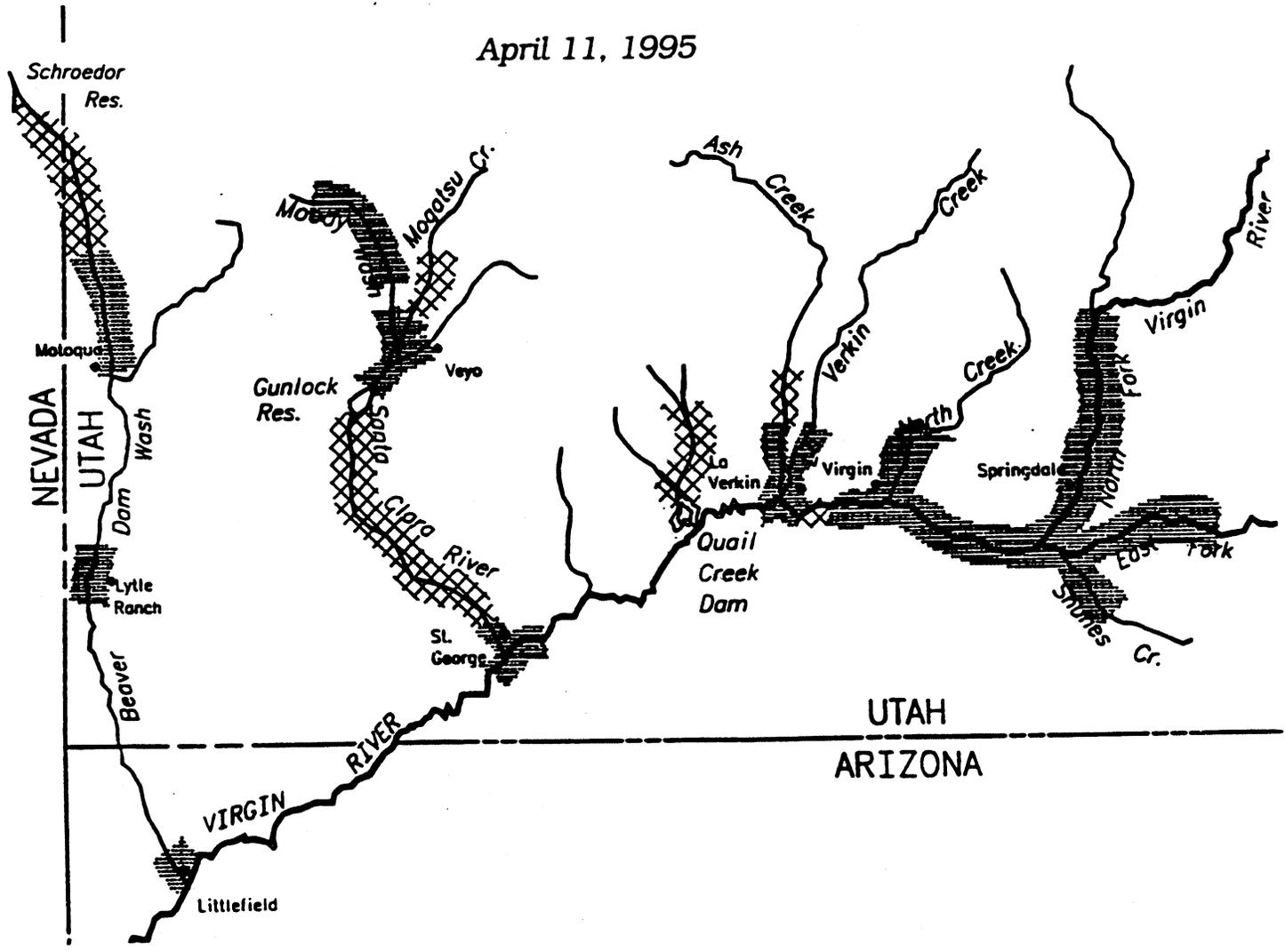


VIRGIN SPINEDACE

CONSERVATION AGREEMENT AND STRATEGY

April 11, 1995



CONSERVATION AGREEMENT

Virgin spinedace

Lepidomeda mollispinis mollispinis

This Conservation Agreement for the Virgin spinedace *Lepidomeda mollispinis mollispinis* has been developed in order to expedite conservation measures needed for the continued existence and recovery of the species. These measures will be taken in accordance with the Endangered Species Act of 1973 as amended (ESA). The agreement focuses on two objectives. The first is to reduce and eliminate significant threats. The second is to enhance and/or stabilize specific reaches of occupied and unoccupied historic habitat. These objectives will be reached through implementation of the Conservation Strategy for the species (Attachment A). Full implementation of this agreement and the associated strategy will reduce threats to the Virgin spinedace that warrant its listing as a sensitive species by State and Federal agencies, and as threatened or endangered under the ESA.

The Virgin spinedace is a small minnow endemic to the Virgin River Basin in Utah, Arizona, and Nevada. Shoreline-land ownership within the flood plains of Virgin spinedace habitat is approximately 38% federal, 3% state, 5% Paiute Tribe managed and 54% private. Past and present human activities such as water development projects, agriculture, mining, urbanization and the introduction of non-indigenous fishes have altered the Virgin River ecosystem. There has been a 37-40% reduction (approximately 84 km/52 mi) in Virgin spinedace historic range (approximately 226 km/140 mi). Current populations are fragmented, and occur almost exclusively within Utah. Due to these reductions and perceived threats to the species, the United States Fish and Wildlife Service (FWS) proposed listing the species as threatened, pursuant to the ESA, on May 18, 1994 (59 FR 25875).

I. OTHER SPECIES INVOLVED

The primary focus of this agreement is the conservation and enhancement of the Virgin spinedace and its habitat; however, other species occurring within or adjacent to Virgin spinedace habitat may also benefit. Three hundred and sixty-six species of fish, amphibians, reptiles, birds, and mammals are known to co-exist in the same or adjacent habitat of the Virgin spinedace. Eighty-one of these species are listed as sensitive in either Utah, Arizona or Nevada and/or are listed under the ESA by FWS (Appendix A in Conservation Strategy). An additional eight sensitive plant species and seven sensitive invertebrate species also co-exist in the same or adjacent habitat of the Virgin spinedace. Using an ecosystem approach, the Virgin spinedace

Conservation Agreement could reduce or possibly eliminate threats for several of these species, which could preclude their need for federal listing pursuant to the ESA.

II. INVOLVED PARTIES

Utah Department of Natural Resources
Division of Wildlife Resources
1596 West North Temple
Salt Lake City, UT 84116
(801) 538-7227

United States Department of Interior
Fish and Wildlife Service
P.O. Box 25486
Denver Federal Center
Denver, CO 80225
(303) 236-7920

Bureau of Land Management
Utah State Office
324 South State Street
Salt Lake City, UT 84111
(801) 539-4072

Bureau of Land Management
Arizona State Office
3707 North 7th Street
Phoenix, AZ 85011
(602) 650-0260

National Park Service
Rocky Mountain Regional Office
P.O. Box 25287
Denver, CO 80225-0287
(303) 969-2500

Nevada Department of Conservation and Natural Resources
Division of Wildlife
1100 Valley Road
Reno, NV 89520-0022
(702) 688-1500

Washington County Water Conservancy District
136 N. 100 East, Suite 1
St. George, UT 84770
(801) 673-3617

Arizona Game and Fish Department
2221 W. Greenway Road
Phoenix, AZ 85023-4312
(602) 942-3000

Separate Memorandum(a) of Understanding and Cooperative Agreements will be developed with additional parties as necessary to ensure implementation of specific conservation measures.

III. AUTHORITY

* The signatory parties hereto enter into this Conservation Agreement and the attached Conservation Strategy under federal and state law, as applicable, including but not limited to Section 2(c)(2) of the Endangered Species Act of 1973, as amended, which states that "the policy of Congress is that Federal agencies shall cooperate with State and local agencies to resolve water resource issues in concert with conservation of endangered species."

* All parties to this Agreement recognize that they each have specific statutory responsibilities that cannot be delegated, particularly with respect to the management and conservation of wildlife and the management, development and allocation of water resources. Nothing in this Agreement or the Strategy is intended to abrogate any of the parties' respective responsibilities.

* This Agreement is subject to and is intended to be consistent with all applicable Federal and State laws and interstate compacts.

IV. STATUS AND DISTRIBUTION OF THE VIRGIN SPINEDACE

In 1979 and 1989, the Virgin spinedace was identified as threatened by the American Fisheries Society, Endangered Species Committee. Criteria used for determining this status were consistent with the ESA. Their determination was based on review of original data and discussions with pertinent agencies and knowledgeable scientists. On May 18, 1994, the FWS proposed the species for listing as threatened under the ESA (59 FR 25875).

The Virgin spinedace currently occupies approximately 60-63% of historic habitat, nearly all being in Utah. Populations no longer exist in Nevada and few individuals remain in Arizona. The species occupies approximately 117 km (73 mi) of tributary streams and 25 km (16 mi) of the mainstem Virgin River. Occupied streams include three reaches of Beaver Dam Wash, two reaches of the Santa Clara River, isolated reaches in Moody Wash and Magotsu Creek, one reach of Ash Creek, two reaches of La Verkin Creek, two reaches of North Creek, the North and East Forks of the Virgin River, and Shunes Creek. Occupied habitat in the mainstem Virgin River is considered to be limited to the area above Quail Creek Diversion. Occasionally, Virgin spinedace have been collected in the Virgin River between Pah Tempe Springs and

Littlefield, Arizona. Their occurrence has generally been associated with tributary inflows. This area is not considered to be historic habitat because this reach does not have the same habitat components found in reaches supporting self-sustaining populations. A detailed description of the status and distribution for this species is presented in the Conservation Strategy.

V. PROBLEMS FACING THE SPECIES

The FWS assessed real and/or potential problems facing the species based on five criteria as required by Section 4(a)(1) of the ESA. Within each of these criteria, several factors which may have contributed to the elimination or degradation of Virgin spinedace habitat and its populations were identified (59 FR 25875 dated May 18, 1994). The threats identified and described by the FWS (59 FR 25875) do not necessarily reflect the views of all signatories to this agreement. The Conservation Strategy provides a detailed review of problems and threats to the species that signatories to this agreement will address with management actions.

VI. CONSERVATION ACTIONS TO BE IMPLEMENTED

In order to meet the objectives of this agreement, seven conservation actions will be implemented. These actions, as defined and detailed in the Strategy, include: establish existing conditions as a baseline; re-establish population maintenance flows; enhance and maintain habitat; selectively control non-indigenous fish; maintain genetic viability; monitor populations and habitat; and develop a mitigation plan and protocol for future activities. In addition, four general administrative actions, as outlined below, will be implemented: coordinate conservation activities; implement the conservation schedule; fund conservation actions; and assess conservation progress.

Coordinating Conservation Activities

* Administration of the conservation agreement will be conducted by the Virgin Spinedace Conservation Team (VSCT). The team will consist of a designated representative from each signatory to this Agreement and may include technical and legal advisors and other members as deemed necessary by the signatories.

* Since the majority of the areas of concern covered by this Agreement are located in Utah, and since the State of Utah presently has primary jurisdiction over Virgin spinedace within the State, the designated team leader will be the Utah Department of Natural Resources, Division of Wildlife Resources

representative.

* Authority of VSCT shall be limited to making recommendations for the conservation of Virgin spinedace to the Director, Utah Division of Wildlife Resources.

* The VSCT will meet annually to develop yearly conservation schedules, review the Strategy, and modify the Strategy as required.

* The VSCT will meet on a quarterly basis to report on the progress of implementing the Conservation Strategy.

* VSCT meetings will be open to the public. Minutes of the meetings will be kept and distributed to any interested party.

Implementing Conservation Schedule

* A total of 10 years is anticipated for full implementation of actions identified and specified in the Conservation Strategy. Nevertheless, the parties agree that significant actions to benefit the Virgin spinedace will be implemented within the first five (5) years. These actions will be determined by the VSCT.

* Conservation actions will be scheduled on a yearly basis. Activities that will be implemented in 1995 are listed in Table 1.

* As leader of the VSCT, the Utah Division of Wildlife Resources, Department of Natural Resources, will coordinate conservation activities and monitor conservation actions taken by participants of this Agreement to determine if all actions are being implemented and carried out in accordance with the Conservation Strategy and annual schedule.

Funding Conservation Actions

* It is anticipated that expenditures to implement this Agreement could exceed \$3,000,000 (Table 2). It is projected that the actions implemented for the re-establishment of population maintenance flows to stream channels will incur the greatest expense and occur during the first three to five years of the agreement.

* Funding for the Conservation Agreement will be provided by a variety of sources. Federal, State and local sources will need to provide or secure funding for initiative procedures of the Conservation Agreement.

- Federal sources include, but will not be limited to, the FWS, BLM, Land and Water Conservation funds, and the Natural Resource Conservation Service.

- State funding sources include, but will not be limited to, direct appropriation of funds by the legislature, Community Impact Boards, Water Resources Revolving funds, State Department of Agriculture (ARD), and State Resource Management Agencies.

- Local sources of funding will be provided by the Habitat Conservation Plan, Water District, cities and towns, Washington County, and local irrigation companies.

