command Team (ICT). Endangered Species Act regulatory requirements may include initiation of Section 7 consultation procedures and issuance of appropriate permits, if necessary.

Agency personnel to be contacted for assessment, planning, and implementation of emergency evacuation efforts are identified in Table 1. At least one contact by the originating land management agency(s) or individual(s) should be made to both agencies listed. Initiation of contacts will vary according to situation, with all wildfire-related communications controlled by Forest Service personnel or other primary fire control land management agency. Initial contacts during discovery of situations involving drought, flood, barrier failure, and non-native species presence are to be carried forward by agency personnel or individuals who detect the threat. Protocols for collection, transport, and holding may vary according to situation and will be derived from general procedures presented below and modified as necessary.

Table 1. Agency personnel to be contacted concerning emergency fish evacuation efforts.

Agency	Primary (Alternate)	Contact Info	Area of Concern
AGFD Fisheries	Kirk Young (Marianne Cox)	Kirk: 623-236-7259; kyoung@azgfd.gov Marianne: 623-236-7672; mcox@azgfd.gov	Statewide: sport fish & native trout
AGFD Nongame	Eric Gardner (Jeff Sorensen) (Tony Robinson)	Eric: 623-236-7507; egardner@azgfd.gov Jeff: 623-236-7740; jsorensen@azgfd.gov Tony: 623-236-7376; trobinson@azgfd.gov	Statewide: T&E spp & native fish
AGFD Region I	Mike Lopez (Kelly Meyers)	Mike: 928-367-4281 (x1104); malopez@azgfd.gov Kelly: 928-367-4281 (x1140); kmeyer@azgfd.gov	White Mtns, east-central AZ, upper LCR
AGFD Region II	Scott Rogers (Chuck Benedict)	Scott: 928-214-1245; srogers@azgfd.gov Chuck: 928-214-1244; cbenedict@azgfd.gov	Flagstaff, northern AZ, Fossil Crk, Grand Canyon,

			lower LCR
AGFD Region III	Matt Chmiel (Gregg Cummins)	Matt: 928-692-7700 (x2340); mchmiel@azgfd.gov Gregg: 928-692-7700 (x2341); gcummings@azgfd.gov	Kingman, Prescott, upper Verde R, Bill Williams watershed
AGFD Region IV	Russ Engel (Mark Brown)	Russ: 928-342-4042; rengel@azgfd.gov Mark: 928-342-4052; mbrown@azgfd.gov	Yuma, lower Colorado R
AGFD Region V	Don Mitchell (Jason Kline)	Don: 520-628-4451; dmitchell@azgfd.gov Jason: 520-628-4452; jkline@azgfd.gov	Tucson, Safford, southern AZ
AGFD Region VI	Chris Cantrell (Curtis Gill)	Chris: 480-324-3541; ccantrell@azgfd.gov Curtis: 480-324-3545; cgill@azgfd.gov	Mesa, central AZ, lower Verde R, Salt R
USFWS ES-Phoenix	Leslie Fitzpatrick (Ryan Gordon)	Leslie: 602-242-0210; leslie_fitzpatrick@fws.gov Ryan: 602-242-0210; ryan_gordon@fws.gov	Statewide: T&E spp & native fish
USFWS ES-Flagstaff	Shaula Hedwall (Dave Smith)	Shaula: 928-226-1289 (x103); Shaula_hedwall@fws.gov Dave: 928-226-1289	Northern AZ: T&E spp & native fish
USFWS ES-Tucson	Doug Duncan (Cat Crawford)	Doug: 520-670-6150 (x236); doug_duncan@fws.gov Cat: 520-670-6150 (x); cat_crawford@fws.gov	Southern AZ: T&E spp & native fish
USFWS AFWCO	Stewart Jacks (Pam Sponholtz)	Stewart: Pam: 928-226-1289 (x113); pam_sponholtz@fws.gov	Statewide: sport fish, native trout, T&E spp
BLM-Phx	Tim Hughes (Codey Carter)		Statewide: T&E spp & native fish
BLM-Tucson	Jeff Simms		Southern AZ: T&E spp & native fish
BLM-Safford	Heidi Blasius		Southern AZ: T&E spp & native fish
USFS-Tonto	Bob Calamusso		central AZ, lower Verde R, Salt R
USFS-Coronado			Southern AZ: T&E spp & native fish
USFS-Prescott			Prescott, upper Verde R, Bill Williams watershed
USFS-Coconino			Flagstaff, northern AZ, Fossil Crk
USFS-Apache-Sitgreaves	Stephanie Coleman (Linda White -Trifaro)		White Mtns, east-central AZ, upper LCR
USFS-Kaibab			North Canyon, Kaibab Plateau

Evacuated fish may be transported to other wild habitats (nearby streams or suitable lands within historic range); selection and availability of local waters to receive evacuated fish will be determined prior to evacuation by AGFD and cooperating agencies (USFWS, land management agency).