* In-kind contributions in the form of personnel, field equipment, supplies etc., will be provided by participating agencies (Table 3). In addition, each agency will have specific task responsibilities and proposed actions/commitments related to their in-kind contributions.

* It is understood that all funding commitments made under this Agreement are subject to approval by the appropriate local, state or federal entities.

Conservation Progress Assessment

* A quarterly assessment of progress towards implementing actions identified in this agreement will be provided to the Director, Utah Division of Wildlife Resources by VSCT. This assessment will be based on updates and evaluations by VSCT members. Copies of this assessment will also be provided to the signatories of this document.

* An annual assessment of conservation accomplishments identified in Table 1 and subsequent yearly schedules will be made by VSCT. This assessment will determine the effectiveness of this agreement and whether revisions are warranted. It will be provided to the Director, Utah Division of Wildlife Resources by VSCT. Copies of this assessment will also be provided to the signatories of this document.

* If threats to the survival of the Virgin spinedace become known that are not or cannot be resolved through this or any Conservation Agreement, the Utah Division of Wildlife Resources immediately will notify all signatories.

VII. DURATION OF AGREEMENT

The initial term of this Agreement shall be 5 years. Prior to the end of each 5 year period, a thorough analysis of actions implemented for the species will be conducted by the VSCT. If all signatories agree that sufficient progress has been made towards the conservation and recovery of the Virgin spinedace this Agreement shall be extended for an additional five (5)

years. Any party may withdraw from this Agreement on sixty (60) days written notice to the other parties.

VIII. NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) COMPLIANCE

Signing of this agreement is covered under authorities outlined in section III listed above. We anticipate that any survey, collection, or research activities for implementation and maintenance of the Conservation Agreement will not entail significant Federal actions under the NEPA and will be given a categorical exclusion designation. All other actions will be evaluated prior to implementation and will comply with NEPA regulations.

IX. FEDERAL AGENCY COMPLIANCE

* During the performance of this agreement, the participants agree to abide by the terms of Executive Order 11246 on non-discrimination and will not discriminate against any person because of race, color, religion, sex or national origin.

* No member or delegate to Congress or resident Commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom, but this provision shall not be construed to extend to this agreement if made with a corporation for this its general benefit.

Table 1: Conservation Actions to be Implemented in Calendar Year 1995

Reach	Date	Lead	Action
Basin-Wide:	Immediate*	States	- Establish existing conditions as a baseline for historic habitat
	Immediate	States	- Maintain all existing population maintenance flows
	Continuing 12/31	States All	- Identify methods for flow protection - Develop mitigation protocols for future activities
	Immediate	States	- Implement procedures to control the introduction of non-indigenous species
	4/30 4/30 4/30 12/31	States States States All	- Implement sport fish stocking procedures - Implement genetic management protocols - Implement population and habitat monitoring - Identify funding mechanisms
Beaver Dam Wash:			
Below Schroeder Res.	10/31 10/31	NDOW NDOW	- Selective removal of rainbow trout - Re-introduce Virgin spinedace
Santa Clara River:			
Below Veyo (Baker Dam)	Immediate	UDWR	- Cease brown trout stocking
Below Gunlock Res.	12/31 12/31 4/30 Immediate	WCWCD UDNR BLM UDWR	- Develop cooperative agreements for providing flows - Identify methods for flow protection - Initiate recreation management - Initiate feasibility analysis for green sunfish removal
Mainstem Virgin River:			
Below Quail Creek Div.	4/30 5/30 6/30 4/30 6/30 4/30	WCWCD WCWCD WCWCD WCWCD All UDNR	- Letter of commitment to provide flows - Finalize cooperative agreements for providing flows - Develop evaluation study plan for population maintenance flows - Provide population maintenance flows (5 km/3 mi) - Evaluate population maintenance flows - Identify methods for flow protection
Below Washington Div.	9/30	UDWR	- Initiate removal of red shiner
Below Johnson Div.	11/30	UDWR	- Initiate removal of red shiner

* Actions implemented upon signing of the Conservation Agreement

Table 2. Estimated Costs for Implementing the Virgin spinedace Conservation Agreement over 10 year period.

Conservation Agreement Actions	Estimated Costs (\$)
<i>Habitat Maintenance and Enhancement:</i>	
Determination of Flow Requirements	200,000
Establish Existing Conditions as a Baseline	30,000
Re-establishment and/or Enhancement of Flows	2,000,000
Formalize Flow Protection	200,000
Implement Habitat Improvements	100,000
<i>Population Genetics Management:</i>	
Develop and Implement Protocols	2,500
<i>Non-Indigenous Fish Management:</i>	
Implement Introduction/Stocking Procedures	2,500
Control/Eradication of Non-indigenous Fish	300,000
<i>Population and Habitat Monitoring:</i>	
Implement monitoring plans	300,000
<i>Administration:</i>	
Annual Review of Activities	100,000

Table 3: Estimated agency in-kind contributions, actions, and responsibilities for implementation of the Virgin spinedace Conservation Agreement.

Agency	Brief Description of Tasks and Responsibilities *
Utah Department of Natural Resources, Utah Division of Wildlife Resources	Serve as Virgin spinedace conservation group team leader (eg: oversee administrative responsibilities of agencies, reports, meetings etc.). Consult on water protection issues. Assist in obtaining and/or securing water rights and land within Virgin spinedace habitat. Assist in funding basin-wide enhancement projects. Plan and implement eradication/control projects of non-indigenous species within the basin (eg: red-shiners, green sunfish, brown trout and crayfish). Serve as lead agency for population and habitat enhancements, re-introductions and monitoring projects in Utah.
Nevada Department of Conservation and Natural Resources, Division of Wildlife	Serve as lead agency for funding, monitoring, Virgin spinedace re-introductions, and non-indigenous control/eradication in Upper Beaver Dam Wash. Cooperate and assist in basin-wide habitat enhancement and population monitoring projects.
Arizona Game and Fish Department	Cooperate and assist in eradication/control projects of non-indigenous species in lower basin reaches, and cooperate and assist in basin-wide habitat enhancement and population monitoring projects.
U.S. Fish and Wildlife Service	Advise and assist implementation of conservation agreement in regard to existing laws (eg: ESA, NEPA regulations etc.). Cooperate and assist in eradication/control projects of non-indigenous species, cooperate and assist in basin-wide habitat enhancement and population monitoring projects. Maintain Virgin River fishes data base. Assist in funding basin-wide enhancement projects.
National Park Service	Serve as lead agency in funding and implementation of population and habitat enhancement and monitoring projects within Zion National Park. Cooperate and assist in basin-wide habitat enhancement and population monitoring projects.
Bureau of Land Management (Utah)	Cooperate and assist in basin-wide habitat enhancement and population monitoring projects. Assist in funding basin-wide enhancement projects. Cooperate and assist in eradication/control projects of non-indigenous species, cooperate and assist in basin-wide habitat enhancement and population monitoring projects.
Bureau of Land Management (Arizona)	Serve as lead agency for planning and locating, and cooperate in securing funding for construction of, and constructing migration barriers for red-shiner eradication in Arizona reaches of Virgin River as well as cooperate and assist in eradication/control projects of other non-indigenous species. Cooperate and assist in basin-wide habitat, enhancement and monitoring projects.
Washington County Water Conservancy District	Assist and facilitate in obtaining and/or securing water rights within Virgin spinedace habitat. Assist in planning, funding, and construction of non-indigenous fish migration barriers and diversion enhancements. Cooperate and assist in monitoring of fish populations and habitat responses to management actions.

* All agencies will participate in, and provide technical and administrative assistance to the Virgin Spinedace Conservation Team

ATTACHMENT A

CONSERVATION STRATEGY

Virgin spinedace

Lepidomeda mollispinis mollispinis

PURPOSE

The purpose of the present document is to describe specific procedures and strategies required for conservation of Virgin spinedace. The general conservation approach focuses on two main objectives. The first objective is to eliminate threats where possible, and reduce threats to the greatest extent possible that cannot be eliminated entirely. The second is to enhance and/or stabilize instream flows in specific reaches of occupied and unoccupied habitat. Though the primary focus of this strategy is conservation and enhancement of the Virgin spinedace, it could also reduce or eliminate threats and improve habitat for many other species, which could preclude their need for federal listing pursuant to the Endangered Species Act of 1973 as amended (ESA).

Definitions

For the purposes of the Agreement and Strategy, the following terms are defined as:

Occupied Habitat - Occupied habitat consists of stream reaches containing self-sustaining Virgin spinedace populations.

Historic Habitat - Historic habitat consists of stream reaches that have been shown, can be shown, and/or can logically be deduced as historically being occupied by Virgin spinedace. This area is approximately 226 km (141 mi). The exact extent of historic habitat is unknown. Historically, spinedace habitat probably fluctuated with changing environmental conditions.

Population Maintenance Flows - Population maintenance flows are flows of sufficient magnitude to maintain self-sustaining Virgin spinedace populations during low-flow periods. These flows are dependent on flow events of sufficient magnitude, timing, and duration to maintain channel characteristics and provide environmental cues.

Self-Sustaining Population - Self-sustaining populations are those with sufficient numbers, age class structure, and natural reproductive success to provide for their long-term survival.

Non-indigenous - An organism that is not native, or occurs naturally in a specific area or environment.

BACKGROUND

The Virgin River basin is characterized by a diverse landscape with unique communities of fauna and flora. The basin encompasses approximately 15,600 km² (6000 mi²). Virgin River headwaters are in Washington and Kane County, Utah, and the stream flows in a general southwesterly direction to empty into Lake Mead on the Colorado River in Nevada. Elevations range from 3300 m (10,000 ft) above mean sea level (msl) near the headwaters to less than 700 m (2000 ft) at Littlefield, Arizona. The river varies from reaches with narrow, steep-walled canyons and steep gradients to low desertland with broad open canyons and low gradients. Mean annual precipitation ranges from about 20 cm (8 in) at low elevations to about 100 cm (40 in) at higher elevations.

Due to the diverse topography, this river and its associated riparian area and floodplain provides habitat for over 366 species of wildlife (Appendix A). Of these, 81 species have been identified as sensitive. There are six fish species indigenous to the basin: woundfin (*Plagopterus argentissimus*), Virgin River chub (*Gila seminuda*), flannelmouth sucker (*Catostomus latipinnis*), desert sucker (*Catostomus clarki*), speckled dace (*Rhinichthys osculus*), and Virgin spinedace (*Lepidomeda m. mollispinis*). Except for the speckled dace, all of these have been listed or are candidates for federal listing under the ESA.

The Virgin spinedace was recognized in 1979 as a threatened species by the scientific community. The Endangered Species Committee of the American Fisheries Society added it to their list of threatened and endangered fish after assessing criteria consistent with the ESA (Deacon et al., 1979). Their determination of the species' status was based on review of original data and discussions with pertinent agencies and knowledgeable scientists. On May 18, 1994, the United States Fish and Wildlife Service (FWS) proposed the species for listing as a threatened species pursuant to the ESA (59 FR 25875).

Systematics and Description

The Virgin spinedace, *Lepidomeda mollispinis mollispinis* is a member of an endemic tribe of western cyprinids, the Plagopterini (Miller and Hubbs, 1960). The group is comprised of three genera: *Meda*, *Plagopterus* and *Lepidomeda*. The first two are monotypic, represented by the spikedace (*M. fulgida*) and woundfin (*P. argentissimus*). *Lepidomeda* is a polytypic genus containing four species: the White River spinedace (*L. albivallis*), the Pahranaagat spinedace (*L. altivelis*), the Little Colorado spinedace (*L. vittata*), and the Virgin spinedace (*L. mollispinis*). *L. mollispinis* is further classified into two subspecies; *L. m. pratensis* (Big Springs spinedace) and *L. m.*

mollispinis (Virgin spinedace). The Pahranagat spinedace is considered extinct (Miller and Hubbs, 1960; Valdez et al., 1991). Extant members of the tribe Plagopterini are rare. The woundfin and White River spinedace are listed as endangered (35 CFR 16047 and 50 FR 37198 respectively). The spikedace (51 FR 23781), Big Springs spinedace (50 FR 12302) and the Little Colorado River spinedace (52 FR 35040) are listed as threatened.

Spinedace get their name from the fusion of two anterior, hardened spiny rays of the dorsal fin and a similar structure located in the pelvic fin. The Virgin spinedace derives its specific name from the latin words *mollis*, meaning soft, and *spinis*, meaning spine, both referring to the soft-tipped second dorsal spine (Miller and Hubbs, 1960).

The body of the Virgin spinedace is silvery with a brassy sheen and occasionally with light sooty blotches on the dorso-lateral half. During breeding, bases of the paired fins are reddish-orange. The Virgin spinedace is characterized by a terminal mouth, rounded head and belly, and a body size typically ranging from 60 mm to 120 mm (2.4 to 4.7 in SL) (Rinne, 1971; Addley and Hardy, 1993). The species has a well-scaled body, with 77-91 scales on the lateral line and two rows of pharyngeal teeth which typically number 2, 5-4, 2 (Addley and Hardy, 1993; Sigler and Miller, 1963; Valdez et al., 1991). The dorsal fin has eight rays and the anal fin usually includes nine rays, but may vary from eight to ten rays.

Life History

The life history of the Virgin spinedace was described by Rinne (1971). Having a life-span of about three years, the fish reaches sexual maturity at about one year. Populations typically are comprised mostly of young-of-the-year (YOY) and one-year-old fish. Because of the mild climate of Virgin spinedace habitat, age determination after one year can be difficult. However, Rinne (1971) indicated that fairly accurate estimates could be made using SL: young-of-the-year <55 mm, age 1 55-76 mm, age 2 77-85 mm, age 3 >85 mm.

Although sexual dimorphism is not apparent most of the year, sexes can be distinguished during peak breeding season. Females tend to be more robust and plump, while males remain streamlined. Furthermore, the vent of the female becomes swollen and the ovipositor becomes a reddish color (Rinne, 1971). Both sexes exhibit the reddish-orange coloration at the bases of the paired fins.

Annual spawning of the Virgin spinedace has been observed from April through June at mean daily water temperatures of 13-17°C and day lengths of about 13 hrs. Rinne (1971) found that one-year-old females had the lowest mean relative fecundity averaging

459 eggs, while two and three-year-old females averaged a 42% and 34% increase in mean relative fecundity over one-year-olds, respectively. Since populations are comprised primarily of one year olds, they often comprise 90% of the spawning population (Addley and Hardy, 1993).

Virgin spinedace are typically found in clear, cool, swift streams that have interspersed pools, runs, and riffles (Deacon et al., 1979; Valdez et al., 1991). Upper thermal preferences have been reported as 23.1°C (Deacon et al., 1987). Rinne (1971) found Virgin spinedace most frequently in pools with some type of protection such as undercut banks, boulders or debris; however, variations in habitat preferences have been noted. For example, in Beaver Dam Wash, Virgin spinedace utilize narrow, shallow runs with large amounts of emergent vegetation, while in North Fork of the Virgin River, they most often occupy quiet pools (Rinne, 1971). Virgin spinedace have also been documented to prefer shear zones between high (100 cm/sec) and low (10 cm/sec) velocities containing cover (Deacon et al., 1979; Deacon et al., 1991; Hardy et al., 1989). Nursery habitat preferences, however, remain unclear.

Virgin spinedace are primarily insectivorous, feeding on a wide range of insects and occasionally plant material and organic debris (Angradi et al., 1991; Gregor and Deacon, 1988; Rinne, 1971). Virgin spinedace feed on drifting prey in midwater and at the surface. Usually they maintain equilibrium in the midwater column darting to the surface to capture prey in a manner similar to drift-feeding salmonids (Addley and Hardy, 1993; Rinne, 1971).

Historic Distribution

The historic distribution of the Virgin spinedace is not well documented. Holden (1977) speculated that historic occurrence was in most of the clearwater tributaries and several mainstem reaches of southwestern Utah, northwestern Arizona, and southeastern Nevada (Figure 1). Museum records from the University of Nevada at Las Vegas, Brigham Young University, University of Michigan Museum of Zoology, and the United States National Museum support Holden (Addley and Hardy, 1993; Cross 1975; Rinne, 1971; Valdez et al., 1991). The earliest survey records indicated this species was common in the Santa Clara River and North Fork of the Virgin River, but probably less common in the Virgin (Tanner (1932, 1936). C.L. Hubbs (unpub. data) collected Virgin spinedace near Bunkerville, Nevada, in 1938, but surveys in 1942 in the same area lacked Virgin spinedace (Cross, 1975). Furthermore, the species was absent from surveys below Littlefield, Arizona between 1942 and 1975 (Cross 1975).

PROBLEMS FACING THE SPECIES

Populations of Virgin spinedace currently exist in the mainstem Virgin River and eleven of its tributaries including East Fork Virgin River, Shunes Creek, North Fork Virgin River, North Creek, La Verkin Creek, Ash Creek, Santa Clara River, Beaver Dam Wash, Coal Pits Wash, Moody Wash and Magotsu Creek (Table 1). According to Addley and Hardy (1993), the largest populations are in the upper mainstem above Quail Creek diversion and in drainages of the Santa Clara River and Beaver Dam Wash. Small populations exist in Ash Creek, La Verkin Creek, and the lower mainstem below Pah Tempe Springs. The remaining areas contain intermediate sized populations.

The present distribution of Virgin spinedace is significantly smaller than historically, with approximately 37-40% (84 km/52 mi) now unoccupied (Table 1). In addition, 24% of currently occupied habitat has experienced some degree of adverse modification (Table 1). Dewatered streams, water depletions, introductions of non-indigenous fish, and habitat degradation through agricultural and recreational uses have been identified as the primary factors involved in the reduction of range of the species (Valdez et al., 1991; Addley and Hardy, 1993).

In 1994, the FWS described pertinent problems and threats they perceived as facing the Virgin spinedace based on criteria for federal listing as required by Section 4(a)(1) of the ESA (59 FR 25875). The threats they listed do not necessarily reflect the view of all signatories to this Agreement. The following discussion summarizes the significant threats to Virgin Spinedace that will be addressed by conservation actions identified in this Strategy.

Present or threatened destruction, modification, or curtailment of its habitat or range.

Virgin spinedace habitat modification and/or elimination has occurred primarily through human activities such as dam and diversion construction, water depletion or diversion, and agricultural practices (Table 1). Approximately 7 km (4 mi) of Virgin spinedace historical habitat has been inundated by reservoirs including Quail Creek Reservoir on Quail Creek, Gunlock on the Santa Clara River, and Schroeder Reservoir on Beaver Dam Wash (Figure 1). Approximately 60 km (37 mi) of historic habitat has been dewatered by diversions. Furthermore, diversions have depleted water in approximately 31 km (19 mi) of currently occupied habitat. Lack of stable instream flows and low water levels as a result of diversions cause changes in water temperature, affect aquatic vegetation, and alter water chemistry and dissolved oxygen levels. Dams and diversions also act as barriers to fish movement within the system and fragment Virgin

spinedace habitat and populations. In areas of extensive habitat fragmentation, migration becomes virtually non-existent.

Agricultural practices have also modified several areas of Virgin spinedace habitat through alteration of the riparian zone. Riparian alterations often cause stream bank erosion, siltation, and devegetation. A recent evaluation of the Virgin River basin riparian zone (Fridell, Hansen, Leany, and Douglas, pers. comm., 1994) indicated that some alterations from crop production are occurring along lower La Verkin Creek, lower Ash Creek, and middle Virgin River reaches. Several reaches are impacted by livestock, including the Santa Clara River below Gunlock Reservoir, lower Santa Clara River, lower North Creek, lower La Verkin Creek, lower Ash Creek, and portions of the Virgin River mainstem. The remaining riparian zones appear to be relatively intact.

Predation, Competition, and Disease

Aquatic species introduced into the Virgin River system have been identified as contributing to reductions of native fish populations (Addley and Hardy, 1993; USFWS, 1993). Several non-indigenous fish species have been identified as occupying the same habitat as Virgin spinedace (Table 2). Several of these prey on the Virgin spinedace. Other non-indigenous species (Table 2), such as crayfish (i.e., Astacidae), may be preying on larval and young-of-year life stages in lower reaches of several tributaries (Addley and Hardy, 1993). Some non-indigenous species may also affect Virgin spinedace habitat by competing for limited resources such as food and space. Disease and parasites do not appear to have had significant roles in the declining status of the Virgin spinedace; however, they may have adverse effects when coupled with other threat and stress factors (Addley and Hardy, 1993).

Other natural or manmade factors affecting the species' continued existence.

Several other natural and manmade factors play a role in the declining status of the Virgin spinedace. Natural limiting factors include drought, flood and in some instances, natural barriers and native species interactions. The extent that natural factors affect Virgin spinedace is unclear.

Pollution from return flows, municipal drains and agriculture is a potential problem for all native species within the basin. Return flows from municipal drains and agriculture can make up a significant portion of a stream's total flow. Water from these return flows can be polluted with pesticides as well as other wastes. Mining along Beaver Dam Wash may contribute to habitat degradation. Low flows, caused naturally or by diversions, increase the impacts of pollution, erosion, siltation and mineral

springs have on the chemical composition of the water.

Recreational use (e.g. off-road vehicles) has been documented (Fridell et al., pers comm.) as significantly impacting several reaches including the Santa Clara below Gunlock Reservoir, the lower Santa Clara, and the lower mainstem Virgin River.

CONSERVATION ACTIONS TO BE IMPLEMENTED

Conservation measures needed for the continued existence of Virgin spinedace focus on two objectives: 1) to eliminate significant threats or reduce those that cannot be completely eliminated to the maximum extent possible, and 2) to stabilize, restore and enhance specific reaches of occupied and unoccupied historic habitat. The goal of these measures is to expand the range so that the species occupies at least 80% (approximately 181 km/112 mi) of its historically occupied habitat. Attainment of the goal and objectives of this strategy would be achieved by implementing the following management actions: 1) establish existing conditions as a baseline 2) re-establish population maintenance flows 3) enhance and maintain habitat 4) selectively control non-indigenous fish 5) maintain genetic viability; 6) monitor populations and habitat and 7) develop a mitigation plan and protocol for future activities.

Establish Existing Conditions As A Baseline

All management actions associated with the conservation of Virgin spinedace will be evaluated as to their effectiveness. In addition, any modification to the existing conditions upon which Virgin spinedace depend, will be evaluated as to their potential effect on the species. For these purposes, the existing conditions of historic habitat are considered to be this baseline. Three primary attributes will be used to describe existing conditions: 1) basin hydrology averaged over the last 20 years, 2) water rights and depletions, and 3) Virgin spinedace populations.

Re-establish Population Maintenance Flows

Existing flow patterns provide the habitat requirements of the Virgin spinedace in approximately 159 km (99 mi) of the species historic habitat (Table 1). These conditions are described by hydrographs in terms of flow quantity, timing, duration, and frequency. In approximately 91 km (57 mi) of historic habitat, stream channels are dry or flows are significantly depleted during the late-summer and early-fall period (Table 1).

Population maintenance flows will be re-established and maintained in approximately 39 km (24 mi) of de-watered historic habitat of the Virgin spinedace in order to reduce habitat fragmentation and to restore populations. These flows will be re-established based on determining the flow requirements of the species using an empirical approach by incorporating components of the conceptual framework outlined by Hill et al. (1991). This empirical approach incorporates current data on flow patterns that are currently maintaining self-sustaining populations in reaches of the Virgin River basin. The process of re-

establishing flows adheres to the following step-wise outline: 1) Estimate population maintenance flows, 2) Provide population maintenance flows, 3) Evaluate population maintenance flows, 4) Finalize flows required, and 5) Protect flows.

Estimate Population Maintenance Flows

Population maintenance flows currently occur in approximately 15 occupied stream reaches (Table 3). These flows were estimated by comparing Virgin spinedace population numbers, stream flows, and habitat characteristics throughout the drainage for empirical relationships (Addley and Hardy, 1993; Valdez et al, 1991). A total of 10 reaches have been identified as potential sites for population maintenance flow re-establishment to reach the goal of 80% of historic habitat (Tables 3 and 4). These reaches were selected because they were identified as areas that are dewatered or experience significant depletions (Table 1). Two reaches have been designated as priority areas toward attaining the goal. The first encompasses approximately 31 km (19 mi) of the Santa Clara River between Gunlock Reservoir and the confluence with the Virgin River. The second encompasses approximately 5 km (3 mi) of the Virgin River between Quail Creek Diversion and Pah Tempe Springs. Historically, these areas supported common to abundant populations of Virgin spinedace. Additional reaches of Virgin spinedace habitat to have flows restored will include one or a combination of the other reaches listed in Tables 1 and 4.

Evaluate Population Maintenance Flows

The response of Virgin spinedace populations and habitat to population maintenance flows will be evaluated over a five year period. A detailed study plan will be developed for each stream reach. The study plan will include, but not be limited to, estimations of population abundance, recruitment, habitat utilization and availability. A progress report will be provided annually. A completion report will be provided at the end of the five year period.

Finalize Population Maintenance Flows Required

A final recommendation for re-establishing population maintenance flows in specific reaches will be developed after completion of the population maintenance flow evaluations. Information obtained from other instream flow studies will be considered in making those recommendations. In the Santa Clara River, the maximum amount of flow provided will not exceed 3 cfs at the point of release.

Protect Population Maintenance Flows

Flow protection measures will be implemented that are consistent with state laws. These measures may include: river operating

agreements, minimum instream flow rights, irrigation rights, and federal reserved water rights. Instream flows for water-related resource attributes, including native fish, are currently being discussed by the National Park Service, the State of Utah, and the Washington County Water Conservancy District. These discussions are part of ongoing negotiations to determine Federal reserved water rights for Zion National Park in the Virgin River adjudication.

Enhance and Maintain Habitat

Habitat enhancement procedures will be implemented in approximately 26 km (16 mi) of occupied habitat. Enhancement projects will focus on specific factors that contribute to Virgin spinedace habitat degradation including: agricultural activities, mining activities, recreational use of riparian zones, and activities that affect water quality (Table 4). Enhancement projects will include maintenance and construction of boundary-line fences between federal and private parcels to control unauthorized grazing and recreational (ie: ORV, hiking, etc.) use along the riparian zones, establishment of intensive grazing management programs for federal lands along streams, and development of barriers and conservation easements within the Virgin River floodplain to reduce additional agricultural, recreational, and developmental impacts. Any future projects which alter habitat will be evaluated as described in the mitigation section of this strategy.