Wildfire

During wildfire situations evacuation efforts may take place prior to or after a fire has burned through a stream. Large-scale wildfires and associated runoff impacts may require near immediate responses and can pose the greatest logistical and safety concerns. Extreme flooding impacts, normally a concern of post-wildfire consequences, may occur during subsequent precipitation events. Therefore, evacuation efforts prior to flooding impacts should be considered. National Forest Service personnel or other primary fire lead will evaluate each fire start to determine if potential exists for impacts to streams with rare species. If it is determined that a fire may affect a sensitive stream, land management agency personnel (ICT resource advisor/planner and fishery and/or wildlife biologists) will contact biologists with AGFD and USFWS (Table 1). These initial contacts will provide for determination of need and priority for evacuating fish populations, will initiate emergency consultation procedures if needed, and will notify field personnel of potential evacuation efforts.

Once the need for evacuation has been determined, efforts will be coordinated through the ICT and the Ranger District or other primary fire lead with responsibilities for management of the fire. An evacuation plan will be prepared in coordination with ICT (see Evacuation Logistics section). Fire safety qualifications of personnel selected to participate in field evacuation efforts will be determined by ICT (may include requirement of fire fighting certification), but at a minimum must include expertise in collection, identification, and proper handling of the subject fish species. All communications during evacuation will be controlled by ICT and a debriefing between field evacuation team and ICT will be conducted within one day after completion of evacuation.

Drought, Post-fire Flood, Barrier Failure, Non-native Fish Invasion

The need to evacuate rare fish from streams during non-fire emergency situations (drought, post-fire flood, barrier failure, nonnative invasion) will be based upon assessment and discussion of relevant field monitoring data. For drought and flood impacts, trigger points (environmental conditions that trigger evacuation) will be established for implementation of actions and periodic field monitoring is required to determine need for action. At the earliest possible date, the reporting agency notifies AGFD and USFWS of impending environmental conditions and AGFD/USFWS will establish appropriate trigger points. Once established trigger points occur and emergency evacuation procedures are identified, coordination with land management agency will be established for use in implementation of evacuation procedures. Discovery of barrier failure and/or deleterious nonnative invasion may be reported to agency personnel or may be discovered during routine field monitoring. Once barrier failure and/or nonnative species presence is established and communications between cooperating agencies have taken place, AGFD/USFWS will assess and determine course of action, including establishment of trigger

points if necessary.

Endangered Species Act Compliance

For all actions regarding evacuation of federally listed fish from streams, compliance with ESA is required. Activities involving evacuation (take, transport and holding) must be covered under USFWS and/or AGFD permit. Other activities may require a request for consultation under emergency, formal, or Intra-Service procedures and are addressed in the March 2, 2006 USFWS ESA Consultation Guidance letter at the end of this document.

Evacuation Logistics: Fish Collection, Handling, and Transport

Once an evacuation decision is made, lead agency and personnel will be established by AGFD and/or USFWS in coordination with the land management agency. Lead agency/personnel will develop an evacuation plan addressing the following evacuation logistical factors: timeframe, personnel requirements/assignments, action authorization (permits), access ingress/egress, fish collection and onsite holding, fish transport, fish pathogens/disease protocol, and fish holding facility. If other aquatic species are to be collected, the proper protocol for their collection and transport will be followed and coordination regarding their transport and disposition will be coordinated with the appropriate contacts. If evacuation is active fire-related, the evacuation plan will also address communications, safe zones, fire safety equipment, and air support, and will be approved by ICT.

If the activity is deemed safe, fish salvage personnel and appropriate equipment will be assembled and transported to the closest access point. If it is an active-fire evacuation, prior communications with ICT and appropriate agency offices will be established and the field crew will be supplied with radios and/or other appropriate safety gear. Transport of personnel, gear, and fish may be on foot, by pack/saddle stock, ground vehicles or by helicopter. Helicopter use will require coordination through the land management agency.