Selectively Control Non-indigenous Fish

Non-indigenous fish populations identified in Table 2 will be evaluated in order to identify detrimental effects on Virgin spinedace populations. Management and control of non-indigenous fish will focus on implementation of stocking and introduction procedures as well as control and/or eradication of selected populations of these fish in the Virgin River basin. Specific management actions will be developed on a reach-by-reach basis to remove the threats to Virgin spinedace associated with non-indigenous species. Table 4 summarizes reaches where non-indigenous fish management actions will be implemented.

Control Fish Stocking and Introductions

The following basin-wide procedures for controlling stocking, introduction, and spread of non-indigenous aquatic species of vertebrates and invertebrates will be implemented by the appropriate agencies. These procedures have been developed using adapted versions of The American Fisheries Society procedures for nonnative fish introductions.

Stocking of Non-indigenous Species Already Occurring:

SALMONIDS:

Several species of salmonids are routinely stocked in the Virgin River Basin. Stocking of salmonids is to be restricted to areas in association with existing salmonid populations OR made in new areas only where they will not conflict with native species of special concern. Areas where salmonids are routinely stocked are presented in Table 5.

Rainbow Trout (*Onchorhynchus mykiss*)

New stockings are prohibited where self-sustaining populations would establish in association with native fishes of special concern or where stocking would cause conflicts with native species of special concern.

Brown Trout (*Salmo trutta*)

Brook Trout (*Salvelinus fontinalis*)

Cutthroat Trout (*Onchorhynchus clarki*)

Other Hybrid Trout

Stocking is prohibited in areas under 5,000 feet elevation or at higher elevations where stocking would cause conflicts with native species of special concern. The only area where maintenance stocking of brown trout occurs in the Virgin River basin is upstream from Glendale, Utah in the East Fork of the Virgin River (Table 5).

OTHER NON-INDIGENOUS SPECIES:

Channel Catfish (*Ictalurus punctatus*)

Stocking is prohibited except in isolated ponds and reservoirs as determined on a case by case basis.

Largemouth bass (*Micropterus salmoides*)

Bluegill sunfish (*Lepomis macrochirus*)

Stocking to be restricted to standing water impoundments, including existing mainstream reservoirs and other isolated ponds and reservoirs. Direct conflicts with native fish species of special concern will be avoided.

Introduction of a New Species:

Guidelines for introducing a new species to the drainage will follow the "Introduction of Aquatic Species, Environmental Policy Statement of the American Fisheries Society" and the "Non-indigenous Aquatic Nuisance/Prevention and Control Act of 1990".

Prohibited Species:

Non-indigenous minnows (Family: Cyprinidae), smallmouth bass (*Micropterus dolomieu*), green sunfish (*Lepomis cyanellus*), black crappie (*Pomoxis nigromaculatus*), all crayfish species (i.e., Astacidae) and all other non-indigenous aquatic species prohibited by respective state regulations or recommended for prohibition by the Colorado River Wildlife Council.

Selective Removal of Non-indigenous Fish

Eradication of detrimental non-indigenous fish will be implemented where feasible and controlled to the maximum extent possible where eradication is not possible (Table 4). Several species have already been targeted for control and/or eradication including rainbow trout in the upper reaches of Beaver Dam Wash, green sunfish from the Santa Clara River and red shiner in the mainstem Virgin River below the Washington Fields Diversion (see below for details). Engineering feasibility for fish barrier structures to control non-indigenous fish is currently being developed. Possible impacts to native species will be evaluated prior to implementation of control and eradication actions.

Upper Beaver Dam Wash:

NDOW will have lead responsibility for an interagency effort to re-introduce Virgin spinedace into historic habitat in Nevada below Schroeder Reservoir. Efforts will be focused on re-creating the historic species matrix which occurred in this reach prior to dam construction, through selective removal of rainbow trout from the reach below Schroeder Reservoir. Virgin spinedace will be obtained from other populations within the Beaver Dam Wash drainage. The anticipated date of re-introduction will be early summer 1995 following the normal peak spring runoff period for upper Beaver Dam Wash. NDOW will provide pre-project assessments, documentation and monitoring of re-introduction efforts.

Santa Clara River:

UDWR will initiate efforts to control and manage green sunfish in the Virgin River basin in ways to benefit native fishes, including Virgin spinedace. The feasibility of chemical renovation projects in the Santa Clara River drainage will be evaluated in respect to controlling or eliminating green sunfish and other exotic fishes that are determined to be a problem.

The overall project will be divided into workable segments that can be treated separately. For example, if upstream sources of green sunfish can be eliminated above Baker Reservoir then, in turn, the stream segment between Baker Reservoir and Moody Wash could be renovated to remove exotic fishes. Providing that upstream treatments are feasible, this area could also be isolated from contamination by exotic fishes from downstream sources. Other project segments could include Moody Wash downstream to Gunlock Reservoir, and from Gunlock Reservoir downstream to the confluence of the Virgin River.

Control of green sunfish in the Santa Clara River below Gunlock Reservoir might be necessary after population maintenance flows are established. In this case, chemical treatments to temporarily reduce exotic fish while Virgin spinedace are re-introduced and become established might be needed. Such work

could be conducted regardless of upstream occurrence of non-indigenous fishes.

Virgin River:

Attempts to eradicate the red shiner from the Virgin River basin, particularly from the Washington Fields diversion downstream to the Mesquite diversion, have been conducted in the past. Though these attempts were not 100% effective, they were successful at eliminating red shiners between Washington Fields and Johnson diversions. These attempts included construction of fish barriers and chemical treatments with the pesticide rotenone.

Chemical procedures to eradicate red shiners will be implemented in 1995 and followed up by subsequent treatments as needed. General chemical treatment methodology will involve 1) approximately 20 drip stations where rotenone will be introduced into the river, 2) spraying Noxfish in standing water areas along stream channels, 3) detoxifying the rotenone in the Virgin River with potassium permanganate. Temporary fish barriers will be constructed in Utah at strategic sites in 1995 to prevent upstream migration of red shiners. These barriers will also assist in dividing the chemical treatments into manageable treatment areas.

Maintain Genetic Viability

Protocols for introduction, re-introduction, and sub-basin transfer of Virgin spinedace will be established and utilized.

Population and Habitat Monitoring

Virgin spinedace population and habitat monitoring will be implemented. Information obtained from the monitoring process will be used to determine if current management actions are attaining the objectives set forth in the Conservation Agreement. In addition, a general assessment of the overall response of other species occurring in the Virgin River basin will be conducted.

Population and habitat monitoring will be implemented cooperatively by participating Virgin Spinedace Conservation Team (VSCT) personnel. VSCT responsibilities regarding monitoring actions are described in Table 3 of the accompanying Conservation Agreement. Protocols for monitoring will be similar to those established by the Virgin River Recovery Team. A general overview of the methodology is presented below.

Monitoring Plan Methodology

A minimum of 10 stations will be chosen as monitoring points throughout the basin. Once re-establishment procedures have been completed, the number of stations established may increase to include the new areas. Sampling will be conducted annually in

the fall.

Seining will consist of repeated hauls of a 4.6 meters wide x 1.8 meters deep x 3.2 mm mesh seine until depletion (the number of fish captured in a haul is 10% or less of the highest seine catch for that sample site). Samples will be taken from preferred Virgin spinedace microhabitats approximately 10 meters in length. In areas where seining is not feasible, electrofishing methods will be incorporated. These repetitive techniques will primarily provide that the population in a given habitat has been thoroughly sampled. It secondarily provides depletion information for population estimates.

All native fish will be identified to species, counted, measured, and returned to site of capture. All non-indigenous fish will be identified to species, counted, measured and returned to site of capture.

In addition to the sampling described above, Virgin spinedace population information will be obtained from data acquired in the bi-annual sampling by the Virgin River Recovery Team.

Data obtained on responses of populations and habitat to management actions from the monitoring process will be assessed and evaluated annually by the Virgin spinedace conservation team. The effectiveness of the management actions will be measured using empirical criteria to be established for this Strategy.

Develop Mitigation Plan and Protocols for Future Activities

A mitigation plan and protocols for mitigating future activities will be developed during 1995. Any new water depletion or habitat alteration of baseline conditions of historic habitat will require prior evaluation, assessment, and approval. Mitigation will be determined based on an evaluation of how baseline conditions would be altered. During 1995, methodologies for conducting this evaluation will be developed. The evaluation will incorporate procedures for determining flow requirements by integrating components of the conceptual framework outlined by Hill et al. (1991).

Descriptions of existing flow patterns will probably include details on the timing, duration, magnitude, slope, and frequency of high-flow events in selected streams along with analyses to determine an average annual hydrograph for timing and slopes of rising and falling limbs. The HEC-2 analysis (U.S. Army Corps of Engineers 1982) may be used to estimate bankfull flows. A frequency-of-occurrence curve may be required to describe the return period for peak flows. A flow duration curve may also be required to describe the flow duration associated with specific exceedence values.

DESIRED OUTCOME

Implementation of the Conservation Agreement and Strategy will initiate management actions that should provide for the continued existence and recovery of Virgin spinedace. We anticipate that the range of the species will be increased to occupy 80% of its historic habitat (Figure 2). The most significant threat to the species has been identified as dewatered-historic habitat (60 km or 37 mi). This threat will be significantly reduced by providing flows in approximately 39 km (24 mi) of stream channel. We anticipate that this single action will greatly enhance current populations of Virgin spinedace by reducing habitat and population fragmentation, enhancing stream productivity, enhancing water quality, and enhancing the riparian communities. Actions such as non-indigenous fish management and habitat improvement should provide additional benefits by removing negative fish interactions and enhancing impacted habitats.

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Table 1: Estimated historic and present occupied Virgin spinedace habitat and estimated kilometers (miles) of impacted stream reaches. (modified from Addley and Hardy, 1993)

RRACH	Occupied Habitat		Water Development			Other Habitat Alteration	
	Historic (km/mi)	Current (km/mi)	Area Dewatered (km/mi)	Area Depleted (km/mi)	Non-indigenous Species (km/mi)	Habitat Degradation (km/mi)	
Beaver Dam Wash							
Below Shroeder Res.	13.8(8.6)	0.0	-	-	13.8(8.6)	-	-
Upper BDW	13.0(8.1)	13.0(8.1)	-	-	-	-	-
Upper Lytle Ranch	4.0(2.5)	4.0(2.5)	-	-	-	1.0(0.6)	-
Lower Lytle Ranch	4.8(3.0)	4.8(3.0)	-	-	-	-	-
Littlefield	1.3(0.8)	1.3(0.8)	-	-	1.3(0.8)	1.3(0.8)	-
East Fork	6.9(4.3)	0.0	2.1(1.3)	-	2.9(1.8)	-	-
Santa Clara River							
Moody Wash	11.3(7.0)	11.3(7.0)	-	-	-	-	-
Magotsu Creek	5.0(3.1)	1.0(0.6)	4.0(2.5)	-	-	-	-
Below Veyo	6.0(3.7)	6.0(3.7)	-	6.0(3.7)	6.0(3.7)	-	-
Above Gunlock Res.	12.2(7.6)	12.2(7.6)	-	12.2(7.6)	12.2(7.6)	3.0(1.9)	-
Below Gunlock Res.	30.6(19.0)	0.0	30.6(19.9)	-	-	-	-
Lower Santa Clara	10.0(6.2)	6.3(3.9)	3.7(2.3)	6.3(3.9)	-	6.3(3.9)	-
Leeds Creek	6.8(4.2)	0.0	6.8(4.2)	-	-	-	-
Quail Creek	5.3(3.3)	0.0	-	-	-	-	-
Ash Creek							
Upper	4.3(2.7)	0.0	4.3(2.7)	-	-	-	-
Lower	4.0(2.5)	4.0(2.5)	-	1.6(1.0)	-	4.0(2.5)	-
La Verkin							
Upper	8.7(5.4)	8.7(5.4)	-	-	-	-	-
Lower	3.2(2.0)	3.2(2.0)	-	3.2(2.0)	-	3.2(2.0)	-
Virgin River							
Below Quail Cr Div	29.9(18.6)	25.4(15.8)	4.5(2.8)	-	-	-	-
North Creek							
Upper	6.9(4.3)	6.9(4.3)	-	-	-	-	-
Lower	5.5(3.4)	1.6(1.0)	3.9(2.4)	1.6(1.0)	-	1.6(1.0)	-
North Fork Virgin	18.5(11.5)	18.5(11.5)	-	-	-	-	-
East Fork Virgin	14.7(9.1)	14.7(9.1)	-	-	-	-	-
Shunes Creek	4.5(2.8)	4.5(2.8)	-	-	-	-	-
TOTAL	226.4(140.7)	142.6(88.6)	59.9(38.1)	30.9(19.2)	36.2(22.5)	26.4(16.4)	

* Includes one or a combination of: agriculture, recreation, development, channelization, or barriers due to dams/diversions.

Table 2: Non-indigenous species which occur in the Virgin River Basin. An "x" indicates where these species occupy Virgin spinedace habitat.

Reach	RBT	BT	GSF	LMB	CCF	BG	MF	RS	GS	GC	KOI	TP	GP	BB	CF
Beaver Dam Wash															
Below Schroeder Res.	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Upper BDW	X	-	-	-	-	-	-	-	-	-	-	-	-	-	X
Upper Lytle Ranch	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X
Lower Lytle Ranch	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X
Littlefield	-	-	X	X	-	-	X	X	-	-	-	-	-	X	-
East Fork	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X
Santa Clara River															
Moody Wash	-	X	X	X	-	-	-	-	-	-	-	-	-	-	X
Magotsu Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X
Below Veyo	X	X	X	X	-	-	-	-	-	-	-	-	-	-	X
Above Gunlock Res.	-	X	X	X	-	-	-	-	-	-	-	-	-	-	X
Below Gunlock Res.	-	-	X	X	-	-	-	-	-	-	-	-	-	-	X
Lower Santa Clara	-	-	X	X	-	-	X	-	-	-	-	-	-	-	X
Leeds Creek															
Leeds Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Quail Creek															
Quail Creek	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ash Creek															
Ash Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Upper	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lower	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X
La Verkin															
La Verkin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Upper	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lower	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-
Virgin River															
Virgin River	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Below Quail Cr Div	-	-	-	X	-	-	-	-	-	-	-	-	-	X	X
North Creek															
North Creek	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Upper	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lower	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X
North Fork Virgin															
North Fork Virgin	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-
East Fork Virgin															
East Fork Virgin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Shunes Creek															
Shunes Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

RBT= Rainbow trout, BT=Brown trout, GSF=Green sunfish, LMB=Large mouth bass, CCF=Channel catfish, BG=Bluegill, MF=Mosquitofish, RS=Red shiner, GC=Grass carp, KOI=Koi, TP=Tilapia, GP=Guppy, BB=Black Bullhead, GS=Goldenshiner, CF=Crayfish

Table 3. Estimated existing conditions and population maintenance flows to be re-established for each of Virgin spinedace habitat (modified from Adley and Hardy, 1993)

REACH	EXISTING CONDITIONS					RE-ESTABLISHED ^a
	Low Flows (cfs)	Density (#/10m) Adult YOY	Density (#/100m ²) Adult YOY	Density (#/100m ²) Adult YOY	Sign. Deplet. Y/N	
Beaver Dam Wash						
Below Shroeder Res.	1-2	-	-	-	N	-
Upper BDM	1-2	4.4	3.5	16	N	-
Upper Lytle Ranch	3	10.7	123	58.9	N	-
Lower Lytle Ranch	0	-	-	-	N	-
Littlefield	4-5	-	-	-	N	-
East Fork	1	-	-	-	Y	1
Santa Clara River						
Moody Wash	1.5	27.9	119	143.1	203	N
Magatsu Creek	1	-	-	-	-	Y
Below Veyo	3-4	2.1	0.8	5.6	2.1	Y
Above Gunlock Res.	2-4	27.9	119	143.1	203	Y
Below Gunlock Res.	0-1	0.0	0.0	0.0	0.0	Y
Lower Santa Clara	1-3	0.4	1.0	2.9	6.9	Y
Leeds Creek	0	0.0	0.0	0.0	0.0	Y
Quail Creek	2-4					Y
Ash Creek						
Upper	0	0.0	0.0	0.0	0.0	Y
Lower	2-4	10.1	11.3	48.9	55.1	Y
La Verkin						
Upper	5-6	0.4	0.3	1.2	0.8	N
Lower	1	0.0	2.0	0.0	5.5	Y
Virgin River						
Below Quail Cr Div	0	-	-	-	-	Y
North Creek						
Upper	3	23.3	12.5	59.9	32.2	N
Lower	0	-	-	-	-	Y
North Fork Virgin	<i>b</i>	2.9	12.4	4.7	20.1	N
East Fork Virgin	<i>b</i>	7.9	7.0	10.2	9.1	N
Shunes Creek	1	0.2	8.5	1.0	47.8	N

^a These flows will be measured at the point of release where dams and diversions exist
^b Instream flows for water-related resource attributes are currently being discussed by the NPS, the State of Utah, and the WCWCD. These discussions are part of ongoing negotiations to determine Federal reserved water rights for Zion National Park in the Virgin River adjudication.

Table 4: Management actions to be implemented by reach and agency involvement

REACH	Flow Re-establishment	Habitat Enhancement	Vs Introduction	Non-Indigenous Fish Management
Beaver Dam Slope Below Shroeder Res. Upper BDW Upper Lytle Ranch Lower Lytle Ranch Littlefield East Fork	-	*NDOW, UDWR, FWS, BLM	*NDOW, UDWR, FWS	*NDOW, USWR, FWS *NDOW, UDWR, FWS
	-	-	-	*UDWR, FWS
	-	-	-	*UDWR, FWS
	-	*BLM, UDWR, FWS,	-	*BLM, UDWR, FWS
	*UDNR, FWS, WCWCD, BLM	*UDWR, FWS, BLM	*UDWR, FWS	*UDWR, FWS
Santa Clara River Moody Wash Magatsu Creek Below Veyo Above Gunlock Res. Below Gunlock Res. Lower Santa Clara	-	-	-	*UDWR, FWS
	*UDNR, WCWCD, FWS, BLM	-	*UDWR, FWS	*UDWR, FWS
	*UDNR, WCWCD, FWS, BLM	-	-	*UDWR, FWS
	*UDNR, WCWCD, FWS, BLM	*UDWR, FWS, BLM	-	*UDWR, FWS
	*UDNR, WCWCD, FWS, BLM	*UDWR, FWS, BLM	*UDWR, FWS	*UDWR, FWS, BLM
Leeds Creek	*UDNR, WCWCD, FWS, BLM	-	*UDWR, FWS	*UDWR, FWS
Quail Creek	*UDNR, WCWCD, FWS, BLM	-	*UDWR, FWS	*UDWR, FWS
Ash Creek Upper Lower	-	*UDWR, FWS, BLM	*UDWR, FWS	-
	-	-	-	*UDWR, FWS
La Verkin Upper Lower	-	-	-	*UDWR, FWS
	-	*UDWR, FWS, BLM	-	*UDWR, FWS
Virgin River Below Quail Cr Div	*UDNR, WCWCD, FWS, BLM	-	*UDWR, FWS	*UDWR, FWS, BLM
	-	-	-	-
North Creek Upper Lower	*UDNR, WCWCD, FWS, BLM	*UDWR, FWS, BLM	*UDWR, FWS	*UDWR, FWS
	-	-	-	*UDWR, FWS
North Fork Virgin East Fork Virgin	-	-	-	*UDWR, FWS
	-	-	-	*UDWR, FWS
Shunes Creek	-	-	-	-

* Represents lead agency for management action(s) to be implemented

Table 5: Routinely stocked Salmonids in the Virgin River Basin

Area/Reach	Rainbow Trout	Brown Trout	Brook Trout	Yellowstone Cutthroat Trout
Baker Reservoir	X	X ^a		
Schroeder Reservoir				
Pine Valley Reservoir	X		X	
Upper Sand Cove Reservoir	X			
Upper Santa Clara River	X			
Quail Creek Reservoir	X			
Kolob Reservoir	X		X	X
Upper East Fork Virgin River	X	X		
Navajo Lake	X		X	
Private Ponds	X		X	

^a Stocking could be discontinued

FIGURE 1: Estimated historic and present distribution of the Virgin Spinedace in the Virgin River Basin (modified from Valdez et al. 1991).

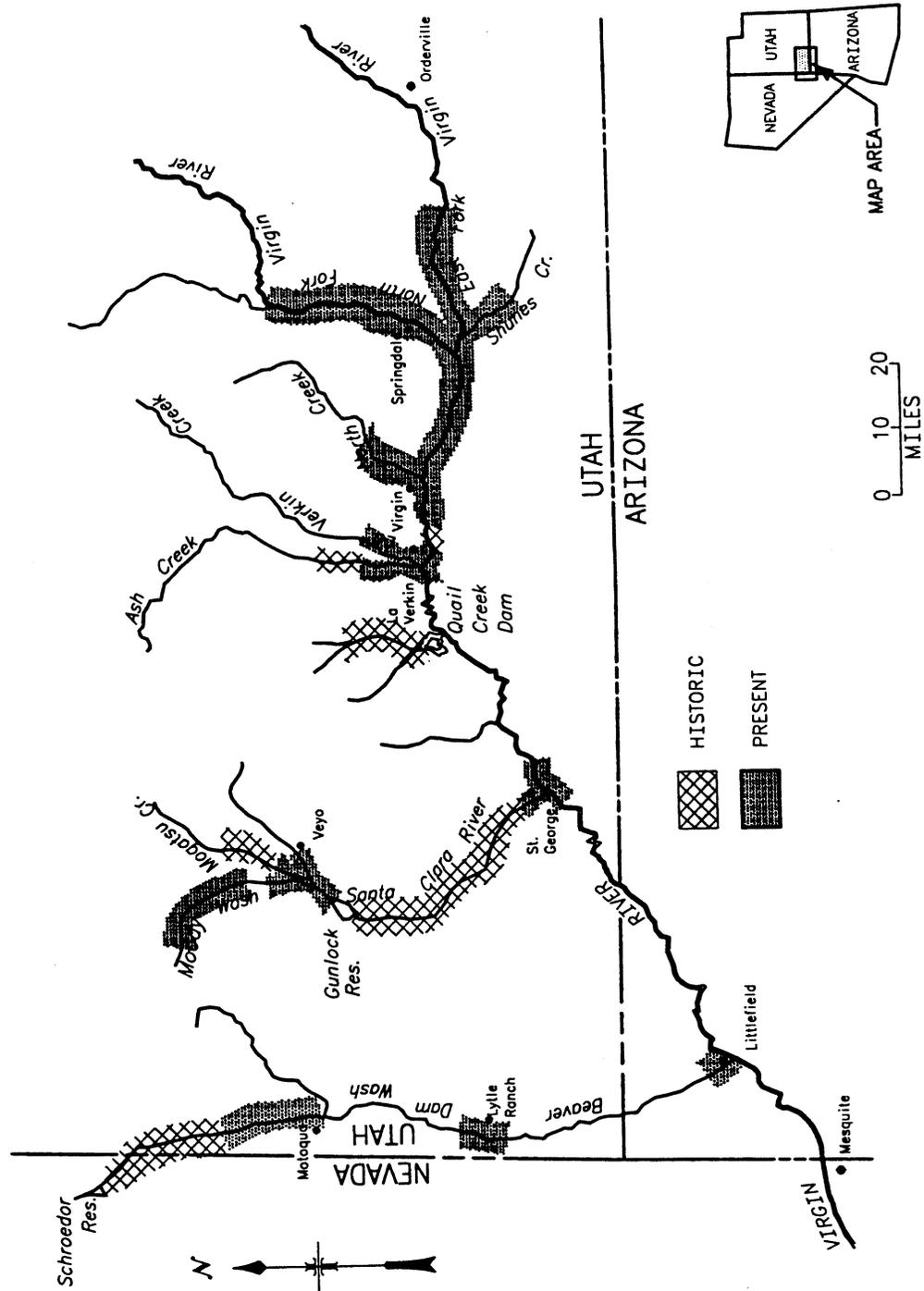
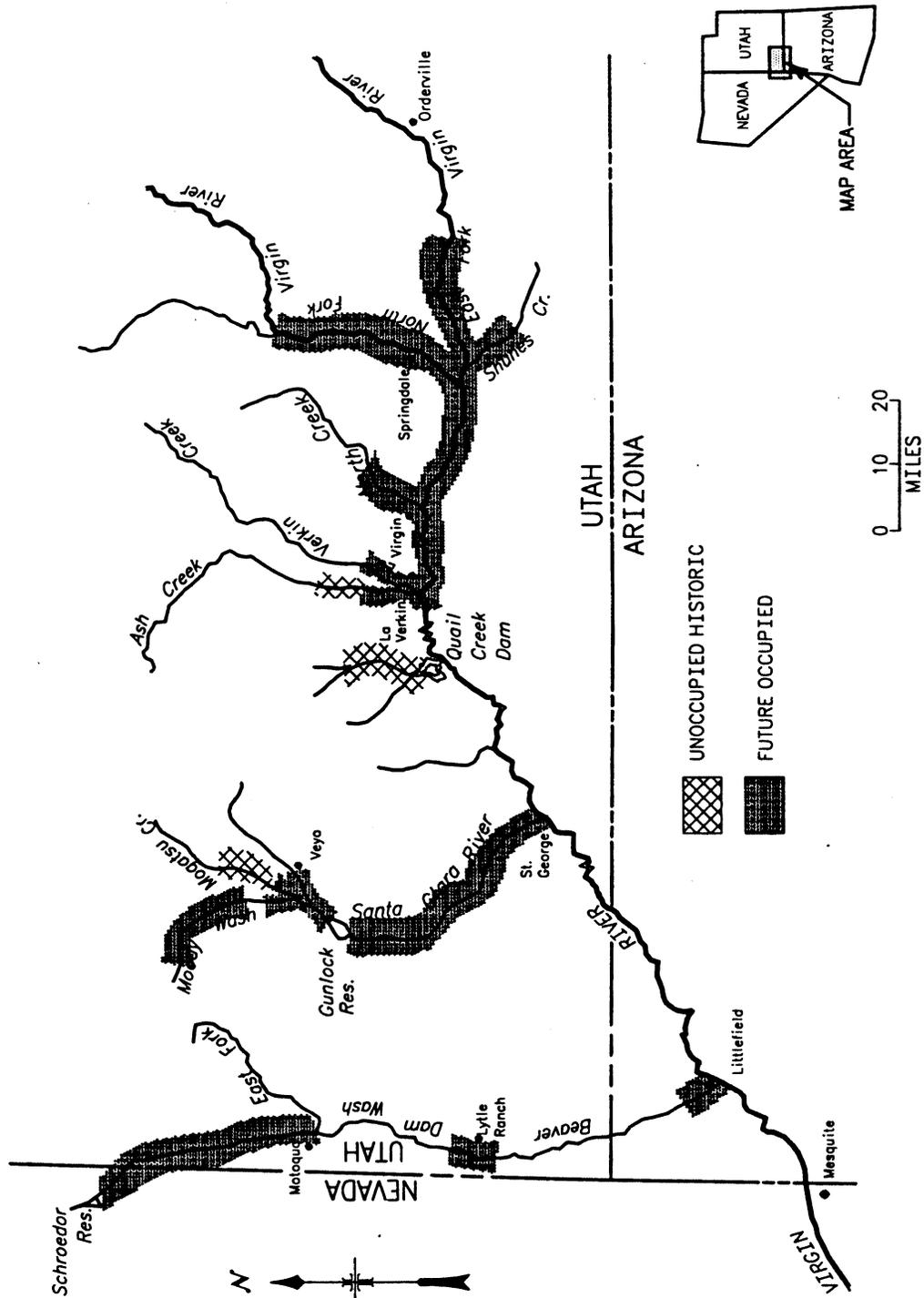