During initial evacuation planning, notification will be made to the approved holding facility of intent to collect targeted fish for evacuation to the facility and to identify possible species-specific fish transport guidelines. Hatchery facility staff will provide a fish transport truck to the appropriate access site, and holding facility staff will ready isolation/quarantine facilities to receive fish evacuated from the stream. At the earliest possible convenience, field personnel will notify holding facility/transport personnel the number and sizes of fish to be evacuated, the stream water temperature, and estimated time of arrival at access point for hatchery truck.

Fish collection will be by battery powered, 24V backpack shocker, dip net, hoop nets, minnow traps, and/or habitat sized seines or other technique necessary to capture species of interest. Amperage and wave form/frequency settings will be at the least harmful (see BMP#1) setting that allows fish to be effectively stunned and captured. Nets will be of knotless nylon material. Captured fish will be placed in live cars and/or buckets and water temperature and dissolved oxygen content maintained at stream conditions. Water temperature should be continuously monitored during transport. Handling fish will be minimal and, wherever possible, water to water transfer will be made. During wildfire situations using helicopter transport, all fish will be transferred as soon as possible from stream collection sites to a pre-determined live-car location

for temporary holding until transport by helicopter. If fish are to be transported by pack mule, captured fish will be held in portable live cars and transferred to fish hauling panniers at streamside when field crew departure is imminent. For non-fire emergency evacuations, captured fish will be held in portable live cars placed in trail-side and/or accessible pools for eventual transport. During drought conditions and when pools capable of supporting live cars are scarce, it may be necessary to immediately place evacuated fish into fish hauling apparatuses. In this method, fish are maintained in therapeutically treated and oxygenated water and kept in close proximity to sampling efforts until sampling is complete and/or temporary live cars are located in suitable pools (adequate depth and size). Evacuation efforts due to deleterious non-native species discovery will also include identification and removal of non-native species. If phenotypic traits indicate evidence of hybridization, the hybridized individuals should be removed from the stream.

Handling of captured fish will be minimized to reduce stress-related responses that can cause mortality. Multiple live cars will be used in streams to temporarily hold fish while waiting for transport and should be located in shaded pools and covered with vegetation to minimize fish disturbance. If non-native fish are present and identifiable, these should be removed by qualified fisheries biologists during fish transfer to live cars. During drought conditions when water temperatures are high and dissolved oxygen content low, holding captured fish in buckets will be minimized and portable live cars used extensively. Fish may be transported via helicopter in a fish hauling tank or by pack animal in fish hauling panniers, both fitted with aeration equipment. Hauling water in both helicopter tank and in panniers will be treated to provide therapeutic agents during fish transport to minimize stress responses. This will constitute the following unless other species-specific therapeutic agents are necessary:

Temperature - slightly lower than host water (determined by thermometer)
Dissolved Oxygen - saturated, > 6.0 mg/l (determined by oxygen meter)
NaCl - 0.5%
AmQuel-Plus® or Stress Coat® - 0.26 ml/l
MS-222® - 6 ppm

Placement in the fish transport truck will occur immediately upon arrival at appropriate access site and transported to destination. Captive fish will be placed into a quarantine system and Fish Health specialists notified of the placement. Subsequent fish health sampling and necessary treatment will be conducted according to standard protocols, but will not include lethal sampling unless approved by AGFD and/or USFWS. Wild fish evacuated to captive facilities will be provided with cover and shading and fed live foods when possible to maximize retention of wild characteristics.

Fish Disposition

Disposition, timing of evacuation, and duration of captive holding of evacuated fish will be based upon specific population threats and species conservation needs. The type of threat will determine specifics of fish disposition. Potential uses of evacuated fish include incorporation into broodstock development, transplant to other streams, or holding in captivity until fish can be returned or introduced to new habitats. Prior to evacuation of any fish population, disposition and use of the evacuated fish will be determined by AGFD and/or USFWS. Threats to habitat require

temporary holding, while threats to population structure and genetic integrity caused by nonnative fish invasion and/or barrier failure may require additional holding requirements, if the evacuated fish are considered irreplaceable. Disposition of evacuated fish will be made on a case-by-case basis, and be based upon type of threat, species status, likelihood of continued threat, availability of captive facilities, captive propagation needs, and availability of donor stream for evacuated fish. Major fish holding facilities are identified in Table 2; universities, museums and research facilities may also be available for short-term holding on a case-by-case basis.