FIGURE 2: Projected Virgin Spinedace distribution in the Virgin River Basin as a result of the Conservation Agreement



APPENDIX A

Native Species of the Virgin River Basin

	ESA	Status		
		UT	NV	AZ
Plants:*				
Holmgren milkvetch (<i>Astragalus holmgreniorum</i>)	C1	S		
Beaver Dam milkvetch	C2			
Hay's sedge (<i>Carex haysii</i>)	C2	S		
Virgin thistle (<i>Cirsium virginensis</i>)	C2	S		
Zion tansy (<i>Sphaeromeria ruthiae</i>)				
Cliff jamesia (<i>Jamesia americana</i>)	C2	S		
Nevada goldenrod		S		
Virgin phacelia (<i>Phacelia cephalotes</i>)				
Invertebrates:*				
Tiger beetle (<i>Cicindela oregona</i>)	C2	S		
Utah hydroporous diving beetle (<i>Hygrotus utahensis</i>)	C2			
Utah minute moss beetle (<i>Limnebius crassalus</i>)	C2			
Utah water scavenger beetle (<i>Chaetarthria utahensis</i>)	C2	S		
MacNeil sooty wing skipper (<i>Hesperopsis graciellae</i>)	C2	S		
Wet Wall snail (<i>Physa zionis</i>)	C2	S		
Desert spring snail (<i>Pyrgulopsis deserta</i>)		S		
Note: Only federal candidate species of plants and invertebrates are included.				
Fish:				
Virgin spinedace (<i>Lepidomeda mollispinis</i>)	PT	E	P	E
Woundfin (<i>Plagopterus argentissimus</i>)	E	E	E	E
Virgin River chub (<i>Gila seminuda</i>)	E	E	S	E
Flannelmouth sucker (<i>Catostomus latipinnis</i>)	C2	S		
Desert sucker (<i>Catostomus clarki</i>)	C2	S		
Speckled dace (<i>Rhinichthys osculus</i>)				
Amphibians:				
Tiger salamander (<i>Ambystoma tigrinum</i>)				
Southwestern toad (<i>Bufo microscaphus</i>)	C2	S		
Red-spotted toad (<i>Bufo punctatus</i>)				
Woodhouse's toad (<i>Bufo woodhousei</i>)				
Great Basin spadefoot (<i>Scaphiopus intermontanus</i>)				
Canyon treefrog (<i>Hyla arenicolor</i>)				
Pacific treefrog (<i>Psuedacris regilla</i>)		S		
Northern leopard frog (<i>Rana pipiens</i>)				C
Lowland leopard frog (<i>Rana yavapaiensis</i>)	C2	S		C
Relict leopard frog (<i>Rana onca</i>)	3A	S		
Reptiles:				
Desert tortoise (<i>Gopherus agassizii</i>)	T	E	T	C
Utah banded gecko (<i>Coleonyx variegatus</i>)		S		
Desert night lizard (<i>Xantusia vigilis</i>)		S		
Desert iguana (<i>Dipsosaurus dorsalis</i>)		S		
Western chuckwalla (<i>Sauromalus obesus</i>)	C2	T		
Collared lizard (<i>Crotophytus collaris</i>)				
Long-nosed leopard lizard (<i>Gambelia wislizenii</i>)				
Zebra-tailed lizard (<i>Callisaurus draconoides</i>)		S		
Desert spiny lizard (<i>Sceloporus magister</i>)				
Western fence lizard (<i>Sceloporus occidentalis</i>)				
Eastern fence lizard (<i>Sceloporus undulatus</i>)				
Sagebrush lizard (<i>Sceloporus graciosus</i>)				
Tree lizard (<i>Urosaurus ornatus</i>)				

Long-tailed brush lizard (<i>Urosaurus graciosus</i>)			
Side-blotched lizard (<i>Uta stansburiana</i>)			
Short-horned lizard (<i>Phrynosoma douglassi</i>)			
Desert horned lizard (<i>Phrynosoma platyrhinos</i>)			
Great Basin skink (<i>Eumeces skiltonianus</i>)			
Western whiptail (<i>Cnemidophorus tigris</i>)			
Plateau striped whiptail (<i>Cnemidophorus velox</i>)	C2	E	S
Banded gila monster (<i>Heloderma suspectum</i>)		S	
Western blind snake (<i>Leptotyphlops humilis</i>)			
Regal ringneck snake (<i>Diadophis punctatus</i>)			
Western leaf-nosed snake (<i>Phyllorhynchus decurtatus</i>)			
Red coachwhip (<i>Masticophis flagellum</i>)			
Striped whipsnake (<i>Masticophis taeniatus</i>)			
Mojave patch-nosed snake (<i>Salvadora hexalepsis</i>)		S	
Great Basin gopher snake (<i>Pituophis melanoleucus</i>)			
Glossy snake (<i>Arizona elegans</i>)		S	
California kingsnake (<i>Lampropeltis getulus</i>)		S	
Utah mountain kingsnake (<i>Lampropeltis pyromelana</i>)		S	
Long-nosed snake (<i>Rhinocheilus lecontei</i>)			
Wandering garter snake (<i>Thamnophis elegans</i>)			
Ground snake (<i>Sonora semiannulata</i>)			
Utah black-headed snake (<i>Tantilla utahensis</i>)		S	
Night snake (<i>Hypsiglena torquata</i>)			
Sonoran lyre snake (<i>Trimorphodon biscutatus</i>)		S	
Great Basin rattlesnake (<i>Crotalus viridis</i>)			
Mojave desert sidewinder (<i>Crotalus cerastes</i>)		S	
Southwest speckled rattlesnake (<i>Crotalus mitchellii</i>)		S	
Mojave rattlesnake (<i>Crotalus scutulatus</i>)		S	

Birds:

Common loon (<i>Gavia immer</i>)			
Pied-billed grebe (<i>Podilymbus podiceps</i>)			
Horned grebe (<i>Podiceps auritus</i>)			
Eared grebe (<i>Podiceps nigricollis</i>)			
Western grebe (<i>Aechmophorus occidentalis</i>)			
Clark's grebe (<i>Aechmophorus clarkii</i>)			C
American white pelican (<i>Pelecanus erythrorhynchos</i>)		S	
Double-crested cormorant (<i>Phalacrocorax auritus</i>)			
American bittern (<i>Botaurus lentiginosus</i>)			C
Western least bittern (<i>Ixobrychus exilis</i>)	C2	S	C
Great blue heron (<i>Ardea herodias</i>)			
Great egret (<i>Casmerodius albus</i>)			E
Snowy egret (<i>Egretta thula</i>)			T
Cattle egret (<i>Bubulcus ibis</i>)			
Green-backed heron (<i>Butorides striatus</i>)			
Black-crowned night-heron (<i>Nycticorax nycticorax</i>)			
White-faced ibis (<i>Plegadis chihi</i>)	C2		
Tundra swan (<i>Cygnus columbianus</i>)			
Greater white-fronted goose (<i>Anser albifrons</i>)			
Snow goose (<i>Chen caerulescens</i>)			
Canada goose (<i>Branta canadensis</i>)			
Wood duck (<i>Aix sponsa</i>)			
Green-winged teal (<i>Anas crecca</i>)			
Mallard (<i>Anas platyrhynchos</i>)			
Northern pintail (<i>Anas acuta</i>)			
Blue-winged teal (<i>Anas discors</i>)			
Cinnamon teal (<i>Anas cyanoptera</i>)			
Northern shoveler (<i>Anas clypeata</i>)			
Gadwall (<i>Anas strepera</i>)			
American wigeon (<i>Anas americana</i>)			
Canvasback (<i>Aythya valisineria</i>)			
Redhead (<i>Aythya americana</i>)			

Ring-necked duck (<i>Aythya collaris</i>)				
Lesser scaup (<i>Aythya affinis</i>)				
Common goldeneye (<i>Bucephala clangula</i>)				
Bufflehead (<i>Bucephala albeola</i>)				
Hooded merganser (<i>Lophodytes cucullatus</i>)				
Common merganser (<i>Mergus merganser</i>)				
Red-breasted merganser (<i>Mergus serrator</i>)				
Ruddy duck (<i>Oxyura jamaicensis</i>)				
Turkey vulture (<i>Cathartes aura</i>)				
Osprey (<i>Pandion haliaetus</i>)		S		T
Bald eagle (<i>Haliaeetus leucocephalus</i>)	E	E		E
Northern harrier (<i>Circus cyaneus</i>)				
Sharp-shinned hawk (<i>Accipiter striatus</i>)				
Cooper's hawk (<i>Accipiter cooperii</i>)				
Northern goshawk (<i>Accipiter gentilis</i>)	C2	S		C
Common black-hawk (<i>Buteogallus anthracinus</i>)				C
Swainson's hawk (<i>Buteo swainsoni</i>)		S		
Red-tailed hawk (<i>Buteo jamaicensis</i>)				
Ferruginous hawk (<i>Buteo regalis</i>)	C2	T		T
Rough-legged hawk (<i>Buteo lagopus</i>)				
Golden eagle (<i>Aquila chrysaetos</i>)				
American kestrel (<i>Falco sparverius</i>)				
Merlin (<i>Falco columbarius</i>)				
Peregrine falcon (<i>Falco peregrinus</i>)	E	E	E	C
Prairie falcon (<i>Falco mexicanus</i>)				
Wild turkey (<i>Meleagris gallopava</i>)				
Gambel's quail (<i>Callipepla gambelii</i>)				
Virginia rail (<i>Rallus limicola</i>)				
Sora (<i>Porzana carolina</i>)				
Common moorhen (<i>Gallinula chloropus</i>)				
American coot (<i>Fulica americana</i>)				
Snowy plover (<i>Charadrius alexandrinus</i>)	C3	S		C
Mountain plover (<i>Charadrius montanus</i>)	C2	S		
Semipalmated plover (<i>Charadrius semipalmatus</i>)				
Killdeer (<i>Charadrius vociferus</i>)				
Black-necked stilt (<i>Himantopus mexicanus</i>)				
American avocet (<i>Recurvirostra americana</i>)				
Greater yellowlegs (<i>Tringa melanoleuca</i>)				
Lesser yellowlegs (<i>Tringa flavipes</i>)				
Solitary sandpiper (<i>Tringa solitaria</i>)				
Willet (<i>Catoptrophorus semipalmatus</i>)				
Spotted sandpiper (<i>Actitis macularia</i>)				
Whimbrel (<i>Numenius phaeopus</i>)				
Long-billed curlew (<i>Numenius americanus</i>)		S		
Marbled godwit (<i>Limosa fedoa</i>)				
Western sandpiper (<i>Calidris mauri</i>)				
Least sandpiper (<i>Calidris minutilla</i>)				
Baird's sandpiper (<i>Calidris bairdii</i>)				
Pectoral sandpiper (<i>Calidris melanotos</i>)				
Long-billed dowitcher (<i>Limnodromus scolopaceus</i>)				
Common snipe (<i>Gallinago gallinago</i>)				
Wilson's phalarope (<i>Phalaropus tricolor</i>)				
Red-necked phalarope (<i>Phalaropus lobatus</i>)				
Franklin's gull (<i>Larus pipixcan</i>)				
Bonaparte's gull (<i>Larus philadelphia</i>)				
Ring-billed gull (<i>Larus delawarensis</i>)				
California gull (<i>Larus californicus</i>)				
Herring gull (<i>Larus argentatus</i>)				
Caspian tern (<i>Sterna caspia</i>)		S		
Forster's tern (<i>Sterna forsteri</i>)				
Black tern (<i>Chlidonias niger</i>)	C2	S		
Band-tailed pigeon (<i>Columba fasciata</i>)				