Fish mortalities incurred during sampling will be enumerated, measured for total lengths, and field preserved in 10% formalin for later examination and inclusion into the fish collection at Arizona State University (Tom Dowling) or University of Arizona (Peter Reinthal). In some cases, it may be necessary to tissue sample moribund individuals prior to death for genetic analyses. Field and fish transport crews will be prepared to record appropriate information and collect tissue samples.

Table 2. Fish holding facilities.

Facility	Location	Contact	Species
Mora NFHTC	Mora, NM	J. Seals – 505-387-6022	Gila trout
Bubbling Ponds State Fish Hatchery	Cornville, AZ	S. Gurtin – 623-236-7262 F. Agyagos – 928-634-4466 M. O'Neill – 928-	Gila Basin fishes
Dexter NFHTC[1]	Dexter, NM	M. Ulibarri – 505-734-5910	Case-by-case
UofA Fish Lab	Tucson, AZ	S. Bonar – 520-621-1193	All, but limited to available equipment and staff
USFS Rocky Mountain Research Facility	Flagstaff, AZ	S. Hedwall – 928-226-1289 (ext. 103)	Case-by-case, but limited to available equipment and staff
Phoenix Zoo	Phoenix, AZ	Stuart Wells 602-273-1341 (ext. 7301)	Case-by-case
Arizona-Sonoran Desert Museum	Tucson, AZ	S. Poulin – 520-883-2702 D. Hutchinson	Case-by-case
San Bernardino NWR	Douglas, AZ	B. Radke – 520-364-2104 (ext. 101)	Yaqui fishes only
Cabeza Prieta NWR	Ajo, AZ	M. Bissell – 520-387-6483	Rio Sonoyta (QBQ) pupfish only

[1]Isolation facility available 2007

Reporting

Within two weeks of fish collection and transport activities, an interagency report providing details on the number, size, and fate of fish collected will be provided to all agencies involved in the evacuation. As appropriate, the evacuation procedures will be evaluated and refined to improve the effectiveness.

Reports will contain information regarding the type and extent of threat to the evacuated source population. In the case of barrier failure and/or discovery of non-native species, condition of the barrier and/or other observations regarding source of non-natives will be addressed. Non-native species identification, distribution, and abundance will be discussed. The location of non-natives relative to barrier location and trail access will be noted to assist in later determination of source. The extent of dry channel conditions should be discussed, including numbers of stream miles impacted and/or an estimate of fish mortality where possible.

USFWS ESA Consultation Guidance:

AESO/SE
March 2, 2006

Dear Interested Party:

We are sending you this letter to offer our assistance in helping you to comply with section 7 of the Endangered Species Act (Act) of 1973, as amended, during emergency events such as wildland fire. The Act's section 7 regulations (50 CFR 402.05) provide for emergency consultations during "situations involving acts of God, disasters, casualties, national defense or security emergencies, etc." During any emergency situation, our primary objective is to provide recommendations for minimizing adverse effects to listed species without impeding response efforts. During emergency events, *protecting human life must come first every time*. Consequently, we will not recommend measures for protection of listed species or their critical habitat if these constraints place human lives in danger.

This letter is intended to clarify when you need to enter into section 7 consultation, and how the consultation process affects the ability to respond to emergency events. There is no need to consult on the emergency itself. Wildfire is considered an emergency. Consequently, consultation is conducted on the agency response to the emergency and is handled in an expedited manner.

Typically, the Federal action agency contacts the U.S. Fish and Wildlife Service (FWS) by telephone if an emergency event is determined to be in proximity to listed species or critical habitat. This contact can be by telephone to the Arizona Ecological Services Office in Phoenix, or the suboffice (Flagstaff or Tucson) that handles your section 7 consultations. If you do not know the appropriate contact, please use the numbers we have provided at the end of this letter. *You should not delay your response to the emergency for this contact.* The contact should be as soon as possible, after responding to the emergency. Upon contact, you will be provided an emergency consultation number by FWS. At that time, please provide us with as much detail as

possible about the location and severity of the emergency and your response. Subsequent calls to FWS can add or update information as appropriate. If your agency distributes news releases on the emergency, please include us on your distribution list. If you have specific information regarding impacts to listed species or their habitats, please provide this information to us. At this initial contact and throughout the emergency response, we will provide recommendations that can be implemented to avoid or minimize impacts to listed species and their habitats.

As soon as practical after the emergency event is under control, we recommend that you initiate formal consultation if you determine that listed species and/or critical habitat have been adversely affected. We recognize that take of listed species is sometimes unavoidable. If you determine that take of a listed species is necessary to control a fire, save lives or property, and ensure that field crews can safely and effectively do their job, then we strongly recommend that you respond appropriately to the emergency and contact FWS as soon as possible to discuss take of listed species that may have occurred. If incidental take of a listed species occurs during the emergency event, we will provide an incidental take statement for your emergency actions in a biological opinion developed at a later date. Because the incidental take statement is after-the-fact, reasonable and prudent measures are not included in the biological opinion. However, the biological opinion will contain an evaluation of whether and how our recommendations were incorporated during the emergency. It is important to note that take resulting from the emergency itself is not attributable to the Federal action agency. Rather, incidental take by the Federal agency would only occur as a result of the response to the emergency.

The lead agency should initiate emergency consultation for actions that are taken on Federally-administered lands that may affect listed or proposed species or designated or proposed critical habitat. However, we recognize that some Federal agencies also support emergency responses on non-Federal lands. If your response on non-Federal lands results in effects to protected species or critical habitats, we recommend that you initiate emergency consultation. At a minimum, to update the baseline for these species, please notify us on what actions were taken and what effects to species or critical habitat occurred.

Although emergency response is addressed by emergency consultation procedures as described above, in some cases the program by which emergencies are handled could be the subject of programmatic consultation. Some agencies have initiated or completed programmatic consultation on their anticipated emergency fire suppression activities. If you have not already initiated this process, we would like to discuss with you developing programmatic consultations for fire suppression and potentially other activities. Such consultation may reduce or eliminate the need for you to consult with us on each and every emergency response that may affect listed species or critical habitat.

We are also currently working with many of our Federal partners to provide technical assistance, coordination, and, in some instances, section 7 consultation for proactive projects to reduce the potential for emergency events (e.g., wildland urban interface treatments). If you have similar projects, we would like to assist you in overall planning activities and collectively discuss and develop information that you can relay to managers on species conservation needs. These efforts may require a commitment of staff time to initiate and complete, but ultimately will result in time savings by reducing or eliminating the need for consultation on a project-by-project basis.

For any fire suppression activity, we recommend you consider implementing the following measures. We stress that firefighter and public safety is the first priority in every fire management activity. We also recognize that you must set priorities among protecting human communities and community infrastructure, other property and improvements, and natural and cultural resources based on the values to be protected, human health and safety, and costs of protection. However, if these measures can be implemented, effects to listed species and their habitats will often be much reduced. We may recommend additional measures, or modifications of the measures below, during emergency consultation.

1. All personnel on the fire should be informed about listed species and the importance of protecting their habitats and minimizing take. This is best identified in the incident objectives.

2. Resource Advisors are designated to coordinate natural resource concerns including listed species and other resources. Aspects could include: identify protective measures endorsed by the Incident Commander; survey prospective campsites, aircraft landing and fueling sites; and perform other duties necessary to ensure adverse effects to listed species and their habitats are minimized. Resource Advisors and monitors should be on call at all times during the fire season.

3. Whenever possible, crew camps, equipment staging areas, and aircraft landing and fueling areas should be located outside of listed species habitats, and preferably in locations that are previously disturbed. If camps must be located in listed species habitat, the Resource Advisor should be consulted to ensure habitat damage and other effects to listed species are minimized and documented.

4. The effectiveness of suppression activities and listed species mitigation measures should be evaluated after a fire. Procedures should be revised as needed.

5. Burned area emergency rehabilitation (BAER) activities should be consulted on independently unless these activities are truly considered emergency actions. We encourage monitoring the effectiveness of these actions after major fires.

We look forward to working with you in your planning activities and responses to any emergency situations, thereby helping to conserve species. If you have any questions, please contact Brenda Smith of our Flagstaff Suboffice at (928) 226-0614 (x101), Jean Calhoun of our Tucson Suboffice at (520) 670-6150 (x223), or Debra Bills of our Phoenix office at (602) 242-0210 (x239).