White-winged dove (<i>Zenaida asiatica</i>)				
Mourning dove (<i>Zenaida macroura</i>)				
Yellow-billed cuckoo (<i>Coccyzus americanus</i>)		T		T
Greater roadrunner (<i>Geococcyx californianus</i>)				
Common barn-owl (<i>Tyto alba</i>)				
Flammulated owl (<i>Otus flammeolus</i>)				
Western screech owl (<i>Otus kennicotti</i>)				
Great horned owl (<i>Bubo virginianus</i>)				
Northern pygmy owl (<i>Glaucidium gnoma</i>)				
Western burrowing owl (<i>Athene cunicularia</i>)	C2	S		
Mexican spotted owl (<i>Strix occidentalis</i>)	T	T		T
Long-eared owl (<i>Asio otus</i>)				
Short-eared owl (<i>Asio flammeus</i>)		S		
Lesser nighthawk (<i>Chordeilus acutipennis</i>)				
Common nighthawk (<i>Chordeilus minor</i>)				
Common poorwill (<i>Phalaenoptilus nuttallii</i>)				
White-throated swift (<i>Aeronautes saxatalis</i>)				
Black-chinned hummingbird (<i>Archilochus alexandri</i>)				
Costa's hummingbird (<i>Calypte costae</i>)				
Broad-tailed hummingbird (<i>Selasphorus platycercus</i>)				
Rufous hummingbird (<i>Selasphorus rufus</i>)				
Belted kingfisher (<i>Ceryle alcyon</i>)				C
Lewis' woodpecker (<i>Melanerpes lewis</i>)		S		
Red-naped sapsucker (<i>Sphyrapicus nuchalis</i>)				
Ladder-backed woodpecker (<i>Picoides scalaris</i>)				
Downy woodpecker (<i>Picoides pubescens</i>)				
Hairy woodpecker (<i>Picoides villosus</i>)				
Northern flicker (<i>Colaptes auratus</i>)				
Olive-sided flycatcher (<i>Contopus borealis</i>)				
Western wood-pewee (<i>Contopus sordidulus</i>)				
Southwest willow flycatcher (<i>Empidonax traillii</i>)	PE	S		E
Hammond's flycatcher (<i>Empidonax hammondii</i>)				
Gray flycatcher (<i>Empidonax wrightii</i>)				
Cordillean flycatcher (<i>Empidonax occidentalis</i>)				
Black phoebe (<i>Sayornis nigricans</i>)				
Say's phoebe (<i>Sayornis saya</i>)				
Vermilion flycatcher (<i>Pyrocephalus rubinus</i>)				
Ash-throated flycatcher (<i>Myiarchus tyrannulus</i>)				
Cassin's kingbird (<i>Tyrannus vociferans</i>)				
Western kingbird (<i>Tyrannus verticalis</i>)				
Horned lark (<i>Eremophila alpestris</i>)				
Tree swallow (<i>Tachycineta bicolor</i>)				
Violet-green swallow (<i>Tachycineta thalassina</i>)				
Northern rough-winged swallow (<i>Stelgidopteryx serripennis</i>)				
Bank swallow (<i>Riparia riparia</i>)				
Cliff swallow (<i>Hirundo pyrrhonota</i>)				
Barn swallow (<i>Hirundo rustica</i>)				
Stellar's jay (<i>Cyanocitta stelleri</i>)				
Scrub jay (<i>Aphelocoma coerulescens</i>)				
Pinyon jay (<i>Gymnorhinus cyanocephalus</i>)				
Clark's nutcracker (<i>Nucifraga columbiana</i>)				
American crow (<i>Corvus brachyrhynchos</i>)				
Common raven (<i>Corvus corax</i>)				
Black-capped chickadee (<i>Parus atricapillus</i>)				
Mountain chickadee (<i>Parus gambeli</i>)				
Plain titmouse (<i>Parus inornatus</i>)				
Verdin (<i>Auriparus flaviceps</i>)				
Bushtit (<i>Psaltriparus minimus</i>)				
Red-breasted nuthatch (<i>Sitta canadensis</i>)				
White-breasted nuthatch (<i>Sitta carolinensis</i>)				
Pygmy nuthatch (<i>Sitta pygmaea</i>)				
Brown creeper (<i>Certhia americana</i>)				

Cactus wren (*Campylorhynchus brunneicapillus*) S
 Rock wren (*Salpinctes obsoletus*)
 Canyon wren (*Catherpes mexicanus*)
 Bewick's wren (*Troglodytes bewickii*)
 House wren (*Troglodytes aedon*)
 Winter wren (*Troglodytes troglodytes*)
 Marsh wren (*Cistothorus palustris*)
 American dipper (*Cinclus mexicanus*)
 Golden-crowned kinglet (*Regulus satrapa*)
 Ruby-crowned kinglet (*Regulus calendula*)
 Blue-gray knatcatcher (*Polioptila caerulea*)
 Western bluebird (*Sialia mexicana*) S
 Mountain bluebird (*Sialia currucoides*)
 Townsend's solitaire (*Myadestes townsendi*)
 Swainson's thrush (*Catharus ustulatus*)
 Hermit thrush (*Catharus guttatus*)
 American robin (*Turdus migratorius*)
 Northern mockingbird (*Mimus polyglottos*)
 Sage thrasher (*Oreoscoptes montanus*)
 Bendire's thrasher (*Toxostoma bendirei*)
 Crissal thrasher (*Toxostoma crissale*) S
 LeConte's thrasher (*Toxostoma lecontei*)
 Water pipit (*Anthus spinoletta*)
 Bohemian waxwing (*Bombycilla garrulus*)
 Cedar waxwing (*Bombycilla cedrorum*)
 Phainopepla (*Phainopepla nitens*)
 Northern shrike (*Lanius excubitor*)
 Loggerhead shrike (*Lanius ludovicianus*) S
 Bell's vireo (*Vireo bellii*) S
 Gray vireo (*Vireo vicinior*)
 Solitary vireo (*Vireo solitarius*)
 Warbling vireo (*Vireo gilvus*)
 Orange-crowned warbler (*Vermivora celata*)
 Nashville warbler (*Vermivora ruficapilla*)
 Virginia's warbler (*Vermivora virginiae*)
 Lucy's warbler (*Vermivora luciae*)
 Yellow warbler (*Dendroica petechia*)
 Yellow-rumped warbler (*Dendroica coronata*)
 Black-throated gray warbler (*Dendroica nigrescens*)
 Grace's warbler (*Dendroica graciae*)
 Northern waterthrush (*Seiurus noveboracensis*)
 MacGillivray's warbler (*Oporornis tolmiei*)
 Common yellowthroat (*Geothlypis trichas*) S
 Wilson's warbler (*Wilsonia pusilla*)
 Yellow-breasted chat (*Icteria virens*)
 Summer tanager (*Piranga rubra*)
 Western tanager (*Piranga ludoviciana*)
 Black-headed grosbeak (*Pheucticus melanocephalus*)
 Blue grosbeak (*Guiraca caerulea*)
 Lazuli bunting (*Passerina ciris*)
 Green-tailed towhee (*Pipilo chlorurus*)
 Rufous-sided towhee (*Pipilo erythrophthalmus*)
 Abert's towhee (*Pipilo aberti*)
 American tree sparrow (*Spizella arborea*)
 Chipping sparrow (*Spizella pallida*)
 Brewer's sparrow (*Spizella breweri*)
 Black-chinned sparrow (*Spizella atrogularis*)
 Vesper sparrow (*Poocetes gramineus*)
 Lark sparrow (*Chondestes grammacus*)
 Black-throated sparrow (*Amphispiza bilineata*)
 Sage sparrow (*Amphispiza belli*)
 Savannah sparrow (*Passerculus sandwichensis*)

Song sparrow (*Melospiza melodia*)
 Lincoln's sparrow (*Melospiza lincolnii*)
 White-crowned sparrow (*Zonotrichia albicollis*)
 Dark-eyed junco (*Junco hyemalis*)
 Red-winged blackbird (*Agelaius phoeniceus*)
 Western meadowlark (*Sturnella neglecta*)
 Yellow-headed blackbird (*Xanthocephalus xanthocephalus*)
 Brewer's blackbird (*Euphagus cyanocephalus*)
 Great-tailed grackle (*Quiscalus mexicanus*)
 Brown-headed cowbird (*Molothrus ater*)
 Hooded oriole (*Icterus cucullatus*)
 Northern oriole (*Icterus galbula*)
 Scott's oriole (*Icterus parisorum*)
 Cassin's finch (*Carpodacus cassinii*)
 House finch (*Carpodacus mexicanus*)
 Red crossbill (*Loxia curvirostra*)
 Pine siskin (*Carduelis pinus*)
 Lesser goldfinch (*Carduelis psaltria*)
 American goldfinch (*Carduelis tristis*)
 Evening grosbeak (*Coccothraustes vespertinus*)

Mammals:

Merriam's shrew (<i>Sorex merriami</i>)				
Dusky shrew (<i>Sorex monticolis</i>)				E
Northern water shrew (<i>Sorex palustris</i>)		S		
Desert shrew (<i>Notiosorex crawfordi</i>)	C2			C
California leaf-nosed bat (<i>Macrotus californicus</i>)	C2			
Little brown myotis (<i>Myotis lucifugus</i>)	C2			
Yuma myotis (<i>Myotis yumanensis</i>)	C2			
Long-eared myotis (<i>Myotis evotis</i>)	C2			
Fringed myotis (<i>Myotis thysanodes</i>)	C2			
Long-legged myotis (<i>Myotis volans</i>)	C2			
California myotis (<i>Myotis californicus</i>)	C2			
Western small-footed myotis (<i>Myotis ciliolabrum</i>)	C2			
Silver-haired bat (<i>Lasionycteris noctivagans</i>)				
Western pipistrelle (<i>Pipistrellus hesperus</i>)				
Big brown bat (<i>Eptesicus fuscus</i>)		S		C
Western red bat (<i>Lasiurus blossevillei</i>)				
Hoary bat (<i>Lasiurus cinereus</i>)	C2	S	T	C
Spotted bat (<i>Euderma maculatum</i>)	C2			
Pale Townsend's big-eared bat (<i>Plecotus townsendii</i>)	C2			
Allen's big-eared bat (<i>Idionycteris phyllotis</i>)	C2			
Pallid bat (<i>Antrozous pallidus</i>)				
Brazilian free-tailed bat (<i>Tadarida brasiliensis</i>)				
Big free-tailed bat (<i>Nyctinomops macrotis</i>)	C2	S		
Pygmy rabbit (<i>Brachylagus idahoensis</i>)	C2	S		
Black-tailed jackrabbit (<i>Lepus californicus</i>)				
Mountain cottontail (<i>Sylvilagus nuttalli</i>)				
Desert cottontail (<i>Sylvilagus auduboni</i>)				
Least chipmunk (<i>Tamias minimus</i>)				
Cliff chipmunk (<i>Tamias dorsalis</i>)				
Yellow-bellied marmot (<i>Marmota flaviventris</i>)				
White-tailed antelope squirrel (<i>Ammospermophilus leucurus</i>)				
Rock squirrel (<i>Spermophilus variegatus</i>)				
Golden-mantled ground squirrel (<i>Spermophilus lateralis</i>)				
Red squirrel (<i>Tamiasciurus hudsonicus</i>)				
Virgin River pocket gopher (<i>Thomomys bottae</i>)		S		
Virgin little pocket mouse (<i>Perognathus longimembris</i>)				
Great Basin pocket mouse (<i>Perognathus parvus</i>)				
Long-tailed pocket mouse (<i>Chaetodipus formosus</i>)				
Desert pocket mouse (<i>Chaetodipus penicillatus</i>)				
Ord's kangaroo rat (<i>Dipodomys ordii</i>)				

Chisel-toothed kangaroo rat (<i>Dipodomys microps</i>)		
Merriam's kangaroo rat (<i>Dipodomys merriami</i>)	C2	S
Desert kangaroo rat (<i>Dipodomys deserti</i>)		S
Beaver (<i>Castor canadensis</i>)		
Western harvest mouse (<i>Reithrodontomys megalotis</i>)		
Canyon mouse (<i>Peromyscus crinitus</i>)		
Cactus mouse (<i>Peromyscus eremicus</i>)		S
Deer mouse (<i>Peromyscus maniculatus</i>)		
Brush mouse (<i>Peromyscus boylii</i>)		
Pinyon mouse (<i>Peromyscus truei</i>)		
Northern grasshopper mouse (<i>Onychomys leucogaster</i>)		
Southern grasshopper mouse (<i>Onychomys torridus</i>)		S
Desert woodrat (<i>Neotoma lepida</i>)		
Bushy-tailed woodrat (<i>Neotoma cinerea</i>)		
Virgin River montane vole (<i>Microtus montanus</i>)	C2	S
Long-tailed vole (<i>Microtus longicaudus</i>)		
Muskrat (<i>Ondatra zibethicus</i>)		
Porcupine (<i>Erethizon dorsatum</i>)		
Coyote (<i>Canis latrans</i>)		
Kit fox (<i>Vulpes macrotis</i>)		S
Gray fox (<i>Urocyon cinereoargenteus</i>)		
Ringtail (<i>Bassariscus astutus</i>)		S
Raccoon (<i>Procyon lotor</i>)		
Long-tailed weasel (<i>Mustela frenata</i>)		
Badger (<i>Taxidea taxus</i>)		
Western spotted skunk (<i>Spilogale gracilis</i>)		
Striped skunk (<i>Mephitis mephitis</i>)		
Mountain lion (<i>Felis concolor</i>)		
Bobcat (<i>Lynx rufus</i>)		
Mule deer (<i>Odocoileus hemionus</i>)		
Desert bighorn sheep (<i>Ovis canadensis</i>)		

Status

E = Endangered
 T = Threatened
 C1 = Candidate species (Category 1)
 C2 = Candidate species (Category 2)
 C3 = Candidate species (Category 3)
 3A = Extinct
 PE = Proposed as endangered
 PT = Proposed as threatened
 S = Sensitive
 P = Protected
 C = Candidate for state list

**VIRGIN SPINEDACE
CONSERVATION AGREEMENT AND
STRATEGY**

April 11, 1995

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Division of Wildlife Resources 1596 West North Temple
Salt Lake City, Utah 84116

An Equal Opportunity Employer

Robert G. Valentine Director

June 1995

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Virgin Spinedace Conservation Team

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CONSERVATION AGREEMENT

Virgin spinedace

Lepidomeda mollispinis mollispinis

This Conservation Agreement for the Virgin spinedace *Lepidomeda mollispinis mollispinis* has been developed in order to expedite conservation measures needed for the continued existence and recovery of the species. These measures will be taken in accordance with the Endangered Species Act of 1973 as amended (ESA). The agreement focuses on two objectives. The first is to reduce and eliminate significant threats. The second is to enhance and/or stabilize specific reaches of occupied and unoccupied historic habitat. These objectives will be reached through implementation of the Conservation Strategy for the species (Attachment A). Full implementation of this agreement and the associated strategy will reduce threats to the Virgin spinedace that warrant its listing as a sensitive species by State and Federal agencies, and as threatened or endangered under the ESA.

The Virgin spinedace is a small minnow endemic to the Virgin River Basin in Utah, Arizona, and Nevada. Shoreline-land ownership within the flood plains of Virgin spinedace habitat is approximately 38% federal, 3% state, 5% Paiute Tribe managed and 54% private. Past and present human activities such as water development projects, agriculture, mining, urbanization and the introduction of non-indigenous fishes have altered the Virgin River ecosystem. There has been a 37-40% reduction (approximately 84 km/52 mi) in Virgin spinedace historic range (approximately 226 km/140 mi). Current populations are fragmented, and occur almost exclusively within Utah. Due to these reductions and perceived threats to the species, the United States Fish and Wildlife Service (FWS) proposed listing the species as threatened, pursuant to the ESA, on May 18, 1994 (59 FR 25875).

I. OTHER SPECIES INVOLVED

The primary focus of this agreement is the conservation and enhancement of the Virgin spinedace and its habitat; however, other species occurring within or adjacent to Virgin spinedace habitat may also benefit. Three hundred and sixty-six species of fish, amphibians, reptiles, birds, and mammals are known to coexist in the same or adjacent habitat of the Virgin spinedace. Eighty-one of these species are listed as sensitive in either Utah, Arizona or Nevada and/or are listed under the ESA by FWS (Appendix A in Conservation Strategy). An additional eight sensitive plant species and seven sensitive invertebrate species also co-exist in the same or adjacent habitat of the Virgin spinedace. Using an ecosystem approach, the Virgin spinedace

Conservation Agreement could reduce or possibly eliminate threats for several of these species, which could preclude their need for federal listing pursuant to the ESA.

II. INVOLVED PARTIES

Utah Department of Natural Resources
Division of Wildlife Resources
1596 West North Temple Salt Lake City, UT 84116
(801) 538-7227

United States Department of Interior
Fish and Wildlife Service
P.O. Box 25486 Denver Federal Center Denver, CO 80225
(303) 236-7920

Bureau of Land Management
Utah State Office
324 South State Street Salt Lake City, UT 84111
(801) 539-4072

Bureau of Land Management
Arizona State Office 3707 North 7th Street Phoenix, AZ 85011
(602) 650-0260

National Park Service
Rocky Mountain Regional Office
P.O. Box 25287 Denver, CO 80225-0287
(303) 969-2500

Nevada Department of Conservation and Natural Resources
Division of Wildlife 1100 Valley Road Reno, NV 89520-0022
(702) 688-1500

Washington County Water Conservancy District
136 N. 100 East, Suite 1 St. George, UT 84770
(435) 673-3617

Arizona Game and Fish Department
2221 W. Greenway Road Phoenix, AZ 85023-4312
(602) 942-3000

Separate Memorandum (a) of Understanding and Cooperative Agreements will be developed with additional parties as necessary to ensure implementation of specific conservation measures.

III. AUTHORITY

➤ The signatory parties hereto enter into this Conservation Agreement and the attached Conservation Strategy under federal and state law, as applicable, including but not limited to Section 2(c)(2) of the Endangered Species Act of 1973, as amended, which states that "the policy of Congress is that Federal agencies shall cooperate with State and local agencies to resolve water resource issues in concert with conservation of endangered species."

➤ All parties to this Agreement recognize that they each have specific statutory responsibilities that cannot be delegated, particularly with respect to the management and conservation of wildlife and the management, development and allocation of water resources. Nothing in this Agreement or the Strategy is intended to abrogate any of the parties' respective responsibilities.

➤ This Agreement is subject to and is intended to be consistent with all applicable Federal and State laws and interstate compacts.

IV. STATUS AND DISTRIBUTION OF THE VIRGIN SPINEDACE

In 1979 and 1989, the Virgin spinedace was identified as threatened by the American Fisheries Society, Endangered Species Committee. Criteria used for determining this status were consistent with the ESA. Their determination was based on review of original data and discussions with pertinent agencies and knowledgeable scientists. On May 18, 1994, the FWS proposed the species for listing as threatened under the ESA (59 FR 25875).

The Virgin spinedace currently occupies approximately 60-63% of historic habitat, nearly all being in Utah. Populations no longer exist in Nevada and few individuals remain in Arizona. The species occupies approximately 117 km (73 mi) of tributary streams and 25 km (16 mi) of the mainstem Virgin River. Occupied streams include three reaches of Beaver Dam Wash, two reaches of the Santa Clara River, isolated reaches in Moody Wash and Magotsu Creek, one reach of Ash Creek, two reaches of La Verkin Creek, two reaches of North Creek, the North and East Forks of the Virgin River, and Shunes Creek. Occupied habitat in the mainstem Virgin River is considered to be limited to the area above Quail Creek'Diversion. Occasionally, Virgin spinedace have been collected in the Virgin River between Pah Tempe Springs and

Littlefield, Arizona. Their occurrence has generally been associated with tributary inflows. This area is not considered to be historic habitat because this reach does not have the same habitat components found in reaches supporting self-sustaining populations. A detailed description of the status and distribution for this species is presented in the Conservation Strategy.

V. PROBLEMS FACING THE SPECIES

The FWS assessed real and/or potential problems facing the species based on five criteria as required by Section 4(a)(1) of the ESA. Within each of these criteria, several factors which may have contributed to the elimination or degradation of Virgin spinedace habitat and its populations were identified (59 FR 25875 dated May 18, 1994). The threats identified and described by the FWS (59 FR 25875) do not necessarily reflect the views of all signatories to this agreement. The Conservation Strategy provides a detailed review of problems and threats to the species that signatories to this agreement will address with management actions.

VI. CONSERVATION ACTIONS TO BE IMPLEMENTED

In order to meet the objectives of this agreement, seven conservation actions will be implemented. These actions, as defined and detailed in the Strategy, include: establish existing conditions as a baseline; re-establish population maintenance flows; enhance and maintain habitat; selectively control non-indigenous fish; maintain genetic viability; monitor populations and habitat; and develop a mitigation plan and protocol for future activities. In addition, four general administrative actions, as outlined below, will be implemented: coordinate conservation activities; implement the conservation schedule; fund conservation actions; and assess conservation progress.

Coordinating Conservation Activities

➤ Administration of the conservation agreement will be conducted by the Virgin Spinedace Conservation Team (VSCT). The team will consist of a designated representative from each signatory to this Agreement and may include technical and legal advisors and other members as deemed necessary by the signatories.

➤ Since the majority of the areas of concern covered by this Agreement are located in Utah, and since the State of Utah presently has primary jurisdiction over Virgin spinedace within the State, the designated team leader will be the Utah Department of Natural Resources, Division of Wildlife Resources representative.

➤ Authority of VSCT shall be limited to making recommendations for the conservation of Virgin spinedace to the Director, Utah Division of Wildlife Resources.

➤ The VSCT will meet annually to develop yearly conservation schedules, review the Strategy, and modify the Strategy as required. The VSCT will meet on a quarterly basis to report on the progress of implementing the Conservation Strategy.

➤ VSCT meetings will be open to the public. Minutes of the meetings will be kept and distributed to any interested party.

Implementing Conservation Schedule

➤ A total of 10 years is anticipated for full implementation of actions identified and specified in the Conservation Strategy. Nevertheless, the parties agree that significant actions to benefit the Virgin spinedace will be implemented within the first five (5) years. These actions will be determined by the VSCT.

➤ Conservation actions will be scheduled on a yearly basis. Activities that will be implemented in 1995 are listed in Table 1.

➤ As leader of the VSCT, the Utah Division of Wildlife Resources, Department of Natural Resources, will coordinate conservation activities and monitor conservation actions taken by participants of this Agreement to determine if all actions are being implemented and carried out in accordance with the Conservation Strategy and annual schedule.

Funding Conservation Actions

➤ It is anticipated that expenditures to implement this Agreement could exceed \$3,000,000 (Table 2). It is projected that the actions implemented for the re-establishment of population maintenance flows to stream channels will incur the greatest expense and occur during the first three to five years of the agreement.

➤ Funding for the Conservation Agreement will be provided by a variety of sources. Federal, State and local sources will need to provide or secure funding for initiative procedures of the Conservation Agreement.

- Federal sources include, but will not be limited to, the FWS, BLM, Land and Water Conservation funds, and the Natural Resource Conservation Service.

- State funding sources include, but will not be limited to, direct appropriation of funds by the legislature, Community Impact Boards, Water Resources Revolving funds, State Department of Agriculture (ARD), and State Resource Management Agencies.

- Local sources of funding will be provided by the Habitat Conservation Plan, Water District, cities and towns, Washington County, and local irrigation companies. In-kind contributions in the form of personnel, field equipment, supplies etc., will be provided by participating agencies (Table 3). In addition, each agency will have specific task responsibilities and proposed actions/commitments related to their in-kind contributions.

➤ It is understood that all funding commitments made under this Agreement are subject to approval by the appropriate local, state or federal entities.
Conservation Progress Assessment

➤ A quarterly assessment of progress towards implementing actions identified in this agreement will be provided to the Director, Utah Division of Wildlife Resources by VSCT. This assessment will be based on updates and evaluations by VSCT members. Copies of this assessment will also be provided to the signatories of this document.

➤ An annual assessment of conservation accomplishments identified in Table I and subsequent yearly schedules will be made by VSCT. This assessment will determine the effectiveness of this agreement and whether revisions are warranted. It will be provided to the Director, Utah Division of Wildlife Resources by VSCT. Copies of this assessment will also be provided to the signatories of this document.

➤ If threats to the survival of the Virgin spinedace become known that are not or cannot be resolved through this or any Conservation Agreement, the Utah Division of Wildlife Resources immediately will notify all signatories.

VII. DURATION OF AGREEMENT

The initial term of this Agreement shall be 5 years. Prior to the end of each 5 year period, a thorough analysis of actions implemented for the species will be conducted by the VSCT. If all signatories agree that sufficient progress has been made towards the conservation and recovery of the Virgin spinedace this Agreement shall be extended for an additional five (5) years. Any party may withdraw from this Agreement on sixty (60) days written notice to the other parties.

VIII. NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) COMPLIANCE

Signing of this agreement is covered under authorities outlined in section III listed above. We anticipate that any survey, collection, or research activities for implementation and maintenance of the Conservation Agreement will not entail significant Federal actions under the NEPA and will be given a categorical exclusion designation. All other actions will be evaluated prior to implementation and will comply with NEPA regulations.

IX. FEDERAL AGENCY COMPLIANCE

➤ During the performance of this agreement, the participants agree to abide by the terms of Executive Order 11246 on nondiscrimination and will not discriminate against any person because of race, color, religion, sex or national origin.

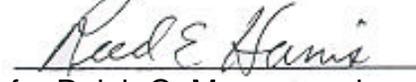
➤ No member or delegate to Congress or resident Commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom, but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.

X. Signatures

Utah Department of Natural Resources
Utah Division of Wildlife Resources
1596 West North Temple
Salt Lake City, UT 84116


Ted Stewart
Executive Director

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Denver, CO 80225


for Ralph O. Morgenweck
Regional Director

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Salt Lake City, UT 84111


for Mat Millenbach
State Director

USDI Bureau of Land Management
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for Lester K. Rosenkrance
State Director

USDI National Park Service
(Rocky Mountain Regional Office)
PO Box 25287
Denver, CO 80225

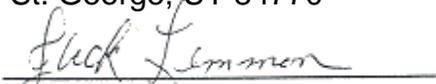

for John Cook
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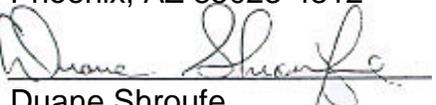
For William A. Molini
Administrator

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Jack Lemmon
Board Chairman

Arizona Game and Fish Department
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Duane Shroufe
Director