Sincerely,

/s/Steven L. Spangle
Field Supervisor

BMP 8: Trap gear

Arizona Game and Fish Department

TRAP GEAR BEST MANAGEMENT PRACTICE (BMP #8):
MINIMIZING INCIDENTAL TAKE OF NON-TARGET SPECIES USING VARIOUS FISHERIES SAMPLING GEAR

June 2011

Fish sampling gear and techniques follow the guidance outlined in the Department's "Standard Fish Sampling Protocol for State of Arizona Waters" (Bryan et al. 2004) and in the American Fisheries Society publication "Standard Methods for Sampling North American Freshwater Fishes" (Bonar, Hubert and Willis, editors 2009). The following guidance is used when sampling areas or times of year where there are determined concerns over impacts to aquatic T&E or other species of conservation concern to minimize incidental take and reduce injury and mortality.

Hoop Nets, Minnow Traps, Crayfish Traps
Hoop nets, minnow, and crayfish traps are often used to capture fishes and aquatic wildlife. Organisms enter through the funnel of a baited or non-baited trap and cannot find their way out. In areas with known T&E or sensitive aquatic species of conservation concern, the following guidelines should be followed. Traps should be placed in shallow locations and tied securely should the trap be moved or weighed down by captured animals, allowing a portion of the trap to break the surface of the water. This prevents the drowning of air-breathing animals (i.e. turtles, snakes, frogs, toads) after being trapped. In deeper locations where the trap would be completely submerged, traps are securely tied (using rope on one or both ends of the trap) to bank vegetation or stationary debris so that a portion of the trap breaks the surface allowing wildlife to get air.

BMP 8- June 2011 v2

BMP 9: Aquatic species tagging

Arizona Game and Fish Department

AQUATIC SPECIES TAGGING BEST MANAGEMENT PRACTICE (BMP #9):
MINIMIZING INCIDENTAL TAKE OF NON-TARGET SPECIES USING VARIOUS FISHERIES SAMPLING GEAR

June 2011

Fish sampling gear and techniques follow the guidance outlined in the Department's "Standard Fish Sampling Protocol for State of Arizona Waters" (Bryan et al. 2004) and in the American Fisheries Society publication "Standard Methods for Sampling North American Freshwater Fishes" (Bonar, Hubert and Willis, editors 2009). The following guidance is used when sampling

areas or times of year where there are concerns over impacts to aquatic T&E or other species of conservation concern occur to minimize incidental take and reduce injury and mortality.

PIT Tags, Fin Clips, and Elastomer Tags

Guidance on the use of Passive Integrated Transponder (PIT) tags, fin clips, and elastomer implant tags to identify individual fish or cohorts in mark-recapture studies is described in Ward's (2011) "Standardized Methods for Handling Fish in Grand Canyon Research". Refer to Ward (2011) for species guidelines. Standard guidelines for handling fish should be as follows:

- Minimize the time that fish are out of the water
- Change water frequently when fish must be held for more than a few minutes or if you see fish surfacing for air
- Do not hold fish tightly around the throat, and avoid touching the gills
- Rinse all sunscreen and lotion from hands prior to handling fish
- Always wet hands and equipment such as nets and fish boards before use

BMP 9- June 2011 v1

Other Standard Guidelines Developed by AGFD

Standard Fish Sampling Protocol for State of Arizona Waters (August 2004)

Protocol for Collection, Transport, Quarantine and Disease Treatment, Maintenance, and Propagation of Roundtail Chub from the Mainstem Verde River (June 2005)

Spikedace and Loach Minnow Captive Propagation Priorities (January 2009)

Page Springsnail Survey and Monitoring Protocol (April 2008)

Mexican Garter Snake Best Management Practices (March 2010)

Appendix D: Section 6 take reports

Species	Number of individuals incidentally taken from the wild				
	2006	2007	2008	2009	2010
Kanab ambersnail					
Apache trout					10
Beautiful shiner					
Bonytail					
Colorado pikeminnow					1
Desert pupfish					
Gila chub					
Gila topminnow		400	~100		
Gila trout					
Humpback chub	42		1		
Little Colorado spinedace		165			
Loach minnow					5
Razorback sucker					
Sonora chub					
Spikedace					7
Virgin River chub					
Woundfin					
Yaqui catfish					
Yaqui chub					
Chiricahua leopard frog					
Sonoran tiger salamander					

Blank fields indicate no incidental take from the wild for that species in that year.